NFPA 1, Fire Code

2015-2018 Changes

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NFPA® 1, Fire Code 2015-2018 Editions Changes	
Subject/2018 Edition Text	**Notes**
Chapter 1 – Administration	
1.3.2.2 Where no applicable codes, standards, or requirements are set forth in this *Code* or contained within other laws, codes, regulations, ordinances, or bylaws adopted by the authority having jurisdiction (AHJ), compliance with applicable codes and standards of NFPA or other nationally recognized standards, as are approved, or approved performance-based options in accordance with Chapter 5, shall be deemed as prima facie evidence of compliance with the intent of this *Code.*	Underlined words added
1.3.5 **Vehicles and Vessels.** Vehicles, vessels, or other similar conveyances, when in fixed locations and occupied as buildings, as described by Section 11.6 of NFPA *101~~, Life Safety Code~~*, shall be treated as buildings and comply with this *Code*.	Words deleted
1.4.1.1 **Compliance with Subsequent Editions of Referenced Publications.** The AHJ shall be authorized to accept subsequent editions of publications referenced in this *Code* as evidence of compliance with the specified edition. When the AHJ accepts compliance with a subsequent edition of a referenced publication, compliance with subsequent edition shall be considered evidence of compliance with this *Code's* specified edition.	New section
1.4.1.1.1 Compliance with subsequent editions of reference publications shall be achieved by complying with the entire subsequent edition of the referenced publication	New section
1.4.1.1.2 Compliance with individual specific sections contained in subsequent editions of referenced publications, and not the entire reference publication, shall only be approved AHJ through technical documentation submitted in compliance with 1.4.1 or 1.4.2	New section
1.4.5 Each application for an equivalent, alternative ~~fire~~, or modified fire protection feature shall be filed with the AHJ and shall be accompanied by such evidence, letters, statements, results of tests, or other supporting information as required to justify the request. The AHJ shall keep a record of actions on such applications, and a signed copy of the AHJ's decision shall be provided for the applicant.	New words, words deleted
1.4.6 **Approval**. The AHJ shall approve such equivalent, alternative, or modified construction systems, materials, or methods of design when it is substantiated that the standards of this *Code* are at least equaled. If, in the opinion of the AHJ, the standards of this *Code* ~~shall~~ are not ~~be~~ equaled by the alternative requested, approval for	New words, words deleted

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permanent work shall be refused. Consideration shall be given to test or prototype installations.	
1.7.2.1 Fire inspectors and plans examiners shall meet the minimum professional qualifications established in NFPA 1031.	New section
1.7.2.2 The AHJ shall be authorized to approve alternative qualifications for personnel conducting fire inspections and plan examination if the AHJ determines the individual possesses the knowledge, skills, and abilities to perform the job performance requirements of the position.	New section
1.7.2.3 Fire marshals shall meet the minimum professional qualifications established in NFPA 1037.	New section
1.7.2.4 The AHJ shall be authorized to approve alternative qualifications for personnel performing the position of fire marshal if the AHJ determines the individual possesses the knowledge, skills, and abilities to perform the job performance requirements of the position.	New section
1.7.17.3 Such standby fire personnel or fire watch personnel shall be subject to the AHJ's orders at all times and shall be identifiable and remain on duty during the times such places are open to the public, when such activity is being conducted, or as required by the AHJ.	Abbreviated "Authority Having Jurisdiction
1.10.5.6 A quorum shall consist of not less ~~than 5~~ than a simple majority of appointed members or alternates.	New words, deleted words
1.12.8 ~~Tables 1.12.8(a) and 1.12.8(d) were revised by a tentative interim amendment. (TIA). See page 1.~~	Deleted words
Table 1.12.8(a) **Permit Requirements.** Crop Maze; ~~10.15.11.1~~ 10.14.11.1	New reference number
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	New row in table
Marijuana growing, processing, or extraction facilities; For the construction, alteration, or operation of a marijuana growing, processing, or extraction facility; 38.2	New row in table
Mobile cooking operations; to conduct mobile cooking operations; 50.7	New row in table

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1.14.5 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.	Replaced words
1.14.6 When required by the AHJ, plans and design documents shall be prepared by a registered design professional.	New section
1.16.4.2 Violations of the provisions of this *Code* shall be punishable by a fine or imprisonment as determined by a penalty schedule adopted by the AHJ or specified by state law/rules	New section
1.16.4.3 Where the AHJ ~~establishes~~ 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 $100.00 penalty per day for each violation.	New words, deleted words
1.17 **Permit Fees.** The AHJ shall be authorized to establish a schedule of fees.	New section
Chapter 2 – Referenced Publications	*** Have not marked the referenced publications that simply have updated editions (Did not mark the new editions as changes in this document
2.1.1 **Compliance with Subsequent Editions of the Referenced Publications.** Compliance with subsequent editions of the referenced publications shall be considered evidence of compliance with the editions specified in this *Code*.	New section
2.1.1.1 Compliance with subsequent editions of reference publications shall be achieved by complying with the entire subsequent edition of the referenced publication.	New section
2.1.1.2 Compliance with individual specific sections contained in subsequent edition referenced publications, and not the entire reference publication, shall only be approved by the AHJ through technical documentation submitted in compliance with 1.4.1 or 1.4.2	New section
2.2 **NFPA Publications**	
NFPA 4, *Standard for Integrated Fire Protection and Life Safety System Testing*, 2018 edition.	New reference
NFPA 30, *Flammable and Combustible Liquids Code,* 2018	New reference

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~~NFPA 51A, *Standard for Acetylene Cylinder Charging Plants*, 2012 edition~~	Deleted reference
NFPA 52, *Vehicular ~~Gaseous~~ Fuel Systems Code,* 2013 edition.	Renamed reference
NFPA 54/ANSI Z223.1, *National Fuel Gas Code,* 2018 edition.	Additional reference
NFPA 56, *Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Ga Piping Systems*, 2017 edition.	New reference
NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and ~~Noncombustible~~ Particulate Solids,* 2015 edition.	Renamed reference
NFPA 99B, *Standard for Hypobaric Facilities*, 2018 edition.	New reference
NFPA 115, *Standard for Laser Fire Protection,* 2016 edition.	New reference
NFPA 251, *Standard Methods of Tests of Fire Resistance of Building Construction and Materials*, 2006 edition.	New reference
NFPA 301, *Code for Safety to Life from Fire on Merchant Vessels,* 2018 edition.	New reference
NFPA 403, *Standard for Aircraft Rescue and Fire-Fighting Services at Airports*, 2018 edition.	New reference
NFPA 423, *Construction and Protection of Aircraft Engine Test Facilities*, 2016 edition.	New reference
~~NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents,* 2013 edition.~~	Deleted reference
NFPA 502, *Standard for Road Tunnels, Bridges, and Other Limited Access Highways*, 2017 edition.	New reference
NFPA 652, *Standard on the Fundamentals of Combustible Dust,* 2016 edition.	New reference
NFPA 731, *Standard for the Installation of Carbon Monoxide (CO) Detection and Warning Equipment*, 2015 edition.	New reference
NFPA 780, *Standard for the Installation of Lightning Protection Systems,* 2017 edition.	New reference
NFPA 804, *Standard for Fire Protection for Advanced Light Water Reactor Electric Generating Plants,* 2015 edition.	New reference

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NFPA 805, *Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants,* 2015 edition.	New reference
NFPA 820, *Standard for Fire Protection in Wastewater Treatment and Collection Facilities,* 2016 edition.	New reference
NFPA 1123, *Code for Fireworks Display*, 2018 edition.	New reference
NFPA 1124, *Code for the Manufacture, Transportation, and Storage of Fireworks and Pyrotechnic Articles*, 2017 edition.	New reference
NFPA 1141, *Standard for Fire Protection Infrastructure for Land Development in Wildland, Rural, and Suburban Areas*, 2017 edition.	New reference
NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*, 2016 edition.	New reference
NFPA 1730, *Standard on Organization and Deployment of Fire Prevention Inspection and Code Enforcement, Plan Review, Investigation, and Public Education Operations,* 2016 edition.	New reference
NFPA 1901, *Standard for Automative Fire Apparatus,* 2016 edition.	New reference
NFPA 1906, *Standard for Wildland Fire Apparatus*, 2016.	New reference
NFPA 1925, *Standard on Marine Fire-Fighting Vessels,* 2013 edition.	New reference
NFPA 2113, *Standard on Selection, Care, Use, and Maintenance of Flame-Resistant Garments for Protection of Industrial Personnel Against ~~Flash Fire~~ Short-Duration Thermal Exposures,* 2015 edition.	Renamed reference
2.3.1 **ANSI Publications.**	
ICC/ANSI A117.1, ~~*American National Standard for*~~ *Accessible and Usable Buildings and Facilities*, 2009	Renamed reference
ANSI/AWWA G200, *Distribution Systems Operation and Management*, 2009.	New references
ANSI/BHMA A156.3, *Exit Devices*, 2008.	
ANSI B11.19, *Performance Requirements for Safeguarding*, 2010.	
~~ANSI/AIHA Z9.7 *Recirculation of Air from Industrial Process Exhaust Systems,* 2007.~~	Deleted reference
~~ANSI B15.1 *Mechanical Power Transmission Apparatus*, 2000.~~	Deleted reference
~~2.3.2 **APA Publication.** American Pyrotechnics Association, P.O. Box 30438, Bethesda, MD 20824.~~	Deleted reference

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~~APA 87-1, *Standard for the Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics*, 2004 edition.~~	Deleted reference
2.3.3 **API Publications.**	
API 607, *Fire Test for Soft-Seated Quarter-Turn Valves,* 6th edition, 2010.	New reference
API BULL 1529, *Aviation Fueling Hose,* 1998.	New reference
~~API BULL 1529, *Aviation Fueling Hose*, 1998.~~	Deleted reference
~~API 607, *Fire Test for Soft-Seated Quarter-Turn Valves*, 1993.~~	Deleted reference
2.3.6 **ASTM Publications.**	
~~ASTM D5/D 5M, *Standard Test Method for Penetration of Bituminous Materials*, 2013.~~	Deleted reference
~~STM D4359, *Standard Test for Determining Whether a Material is a Liquid or a Solid*, 1990 (reaffirmed 2012).~~	Deleted reference
ASTM D5456, *Standard Specification for Evaluation of Structural Composite Lumber Products*, 2014b.	New reference
ASTM ~~E2074~~ E2019, *Standard Test Method for* ~~*Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies*~~ *Minimum Ignition Energy of a Dust Cloud in Air*, ~~2000e1 (withdrawn 2007)~~ 2003 (2007).	Renamed reference
ASTM E2336, *Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems*, 2014.	New reference
ASTM E2768, *Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials (30 min Tunnel Test)*, 2011.	New reference
ASTM F2200, *Standard Specification for Automated Vehicular Gate Construction*, 2014.	New reference
2.3.7 **CGA Publications.**	
CGA M-1, ~~*Guide for Medical Gas Installations at Consumer Sites*~~ *Standard for Medical Gas Supply Systems at Health Care Facilities*, 2013.	Renamed reference
CGA S-1.2, *Pressure Relief Device Standards — Part 2 —* ~~*Cargo and Portable Tanks*~~ *Portable Containers for Compressed Gases,* 2009.	Renamed reference

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CGA-V6, *Standard ~~Cryogenic~~ Bulk Refrigerated Liquid Transfer Connections*, 2008.	Renamed reference
2.3.9 **FM Publications**	
~~*Approval Standard for Safety Containers and Filling, Supply, and Disposal Containers* — Class Number 6051 and 6052, May 1976.~~	Deleted reference
~~ANSI/FM 4880, *American National Standard for Evaluating Insulated Wall or Wall and Roof/Ceiling Assemblies, Plastic Interior Finish Materials, Plastic Exterior Building Panels, Wall/Ceiling Coating Systems, Interior or Exterior Finish Systems*, 2007.~~	Deleted reference
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,* 2010.	New reference
Approval Standard 6921, Containers for Combustible Waste, 2004.	New reference
Approval Standard 6921, ~~Containers for Combustible Waste~~ for Safety Containers and Filling, Supply, and Disposal Containers — Class Number 6051 and 6052, ~~2004.~~, May 1976.	Renamed Reference
2.3.11 **IIAR Publications.**	
ANSI/IIAR 8, *Decommissioning of Closed-Circuit Ammonia Mechanical Refrigerating Systems*, 2015.	New reference
2.3.13 **NBBPVI Publications.**	
~~ANSI/NB23~~ NBBI NB23, *National Board Inspection Code*, 2015.	Re-titled reference
2.3.15 **RVIA Publications.**	
RVIA/ANSI A119.5, ~~Standard for Recreational Park Trailers, 2009.~~ Park Model Recreational Vehicle Standard, 2015.	Renamed reference
2.3.17 **UL Publications.**	
ANSI/UL 8, *Standard for Water Based Agent Fire Extinguishers,* ~~2005, Revised 2009.~~ 2011.	
ANSI/UL 305, *Standard for Safety Panic Hardware*, 1997, revised 2014.	New reference
ANSI/UL 325, *Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems,* 2013.	New reference
UL 647, *Standard for Unvented Kerosene-Fired Room Heaters and Portable Heaters*, 1993.	New reference

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UL 1363, *Standard for Relocatable Power Taps,* 2014.	New reference
UL 1363A, *Outline of Investigation for Special Purpose Relocatable Power Taps*, 2010.	New reference
UL 1564, *Standard for Industrial Battery Chargers,* 2015.	New reference
ANSI/UL 1973, *Standard for Batteries for Use in Light Electric Rail (LER) Applications and Stationary Application*, 2013.	New reference
UL 9540, *Outline of Investigation for Energy Storage Systems and Equipment,* 2014.	New reference
2.3.20 **U.S. Government Publications.**	
~~FAA A/C~~ FAA AC 150/5390-2B, *Heliport Design Advisory Circular*, September 30, 2004.	Re-titled reference
Title 16, Code of Federal Regulations, Part 1500.41, "Method of Testing Primary Irritant Substances."	New reference
~~Title 18, United States Code, "Importation, Manufacture, Distribution and Storage of Explosive Materials," 1970.~~	Deleted reference
~~Title 27, Code of Federal Regulations, Part 555, Bureau of Alcohol, Tobacco, Firearms, and Explosives, U.S. Department of Justice.~~	Deleted reference
Title 29, Code of Federal Regulations, Part 1910.242(b), "Compressed Air Used for Cleaning."	New reference
Title 29, Code of Federal Regulations, Part 1910.1000, "Air Contaminants."	New reference
Title 29, Code of Federal Regulations, ~~Parts~~ Part ~~1910 .1000 and~~ 1910. 1200, "Hazard Communication," ~~U.S. Department of Labor.."~~	Renamed reference
Title 49, Code of Federal Regulations, Part ~~100 to end, U.S. Department of Transportation.~~ 173, "Shippers — General Requirements for Shipments and Packages."	Renamed reference
2.4 **References for Extracts in Mandatory Sections.**	
NFPA 36, *Standard for Solvent Extraction Plants,* 2017 edition.	New reference
~~NFPA 102, *Standard for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures,* 2011 edition.~~	Deleted reference

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NFPA 652, *Standard on the Fundamentals of Combustible Dust,* 2016 edition. NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting,* 2017 edition. NFPA 1730, *Standard on Organization and Deployment of Fire Prevention Inspection and Code Enforcement, Plan Review, Investigation, and Public Education Operations,* 2016 edition.	New reference New reference New reference
Chapter 3 – Definitions	
3.2.10 **Standard.** ~~A document, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an appendix or annex, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.~~ An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides. 3.3.2 **Access Box.** …accessible by the AHJ's master key or control… 3.3.8 **Alarm.** ~~A warning of danger~~. An indication of the existence of a condition that requires immediate response. 3.3.12 **Alternative.** 3.3.14.5 **Indoor Area.** An area that is within a building or structure having overhead cover, other than a structure qualifying as "weather protection" in accordance with Section 6.6 of NFPA 55, ~~*Compressed Gases and Cryogenic Fluids Code*~~ 3.3.14.12 **Spray Area.** Any fully enclosed, partly enclosed, or unenclosed area in which dangerous quantities of flammable or combustible vapors, mists, residues, dusts, or deposits are present due to the operation of spray processes, including (1) any area in the direct path of a spray application process; (2) the interior of a spray booth ~~or~~, spray room, or limited finishing workstation, as herein	

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defined; (3) the interior of any exhaust plenum, eliminator section, or scrubber section; (4) the interior of any exhaust duct or exhaust stack leading from a spray application process; (5) the interior of any air recirculation ~~filter house or enclosure~~, path up to and including ~~secondary~~ recirculation particulate filters; (6) any solvent concentrator (pollution abatement) unit or solvent recovery (distillation) unit; and (7) the inside of a membrane enclosure. The following ~~shall not be considered~~ are not part of the spray area: (1) ~~Fresh~~ fresh air make-up units; (2) ~~Air~~ air supply ducts and air supply plenums; (3) ~~Recirculation~~ recirculation air supply ducts downstream of ~~secondary~~ recirculation particulate filters; and (4) ~~Exhaust~~ exhaust ducts from solvent concentrator (pollution abatement) units. [**33,** ~~2011~~ 2016]

~~3.3.19 **Available Height for Storage.** The maximum height at which commodities can be stored above the floor and still maintain necessary clearance from structural members and the required clearance below sprinklers. [**13,** 2013]~~

3.3.20 **Barricade (Explosives or Fireworks).** A natural or artificial barrier that effectively screens a magazine, building, railway, or highway from the effects of an explosion in a magazine or building containing explosives. [**1124,** 2017]

3.3.20.1 **Artificial Barricade**. An artificial mound or revetted wall of earth of a minimum thickness of 3 ft (0.9 m). [**1124,** 2017]

3.3.20.2 **Natural Barricade**. A natural outdoor feature(s), such as hills or trees, with a density sufficient to prevent surrounding exposures that require protection from being seen from a magazine or building containing explosives when the trees are bare of leaves. [**1124,** 2017]

3.3.42 **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]

3.3.78 **Cultural Resource Properties**. Buildings, structures, or sites, or portions thereof, that are culturally significant, or that house culturally significant collections for museums, libraries, and places of worship. [**914,** ~~2010~~ 2015]

3.3.83 **Deficiency**. For the purposes of inspection, testing, and maintenance of water-based fire protection systems, a condition that will or has the potential to adversely impact the performance of a system or portion thereof but does not rise to the level of an impairment. [**25,** 2017]

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3.3.83.1 **Critical Deficiency**. A deficiency that, if not corrected, can have a material effect on the ability of the fire protection system or unit to function as intended in a fire event. [**25,** 2017]

3.3.83.2 **Noncritical Deficiency**. A deficiency that does not have a material effect on the ability of the fire protection system or unit to function in a fire event, but correction is needed to meet the requirements of this standard or for the proper inspection, testing, and maintenance of the system or unit. [**25,** 2017]

3.3.86 **Desolventizing**. The act of removing a solvent from a material.

3.3.111 **Extraction Room (Marijuana).** The room or space in which the solvent–based extraction process of marijuana occurs.

3.3.127 **Fireworks**. Any composition or device for the purpose of producing a visible or an audible effect for entertainment purposes by combustion, deflagration, or detonation, that meets the definition of *Consumer Fireworks* or *Display Fireworks* as set forth in NFPA 1124. [**1124,** 2017]

3.3.127.1 **Display Fireworks**. Large fireworks devices that are explosive materials intended for use in fireworks displays and designed to produce visible or audible effects by combustion, deflagration, or detonation, as set forth in 27 CFR 555, 49 CFR 172, and APA 87-1, *Standard for the Construction and Approval for Transportation of Fireworks, Novelties, and Theatrical Pyrotechnics*. [**1124,** 2017]

3.3.131* **Flash Point**. The minimum temperature of a liquid at which sufficient vapor is given off to form an ignitible mixture with the air, near the surface of the liquid or within the vessel used, as determined by the appropriate test procedure and apparatus specified in Section 4.4 of NFPA 30, ~~*Flammable and Combustible Liquids Code*~~. [**30,** 2018]

3.3.137.1* **Compressed Gas**. A material, or mixture of materials, that (1) is a gas at 68°F (20°C) or less at an absolute pressure of 14.7 psi (101.3 kPa) and (2) has a boiling point of 68°F (20°C) or less at an absolute pressure of 14.7 psi (101.3 kPa) and that is liquefied, nonliquefied, or in solution, except those gases that have no other health or physical hazard properties are not considered to be compressed until the pressure in the packaging exceeds an absolute pressure of 40.6 psi (280 kPa) at 68°F (20°C). [**55,** 2016]

~~3.3.136.7 **Irritant Gas**. A chemical that is not corrosive, but that causes a reversible inflammatory effect on living tissue by chemical~~

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~~action at the site of contact. A chemical is a skin irritant if, when tested on the intact skin of albino rabbits by the methods of 16 CFR 1500.41, for an exposure of 4 or more hours or by other appropriate techniques, it results in an empirical score of 5 or more. A chemical is classified as an eye irritant if so determined under the procedure listed in 16 CFR 1500.42, or other appropriate techniques. [**55,** 2013]~~

3.3.141 **Gaseous Hydrogen (GH$_2$) System**. ~~A system in which hydrogen is delivered, stored, and discharged in the gaseous form to a piping system. The gaseous hydrogen system terminates at the point where hydrogen at service pressure first enters the distribution piping~~ An assembly of equipment that consists of, but is not limited to, storage containers, pressure regulators, pressure relief devices, compressors, manifolds, and piping and that terminates at the source valve.

~~3.3.175 **Material Safety Data Sheet (MSDS).** Written or printed material concerning a hazardous material that is prepared in accordance with the provisions of OSHA 29 CFR 1910.1200.~~

3.3.176 **Marijuana Extraction Equipment**. Equipment or appliances used for the extraction of botanical material, such as essential oils, from marijuana.

3.3.177 **Marijuana Extraction Facility**. A building used for the solvent-based extraction process of marijuana.

3.3.181* **Mobile or Temporary Cooking**. Any cooking apparatus or equipment operated on a one-time basis, interim basis, or for less than 90 days in the same location, other than at a fixed location, building, or structure that has been inspected and permitted under another section of this *Code*, regulation, or statute.

3.3.185 **Miscella**. A mixture, in any proportion, of the extracted oil or fat and the extracting solvent.

3.3.185.12* **High-Risk Occupancy**. An occupancy that has a history of high frequency of fires, high potential for loss of life or economic loss, or that has a low or moderate history of fires or loss of life but the occupants have a high dependency on the built-in fire protection features or staff to assist in evacuation during a fire or other emergency. [**1730,** 2016]

3.3.185.18* **Low-Risk Occupancy**. An occupancy that has a history of low frequency of fires and minimal potential for loss of life or economic loss. [**1730,** 2016]

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3.3.185.21* **Moderate-Risk Occupancy**. An occupancy that has a history of moderate frequency of fires or a moderate potential for loss of life or economic loss. [**1730,** 2016]

3.3.191 **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.

3.3.191.1* **Organic Peroxide Formulation**. A pure or technically pure organic peroxide or a mixture of organic peroxides with an active oxygen (aO) concentration greater than 1 % alone or in combination with one or more materials ~~in various combinations and concentrations.~~

3.3.192.1* **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]

3.3.224 **Rubberized Asphalt Melter (Melter**). Portable equipment used for the heating of rubberized asphalt material that is a mix of asphalt, rubber polymer, and filler material.

3.3.226 **Safety Data Sheet (SDS).** The document that describes composition of a material, hazardous properties and hazard mitigation, and disposal information. [**400,** 2016]

3.3.232* **Signal**. An indication of a condition communicated by electrical, visible, audible, wireless, or other means. [**72,** 2016]

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]

3.3.242 **Solid Shelving**. ~~Solid shelving~~ Shelving that is fixed in place, slatted, wire mesh, or other type of shelves located within racks. The area of a solid shelf is defined by perimeter aisle or flue space on all four sides or by placement of loads that block openings that otherwise serve as the required flue spaces. Solid shelves having an

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area equal to or less than 20 ft^2 (1.9 m^2) ~~shall be~~ are defined as open racks. Shelves of wire mesh, slats, or other materials more than 50 percent open and where the flue spaces are maintained ~~shall be~~ are defined as open racks. [**13,** 20132016] 3.3.258.1* **Bulk Hydrogen Compressed Gas System.** ~~An assembly of equipment that consists of, but is not limited to, storage containers, pressure regulators, pressure relief devices, compressors, manifolds, and piping, with a storage capacity of more than (5000 scf) (141.6 Nm^3) of compressed hydrogen gas and that terminates at the source valve.~~ A gaseous hydrogen (GH_2) system with a storage capacity of more than 5000 scf (141.6 Nm^3) of compressed hydrogen gas. [**55,** 2016] 3.3.258.3 **Bulk Liquefied Hydrogen System.** ~~An assembly of equipment that consists of, but is not limited to, storage containers, pressure regulators, pressure relief devices, vaporizers, liquid pumps, compressors, manifolds, and piping, with a storage capacity of more than 39.7 gal (150 L) of liquefied hydrogen that terminates at the source valve~~. A liquefied hydrogen (LH_2) system with a storage capacity of more than 39.7 gal (150 L) of liquefied hydrogen. [**55,** 2016] 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] 3.3.274* **Transfilling**. The process of transferring a gas, either in compressed or liquid form from one cylinder or container to another cylinder or container. 3.3.289* **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,** 2018]	
Chapter 4 – General Requirements	
4.5.10.5 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/m^2 for a 20-minute exposure, the peak heat release rate does	

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not exceed 150 kW/m^2 for longer than 10 seconds, and the total heat released does not exceed 8 MJ/m^2. [**5000**:7.1.4.2.3]	
Chapter 5 – Performance-Based Option	
Chapter 6 – Classification of Occupancy	
6.1.8.1.1 **Definition – One- and Two-Family Dwelling Unit.** A building that contains not more than two dwelling units ~~with independent cooking and bathroom facilities~~, each dwelling unit occupied by members of a single family with not more than three outsiders, if any, accommodated in rented rooms. 6.1.13.1 **Definition – Storage Occupancy.** An occupancy used primarily for the storage or sheltering of goods, merchandise, products, or vehicles, ~~or animals~~ 6.1.14.2.3 **Separated Occupancy.** A multiple occupancy where the occupancies are separated by fire ~~resistance-rated assemblies~~ barriers**.** 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-~~resistive assemblies~~ barriers 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 ~~separations~~ separation fire barriers 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 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]	
Chapter 7 – ~~Reserved~~ Emergency Communication and Mass Notification	

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7.1 **Fundamental Requirements**. Every new educational (K-12) and college-university building shall conduct a risk analysis and prepare an emergency response plan for the emergency communications and mass notification needs. 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~~ 7.2.1 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~~ response plan in accordance with *NFPA 72* shall be used for the design of the mass notification and emergency communication systems.	
Chapter 8 – Reserved	
Chapter 9 – Reserved	
Chapter 10 – General Safety Requirements	
10.2.7 **Minimum Fire Prevention Inspection Frequencies for Existing Occupancies** 10.2.7.1 Fire Prevention inspections shall occur on existing premises in accordance with the minimums inspection frequency schedule specified in Table 10.2.7.1 Table 10.2.7.1 **Minimum Inspection Frequency.** 10.2.7.2 Where required or permitted by the AHJ, the required fire prevention inspection shall be conducted by an approved party that is qualified in accordance with NFPA 1031. 10.2.7.3 The AHJ shall be permitted to approve alternative qualifications for the approved party specified in 10.2.7.2	See NFPA 1 for full table

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10.2.7.4 The provisions of 10.2.7 shall not apply to detached one- and two-family dwellings or townhomes.

10.8.2.1 Emergency action plans shall include the following:

10.10.10 **Discontinuance.** 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.

10.11.1.2 Address numbers shall be a minimum of 4 in. (100 mm) high with a minimum stroke width of ½ in. (13 mm).

10.11.1.3 Telecommunications equipment utilized to communicate address data to E911 communication centers shall be programmed and maintained to accurately convey such address information to the E911 communication center

10.11.1.4 The assignment of addresses to buildings shall be in accordance with a method approved by the AHJ

10.11.1.5 Addresses shall not be changed unless approved by that AHJ

10.11.1.6 Address numbers for suites within a multiple tenant building or complex shall be individually identified in a manner approved by the AHJ

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

10.14.3.3.3.2 Prior to issuance of the certificate of occupancy, the ~~persons performing the life safety evaluations~~ 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

10.14.3.4.2 **Life Safety Narrative.**
(3) Principal fire and life safety safety features/strategies for the building, including the following, as applicable:
(a) Egress

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(b) Access Control
(c) Fire barriers, smoke barriers, and smoke partitions
(d) ~~Sprinkler protection~~ Fire suppression systems
…….
(f) Fire detection and alarm ~~– visual and audible~~
…….
(h) Emergency elevator operation
…….
(l) Fire/emergency command center

10.14.3.4.3 **Life Safety Floor Plans.**
(1) Occupancy load, exit location, ~~exit~~ egress capacity, main entrance/exit~~/entry~~, horizontal exits, travel distance and exit discharge
(2) Fire ~~and smoke barriers~~ barriers, smoke barriers, and smoke partitions
……
(6) Unprotected vertical openings~~, including atriums, communicating spaces, and convenience openings~~
(7) Event planning….
(d) Occupant load, ~~exit~~ egress capacity required…
……
(f) Plan and/or section drawing indicating ~~areas~~ where ~~the roof construction is more than 50 feet and limits of~~ sprinkler protection. is omitted

10.14.3.4.4 **Engineering Analysis and Calculations.** ~~An~~ Where active or passive smoke control is used, an engineering analysis ~~and calculations~~ shall be provided ~~with~~ and shall include the following:
(1) Smoke protection ~~calculations~~ analysis 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~~ control air requirements per NFPA 92
(3) ~~Smoke maintained at a level six ft above the floor of the means of egress~~ Smoke control assumptions, such as fire scenario description, fire size quantification, and smoke development/smoke movement analysis
(4) Proposed testing protocol for smoke control system and pass/fail criteria
~~Calculations for performance-based design methods accepted by the AHJ~~
~~Smoke and fire modeling~~
10.14.3.5.4.3 The life safety building systems document in accordance with 10.14.3.4 shall be permitted to be used, ~~but~~ and

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additionally the life safety building systems reference guide shall include the following:, as applicable:

……..

(7) Management-level ~~(lay)~~ sequencing charts for alarm and emergency communication systems, the manual, or override options/instructions that include the following:

…….

(c) 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

……..

(13) Locations and capacities of ~~"Safe Haven"~~ areas of refuge and other safe areas

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:

……

(2) ~~The AHJ shall provide guidance as needed, but approval~~ Approval of the AHJ for the specific facility management plan shall occur prior to such event.

10.18.3.2 The clearance between the deflector and the top of storage shall be 18 in. (~~457~~ 450 mm) or greater. [**13:**8.6.6.1]

10.18.3.3 The 18 in. (~~457~~ 450 mm) dimension shall not limit the height of shelving on a wall or shelving against a wall in accordance with ~~10.19.3~~ 10.18.3, of this *Code*, and 8.7.6, 8.8.6, and Section 8.9 of NFPA 13. [**13:**8.6.6.2]

10.18.3.3.1 Where shelving is installed on a wall and is not directly below sprinklers, the shelves, including storage thereon, shall be permitted to extend above the level of a plane located 18 in. (~~457~~ 450 mm) below ceiling sprinkler deflectors. [**13:**8.6.6.2.1]

10.18.3.3.2 Shelving, and any storage thereon, directly below the sprinklers shall not extend above a plane located 18 in. (~~457~~ 450 mm) below the ceiling sprinkler deflectors. [**13:**8.6.6.2.2]

10.19.1 Structures intended as children's playgrounds installed indoors and ~~that which exceed~~ exceeding 10 ft (3.1 m) in height ~~and~~ or 160 ft^2 (14.9 m^2) in area shall comply with the specifications in 10.19.1.1 through 10.19.1.4.

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10.19.1.1 Indoor children's playground structures shall be constructed of noncombustible materials or of combustible materials that comply with the following: …. (9) The floor covering within the children's playground structure shall exhibit a Class I interior floor finish classification, as described in Chapter 10 of NFPA *101*, when tested in accordance with NFPA 253 ~~*Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source*~~ or with ASTM E648, *Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source*.	
Chapter 11 – Building Services	
11.1.4.1 Relocatable power taps shall be ~~of the polarized or grounded type with overcurrent protection and shall be listed.~~ listed to UL 1363, *Standard for Relocatable Power Taps,* or UL 1363A, *Outline of Investigation for Special Purpose Relocatable Power Taps*, where applicable. 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~~, and shall comply with Section 11.5 and NFPA 31, *Standard for the Installation of Oil-Burning Equipment.*~~ [**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, ~~and shall comply with Section 11.5 and NFPA 31, *Standard for the Installation of Oil-Burning Equipment.*~~ [**31:**1.1.3] 11.5.1.10.2 ~~Crankcase oil or used oil shall not be used as fuel unless all of the following conditions are met~~ 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: 11.5.2.3 ~~Only listed kerosene~~ Kerosene heaters shall be ~~used. The~~ listed and labeled in accordance with UL 647, *Standard for Unvented Kerosene-Fired Room Heaters and Portable Heaters*, and their use shall meet all of the following: (1) ~~Provide adequate~~ Adequate ventilation shall be provided. (2) ~~Do~~ Kerosene heaters shall not ~~place~~ be placed on carpeting. (3) ~~Keep~~ Kerosene heaters shall be located not less than 3 ft (0.9 m) ~~away~~ from combustible furnishings ~~or~~ and drapes (4) ~~Use only~~ Only approved Type 1-K water clear kerosene shall be used	All sections replace the original sections in the 1015 edition that are labeled as 11.12.2.1.1 to 11.12.3

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(5) ~~Allow~~ Kerosene heaters shall be allowed to cool before refueling.

11.9.3 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.

~~11.12.2.1.1 **Main Service Disconnect Marking**. A label shall be permanently affixed to the main service disconnect panel serving alternating current (ac) and direct current (dc) photovoltaic systems. The label shall be red with white capital letters at least 3⁄4 in. (19 mm) in height and in a nonserif font, to read: "WARNING: PHOTOVOLTAIC POWER SOURCE." The materials used for the label shall be reflective, weather resistant, and suitable for the environment.~~

~~11.12.2.1.2 **Circuit Disconnecting Means Marking**. A permanent label shall be affixed adjacent to the circuit breaker controlling the inverter or other photovoltaic system electrical controller serving ac and dc photovoltaic systems. The label shall have contrasting color with capital letters at least 3⁄8 in. (10 mm) in height and in a nonserif font, to read: "PHOTOVOLTAIC DISCONNECT." The label shall be constructed of durable adhesive material or other approved material.~~

~~11.12.2.1.3 **Conduit, Raceway, Enclosure, Cable Assembly, and Junction Box Markings**. Marking shall be required on all interior and exterior dc conduits, raceways, enclosures, cable assemblies, and junction boxes.~~

~~11.12.2.1.3.1 **Marking Locations**. Marking shall be placed on all dc conduits, raceways, enclosures, and cable assemblies every 10 ft (3048 mm), at turns, and above and below penetrations. Marking shall be placed on all dc combiner and junction boxes.~~

~~11.12.2.1.3.2 **Marking Content and Format**. Marking for dc conduits, raceways, enclosures, cable assemblies, and junction boxes shall be red with white lettering with minimum 3⁄8 in. (10 mm) capital letters in a nonserif font, to read: "WARNING: PHOTOVOLTAIC POWER SOURCE." Marking shall be reflective, weather resistant, and suitable for the environment.~~

~~11.12.2.1.4 **Secondary Power Source Markings**. Where photovoltaic systems are interconnected to battery systems, generator backup systems, or other secondary power systems,~~

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~~additional signage acceptable to the AHJ shall be required indicating the location of the secondary power source shutoff switch.~~

~~11.12.2.1.5 **Installer Information**. Signage, acceptable to the AHJ, shall be installed adjacent to the main disconnect indicating the name and emergency telephone number of the installing contractor.~~

~~11.12.2.1.6 **Inverter Marking**. Markings shall not be required for inverters.~~

11.12.2.1.1* **Rapid Shutdown Marking**. Buildings with a PV system shall be provided with permanent labels as described in 11.12.2.1.1.1 through 11.12.2.1.1.7.

11.12.2.1.1.1 **Rapid Shutdown Type**. The type of PV system rapid shutdown shall be labeled as described in 11.12.2.1.1.1(A) or 11.12.2.1.1.1(B).

(A) For PV systems that shut down the array and conductors leaving the array:

EMERGENCY RESPONDER:
THIS SOLAR PV SYSTEM IS EQUIPPED WITH RAPID SHUTDOWN
TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION
TO SHUT DOWN ENTIRE PV SYSTEM

(B) For PV systems that only shut down conductors leaving the array:

EMERGENCY RESPONDER:
THIS SOLAR PV SYSTEM IS EQUIPPED WITH RAPID SHUTDOWN
TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION.
ONLY CONDUCTORS INSIDE BUILDING OR OFF THE ROOF WILL SHUT DOWN

11.12.2.1.1.2 The label shall be reflective, with all letters capitalized and having a minimum height of 3⁄8 in. (9.5 mm), in white on a red background.

11.12.2.1.1.3 The label shall include a simple diagram of a building with a roof. Diagram sections in red shall signify sections of the PV system that are not shut down when the rapid shutdown switch is operated. Sections of the diagram in green shall signify sections of the PV system that are shut down when the rapid shutdown switch is operated.

11.12.2.1.1.4 The rapid shutdown label shall be located on or no more than 3 ft (1 m) from the service disconnecting means to which the PV systems are connected, and the label shall indicate the location of the rapid shutdown switch if it is not at the same location.

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11.12.2.1.1.5 **Buildings with More Than One Rapid Shutdown Type**. For buildings that have PV systems with both rapid shutdown types, or a rapid shutdown type and a PV system with no rapid shutdown, a detailed plan view diagram of the roof shall be provided showing each PV system and a dotted line around areas that remain energized after the rapid shutdown switch is operated.

11.12.2.1.1.6 **Rapid Shutdown Switch**. The rapid shutdown switch shall have a label located on or no more than 3 ft (1 m) from the switch that includes the following words:

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

11.12.2.1.1.7 The label required by 11.12.2.1.1.6 shall be reflective, with all letters capitalized and having a minimum height of 3⁄8 in. (9.5 mm), in white on red background. [**70:**690.56(C)]

11.12.2.1.2 Each PV system disconnecting means shall be permanently marked to identify it as a PV system disconnect and shall indicate whether in the open or closed position. [**70:**690.13(B)]

11.12.2.1.3 **Markings for Direct-Current Photovoltaic Source and Direct-Current Output Circuits on or Inside a Building**. The following wiring methods and enclosures that contain PV power source conductors shall be marked with the words WARNING: PHOTOVOLTAIC POWER SOURCE by means of permanently affixed labels or other approved permanent marking:

(1) Exposed raceways, cable trays, and other wiring methods
(2) Covers or enclosures of pull boxes and junction boxes
(3) Conduit bodies in which any of the available conduit openings are unused [**70:**690.31(G)(3)]

11.12.2.1.3.1 **Marking Locations and Methods**. The labels or markings shall be visible after installation. The labels shall be reflective and shall have all letters capitalized with a minimum height of 3⁄8 in. (9.5 mm) white on red background. PV power circuit labels shall appear on every section of the wiring system that is separated by enclosures, walls, partitions, ceilings, or floors. Spacing between labels or markings, or between a label and a marking, shall not be more than 10 ft (3 m). Labels required by this section shall be suitable for the environment where they are installed. [**70:**690.31(G)(4)]

11.12.2.1.4 **Secondary Power Source Markings**. A permanent plaque or directory, denoting all electric power sources on or in the premises, shall be installed at each service equipment location and at locations of all electric power production sources capable of being interconnected. [**70:**705.10]

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11.12.2.1.5 **Installer Information**. A label shall be installed adjacent to the main disconnect indicating the name and emergency telephone number of the company currently servicing the PV system. 11.12.2.2 **Roof Access.** 11.12.2.2.1 **General**. Access and spacing requirements shall be required to provide emergency access to the roof, provide pathways to specific areas of the roof, provide for smoke ventilation opportunity areas, and to provide emergency egress from the roof. The AHJ shall be permitted to reduce or modify roof access based upon fire department ventilation procedures or alternative methods that ensure adequate fire department access, pathways, and smoke ventilation. 11.12.2.2.2 **One- and Two-Family Dwellings and Townhouses**. Photovoltaic systems installed in one- and two-family dwellings and townhouses shall provide roof access in accordance with 11.12.2.2.2. Designation of ridges shall not apply to roofs with 2 in 12 or less pitch. 11.12.2.2.2.1 **Pathways**. Not less than two 36 in. (914 mm) wide pathways on separate roof planes, from gutter to ridge, shall be provided on all buildings. One pathway shall be provided on the street or driveway side of the roof. For each roof plane with a PV array, a 36 in. (914 mm) wide pathway from gutter to ridge shall be provided on the same roof plane as the PV array, on an adjacent roof plane or straddling the same and adjacent roof planes. Pathways shall be located in areas with minimal obstructions such as vent pipes, conduit, or mechanical equipment. 11.12.2.2.2.2 For PV arrays occupying up to 33 percent of the plan view roof area, a minimum 18 in. (457 mm) pathway shall be provided on either side of a horizontal ridge. For PV arrays occupying more than 33 percent of the plan view roof area, a minimum of 36 in. (914 mm) pathway shall be provided on either side of a horizontal ridge. 11.12.2.2.2.3 **Buildings Other Than One- and Two-Family Dwellings and Townhouses**. Photovoltaic systems installed on any building other than one- and two-family dwellings and townhouses shall provide roof access in accordance with 11.12.2.2.2.3. Where the AHJ determines that the roof configuration is similar to a one- and two-family dwelling or townhouse, the AHJ shall allow the roof access requirements of 11.12.2.2.2. Detached, nonhabitable structures including, but not limited to, parking shade structures, carports,	

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solar trellises, and similar structures shall not be required to provide roof access.

(A) **Perimeter Pathways**. A minimum 4 ft (1219 mm) wide perimeter pathway shall be provided around the edges of the roof for buildings with a length or width of 250 ft (76.2 m) or less along either axis. A minimum 6 ft (1829 mm) wide perimeter pathway shall be provided around the edges of the roof for buildings having length or width greater than 250 ft (76.2 m) along either axis.

(B) **Other Pathways**. Pathways shall be over areas capable of supporting fire fighters accessing the roof and shall be provided between array sections as follows:

(1) Pathways shall be provided in a straight line 48 in. (1219 mm) or greater in width to all ventilation hatches, and roof standpipes.

(2) Pathways shall be provided 48 in. (1219 mm) or greater in width around roof access hatches with at least one 48 in. (1219 mm) or greater in width pathway to the parapet or roof edge.

(3) Pathways shall be provided at intervals no greater than 150 ft (46 m) throughout the length and width of the roof.

(C) **Smoke Ventilation.** A pathway shall be provided 48 in. (1219 mm) or greater in width bordering all sides of nongravity-operated smoke and heat vents. Ventilation options between array sections shall be one of the following:

(1) A pathway 96 in. (2438 mm) or greater in width

(2) A pathway 48 in. (1219 mm) or greater in width and bordering on existing roof skylights or gravity-operated dropout smoke and heat vents on not less than one side

(3) A pathway 48 in. (1219 mm) or greater in width and bordering 48 in. (1219 mm) by 96 in. (2438 mm) venting cutouts options every 20 ft (6096 mm)

(D) **Minimizing Obstructions in Pathways.** Pathways shall be located in areas with minimal obstructions such as vent pipes, conduit, or mechanical equipment to reduce trip hazards and maximize ventilation opportunities.

~~11.12.2.2 **Access, Pathways, and Smoke Ventilation**.~~

~~11.12.2.2.1 **General**. Access and spacing requirements shall be required to provide emergency access to the roof, provide pathways to specific areas of the roof, provide for smoke ventilation opportunity areas, and to provide emergency egress from the roof.~~

~~11.12.2.2.1.1 **Exceptions**.~~

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~~The AHJ shall be permitted to grant exceptions where access, pathway, or ventilation requirements are reduced due to any of the following circumstances:~~

- ~~Proximity and type of adjacent exposures~~
- ~~Alternative access opportunities, as from adjoining roofs~~
- ~~Ground level access to the roof~~
- ~~Adequate ventilation opportunities beneath photovoltaic module arrays~~
- ~~Adequate ventilation opportunities afforded by module set back from other rooftop equipment~~
- ~~Automatic ventilation devices~~
- ~~New technologies, methods, or other innovations that ensure adequate fire department access, pathways, and ventilation opportunities~~

~~11.12.2.2.1.2 **Pitch**. Designation of ridge, hip, and valley shall not apply to roofs with 2-in-12 or less pitch.~~

~~11.12.2.2.1.3 **Roof Access Points**. Roof access points shall be defined as areas where fire department ladders are not placed over openings (windows or doors), are located at strong points of building construction, and are in locations where they will not conflict with overhead obstructions (tree limbs, wires, or signs).~~

~~11.12.2.2.2 **One- and Two-Family Dwellings and Townhouses**. Photovoltaic systems installed in one- and two-family dwellings and townhouses shall be in accordance with this section.~~

~~11.12.2.2.2.1 **Access and Pathways**.~~

~~11.12.2.2.2.1.1 **Hip Roof Layouts**. Photovoltaic modules shall be located in a manner that provides a 3 ft (914 mm) wide clear access pathway from the eave to the ridge of each roof slope where the photovoltaic modules are located. The access pathway shall be located at a structurally strong location of the building, such as a bearing wall.~~
~~*Exception: The requirement of 11.12.2.2.2.1.1 shall not apply where adjoining roof planes provide a 3 ft (914 mm) wide clear access pathway.*~~

~~11.12.2.2.2.1.2 **Single Ridge Layouts**. Photovoltaic modules shall be located in a manner that provides two 3 ft (914 mm) wide access pathways from the eave to the ridge on each roof slope where the modules are located.~~

~~11.12.2.2.2.1.3 **Hip and Valley Layouts**. Photovoltaic modules shall be located no closer than 11/2 ft (457 mm) to a hip or valley if modules are to be placed on both sides of the hip or valley. Where~~

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~~modules are located on only one side of a hip or valley of equal length, the photovoltaic modules shall be allowed to be placed directly adjacent to the hip or valley.~~

~~11.12.2.2.2.2 **Ridge Setback**. Photovoltaic modules shall be located not less than 3 ft (914 mm) below the ridge.~~

~~11.12.2.2.3 B**uildings Other Than One- and Two-Family Dwellings and Townhouses**. Photovoltaic energy systems installed in any building other than one- and two-family dwellings and townhouses shall be in accordance with this section. Where the AHJ determines that the roof configuration is similar to a one- and two-family dwelling or townhouse, the AHJ shall allow the requirements of 11.12.2.2.2.~~

~~11.12.2.2.3.1 **Access**. A minimum 4 ft (1219 mm) wide clear perimeter shall be provided around the edges of the roof for buildings with a length or width of 250 ft (76.2 m) or less along either axis. A minimum 6 ft (1829 mm) wide clear perimeter shall be provided around the edges of the roof for buildings having length or width greater than 250 ft (76.2 m) along either axis.~~

~~11.12.2.2.3.2 **Pathways**. Pathways shall be established as follows:~~

- ~~Pathways shall be over areas capable of supporting the live load of fire fighters accessing the roof.~~
- ~~Centerline axis pathways shall be provided in both axes of the roof.~~
- ~~Centerline axis pathways shall run where the roof structure is capable of supporting the live load of fire fighters accessing the roof.~~
- ~~Pathways shall be in a straight line not less than 4 ft (1219 mm) clear to skylights, ventilation hatches, and roof standpipes.~~
- ~~Pathways shall provide not less than 4 ft (1219 mm) clear around roof access hatches with at least one not less than 4 ft (1219 mm) clear pathway to the parapet or roof edge.~~

~~11.12.2.2.3.3 **Smoke Ventilation**. Ability for fire department smoke ventilation shall be provided in accordance with this section.~~

~~11.12.2.2.3.3.1 **Maximum Array**. Arrays of photovoltaic modules shall be no greater than 150 ft (45.7 m) × 150 ft (45.7 m) in distance in either axis.~~

~~11.12.2.2.3.3.2 **Ventilation Options**. Ventilation options between array sections shall be one of the following:~~

- ~~A pathway 8 ft (2438 mm) or greater in width~~

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~~- A pathway 4 ft (1219 mm) or greater in width and bordering on existing roof skylights or ventilation hatches~~ ~~- A pathway 4 ft (1219 mm) or greater in width and bordering 4 ft (1219 mm) × 8 ft (2438 mm) venting cutouts options every 20 ft (6096 mm) on alternating sides of the pathway~~ ~~11.12.2.2.4 **Location of Direct Current (DC) Conductors.**~~ ~~11.12.2.2.4.1 Exterior-mounted dc conduits, wiring systems, and raceways for photovoltaic circuits shall be located as close as possible to the ridge, hip, or valley and from the hip or valley as directly as possible to an outside wall to reduce trip hazards and maximize ventilation opportunities.~~ ~~11.12.2.2.4.2 Conduit runs between subarrays and to dc combiner boxes shall be designed to take the shortest path from the array to the dc combiner box.~~ ~~11.12.2.2.4.3 DC combiner boxes shall be located so that conduit runs are minimized in the pathways between arrays.~~ ~~11.12.2.2.4.4 DC wiring shall be run in metallic conduit or raceways where located within enclosed spaces in a building.~~ ~~11.12.2.2.4.4.1 Where dc wiring is run perpendicular or parallel to load-bearing members, a minimum 10 in. (254 mm) space below roof decking or sheathing shall be maintained.~~ 11.12.3.2 ~~Noncombustible Base~~ **Vegetation Management Plan.** A ~~gravel base~~ vegetation management plan or ~~other~~ noncombustible base acceptable to the AHJ shall be ~~installed~~ approved and maintained under and around the installation where required by the AHJ.	
Chapter 12 – Features of Fire Protection	
12.3.3 **Maintenance of Fire-Resistive Construction, Draft-Stop Partitions, and Roof Coverings** 12.4.5 Section 12.4 shall not cover fire resistance ~~rated~~ glazing materials and horizontally sliding accordion or folding assemblies fabricated for use as walls and tested as wall assemblies in accordance with ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials,* or ANSI/UL 263, *Standard for Fire Tests of Building Construction and Materials*. 12.4.6.2 The requirements of Section 12.4 shall apply to new and existing installations. [**80:**5.1.1.2]	

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12.4.6.3.3 **Prevention of Door Blockage**.

12.4.6.3.3.1 Door openings and their surrounding areas shall be kept clear of anything that could obstruct or interfere with the free operation of the door. [**80:**5.1.2.3.2]

12.4.6.3.3.2 Where necessary, a barrier shall be built to prevent the piling of material against sliding doors. [**80:**5.1.2.3.2]

12.4.6.3.3.3 Blocking or wedging of doors in the open position shall be prohibited. [**80:**5.1.2.3.3]

12.4.6.5 **Field Labeling**.

12.4.6.5.1 Field labeling shall be performed only by individuals or companies that have been certified or listed, or by individuals or companies that are representatives of a labeling service that maintains periodic inspections of production of labeled equipment or materials and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner. [**80:**5.1.4.1]

12.4.6.5.2 Individuals performing the service shall provide proof of qualifications to the authority having jurisdiction prior to performing work, as described in 12.4.6.5.1. [**80:**5.1.4.2]

12.4.6.5.3 At a minimum, field labels shall contain the following information:

(1) The words “field inspected” or “field labeled”
(2) The words “fire door” or “fire door frame”
(3) The marking of a third-party certification agency
(4) The fire protection rating
(5) A unique serial number (if provided by the listing agency)
(6) The fire test standard designation to which the assembly was tested

[**80:**5.1.4.3]

12.4.6.5.4 Field modifications shall not be permitted to be made to a non-fire-rated door assembly to achieve a fire rating unless the field modification is completed under label service. [**80:**5.1.4.4]

12.4.6.5.5 Doors in which a field modification in accordance with 5.1.4.4 has been completed shall be labeled. [**80:**5.1.4.5]

12.4.6.5.6 When an opening with a non-fire-rated door requires a fire door, the door assembly shall be replaced. [**80:**5.1.4.6]

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12.4.6.8.2.5 Upon completion of maintenance work, fire door assemblies shall be inspected and tested in accordance with ~~5.2.3 of NFPA 80~~ 12.4.6.8.3. [**80:**5.2.2.5] 12.4.6.8.3.4 A record of these inspections and testing shall be made in accordance with ~~5.2.2 of NFPA 80~~ 12.4.6.8.2. [**80:**5.2.3.4] 12.4.6.8.3.6.2 ~~The~~ At a minimum, the following items shall be verified: 12.4.6.11.6 If repairs cannot be made with labeled components or parts obtained from the original manufacturer or retrofitted in accordance with ~~12.4.6.9~~ Section 5.3 of NFPA 80, the fire door frame, fire door assembly, or appurtenances shall be replaced. [**80:**5.5.6] 12.4.6.11.7 When fastener holes are left in a door or frame due to changes or removal of hardware or plant-ons, the holes shall be repaired by the following methods: …….. (3) Fill holes with material listed for this use and installed in accordance with the manufacturer's procedures 12.4.6.11.8 Holes, other than those as described by 12.4.6.9.7, shall be treated as a field modification in accordance with 12.4.6.4. [**80:**5.5.8] 12.4.6.11.9* Upon completion of maintenance work, fire door assemblies shall be inspected and tested in accordance with 12.4.6.6.3. A record of these inspections and testing shall be made in accordance with 12.4.6.6.2. A record of maintenance performed on existing fire door assemblies shall be provided that includes the following information: (1) Date of maintenance (2) Name of facility (3) Address of facility (4) Name of person(s) performing maintenance (5) Company name and address of maintenance personnel (6) Signature of maintenance personnel performing the work (7) Individual listings of each inspected and tested fire door assembly (8) Opening identifier and location of each repaired fire door assembly (9) Type and description of each repaired fire door assembly (10) Description or listing of the work performed on each fire door assembly [**80:**5.5.9]	Many of these sections were not "deleted," but rearranged with different section numbers to accommodate for new additions to the code

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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.~~ 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
~~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:~~

- ~~The wall or ceiling surface is a noncombustible or limited combustible material.~~
- ~~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***:10.2.1.2]~~
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

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~~. Lockers shall be considered interior finish. [***101***:10.2.1.3]

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 12.5.3 through 12.5.4.7.2 shall not apply~~. Washroom water closet partitions shall be considered interior finish

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.~~ Fire-retardant coatings shall be in accordance with 12.5.7

12.5.2.6 ~~Lockers constructed of combustible materials shall be considered interior finish. [***101***:10.2.1.6]~~

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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)*~~ 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*~~ 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/cm^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/cm^2

[***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~~. 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 12.5.4.2, except as indicated in 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] ~~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 ASTM E84, or ANSI/UL 723. [***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

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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**. ~~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]~~ 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 m^2.

[***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**. ~~For fire-retardant coatings, see 12.5.7. [***101***:10.2.3.3]~~ 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:

(1) Class A: Flame spread index 0–25; smoke developed index 0–450.
(2) Class B: Flame spread index 26–75; smoke developed index 0–450.
(3) 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. [***101***:10.2.3.3.1]

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. [***101***:10.2.3.3.2]

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. [***101***:10.2.3.3.3]

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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. [***101***:10.2.3.4]

12.5.4.5 Materials described in 12.5.5 shall be tested as described in the corresponding sections. [***101***:10.2.3.5]

~~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 accordance with 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 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]~~

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~~12.5.4.6 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]~~

~~12.5.4.6.1 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]~~

~~12.5.4.6.2 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~~.

~~[***101:***10.2.3.7.2]~~

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. [***101:***10.2.4]

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]

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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 12.5.5.3.3.1. [***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 m^2)
(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***:10.2.4.3.3.1]

12.5.5.3.3.2* The tests shall be performed on a finished foamed plastic assembly related to the actual end-use configuration,

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including any cover or facing, and at the maximum thickness intended for use. [***101***:10.2.4.3.3.2]

12.5.5.3.4 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/ft^3 (320 kg/m^3) 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]

12.5.5.4* **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]

12.5.5.4.1* 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 m^2.

[***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.

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(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
(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:**10.2.4.6]

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*

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Burning Characteristics, and used on the ceilings of rooms or areas protected by an approved automatic sprinkler system [***101***:10.2.4.7]

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***:10.2.4.8.1]

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***:10.2.4.8.2]

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**.

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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] 12.5.5.12.2 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]	

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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 3.3.116.2, 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**.

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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]

~~12.5.6 **Specific Materials**.~~

~~12.5.6.1 **Textile Wall and Textile Ceiling Materials**. The use of textile materials on walls or ceilings shall comply with one of the following conditions:~~

- ~~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*~~

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~~*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.~~

- ~~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.~~
- ~~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.~~
- ~~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.~~
- ~~Textile materials shall be permitted on walls and partitions where tested in accordance with NFPA 265. *(See 12.5.4.7.)*~~
- ~~Textile materials shall be permitted on walls, partitions, and ceilings where tested in accordance with NFPA 286. *(See 12.5.4.7.)*~~

~~[***101:***10.2.4.1]~~

~~12.5.6.2 **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:~~

- ~~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.~~

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- ~~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.~~
- ~~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.~~
- ~~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.~~
- ~~Materials shall be permitted on walls and partitions where tested in accordance with NFPA 265. *(See 12.5.4.7.)*~~
- ~~Materials shall be permitted on walls, partitions, and ceilings where tested in accordance with NFPA 286. *(See 12.5.4.7.)*~~

~~[***101:***10.2.4.2]~~

~~12.5.6.3 **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:***10.2.4.3]~~

~~12.5.6.3.1 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]~~

~~12.5.6.3.1.1 One of the following fire tests shall be used for assessing the combustibility of cellular or foamed plastic materials as interior finish:~~

- ~~NFPA 286 with the acceptance criteria of 12.5.4.7.2.~~
- ~~ANSI/UL 1715, *Standard for Fire Test of Interior Finish Material* (including smoke measurements, with total smoke release not to exceed 1000 m^2)~~
- ~~ANSI/UL 1040, *Standard for Fire Test of Insulated Wall Construction*~~
- ~~ANSI/FM 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*~~

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~~[***101:***10.2.4.3.1.1]~~

~~12.5.6.3.1.2 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]~~

~~12.5.6.3.1.3 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/FM 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]~~

~~12.5.6.3.2 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^3 (320 kg/m^3) 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]~~

~~12.5.6.4 **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]~~

~~12.5.6.5 **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]~~

~~12.5.6.6 **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]~~

~~12.5.6.7 **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~~

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~~shall be performed on a finished assembly and on the maximum thickness intended for use. [***101:***10.2.4.7]~~

~~12.5.6.8 **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]~~

~~12.5.6.9 **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 for 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]~~

~~12.5.7 **Trim and Incidental Finish**.~~

~~12.5.7.1 **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]~~

~~12.5.7.2 **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]~~

~~12.5.7.3 **Bulletin Boards, Posters, and Paper**.~~

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~~12.5.7.3.1 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]~~

~~12.5.7.3.2 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]~~

~~12.5.8 **Fire-Retardant Coatings**.~~

~~12.5.8.1 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]~~

~~12.5.8.2 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]~~

~~12.5.8.3 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]~~

~~12.5.9 **Interior Floor Finish Testing and Classification**.~~

~~12.5.9.1 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]~~

~~12.5.9.2 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/cm^2. [***101:***10.2.7.2]~~

~~12.5.9.3 Interior floor finishes shall be classified in accordance with 12.5.9.4, 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]~~

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~~12.5.9.4 Interior floor finishes shall be grouped in the classes specified in 12.5.9.4.1 and 12.5.9.4.2 in accordance with the critical radiant flux requirements. [***101:***10.2.7.4]~~

~~12.5.9.4.1 **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 12.5.9.3. [***101:***10.2.7.4.1]~~

~~12.5.9.4.2 **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 12.5.9.3. [***101:***10.2.7.4.2]~~

~~12.5.9.5 Wherever the use of Class II interior floor finish is required, Class I interior floor finish shall be permitted. [***101:***10.2.7.5]~~

12.5.8* 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/cm^2. [***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/cm^2, 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/cm^2, but less than 0.45 W/cm^2, 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**.

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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 12.5.9.2 shall apply. [***101***:10.2.8.2]

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 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]

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:

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(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 of *NFPA 101*, 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.

[***101***:10.3.3.1]

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.

[***101***:10.3.3.2.1]

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]

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12.6.4* Furnishings or decorations of an explosive or highly flammable character shall not be used. [***101***:10.3.4]

12.6.5 Fire-retardant coatings shall be maintained to retain the effectiveness of the treatment under service conditions encountered in actual use. [***101***:10.3.5]

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/m^2 when tested at an incident heat flux of 50 kW/m^2 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*

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Metal Waste Paper Containers, and shall be provided with a noncombustible lid. [***101***:10.3.8.2]

~~12.6 **Contents and Furnishings**.~~

~~12.6.1 Furnishings, contents, decorations, and treated finishes in buildings and structures shall meet the requirements of NFPA *101* and this *Code*.~~

~~12.6.2 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 **Smoldering Ignition of Upholstered Furniture and Mattresses**.~~

~~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 11/2in. (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]~~

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~~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]~~

~~12.6.6 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 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]~~

~~12.6.7 **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:***10.3.8.1]~~

~~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]~~

12.7.2* Fire barriers shall comply with one of the following:

(1) The fire barriers are continuous from outside wall to outside wall or from one fire barrier to another, or a combination thereof, including continuity through all concealed spaces, such as those found above a ceiling, including interstitial spaces.

(2) The fire barriers are continuous from outside wall to outside wall or from one fire barrier to another, and from the floor to the bottom of the interstitial space, provided that the construction assembly forming the bottom of the interstitial

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space has a fire resistance rating not less than that of the fire barrier.
[***101***:8.3.1.2]

12.7.3 Walls used as fire barriers shall comply with Chapter 7 of NFPA 221. The NFPA 221 limitation on percentage width of openings shall not apply. [***101***:8.3.1.3]

12.7.4 **Smoke Barrier Used as a Fire Barrier**. A smoke barrier shall be permitted to be used as a fire barrier, provided that it meets the requirements of Section 8.3 of NFPA *101*. [***101***:8.3.1.4]

~~12.7.5.1.2 New fire resistance–rated glazing shall bear the identifier "W-XXX" where "XXX" is the fire resistance rating in minutes. Such identification shall be permanently affixed. [***101***:8.3.2.1.2]~~

12.7.6 ~~Fire Doors and Windows~~. Opening Protectives.

12.7.6.1 **General**. ~~Openings required to have a fire protection rating by Table 12.7.4.2 shall be protected by approved, listed, labeled fire door assemblies and fire window assemblies and their accompanying hardware, including all frames, closing devices, anchorage, and sills in accordance with the requirements of Section 12.4, except as otherwise specified in this *Code*. [***101***:8.3.3.1]~~ Every opening in a fire barrier shall be protected to limit the spread of fire from one side of the fire barrier to the other. [***101***:8.3.3.1]

~~12.7.6.1.1 Fire resistance–rated glazing tested in accordance with ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, or ANSI/UL 263, *Standard for Fire Tests of Building Construction and Materials*, shall be permitted in fire door assemblies and fire window assemblies where tested and installed in accordance with their listings. [***101***:8.3.3.1.1]~~

~~12.7.6.1.2 New fire resistance–rated glazing shall be marked in accordance with Table 12.7.3.12 and Table 12.7.4.2. Such marking shall be permanently affixed. [***101***:8.3.3.1.2]~~

12.7.6.2.5 Openings required to have a fire protection rating by Table 12.7.6.2.2 shall be protected by approved, listed and labeled fire door assemblies and fire window assemblies and their accompanying hardware, including all frames, closing devices, anchorage, and sills in accordance with the requirements of NFPA 80, except as otherwise specified in NFPA *101*. [***101***:8.3.3.2.5]

12.7.6.3* **Fire Doors**.

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12.7.6.3.1 ~~Fire protection–rated glazing shall be evaluated under positive pressure in accordance with NFPA 257~~ Fire door assemblies shall be installed, inspected, tested, and maintained in accordance with NFPA 80. [***101***:8.3.3.23.1]

12.7.6.3.2 ~~All products required to comply with 12.7.6.2 shall bear an approved label~~. All fire door assemblies shall be labeled. [***101***:8.3.3.23.2]

12.7.6.4 ~~**Labels.**~~ **Floor Fire Door Assemblies.**

12.7.6.4.1 Floor fire door assemblies used to protect openings in fire-resistance rated floors shall be tested in accordance with NFPA 288 and shall achieve a fire resistance rating not less than the assembly being penetrated. [***101***:8.3.3.4.1]

12.7.6.5 **Fire Windows.**

12.7.6.5.1 Fire window assemblies shall be installed, inspected, tested, and maintained in accordance with NFPA 80. [***101***:8.3.3.5.1]

12.7.6.5.2 All fire window assemblies be labeled. [***101***:8.3.3.5.2]

12.7.6.5.3* ~~Fire protection–rated glazing~~ Fire window assemblies shall be permitted in fire barriers having a required fire resistance rating of 1 hour or less and shall be of an approved type with the appropriate fire protection rating for the location in which ~~the barriers~~ they are installed. [***101***:8.3.3.5.3]

12.7.6.6 **Glazing**.

12.7.6.6.1 Glazing materials that have been tested, listed, and labeled to indicate the type of opening to be protected for fire protection purposes shall be permitted to be used in approved opening protectives in accordance with Table 12.7.6.2.2 and NFPA 80. [***101***:8.3.3.6.1]

12.7.6.6.2 Fire-rated glazing assemblies shall be permitted as follows:

(1) Those marked as complying with hose stream requirements (H) shall be permitted in applications that do not require compliance with hose stream requirements.
(2) Those marked as complying with temperature rise requirements (T) shall be permitted in applications that do not require compliance with temperature rise requirements.
(3) Those marked with ratings that exceed the ratings required by NFPA *101* shall be permitted.

[***101***:8.3.3.6.2]

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12.7.6.6.3 New fire protection-rated glazing shall be marked in accordance with Table 12.7.6.6.3 and Table 12.7.6.2.2, and such marking shall be permanently affixed. [***101***:8.3.3.6.3] Table 12.7.6.6.3 **Marking Fire-Rated Glazing Assemblies** 12.7.6.6.4 New fire resistance–rated glazing shall be marked in accordance with Table 12.7.6.6.3 and Table 12.7.6.2.2, and such marking shall be permanently affixed. [***101***:8.3.3.6.4] 12.7.6.6.5 Fire protection–rated glazing shall be permitted in fire barriers having a required fire resistance rating of 1 hour or less and shall be of an approved type with the appropriate fire protection rating for the location in which the barriers are installed. [***101***:8.3.3.6.5] 12.7.6.6.6* Glazing in fire window assemblies, other than in existing fire window installations of wired glass and other fire-rated glazing material, shall be of a design that has been tested to meet the conditions of acceptance of NFPA 257 or ANSI/UL 9, *Standard for Fire Tests of Window Assemblies*. [***101***:8.3.3.6.6] 12.7.6.6.7 Fire protection–rated glazing in fire door assemblies, other than in existing fire-rated door assemblies, shall be of a design that has been tested to meet the conditions of acceptance of NFPA 252, ANSI/UL 10B, *Standard for Fire Tests of Door Assemblies*, or ANSI/UL 10C, *Standard for Positive Pressure Fire Tests of Door Assemblies*. [***101***:8.3.3.6.7] 12.7.6.6.8 Fire resistance–rated glazing complying with 12.7.5.1.1 tested in accordance with ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, or ANSI/UL 263, *Standard for Fire Tests of Building Construction and Materials*, shall be permitted in fire doors and fire window assemblies in accordance with their listings. [***101***:8.3.3.6.8] 12.7.6.6.9 Nonsymmetrical fire protection–rated glazing systems shall be tested with each face exposed to the furnace, and the assigned fire protection rating shall be that of the shortest duration obtained from the two tests conducted in compliance with NFPA 257; or ANSI/UL 9, *Standard for Fire Tests of Window Assemblies*. [***101***:8.3.3.6.9] 12.7.6.6.10 The total combined area of glazing in fire-rated window assemblies and fire-rated door assemblies used in fire barriers shall not exceed 25 percent of the area of the fire barrier that is common	See NFPA 1 for complete table

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with any room, unless the installation meets one of the following criteria:

(1) The installation is an existing fire window installation of wired glass and other fire-rated glazing materials in approved frames.

(2) The fire protection–rated glazing material is installed in approved existing frames.

[***101***:8.3.3.10]

12.7.6.6.11 Existing installations of wired glass of 1⁄4 in. (6.3 mm) thickness and labeled for fire protection purposes shall be permitted to be used in approved opening protectives, provided that the maximum size specified by the listing is not exceeded. [***101***:8.3.3.6.11]

12.7.6.7 **Sidelights and Transoms**. Glazing used in sidelights and transoms adjacent to 20-minute doors in 1-hour corridor fire barriers shall be tested in accordance with 12.7.6.2, including hose stream, and shall attain a minimum 45-minute fire protection rating. [***101***:8.3.3.7]

~~12.7.6.6 Glazing in fire window assemblies, other than in existing fire window installations of wired glass and other fire-rated glazing material, shall be of a design that has been tested to meet the conditions of acceptance of NFPA 257; or ANSI/UL 9, *Standard for Fire Tests of Window Assemblies*. Fire protection–rated glazing in fire door assemblies, other than in existing fire-rated door assemblies, shall be of a design that has been tested to meet the conditions of acceptance of NFPA 252; ANSI/UL 10B, *Standard for Fire Tests of Door Assemblies*; or ANSI/UL 10C, *Standard for Positive Pressure Fire Tests of Door Assemblies*. [***101***:8.3.3.6]~~

~~12.7.6.7 Fire resistance–rated glazing complying with 12.7.5.1.1 shall be permitted in fire doors and fire window assemblies in accordance with their listings. [***101***:8.3.3.7]~~

~~12.7.6.8 Glazing materials that have been tested, listed, and labeled to indicate the type of opening to be protected for fire protection purposes shall be permitted to be used in approved opening protectives in accordance with Table 8.3.4.2 of NFPA *101* and in sizes in accordance with NFPA 80. [***101***:8.3.3.8]~~

~~12.7.6.9 Existing installations of wired glass of 1⁄4 in. (6.3 mm) thickness and labeled for fire protection purposes shall be permitted to be used in approved opening protectives, provided that the maximum size specified by the listing is not exceeded. [***101***:8.3.3.9]~~

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~~12.7.6.10 Nonsymmetrical fire protection–rated glazing systems shall be tested with each face exposed to the furnace, and the assigned fire protection rating shall be that of the shortest duration obtained from the two tests conducted in compliance with NFPA 257; or ANSI/UL 9, *Standard for Fire Tests of Window Assemblies*. [***101:***8.3.3.10]~~

~~12.7.6.8 The total combined area of glazing in fire-rated window assemblies and fire-rated door assemblies used in fire barriers shall not exceed 25 percent of the area of the fire barrier that is common with any room, unless the installation meets one of the following criteria:~~

~~(1) The installation is an existing fire window installation of wired glass and other fire-rated glazing materials in approved frames.~~

~~(2) The fire protection–rated glazing material is installed in approved existing frames. [***101:***8.3.3.11]~~

~~12.7.6.9 New fire protection-rated glazing shall be marked in accordance with Table 12.7.6.9 and Table 12.7.6.2.2, and such marking shall be permanently affixed. [***101:***8.3.3.12]~~

~~Table 12.7.6.9 **Marking Fire-Rated Glazing Assemblies**~~

~~12.7.6.10 Fire-rated door assemblies shall be inspected and tested in accordance with NFPA 80. [***101:***8.3.3.13]~~

~~12.7.7.2 The fire protection rating for opening protectives in fire barriers, fire-rated smoke barriers, and fire-rated smoke partitions shall be in accordance with Table 12.7.7.2, except as otherwise permitted in 12.7.7.3 or 12.7.7.4. [***101:***8.3.4.2].~~

~~Table 12.7.7.2 **Minimum Fire Protection Ratings for Opening Protectives in Fire Resistance-Rated Assemblies and Fire-Rated Glazing Markings**~~

~~12.7.7.2.1 Fire-rated glazing assemblies marked as complying with hose stream requirements (H) shall be permitted in applications that do not require compliance with hose stream requirements. Fire-rated glazing assemblies marked as complying with temperature rise requirements (T) shall be permitted in applications that do not require compliance with temperature rise requirements. Fire-rated glazing assemblies marked with ratings that exceed the ratings required by this *Code* (XXX) shall be permitted. [***101:***8.3.4.2.1]~~

~~12.7.7.2 Existing fire door assemblies having a minimum 3⁄4-hour fire protection rating shall be permitted to continue to be used in~~

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~~vertical openings and in exit enclosures in lieu of the minimum 1-hour fire protection rating required by Table 12.7.6.2.2. [***101*:**8.3.4.3]~~

~~12.7.7.3 Where a 20-minute fire protection–rated door is required in existing buildings, an existing 13⁄4 in. (44 mm) solid-bonded wood-core door, an existing steel-clad (tin-clad) wood door, or an existing solid-core steel door with positive latch and closer shall be permitted, unless otherwise specified by Chapters 11 through 43 of NFPA *101*. [***101*:**8.3.4.4]~~

12.7.8.1 **General.**

12.7.8.1.3 Penetrations shall be protected in accordance with a tested system, and installed and maintained in accordance with the manufacturer's instructions. [***101*:**8.3.4.1.3]

12.7.8.2.4.1 Penetrations in fire resistance–rated horizontal assemblies shall ~~be required to~~ have a T rating of ~~at least~~ not less than 1 hour, ~~but~~ and not less than the fire resistance rating of the horizontal assembly,. [***101*:**8.3.4.2.4.1]

12.7.8.2.5 **Alternative Fire stop Requirements.**

12.7.8.2.5.1
The requirements of 12.7.8.2 shall not apply where otherwise permitted by any one of the following:

(1) Where penetrations are tested and installed as part of an assembly tested and rated in accordance with ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials* or ANSI/UL 263, *Standard for Fire Tests of Building Construction and Materials*
(2) Where penetrations through floors are enclosed in a shaft enclosure designed as a fire barrier
(3) Where concrete, grout, or mortar has been used to fill the annular spaces around cast-iron, copper, or steel piping, conduit or tubing that penetrates one or more concrete or masonry fire resistance–rated assemblies and ~~both~~ all of the following ~~criteria are also met~~ applies:
    (a) The nominal diameter of each penetrating item ~~shall~~ does not exceed 6 in. (150 mm), ~~and~~
    (b) the opening size ~~shall~~ does not exceed 1 ft^2 (0.09 m^2).
    (c) The thickness of the concrete, grout, or mortar ~~shall be~~ is the full thickness of the assembly.
(4) Where ~~firestopping materials are used with the following penetrating items, the~~ penetration is limited to one floor, ~~and~~ the firestopping material is capable of preventing the passage of flame and hot gases sufficient to ignite cotton

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waste when subjected to the time–temperature fire conditions of ~~NFPA 251~~ ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, or ANSI/UL 263, *Standard for Fire Tests of Building Materials* under a minimum positive pressure differential of 0.01 in. water column (2.5 Pa) at the location of the penetration for the time period equivalent to the required fire resistance rating of the assembly penetrated, and the firestopping materials are used with the following penetrating items:

(a) Steel, ferrous, or copper cables
(b) Cable or wire with steel jackets
(c) Cast-iron, steel, or copper pipes
(d) Steel conduit or tubing

[***101***:~~8.3.5.1.1~~ 8.3.4.2.5.1]

12.7.8.5 ~~**Transmission of Vibrations.**~~ **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***:8.3.4.5] ~~Where designs take transmission of vibrations into consideration, any vibration isolation shall meet one of the following conditions:~~

~~- It shall be provided on either side of the wall or floor.~~
~~- It shall be designed for the specific purpose. [***101***:8.3.5.4]~~

12.7.8.6.1 Where piping penetrates a fire resistance–rated wall or floor assembly, combustible piping shall not connect to noncombustible piping within 36 in. (915 mm) of the firestop system or device ~~without demonstration~~ unless it can be demonstrated that the transition will not reduce the fire resistance rating, except in the case of previously approved installations. [***101***:8.3.4.6.1]

12.7.8.7.2
The firestop system or device shall be tested in accordance with ASTM E814, *Standard Test Method for Fire Tests of Through Penetration Fire Stops*, or ANSI/UL 1479, *Standard for Fire Tests of Through-Penetration Firestops*, at a minimum positive pressure differential of 0.01 in. water column (2.5 ~~N/m²~~ Pa) between the exposed and the unexposed surface of the test assembly, unless one of the following conditions applies:

(1) Membrane penetrations of ceilings that are not an integral part of a fire resistance–rated floor/ceiling or roof/ceiling assembly ~~shall be permitted.~~
(2) Membrane penetrations of steel, ferrous, or copper conduits, ~~pipes, tubes~~, piping, or tubing, and steel electrical outlet boxes and wires, or combustion vents or exhaust vents ~~shall be permitted~~ where the annular space is protected with an approved material, and the aggregate

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area of the openings does not exceed ~~0.7 ft~~ 100 in.^{2} (~~0.06 m~~ 64,520 mm^2) in any 100 ft^2 (9.3 m^2) of ceiling area.

……..

12.7.8.7.3
Where walls or partitions are required to have a minimum 1-hour fire resistance rating, recessed fixtures shall be installed in the wall or partition in such a manner that the required fire resistance is not reduced, unless one of the following criteria is met:

(1) Any steel electrical box not exceeding ~~0.1 ft^2 (0.01 m^2)~~ 16 in.^{2} (10,300 mm^2) in area shall be permitted where the aggregate area of the openings provided for the boxes does not exceed ~~0.7 ft^2 (0.06 m^2)~~ 100 in.^{2} (64,520 mm^2) in any 100 ft^2 (9.3 m^2) of wall area, and, where outlet boxes are installed on opposite sides of the wall, the boxes shall be separated by one of the following means:

……

12.7.8.8 ~~**Openings for Air Handling Ductwork.**~~ **Ducts and Air-Transfer Openings.**

12.7.9.2* **Joint System Requirements.**

12.7.9.2.1 ~~Joints made within or at the perimeter of fire barriers shall be protected with a joint system that is capable of limiting the transfer of smoke. [***101***:8.3.6.2]~~ Joints made within or at the perimeter of fire barriers, between fire resistance–rated assemblies, or where fire barriers meet other fire barriers, the floor or roof deck above, or the outside walls shall be protected with a joint system that is designed and tested to prevent the spread of fire for a time period equal to that of the assembly in which the joint is located. [***101***:8.3.5.2.1]

12.7.9.2.2 ~~Joints made within or between fire barriers shall be protected with a smoke-tight joint system that is capable of limiting the transfer of smoke~~. Joints made within or at the perimeter of fire barriers used as smoke barriers shall be capable of restricting the transfer of smoke in accordance with 8.5.7.4 of NFPA *101*. [***101***:8.3.5.2.2]

12.7.9.2.3 Joints shall be installed in accordance with a tested system, and installed and maintained in accordance with the manufacturer's instructions. [***101***:8.3.5.2.3]

12.7.9.2.5 ~~Joints made within or between fire resistance–rated assemblies shall be protected with a joint system that is designed and tested to prevent the spread of fire for a time period equal to~~

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~~that of the assembly in which the joint is located~~. Such materials, systems, or devices shall be tested as part of the assembly in accordance with the requirements of ASTM E1966, *Standard Test Method for Fire-Resistive Joint Systems*, or ANSI/UL 2079, *Standard for Tests for Fire Resistance of Building Joint Systems*. [***101***:8.3.65.2.5] 12.7.9.3 Joints made between a fire barrier and a non-fire-resistance-rated floor or roof sheathing, slab, or deck above shall be protected by an approved continuity head of wall joint system installed as tested in accordance with ASTM E2837, *Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies*, and the system shall have an F rating and T rating of not less than the required fire resistance rating of the fire barrier. [***101***:8.3.5.3] 12.8.4.2 **Vibration Isolation Equipment or Systems**. Where vibration isloation 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] ~~Where designs take transmission of vibrations into consideration, any vibration isolation shall meet one of the following conditions:~~ ~~- It shall be provided on either side of the smoke partition.~~ ~~- It shall be designed for the specific purpose. [***101***:8.4.4.2]~~ 12.9.6.6 **Vibration Isolation Equipment or Systems**. ~~Where designs take transmission of vibrations into consideration, any vibration isolation shall meet one of the following conditions:~~ Where vibration isloation 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] ~~- It shall be provided on either side of the smoke barrier.~~ ~~- It shall be designed for the specific purpose.~~	
Chapter 13 – Fire Protection Systems	
13.1.3 **Integrated Fire Protection and Life Safety System Test.** Where required by Chapters 11 through 43 of NFPA *101*, 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] 13.1.5 A minimum 36 in. (~~91~~ 915 mm) of clear space shall be maintained to permit access to and operation of fire protection equipment, fire department inlet connections, or fire protection system control valves. The fire department shall not be deterred or	

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hindered from gaining immediate access to fire protection equipment. 13.1.8/9 Whenever impairments, critical deficiencies, or non-critical deficiencies are identified in water-based fire protection systems maintained in accordance with NFPA 25, they shall be corrected in a time frame approved by the AHJ ~~13.1.10 When a fire protection system is out of service for more than 4 hours in a 24-hour period, the AHJ shall be permitted to require the building to be evacuated or an approved fire watch to be provided for all portions left unprotected by the fire protection system shutdown until the fire protection system has been returned to service.~~	After second revision, became 13.1.**9**
~~13.1.13* **Integrated Systems**. Where fire alarm systems are integrated with other building systems and equipment, the integrated systems shall be tested in accordance with NFPA 4.~~ 13.3.1.6* In areas protected by automatic sprinklers, automatic ~~water mist~~ heat-detection devices required by other sections of this *Code* shall not be required. [***101*:**9.7.1.4] 13.3.2.6.2 Sprinklers shall be permitted to be omitted where the exterior canopies, roofs, porte-cocheres, balconies, decks, and similar projections are constructed with materials that are noncombustible, limited-combustible, or fire retardant–treated wood as defined in NFPA 703, ~~*Standard for Fire Retardant–Treated Wood and Fire-Retardant Coatings for Building Materials*~~, or where the projections are constructed utilizing a noncombustible frame, limited-combustibles, or fire retardant-treated wood with an inherently flame-resistant fabric overlay as demonstrated by Test Method 2 in accordance with NFPA 701. [**13:**8.15.7.2] 13.3.2.7.5 ~~**Stages.**~~ **Fire Protection.** Every stage shall be protected by an approved, supervised automatic sprinkler system in compliance with Section 13.3. [***101*:**12.4.6.10] 13.3.2.8.5 ~~**Stages.**~~ **Fire Protection.** Every stage shall be protected by an approved, supervised automatic sprinkler system in compliance with Section 13.3. [***101*:**12.4.6.10] 13.3.2.9.1 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~~ shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 13.3. [***101*:**14.3.5.1]	Added and then deleted

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~~13.3.2.9.2 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]~~

13.3.2.9.2 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:
    (a) Building area does not exceed 1000 ft^2 (93 m^2)
    (b) Building contains a single classroom
    (c) Building is located not less than 30 ft (9.1 m) from another building

13.3.2.15.2 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 13.3.2.15.3. In hotel or dormitory occupancies up to and including four 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:***28.3.5.3]

13.3.2.15.2.1 Where located in a building of Type III, Type IV, or Type V construction designed in accordance with 4.6.3(5) of NFPA *101*, and where the roof assembly is located more than 55 ft (17 m) above the lowest level of required fire department vehicle access, attics shall comply with 13.3.2.15.2.1.1, 13.3.2.15.1.2, 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]

13.3.2.15.2.1.1 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:***28.3.5.3.1.1]

13.3.2.15.2.1.2
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]

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13.3.2.16.2 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 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 four or fewer stories~~ In apartment buildings up to and including four 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 4.6.3(5) of NFPA *101*, and where the roof assembly is located more than 55 ft (17 m) above the lowest level of required fire department vehicle access, attics shall comply with 13.3.2.17.2.1.1, 13.3.2.17.2.1.2, 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***: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 13.3.2.17.2.1.1 shall include only those roads that are necessary for required fire department vehicle access in accordance with Section 18.2. [***101***:30.3.5.2.1.2]

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 and not exceeding 60 ft (18.3 m) in height above grade plane, systems in accordance with NFPA 13R shall be permitted.

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13.3.2.19.2.2 In buildings 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***: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~~

13.3.2.21.2.3.1 In buildings 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. All habitable areas, closets, roofed porches, roofed decks, and roofed balconies shall be sprinklered. [***101***:32.2.3.5.3.1]

13.3.3.4.1.1.2.1 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]

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]

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

13.3.3.4.1.6.2 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

13.3.3.4.1.10 **Antifreeze Information Sign.** An antifreeze information sign shall be placed on the antifreeze system main

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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]

13.3.3.5.1.2.2 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/ft^2 (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]

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

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

…….

(8) Foam-water sprinkler systems

…….

(11) Water supply

13.4.1.4.3.1 Plans shall be drawn to an indicated scale, on sheets of uniform size, and shall indicate, as a minimum, the items from the following list that pertain to the design of the system:

(1) ~~Name~~ Name(s) of owner and occupant
(2) Location, including street address
(3) Point of compass
(4) Name and address of installing contractor
(5) Pump make and model number
(6) Pump rating _____ gpm @ _____ psi _____ rpm
(7) Suction main size, length, location, ~~weight~~, type and class/schedule of material, and point of connection to water supply, as well as ~~size and type of valves, valve indicators, regulators, meters, and valve pits,~~ and depth to top of pipe below grade
(8) Water storage tank, if applicable
(9) Size and type of valves, regulators, meters, and valve pits, if applicable
(10) Water supply ~~capacity~~ information including the following flow test information, if applicable:
    (a) Location and elevation of static and residual test gauge with relation to the ~~riser~~ elevation reference point
    (b) Flow location
    (c) Static pressure, psi (bar)

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(d) Residual pressure, psi (bar) (e) Flow, gpm (L/min) (f) Date (g) Time (h) Name of person who conducted the test or supplied the information (i) Other sources of water supply, with pressure or elevation (11) Pump driver details including manufacturer, and horsepower~~, voltage, or fuel system details~~ (12) Voltage for electric motor-driven pumps (13) Fuel system details for diesel-driven pumps (14) Controller manufacturer, type, and rating (15) Suction and discharge pipe, fitting, and valve types (16) Test connection piping and valves (17) Flow meter details (~~if used~~), if applicable (18) ~~Jockey~~ Pressure maintenance pump and controller arrangement, including sensing line details, if applicable [**20**:4.2.3.1]	
13.4.2.1.1.1 ~~Fire~~ Except as permitted in 13.4.2.1.1.3, fire pump units serving high-rise buildings shall be protected from surrounding occupancies by a minimum of 2-hour fire-rated construction or physically separated from the protected building by a minimum of 50 ft (15.3 m). [**20:**4.13.1.1.1] 13.4.2.1.1.2 ~~Indoor~~ Except as permitted in 13.4.2.1.1.3, indoor fire pump rooms in non-high-rise buildings or in separate fire pump buildings shall be physically separated or protected by fire-rated construction in accordance with Table 13.4.2.1.1.2. [**20:**4.13.1.1.2] 13.4.2.1.1.3 Fire pump units supplying a local application fire protection system(s) shall be physically separated from the hazard being protected in a manner that will prevent a fire associated with the hazard from directly exposing the pumping unit. [**20:**4.12.1.1.3] 13.4.2.2.1.1 ~~Fire~~ Except as provided in 13.4.2.2.1.1.1 fire pump rooms not directly accessible from the outside shall be accessible through an enclosed passageway from an enclosed stairway or exterior exit. [**20:**4.12.2.1.14.13.2.1.1] 13.4.2.2.1.1.1 Fire pump units supplying only local application fire protection systems shall be accessible by a path that is not subject to exposure from a fire in any hazard protected by the fire pump. 13.4.5.1.3 Separate visible indicators and a common audible fire pump alarm capable of being heard while the engine is running and operable in	Completely rewritten with bullet points added beneath

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all positions of the main switch except the off position shall be provided to immediately indicate the following conditions:

(1) Critically low oil pressure in the lubrication system.
(2) High engine temperature.
(3) Failure of engine to start automatically.
(4) Shutdown from overspeed.
(5) High cooling water temperature [**20:**12.4.1.3]

13.4.5.1.4 Separate visible indicators and a common audible signal capable of being heard while the engine is running and operable in all positions of the main switch except the off position shall be provided to immediately indicate the following conditions:

……

(6) ~~Fuel~~ Common alarm for fuel injection malfunction (only for engines with ECM).

……

(12) Fuel maintenance needed if automatic fuel maintenance system is provided

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 ~~one of the following fire test standards~~ ANSI/UL 711, CAN/ULC-S508, *Standard for Rating and Fire Testing of Fire Extinguishers*, and one of the following applicable performance standards:

- ~~Fire test standards: ANSI/UL 711, CAN/ULC S508, *Standard for Rating and Testing of Fire Extinguishers*~~

……..

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]

13.6.1.6 **Obsolete Fire Extinguishers.** The following types of fire extinguishers are considered obsolete and shall be removed from service:

…….

~~(3) Vaporizing liquid (e.g., carbon tetrachloride~~) Carbon tetrachloride, methyl bromide, and chlorobromomethane (CBM)

…….

(11) Any ~~stored pressure~~ extinguisher manufactured prior to 1955

…….

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13.6.1.6.1 Dry chemical stored-pressure extinguishers ~~manufactured prior to October~~ with an indicated manufacturing date of 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]

~~13.6.2.5.1.1.1 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]~~

13.6.2.5.1.1.1 **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]

13.6.2.5.7.1 Only water ~~type~~ or foam extinguishers shall be installed in areas ~~containing oxidizers, such as~~ where pool chemicals containing chlorine or bromine are stored

13.6.2.5.7.2 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

13.6.2.5.7.3 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]

~~13.6.3.1.3.3.3 Where signs are used to indicate fire extinguisher location, the signs shall comply with the following:~~

- ~~They shall be located in close proximity to the extinguisher.~~
- ~~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:

…….

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(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
…….

13.6.3.1.3.9.1 ~~Extinguishers'~~ Fire extinguishers shall be installed so that the fire extinguisher's operating instructions ~~shall be located on the front of the extinguisher and shall be clearly visible~~. face outward. [**10:**6.1.3.9.1]

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]

13.6.3.2.1.7 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]

13.6.4.2.2 **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~~ Visibility of the extinguisher or means of indicating the extinguisher location
(3) Access to the extinguisher
(4) Pressure gauge reading or indicator in the operable range or position
(5) Fullness determined by weighing or hefting
(6) Condition of tires, wheels, carriage, hose, and nozzle for wheeled extinguishers
(7) 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. [**10:**7.2.2.1]

13.6.4.2.2.2 Any method(s) of inspection other than manual inspection shall require the approval of the authority having jurisdiction. [**10:**7.2.2.2]

13.6.4.2.2.5 Inspection Procedure for Containers of Class D Extinguishing Agent.

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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~~ Visibility of the container or means of indicating the container location (3) Access to the container (4) Lid is sealed (5) Fullness by hefting or weighing (6) No obvious physical damage to container 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] 13.6.4.5 **Hose Station Maintenance.** Where hose stations are installed to comply with 13.6.3.2.1.5, they shall be maintained in accordance with NFPA 1962. [**10:**7.5] 13.6.4.7.1 **Wheeled Unit Hoses.** Discharge hoses on wheeled-type fire extinguishers shall be completely uncoiled and examined for damage annually. [**10:**7.67.1] 13.6.4.7.2 ~~**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:**7.7.1.1] 13.6.4.8.1.3.5 In no case shall an extinguisher be recharged without hydrostatic testing if it is beyond its specified hydrostatic test date. [**10:**7.8.1.3.5] 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] 13.7.1.15* **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]	

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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] 13.7.2.1.4 **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 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	

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(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 13.7.2.1.4.1 shall not be required in the following locations:

(1) Garages
(2) Occupiable spaces with attached garages that are open parking structures as defined in 3.3.192.26.3.
(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 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]

13.7.2.3.4.1
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) ~~On~~ Carbon monoxide detectors shall be installed on the ceilings of rooms containing permanently installed fuel-burning appliances.
(2) ~~Centrally~~ 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) ~~Centrally~~ 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***:14.3.4.4.1]

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 3.3.192.26.3
(3) Occupiable spaces with communicating attached garages that are mechanically ventilated in accordance with the applicable mechanical code

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(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 3.3.192.26.3
(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 13.7.1.15 shall be performed to determine if a mass notification system is required. [***101*:**14.3.4.5]

13.7.2.5.6 **New Day-Care Homes.**

13.7.2.5.6.1 Smoke alarms shall be installed within day-care homes in accordance with 13.7.1.8. [***101*:**16.6.3.4.1]

13.7.2.5.6.2 Where a day-care home is located within a building of another occupancy, such as in an apartment building or office building, any corridors serving the day-care home shall be provided with a smoke detection system in accordance with 13.7.1.4. [***101*:**16.6.3.4.2]

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*:**16.6.3.4.3]

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*:**16.6.3.4.5]

13.7.2.6.6 **Existing Day-Care Homes**.

13.7.2.6.6.1 Smoke alarms shall be installed within day-care homes in accordance with 13.7.1.8. [***101*:**17.6.3.4.1]

13.7.2.6.6.2 Where a day-care home is located within a building of another occupancy, such as in an apartment building or office building, any corridors serving the day-care home shall be provided with a smoke detection system in accordance with 13.7.1.7. [***101*:**17.6.3.4.2]

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

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accordance with 13.7.1.8, other than as permitted by 13.7.2.6.6.4. [***101***:17.6.3.4.3]

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***:17.6.3.4.4]

13.7.2.7.4 ~~**Fire Safety**~~ **Emergency Control 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]

13.7.2.8.4 ~~**Fire Safety**~~ **Emergency Control 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]

13.7.2.10.4 ~~**Fire Safety**~~ **Emergency Control 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***:20.3.4.4]

13.7.2.15.6.5 Where carbon monoxide detectors are installed in accordance with 13.7.2.15.6.4(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***: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 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]

13.7.2.15.7.2 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]

13.7.2.17.6.5 Where carbon monoxide detectors are installed in accordance with 13.7.2.17.6.4(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]

13.7.2.19.1 **General**. A fire alarm system shall be provided in accordance with Section 13.7. [***101***:32.2.3.4.1]

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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]

13.7.2.20.9 **Carbon Monoxide Alarms and Carbon Monoxide Detection Systems.**

13.7.2.20.9.1 Carbon monoxide alarms or carbon monoxide detectors in accordance with 13.7.1.14 and 13.7.2.20.9 shall be provided in new large board and care facilities where either of the following conditions exists:

(1) Where large board and care facilities have communicating attached garages, unless otherwise exempted by 13.7.2.20.9.3
(2) Where sleeping rooms or sleeping room suites contain fuel-burning appliances or fuel-burning fireplaces

[***101***:32.3.3.4.9.1]

13.7.2.20.9.2 Where required by 13.7.20.9.1, 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 13.7.2.20.9.3

[***101***:32.3.3.4.9.2]

13.7.2.20.9.3 Carbon monoxide alarms and carbon monoxide detectors as specified in 13.7.2.20.9.1(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

[***101***:32.3.3.4.9.3]

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:

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(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
[***101***:32.3.3.4.9.4]

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 13.7.2.21.3.1 or 13.7.2.21.3.2 are met. [***101***:33.2.3.4.1]

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]

13.7.2.25.5 **Risk Analysis for Mass Notification**.

13.7.2.25.5.1 Business occupancies requiring a fire alarm system in accordance with 13.7.2.25.5.1 shall conduct a risk analysis to determine the need for a mass notification system in accordance with 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]

13.7.3.2.2.1 Where documentation is required by the ~~enforcing authority~~ authority having jurisdiction … documentation required for new fire alarm systems, supervising station and shared communication equipment, and emergency communications systems, including new systems and additions or alterations to existing systems

……

(3) Floor plan layout showing locations of all devices, control equipment, and supervising station and shared communications equipment with each sheet showing the following:

(a) Point of compass (north arrow)
(b) A graphic representation of the scale used
(c) Room use identification

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(d) Building features that will affect the placement of initiating devices and notification appliances

……

(7) Battery capacity and de-rating calculations (where batteries are provided)

……

(9) Mounting height elevation for wall-mounted devices and appliances

(10) Where occupant notification is required, minimum sound pressure levels that must be produced by the audible notification appliances in applicable covered areas

(11) Pathway diagrams between the control unit and the supervising station and shared communications equipment

……

(13) ~~Copy~~ For software-based systems, a copy of site-specific software, ~~where applicable~~ including specific instructions on how to obtain the means of system and software access (password)

(14) Record (as-built) drawings

~~Periodic inspection, testing, and maintenance documentation in accordance with 13.7.3.2.3.4~~

……

(16) Completed record of inspection and testing in accordance with 13.7.3.2.4.6 and 13.7.3.2.5.2

13.7.3.2.3.4 For new emergency communications systems, an owner's manual shall be provided and shall contain the following documentation:

(1) Detailed narrative description of the system inputs, evacuation signaling, ancillary functions, annunciation, intended sequence of operations, expansion capability, application considerations, and limitations

(2) Written sequence of operation for the system including an operational input/output matrix

(3) Operator instructions for basic system operations, including alarm acknowledgement, system reset, interpretation of system output (LEDs, CRT display, and printout), operation of manual evacuation signaling and ancillary function controls, and change of printer paper

(4) Detailed description of routine maintenance and testing as required and recommended and as would be provided under a maintenance contract, including testing and maintenance instructions for each type of device installed, which includes the following:

(a) Listing of the individual system components that require periodic testing and maintenance

(b) Step-by-step instructions detailing the requisite testing and maintenance procedures, and the

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intervals at which those procedures shall be performed, for each type of device installed
(c) Schedule that correlates the testing and maintenance procedures that are required by this section

(5) Service directory, including a list of names and telephone numbers of those who provide service for the system
(6) Product data sheets for all system equipment (SIG-ECS)

13.7.3.2.3.7 ~~Electronic Record of Completion~~ Site-Specific Software ~~Site-specific software documentation shall be in accordance with 14.6.1.2 of *NFPA 72*. [**72:**7.5.7]~~

13.7.3.2.3.7.1 For software-based systems, a copy of the site-specific software shall be provided to the system owner or owner's designated representative. [**72:**7.5.7.1]

13.7.3.2.3.7.1.1 The site-specific software documentation shall include both the user passcode and either the system programming password or specific instructions on how to obtain the programming password from the system manufacturer. [**72:**7.5.7.1.1]

13.7.3.2.3.7.1.2 The passwords provided shall enable currently certified qualified programming personnel to access, edit, modify, and add to the existing system site-specific software. [**72:**7.5.7.1.2]

13.7.3.2.3.7.2 A copy of the site-specific software shall be stored on-site in nonvolatile, nonerasable, nonrewritable memory. [**72:**7.5.7.2]

13.7.3.2.3.8.1 Where required by the AHJ, compliance of the completed installation with the requirements of *NFPA 72*~~, as implemented via the referring code(s), specifications, and/or other criteria applicable to the specific installation,~~ shall be certified by a qualified and impartial third-party organization acceptable to the AHJ. [**72:**7.5.8.1]

13.7.3.2.5.2 **Forms for Documentation** ~~**Record of Completion, Record of Inspection and Testing, and Risk Analysis.**~~ Forms for documentation shall be as follows:

(1) Unless otherwise permitted or required in 13.7.3.2.3.6, 13.7.3.2.4.6, or 13.7.3.2.5.1.2, 13.7.3.2.5.2(a) through Figure 13.7.3.2.5.2(l) shall be used to document the record of completion and record of inspection and testing.
(2) Unless otherwise permitted or required in Figure 13.7.3.2.5.2(g) through Figure 13.7.3.2.5.2(1) shall be used to document the record of inspection and testing.

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Figure 13.7.3.2.5.2(b) **Emergency Communications Systems Supplementary Record of Completion**
Page 2, ~~3.2 Two-Way Radio Communications Enhancement System~~

Figure 13.7.3.2.5.2(c) **Power Systems Supplementary Record of Completion**
Section added:
2.4 **Supervising Station Transmission Equipment**
2.4.1 **Primary Power**
2.4.2 **Engine Driven Generator**
2.4.3 **Uninterruptible Power System**
2.4.4 **Batteries**

Figure 13.7.3.2.5.2(k) **Emergency Communications Systems Supplementary Record of Inspection and Testing**
Page 2:
~~3.2 Two-Way Radio Communications Enhancement System~~
→ 3.2 Area of Refuge (Area of Rescue Assistance) Emergency Communications Systems
Page 3:
~~3.3 Area of Refuge (Area of Rescue Assistance) Emergency Communications Systems~~

13.7.3.4.7 The AHJ(s) identified in 13.7.3.4.2(5) shall be notified within 30 calendar days of the expiration or cancellation by the organization that has listed the prime contractor. [**72:**26.3.4.7]

13.7.4.3.6.1
Where detectors are installed for signal initiation during construction, they shall be cleaned and verified to be operating in accordance with the listed sensitivity, or they shall be replaced prior to the final ~~commissioning~~ acceptance test of the system. [**72:**17.7.1.11.1]

13.7.4.3.6.2
Where detectors are installed but not operational during construction, they shall be protected from construction debris, dust, dirt, and damage in accordance with the manufacturer's recommendations and verified to be operating in accordance with the listed sensitivity, or they shall be replaced prior to the final ~~commissioning~~ acceptance test of the system. [**72:**17.7.1.11.2]

13.7.4.3.8.2.2 Where spacing must be adjusted for airflow, spot-type smoke detector spacing shall be adjusted in accordance with ~~Table 17.7.6.3.3.2~~ Table 13.7.4.3.8.2.2 or Figure 13.7.4.3.8.2.2 ~~Figure 17.7.6.3.3.2of *NFPA 72*~~ before making any other spacing adjustments required by this *Code*. [**72:**17.7.6.3.3.2]

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Table 13.7.4.3.8.2.2 **Smoke Detector Spacing Based on Air Movement (Not to Be Used for Under-Floor or Above-Ceiling Spaces)** Figure 13.7.4.3.8.2.2 **High Air Movement Areas (Not to Be Used for Under-Floor or Above-Ceiling Spaces). [72:Figure 17.7.6.3.3.2]** 13.7.4.3.8.2.3 Air-sampling or projected beam smoke detectors shall be installed in accordance with the manufacturer's published instructions. [**72:**17.7.6.3.3.3] ~~13.7.4.6.3 A functional test shall be performed on all smoke detectors upon initial installation and at least annually as required by Table 13.7.3.2.4. [72:Table 14.4.5, 15(h)]~~ ~~13.7.4.7.4 To ensure that each smoke detector is within its listed and marked sensitivity range, it shall be tested using any of the following methods:~~ ~~- Calibrated test method~~ ~~- Manufacturer's calibrated sensitivity test instrument~~ ~~- Listed control equipment arranged for the purpose~~ ~~- Smoke detector/fire alarm control unit arrangement whereby the detector causes a signal at the fire alarm control unit where its sensitivity is outside its listed sensitivity range~~ ~~- Other calibrated sensitivity test methods approved by the AHJ [**72:**14.4.4.3.4]~~	
Chapter 14 – Means of Egress	
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] 14.3.1 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: (7) ~~In Type III, Type IV, and Type V construction, as defined in NFPA 220 *(see 8.2.1.2 of* NFPA *101),* fire~~ Fire-retardant-treated wood enclosed in noncombustible or limited-	

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combustible materials shall be permitted in accordance with NFPA 220.

……

(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:

……..

(e) 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:

……..

(iii) 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 13.3 and provided with complete smoke detection in accordance with Section 13.7

(10) Penetrations into, and opening through, an exit enclosure assembly shall be limited to the following:

…….

(c) Pathways for devices for security and communication systems serving the exit enclosure, where pathways are installed in metal conduit

…….

(i) Existing penetrations ~~protected in accordance with 12.7.8~~

(j) Penetrations for fire alarm circuits, where the circuits are installed in metal conduit ~~and the penetrations are protected in accordance with 12.7.8~~

……..

(12) All penetrations in fire barriers separating the exit from other parts of the building shall be protected in accordance with 12.7.8

……..

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*. [***101*:**7.1.9]

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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:

……

……

14.5.2.6 ~~**Electrically Controlled**~~ **Door Hardware Release of Electrically Locked Egress Door Assemblies.** Door assemblies in the means of egress shall be permitted to be equipped with approved electrical locking systems released by the operation of door hardware 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) … readily operated in the direction of egress under all lighting conditions

……..

(5) Loss of power to the listed releasing hardware automatically electrically unlocks the door assembly in the direction of egress

14.5.2.10.7 Where permitted by Chapters 11 through 43 of NFPA 101, two releasing operations shall be permitted for doors secured against unwanted entry

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 ~~door leaves shall unlock~~ delay of the delayed-egress electrical locking system shall deactivate allowing unobstructed egress upon actuation of one of the following:

……

(2) The ~~door leaves shall unlock~~ delay of the delayed-egress electrical locking system shall deactivate allowing unobstructed egress upon loss of power controlling the lock or locking mechanism.

(3) An irreversible process shall release the electrical lock in the direction of egress within 15 seconds , or 30 seconds where approved by the AHJ, upon application of a force to

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the release device required in 14.5.2.10 under all of the following conditions:

…..

(4) A readily visible, durable sign ~~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~~ that conforms to the visual characters requirements of ICC/ANSI A117.1 shall be located on the door leaf adjacent to the release device in the direction of egress, and shall read as follows:

……

(6) Hardware for new installations shall be listed in accordance with ANSI/UL 294, *Standard for Access Control System Units*.

14.5.3.1.2
The provisions of 14.5.3.2 ~~for access-controlled egress door assemblies~~ for sensor-release of electrical locking systems shall not apply to door assemblies with delayed-egress electrical locking systems. [***101***:7.2.1.6.1.2]

14.5.3.2 ~~**Access-Controlled Egress Door Assemblies**~~**. Sensor-Release of Electrical Locking Systems.** Where permitted in Chapters 11 through 43 of NFPA *101*, door assemblies in the means of egress shall be permitted to be equipped with ~~an approved entrance and egress access control system~~, sensor-release electrical locking system hardware provided that all of the following criteria are met:

……

(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:

……

(b) The requirement of 14.5.3.2(3)(a) to locate the manual release device within 60 in. (1525 mm) of the secured door opening shall not apply to previously approved existing installations.

……

……

(7) The egress side of ~~access-controlled~~ sensor-release electrically locked egress doors, other than existing ~~access-controlled~~ sensor-release electrically locked egress doors, shall be provided with emergency lighting in accordance with Section 14.13.

(8) Hardware for new installations shall be listed in accordance with ANSI/UL 294.

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

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required by 14.9.1.6.1 shall be permitted to be ~~electronically~~ electrically locked, provided that all the following criteria are met:

……

(14) The provisions of 14.5.3.2 for ~~access-controlled egress door assemblies~~ sensor-release of electrical locking systems are not applied to the elevator lobby door assemblies.

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.

…….

14.5.3.4.4 **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 14.5.5.1 shall not exceed those required in 14.5.1.5, 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]

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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 14.5.1.)* [***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 14.5.1.5, shall not be required to have the swing-out feature required by 14.5.5.1.5. 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) of NFPA *101*, provided that the clear width of the single leaf is not less than 30 in. (760 mm). [***101***:7.2.1.9.1.8]

14.5.5.1.9 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 7.2.1.2.3.2(1) of NFPA *101* 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]

14.5.5.1.10 Door assemblies complying with 14.5.10 shall be permitted to be used. [***101***:7.2.1.9.1.10]

14.5.5.1.11 The requirements of 14.5.5.1.1 through 14.5.5.1.10 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:

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(1) The door leaves can be opened manually in accordance with 14.5.5.1.1 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 14.5.5.2(4).
(6) New power-assisted swinging door assemblies comply with BHMA/ANSI A156.19, *Power Assist and Low Energy Power Operated Doors*.

[***101***:7.2.1.9.2]

14.5.6 **Revolving Door Assemblies**.

14.5.6.1 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:
    (a) The values in Table 14.5.6.1 for existing revolving doors.
    (b) The values in BHMA A156.27 for new revolving doors.

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(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:

(a) Revolving door assemblies shall be permitted without adjacent swinging door assemblies, as required by 14.5.6.1(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.

(b) 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.**

14.5.6.2 Where permitted in Chapters 11 through 43 of NFPA *101*, 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 14.5.6.3 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:

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(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 14.5.7.1.1, 14.5.7.1.2 and 14.5.7.1.3. [***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 of NFPA *101*. [***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 16 1/2 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 of NFPA *101*, 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 14.8.
(2) Each security access turnstile lane configuration has a minimum clear passage width of 22 in. (560 mm).

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(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 14.5.6.

(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:

(a) Upon loss of power to the turnstile or any part of the access control system that secures the physical barrier

(b) 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:

(i) The manual release device is located on the egress side of each security access turnstile lane.

(ii) The manual release device is located at an approved location where it can be actuated by an employee assigned to the area.

(c) Upon actuation of the building fire-protective signaling system, if provided, and for which the following apply:

(i) The physical barrier remains in the open position until the fire-protective signaling system is manually reset.

(ii) The actuation of manual fire alarm boxes that actuate the building fire-protective signaling system is not required to meet the requirements specified in 14.5.7.1.3(5)(c)(i).

(d) 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***:7.2.1.11.1.3]

14.5.7.2 Turnstiles exceeding 39 in. (990 mm) in height shall meet the requirements for revolving door assemblies in 14.5.6 or the requirements of 14.5.7.1.3 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 1/2 in. (420 mm) clear width at and

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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 14.5.8.1 and 14.5.8.2. [***101***:7.2.1.12]

14.5.8.1 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]

14.5.8.2 Where a subdivided space is provided with not less than two means of egress, the swinging door leaf in the folding partition specified in 14.5.8 shall not be required, and one such means of egress shall be permitted to be equipped with a horizontal-sliding door assembly complying with 14.5.10. [***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 14.5.3.4.1(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

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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 14.5.4 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 of NFPA *101*, the following door assemblies shall be inspected and tested not less than annually in accordance with 14.5.11.2 through 14.5.11.7:

(1) Door leaves equipped with panic hardware or fire exit hardware in accordance with 14.5.3.4
(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 14.5.3.3

[***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]

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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 14.5.1.5.
(3) Latching and locking devices comply with 14.5.2.
(4) Releasing hardware devices are installed in accordance with 14.5.2.10.1.
(5) Door leaves of paired openings are installed in accordance with 14.5.2.11.
(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 14.5.1.3.
(8) Powered door openings operate in accordance with 14.5.5.
(9) Signage required by 14.5.1.1(3), 14.5.2.5, 14.5.3, and 14.5.5 is intact and legible.
(10) Door openings with special locking arrangements function in accordance with 14.5.3.
(11) Security devices that impede egress are not installed on openings, as required by 14.5.2.12.
(12) Where required by 7.2.2.5.5.7 of NFPA *101*, 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 14.13.

[***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]

14.8.1.1.1
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:

(1) The authority having jurisdiction shall be permitted to establish the occupant load as the number of persons for

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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] 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]~~ 14.9.2.1.1 ~~**Over 600 Volts, Nominal.**~~ **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)~~26(C). [***101***:7.4.2.21.1] 14.9.2.1.2 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***:7.4.2.1.2] 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] 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 110.33(A)(3) of *NFPA 70*. [***101***:7.4.2.2.2] 14.13.1.1 Emergency lighting facilities for means of egress shall be provided in accordance with Section 14.13 for the following: …… (6) New ~~access-controlled egress doors~~ sensor-release of electrical locking systems in accordance with 14.5.3.2	
Chapter 15 – Fire Department Service Delivery Concurrency Evaluation	
Chapter 16 – Safeguarding Construction, Alteration, and Demolition Operations	
16.7 **Tar Kettles and Rubberized Asphalt Melters.**	

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~~16.7.1.3 Operating kettles shall not be located inside of or on the roof of any building~~

16.7.2 **Tar Kettles**
16.7.2.1 Operating kettles shall not be located inside of or on the roof of any building

16.7.3 **Rubberized Asphalt Melters for Roof Deck Systems**.

16.7.3.1 **General**.

16.7.3.1.1 Fully enclosed chassis-mounted and portable rubberized asphalt melters shall comply with 16.7.3.

16.7.3.1.2 Fully enclosed chassis-mounted and portable rubberized asphalt melters for heating a mix of asphalt and inert material for application on roof decks shall use an indirect method of heating that complies with all of the following:

(1) The heating system shall use a fully enclosed oil or air system that transfers heat from a burner to the oil or air around the outside of a material vat which then heats the rubberized material.
(2) The material vat shall not be subject to direct burner or flame inpingement.
(3) The temperature rise in the material vat shall be gradual and controlled.

16.7.3.2 **Permits**.

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

16.7.3.2.2 Permits for the operation of a rubberized asphalt melter on a roof deck shall not be deemed a permit for torches or burners. Any use of torches or burners will require a separate permit.

16.7.3.3 **Rubberized Asphalt Melter Location**. The melter shall be located and operated in a controlled area identified by the use of traffic cones, barriers, and other suitable means as designated by the AHJ.

16.7.3.3.1 Melters shall not be located or operated on combustible roof decks.

16.7.3.3.2 The design load of the roof deck shall be capable of supporting the weight of the melter when loaded to capacity with rubberized asphalt material. The design load of the roof deck shall

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be as determined on building drawings or by a design professional acceptable to the AHJ.

16.7.3.3.3 Melters shall be chocked in place on the roof deck at locations identified by the design professional and acceptable to the AHJ.

16.7.3.3.4 Rubberized asphalt cakes for use in melters shall be located on the roof at a location agreed upon by the design professional and the AHJ.

16.7.3.3.5 Rubberized asphalt melters shall not be located inside of any building.

16.7.3.4 **Exits**.

16.7.3.4.1 Melters shall not block exits or a means of egress or escape to an exit.

16.7.3.4.2 Melters shall not be closer than 10 ft from exits.

16.7.3.5 **Fire Extinguishers**.

16.7.3.5.1 Two approved 4-A:40-B:C fire extinguishers shall be provided and maintained within 25 ft of the melter.

16.7.3.5.2 A minimum of one approved 4-A:40-B:C fire extinguisher shall be provided in close proximity to the roofing material application.

16.7.3.5.3 Each worker shall be instructed on the proper use of fire extinguishers and in the event of a fire to turn off all Melter engines and burners and notify the fire department.

16.7.3.6 **Melter Operation**.

16.7.3.6.1 Melters shall be operated according to manufacturer instructions. Melters shall operate using integral control systems that include shut off controls for the diesel fired burner and temperature controls for the oil system and the material vat.

16.7.3.6.2 The diesel burner shall fire into an oil or air jacketed tank for uniform transfer.

16.7.3.6.3 Melters shall have melter lids permanently attached and closed at all times during operation.

16.7.3.7 **Melter Supervision**.

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16.7.3.7.1 An operating melter shall be constantly attended by an employee who is knowledgeable and solely dedicated to the operation of the equipment and associated hazards.

16.7.3.7.2 The employee shall be within 25 ft of the melter and shall have the melter within sight.

16.7.3.7.3 The employee shall remain in the area of the melter for a minimum of one-hour after the device is shut down.

16.7.3.7.4 The roofing contractor shall have the capability to immediately notify the fire department of an emergency on the site.

16.7.3.8 **Fuel System**.

16.7.3.8.1 Fuel containers shall be constructed and approved for the use for which they were designed. Melter fuel tanks shall be attached to the frame of the melter.

16.7.3.8.2 Melters shall be diesel fuel or electrically powered.

16.7.3.8.3 Portable fuel tanks shall not be utilized to power melters.

16.7.3.8.4 Diesel tanks and engines integral to melters shall be maintained in accordance with manufacturer instructions.

16.7.3.8.5 Refueling of diesel tanks shall be performed when the melter is off.

16.7.3.8.5.1 A refueling and spill prevention plan acceptable to the AHJ shall be utilized.

16.7.3.8.5.2 Refueling shall be conducted using approved safety cans.

16.7.3.8.5.3 No open flames shall be present within 20 ft of the refueling operation.

16.7.3.9 **Maintenance**. Melters and all integral working parts shall be in good working condition and shall be maintained free of excessive residue.

16.7.3.10 **Minimum Requirements**.

16.7.3.10.1 Melters shall be operated as a complete unit as designed and built by the manufacturer. Field changes that override controls or safety features shall not be permitted.

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16.7.3.10.2 Material vats on melters shall have a capacity of 230 gal or less. Material vats shall be a permanent integral part of the melter unit. 16.7.3.10.3 The melter chassis shall be substantially constructed and capable of carrying the load imposed upon it whether it is standing still or being transported.	
Chapter 17 – Wildland Urban Interface	
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. 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 17.3.5.2.1.9.1 Permanently located mobile and manufactured homes with an open space beneath shall have a skirt of noncombustible materials, exterior fire-retardant-treated wood, or other ignition-resistant material ~~or material that has a minimum fire-resistive rating of 20 minutes~~ 17.3.5.2.1.11.4	

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Propane tanks and other ~~flammable or~~ combustible liquids storage shall conform to NFPA 58 and the wildland fire hazard mitigation plan required in 17.1.10. [**1144:**5.12.4]	
Chapter 18 – Fire Department Access and Water Supply	
18.1.3.1 **Fire Apparatus Access.** Plans for fire apparatus access roads shall be submitted to the ~~fire department~~ AHJ for review and approval prior to construction. 18.1.3.2 **Fire Hydrant Systems.** Plans and specifications for fire hydrant systems shall be submitted to the ~~fire department~~ AHJ for review and approval prior to construction. 18.2.3.2.1.1 Where a one- or two-family dwelling, or townhouse, is protected with an approved automatic sprinkler system that is installed in accordance with ~~NFPA 13D or NFPA 13R, as applicable~~ Section 13.3, the distance in 18.2.3.2.1 shall be permitted to be increased to 150 ft (46 m). 18.2.3.4 **Traffic Signal Pre-emption.** Where fire department apparatus are equipped with traffic signal pre-emption devices, newly installed traffic signals shall be equipped with traffic signal pre-emption. 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. 18.2.3.5.1.1.2 The width of fire department access roads shall be increased when the minimum width specified in 18.2.3.5.1.1 is not adequate to accommodate fire apparatus. 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. 18.2.3.5.1.3.1 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. 18.2.3.5.3.3 Fire department access roads connecting to roadways shall be provided with curb cuts extending at least 2 ft (.61 m) beyond each edge of the fire department access road 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	

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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 lane department access road~~. 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*. 18.2.4.2.6.2 Gates intended for automatic operation shall be designed, constructed, ~~and~~ installed, and maintained to comply with ASTM F2200, *Standard Specification for Automated Vehicular Gate Construction*. 18.5.2 **Detached One- and Two-Family Dwellings.** Fire hydrants shall be provided for detached one- and two-family dwellings in accordance with both of the following: (1) The maximum distance to a fire hydrant from the closest point on the building shall not exceed 600 ft (~~122~~ 183 m). (2) The maximum distance between fire hydrants shall not exceed 800 ft (244 m). 18.5.3 **Buildings Other than Detached One- and Two-Family Dwellings.** Fire hydrants shall be provided for buildings other than detached one- and two-family dwellings in accordance with both of the following: (1) The maximum distance to a fire hydrant from the closest point on the building shall not exceed 400 ft (~~76~~ 122 m). (2) The maximum distance between fire hydrants shall not exceed 500 ft (152 m).	
Chapter 19 – Combustible Waste and Refuse	
19.2.1.4 **Rubbish Within Dumpsters.** Dumpsters and combustible waste containers with an individual capacity of 1.5 yd^3 [40.5 ft^3 (1.15 m^3)] or more shall not be stored in buildings or placed within 10 ft (~~3 m~~ 3050 mm) of combustible walls, openings, or combustible roof eave lines unless otherwise permitted by 19.2.1.4.1 or 19.2.1.4.2. 19.2.1.4.1 ~~Areas containing dumpsters or containers shall be~~ The requirement of 19.2.1.4 shall not apply to building areas protected by an approved automatic sprinkler system and enclosed ~~with~~ by fire barriers having a fire resistance rating not less than of 1 hour. 19.2.1.4.2 ~~Structures of Types I and II fire-resistive construction used for dumpster or container storage~~ The requirement of 19.2.1.4 shall	

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not apply to structures meeting all of the following requirements: ~~shall be located not less than 10 ft (3 m) from openings and other buildings.~~ (1) Structures shall be Type I or Type II construction. (2) Structures shall be located not less than 10 ft (~~3 m~~ 3050 mm) from other structures. (3) Structures shall be used only for storage of dumpsters and combustible waste containers.	
Chapter 20 – Occupancy Fire Safety	
20.1.2.4 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 20.1.5.13 **Integrated Fire Protection Systems**. Integrated fire protection systems shall be tested in accordance with 13.1.3 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] 20.3.1.3 ~~Places of religious worship shall not be required to meet the provisions of Section 20.3 where providing day care while services are being held in the building.~~ 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 20.3.4.2.2.2 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 20.3.4.2.2.2(1) shall be permitted to be bimonthly in adult day-care centers. (3) All occupants of the building shall participate in the drill.	

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(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.

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]

20.4.2.5.7 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/ft^2 (20.4 L/m^2).
~~A capacity of 32 gal (121 L) shall not be exceeded within any 64 ft^2 (6 m^2) area.~~
(2) 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.
(3) Container size and density shall not be limited in hazardous areas.

[***101***:18.7.5.7.1; ***101***:19.7.5.7.1]

20.4.2.7 **Integrated Fire Protection Systems.** Integrated fire protection systems shall be tested in accordance with 13.1.3

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/ft^2 (20.4 L/m^2).
~~A capacity of 32 gal (121 L) shall not be exceeded within any 64 ft^2 (6 m^2) area.~~
(2) 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.
(3) Container size and density shall not be limited in hazardous areas.

[***101***:20.7.5.5.1; ***101***:21.7.5.5.1]

20.6.2.7 **Integrated Fire Protection Systems.** Integrated fire protection systems shall be tested in accordance with 13.1.3

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]

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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 20.7.2.8 **Integrated Fire Protection Systems.** Integrated fire protection systems shall be tested in accordance with 13.1.3 20.8.2.7 **Integrated Fire Protection Systems.** In new hotels and dormitories, integrated fire protection systems shall be tested in accordance with 13.1.3 20.9.2.3 **Inspection of Door Openings.** Door openings shall be inspected in accordance with 7.2.1.15 of NFPA *101*. 20.9.2.4 **Integrated Fire Protection Systems.** In new high-rise apartment buildings, integrated fire protection systems shall be tested in accordance with 13.1.3 20.12.2.5 **Inspection of Door Openings.** Door openings shall be inspected in accordance with 7.2.1.15 of NFPA *101* 20.12.2.6 **Integrated Fire Protection Systems.** In new apartment buildings, integrated fire protection systems shall be tested in accordance with 13.1.3 20.13.2.5 **Inspection of Door Openings.** Door openings shall be inspected in accordance with 7.2.1.15 of NFPA *101* 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] 20.14.3 **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* 20.14.3.2 **Integrated Fire Protection Systems.** Integrated fire protection systems shall be tested in accordance with 13.1.3 20.15.3 **Operating Features.** 20.15.3.1 **Inspection of Door Openings.** Door openings shall be inspected in accordance with 7.2.1.15 of NFPA *101* 20.15.3.2 **Integrated Fire Protection Systems.** Integrated fire protection systems shall be tested in accordance with 13.1.3	

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~~20.15.5 **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 30B, *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]~~ 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 20.15.5.2 Subsection 20.15.5 shall not apply to oilseed extraction processes ~~plants~~ that are covered by NFPA 36	
Chapter 21 – Airports and Heliports	
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] 21.3.4.3.2 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] New Sections (for 21.3.4.6 **Fire Protection**) 21.3.4.6.1 **General.** A foam fire-extinguishing system with either a fixed discharge outlet(s) in accordance with 21.3.4.6.2.1 or a hose	

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line(s) in accordance with 21.3.4.6.3.1 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. 21.3.4.6.1.3 Where freezing is possible, freeze protection shall be provided. [**418:**5.7.1.3] 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*. [**418:**5.7.1.4] 21.3.4.6.2 **Fixed Foam Fire-Extinguishing Systems.** 21.3.4.6.2.1 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. [**418:**5.7.2.1] ~~21.3.4.6.2.2.1 The supply calculation method shall be performed in accordance with Chapter 6 of NFPA 409. [**418:**5.7.3.2.1]~~ 21.3.4.6.2.3 The duration of foam discharge for the fixed discharge outlet systems shall be 10 ~~5~~ minutes 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	Many of these sections are marked as "new," but are actually just deleted from section 21.3.4.6.4 **Manual Fire-Fighting Equipment** and added in a new section, 21.3.4.6.5 **Water Supply**.

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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]

21.3.4.6.2.7 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]

21.3.4.6.2.8 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]

~~21.3.4.6.3.3 The supply calculation method shall be performed in accordance with Chapter 6 of NFPA 409. [**418:**5.7.4.3]~~

~~21.3.4.6.3.4 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]~~

21.3.4.6.4 Standpipes and hose stations, if used, shall be installed in accordance with Section 13.4. [**418:**5.7.4]

21.3.4.6.5 **Water Supply.**

~~21.3.4.6.4.3 Standpipes and hose stations, if used, shall be installed in accordance with Section 13.2. [**418:**5.7.5.2]~~

~~21.3.4.6.4.4 Where freezing is possible, freeze protection shall be provided. [**418:**5.7.5.3]~~

~~21.3.4.6.5 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 150/5390-2B, *Heliport Design Advisory Circular*. [**418:**5.7.6]~~

~~21.3.4.6.6 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]~~

~~21.3.4.6.7 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.**

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21.3.4.6.6.1 The supply of foam concentrate shall be sufficient to supply the largest system. 21.3.4.6.9 **Acceptance Testing.** 21.3.4.6.9.1 **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] 21.3.4.6.9.1.1 The system shall cover 95 percent of the rooftop landing pad during the test. [**418:**5.7.8.1.1] 21.3.4.6.9.1.2 The access points for firefighting and for egress shall be covered. [**418:**5.7.8.1.2] 21.3.4.6.9.2 **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] 21.3.4.6.10 **Inspection, Testing, and Maintenance.** 21.3.4.6.10.1 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] 21.3.4.6.10.2 Foam systems installed in accordance with NFPA 11 shall be maintained in accordance with NFPA 11. [**418:**5.7.9.2] ~~21.3.4.7 **Activation of Systems.**~~ ~~21.3.4.7.1 The fixed discharge outlet system shall be activated manually. [**418:**5.8.1]~~ ~~21.3.4.7.2 The activation shall be by manual pull stations located at each egress point from the rooftop landing pad. An additional manual pull station shall be located at an approved location inside the building from which the rooftop landing pad can be viewed. [**418:**5.8.2]~~ ~~21.3.4.7.3 Where buildings are provided with a fire alarm system, the activation of the system shall be monitored by the building fire alarm system in accordance with *NFPA 72*. [**418:**5.8.3]~~	
Chapter 22 – Automobile Wrecking Yards	
Chapter 23 – Cleanrooms	
Chapter 24 – Drycleaning	

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Chapter 25 – Grandstands and Bleachers, Folding and Telescopic Seating, Tents, and Membrane Structures	
25.1.4 **Flammable Liquids and Gases** 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:~~ ~~Chapter 66 for flammable and combustible liquids~~ ~~NFPA 54~~ ~~Chapter 69 for liquefied petroleum gases and liquefied natural gases~~ 25.1.4.2 No storage, use, or handling of ~~flammable liquids or gases~~ 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.	
Chapter 26 – Laboratories Using Chemicals	
26.1..2 Chapter 26 shall apply to laboratory buildings, laboratory units, and laboratory work areas whether located above or below grade in which chemicals, as defined, ~~are handled or stored~~ in NFPA 704 with one or more of the following hazard ratings are handled or stored: health — 2, 3, or 4; flammability — 2, 3, or 4; or instability — 2, 3, or 4. *(See also Section B.2 of NFPA 45.).* [**45:**1.1.1] 26.1.3 Chapter 26 shall apply to all educational laboratory units and instructional laboratory units in which any quantity of chemicals, as defined in NFPA 704 with one or more of the following hazard ratings, is handled or stored: health — 2, 3, or 4: flammability — 2, 3, 4; or instability — 2, 3, 4. *(See also Section B.2 of NFPA 45).* [**45:**1.1.2] 26.1.4 With the exception of 26.1.3, Chapter 26 shall not apply to the following: (1) *Laboratories for which the following conditions apply: (a) Laboratory units that contain less than or equal to 1 gal (4 L) of flammable or combustible liquid (b) Laboratory units that contain less than 75 scf (2.2 standard m^3) of flammable gas, not including piped-in low-pressure utility gas installed in accordance with NFPA 54, ~~*National Fuel Gas Code*~~	

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(2) *~~Laboratories that are pilot~~ Pilot plants (3) Laboratories that handle only chemicals with a hazard rating of 0 or 1, ~~as defined by NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*~~, for all of the following: health, flammability, and instability, as defined by NFPA 704 (4) Laboratories that are primarily manufacturing plants (5) Incidental testing facilities (6) Physical, electronic, instrument, laser, or similar laboratories that use chemicals only for incidental purposes, such as cleaning (7) *Hazards associated with radioactive materials, as covered by NFPA 801, ~~*Standard for Fire Protection for Facilities Handling Radioactive Materials*~~ (8) Laboratories that work only with explosive material, as covered by NFPA 495, ~~*Explosive Materials Code*~~ (9) A laboratory work area containing an explosion hazard great enough to cause property damage outside that laboratory work area or injury outside that laboratory work area requiring medical treatment beyond first aid [**45:**1.1.21.1.3]	
Chapter 27 – Manufactured Home and Recreational Vehicle Sites	
Chapter 28 – Marinas, Boatyards, Marine Terminals, Piers, and Wharves	
28.1.1 **Scope**. The construction and operation of marinas, boatyards, yacht clubs, boat condominiums, docking facilities associated with residential condominiums, multiple-docking facilities at multiple-family residences, and all associated piers, docks, and floats shall comply with NFPA 303, ~~*Fire Protection Standard for Marinas and Boatyards*~~, and Section 28.1. [**303:**1.1] 28.1.1.1 Section 28.1 also applies to support facilities and structures used for construction, repair, storage, hauling and launching, or fueling of vessels if fire on a pier would pose an immediate threat to these facilities, or if a fire at a referenced facility would pose an immediate threat to a docking facility. [**303:**1.1.1] 28.1.1.2 Section 28.1 applies to marinas and facilities servicing small recreational and commercial craft, yachts, and other craft of not more than 300 gross tons. [**303:**1.1.2] 28.1.1.3 Section 28.1 shall not apply to private, non-commercial docking facility constructed or occupied for the use of the owners or residents of an associated single-family dwelling. [**303:**1.1.3]	

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~~28.1.2 Section 28.1 shall not apply to private, non-commercial docking facility constructed or occupied for the use of the owners or residents of an associated single-family dwelling.~~ ~~28.1.3 Section 28.1 also applies to support facilities and structures used for construction, repair, storage, hauling and launching, or fueling of vessels if fire on a pier would pose an immediate threat to these facilities, or if a fire at a referenced facility would pose an immediate threat to a docking facility. [**303:**1.1.1]~~ ~~28.1.4 Section 28.1 applies to marinas and facilities servicing small recreational and commercial craft, yachts, and other craft of not more than 300 gross tons. [**303:**1.1.2]~~ 28.1.2.1.1.1.1 Placement of portable fire extinguishers on piers and along bulkheads where vessels are moored or are permitted to be moored shall meet the following criteria: (1) Extinguishers listed for Class A, Class B, and Class C fires shall be installed at the pier/land intersection on a pier that exceeds 25 ft (7.62 m) in length. (2) Additional fire extinguishers shall be placed such that the maximum travel distance to an extinguisher does not exceed 75 ft (22.86 m). (3) Extinguishers shall be protected from environmental exposures to prevent damage and lack of operability. [**303:**6.2.1.1.1.1] 28.1.2.1.2 ~~Maintenance~~ **Visibility and Identification**. All portable fire extinguishers ~~shall be maintained in accordance with 13.6.3 and~~ shall be clearly visible and marked. [**303:**6.2.2] 28.1.2.3.5 Supply piping for standpipes on piers and bulkheads shall be sized for the minimum flow rate ~~for Class II systems~~ of 300 gpm (1136 L/min). 28.1.2.4 **In-Out Dry Storage and Rack Storage.** Water supply and hoses or portable fire extinguishers and wheeled cart assemblies equipped with discharge nozzles capable of reaching all boats on the highest racks shall be provided. [**303:**6.4] 28.1.2.5 **Hydrants and Water Supplies.** Hydrants and water supplies for fire protection in marinas and boatyards shall be provided in accordance with ~~Section 13.2, Section 13.3, and 13.5.1~~ NFPA 13, NFPA 14, and NFPA 24. [**303:**6.5]	
Chapter 29 – Parking Garages	
29.1.3 The storage of self-propelled vehicles powered by GH_2 or LH_2 shall be in accordance with NFPA 2	

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Chapter 30 – Motor Fuel Dispensing Facilities and Repair Garages	
30.2.1.1 Repair garages servicing self-propelled vehicles powered by GH_2 or LH_2 shall comply with NFPA 2. 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 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 ~~*Exception: Slip-resistant, nonabsorbent, interior floor finishes having a critical radiant flux not more than 9.87 Btu/in.^{2} (0.45 W/cm^2), as determined by NFPA 253, shall be permitted. [**30A:**7.4.4]*~~ 30.2.5.1 Slip-resistant, nonabsorbent, interior floor finishes having a critical radiant flux not more than 9.87 Btu/in^2 (.45 W/cm^2), as determined by NFPA 253, shall be permitted 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 ft^2 (930 m^2). (2) The major repair garage is one story and exceeds 12,000 ft^2 (1115 m^2). (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 ~~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	

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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] 30.2.9.4 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. 30.2.10.6 Where major repairs are conducted on lighter-than-air ~~CNG-fueled vehicles or LNG-fueled vehicles~~ lighter-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 ignitible concentrations of gas. [**30A:**7.6.6]	
Chapter 31 – Forest Products and Biomass Feedstocks	
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. 31.3.1 **Application.** 31.3.1.1 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 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	

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(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 (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*.

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Chapter 32 – Motion Picture and Television Production Studio Soundstages and Approved Production Facilities	
Chapter 33 – Outside Storage of Tires	
Chapter 34 – General Storage	
34.2.1.1 The type and amount of materials used as part of the product and its primary packaging as well as the storage pallet shall be considered in the classification of the commodity. 34.2.5.3.2 A Class III commodity shall be permitted to contain a limited amount (5 percent or less by weight ~~or~~ of unexpanded plastic or 5 percent or less by volume ~~or less~~ of expanded plastic) of Group A or Group B plastics 34.2.5.3.3 Commodities containing a mix of both Group A expanded and unexpanded plastics shall comply with Figure 5.6.3.4.2 Figure 34.2.5.4.2 **Commodities Containing a Mixture of Expanded and Unexpanded Group A Plastics** 34.2.5.4.1 A Class IV commodity shall be defined as a product, with or without pallets, that meets one of the following criteria: (1) Constructed partially or totally of Group B plastics (2) Consists of free-flowing Group A plastic materials (3) Contains within itself or its packaging an appreciable amount (~~5 percent to 15 percent by weight or 5 percent to 25 percent by volume~~) (greater than 5 to 15 percent by weight of Group A unexpanded plastic or greater than 5 percent to 25 percent by volume of expanded Group A plastic) of Group A plastics [**13:**5.6.3.4.1] 34.2.5.4.2 ~~The remaining materials shall be permitted to be metal, wood, paper, natural or synthetic fibers, or Group B or Group C plastics~~ Commodities containing a mix of both Group A expanded and unexpanded plastics shall comply with Figure 34.2.5.4.2 Figure 34.2.5.4.2 **Commodities Containing a Mixture of Expanded and Unexpanded Group A Plastics** 34.2.5.4.3 The remaining materials shall be permitted to be metal, wood, paper, natural or synthetic fibers, or Group B or Group C plastics. 34.2.6.1 **Group A.** The following materials shall be classified as Group A: (1) ABS (acrylonitrile-butadiene-styrene copolymer) (2) Acetal (polyformaldehyde) (3) Acrylic (polymethyl methacrylate) (4) Butyl rubber	

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(5) Cellulosics (cellulose acetate, cellulose acetate butyrate, ethyl cellulose)
(6) EPDM (ethylene-propylene rubber)
(7) FRP (fiberglass-reinforced polyester)
(8) Natural rubber (~~if expanded~~)
(9) Nitrile-rubber (acrylonitrile-butadiene-rubber)
(10) Nylon (nylon 6, nylon 6/6)
(11) PET (thermoplastic polyester)
(12) Polybutadiene
(13) Polycarbonate
(14) Polyester elastomer
(15) Polyethylene
(16) Polypropylene
(17) Polystyrene
(18) Polyurethane
(19) PVC (polyvinyl chloride — highly plasticized, with plasticizer content greater than 20 percent) (rarely found)
(20) PVF (polyvinyl fluoride)
(21) SAN (styrene acrylonitrile)
(22) SBR (styrene-butadiene rubber) [**13:**5.6.4.1]

34.2.6.1.1 Group A plastics shall be further subdivided as either expanded or unexpanded.

34.2.6.1.1.1 If a cartooned commodity is more than 40 percent (by volume) expanded plastic, it shall be protected as a cartooned expanded plastic.

34.2.6.1.1.2 Exposed commodities containing greater than 25 percent by volume expanded plastic shall be protected as an exposed expanded plastic.

34.2.6.2 **Group B.** The following materials shall be classified as Group B:

~~Cellulosics (cellulose acetate, cellulose acetate butyrate, ethyl cellulose)~~

(1) Chloroprene rubber
(2) Fluoroplastics (ECTFE — ethylene-chlorotrifluoro-ethylene copolymer; ETFE — ethylene-tetrafluoroethylene copolymer; FEP — fluorinated ethylene-propylene copolymer)

~~Natural rubber (not expanded)~~
~~Nylon (nylon 6, nylon 6/6)~~

(3) Silicone rubber [**13:**5.6.4.2]

34.2.6.3 **Group C.** The following materials shall be classified as Group C:

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(1) Fluoroplastics (PCTFE — polychlorotrifluoroethylene; PTFE — polytetrafluoroethylene) (2) Melamine (melamine formaldehyde) (3) Phenolic (4) PVC (polyvinyl chloride — flexible — PVCs with plasticizer content up to 20 percent) (5) PVDC (polyvinylidene chloride) (6) PVDF (polyvinylidene fluoride) ~~PVF (polyvinyl fluoride)~~ (7) Urea (urea formaldehyde) [**13:**5.6.4.3] ~~34.2.6.4 Group A plastics shall be further subdivided as either expanded or nonexpanded. [**13:**5.6.4.4]~~ ~~34.2.6.4.1 If a cartoned commodity is more than 40 percent (by volume) expanded plastic, it shall be protected as a cartoned expanded plastic. [**13:**5.6.4.4.1]~~ ~~34.2.6.4.2 Exposed commodities containing greater than 25 percent by volume expanded plastic shall be protected as an exposed expanded plastic. [**13:**5.6.4.4.2]~~ 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. 34.10.4 **Outside Storage at Pallet Manufacturing and Pallet Recycling Facilities.** 34.10.4.1 The outside storage of pallets on the same site as a manufacturing or 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	Added in revision #1 and then omitted in revision #2

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(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~~ submit a 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 plan
(2) Hot work permit process in accordance with Chapter 41
(3) Preventive maintenance program for equipment associated with the pallet
(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~~ action 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 34.10.4.10, 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 34.10.4.10, 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.

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(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.	
Chapter 35 – Animal Housing Facilities ~~Reserved~~	
35.1 **General.** General. Animal housing facilities shall comply with NFPA 150 and this chapter. 35.2 **Permits.** Permits, where required, shall comply with Section 1.12.	
Chapter 36 – Telecommunication Facilities and Information Technology Equipment	
Chapter 37 – Fixed Guideway Transit and Passenger Rail Systems	
Chapter 38 – Marijuana Growing, Processing, or Extraction Facilities ~~Reserved~~	
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.	

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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

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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

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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.

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38.6.1.1.3 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.

38.6.1.1.4* **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.

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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.

38.6.1.5.2.2 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*.

38.6.1.5.2.3* LPG tanks shall comply with 69.2.1.

38.6.1.5.3 **Approval for Systems and Equipment with No Listing**.

38.6.1.5.3.1 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.

38.6.1.5.3.2 The designer of record shall be a registered design professional.

38.6.1.5.4* **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.

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38.6.1.5.5 **Change of Extraction Medium**.

38.6.1.5.5.1 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.

38.6.1.5.5.2 If the original designer of record is not available, then the new designer of record shall comply with 38.6.1.5.3.1.

38.6.1.5.6 **Equipment Field Verification**.

38.6.1.5.6.1 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.

38.6.1.5.6.2 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.

38.6.1.5.6.3 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.

38.6.2 **Liquified Petroleum Gas (LPG) Extraction**.

38.6.2.1 **General**. Marijuana extraction facilities using liquefied petroleum gas solvents shall comply with 38.6.1 and 38.6.2.

38.6.2.2 **Exhaust**.

38.6.2.2.1 An approved exhaust system shall be provided for LPG extractions.

38.6.2.2.2 The exhaust systems shall be installed and maintained accordance with NFPA 91 or the mechanical code.

38.6.2.2.3 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**.

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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 1.0×10^6 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**. 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.

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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.

38.6.3.2.3 Classified electrical systems shall be in accordance with *NFPA 70*.

38.6.3.2.4 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.

38.6.3.3 **Storage and Handling**. The storage, use, and handling of flammable liquids shall be in compliance with this chapter and Chapter 66.

38.6.3.4 Heating of flammable or combustible liquids over an open flame shall be prohibited.

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 CO_2 compressed gas cylinders shall be secured to a fixed object to prevent falling.

38.6.4.3 **CO_2 Gas Detection**.

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38.6.4.3.1 An approved, listed CO_2 detector shall be installed in the CO_2 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 CO_2. 38.6.4.4* **CO_2 Discharges**. The extraction equipment pressure relief devices and blow-off valves shall be piped to the exterior of the building. 38.7* **Transfilling**. Filling LPG extraction equipment supply containers shall be in compliance with 69.3.5, 69.4.2, and NFPA 58.	
Chapter 39 – Reserved	
Chapter 40 – Dust Explosion and Fire Protection	
40.1 **Application** ~~**General.**~~ 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:~~ ~~(1) NFPA 61, *Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities*~~ ~~(2) NFPA 69, *Standard on Explosion Prevention Systems*~~ ~~(3) NFPA 85, *Boiler and Combustion Systems Hazards Code*~~ ~~(4) NFPA 120, *Standard for Fire Prevention and Control in Coal Mines*~~ ~~(5) NFPA 484, *Standard for Combustible Metals*~~ ~~(6) NFPA 652, *Standard on the Fundamentals of Combustible Dust*~~ ~~(7) NFPA 654, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids*~~ ~~(8) NFPA 655, *Standard for Prevention of Sulfur Fires and Explosions*~~ ~~(9) 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. 40.3 **Retroactivity**. This chapter shall apply to new and existing facilities and processes. [**652:**9.1]	

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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]

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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]

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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]

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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]

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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 6.1of 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~~

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~~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:~~

~~(1) Vacuuming, sweeping, or water wash-down methods are first used to clean surfaces that can be safely accessed prior to using compressed air.~~
~~(2) Dust accumulations in the area after vacuuming, sweeping, or water wash-down do not exceed the threshold dust accumulation.~~
~~(3) 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."~~
~~(4) 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.~~
~~(5) All ignition sources and hot surfaces capable of igniting a dust cloud or dust layer are shut down or removed from the area.~~

~~[**654:**8.2.2.4]~~

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~~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:~~

~~(1) Materials of construction shall comply with 7.13.2 and 9.3.2 of NFPA 654.~~
~~(2) Hoses shall be conductive or static dissipative.~~
~~(3) All conductive components, including wands and attachments, shall be bonded and grounded.~~
~~(4) Dust-laden air shall not pass through the fan or blower.~~
~~(5) Electrical motors shall not be in the dust-laden air stream unless listed for Class II, Division 1 locations.~~
~~(6) When liquids or wet material are picked up by the vacuum cleaner, paper filter elements shall not be used.~~
~~(7) Vacuum cleaners used for metal dusts shall meet the requirements of NFPA 484.~~

~~[**654:**8.2.3.1]~~

~~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]~~

~~40.4 **Ignition Sources**.~~

~~40.4.1 **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]~~

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~~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:~~

~~(1) Permanent magnetic separators or electromagnetic separators that indicate loss of power to the separators~~

~~(2) Pneumatic separators~~

~~(3) 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]~~

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~~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:~~

~~(1) Hybrid mixtures are not present.~~
~~(2) Conductive dusts are not handled.~~
~~(3) The MIE of the material being handled is greater than 3 mJ.~~
~~(4) The nonconductive components do not result in isolation of conductive components from ground.~~
~~(5) 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 1.0×10^6 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 1.0×10^6 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]~~

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~~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]~~

~~40.4.3.4.3.2 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]~~

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~~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 be 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 40.4.3.7.140.4.3.7.1 through 40.4.3.7.740.4.3.7.7 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]~~

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~~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]~~

~~40.4.4.4 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]~~

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~~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:~~

~~(1) Only fresh makeup air is heated.~~
~~(2) The return air is filtered to prevent accumulations of dust in the recirculating system.~~
~~(3) The exhaust flow is balanced with fresh air intake.~~

~~[**654:**9.6.5]~~

~~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~~

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~~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 vaccum 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~~

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~~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]~~

~~40.5.2.8.2 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]~~

~~40.5.2.9 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]~~

~~40.5.2.10 **Abort Gates and Abort Dampers**.~~

~~40.5.2.10.1 All fire protection 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]~~

~~40.5.2.10.2 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]~~

~~40.5.3 **Fire Extinguishers**.~~

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~~40.5.3.1 Portable fire extinguishers shall be provided throughout all buildings in accordance with the requirements of Section 13.6. [**654:**10.3.1]~~

~~40.5.3.2 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]~~

~~40.5.4 **Hoses, Nozzles, Standpipes, and Hydrants**.~~

~~40.5.4.1 Standpipes and hose, where provided, shall comply with Section 13.2. [**654:**10.4.1]~~

~~40.5.4.2 **Nozzles**.~~

~~40.5.4.2.1 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]~~

~~40.5.4.2.2 Straight-stream nozzles shall not be used on fires in areas where dust clouds can be generated. [**654:**10.4.2.2]~~

~~40.5.4.2.3 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]~~

~~40.5.4.3 Private outside protection, including outside hydrants and hoses, where provided, shall comply with Section 13.3. [**654:**10.4.3]~~

~~40.5.5 **Automatic Sprinklers**.~~

~~40.5.5.1 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]~~

~~40.5.5.2 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,~~

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~~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:.~~

~~(1) NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*~~
~~(2) NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*~~
~~(3) NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*~~
~~(4) NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*~~
~~(5) NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*~~
~~(6) NFPA 17, *Standard for Dry Chemical Extinguishing Systems*~~
~~(7) NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*~~
~~(8) NFPA 750, *Standard on Water Mist Fire Protection Systems*~~
~~(9) 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]~~

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~~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:~~

~~(1) Hazards of their workplace~~
~~(2) General orientation, including plant safety rules~~
~~(3) Process description~~
~~(4) Equipment operation, safe startup and shutdown, and response to upset conditions~~
~~(5) The necessity for proper functioning of related fire and explosion protection systems~~
~~(6) Equipment maintenance requirements and practices~~
~~(7) Housekeeping requirements~~
~~(8) Emergency response plans~~

~~[**654:**11.3.2]~~

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~~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]~~

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~~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:~~

~~(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~~

~~[**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]~~

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~~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]~~

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~~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]~~	
Chapter 41 – Welding, Cutting, and Other Hot Work	
41.1.4 Acetylene cylinder charging plants shall comply with NFPA 55 ~~51A~~.	
Chapter 42 – Refueling	
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. 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. 42.5.4.2 Each pump shall have installed on the discharge side a listed leak detection device that restricts or shuts off the flow of product ~~will provide an audible or visible indication~~ 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	

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shall require manual intervention and the manner of resetting shall be approved by the AHJ.

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.

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.

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 ~~by at least 25 ft (7.6 m)~~ in accordance with Table 42.7.2.2.3.

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]

42.7.2.2.3.2 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]

Table 42.7.2.2.3 **Minimum Separation Distances Between Delivery Vehicles and Aboveground Tanks**

> ~~*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]

42.7.2.5 **Display of Materials.** The storage or placement for display or sale of products shall be prohibited within 20 ft of any fuel dispenser. [**30A:**9.2.5.5]

42.7.2.10 **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.

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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 motor fluids ~~Class I liquids while said liquids are being dispensed~~

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~~ 42.7.6.9 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.

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 **Additional Requirements for CNG, LNG, Hydrogen, and LP-Gas.**

42.8.2.3 Dispensing devices for CNG, LNG, hydrogen, and LP-Gas shall be listed or approved. [**30A:**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]

42.10.2 **General Requirements**.

42.10.2.1 **Design and Construction**.

42.10.2.1.1 **General Requirements**.

42.10.2.1.1.1 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]

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

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

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

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

42.10.2.1.2 **Fuel Storage Tanks. (Reserved)**

42.10.2.1.3 **Fuel Dispensing Systems**.

42.10.2.1.3.1 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]

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

42.10.2.1.3.3 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]

42.10.2.1.3.4 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]

42.10.2.1.3.5 Disengaging the nozzle from the aircraft adapter shall not be possible until the nozzle is fully closed. [**407:**4.1.3.5]

42.10.2.1.3.6 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]

42.10.2.1.3.7 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]

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

42.10.2.1.4* **Fueling Hose**.

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

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42.10.2.1.4.2 **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]

42.10.2.1.4.3 **Additional Requirements**.

42.10.2.1.4.3.1 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]

42.10.2.1.4.3.2 A test certificate shall be provided for each coupled length of hose and shall state the following:

(1) Manufacturer's name of hose
(2) Manufacturer's name of couplings
(3) Hose type
(4) Hose grade
(5) Size and length of hose
(6) Serial number or reference number of hose
(7) Quarter and year of manufacture of hose
(8) Model number of couplings
(9) Sizes of coupling ferrules
(10) Hydrostatic test pressures
(11) Coupled length serial number
(12) Identification of individual responsible for coupling the hose
(13) Name and address of company responsible for coupling the hose
(14) Date of certification

[**407:**4.1.4.3.2]

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

42.10.2.1.4.3.4 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]

42.10.2.1.4.3.5 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]

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

42.10.2.1.4.3.7 **Hydrostatic Testing**. Hydrostatic testing shall be in accordance with ASTM D380. [**407:**4.1.4.3.7]

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42.10.2.1.4.3.7.1 Following a hydrostatic test, all the water shall be drained and the hose shall be dried internally. [**407:**4.1.4.3.7.1]

42.10.2.1.4.3.7.2 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]

42.10.2.1.4.3.7.3 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]

42.10.2.1.4.3.8 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]

42.10.2.1.5 **Electrostatic Hazards and Bonding**.

42.10.2.1.5.1 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]

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

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

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

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

42.10.2.1.5.6 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]

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

42.10.2.1.5.8 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]

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42.10.2.1.5.9* 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] 42.10.2.1.5.9.1* The relaxation period required by 42.10.2.1.5.9 shall not apply to the actual refueling of an aircraft. [**407:**4.1.5.9.1] 42.10.2.1.5.9.2 The relaxation period required by 42.10.2.1.5.9 shall not apply to fuels with static dissipater additives. [**407:**4.1.5.9.2] 42.10.2.1.6 **Electrical Systems. (Reserved)** 42.10.2.1.7 **Control of Fuel Flow. (Reserved)** 42.10.2.1.8 **Filters and Ancillary Equipment**. 42.10.2.1.8.1 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] 42.10.2.1.8.2 The AAV or AAE shall discharge to a closed system. [**407:**4.1.8.2] 42.10.2.1.9 **Emergency Fuel Shutoff Systems. (Reserved)** 42.10.2.1.10 **Fire Extinguishers**. 42.10.2.1.10.1 During fueling operations, fire extinguishers shall be available on aircraft servicing ramps or aprons, in accordance with NFPA 410. [**407:**4.1.10.1] 42.10.2.1.10.2 All fire extinguishers shall conform to the requirements of NFPA 10. [**407:**4.1.10.2] 42.10.2.1.10.3* 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] 42.10.2.1.11 **Marking and Labeling**. 42.10.2.1.11.1 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]	

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42.10.2.1.11.2 The method of operation shall be indicated by an arrow or by the word PUSH or PULL, as appropriate. [**407:**4.1.11.2]

42.10.2.1.11.3 Any action necessary to gain access to the shutoff device (e.g., BREAK GLASS) shall be shown clearly. [**407:**4.1.11.3]

42.10.2.1.11.4 Lettering shall be of a color contrasting sharply with the placard background for visibility. [**407:**4.1.11.4]

42.10.2.1.11.5 Placards shall be weather resistant. [**407:**4.1.11.5]

42.10.2.1.12 **Aircraft Fueling Ramps**.

42.10.2.1.12.1 **Aircraft Radar Equipment**.

42.10.2.1.12.1.1 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]

42.10.2.1.12.1.2 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]

42.10.2.1.12.2* **Ground Radar Equipment**.

42.10.2.1.12.2.1 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]

42.10.2.1.12.2.2 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]

42.10.2.1.12.2.3 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]

42.10.2.1.12.2.4 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]

42.10.2.1.12.3 **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]

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42.10.2.1.12.4 **Ramp and Apron Drainage**. Aircraft servicing ramps or aprons shall be sloped and drained in accordance with NFPA 415. [**407:**4.1.12.4]

42.10.2.1.12.4.1 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]

42.10.2.1.12.4.2 Fueling hydrant boxes or fueling pits that are connected to a ramp drainage system shall be fitted with vaporsealing traps. [**407:**4.1.12.4.2]

42.10.2.2 **Operations**.

42.10.2.2.1 **Security. (Reserved)**

42.10.2.2.2 **Training**.

42.10.2.2.2.1* 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]

42.10.2.2.2.2* 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]

42.10.2.2.3* **Prevention and Control of Spills**.

42.10.2.2.3.1 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]

42.10.2.2.3.2 All hoses shall also be properly stowed. [**407:**4.2.3.2]

42.10.2.2.3.3 Fuel nozzles shall not be dragged along the ground. [**407:**4.2.3.3]

42.10.2.2.3.4 Approved pumps, either hand operated or power operated, shall be used where aircraft are fueled from drums. [**407:**4.2.3.4]

42.10.2.2.3.4.1 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]

42.10.2.2.3.5 **Fuel Spill Procedures**.

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42.10.2.2.3.5.1 Where a spill is observed, the fuel servicing shall be stopped immediately by release of the deadman controls. [**407:**4.2.3.5.1] 42.10.2.2.3.5.2 In the event that a spill continues, the equipment emergency fuel shutoff shall be actuated. [**407:**4.2.3.5.2] 42.10.2.2.3.5.3 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] 42.10.2.2.3.5.4 The supervisor shall be notified immediately. [**407:**4.2.3.5.4] 42.10.2.2.3.5.5 Cleaning operations shall be performed by personnel trained in accordance with 42.10.2.2.2.1. [**407:**4.2.3.5.5] 42.10.2.2.3.5.6 Operation shall not be resumed until the spill has been cleared and conditions are determined to be safe. [**407:**4.2.3.5.6] 42.10.2.2.3.5.7 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 m^2 (50 ft^2) in area, continues to flow, or is otherwise a hazard to persons or property. [**407:**4.2.3.5.7] 42.10.2.2.3.5.8 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] 42.10.2.2.3.5.9 Corrective measures identified by the spill investigation shall be implemented as required by the authority having jurisdiction. [**407:**4.2.3.5.9] 42.10.2.2.3.6 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] 42.10.2.2.3.7 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] 42.10.2.2.4 **Emergency Fuel Shutoff**.	

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42.10.2.2.4.1 Emergency fuel shutoff control stations shall be accessible at all times. [**407:**4.2.4.1]

42.10.2.2.4.2 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]

42.10.2.2.4.3 If the fuel flow stops for an unknown reason, the emergency fuel shutoff system shall be checked first. [**407:**4.2.4.3]

42.10.2.2.4.4 The cause of the shutoff shall be identified and corrected before fuel flow is resumed. [**407:**4.2.4.4]

42.10.2.2.4.5 Emergency fuel shutoff systems shall be operationally checked at intervals not exceeding 6 months. [**407:**4.2.4.5]

42.10.2.2.4.6 Each individual device shall be checked at least once during every 12-month period. [**407:**4.2.4.6]

42.10.2.2.4.7 Suitable records shall be kept of tests required by this section. [**407:**4.2.4.7]

42.10.2.2.5* **Bonding**.

42.10.2.2.5.1 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]

42.10.2.2.5.1.1 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]

42.10.2.2.5.1.2 Grounding for the sole purpose of aircraft fueling shall not be permitted. [**407:**4.2.5.1.2]

42.10.2.2.5.2 **Bonding for Overwing Fueling**. In addition to the requirements in 42.10.2.2.5.1, 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]

42.10.2.2.5.2.1 The bond connection shall be made before the filler cap is removed. [**407:**4.2.5.2.1]

42.10.2.2.5.2.2 If a nozzle bond cable and plug receptacle or means for attaching a clip is available, the operator shall attach the nozzle

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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]

42.10.2.2.5.2.3 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]

42.10.2.2.5.2.4 The nozzle spout shall be kept in contact with the filler neck until the fueling is completed. [**407:**4.2.5.2.4]

42.10.2.2.5.3 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]

42.10.2.2.5.3.1* Only metal funnels shall be used. [**407:**4.2.5.3.1]

42.10.2.2.5.4 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]

42.10.2.2.5.5 Bonding and fueling connections shall be disconnected in the reverse order of connection. [**407:**4.2.5.5]

42.10.2.2.5.6 Conductive hose shall be used to prevent electrostatic discharge but shall not be used to accomplish required bonding. [**407:**4.2.5.6]

42.10.2.2.6 **Control of Fuel Flow**.

42.10.2.2.6.1 Fuel flow shall be controlled by use of a dead-man control device. [**407:**4.2.6.1]

42.10.2.2.6.2 The use of any means that defeats the dead-man control shall be prohibited. [**407:**4.2.6.2]

42.10.2.2.7 **Fire Protection**.

42.10.2.2.7.1* During fueling operations, fire extinguishers shall be available on aircraft servicing ramps or aprons, in accordance with NFPA 410. [**407:**4.2.7.1]

42.10.2.2.7.2* Extinguishers shall be kept clear of elements such as ice and snow. [**407:**4.2.7.2]

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42.10.2.2.7.3 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]

42.10.2.2.7.4 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]

42.10.2.2.8 **Maintenance**.

42.10.2.2.8.1 Fuel servicing equipment shall be maintained in safe operating condition. [**407:**4.2.8.1]

42.10.2.2.8.2 Malfunctioning equipment shall be removed from service. [**407:**4.2.8.2]

42.10.2.2.8.3 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]

42.10.2.2.8.4 The tag/lock shall not be removed until the operation is completed. [**407:**4.2.8.4]

42.10.2.2.8.5 All inspection and maintenance activities shall be recorded. [**407:**4.2.8.5]

42.10.2.2.8.6 Inspection and maintenance records shall be retained for a minimum of 12 months. [**407:**4.2.8.6]

42.10.2.2.9* **Aircraft Fueling Hose**. Any hose found to be defective, in accordance with 42.10.2.2.9.1 through 42.10.2.2.9.4, shall be removed from service. [**407:**4.2.9]

42.10.2.2.9.1 Suitable records shall be kept of required inspections and hydrostatic tests. [**407:**4.2.9.1]

42.10.2.2.9.2 Aircraft fueling hose shall be removed from service after 10 years from the date of manufacture. [**407:**4.2.9.2]

42.10.2.2.9.3 Aircraft fueling hose not placed into service within 2 years of the date of manufacture shall not be used. [**407:**4.2.9.3]

42.10.2.2.9.4 **Daily Inspection**. Aircraft fueling hose shall be inspected before use each day. [**407:**4.2.9.4]

42.10.2.2.9.4.1 The hose shall be extended as it normally would be for fueling. [**407:**4.2.9.4.1]

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42.10.2.2.9.4.2 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]

42.10.2.2.9.5 **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]

42.10.2.2.9.5.1* The hose couplings and the hose shall be examined for structural weakness or soft spots. [**407:**4.2.9.5.1]

42.10.2.2.9.5.2 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]

42.10.2.2.9.6 **Quarterly Inspection**.

42.10.2.2.9.6.1 The nozzle screens shall be examined for evidence of hose deterioration. [**407:**4.2.9.6.1]

42.10.2.2.9.7 Kinks or short loops in fueling hose shall be avoided. [**407:**4.2.9.7]

42.10.2.2.10* **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]

42.10.2.2.11 **Aircraft Fuel Servicing**.

42.10.2.2.11.1 **Location of Aircraft During Fuel Servicing**.

42.10.2.2.11.1.1 Aircraft fuel servicing shall be performed outdoors. [**407:**4.2.11.1.1]

42.10.2.2.11.1.2 Aircraft fuel servicing incidental to aircraft fuel system maintenance operations shall comply with the requirements of NFPA 410. [**407:**4.2.11.1.2]

42.10.2.2.11.1.3* 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

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enclosed passenger concourse other than a loading walkway. [**407:**4.2.11.1.3]

42.10.2.2.11.1.4 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]

42.10.2.2.11.1.5 Accessibility to aircraft by emergency fire equipment shall be maintained for aircraft fuel servicing positions. [**407:**4.2.11.1.5]

42.10.2.2.11.2 **Aircraft Occupancy During Fuel Servicing**.

42.10.2.2.11.2.1 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]

42.10.2.2.11.2.1.1 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]

42.10.2.2.11.2.1.2 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]

42.10.2.2.11.2.1.3 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]

42.10.2.2.11.2.1.4 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]

42.10.2.2.11.2.2 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]

42.10.2.2.11.2.2.1 Controls shall be established so that passengers avoid such areas. [**407:**4.2.11.2.2.1]

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42.10.2.2.12 **Fire Hazards on Aircraft Fuel Servicing Ramps**.

42.10.2.2.12.1* **Electrical Equipment Operated on Aircraft Fuel Servicing Ramps or Aprons**.

42.10.2.2.12.1.1 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]

42.10.2.2.12.1.2* 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]

42.10.2.2.12.1.3 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]

42.10.2.2.12.1.4 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]

42.10.2.2.12.1.5* 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]

42.10.2.2.12.2 **Open Flames on Aircraft Fuel Servicing Ramps**.

42.10.2.2.12.2.1 Entrances to fueling areas shall be posted with “no smoking” signs. [**407:**4.2.12.2.1]

42.10.2.2.12.2.2 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]

42.10.2.2.12.2.3 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

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(5) Flare pots or other open-flame lights [**407:**4.2.12.2.3]

42.10.2.2.12.2.4 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]

42.10.2.2.12.2.5 Personnel shall not carry lighters, matches, or electronic cigarettes on their person while engaged in fuel servicing operations. [**407:**4.2.12.2.5]

42.10.2.2.12.2.6 Lighters, matches, or electronic cigarettes shall not be permitted on or in fueling equipment. [**407:**4.2.12.2.6]

42.10.2.2.12.2.7 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]

42.10.2.2.12.3 **Operation of Aircraft Engines and Heaters**.

42.10.2.2.12.3.1 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]

42.10.2.2.12.3.2 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]

42.10.2.2.12.3.3 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]

42.10.2.2.13 **Defueling of Aircraft**.

42.10.2.2.13.1 All requirements of this standard shall apply to defueling operations. [**407:**4.2.13.1]

42.10.2.2.13.2 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]

42.10.2.2.14 **Rapid Refueling**.

42.10.2.2.14.1 Rapid refueling of aircraft shall be limited to the following aircraft types:

(1) Helicopters
(2) Agricultural aircraft actively engaged in aerial application duties

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(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]

42.10.2.2.14.2 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]

42.10.2.2.14.3 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]

42.10.2.2.14.4 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 42.10.2.2.14.3(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)

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(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]

42.10.3 **Aviation Fueling Facilities**.

42.10.3.1 **Design and Construction**.

42.10.3.1.1 **General Requirements**.

42.10.3.1.1.1 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]

42.10.3.1.1.2 The system and each of its components shall be designed for the working pressure of the system. [**407:**5.1.1.2]

42.10.3.1.1.3 The emergency fuel shutoff system shall be designed and installed as an integral part of the airport fuel system. [**407:**5.1.1.3]

42.10.3.1.1.4 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]

42.10.3.1.1.5 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]

42.10.3.1.1.6 **System Design and Approval**.

42.10.3.1.1.6.1 **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]

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42.10.3.1.1.6.2 **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]

42.10.3.1.1.6.3 **Hydrostatic Test**.

42.10.3.1.1.6.3.1 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]

42.10.3.1.1.6.3.2 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]

42.10.3.1.2 **Fuel Storage Tanks**.

42.10.3.1.2.1* Fuel storage tanks shall conform to the applicable requirements of NFPA 30. [**407:**5.1.2.1]

42.10.3.1.2.2 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]

42.10.3.1.3 **Pumps and Piping Systems**.

42.10.3.1.3.1 Underground piping or impact-protected aboveground piping shall be used in the vicinity of aircraft operating areas. [**407:**5.1.3.1]

42.10.3.1.3.2 Piping shall be laid on firm supports using clean, noncorrosive backfill. [**407:**5.1.3.2]

42.10.3.1.3.3 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]

42.10.3.1.3.3.1 The casing shall extend beyond the building. [**407:**5.1.3.3.1]

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42.10.3.1.3.3.2 The casing shall terminate at a low point(s) with an automatic leak detection system. [**407:**5.1.3.3.2]

42.10.3.1.3.3.3 The casing shall be capable of being drained to a safe location. [**407:**5.1.3.3.3]

42.10.3.1.3.4 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]

42.10.3.1.3.5 Cast-iron, copper, copper alloy, and galvanized steel piping, valves, and fittings shall not be permitted. [**407:**5.1.3.5]

42.10.3.1.3.6 Ductile iron valves shall be permitted. [**407:**5.1.3.6]

42.10.3.1.3.7 Aluminum piping, valves, and fittings shall be used only where specifically approved by the authority having jurisdiction. [**407:**5.1.3.7]

42.10.3.1.3.8 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]

42.10.3.1.3.9 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]

42.10.3.1.3.10 Flanges and their associated bolts shall be steel or stainless steel. [**407:**5.1.3.10]

42.10.3.1.3.10.1 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]

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42.10.3.1.3.10.2 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]

42.10.3.1.3.11 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]

42.10.3.1.3.12 Pressure relief valves shall be provided in lines that can be isolated. [**407:**5.1.3.12]

42.10.3.1.3.13 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]

42.10.3.1.3.14* Isolation valves or devices shall be provided to facilitate dismantling portions of the fueling system. [**407:**5.1.3.14]

42.10.3.1.3.15 Isolation valves shall be capable of being locked closed. [**407:**5.1.3.15]

42.10.3.1.3.16 Buried flanges and valves shall not be permitted. [**407:**5.1.3.16]

42.10.3.1.3.17* All fueling systems with underground piping shall have cathodic protection to mitigate corrosion. [**407:**5.1.3.17]

42.10.3.1.3.18 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]

42.10.3.1.4 **Hose and Nozzles. (Reserved)**

42.10.3.1.5 **Bonding. (Reserved)**

42.10.3.1.6 **Electrical Systems**.

42.10.3.1.6.1 **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]

42.10.3.1.7 **Control of Fuel Flow**.

42.10.3.1.7.1* **Deadman Controls**.

42.10.3.1.7.1.1 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]

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42.10.3.1.7.1.2 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]

42.10.3.1.7.1.3 Deadman controls shall be designed to preclude defeating their intended purpose. [**407:**5.1.7.1.3]

42.10.3.1.7.2 **Pressure Fuel Servicing System Controls**.

42.10.3.1.7.2.1 The system shall be designed to minimize surge pressure. [**407:**5.1.7.2.1]

42.10.3.1.7.2.2* 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]

42.10.3.1.7.2.3 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]

42.10.3.1.7.2.4 The control valve shall be fail-safe by closing completely in the event of control power loss. [**407:**5.1.7.2.4]

42.10.3.1.7.3* **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]

42.10.3.1.7.3.1 Hydrant valves shall be of the self-closing, dry-break type. [**407:**5.1.7.3.1]

42.10.3.1.7.4 **Flow Control Valves**. The flow control valve shall be an integral part of the hydrant valve or coupler. [**407:**5.1.7.4]

42.10.3.1.7.4.1 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]

42.10.3.1.7.4.2 The fuel control system shall be designed to minimize overshoot. [**407:**5.1.7.4.2]

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42.10.3.1.7.4.3 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] 42.10.3.1.7.4.4 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] 42.10.3.1.7.4.5 The hydrant valve that allows the flow of fuel to the aircraft shall have a deadman control. [**407:**5.1.7.4.5] 42.10.3.1.7.4.6 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] 42.10.3.1.7.4.7 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] 42.10.3.1.7.4.8 Wireless deadman controls shall be permitted. [**407:**5.1.7.4.8] 42.10.3.1.7.5* **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] 42.10.3.1.8 **Filters and Ancillary Equipment**. 42.10.3.1.8.1 All sections of the filtering system shall have electrical continuity with adjoining piping and equipment. [**407:**5.1.8.1] 42.10.3.1.8.2 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] 42.10.3.1.8.3 Heaters shall be constructed of noncorrosive materials. [**407:**5.1.8.3] 42.10.3.1.8.4 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] 42.10.3.1.9 **Emergency Fuel Shutoff Systems**.	

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42.10.3.1.9.1 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] 42.10.3.1.9.2 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] 42.10.3.1.9.3 The emergency fuel shutoff system shall be of a failsafe design. [**407:**5.1.9.3] 42.10.3.1.9.4* 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] 42.10.3.1.9.5 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] 42.10.3.1.9.6* 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] 42.10.3.1.9.7 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] 42.10.3.1.9.8 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] 42.10.3.1.9.9 Emergency fuel shutoffs shall not be located beneath piping, pumps, vents, or other components containing fuel or fuel vapors. [**407:**5.1.9.9] 42.10.3.1.10 **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] 42.10.3.1.11 **Marking and Labeling**. 42.10.3.1.11.1 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]	

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42.10.3.1.11.2 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]

42.10.3.1.11.3 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]

42.10.3.1.11.4 Fuel storage tanks shall be labelled in accordance with the requirements of NFPA 704. [**407:**5.1.11.4]

42.10.3.1.11.5 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]

42.10.3.1.12 **Aircraft Fuel Servicing Vehicle Loading and Unloading Racks**.

42.10.3.1.12.1 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]

42.10.3.1.12.2 All fuel servicing tank vehicle primary shutdown systems shall be compatible with the system utilized at the loading rack. [**407:**5.1.12.2]

42.10.3.1.12.3 The automatic secondary shutoff control shall not be used for normal filling control. [**407:**5.1.12.3]

42.10.3.1.12.4 New and existing loading systems shall comply with 42.10.3.1.12.1 through 42.10.3.1.12.3 within 5 years of the effective date of this edition. [**407:**5.1.12.4]

42.10.3.1.13 **Fuel Servicing Hydrants, Pits, and Cabinets**.

42.10.3.1.13.1 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]

42.10.3.1.13.2 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]

42.10.3.2 **Operations**.

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42.10.3.2.1* **Security**. Access to fuel storage and fuel vehicle loading areas shall be secured. [**407:**5.2.1]

42.10.3.2.2 **Personnel. (Reserved)**

42.10.3.2.3 **Prevention and Control of Spills. (Reserved)**

42.10.3.2.4 **Emergency Fuel Shutoff. (Reserved)**

42.10.3.2.5 **Bonding. (Reserved)**

42.10.3.2.6 **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]

42.10.3.2.7 **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]

42.10.3.2.8 **Maintenance. (Reserved)**

42.10.3.2.9 **Aircraft Fueling Hose. (Reserved)**

42.10.4 **Airport Fueling Vehicles.**

42.10.4.1 **Design and Construction**.

42.10.4.1.1 **General Requirements**.

42.10.4.1.1.1 Aircraft fuel servicing tank vehicles that are operated on public roadways shall comply with the requirements of NFPA 385. [**407:**6.1.1.1]

42.10.4.1.1.2 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]

42.10.4.1.1.3 Magnesium shall not be used in the construction of any portion of an aircraft fuel servicing vehicle or cart. [**407:**6.1.1.3]

42.10.4.1.1.4 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]

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42.10.4.1.2 **Tanks**.

42.10.4.1.2.1 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]

42.10.4.1.2.2 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]

42.10.4.1.2.3 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]

42.10.4.1.2.4 Tank outlets shall be of substantial construction. [**407:**6.1.2.4]

42.10.4.1.2.5 Tank outlets shall be attached securely to the tank. [**407:**6.1.2.5]

42.10.4.1.2.6 **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]

42.10.4.1.2.6.1 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]

42.10.4.1.2.6.2 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]

42.10.4.1.2.7 Venting shall be in accordance with 49 CFR, DOT 406. [**407:**6.1.2.7]

42.10.4.1.2.8 Cargo draw-off valves or faucets projecting beyond the frame of a tank vehicle shall be protected against damage. [**407:**6.1.2.8]

42.10.4.1.2.9 **Fill Openings and Top Flashings**.

42.10.4.1.2.9.1 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

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spillage or leakage from overturn and to prevent water entry. [**407:**6.1.2.9.1]

42.10.4.1.2.9.2 Dome covers shall automatically close and latch with the forward motion of the vehicle. [**407:**6.1.2.9.2]

42.10.4.1.2.9.3 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]

42.10.4.1.2.9.4 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]

42.10.4.1.2.9.5 Overturn protection shall be braced adequately to prevent collapse. [**407:**6.1.2.9.5]

42.10.4.1.2.9.6 Overturn 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]

42.10.4.1.2.10 **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]

42.10.4.1.2.10.1 Tanks shall be substantially protected by their location. [**407:**6.1.2.10.1]

42.10.4.1.2.10.2 Fill pipes shall not project beyond the vehicle profile. [**407:**6.1.2.10.2]

42.10.4.1.2.10.3 Tanks and containers shall vent away from sources of ignition during filling. [**407:**6.1.2.10.3]

42.10.4.1.2.10.4 Any arrangement not protected by location shall be listed for such use. [**407:**6.1.2.10.4]

42.10.4.1.2.10.5 The fuel tank arrangement shall allow for drainage without the tank's removal from its mountings. [**407:**6.1.2.10.5]

42.10.4.1.2.11 **Tests**. Cargo tanks, at the time of manufacture, shall be tested by a minimum air or hydrostatic pressure of 24.4 kg/m^2 (5 psi) applied to the whole tank (or each compartment thereof if the

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tanks are compartmented) for a period of at least 5 minutes. [**407:**6.1.2.11]

42.10.4.1.2.11.1 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]

42.10.4.1.2.11.2 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]

42.10.4.1.2.11.3 Any leakage discovered by either of the methods described in 42.10.4.1.2.11.1 and 42.10.4.1.2.11.2, or by any other method, shall be considered evidence of failure to meet these requirements. [**407:**6.1.2.11.3]

42.10.4.1.3 **Pumps and Piping System**.

42.10.4.1.3.1 All portions of the flammable liquid feed system shall be constructed and located to minimize the fire hazard. [**407:**6.1.3.1]

42.10.4.1.3.2 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]

42.10.4.1.3.3 Piping and plumbing shall be of adequate strength for the purpose. [**407:**6.1.3.3]

42.10.4.1.3.4 Piping and plumbing shall be secured to avoid chafing or undue vibration. [**407:**6.1.3.4]

42.10.4.1.3.5 Piping and plumbing shall be supported adequately. [**407:**6.1.3.5]

42.10.4.1.3.6 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]

42.10.4.1.3.7 Except as provided in 42.10.4.1.3.8, all joints shall be welded. [**407:**6.1.3.7]

42.10.4.1.3.8 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]

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42.10.4.1.3.9 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]

42.10.4.1.3.10 Gravity feed systems shall not be used. [**407:**6.1.3.10]

42.10.4.1.3.11 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]

42.10.4.1.3.11.1 Hose connections shall be permitted to be plugged during this test. [**407:**6.1.3.11.1]

42.10.4.1.3.12 **Loading System**.

42.10.4.1.3.12.1 **Top Loading**.

42.10.4.1.3.12.1.1 Drop tubes shall be used. [**407:**6.1.3.12.1.1]

42.10.4.1.3.12.1.2 Splash filling shall be prohibited. [**407:**6.1.3.12.1.2]

42.10.4.1.3.12.1.3 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]

42.10.4.1.3.12.1.4 Drop tubes shall be metallic. [**407:**6.1.3.12.1.4]

42.10.4.1.3.12.1.5 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]

42.10.4.1.3.12.2 **Bottom Loading**.

42.10.4.1.3.12.2.1 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]

42.10.4.1.3.12.2.2 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]

42.10.4.1.3.12.2.3* 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]

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42.10.4.1.3.12.2.4 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]

42.10.4.1.3.12.2.5 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]

42.10.4.1.3.12.2.6 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]

42.10.4.1.3.12.2.7 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 42.10.4.1.3.12. [**407:**6.1.3.12.2.7]

42.10.4.1.3.12.2.8 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]

42.10.4.1.3.12.2.9 The automatic secondary shutoff control shall not be used for normal filling control. [**407:**4.1.1.1]

42.10.4.1.3.13 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]

42.10.4.1.3.14 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]

42.10.4.1.3.15 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]

42.10.4.1.3.15.1 Unless the valves required in 42.10.4.1.3.15 are located inside the tank, they shall be equipped with a shear section as described in 42.10.4.1.3.14. [**407:**6.1.3.15.1]

42.10.4.1.3.16 The operating mechanism for each tank outlet valve shall be adjacent to the fuel delivery system operating controls. [**407:**6.1.3.16]

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42.10.4.1.3.16.1 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] 42.10.4.1.3.16.2 A means shall be provided to assure proper operation. [**407:**6.1.3.16.2] 42.10.4.1.4 **Hose and Nozzles. (Reserved)** 42.10.4.1.5 **Bonding**. 42.10.4.1.5.1 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] 42.10.4.1.5.2 Such bonding shall be inherent to the installation or by physical application of a suitable bonding mechanism. [**407:**6.1.5.2] 42.10.4.1.5.3 A provision shall be provided on the vehicle to bond the tank to a fill pipe or loading rack as specified in 42.10.4.2.11.10.1. [**407:**6.1.5.3] 42.10.4.1.5.4 Cables shall be provided on the vehicle or cart to allow the bonding operations specified in 4.2.5. [**407:**6.1.5.4] 42.10.4.1.6 **Electrical System**. 42.10.4.1.6.1 **Battery Compartments**. Batteries that are not in engine compartments shall be securely mounted in compartments to prevent accidental arcing. [**407:**6.1.6.1] 42.10.4.1.6.1.1 The compartment shall be separate from fueling equipment. [**407:**6.1.6.1.1] 42.10.4.1.6.1.2 Suitable shielding shall be provided to drain possible fuel spillage or leakage away from the compartment. [**407:**6.1.6.1.2] 42.10.4.1.6.1.3 The compartment shall be provided with a vent at the top of the compartment. [**407:**6.1.6.1.3] 42.10.4.1.6.2 **Wiring**. Wiring shall be of adequate size to provide the required current-carrying capacity and mechanical strength. [**407:**6.1.6.2] 42.10.4.1.6.2.1 Wiring shall be installed to provide protection from physical damage and from contact with spilled fuel either by its	

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location or by enclosing it in metal conduit or other oil-resistant protective covering. [**407:**6.1.6.2.1]

42.10.4.1.6.2.2 All circuits shall have overcurrent protection. [**407:**6.1.6.2.2]

42.10.4.1.6.2.3 Junction boxes shall be weatherproofed. [**407:**6.1.6.2.3]

42.10.4.1.6.2.4 The vehicle shall be equipped with a battery disconnect switch. [**407:**6.1.6.2.4]

42.10.4.1.6.3 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]

42.10.4.1.6.4* 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]

42.10.4.1.6.5 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]

42.10.4.1.6.6 Lamps, switching devices, and electronic controls, other than those covered in 42.10.4.1.6.4 and 42.10.4.1.6.5, shall be of the enclosed, gasketed, weatherproof type. [**407:**6.1.6.6]

42.10.4.1.6.7 Other electrical components not covered in 42.10.4.1.6.4 through 42.10.4.1.6.6 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]

42.10.4.1.6.8 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]

42.10.4.1.6.9 **Tractor Trailer Wiring**. Electrical service wiring between a tractor and trailer shall be designed for heavy-duty service. [**407:**6.1.6.9]

42.10.4.1.6.9.1 The connector shall be of the positive-engaging type. [**407:**6.1.6.9.1]

42.10.4.1.6.9.2 The trailer receptacle shall be mounted securely. [**407:**6.1.6.9.2]

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42.10.4.1.7 **Control of Fuel Flow**.

42.10.4.1.7.1* The valve that controls the flow of fuel to an aircraft shall have a deadman control. [**407:**6.1.7.1]

42.10.4.1.7.2 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]

42.10.4.1.7.3 Deadman controls shall be designed to preclude defeating their intended purpose. [**407:**6.1.7.3]

42.10.4.1.7.4 **Pressure Fuel Servicing System Controls**.

42.10.4.1.7.4.1 The system shall be designed to minimize surge pressure. [**407:**6.1.7.4.1]

42.10.4.1.7.4.2* 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]

42.10.4.1.7.4.3 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:**6.1.7.4.3]

42.10.4.1.7.4.4 The control valve shall be fail-safe by closing completely in the event of control power loss. [**407:**6.1.7.4.4]

42.10.4.1.7.5 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 42.10.4.1.7.1 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]

42.10.4.1.7.6 **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]

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42.10.4.1.8 **Filters and Ancillary Equipment**.

42.10.4.1.8.1 **Cabinets**.

42.10.4.1.8.1.1 All cabinets, other than those housing electronic equipment, shall be vented to prevent the accumulation of fuel vapors. *(See 42.10.4.1.6.)* [**407:**6.1.8.1.1]

42.10.4.1.8.1.2 All cabinets, other than those housing electronic equipment, shall be constructed of noncombustible materials.*(See 42.10.4.1.6.)* [**407:**6.1.8.1.2]

42.10.4.1.8.2 **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]

42.10.4.1.9 **Emergency Fuel Shutoff Systems**.

42.10.4.1.9.1 The vehicle shall have at least two emergency shutoff controls, one mounted on each side of the vehicle. [**407:**6.1.9.1]

42.10.4.1.9.2 The emergency fuel shutoff controls shall be quick-acting to close the outlet valve in case of emergency. [**407:**6.1.9.2]

42.10.4.1.9.3 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]

42.10.4.1.9.4 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]

42.10.4.1.10 **Fire Protection**.

42.10.4.1.10.1 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]

42.10.4.1.10.2 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]

42.10.4.1.10.3 Extinguishers shall be readily accessible from the ground. [**407:**6.1.10.3]

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42.10.4.1.10.4 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]

42.10.4.1.10.5 Extinguishers shall be kept clear of elements such as ice and snow. [**407:**6.1.10.5]

42.10.4.1.10.6 Extinguishers located in enclosed compartments shall be readily accessible. [**407:**6.1.10.6]

42.10.4.1.10.7 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]

42.10.4.1.10.8 **Smoking Equipment**.

42.10.4.1.10.8.1* Smoking equipment, such as cigarette lighter elements and ashtrays, shall not be provided. [**407:**6.1.10.8.1]

42.10.4.1.10.8.2 If a vehicle includes smoking equipment, it shall be removed or rendered inoperable. [**407:**6.1.10.8.2]

42.10.4.1.10.8.3 Subsection 42.10.4.1.10.8.2 shall be retroactive to existing vehicles. [**407:**6.1.10.8.3]

42.10.4.1.11 **Marking and Labeling**.

42.10.4.1.11.1 Aircraft fueling vehicles shall be marked with the name of the operator or the responsible organization. [**407:**6.1.11.1]

42.10.4.1.11.2 The marking shall be approved, legible signs on both sides of the exterior of the vehicle. [**407:**6.1.11.2]

42.10.4.1.11.3 **Signage**. Each aircraft fuel servicing vehicle or cart shall have a signage viewable from all sides of the vehicle. [**407:**6.1.11.3]

42.10.4.1.11.3.1 Signs shall have letters at least 75 mm (3 in.) high. [**407:**6.1.11.3.1]

42.10.4.1.11.3.2 Signs shall be of a color contrasting sharply with the sign background for visibility. [**407:**6.1.11.3.2]

42.10.4.1.11.3.3 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]

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42.10.4.1.11.4 **Emergency Fuel Shutoff Signs**.

42.10.4.1.11.4.1 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]

42.10.4.1.11.4.2 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]

42.10.4.1.11.4.3 Any action necessary to gain access to the shutoff device (e.g., BREAK GLASS) shall be shown clearly. [**407:**6.1.11.4.3]

42.10.4.1.11.4.4 Lettering shall be of a color contrasting sharply with the placard background for visibility. [**407:**6.1.11.4.4]

42.10.4.1.11.4.5 Placards shall be weather resistant. [**407:**6.1.11.4.5]

42.10.4.1.11.5 A "NO SMOKING" sign shall be posted prominently in the cab of every aircraft fuel servicing vehicle. [**407:**6.1.11.5]

42.10.4.1.11.6 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]

42.10.4.1.12 **Drive Train**.

42.10.4.1.12.1 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]

42.10.4.1.12.2 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]

42.10.4.1.12.3 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]

42.10.4.1.12.4 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]

42.10.4.1.12.5 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]

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42.10.4.1.12.6 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]

42.10.4.1.12.7 The vehicle shall have a means to override the system or device required by 42.10.4.1.12.6 so that the vehicle can be moved during an emergency. [**407:**6.1.12.7]

42.10.4.1.12.7.1 The override control shall be clearly marked and accessible. [**407:**6.1.12.7.1]

42.10.4.1.12.7.2 A light to indicate activation of the override shall be located in the cabin and visible outside. [**407:**6.1.12.7.2]

42.10.4.1.12.7.3 The override control shall be secured in the normal position with a breakaway seal. [**407:**6.1.12.7.3]

42.10.4.1.12.7.4 The override control shall deactivate the fueling system. [**407:**6.1.12.7.4]

42.10.4.1.13 **Exhaust System**.

42.10.4.1.13.1* 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]

42.10.4.1.13.2 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]

42.10.4.1.13.3 Suitable shielding shall be provided to drain possible fuel spillage or leakage away from exhaust system components safely. [**407:**6.1.13.3]

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42.10.4.1.13.3.1 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]

42.10.4.1.13.3.2 DPF regeneration–equipped vehicles shall have a listed diffuser installed at the outlet of the exhaust tailpipe. [**407:**6.1.13.3.2]

42.10.4.1.13.4 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]

42.10.4.1.13.4.1 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]

42.10.4.1.13.5 A muffler (or silencer) cutout shall not be provided. [**407:**6.1.13.5]

42.10.4.1.13.6 Carbureted gasoline-powered engines on fuel servicing vehicles shall be provided with flame- and spark-arresting exhaust systems. [**407:**6.1.13.6]

42.10.4.1.13.7* Non-turbo-charged diesel engines on fuel servicing vehicles shall be equipped with flame- and spark-arresting exhaust systems. [**407:**6.1.13.7]

42.10.4.2 **Operations**.

42.10.4.2.1 **Security**.

42.10.4.2.1.1 **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]

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42.10.4.2.1.2 **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]

42.10.4.2.1.3* 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]

42.10.4.2.2 **Training. (Reserved)**

42.10.4.2.3 **Prevention and Control of Spills. (Reserved)**

42.10.4.2.4 **Emergency Fuel Shutoff. (Reserved)**

42.10.4.2.5 **Bonding. (Reserved)**

42.10.4.2.6 **Control of Fuel Flow**.

42.10.4.2.6.1 The fueling operator shall monitor the fueling operation. [**407:**6.2.6.1]

42.10.4.2.6.2 During overwing fueling, the operator shall monitor the fill port. [**407:**6.2.6.2]

42.10.4.2.7 **Fire Protection. (Reserved)**

42.10.4.2.8 **Maintenance**.

42.10.4.2.8.1 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]

42.10.4.2.8.2 Leaking vehicles or carts shall be removed from service, defueled, and parked in a safe area until repaired. [**407:**6.2.8.2]

42.10.4.2.8.3 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]

42.10.4.2.8.4 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]

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42.10.4.2.9 **Aircraft Fueling Hose. (Reserved)**

42.10.4.2.10 **Exhaust System**.

42.10.4.2.10.1 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]

42.10.4.2.10.2 DPF regeneration shall be performed only in area(s) designated by the authority having jurisdiction. [**407:**6.2.10.2]

42.10.4.2.10.3 DPF regeneration shall not be performed within 30 m (100 ft) of any aircraft refueling operations. [**407:**6.2.10.3]

42.10.4.2.10.4* **Vehicle Regeneration Area**.

42.10.4.2.10.4.1 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]

42.10.4.2.10.4.2 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]

42.10.4.2.10.4.3 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]

42.10.4.2.10.5 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]

42.10.4.2.10.6 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]

42.10.4.2.10.7 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]

42.10.4.2.10.8 Once a regeneration cycle is started, it shall be completed without interruption. [**407:**6.2.10.8]

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42.10.4.2.10.9 After the regeneration process is successfully completed, the vehicle shall be permitted to return to normal service. [**407:**6.2.10.9]

42.10.4.2.10.10 Problems occurring during the regeneration cycle shall be corrected prior to the vehicle returning to normal service. [**407:**6.2.10.10]

42.10.4.2.10.11 Aircraft refueling operations shall not be initiated if the regenerative system indicates regeneration is required. [**407:**6.2.10.11]

42.10.4.2.11 **Loading and Unloading**.

42.10.4.2.11.1 Aircraft fuel servicing tank vehicles shall be loaded only at an approved loading rack. [**407:**6.2.11.1]

42.10.4.2.11.2 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]

42.10.4.2.11.3 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]

42.10.4.2.11.4 The required deadman and automatic overfill controls shall be in normal operating condition during the filling operation. [**407:**6.2.11.4]

42.10.4.2.11.5 The controls shall not be blocked open or otherwise bypassed. [**407:**6.2.11.5]

42.10.4.2.11.6 The engine of the tank vehicle shall be shut off before starting to fill the tank. [**407:**6.2.11.6]

42.10.4.2.11.7 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]

42.10.4.2.11.7.1 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]

42.10.4.2.11.7.2 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]

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42.10.4.2.11.8 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]

42.10.4.2.11.8.1 Delivery hose, when attached to a tank vehicle, shall be considered to be a part of the tank vehicle. [**407:**6.2.11.8.1]

42.10.4.2.11.9 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]

42.10.4.2.11.10 **Top Loading**.

42.10.4.2.11.10.1 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]

42.10.4.2.11.10.2 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]

42.10.4.2.11.10.3 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]

42.10.4.2.11.10.4 Splash filling shall be prohibited. [**407:**6.2.11.10.4]

42.10.4.2.11.10.5 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]

42.10.4.2.11.10.6 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]

42.10.4.2.11.10.7 The level in the tank shall be visually monitored at all times during top loading. [**407:**6.2.11.10.7]

42.10.4.2.11.11 **Bottom Loading**.

42.10.4.2.11.11.1 A bonding connection shall be made between the cargo tank and the loading rack before any fuel connections are

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made and shall remain in place throughout the loading operation. [**407:**6.2.11.11.1]

42.10.4.2.11.11.2 The operator shall initiate fuel flow by means of a dead-man control device. [**407:**6.2.11.11.2]

42.10.4.2.11.11.3 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]

42.10.4.2.12 **Positioning of Aircraft Fuel Servicing Vehicles and Carts During Fueling**.

42.10.4.2.12.1 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]

42.10.4.2.12.2 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]

42.10.4.2.12.3 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]

42.10.4.2.12.4 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]

42.10.4.2.12.5 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]

42.10.5 **Rooftop Heliports**.

42.10.5.1 **Design and Construction**.

42.10.5.1.1 **General Requirements**.

42.10.5.1.1.1 **System Design and Approval**.

42.10.5.1.1.1.1 Fueling on rooftop heliports shall be permitted only where approved by the authority having jurisdiction. [**407:**7.1.1.1.1]

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42.10.5.1.1.1.2 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]

42.10.5.1.1.1.3 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]

42.10.5.1.1.1.4 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]

42.10.5.1.1.1.5 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]

42.10.5.1.2 **Fuel Storage Tanks**.

42.10.5.1.2.1 Fuel storage tanks and components shall comply with the requirements of NFPA 30. [**407:**7.1.2.1]

42.10.5.1.2.2 The fuel storage system shall be located at or below ground level. [**407:**7.1.2.2]

42.10.5.1.3 **Pumps and Piping Systems**.

42.10.5.1.3.1 Pumps and piping systems shall comply with the requirements of NFPA 30. [**407:**7.1.3.1]

42.10.5.1.3.2 Pumps shall be located at or below ground level. [**407:**7.1.3.2]

42.10.5.1.3.3 Relay pumping shall not be permitted. [**407:**7.1.3.3]

42.10.5.1.3.4 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]

42.10.5.1.3.5 Pumps shall be anchored and protected against physical damage from collision. [**407:**7.1.3.5]

42.10.5.1.3.6 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]

42.10.5.1.3.7 The pump room shall be adequately ventilated. [**407:**7.1.3.7]

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42.10.5.1.3.8 Electrical wiring and equipment in pump rooms shall conform to the requirements of *NFPA 70* , Article 515. [**407:**7.1.3.8]

42.10.5.1.3.9 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]

42.10.5.1.3.9.1 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]

42.10.5.1.3.9.2 All pipe casings, ducts, and chases shall be drained. [**407:**7.1.3.9.2]

42.10.5.1.3.10 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]

42.10.5.1.3.11 An isolation valve shall be installed on the suction and discharge piping of each pump. [**407:**7.1.3.11]

42.10.5.1.3.12 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]

42.10.5.1.3.13 Piping within buildings shall comply with 5.1.3.3. [**407:**7.1.3.13]

42.10.5.1.4 **Hose and Nozzles. (Reserved)**

42.10.5.1.5 **Electrostatic Bonding. (Reserved)**

42.10.5.1.6 **Electrical Systems. (Reserved)**

42.10.5.1.7 **Control of Fuel Flow. (Reserved)**

42.10.5.1.8 **Filters and Ancillary Equipment. (Reserved)**

42.10.5.1.9 **Emergency Fuel Shutoff Systems.**

42.10.5.1.9.1 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]

42.10.5.1.9.2 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]

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42.10.5.1.10 **Fire Protection**. Fire protection shall conform to the requirements of NFPA 418. [**407:**7.1.10]

42.10.5.1.11 **Marking and Labeling. (Reserved)**

42.10.5.2 **Operations**.

42.10.5.2.1 **Security. (Reserved)**

42.10.5.2.2 **Personnel**. All heliport personnel shall be trained in the use of the available fire extinguishers and fixed extinguishing systems. [**407:**7.2.2]

42.10.5.2.3 **Prevention and Control of Spills. (Reserved)**

42.10.5.2.4 **Emergency Fuel Shutoff**. All heliport personnel shall be trained in the operation of emergency fuel shutoff controls. [**407:**7.2.4]

42.10.5.2.5 **Bonding. (Reserved)**

42.10.5.2.6 **Monitoring of Fuel Flow. (Reserved)**

42.10.5.2.7 **Fire Protection. (Reserved)**

42.10.5.2.8 **Maintenance. (Reserved)**

42.10.5.2.9 **Aircraft Fueling Hose. (Reserved)**

42.10.6 **Self-Service Aircraft Fueling.**

42.10.6.1 **Design and Construction**.

42.10.6.1.1 **General Requirements**.

42.10.6.1.1.1 **System Design and Approval**. Self-service fueling shall be permitted, subject to the approval of the authority having jurisdiction. [**407:**8.1.1.1]

42.10.6.1.1.2 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]

42.10.6.1.2 **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]

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42.10.6.1.3 **Pumps and Piping Systems**.

42.10.6.1.3.1 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]

42.10.6.1.3.2 Listed or approved dispensing devices shall be used. [**407:**8.1.3.2]

42.10.6.1.4 **Hose and Nozzles. (Reserved)**

42.10.6.1.5 **Electrostatic Bonding. (Reserved)**

42.10.6.1.6 **Electrical Systems. (Reserved)**

42.10.6.1.7 **Control of Fuel Flow. (Reserved)**

42.10.6.1.8 **Filters and Ancillary Equipment. (Reserved)**

42.10.6.1.9 **Emergency Fuel Shutoff Systems.**

42.10.6.1.9.1 The controls shall be designed to allow only authorized personnel to reset the system after an emergency fuel shutoff. [**407:**8.1.9.1]

42.10.6.1.9.2 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]

42.10.6.1.9.3 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.]

42.10.6.1.9.4 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]

42.10.6.1.9.5 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]

42.10.6.1.9.6 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]

42.10.6.1.10 **Fire Protection**.

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42.10.6.1.10.1 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]

42.10.6.1.10.2 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]

42.10.6.1.11 **Marking and Labeling**.

42.10.6.1.11.1 Emergency instructions shall be conspicuously posted in the dispensing area and at the emergency fuel shutoff control. [**407:**8.1.11.1]

42.10.6.1.11.2 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]

42.10.6.1.11.3 **Operating Instructions**. Operating instructions shall be posted. [**407:**8.1.11.3]

42.10.6.1.11.4 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]

42.10.6.2 **Operations**.

42.10.6.2.1 **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]

42.10.6.2.2 **Training. (Reserved)**

42.10.6.2.3 **Prevention and Control of Spills. (Reserved)**

42.10.6.2.4 **Emergency Fuel Shutoff. (Reserved)**

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42.10.6.2.5 **Bonding. (Reserved)**

42.10.6.2.6 **Monitoring of Fuel Flow. (Reserved)**

42.10.6.2.7 **Fire Protection. (Reserved)**

42.10.6.2.8 **Maintenance. (Reserved)**

42.10.6.2.9 **Occupancy**. The aircraft shall not be occupied during self-service fueling. [**407:**8.2.9]

~~42.10.2 **Design**.~~

~~42.10.2.1 **General**.~~

~~42.10.2.1.1 **Fueling Hose Apparatus**. Nozzle receptacles and hose storage shall be arranged to avoid kinks and maintain the hose bend radius within the requirements of API BULL 1529, *Aviation Fueling Hose*. [**407:**4.1.1]~~

~~42.10.2.1.2 **Electrostatic Hazards and Bonding**.~~

~~42.10.2.1.2.1 A provision for bonding shall be incorporated in the design of fuel servicing vehicles or carts and systems to prevent differences in electrostatic potential in accordance with 42.10.5.4. [**407:**4.1.2.1]~~

~~42.10.2.1.2.2 The maximum resistance between the bonding cable clip and the fueling system framework shall not exceed 25 ohms. [**407:**4.1.2.2]~~

~~42.10.2.1.2.3 Bonding cables shall be constructed of conductive, durable, and flexible material. [**407:**4.1.2.3]~~

~~42.10.2.1.2.4 Bonding connections shall be electrically and mechanically firm. Jacks, plugs, clamps, and connecting points shall be clean, unpainted metal to provide a positive electrical connection. [**407:**4.1.2.4]~~

~~42.10.2.1.2.5 API BULL 1529 Type C hose (semiconductive) shall be used to prevent electrostatic discharges but shall not be used to accomplish required bonding. API BULL 1529 Type A hose that does not have a semiconductive cover shall not be used. Type F hose (hard wall) and Type CT hose (cold temperature) shall be permitted because they have semiconductive covers. [**407:**4.1.2.5]~~

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~~42.10.2.1.2.6 The design of airport fueling systems shall incorporate the provision of a 30-second relaxation period between the filter separator, monitors, or other filtration devices discharging into tanks. [**407:**4.1.2.6]~~

~~42.10.2.1.2.6.1 Paragraph 42.10.2.1.2.6 shall not apply to the actual refueling of an aircraft. [**407:**4.1.2.6.1]~~

~~42.10.2.1.2.6.2 Paragraph 42.10.2.1.2.6 shall not apply to fuels with static dissipater additives. [**407:**4.1.2.6.2]~~

~~42.10.2.1.3 **No Smoking Signs**. Entrances to fueling areas shall be posted with "no smoking" signs. [**407:**4.1.3]~~

~~42.10.2.1.4 **Aircraft Radar Equipment**.~~

~~42.10.2.1.4.1 Surveillance radar equipment in aircraft shall not be operated within 300 ft (90 m) of any fueling, servicing, or other operation in which flammable liquids, vapors, or mist could be present. [**407:**4.1.4.1.1]~~

~~42.10.2.1.4.2 Weather-mapping radar equipment in aircraft shall not be operated while the aircraft in which it is mounted is undergoing fuel servicing. [**407:**4.1.4.1.2]~~

~~42.10.2.1.5 **Ground Radar Equipment**.~~

~~42.10.2.1.5.1 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 300 ft (90 m). Aircraft fuel servicing shall not be conducted within this 300 ft (90 m) distance. [**407:**4.1.4.2.1]~~

~~42.10.2.1.5.2 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 100 ft (30 m). Aircraft fuel servicing or any other operations involving flammable liquids or vapors shall not be conducted within 100 ft (30 m) of such antennas. [**407:**4.1.4.2.2]~~

~~42.10.2.1.6 **Emergency Fire Equipment Accessibility**. Accessibility to aircraft by emergency fire equipment shall be considered in establishing aircraft fuel servicing positions. [**407:**4.1.5]~~

~~42.10.2.1.7 **Portable Fire Extinguishers**.~~

~~42.10.2.1.7.1 Portable extinguishers shall be provided in accordance with 42.10.2.4 and 42.10.5.13. [**407:**4.1.6.1]~~

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~~42.10.2.1.7.2 Extinguishers shall conform to the requirements of Section 13.6. [**407:**4.1.6.2]~~

~~42.10.2.1.7.3 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. [**407:**4.1.6.3]~~

~~42.10.2.2 **Vehicle or Cart Lighting and Electrical Equipment**.~~

~~42.10.2.2.1 **Battery Compartments**. Batteries that are not in engine compartments shall be securely mounted in compartments to prevent accidental arcing. The compartment shall be separate from fueling equipment. Suitable shielding shall be provided to drain possible fuel spillage or leakage away from the compartment. The compartment shall be provided with a vent at the top of the compartment. [**407:**4.3.7.1]~~

~~42.10.2.2.2 Wiring shall be of adequate size to provide the required current-carrying capacity and mechanical strength. 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. All circuits shall have overcurrent protection. Junction boxes shall be weatherproofed. [**407:**4.3.7.2]~~

~~42.10.2.2.3 Spark plugs and other exposed terminal connections shall be insulated to prevent sparking in the event of contact with conductive materials. [**407:**4.3.7.3]~~

~~42.10.2.2.4 Motors, alternators, generators, and 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:**4.3.7.4]~~

~~42.10.2.2.5 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:**4.3.7.5]~~

~~42.10.2.2.6 Lamps, switching devices, and electronic controls, other than those covered in 42.10.2.2.4 and 42.10.2.2.5, shall be of the enclosed, gasketed, weatherproof type. Other electrical components shall be of a type listed for use in accordance with *NFPA 70* Class I, Division 2, Group D locations. [**407:**4.3.7.6]~~

~~42.10.2.2.7 Electrical service wiring between a tractor and trailer shall be designed for heavy-duty service. The connector shall be of~~

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~~the positive-engaging type. The trailer receptacle shall be mounted securely. [**407:**4.3.7.7]~~

~~42.10.2.3 **Cabinets**. All cabinets housing vehicle auxiliary equipment shall have expanded metal flooring, perforated metal grating-type flooring, or open floor to facilitate air circulation within the enclosed space and to prevent the accumulation of fuel. [**407:**4.3.8]~~

~~42.10.2.4 **Fire Extinguishers for Aircraft Fuel Servicing Vehicles or Carts**.~~

~~42.10.2.4.1 Each aircraft fuel servicing tank vehicle shall have two listed fire extinguishers, each having a rating of at least 20-B:C with one extinguisher mounted on each side of the vehicle. [**407:**4.3.9.1]~~

~~42.10.2.4.2 One listed extinguisher having a rating of at least 20-B:C shall be installed on each hydrant fuel servicing vehicle or cart. [**407:**4.3.9.2]~~

~~42.10.2.4.3 Extinguishers shall be readily accessible from the ground. The area of the paneling or tank adjacent to or immediately behind the extinguisher(s) on fueling vehicles or carts shall be painted with a contrasting color. [**407:**4.3.9.3]~~

~~42.10.2.4.4 Extinguishers shall be kept clear of elements such as ice and snow. Extinguishers located in enclosed compartments shall be readily accessible, and their location shall be marked clearly in letters at least 2 in. (50 mm) high. [**407:**4.3.9.4]~~

~~42.10.2.5 **Smoking Restrictions**.~~

~~42.10.2.5.1 A "no smoking" sign shall be posted prominently in the cab of every aircraft fuel servicing vehicle. [**407:**4.3.11.1]~~

~~42.10.2.5.2 Smoking equipment such as cigarette lighters and ash trays shall not be provided. If a vehicle includes such equipment when initially procured, it shall be removed or rendered inoperable. [**407:**4.3.11.2]~~

~~42.10.2.6 **Fuel Dispensing System**.~~

~~42.10.2.6.1 The valve that controls the flow of fuel from an aircraft fuel servicing vehicle or cart to an aircraft shall have a deadman control(s) in accordance with the requirements of 4.1.7 of NFPA 407. [**407:**4.3.16.1]~~

~~42.10.2.6.2 The deadman flow control in the nozzle shall be permitted for overwing fueling. Notches or latches in the nozzle~~

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~~handle that could allow the valve to be locked open shall be prohibited. Each overwing servicing nozzle shall have a cable with a plug or clip for bonding to the aircraft. *(See 42.10.5.4.2.)* [**407:**4.3.16.2]~~

~~42.10.2.6.3 Nozzles for underwing fueling shall be designed to be attached securely to the aircraft adapter before the nozzle can be opened. Disengaging the nozzle from the aircraft adapter shall not be possible until the nozzle is fully closed. [**407:**4.3.16.3]~~

~~42.10.2.6.4 Fuel servicing pump mechanisms shall be designed and arranged so that failure or seizure does not cause rupture of the pump housing, a tank, or of any component containing fuel. Fuel pressure shall be controlled within the stress limits of the hose and plumbing by means of either an in-line pressure controller, a system pressure relief valve, or other suitable means. The working pressure of any system component shall equal or exceed any pressure to which it could be subjected. [**407:**4.3.16.4]~~

~~42.10.2.6.5 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 42.10.2.6.1 are arranged to be normally closed and to open only when the brakes are set and the pump is engaged. [**407:**4.3.16.5]~~

~~(3)~~

~~42.10.2.6.6 Hose shall be connected to rigid piping or coupled to the hose reel in a manner that prevents kinks or undue bending action or mechanical stress on the hose or hose couplings. [**407:**4.3.16.6]~~

~~42.10.2.6.7 Aircraft fuel servicing vehicles and carts shall have an integral system or device that prevents the vehicle or cart from being moved unless all fueling nozzles and hydrant couplers are properly stowed and mechanical lifts are lowered to their stowed position. [**407:**4.3.16.7]~~

~~42.10.2.6.8 **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:**4.3.16.8]~~

~~42.10.3 **Airport Fuel Systems**.~~

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~~42.10.3.1 **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 AHJ. [**407:**4.4.1]~~ ~~42.10.3.2 **System Approval**. The AHJ shall inspect and approve the completed system before it is put into service. [**407:**4.4.2]~~ ~~42.10.3.3 **Fuel Storage Tanks**.~~ ~~42.10.3.3.1 Fuel storage tanks shall conform to the applicable requirements of NFPA 30. [**407:**4.4.4.1]~~ ~~42.10.3.3.2 The AHJ 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. Tanks located in designated aircraft movement areas or aircraft servicing areas shall be underground or mounded over with earth. Vents from such tanks shall be constructed in a manner to preclude collision hazards with operating aircraft. Aircraft operators shall be consulted regarding the height and location of such vents to avoid venting flammable vapors in the vicinity of ignition sources, including operating aircraft and automotive equipment permitted in the area. [**407:**4.4.4.2]~~ ~~42.10.4 **Fueling at Rooftop Heliports**. Fueling on rooftop heliports shall be permitted only where approved by the AHJ. [**407:**4.5]~~ ~~42.10.4.1 **General Limitations**.~~ ~~42.10.4.1.1 In addition to the special requirements in Section 42.10, the heliport shall comply with the requirements of NFPA 418. [**407:**4.5.1.1]~~ ~~42.10.4.1.2 Facilities for dispensing fuel with a flash point below 100°F (37.8°C) shall not be permitted at any rooftop heliport. [**407:**4.5.1.2]~~ ~~42.10.4.2 **Fueling Facilities**.~~ ~~42.10.4.2.1 In addition to the special requirements of Section 42.10, the fuel storage, piping, and dispensing system shall comply with the requirements of NFPA 30 and with applicable portions of NFPA 407 and this *Code*. [**407:**4.5.2.1]~~	

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~~42.10.4.2.2 The entire system shall be designed so that no part of the system is subjected to pressure above its working pressure. [**407:**4.5.2.2]~~

~~42.10.4.2.3 The fuel storage system shall be located at or below ground level. [**407:**4.5.2.3]~~

~~42.10.4.3 **Pumps**.~~

~~42.10.4.3.1 Pumps shall be located at or below ground level. Relay pumping shall not be permitted. [**407:**4.5.3.1]~~

~~42.10.4.3.2 Pumps installed outside of buildings shall be located not less than 5 ft (1.5 m) from any building opening. They shall be substantially anchored and protected against physical damage from collision. [**407:**4.5.3.2]~~

~~42.10.4.3.3 Pumps installed within a building shall be in a separate room with no opening into other portions of the building. The pump room shall be adequately ventilated. Electrical wiring and equipment shall conform to the requirements of *NFPA 70*, Article 515. [**407:**4.5.3.3]~~

~~42.10.4.4 **Emergency Fuel Shutoff Stations**.~~

~~42.10.4.4.1 A system shall be provided to completely shut off the flow of fuel in an emergency. The system shall shut off the fuel at the ground level. The emergency fuel shutoff controls shall be in addition to the normal operating controls for the pumps and deadman control. [**407:**4.5.9.1]~~

~~42.10.4.4.2 At least two emergency fuel shutoff stations located on opposite sides of the heliport at exitways or at similar locations shall be provided. An additional emergency fuel shutoff station shall be located at ground level and shall be near, but at least 10 ft (3 m) from, the pumps. [**407:**4.5.9.2]~~

~~42.10.4.4.3 Each emergency fuel shutoff station location shall be placarded EMERGENCY FUEL SHUTOFF in letters at least 2 in. (50 mm) high. The method of operation shall be indicated by an arrow or by the word PUSH or PULL, as appropriate. Any action necessary to gain access to the shutoff device (e.g., BREAK GLASS) shall be shown clearly. Lettering shall be of a color contrasting sharply with the placard background for visibility. Placards shall be weather resistant, shall be conspicuously located, and shall be positioned so that they can be seen readily from a distance of at least 25 ft (7.6 m). [**407:**4.5.9.3]~~

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~~42.10.4.5 **Fire Protection**. Fire protection shall conform to the requirements of NFPA 418. [**407:**4.5.10]~~

~~42.10.4.6 **Personnel Training**. All heliport personnel shall be trained in the operation of emergency fuel shutoff controls and in the use of the available fire extinguishers. [**407:**4.5.11]~~

~~42.10.5 **Operations**.~~

~~42.10.5.1 **General**.~~

~~42.10.5.1.1 Only personnel trained in the safe operation of the equipment and fuels they use, the operation of emergency controls, and the procedures to be followed in an emergency shall be permitted to handle fuel. [**407:**5.1.1]~~

~~42.10.5.1.2 Where a valve or electrical device is used for isolation during maintenance or modification of the fuel system, it shall be tagged/locked. The tag/lock shall not be removed until the operation is completed. [**407:**5.1.2]~~

~~42.10.5.1.3 Aircraft fueling vehicles shall be marked with the name of the operator or the responsible organization. [**407:**5.1.3]~~

~~42.10.5.1.3.1 The marking shall be approved, legible signs on both sides of the exterior of the vehicle. [**407:**5.1.3.1]~~

~~42.10.5.1.4 The AHJ shall determine the suitability of fuel servicing vehicles utilizing tunnels, enclosed roadways, or the like. [**407:**5.1.4]~~

~~42.10.5.2 **Prevention and Control of Spills**.~~

~~42.10.5.2.1 Fuel servicing equipment shall comply with the requirements of NFPA 407 and this *Code* and shall be maintained in safe operating condition. Leaking or malfunctioning equipment shall be removed from service. [**407:**5.2.1]~~

~~42.10.5.2.2 Following fueling of an aircraft, all hoses shall be removed, including those from hydrant systems. All hoses shall also be properly stowed. [**407:**5.2.2]~~

~~42.10.5.2.3 Fuel nozzles shall not be dragged along the ground. [**407:**5.2.3]~~

~~42.10.5.2.4 Approved pumps, either hand operated or power operated, shall be used where aircraft are fueled from drums. Pouring or gravity flow shall not be permitted from a container with a capacity of more than 5 gal (19 L). [**407:**5.2.4]~~

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~~42.10.5.2.5 Where a spill is observed, the fuel servicing shall be stopped immediately by release of the deadman controls. [**407:**5.2.5]~~

~~42.10.5.2.5.1 In the event that a spill continues, the equipment emergency fuel shutoff shall be actuated. [**407:**5.2.5.1]~~

~~42.10.5.2.5.2 In the event that a spill continues from a hydrant system, the system emergency fuel shutoff shall be actuated. [**407:**5.2.5.2]~~

~~42.10.5.2.5.3 The supervisor shall be notified immediately. [**407:**5.2.5.3]~~

~~42.10.5.2.5.4 Cleaning operations shall be performed by personnel trained in accordance with 42.10.5.1.1. [**407:**5.2.5.4]~~

~~42.10.5.2.5.5 Operation shall not be resumed until the spill has been cleared and conditions are determined to be safe. [**407:**5.2.5.5]~~

~~42.10.5.2.6 The airport fire crew shall be notified if a spill covers over 10 ft (3 m) in any direction or is over 50 ft^2 (5 m^2) in area, continues to flow, or is otherwise a hazard to persons or property. 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:**5.2.6]~~

~~42.10.5.2.7 Transferring fuel by pumping from one tank vehicle to another tank vehicle within 200 ft (61 m) of an aircraft shall not be permitted. [**407:**5.2.7]~~

~~42.10.5.2.8 Not more than one tank vehicle shall be permitted to be connected to the same aircraft fueling manifold.~~

~~*Exception: Where means are provided to prevent fuel from flowing back into a tank vehicle because of a difference in pumping pressure*. [**407:**5.2.8]~~

~~42.10.5.3 **Emergency Fuel Shutoff**.~~

~~42.10.5.3.1 Access to emergency fuel shutoff control stations shall be kept clear at all times. [**407:**5.3.1]~~

~~42.10.5.3.2 A procedure shall be established to notify the fire department serving the airport in the event of a control station activation. [**407:**5.3.2]~~

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~~42.10.5.3.3 If the fuel flow stops for any reason, it first shall be presumed that an emergency fuel shutoff system has been actuated. The cause of the shutoff shall be corrected before fuel flow is resumed. [**407:**5.3.3]~~

~~42.10.5.3.4 Emergency fuel shutoff systems shall be operationally checked at intervals not exceeding 6 months. Each individual device shall be checked at least once during every 12-month period. [**407:**5.3.4]~~

~~42.10.5.3.5 Suitable records shall be kept of tests required by 42.10.5.3. [**407:**5.3.5]~~

~~42.10.5.4 **Bonding**.~~

~~42.10.5.4.1 Prior to making any fueling connection to the aircraft, the fueling equipment shall be bonded to the aircraft by use of a cable, thus providing a conductive path to equalize the potential between the fueling equipment and the aircraft. The bond shall be maintained until fueling connections have been removed, thus allowing separated charges that could be generated during the fueling operation to reunite. Grounding during aircraft fueling shall not be permitted. [**407:**5.4.1]~~

~~42.10.5.4.2 In addition to the requirements in 42.10.5.4.1, where fueling overwing, the nozzle shall be bonded with a nozzle bond cable having a clip or plug to a metallic component of the aircraft that is metallically connected to the tank filler port. The bond connection shall be made before the filler cap is removed. 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. The spout shall be kept in contact with the filler neck until the fueling is completed. [**407:**5.4.2]~~

~~42.10.5.4.3 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. Only metal funnels shall be used. [**407:**5.4.3]~~

~~42.10.5.4.4 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:**5.4.4]~~

~~42.10.5.4.5 Bonding and fueling connections shall be disconnected in the reverse order of connection. [**407:**5.4.5]~~

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~~42.10.5.4.6 Conductive hose shall be used to prevent electrostatic discharge but shall not be used to accomplish required bonding. [**407:**5.4.6]~~

~~42.10.5.5 **Operation of Aircraft Engines and Heaters**.~~

~~42.10.5.5.1 Fuel servicing shall not be performed on a fixed wing aircraft while an onboard engine is operating. *(See 42.10.5.21.)* Exception: In an emergency resulting from the failure of an onboard auxiliary power unit on a jet aircraft and in the absence of suitable ground support equipment, a jet engine mounted at the rear of the aircraft or on the wing on the side opposite the fueling point shall be permitted to be operated during fueling to provide power, provided that the operation follows written procedures approved by the AHJ. [**407:**5.5.1]~~

~~42.10.5.5.2 Combustion heaters on aircraft (e.g., wing and tail surface heaters, integral cabin heaters) shall not be operated during fueling operations. [**407:**5.5.2]~~

~~42.10.5.6 **Use of Equipment Powered by Internal Combustion Engines Around Aircraft**.~~

~~42.10.5.6.1 Equipment, other than that performing aircraft servicing functions, shall not be permitted within 50 ft (15 m) of aircraft during fuel servicing operations. [**407:**5.6.1]~~

~~42.10.5.6.2 Equipment performing aircraft servicing functions shall not be positioned within a 10 ft (3 m) radius of aircraft fuel system vent openings. [**407:**5.6.2]~~

~~42.10.5.6.3 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:**5.6.3]~~

~~42.10.5.6.4 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 42.10.5.6.4.1 through 42.10.5.6.4.7. [**407:**5.6.4]~~

~~42.10.5.6.4.1 DPF regeneration shall be performed only in area(*s*) designated by the AHJ. [**407:**5.6.4.1]~~

~~42.10.5.6.4.2 DPF regeneration shall not be performed within 100 ft (30 m) of any aircraft refueling operations. [**407:**5.6.4.2]~~

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~~42.10.5.6.4.3 **Vehicle Regeneration Area**. [407:5.6.4.3]~~

~~42.10.5.6.4.3.1 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:**5.6.4.3.1]~~

~~42.10.5.6.4.3.2 The area shall be in a remote location that is a minimum of 100 ft (30 m) from the nearest aircraft parking location, airport terminal, or flammable storage or a minimum of 50 ft (15 m) from any other building. [**407:**5.6.4.3.2]~~

~~42.10.5.6.4.3.3 The area shall be clearly marked with a minimum 2 ft by 1 ft (61 cm by 30 cm) sign reading "Vehicle DPF Regeneration Area," which shall have letters at least 3 in. (75 mm) high and shall be of a color contrasting sharply with the sign background for visibility. [**407:**5.6.4.3.3]~~

~~42.10.5.6.4.4 The regeneration cycle shall be performed only by trained personnel, who shall remain with the vehicle until the regeneration cycle is complete. [**407:**5.6.4.4]~~

~~42.10.5.6.4.5 The vehicle shall be visually inspected for any signs of fluid leaks under or around the vehicle before regeneration is initiated. DPF regeneration shall not be initiated if there are any signs of any fluid leaks on or beneath the vehicle. [**407:**5.6.4.5]~~

~~42.10.5.6.4.6 Once a regeneration cycle is started, it shall be completed without interruption. [**407:**5.6.4.6]~~

~~42.10.5.6.4.7 After the regeneration process is successfully completed, the vehicle shall be permitted to return to normal service. Problems occurring during the regeneration cycle shall be corrected prior to the vehicle returning to normal service. [**407:**5.6.4.7]~~

~~42.10.5.6.4.8 Aircraft refueling operations shall not be initiated if the regenerative system indicates regeneration is required. [**407:**5.6.4.8]~~

~~42.10.5.7 **Electrical Equipment Used on Aircraft Servicing Ramps**.~~

~~42.10.5.7.1 Battery chargers shall not be connected, operated, or disconnected while fuel servicing is performed on the aircraft. [**407:**5.7.1]~~

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~~42.10.5.7.2 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:**5.7.2]~~

~~42.10.5.7.3 Electric tools or similar tools likely to produce sparks or arcs shall not be used while fuel servicing is performed on the aircraft. [**407:**5.7.3]~~

~~42.10.5.7.4 Photographic equipment shall not be used within 10 ft (3 m) of the fueling equipment or the fill or vent points of aircraft fuel systems. [**407:**5.7.4]~~

~~42.10.5.7.5 Other than aircraft fuel servicing vehicles, battery-powered vehicles that do not comply with the provisions of NFPA 407 shall not be operated within 10 ft (3 m) of fueling equipment or spills. *(See 42.10.5.6.)* [**407:**5.7.5]~~

~~42.10.5.7.6 Communication equipment located outside the cab of the vehicle and used during aircraft fuel servicing operations within 10 ft (3 m) 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, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III Division 1, Hazardous (Classified) Locations*. [**407:**5.7.6]~~

~~42.10.5.8 **Open Flames on Aircraft Fuel Servicing Ramps**.~~

~~42.10.5.8.1 Entrances to fueling areas shall be posted with "no smoking" signs. [**407:**5.8.1]~~

~~42.10.5.8.2 Open flames on aircraft fuel servicing ramps or aprons within 50 ft (15 m) of any aircraft fuel servicing operation or fueling equipment shall be prohibited. [**407:**5.8.2]~~

~~42.10.5.8.3 The category of open flames and lighted open-flame devices shall include, but shall not be limited to, the following:~~

~~(1) Lighted cigarettes, cigars, pipes~~
~~(2) Exposed flame heaters, liquid, solid, or gaseous devices, including portable and wheeled gasoline or kerosene heaters~~
~~(3) Heat-producing, welding, or cutting devices and blowtorches~~
~~(4) Flare pots or other open-flame lights [**407:**5.8.3]~~

~~42.10.5.8.4 The AHJ might establish other locations where open flames and open-flame devices shall not be permitted. [**407:**5.8.4]~~

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~~42.10.5.8.5 Personnel shall not carry lighters or matches on their person while engaged in fuel servicing operations. [**407:**5.8.5]~~

~~42.10.5.8.6 Lighters or matches shall not be permitted on or in fueling equipment. [**407:**5.8.6]~~

~~42.10.5.9 **Lightning Precautions**.~~

~~42.10.5.9.1 Fuel servicing operations shall be suspended where lightning flashes are in the immediate vicinity of the airport. [**407:**5.9.1]~~

~~42.10.5.9.2 A written procedure shall be established to set the criteria for where fueling operations are to be suspended at each airport as approved by the fueling agent and the airport authority. [**407:**5.9.2]~~

~~42.10.5.10 **Aircraft Fuel Servicing Locations**.~~

~~42.10.5.10.1 Aircraft fuel servicing shall be performed outdoors. Aircraft fuel servicing incidental to aircraft fuel system maintenance operations shall comply with the requirements of NFPA 410. [**407:**5.10.1]~~

~~42.10.5.10.2 Aircraft being fueled shall be positioned so that aircraft fuel system vents or fuel tank openings are not closer than 25 ft (7.6 m) to any terminal building, hangar, service building, or enclosed passenger concourse other than a loading walkway. Aircraft being fueled shall not be positioned so that the vent or tank openings are within 50 ft (15 m) of any combustion and ventilation air intake to any boiler, heater, or incinerator room. [**407:**5.10.2]~~

~~42.10.5.10.3 Accessibility to aircraft by emergency fire equipment shall be established for aircraft fuel servicing positions. [**407:**5.10.3]~~

~~42.10.5.11 **Aircraft Occupancy During Fuel Servicing Operations**.~~

~~42.10.5.11.1 If passengers remain onboard 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. A clear area for emergency evacuation of the aircraft shall be maintained at not less than one additional exit. Where fueling operations take place with passengers onboard 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~~

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~~vicinity of the fueling activity with at least one vehicle. Aircraft operators shall establish specific procedures covering emergency evacuation under such conditions for each type of aircraft they operate. All "no smoking" signs shall be displayed in the cabin(s), and the no smoking rule shall be enforced. [**407:**5.11.1]~~

~~42.10.5.11.2 For each aircraft type, operators shall determine the areas through which it could be hazardous for boarding or deplaning passengers to pass while the aircraft is being fueled. Controls shall be established so that passengers avoid such areas. [**407:**5.11.2]~~

~~42.10.5.11.3 Passengers shall not be permitted to linger about the plane but shall proceed directly between the loading gate and the aircraft. [**407:**5.11.3]~~

~~42.10.5.12 **Positioning of Aircraft Fuel Servicing Vehicles and Carts**.~~

~~42.10.5.12.1 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:**5.12.1]~~

~~42.10.5.12.2 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. Aircraft fuel servicing vehicles or carts shall not be positioned within a 10 ft (3 m) radius of aircraft fuel system vent openings. [**407:**5.12.2]~~

~~42.10.5.12.3 Parking brakes shall be set on all fuel servicing vehicles or carts before operators begin the fueling operation. [**407:**5.12.3]~~

~~42.10.5.13 **Portable Fire Extinguishers**.~~

~~42.10.5.13.1 During fueling operations, fire extinguishers shall be available on aircraft servicing ramps or aprons. [**407:**5.13.1]~~

~~42.10.5.13.2 Each aircraft fuel servicing tank vehicle shall have two listed fire extinguishers, each having a rating of at least 20-B:C, with one extinguisher mounted on each side of the vehicle. [**407:**5.13.2]~~

~~42.10.5.13.3 One listed fire extinguisher having a rating of at least 20-B:C shall be installed on each hydrant fuel servicing vehicle or cart. [**407:**5.13.3]~~

~~42.10.5.13.4 Where the open hose discharge capacity of the aircraft fueling system or equipment is more than 200 gpm (750 L/min), at least one listed wheeled extinguisher having a rating of not less than~~

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~~80-B:C and a minimum capacity of 125 lb (55 kg) of agent shall be provided. [**407:**5.13.4]~~

~~42.10.5.13.5 Extinguishers shall be kept clear of elements such as ice and snow. Extinguishers located in enclosed compartments shall be readily accessible, and their location shall be marked clearly in letters at least 2 in. (50 mm) high. [**407:**5.13.5]~~

~~42.10.5.13.6 Fuel servicing personnel shall be trained in the use of the available fire extinguishing equipment they could be expected to use. [**407:**5.13.6]~~

~~42.10.5.14 **Defueling**.~~

~~42.10.5.14.1 The transfer of fuel from an aircraft to a tank vehicle through a hose generally is similar to fueling, and the same requirements shall apply. In addition, each operator shall establish procedures to prevent the overfilling of the tank vehicle, which is a special hazard when defueling *(see 4.3.21.7 of NFPA 407).* [**407:**5.14.1]~~

~~42.10.5.14.1.1 There shall be a procedure to eliminate air ingested during a defueling operation prior to the aircraft fuel servicing tank vehicle being reused. [**407:**5.14.1.1]~~

~~42.10.5.14.2 Where draining residual fuel from aircraft tanks incidental to aircraft fuel system maintenance, testing, manufacturing, salvage, or recovery operations, the procedures of NFPA 410 shall apply. [**407:**5.14.2]~~

~~42.10.5.15 **Deadman Control Monitoring**.~~

~~42.10.5.15.1 The fueling operator shall monitor the panel of the fueling equipment and the aircraft control panel during pressure fueling or shall monitor the fill port during overwing fueling. [**407:**5.15.1]~~

~~42.10.5.15.2 Fuel flow shall be controlled by use of a deadman control device. The use of any means that defeats the deadman control shall be prohibited. [**407:**5.15.2]~~

~~42.10.5.16 **Aircraft Fueling Hose**.~~

~~42.10.5.16.1 Aircraft fueling hose shall be inspected before use each day. The hose shall be extended as it normally would be for fueling and checked for evidence of blistering, carcass saturation or separation, cuts, nicks, or abrasions that expose reinforcement material, and for slippage, misalignment, or leaks at couplings. If~~

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~~coupling slippage or leaks are found, the cause of the problem shall be determined. Defective hose shall be removed from service. [**407:**5.16.1]~~

~~42.10.5.16.2 At least once each month the hose shall be completely extended and inspected as required in 42.10.5.16.1. The hose couplings and the hose shall be examined for a length approximately 12 in. (305 mm) adjacent to the couplings. Structural weakness shall be checked by pressing the hose in this area around its entire circumference for soft spots. Hoses that show evidence of soft spots shall be removed from service. The nozzle screens shall be examined for rubber particles. The presence of such particles indicates possible deterioration of the interior, and the hose shall be removed from service. With the hose still completely extended, it shall be checked at the working pressure of the fueling equipment to which it is attached. Any abnormal twisting or ballooning during this test indicates a weakening of the hose carcass, and the hose shall be removed from service. [**407:**5.16.2]~~

~~42.10.5.16.3 A hose assembly that has been subjected to abuse, such as severe end-pull, flattening or crushing by a vehicle, or sharp bending or kinking, shall be removed from service. The hose assembly that has been subjected to abuse shall be hydrostatically tested prior to use. *(See 4.2.2.1 of NFPA 407.)* [**407:**5.16.3]~~

~~42.10.5.16.4 If inspection shows that a portion of a hose has been damaged, the damaged portion shall be cut off and the undamaged portion recoupled. Two lengths of hose shall not be coupled together. Only couplings that are an exact match for the interior and exterior dimensions of the hose shall be used. Recoupled hose assemblies shall be hydrostatically tested. *(See 4.2.2.1 of NFPA 407.)* [**407:**5.16.4]~~

~~42.10.5.16.5 Before any hose assembly, new or recoupled, is placed in service, it shall be visually inspected for evidence of damage or deterioration. [**407:**5.16.5]~~

~~42.10.5.16.6 Kinks or short loops in fueling hose shall be avoided. [**407:**5.16.6]~~

~~42.10.5.16.7 Suitable records shall be kept of required inspections and hydrostatic tests. [**407:**5.16.7]~~

~~42.10.5.17 **Maintenance of Aircraft Fuel Servicing Vehicles and Carts**.~~

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~~42.10.5.17.1 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:**5.17.1]~~

~~42.10.5.17.2 Leaking vehicles or carts shall be removed from service, defueled, and parked in a safe area until repaired. [**407:**5.17.2]~~

~~42.10.5.17.3 Maintenance and servicing of aircraft fuel servicing vehicles and carts shall be performed outdoors or in a building approved for the purpose. [**407:**5.17.3]~~

~~42.10.5.18 **Parking 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 10 ft (3 m) 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 50 ft (15 m) from any parked aircraft and buildings other than maintenance facilities and garages for fuel servicing tank vehicles [**407:**5.18]~~

~~42.10.5.19 **Parking 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:**5.19]~~

~~42.10.5.20 **Loading of Aircraft Fuel Servicing Tank Vehicles**.~~

~~42.10.5.20.1 **General Requirements**.~~

~~42.10.5.20.1.1 **Loading and Unloading**.~~

~~42.10.5.20.1.1.1 Aircraft fuel servicing tank vehicles shall be loaded only at an approved loading rack. [**407:**5.20.1.1.1]~~

~~42.10.5.20.1.1.2 Aircraft fuel servicing tank vehicles shall not be loaded from a hydrant pit under emergency conditions unless permitted by the AHJ. [**407:**5.20.1.1.2]~~

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~~42.10.5.20.1.2 Filling of the vehicle cargo tank shall be under the observation and control of a qualified and authorized operator at all times. [**407:**5.20.1.2]~~

~~42.10.5.20.1.3 The required deadman and automatic overfill controls shall be in normal operating condition during the filling operation. The controls shall not be blocked open or otherwise bypassed. [**407:**5.20.1.3]~~

~~42.10.5.20.1.4 The engine of the tank vehicle shall be shut off before starting to fill the tank. [**407:**5.20.1.4]~~

~~42.10.5.20.1.5 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:**5.20.1.5]~~

~~42.10.5.20.2 **Top Loading**.~~

~~42.10.5.20.2.1 Where loading tank trucks through open domes, a bond shall be established between the loading piping and the cargo tank to equalize potentials. The bond connection shall be made before the dome is opened and shall be removed only after the dome is closed. [**407:**5.20.2.1]~~

~~42.10.5.20.2.2 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 fall of fuel through the tank atmosphere. The flow rate into the tanks shall not exceed 25 percent of the maximum flow until the outlet is fully covered. [**407:**5.20.2.2]~~

~~42.10.5.20.2.3 The level in the tank shall be visually monitored at all times during top loading. [**407:**5.20.2.3]~~

~~42.10.5.20.3 **Bottom Loading**.~~

~~42.10.5.20.3.1 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:**5.20.3.1]~~

~~42.10.5.20.3.2 The operator shall initiate fuel flow by means of a deadman control device. [**407:**5.20.3.2]~~

~~42.10.5.20.3.3 The operator shall perform the precheck on each compartment shortly after flow has started, to ensure that the~~

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~~automatic high-level shutoff system is functioning properly. [**407:**5.20.3.3]~~

~~42.10.5.20.3.4 At least monthly the operator shall perform a check to ensure complete closure of the bottom-loading valve on the tank vehicle. [**407:**5.20.3.4]~~

~~42.10.5.21 **Rapid Refueling of Helicopters**.~~

~~42.10.5.21.1 Only turbine engine helicopters fueled with JET A or JET A-1 fuels shall be permitted to be fueled while an onboard engine is operating. Helicopters 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. Ignition sources shall include, but shall not be limited to, engines, exhausts, auxiliary power units (APUs), and combustion-type cabin heater exhausts. [**407:**5.21.1]~~

~~42.10.5.21.2 Helicopter fueling while onboard engines are operating shall be permitted only under the following conditions:~~

~~(1) An FAA-licensed helicopter pilot shall be at the aircraft controls during the entire fuel servicing process.~~
~~(2) Passengers shall be deboarded to a safe location prior to rapid refueling operations. Where the pilot in command deems it necessary for passengers to remain onboard for safety reasons, the provisions of 42.10.5.11.1 shall apply.~~
~~(3) Passengers shall not board or deboard during rapid refueling operations.~~
~~(4) 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.~~
~~(5) All doors, windows, and access points allowing entry to the interior of the helicopter that are adjacent to, or in the immediate vicinity of, the fuel inlet ports shall be closed and shall remain closed during refueling operations.~~
~~(6) Fuel shall be dispensed into an open port from approved deadman-type nozzles, with a flow rate not to exceed 60 gpm (227 L/min), or it shall be dispensed through close-coupled pressure fueling ports. Where fuel is dispensed from fixed piping systems, the hose cabinet shall not extend into the rotor space. A curb or other approved barrier shall be provided to restrict the fuel servicing vehicle from coming closer than within 10 ft (3 m) of any helicopter rotating components. If a curb or approved barrier cannot be provided, fuel servicing vehicles shall be kept 20 ft (6 m) away from any helicopter rotating components, and a~~

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~~trained person shall direct fuel servicing vehicle approach and departure. [**407:**5.21.2]~~ ~~42.10.5.22 **Self-Service Fueling**. Occupancy of the aircraft during self-service fueling shall be prohibited. [**407:**5.22]~~ 42.11.2.2.1 Chapter 11 of NFPA 58 applies to engine fuel systems installed on mobile and nonstationary engines and off-road 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. 42.11.2.2.2 Chapter 11 of NFPA 58 applies to the installation of fuel systems supplying engines used to propel motorized vehicles as defined in 42.11.2.2.1. ~~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]~~	
Chapter 43 – Spraying, Dipping, and Coating Using Flammable or Combustible Materials	
43.1.1.1 Section 43.1 shall apply to the spray application of flammable ~~liquids, combustible liquids~~, or combustible ~~powders~~ materials, as herein defined, either continuously or intermittently by any of the following methods: 1. Compressed air atomization 2. Airless or hydraulic atomization 3. Electrostatic application methods ~~Fluidized bed application methods~~ ~~Electrostatic fluidized bed application methods~~ 4. Other ~~acceptable application~~ means of atomized application	

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43.1.2.1 **General.** Spray application operations and prcesses shall be located in industrial occupancies as defined by NFPA *5000* and shall be confined to spray booths, spray rooms, spray areas, or in temporary membrane enclosures as defined in this *Code*.

43.1.2.2 **Locations in Other Occupancies.** Spray application operations and processes shall not be conducted in any building that is classified as an assembly, educational, ~~institutional,~~ day care, health care, ambulatory health care, detention/correctional, residential, mercantile, business, or storage occupancy, unless ~~they are~~ the following requirements are met:

(1) The spraying is located in a room that is separated both vertically and horizontally from all surrounding areas by construction having a fire resistance rating of not less than 2 hours

(2) The room ~~shall be~~ is protected by an approved automatic sprinkler system designed and installed in accordance with Section 13.313.3

43.1.3.1.7 Enclosed spray booths and spray rooms shall be provided with means of egress that meet the applicable requirements of Chapter 40 of NFPA *101*

43.1.3.1.8 Spray booths that are used exclusively for powder coating shall meet the requirements of ~~Section 43.6~~ Chapter 15 of NFPA 33 They shall be permitted to be constructed of fire-retardant combustible materials where approved by the AHJ. [**33:**5.1.8]

~~*Exception: Listed spray booth assemblies that are constructed of other materials shall be permitted. [**33:**5.1.8]*~~

43.1.3.3.2 A clear space of not less than 3 ft (915 mm) shall be maintained on all sides and above the spray booth. This clear space shall be kept free of any storage or combustible construction.

~~*Exception No. 1: This requirement shall not prohibit locating a spray booth closer than 3 ft (915 mm) to or directly against an interior partition, wall, or floor/ceiling assembly that has a fire resistance rating of not less than 1 hour, provided the spray booth can be maintained and cleaned.*~~

~~*Exception No. 2: This requirement shall not prohibit locating a spray booth closer than 3 ft (915 mm) to an exterior wall or a roof assembly, provided the wall or roof is constructed of noncombustible material and provided the spray booth can be maintained and cleaned. [**33:**5.3.2]*~~

43.1.3.3.2.1 This requirement shall not prohibit locating a spray booth closer than 3 ft (915 mm) to or directly against an interior partition, wall, or floor/ceiling assembly that has a fire resistance

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rating of not less than 1 hour, provided the spray booth can be maintained and cleaned. [**33:**5.3.2.1]

43.1.3.3.2.2 This requirement shall not prohibit locating a spray booth closer than 3 ft (915 mm) to an exterior wall or a roof assembly, provided the wall or roof is constructed of noncombustible material and provided the spray booth can be maintained and cleaned. [**33:**5.3.2.2]

43.1.3.5. **Vision and Observation Panels.**
43.1.3.5.1 Panels for ~~light fixtures~~ luminaires or ~~for~~ observation shall be of heat-treated glass, laminated glass, wired glass, or hammered-wired glass and shall be sealed to confine vapors, mists, residues, dusts, and deposits to the spray area. [**33:**5.4.1]

~~*Exception: Listed spray booth assemblies that have vision panels constructed of other materials shall be permitted. [**33:**5.5.1]*~~

43.1.3.5.1.1 Listed spray booth assemblies that have *observation* panels constructed of other materials shall be permitted. [**33:**5.4.1.1]

43.1.4.1.5 Open flames, spark-producing equipment or processes, and equipment whose exposed surfaces exceed the autoignition temperature of the material being sprayed shall not be located in a spray area or in any surrounding area that is classified as Division 2, Zone 2, or Zone 22.

~~*Exception: This requirement shall not apply to drying, curing, or fusing apparatus covered by Section 43.4. [**33:**6.2.5]*~~

43.1.4.1.5.1 This requirement shall not apply to drying, curing, or fusing apparatus covered by Section 43.4. [**33:**6.2.5.1]

43.1.4.4.4 If spray application operations are confined to an enclosed spray booth or room, electrical area classification shall be as follows:

(1) The area within 3 ft (915 mm) of any opening shall be classified as Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 locations, whichever is applicable, as shown in Figure 43.1.4.4.4.
(2) *Where automated spray application equipment is used, the area outside the access doors shall be unclassified provided the door interlock prevents the spray application operations when the door is open.
(3) Where exhaust air is recirculated and all requirements of 43.1.5.5 are met, both of the following shall apply:

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(a) The interior of any recirculation path ~~from the secondary particulate filters~~ downstream of the recirculation particulate filter up to and including the air supply plenum shall be classified as Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 locations, whichever is applicable.
(b) The interior of fresh air supply ducts shall be unclassified.

(4) Where exhaust air is not recirculated, the interior of fresh air supply ducts and fresh air supply plenums shall be unclassified. [**33:**6.5.4]

43.1.4.5 **Illumination.** ~~**Light Fixtures.**~~ ~~Light fixtures~~ Luminaires, like that shown in Figure 43.1.4.5.1, that are attached to the walls or ceiling of a spray area but that are outside any classified area and are separated from the spray area by glass panels that meet the requirements of 43.1.3.5 shall be suitable for use in unclassified locations. Such fixtures shall be serviced from outside the spray area. [**33:**6.6.1]

43.1.5.2.4 In confined spaces, where ventilation is not capable of meeting the requirements of 43.1.5.2, and inerting procedure shall be permitted to be used. Such procedures shall meet the applicable requirements of NFPA 69 and shall be acceptable to the AHJ.

43.1.5.4 **Routing of Exhaust Ducts.** Air exhausted ~~to the atmosphere~~ from liquid spray operations shall be conducted by ducts directly to the outside of the building. Exhaust ducts shall follow the ~~most direct~~ shortest route to the point of discharge and shall meet the following conditions:

(1) Exhaust ducts ~~but~~ shall not penetrate a fire wall.
(2) ~~The exhaust~~ Exhaust discharge shall be directed away from any fresh air intakes.
(3) ~~The exhaust duct~~ Exhaust discharge point shall be at least 6 ft (1830 mm) from any exterior wall or roof.
(4) Exhaust discharge point shall be at least 10 ft (3048 mm) from openings into the building.
(5) Exhaust discharge point shall be at least 10 ft (3048 mm) above adjoining grade.
(6) ~~The exhaust~~ Exhaust duct shall not discharge in the direction of any combustible construction that is within 25 ft (7625 mm) of the exhaust duct discharge point.
(7) Exhaust duct shall not discharge in the direction of any unprotected opening in any noncombustible or limited-combustible construction that is within 25 ft (7625 mm) of the exhaust duct discharge point.

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(8) Exhaust duct shall not discharge in the direction of any exit discharge or public way that is within 25 ft (7625 mm) of the exhaust duct discharge point.

[**33:**7.4]

43.1.5.5.1 Air exhausted from spray areas shall not be recirculated unless all of the following requirements are met:

(1) Recirculation particulate filters as defined in this *Code* shall be ~~allowed only for unmanned spray operations and for cascading to subsequent unmanned spray operations~~. used to remove particulates ~~shall be removed~~ from the recirculated air.
~~Solid particulates shall be removed from the recirculated air~~.
(2) The concentration of vapors in the exhaust airstream shall not exceed 25 percent of the lower flammable limit.
(3) Listed equipment shall be used to monitor the concentration of vapors in all exhaust airstreams.
(4) The equipment specified in 43.1.5.5.1(3) shall ~~sound an~~ initiate a local alarm and shall automatically shut down the spray operation if the concentration of any vapor in the exhaust airstream exceeds 25 percent of the lower flammable limit.
(5) All equipment installed to process and remove contaminants from the air exhausted from spray operations shall be approved by the AHJ.
(6) *For occupied spray areas where a portion of the exhaust air is recirculated within the spray area, toxicity and worker exposures shall be addressed.

43.1.5.10.1 The rotating element of the exhaust fan shall be nonferrous, or the fan shall be constructed so that a shift of the impeller or shaft will not permit two ferrous parts of the fan to rub or strike. ~~There shall be ample clearance between the rotating element and fan casing to avoid a fire by friction, with necessary~~ Necessary allowances ~~being~~ shall be made for ordinary expansion and loading and to prevent contact between moving parts and the duct or fan housing. Fan blades shall be mounted on a shaft that is sufficiently heavy to maintain alignment even when the blades of the fan are heavily loaded. All bearings shall be of the self-lubricating type or shall be provided with accessible lubricating ports.

43.1.6.3.2 Mixing rooms shall meet all of the following requirements:

(1) ~~The mixing room~~ Mixing rooms shall meet the construction requirements of 43.1.3.
(2) The area of ~~the~~ a mixing room shall not exceed 150 ft^2 (14 m^2).

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(3) If more than one mix room is installed, the total quantity of liquids shall not exceed the limits in 43.1.6.3.4 or 43.1.6.3.5.
(4) ~~The mixing room~~ Mixing rooms shall be designed to contain a spill of the contents in the room.
(5) ~~The mixing room~~ Mixing rooms used for mixing and dispensing operations shall be provided with continuous mechanical ventilation capable of providing air movement of not less than 1 ft^3/min per square foot of floor area (0.3 $m^3/min/m^2$) or 150 ft^3/min (4 m^3/min), whichever is greater. The ventilation system shall be in operation at all times.
(6) The mixing room air make-up system and exhaust system shall remain functioning during any fire alarm condition in accordance with Section 9.3 of NFPA 33.
(7) ~~Dispensing and mixing rooms~~ Mixing rooms shall be classified, for purposes of electrical area classification, the same as enclosed spray booths, in accordance with 43.1.4.4.4.
(8) ~~The mixing room~~ Mixing rooms shall be provided with an approved automatic fire protection system that meets all applicable requirements of 43.1.7Chapter 9 of NFPA 33.
(9) ~~The mixing room~~ Mixing rooms shall be provided with portable fire extinguishers located in accordance with ~~Section 13.6~~ NFPA 10.

[**33:**8.3.3]

~~*Exception: See 43.1.6.3.6. [**33:**8.3.2]*~~

~~43.1.6.3.6 Where the quantities of liquids required or the floor area necessary to provide a suitable mixing room exceeds the limits specified in 43.1.6.3.2 through 43.1.6.3.5, the mixing room shall meet all applicable requirements of NFPA 30.~~

43.1.6.5.5 Containers that are pressurized to supply spray nozzles, air storage tanks, and coolers shall comply with all applicable requirements of the ASME *Boiler and Pressure Vessel Code*, Section VIII, for construction, tests, and maintenance. [**33:**8.5.5]

Exception: The following need not meet this requirement:

43.1.6.5.5.1 Containers that meet the following requirements need not meet the requirements of the ASME *Boiler and Pressure Vessel Code*, Section VIII, for construction, tests, and maintenance:
(1) Pressure containers less than 6 in. (150 mm) in diameter
(2) Pressure containers that operate at less than a gauge pressure of 15 psi (1.03 kPa)
(3) Siphon-type spray cups

43.1.6.5.6.1 If electric , ~~it~~ heaters are used to heat the liquid being sprayed, the electric heater shall be approved and listed for the

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specific location in which it is used. *(See ~~43.1.4~~ Chapter 6 of NFPA 33.)* [**33:**8.5.6.1]

New Sections:
43.1.6.5.6.1
43.1.6.5.6.2
43.1.6.5.7
43.1.6.5.7.1

43.1.6.5.8 Methods for cleaning paint circulation systems shall meet the requirements of Chapter 18 ~~7.3.7~~ of NFPA 30

43.1.7.1 **General.** Spray areas, as defined in this *Code* ~~which include by definition any associated exhaust plenums and exhaust ductwork, any particulate filters, any solvent concentrator units, any recirculation air supply units~~, and mixing rooms, shall be protected with an approved automatic fire protection system. This shall apply to both manual and automated spray application processes.

43.1.7.1.1 The automatic fire protection system shall be permitted to be, and shall be installed in accordance with, any of the following:

(1) An automatic water sprinkler system that meets all applicable requirements of NFPA 13
(2) An automatic foam water sprinkler system that meets all applicable requirements of NFPA 16
(3) A carbon dioxide extinguishing system that meets all applicable requirements of NFPA 12
(4) A dry chemical extinguishing system that meets all applicable requirements of NFPA 17
(5) A gaseous agent extinguishing system that meets all applicable requirements of NFPA 2001
(6) A water mist fire protection system that meets the applicable requirements of NFPA 750

43.1.7.3 **Ventilation Systems.** Air make-up systems and spray area exhaust systems shall remain functioning during any fire alarm condition. [**33:**9.3]

~~*Exception No. 1: Where the type of automatic fire protection system requires that ventilation be discontinued, air make-up systems and spray area exhaust systems shall be permitted to be shut down and dampers shall be permitted to close.*~~

~~*Exception No. 2: For powder coating systems, the requirements of 43.1.7.7 shall be met instead of those of this paragraph. [**33:**9.3]*~~

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43.1.7.3.1 Where the type of automatic fire protection system requires that ventilation be discontinued, air make-up systems and spray area exhaust systems shall be permitted to be shut down and dampers shall be permitted to close

43.1.7.4.2 The automatic sprinkler system shall be designed as follows: for Extra Hazard (Group 2) occupancies, as defined in NFPA 13.

(1) For spray application of styrene cross-link thermoset resins application areas, sprinklers shall be designed for Ordinary Hazard (Group 2) as defined in NFPA 13.
(2) For powder coating operations, sprinklers shall be designed for Ordinary Hazard (Group 2) as defined in NFPA 13.
(3) For all other spray areas, sprinklers shall be designed for Extra Hazard (Group 2) as defined in NFPA 13.

[**33:**9.4.2]

~~*Exception No. 1: For spray application of styrene cross-link thermoset resins, Section 17.3 of NFPA 33 shall apply.*~~
~~*Exception No. 2: Automatic sprinkler systems for powder coating operations shall be designed for Ordinary Hazard (Group 2), as defined in NFPA 13. [**33:**9.4.2]*~~

43.1.7.4.2.1 The sprinkler design area shall not be required to exceed the area of the booth or room in which spraying or resin application is conducted. [**33:**9.4.2.1]

43.1.7.4.6_Sprinkler systems protecting stacks or ducts shall meet all of the following requirements:

(1) One sprinkler shall be located at the top of each vertical riser and at the midpoint of each offset. Additional heads shall be spaced on 24 ft (7.3 m) centers if the rise is greater than 24 ft (7.3 m).
(2) ~~Sprinklers shall be spaced no more than 12 ft (3.7 m) apart~~. Horizontal exhaust ducts shall have sprinklers located on 12 ft (3.7 m) centers beginning no more than 6 ft (1.7 m) from the duct entrance.
(3) ~~If~~ Where exhaust ducts are manifolded, a sprinkler shall be located in the manifold at the junction of each exhaust duct with the manifold.
(4) Sprinklers shall provide a minimum flow of 30 gpm (114 L/min) per head at a minimum of 15 psi (1 bar) pressure.
(5) Sprinklers shall be ordinary temperature rated, unless required to be higher due to operating temperatures measured in the ducts, in which case the operating temperature shall be at least 50°F (28°C) above the inside temperature of the duct. [**33:**9.4.6]

43.1.7.7.2

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Automated powder application equipment that is unlisted shall be further protected by the following:

(1) In addition to meeting the requirements in 43.1.7.2.1 and 43.1.7.7.1, the optical flame detection system shall also activate the automatic fire protection system, if provided.
(2) Automatic electrostatic equipment enclosures inside the booth shall be protected with an approved automatic fire protection system. Activation of this system shall automatically accomplish the requirements of 43.1.7.2.1 and 43.1.7.7.1.
(3) Manual activation stations shall be installed. At least one such station shall be within ready access of operating personnel. If access to this station is likely to involve exposure to danger, an additional station shall be located adjacent to an exit from the area. These devices shall activate the fire protection system as specified in 43.1.7.1.1 for the affected automated zone, if applicable, and accomplish the requirements in 43.1.7.7.1.

[**33:**9.7.2]

~~*Exception: This requirement shall not apply to a closed-head wet pipe automatic sprinkler system.*~~

43.1.7.8.2 Automated liquid electrostatic spray application equipment that is unlisted shall be protected further by the following:

(1) In addition to meeting the requirements in 43.1.7.8.1, the optical flame detection system shall also activate one of the following over each zone in which fire has been detected:
    (a) An open head deluge system designed to discharge a minimum density of 0.6 gpm/ft^2 (24.4 mm/min)
    (b) A carbon dioxide extinguishing system
    (c) A dry chemical extinguishing system
    (d) A gaseous agent extinguishing system
    (e) <u>A water mist fire protection system</u>
(2) Manual activation stations shall be installed. At least one such station shall be within ready access of operating personnel. If access to this station is likely to involve exposure to danger, an additional station shall be located adjacent to an exit from the area. These devices shall activate the fire protection system as specified in 43.1.7.8.2(1) and accomplish the requirements of 43.1.7.2.1 and 43.1.7.8.2(2).
(3) A wet pipe sprinkler system shall also be provided throughout the spray booth. This system shall meet all the applicable requirements of NFPA 13 for Extra Hazard (Group 2) occupancies.
(4) Automatic electrostatic equipment enclosures inside the booth systems shall be protected with an approved

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automatic fire protection system. Activation of this system shall automatically accomplish the requirements of 43.1.7.2.1 and 43.1.7.8.1(2). [**33:**9.8.2] 43.1.8.4.1 Overspray collectors shall be inspected daily and clogged filters shall be discarded and replaced. Maintenance procedures shall be established to ensure that overspray collector filters are replaced before ~~excessive~~ restriction to airflow ~~occurs~~ is reduced below the minimum established by Section 7.2 of NFPA 33. ~~Overspray collectors shall be inspected after each period of use and clogged filters shall be discarded and replaced.~~ 43.5.2 **Preparation Workstations.** If spray finishing operations are performed at or in a preparation workstation, the preparation workstation shall be considered an unenclosed spray area and shall meet all requirements of an unenclosed spray area. [**33:**14.2] ~~*Exception: A preparation workstation that is designed and operated in accordance with 43.5.3 shall be considered a limited finishing workstation and not an unenclosed spray area. [**33:**14.2]*~~ 43.5.2.1 A preparation workstation that is designed and operated in accordance with 43.5.3 shall be considered a limited finishing workstation and not an unenclosed spray area. 43.5.3.5 The area inside the curtains or partitions shall be considered a Class I, Division 1; Class I, Zone 1; Class II, Division 1; or Zone 21 hazardous (classified) location, as defined by Article 500 of NFPA *70* 43.8.3 **Fire Protection.** Resin application areas shall be protected in accordance with 43.1.7. ~~If an automatic sprinkler system is utilized, it shall be permitted to be designed and installed in accordance with the requirements of NFPA 13 for at least Ordinary Hazard, Group 2 occupancies~~	
Chapter 44 – Solvent Extraction	
Chapter 45 – Combustible Fibers	
45.1.3 Chapter 45 shall not apply to biomass feedstock regulated by Chapter 31	
Chapter 46 – Reserved	
Chapter 47 – Reserved	
Chapter 48 – Reserved	
Chapter 49 – Reserved	
Chapter 50 – Commercial Cooking	

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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

50.2.1.5 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]

50.2.1.9 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.~~

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]

50.4.4.2 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.

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]

50.4.4.8.4 The water supply for water-wash fire-extinguishing systems shall be controlled by a ~~supervised water supply control~~ listed indicating valve.

50.4.4.8.5 ~~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

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thereof shall be provided with instructions and appropriate means for electrical interface for simultaneous activation.

~~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~~

50.4.4.10 **Water Valve Supervision.** Valves controlling the water supply to listed ~~fixed baffle hood assemblies~~ water-wash fire-extinguishing systems, automatic fire-extinguishing systems, or both shall be listed indicating type of valve and shall be supervised open by one of the following methods:

(1) Central station, proprietary, or remote station alarm service
(2) Local alarm service that will cause the sounding of an audible signal at a constantly attended point
(3) Locking valves open
(4) *Sealing of valves and approved weekly recorded inspection

[**96:**10.2.10]

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.

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 50.4.5.1.1~~, the hoods' fire-extinguishing system(s) shall be independent and shall not be required to simultaneously discharge.

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]

50.4.6.5 Solid fuel cooking operations shall not be required to be shut down.

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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.~~

50.4.7 **Manual Activation.**
50.4.7.1 ~~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~~. All systems shall have both automatic and manual methods of actuation. [**96:**10.5.1]

50.4.7.1.1 At least one manual actuation device shall be located ~~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~~ in means of egress or ~~at an alternative~~ a 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-extinguishing equipment.~~ The manual actuation device shall clearly identify the hazard protected. [**96:**10.5.1.2]

50.4.7.2 ~~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~~. An automatic sprinkler system shall not require a method of manual actuation. [**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]~~

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50.4.7.1.2 The manual actuation device shall clearly identify the hazard protected

50.4.7.2 An automatic sprinkler system shall not require a method of manual actuation.

50.4.7.3 Instruction regarding the proper use of portable fire extinguishers and the manual activation of fire-extinguishing equipment shall be documented and shall be provided by the management to new employees on hiring and to all employees annually

~~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]~~

50.4.9.1 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 additional sprinkler ~~floor~~ coverage underneath.

50.4.11.4 Carbon dioxide-type extinguishers shall not be permitted.

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~~

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~~posted conspicuously in the kitchen and shall be reviewed with employees by the management~~

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]

50.5.1.4.2 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]

50.5.2.4 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~~

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]

Table 50.5.4 **Schedule of Inspection for Grease Buildup**

- Systems serving solid fuel cooking operations
- Systems serving high-volume cooking operations, ~~such as 24-hour cooking, charboiling, or wok cooking~~
- Systems serving moderate-volume cooking operations
- Systems serving low-volume cooking operations, ~~such as churches, day camps, seasonal businesses, or senior centers~~

High-volume cooking operations include 24-hour cooking, charboiling, and wok cooking.
Low-volume cooking operations include churches, day camps, seasonal businesses, and senior centers.

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 50.5.4. [**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**.

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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]

50.5.6.16 Metal containers used to collect grease drippings shall be inspected or emptied at least weekly. [**96:**11.6.16]

50.7 Mobile **and Temporary Cooking Operations**.

50.7.1 **General**.

50.7.1.1 Mobile and temporary cooking operations shall comply with 50.7.1 and the applicable section for the type of cooking performed.

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

50.7.1.3 Wheel chocks shall be used to prevent mobile and temporary cooking units from moving.

50.7.1.4 **Portable Fire Extinguishers**.

50.7.1.4.1 Portable fire extinguishers shall be provided per NFPA 96 for cooking operations.

50.7.1.4.2 A minimum of one 2A:10BC portable fire extinguisher shall be provided when a generator or other fuel fired appliance is used.

50.7.1.4.3 When wood or charcoal is used, a minimum of one 2A portable fire extinguisher or an approved hose line shall be provided.

50.7.1.5 **Separation**. Mobile or temporary cooking operations shall be separated from buildings or structures, combustible materials, vehicles, and other cooking operations by a minimum of 10 ft (3 m).

50.7.1.6 **Tents**.

50.7.1.6.1 Mobile or temporary cooking shall not take place within tents occupied by the public.

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50.7.1.6.2 Tents shall comply with Chapter 25.

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

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

50.7.1.8 **Communications**.

50.7.1.8.1 An approved method of communication to emergency personnel shall be accessible to all employees.

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

50.7.1.9 **Training**.

50.7.1.9.1 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

50.7.1.9.2 Refresher training shall be provided every year.

50.7.1.9.3 Initial and refresher training shall be documented and made available to the AHJ on request.

50.7.1.10 **Internal Combustion Power Sources**.

50.7.1.10.1 Electric generator and internal combustion power sources used for mobile or temporary cooking shall comply with 11.7.2.

50.7.1.10.2 Portable generators shall be positioned so that the exhaust is at least 5 ft (1.5 m) in any direction away from any openings, air intakes, means of egress, or from any building, structure, or vehicle.

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

50.7.1.11 **Charcoal and Wood Burning**.

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

50.7.1.11.2 An approved carbon monoxide detector shall be installed where mobile cooking operations are performed in an enclosed area.

50.7.1.12 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 **Mobile Cooking**.

50.7.2.1 General. Mobile cooking operations and equipment shall comply with 50.7.1 and 50.7.2 of NFPA 96.

50.7.2.2 **LP-Gas Systems**.

50.7.2.2.1 Cylinders shall be secured in an upright position to prevent tipping over.

50.7.2.2.2 Gas systems on mobile cooking vehicles shall comply with NFPA 58 and this section.

50.7.2.2.3 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.

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.

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~~. Leak

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detection shall be performed every time a new connection or a change in a cylinder is made to any gas system.
50.7.2.4 LP-Gas Systems on Vehicles (Other than Engine Fuel Systems).

50.7.2.3.4.1 The certification shall be good for one year.

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

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

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

50.7.2.4.1* **Application**. Section 50.7.2.4 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:**6.24.1]

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

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

[**58:**6.24.2]

50.7.2.4.3 **Container Installation Requirements**.

50.7.2.4.3.1 Containers shall comply with 50.7.2.4.3.1(A) through 50.7.2.4.3.1(D).
(A) ASME mobile containers shall be 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

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(B) LP-Gas fuel containers used on passenger-carrying vehicles shall not exceed 200 gal (0.8 m^3) aggregate water capacity. (C) The capacity of individual LP-Gas containers on highway vehicles shall be in accordance with Table 50.7.2.4.3.1(C). (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:**6.24.3] 50.7.2.4.3.1.4 The capacity of cargo tank motor vehicles shall not be limited by NFPA 58. 50.7.2.4.3.2 ASME containers and cylinders used for the purposes covered by 50.7.2.4 shall not be installed, transported, or stored (even temporarily) inside any vehicle covered by 50.7.2.4, except for ASME containers installed in accordance with 50.7.2.4.3.4(I), Chapter 9, or DOT regulations. [**58:**6.24.3.2] 50.7.2.4.3.3 The LP-Gas supply system, including the containers, shall be installed either on the outside of the vehicle or in a recess or cabinet vaportight to the inside of the vehicle but accessible from and vented to the outside, with the vents located near the top and bottom of the enclosure and 3 ft (1 m) horizontally away from any opening into the vehicle below the level of the vents. [**58:**6.24.3.3] 50.7.2.4.3.4 Containers shall be mounted securely on the vehicle or within the enclosing recess or cabinet. (A) Containers shall be installed with road clearance in accordance with 11.8.3 of NFPA 58. (B) 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. (C) 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. (D) 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. (E) All container valves, appurtenances, and connections shall be protected to prevent damage from accidental contact with stationary objects; from loose objects, stones, mud, or ice thrown up from the ground or floor; and from damage due to overturn or similar vehicular accident. (F) Permanently mounted ASME containers shall be located on the vehicle to provide the protection specified in 50.7.2.4.3.4(E).	

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(G) Cylinders shall have permanent protection for cylinder valves and connections.
(H) Where cylinders are located on the outside of a vehicle, weather protection shall be provided.
(I) Containers mounted on the interior of passenger-carrying vehicles shall be installed in compliance with Section 11.9 of NFPA 58. Pressure relief valve installations for such containers shall comply with 11.8.5 of NFPA 58. [**58:**6.24.3.4]

50.7.2.4.4 **Installation of Container Appurtenances**.

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

(1) Pressure relief valve installation on ASME containers installed in the interior of vehicles complying with Section 11.9 of NFPA 58 shall comply with 11.8.5 of NFPA 58.
(2) Pressure relief valve installations on ASME containers installed on the outside of vehicles shall comply with 11.8.5 of NFPA 58 and 50.7.2.4.3.3.
(3) Main shutoff valves on containers for liquid and vapor shall be readily accessible.
(4) Cylinders shall be designed to be filled in either the vertical or horizontal position, or if they are the universal type, they are permitted to be filled in either position.
(5) All container inlets, outlets, or valves installed in container inlets or outlets, except pressure relief devices and gauging devices, shall be labeled to designate whether they communicate with the vapor or liquid space.
(6) Containers from which only vapor is to be withdrawn shall be installed and equipped with connections to minimize the possibility of the accidental withdrawal of liquid. [**58:**6.24.4.1]

50.7.2.4.4.2 Regulators shall be installed in accordance with 6.8.2 of NFPA 58 and 50.7.2.4.4.2(A) through 50.7.2.4.4.2(E).
(A) 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.
(B) 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.
(C) 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.
(D) 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).

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(2) The compartment shall be vaportight to the interior of the vehicle.
(3) The compartment shall have a 1 in.^{2} (650 mm^2) minimum vent opening to the exterior located within 1 in. (25 mm) of the bottom of the compartment.
(4) The compartment shall not contain flame or spark-producing equipment.

(E) A regulator vent outlet shall be at least 2 in. (51 mm) above the compartment vent opening. [**58:**6.24.4.2]

50.7.2.4.5 **Piping**.

50.7.2.4.5.1 Piping shall be installed in accordance with 6.9.3 of NFPA 58 and 50.7.2.4.5.1(A) through 50.7.2.4.5.1(M).
(A) Steel tubing shall have a minimum wall thickness of 0.049 in. (1.2 mm).
(B) A flexible connector shall be installed between the regulator outlet and the fixed piping system to protect against expansion, contraction, jarring, and vibration strains.
(C) Flexibility shall be provided in the piping between a cylinder and the gas piping system or regulator.
(D) Flexible connectors shall be installed in accordance with 6.9.6 of NFPA 58.
(E) Flexible connectors longer than the length allowed in the *Code*, or fuel lines that incorporate hose, shall be used only where approved.
(F) The fixed piping system shall be designed, installed, supported, and secured to minimize the possibility of damage due to vibration, strains, or wear and to preclude any loosening while in transit.
(G) Piping shall be installed in a protected location.
(H) 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.
(I) Gas piping shall be installed to enter the vehicle through the floor directly beneath or adjacent to the appliance served.
(J) If a branch line is installed, the tee connection shall be located in the main gas line under the floor and outside the vehicle.
(K) Exposed parts of the fixed piping system either shall be of corrosion-resistant material or shall be coated or protected to minimize exterior corrosion.
(L) Hydrostatic relief valves shall be installed in isolated sections of liquid piping as provided in Section 6.13 of NFPA 58.

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(M) Piping systems, including hose, shall be pressure tested and proven free of leaks in accordance with Section 6.14 of NFPA 58. [**58:**6.24.5.1]

50.7.2.4.5.2 There shall be no fuel connection between a tractor and trailer or other vehicle units. [**58:**6.24.5.2]

50.7.2.4.6 **Equipment Installation**. Equipment shall be installed in accordance with Section 6.18 of NFPA 58, 50.7.2.4.6.1, and 50.7.2.4.6.2. [**58:**6.24.6]

50.7.2.4.6.1 Installation shall be made in accordance with the manufacturer's recommendations and, in the case of approved equipment, as provided in the approval. [**58:**6.24.6.1]

50.7.2.4.6.2 Equipment installed on vehicles shall be protected against vehicular damage as provided for container appurtenances and connections in 50.7.2.4.3.4(E). [**58:**6.24.6.2]

50.7.2.4.7 **Appliance Installation on Vehicles**.

50.7.2.4.7.1 Subsection 50.7.2.4.7 shall apply to the installation of all appliances on vehicles. It shall not apply to engines. [**58:**6.24.7.1]

50.7.2.4.7.2 All appliances covered by 50.7.2.4.7 installed on vehicles shall be approved. [**58:**6.24.7.2]

50.7.2.4.7.3 Where the device or appliance, such as a cargo heater or cooler, is designed to be in operation while the vehicle is in transit, means, such as an excess-flow valve, to stop the flow of gas in the event of a line break shall be installed. [**58:**6.24.7.3]

50.7.2.4.7.4 Gas-fired heating appliances shall be equipped with shutoffs in accordance with 5.20.7(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:**6.24.7.4]

50.7.2.4.7.5 Gas-fired heating appliances, other than ranges and illuminating appliances installed on vehicles intended for human occupancy, shall be designed or installed to provide for a complete separation of the combustion system from the atmosphere inside the vehicle. [**58:**6.24.7.5]

50.7.2.4.7.6* Where unvented-type heaters that are designed to protect cargo are used on vehicles not intended for human occupancy, provisions shall be made to provide air from the outside

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for combustion and dispose of the products of combustion to the outside. [**58:**6.24.7.6]

50.7.2.4.7.7 Appliances installed in the cargo space of a vehicle shall be readily accessible whether the vehicle is loaded or empty. [**58:**6.24.7.7]

50.7.2.4.7.8 Appliances shall be constructed or otherwise protected to minimize possible damage or impaired operation due to cargo shifting or handling. [**58:**6.24.7.8]

50.7.2.4.7.9 Appliances shall be located so that a fire at any appliance will not block egress of persons from the vehicle. [**58:**6.24.7.9]

50.7.2.4.7.10 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.

50.7.2.4.7.11 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:**6.24.7.11]

50.7.2.4.8 **General Precautions**.

~~50.7.2.4.8.1 Mobile units including mobile kitchens and catering vehicles that contain hot plates and other cooking equipment shall be provided with at least one approved portable fire extinguisher rated in accordance with NFPA 10 at not less than 10-B:C. [**58:**6.24.7.8.1]~~

~~50.7.2.4.8.2 Where fire extinguishers have more than one letter classification, they shall be considered as meeting the requirements of each letter class. [**58:**6.24.7.8.2]~~

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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.

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

50.7.2.4.9.1 Where vehicles with LP-Gas fuel systems used for purposes other than propulsion are parked, serviced, or repaired inside buildings, the requirements of 50.7.2.4.9.2 through 50.7.2.4.9.4 shall apply. [**58:**6.24.7.9.1]

50.7.2.4.9.2 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:**6.24.7.9.2]

50.7.2.4.9.3 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:**6.24.7.9.3]

50.7.2.4.9.4 The vehicle shall not be parked near sources of heat, open flames, or similar sources of ignition, or near unventilated pits. [**58:**6.24.7.9.4]

50.7.2.4.9.5 Vehicles having containers with water capacities larger than 300 gal (1.1 m^3) shall comply with the requirements of Section 9.7 of NFPA 58. [**58:**6.24.7.9.5]

50.7.2.4.10* Containers shall be designed, fabricated, tested, and marked (or stamped) in accordance with the regulations of the U.S. Department of Transportation (DOT); Section VIII of the ASME code, "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.
(A) Used containers constructed to specifications of the Association of American Railroads shall not be installed.
(B) Adherence to applicable ASME code case interpretations and addenda that have been adopted and published by ASME 180 calendar days prior to the effective date of this *Code* shall be considered as compliant with the ASME code.
(C) Where containers fabricated to earlier editions of regulations, rules, or codes listed in 5.2.1.1 of NFPA 58, 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]
(D) Containers that show excessive denting, bulging, gouging, or corrosion shall be removed from service. [**58:**5.2.1.4]

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50.7.2.4.11 Where a hose or swivel-type piping is used for liquid transfer, 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-type piping where flow goes only into the railroad tank car.

(3) *Where a facility hose is used at a LP-Gas bulk plant or industrial plant to transfer LP-Gas liquid from a cargo tank vehicle in non-metered service to a bulk plant or industrial plant, the facility hose or the facility shall be equipped with an emergency discharge control system that provides a means to shut down the flow of LP-Gas caused by the complete separation of the facility hose within 20 seconds and without the need for human intervention.

[**58:**6.19.2.6]

~~50.7.2.4.11 Where a hose or swivel-type piping is used for liquid transfer, it shall be protected as follows:~~

- ~~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.~~
- ~~An emergency shutoff valve or a backflow check valve shall be installed on the railroad tank car end of the hose or swivel-type piping where flow goes only into the railroad tank car.~~
- ~~Where a facility hose is used at a LP-Gas bulk plant or industrial plant to transfer LP-Gas liquid from a cargo tank vehicle in non-metered service to a bulk plant or industrial plant, the facility hose or the facility shall be equipped with an emergency discharge control system that provides a means to shut down the flow of LP-Gas caused by the complete separation of the facility hose within 20 seconds and without the need for human intervention.~~

~~[**58:**6.19.2.6]~~

50.7.2.4.11.1 After installation or modification, piping systems (including hose) shall be proven free of leaks by performing a pressure test at not less than the normal operating pressure. [**58:**6.14.1.1]

50.7.2.4.12 **General Location of Cylinders**.

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

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

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

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

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

50.7.2.4.13 **Protection of Valves on Cylinders in Storage**.

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

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

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

50.7.2.4.14 **Transportation of Cylinders**.

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

50.7.2.4.14.2 Cylinders shall be constructed as provided in Section 5.2 of NFPA 58 and equipped in accordance with Section 5.7 of NFPA 58 for transportation as cylinders. [**58:**9.3.2.2]

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

50.7.2.4.14.4 Cylinder valves shall comply with the following:

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

50.7.2.4.14.5 The cargo space of the vehicle shall be isolated from the driver's compartment, the engine, and the engine's exhaust system.
(A) Open-bodied vehicles shall be considered to be in compliance with this provision.
(B) Closed-bodied vehicles having separate cargo, driver, and engine compartments shall be considered to be in compliance with this provision.
(C) 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]

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

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

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

50.7.2.4.14.9 Cylinders being transported by vehicles shall be positioned in accordance with Table 50.7.2.4.14.9. [**58:**9.3.2.9]

Table 50.7.2.4.14.9 **Orientation of Cylinders on Vehicles.**

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

50.7.3 **Temporary Cooking**.

50.7.3.1 Temporary cooking operations and equipment shall comply with NFPA 96, Section 50.7.1 and Section 50.7.3.

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50.7.3.2 Temporary cooking equipment and installations shall comply with NFPA 58. 50.7.3.3 Deep fat fryers, fry-o-lators, or other appliances having combustible liquids heated by LP Gas, solid fuels, or electricity shall be protected by an approved hood fire suppression system or other approved means of extinguishment in the event of fire.	
Chapter 51 – Industrial Ovens and Furnaces	
Chapter 52 – ~~Stationary Storage Battery Systems~~ Energy Storage Systems	
New Sections: 52.1 **General**. 52.1.1 Energy storage systems shall comply with Chapter 52. 52.1.2 **Permits**. 52.1.2.1 Permits, where required, shall comply with Section 1.12. 52.1.2.2 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.** Lithium-Ion (Recombinant Batteries) and Lithium Metal Polymer (Other) columns **deleted** 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.	

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~~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.

52.2.2.4.3 VRLA, ~~lithium-ion, lithium metal polymer, or other types of sealed~~ batteries with immobilized electrolyte shall not require spill control.

52.2.2.5.2 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

~~52.2.2.5.3 Lithium-ion and lithium metal polymer batteries shall not require neutralization~~

~~52.2.2.6.1 Lithium-ion and lithium metal polymer batteries shall not require ventilation~~

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

52.2.2.9 **Seismic Protection.** ~~In seismically active areas, battery~~ 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 ft^2 (140 m^2)shall not be required to have the detection as indicated in 52.2.2.10.

52.3* **Additional Battery Technologies**.

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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**

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;

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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.

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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

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.

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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

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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.

52.3.2.5.2 **Environment**. The storage battery environment shall be controlled to maintain temperatures and conditions within the battery manufacturer's specifications.

52.3.2.6 **Installation**.

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.

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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**.

52.3.2.6.4.1 Combustible materials not related to the stationary storage battery system shall not be stored in battery rooms, cabinets, or enclosures.

52.3.2.6.4.2 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

52.3.2.6.5.3 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*.

52.3.2.6.5.4 Existing stationary storage battery systems shall be permitted to include the signage required at the time it was installed.

52.3.2.6.5.5 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.

52.3.2.6.5.6 Signs shall be provided within battery cabinets to indicate the relevant electrical, chemical, and fire hazard.

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52.3.2.6.5.7 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"

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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 $ft^3/min/ft^2$ (5.1 $L/sec/m^2$) 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 onsite 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.

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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.

52.3.2.11.2 **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**.

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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 52.3.1 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**.

52.3.3.4.1 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.

52.3.3.4.2 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.

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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.

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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.~~	
Chapter 53 – Mechanical Refrigeration	
53.2.3.1.1 **Alarm Threshold.** The refrigerant vapor detector shall activate approved visual and audible alarm signaling devices at one of the following refrigerant thresholds: (1) At a value not greater than the corresponding TLV-TWA (or toxicity measure consistent therewith); not to exceed 25 percent of the lower flammable limit (LFL) (2) For ammonia, at a concentration not exceeding ~~1000~~ 25 parts per million 53.2.3.3.3 ~~Purge~~ For systems using a refrigerant other than ammonia, purge shall also respond automatically to the refrigerant concentration detection system set to activate the ventilation system at the threshold levels set forth in 53.2.3.1.1. For systems using ammonia, purge fans shall also respond automatically to the refrigerant concentration detection system set to activate the ventilation system at an ammonia concentration not exceeding 150 parts per million.	

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53.3 **Operations, Maintenance, Testing, and Decommissioning.** 53.3.1.1 …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… 53.3.3 **Decommissioning of Ammonia Refrigeration Systems.** Decommissioning of close-circuit ammonia refrigeration systems shall comply with ANSI/IIAR 8, *Decommissioning of Closed-Circuit Ammonia Mechanical Refrigerating Systems.*	
Chapter 54 – Ozone Gas-Generating Equipment	
Chapter 55 – 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	
Chapter 56 – Reserved	
Chapter 57 – Reserved	
Chapter 58 – Reserved	
Chapter 59 – Reserved	
Chapter 60 – Hazardous Materials	
60.1.2 **Subjects Not Regulated.** (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 60.4.2.1.1.3 For all occupancies not covered by 60.4.2.1.2 through 60.4.2.1.13, the MAQ of hazardous materials per control area shall be as specified in Table 60.4.2.1.1.3. Ammonium nitrate shall also comply with Chapter 11 of NFPA 400. Table 60.4.2.1.1.3 **Maximum Allowable Quantity (MAQ) of Hazardous Materials per Control Area** - ~~UD: Unclassified detonable~~ N/A: Not applicable. NL: Not limited. NP: Not permitted. UD: Unclassified detonable. - ~~N/A: Not applicable. NL: Not limited. NP: Not permitted~~. - [b]Measured at NTP or 70°F (21°C) and ~~14.7 psia~~ absolute pressure of 14.7 psi (101.3 kPa).	

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- [f]A maximum quantity of ~~200 lb (91 kg) of solid or 20 gal (76 L)~~ 220 lb (99 kg) of solid or 22 gal (83 L) of liquid Class 3 oxidizer is permitted where such materials are necessary for maintenance purposes, operation, or sanitation of equipment. Storage containers and the manner of storage are required to be approved.
- [m]The permitted quantities are not limited in a building equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13 and designed in accordance with the protection criteria contained in Chapter 16 of NFPA 30.
- [n]Containing not more than the maximum allowable quantity per control area of Class I-A, Class I-B, or Class I-C flammable liquids, individually.
- [o]Medicines, foodstuffs, cosmetics, and other consumer products that contain not more than 50% by volume water-miscible flammable or combustible liquids, with the remainder of the product consisting of components that do not burn, shall not be limited, where packaged in individual containers that do not exceed a 1.3-gallon capacity. [**30:**9.1.4(4)]
- [p]Additional storage locations are required to be separated by a minimum of 300 ft (92 m).
- [q]In mercantile occupancies, storage of LP-gas is limited to a maximum of 200 lb (91 kg) in nominal 1 lb (0.45 kg) LP-gas containers.
- [r]See NFPA 58 for liquefied petroleum gas (LP-gas) requirements. LP-gas is not within the scope of NFPA 400.

Table 60.4.2.1.2 **Maximum Allowable Quantities (MAQ) of Hazardous Materials per Control Area in Assembly Occupancies**

- [i]A maximum quantity of ~~200 lb (91 kg) of solid or 20 gal (76 L)~~ 220 lb (99 kg) of solid or 22 gal (83 L) of liquid Class 3 oxidizer is permitted where such materials are necessary for maintenance purposes, operation, or sanitation of equipment. Storage containers and the manner of storage are required to be approved.
- [l]Medicines, foodstuffs, cosmetics, and other consumer products that contain not more than 50% by volume water-miscible flammable or combustible liquids, with the remainder of the product consisting of components that do not burn, shall not be limited, where packaged in individual containers that so not exceed a 1.3-gallon capacity. [**30:**9.1.4(4)]

Table 60.4.2.1.3 **Maximum Allowable Quantities (MAQ) of Hazardous Materials per Control Area in Educational Occupancies**

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- [i]A maximum quantity of ~~200 lb (91 kg) of solid or 20 gal (76 L)~~ 220 lb (99 kg) or 22 gal (83 L) of liquid Class 3 oxidizer is permitted where such materials are necessary for maintenance purposes, operation, or sanitation of equipment. Storage containers and the manner of storage are required to be approved.
- [n]Storage shall be permitted to be increased 100% if the building is protected throughout with an automatic sprinkler system installed in accordance with NFPA 13.
- [o]Medicines, foodstuffs, cosmetics, and other consumer products that contain not more than 50% by volume water-miscible flammable or combustible liquids, with the remainder of the product consisting of components that do not burn, shall not be limited, where packaged in individual containers that do not exceed 1.3-gallon capacity. [30:9.1.4(4)]

Table 60.4.2.1.4 **Maximum Allowable Quantities (MAQ) of Hazardous Materials per Control Area in Day-Care Occupancies**

- Gas[a] (at NTP) for Flammable Gas, Liquefied = 20 ~~N/A~~
- [i]A maximum quantity of ~~200 lb (91 kg) of solid or 20 gal (76 L)~~ 220 lb (99 kg) or 22 gal (83 L) of liquid Class 3 oxidizer is permitted where such materials are necessary for maintenance purposes, operation, or sanitation of equipment. Storage containers and the manner of storage are required to be approved.
- [l]Storage shall be permitted to be increased 100% if the building is protected throughout with an automatic sprinkler system installed in accordance with NFPA 13.
- [m]Medicines, foodstuffs, cosmetics, and other consumer products that contain not more than 50% by volume water-miscible flammable or combustible liquids, with the remainder of the product consisting of components that do not burn, shall not be limited, where packaged in individual containers that do not exceed 1.3-gallon capacity. [30:9.1.4(4)]

Table 60.4.2.1.5 **Maximum Allowable Quantities (MAQ) of Hazardous Materials per Control Area in Health Care Occupancies**

- Liquid for Organic Peroxides; Class III (1,500 lb ~~25 lb~~) and Class IV (100,000 lb ~~NL~~)
- [h]A maximum quantity of ~~200 lb (91 kg) of solid or 20 gal (76 L)~~ 220 lb (99 kg) or 22 gal (83 L) of liquid Class 3 oxidizer is permitted where such materials are necessary for maintenance purposes, operation, or sanitation of equipment. Storage containers and the manner of storage are required to be approved.

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- [l]Storage shall be permitted to be increased 100% if the building is protected throughout with an automatic sprinkler system installed in accordance with NFPA 13.
- [m]Medicines, foodstuffs, cosmetics, and other consumer products that contain not more than 50% by volume water-miscible flammable or combustible liquids, with the remainder of the product consisting of components that do not burn, shall not be limited, where packaged in individual containers that do not exceed 1.3-gallon capacity. [30:9.1.4(4)]

Table 60.4.2.1.6 **Maximum Allowable Quantities (MAQ) of Hazardous Materials per Control Area in Ambulatory Health Care Occupancies**

- [h]A maximum quantity of ~~200 lb (91 kg) of solid or 20 gal (76 L)~~ 220 lb (99 kg) or 22 gal (83 L) of liquid Class 3 oxidizer is permitted where such materials are necessary for maintenance purposes, operation, or sanitation of equipment. Storage containers and the manner of storage are required to be approved.
- [l]Storage shall be permitted to be increased 100% if the building is protected throughout with an automatic sprinkler system installed in accordance with NFPA 13.
- [m]Medicines, foodstuffs, cosmetics, and other consumer products that contain not more than 50% by volume water-miscible flammable or combustible liquids, with the remainder of the product consisting of components that do not burn, shall not be limited, where packaged in individual containers that do not exceed 1.3-gallon capacity. [30:9.1.4(4)]

Table 60.4.2.1.7 **Maximum Allowable Quantities (MAQ) of Hazardous Materials per Control Area in Detention and Correctional Occupancies**

- [i]A maximum quantity of ~~200 lb (91 kg) of solid or 20 gal (76 L)~~ 220 lb (99 kg) or 22 gal (83 L) of liquid Class 3 oxidizer is permitted where such materials are necessary for maintenance purposes, operation, or sanitation of equipment. Storage containers and the manner of storage are required to be approved.
- [l]Medicines, foodstuffs, cosmetics, and other consumer products that contain not more than 50% by volume water-miscible flammable or combustible liquids, with the remainder of the product consisting of components that do not burn, shall not be limited, where packaged in individual containers that do not exceed 1.3-gallon capacity. [30:9.1.4(4)]

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Table 60.4.2.1.8 **Maximum Allowable Quantities (MAQ) of Hazardous Materials per Control Area in Residential Occupancies Consisting of Lodging and Rooming Houses, Hotels, Dormitories, Apartments, and Residential Board and Care Facilities**

- Liquid for Oxidizing Gas, Liquefied = NL ~~15~~
- [m]Medicines, foodstuffs, cosmetics, and other consumer products that contain not more than 50% by volume water-miscible flammable or combustible liquids, with the remainder of the product consisting of components that do not burn, shall not be limited, where packaged in individual containers that do not exceed 1.3-gallon capacity. [30:9.1.4(4)]

Table 60.4.2.1.10.1 **Maximum Allowable Quantities (MAQ) of Hazardous Materials per Control Area in Business Occupancies**

- [k]Medicines, foodstuffs, cosmetics, and other consumer products that contain not more than 50% by volume water-miscible flammable or combustible liquids, with the remainder of the product consisting of components that do not burn, shall not be limited, where packaged in individual containers that do not exceed 1.3-gallon capacity. [30:9.1.4(4)]

Table 60.4.2.1.13.3(a) **Maximum Allowable Quantity (MAQ) per Indoor and Outdoor Control Area for Selected Hazard Categories in Mercantile, Storage, and Industrial Occupancies.**

- Oxidizers in Class III; Solids (1,350 lb, 616 kg ~~1,150 lb, 522 kg~~)
- Oxidizers in Class III; Liquids (135 lb, 511 kg ~~115 lb, 435 kg~~)

Table 60.4.2.1.13.3(b) **Maximum Allowable Quantity (MAQ) per Indoor and Outdoor Control Area for Selected Hazard Categories in Mercantile and Storage Occupancies**

- [d]Toxic or highly toxic solids or liquids displayed in original packaging in mercantile or storage occupancies and intended for maintenance, operation of equipment, or sanitation when contained in individual packaging not exceeding 100 lb (45.4 kg) shall be limited to an aggregate of 1200 lb (544.3 kg) or ~~220 gal (832.8 L)~~ 120 gal (454.2 L). The increases allowed by footnotes a, b, and c shall not apply to highly toxic solids and liquids. [**400:** Table 5.2.1.13.3(b)]

Table 60.4.3.7 ~~**High Hazard Level 2 and High Hazard Level 3 Materials —**~~**Detached ~~Building~~ Buildings Required Where Quantity of Material Exceeds Amount Shown**

- Category: ~~Material~~ Gas Hazard
- Category: ~~Maximum Quantity Without a Detached Building~~ Quantity of Material
- Category: ~~Solids and Liquids (tons)~~ scf

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- Category: ~~Gases scf (Nm³) [m³]~~ Nm³ 60.5.1.1.1 Storage of hazardous materials in quantities exceeding the maximum allowable quantity ~~permitted in control areas set forth in Section 60.4 shall comply with Section 6.2 of NFPA 400~~ set forth in Section 60.4 and the applicable material specific requirements in Chapters 11 through 21 of NFPA 400. [**400:**6.1.1.1] 60.5.1.1.2 The use, dispensing, and handling of hazardous materials in quantities exceeding the maximum allowable quantity (MAQ) ~~permitted in control areas set forth in Section 60.4~~ set forth in Section 60.4 shall comply with Section 6.3 of NFPA 400 and the applicable material specific requirements in Chapters 11 through 21 of NFPA 400. [**400:**6.1.1.2] 60.5.1.2 **~~Material~~ Safety Data Sheets (~~M~~SDS)**. ~~Material safety~~ Safety data sheets (~~M~~SDS) shall be available on the premises for hazardous materials regulated by this code. When approved, ~~M~~SDSs shall be permitted to be retrievable by electronic access. [**400:**6.1.2] 60.5.1.4.2.1 **Physical and Health Hazard Properties.** Operations personnel shall be trained in the chemical nature of the materials, including their physical hazards and the symptoms of acute or chronic exposure as provided by the ~~Material Safety Data Sheet (MSDS)~~ safety data sheet (SDS) furnished by the manufacturer or other authoritative sources. [**400:**6.1.4.2.1] 60.5.1.5.3.1 **Powered Industrial Trucks.** Powered industrial trucks shall be operated and maintained in accordance with NFPA 505 ~~Section 10.17~~. 60.5.1.9.2 Where guard posts are installed, the posts shall meet the following criteria: (1) They shall be constructed of steel not less than 4 in. (102 mm) in diameter and concrete filled. (2) They shall be spaced not more than 4 ft (1.2 m) between posts on center. (3) They shall be set not less than 3 ft (0.9 m) deep in a concrete footing of not less than a 15 in. (381 mm) diameter. (4) They shall be set with the top of the posts not less than 3 ft (0.9 m) above ground. (5) They shall be located not less than ~~5 ft (1.5 m)~~ 3 ft (0.9 m) from the tank. [**400:**6.1.9.2]	
Chapter 61 – Aerosol Products	
61.1.5.3 Cartons or packages containing aerosol cooking spray products in metal containers shall be clearly marked as follows: - Aerosol Cooking Spray	

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61.2.6.1.3 Production areas that contain base product fillers, button tippers, valve crimpers, test baths, and aerosol product packaging equipment shall be protected by a wet-pipe automatic sprinkler system installed in accordance with NFPA 13. The sprinkler system shall be designed to protect the highest level of storage or production hazard that is present. [**30B:**5.8.2]

61.2.6.1.3.1 Level 2 and Level 3 aerosol products shall be permitted to be stored in production areas, such as staging areas (e.g., awaiting transfer to a warehouse), provided all of the following are met:

(1) They are stacked no more than 5 ft (1.5 m) high.
(2) There is no warehouse storage of aerosol products within 25 ft (7.6 m) of the production line.

[**30B:**5.8.2.1]

61.2.6.1.3.1.1 All other storage shall be protected in accordance with Table 6.4.2.7(a) through Table 6.4.2.7(l), of NFPA 30B, as applicable. [**30B:**5.8.2.1.1]

61.2.6.1.3.2 Aerosol products in plastic containers of capacity larger than 4 fl oz (118 ml) shall be permitted to be stored in production areas, such as staging areas (e.g., awaiting transfer to a warehouse), up to a maximum quantity of 1000 lb (454 kg), provided all of the following are met:

(1) The aerosol products are not treated as Class III commodities in accordance with Section 6.5 of NFPA 30B.
(2) They are stacked no more than 5 ft (1.5 m) high.
(3) There is no warehouse storage of aerosol products within 25 ft (7.6 m) of the production line.

[**30B:**5.8.2.2]

61.3.4.3 **Aerosol Products in Plastic Containers Greater Than 4 fl oz (118 ml) and Not More Than 33.8 fl oz (1000 ml).**

61.3.4.3.1 **Fire Protection — Plastic Aerosol 1 Products**.

61.3.4.3.1.1 Plastic aerosol 1 products shall be permitted to be stored in a general-purpose warehouse without isolation. [**30B:**6.5.1.1]

61.3.4.3.1.2* Plastic aerosol 1 products shall be considered equivalent to Class III commodities, as defined in NFPA 13. [**30B:**6.5.1.2.]

61.3.4.3.1.3 In cases where the storage of plastic aerosol 1 products is required to be protected, they shall be protected in accordance with the requirements of NFPA 13. [**30B:**6.5.1.3]

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61.3.4.3.2 **Fire Protection — Plastic Aerosol X Products**. 61.3.4.3.2.1 Storage of plastic aerosol X products in occupancies other than warehouses or mercantile occupancies, such as in assembly, business, educational, industrial, and institutional occupancies, shall be permitted up to a maximum of 100 lb (45 kg) net weight. [**30B:**6.5.2.1] 61.3.4.3.2.2 Solid pile, palletized, or rack storage of plastic aerosol X products shall be permitted in a general-purpose warehouse or an aerosol warehouse regardless of protection level up to a maximum of 250 lb (115 kg). [**30B:**6.5.2.2]	
Chapter 62 – Reserved	
Chapter 63 – Compressed Gases and Cryogenic Fluids	
~~63.1.3.25.7 **Irritant Gas** See 3.3.141.7~~ Table 63.2.3.1.1 **Maximum Allowable Quantity (MAQ) of Hazardous Materials per Control Area ~~(Quantity Thresholds for Gases Requiring Special Provisions)~~** Check all tables 63.2.3.1.7 **Toxic and Highly Toxic Compressed Gases.** Except for containers or cylinders not exceeding 20 scf ~~ft³~~ (0.6 Nm^3 ~~m³~~) 63.2.10.2 **Sprinkler System Design.** 63.2.10.2.1 ~~When~~ Where sprinkler protection is required, the area in which compressed gases or cryogenic fluids are stored or used shall be protected with a sprinkler system designed to be not less than that required by 11.2.3.1.1 of NFPA 13 for the Ordinary Hazard Group 2 density/area curve 63.2.10.2.2 When sprinkler protection is required, the area in which the flammable or pyrophoric compressed gases or cryogenic fluids are stored or used shall be protected with a sprinkler system designed to be not less than that required by 11.2.3.1.1 of NFPA 13 for the Extra Hazard Group 1 density/area curve. [**55:**6.10.2.2] ~~63.2.12.1.2 Rooms or cabinets containing compressed gases shall be conspicuously labeled as follows:~~ ~~**COMPRESSED GAS**~~ 63.2.16.9 **Recirculation of Exhaust.** Exhaust ventilation shall not be recirculated ~~within the room or building if the cylinders, containers, or tanks stored are capable of releasing hazardous gases.~~	

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63.3.1.4.1 Listed or ~~and~~ approved hydrogen-generating and hydrogen-consuming equipment shall be in accordance with the listing requirements and manufacturers' instructions

63.3.1.18.7 In areas not subject to vehicle traffic, the pipe trench shall be deep enough to permit a cover of at least 12 ~~6~~ in (300 ~~150~~ mm)

63.3.1.19.1.1 Piping systems shall be cleaned and purged in accordance with the requirements of 63.3.1.19 when one or more of the following conditions exist:

(1) ~~When the~~ The system is installed and prior to being placed into service
(2) ~~When there~~ There is a change in service
(3) *~~When there~~ There are alterations or repair of the system involving the replacement of parts or addition to the piping system and prior to returning the system to service
(4) *~~Where specified by the~~ The design standards or written procedures specify cleaning and purging

63.3.1.19.3.2.2 The termination point for the release of purged gases resultant from the purging of piping systems out of service, other than those in accordance with 63.3.1.19.3.2.1, shall not be required to be in accordance with 63.2.15 where the contained volume of the piping system when released to indoor areas does not result in a concentration in the room or area ~~that exceeds any of the following limits or~~ that will reduce the oxygen concentration in the room or area below a level of 19.5 percent or that exceeds any of the following limits:

(1) Ceiling limit
(2) Permissible exposure limit
(3) Short term exposure limit
(4) ~~25%~~ Twenty-five percent of the lower flammable limit

63.3.3.1.12 **Emergency Isolation.** ~~**Excess Flow Control.**~~

63.3.3.1.12.1 Where compressed gases having a hazard ranking in one or more of the following hazard classes in accordance with NFPA 704 are carried in pressurized piping above a gauge pressure of 15 psi (103 kPa), an approved ~~means of either leak detection with emergency shutoff or excess flow control~~ method of emergency isolation shall be provided:

(1) Health hazard Class 3 or Class 4
(2) Flammability Class 4
(3) Instability Class 3 or Class 4

~~63.3.3.1.12.1.1 **Excess Flow Control Location with Hazardous Material Storage**. Where the piping originates from within a~~

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~~hazardous material storage room or area, the excess flow control shall be located within the storage room or area. [**55:**7.3.1.12.1.1]~~

~~63.3.3.1.12.1.2 **Excess Flow Control Location with Bulk Storage.** Where the piping originates from a bulk source, the excess flow control shall be located at the bulk source at a point immediately downstream of the source valve.~~ Approved means of meeting the requirements for emergency isolation shall include any of the following:

(1) Automatic shutoff valves, located as close to the bulk source as practical, tied to leak detection systems
(2) Attended control stations where trained personnel can monitor alarms or supervisory signals and can trigger emergency responses
(3) A constantly monitored control station with an alarm and remote shut off of the gas supply system
(4) Excess flow valves at the bulk source

~~63.3.3.1.12.4 **Location**. The location of excess flow control shall be as specified in 63.3.3.1.12.1.1 and 63.3.3.1.12.1.2. [**55:**7.3.1.12.3~~

~~63.3.3.1.12.4.1 Where piping originates from a source located in a room or area, the excess flow control shall be located within the room or area. [**55:**7.3.1.12.3.1]~~

~~63.3.3.1.12.4.2 Where piping originates from a bulk source, the excess flow control shall be as close to the bulk source as possible. [**55:**7.3.1.12.3.2]~~

63.3.6.1.3 Storage, use, and handling of compressed natural gas shall be in accordance with 63.3.6.1.

63.3.6.3.1 Hydrogen systems of less than 5000 ~~3500~~ scf (141.6 ~~99~~ Nm^3) and greater than the MAQ, where located inside buildings, shall be in accordance with the following:

(1) In a ventilated area in accordance with the provisions of 63.2.16
(2) Separated from incompatible materials in accordance with the provisions of ~~7.1.11.2 of NFPA 55~~ 63.3.1.11.2
(3) A distance of 25 ft (7.6 m) from open flames and other sources of ignition
(4) A distance of 50 ft (15 m) from intakes of ventilation, air-conditioning equipment, and air compressors located in the same room or area as the hydrogen system
    (a) The distance shall be permitted to be reduced to 10 ft (3.1 m) where the room or area in which the hydrogen system is installed is protected by a listed detection system per Article 500.7(K) of *NFPA 70*,

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~~*National Electrical Code*~~, and the detection system shuts down the fuel supply in the event of a leak that results in a concentration that exceeds 25 percent of the LFL.

(b) Emergency shutoff valves shall be provided in accordance with 63.3.3.1.11.

(5) A distance of 50 ft (15 m) from other flammable gas storage

(6) Protected against damage in accordance with the provisions of ~~63.3.1.9.3~~ 63.3.1.9.4.

63.3.6.3.2.1 More than one system of 5000 ~~3500~~ scf (141.6 ~~99~~ Nm^3) or less shall be permitted to be installed in the same room or area, provided the systems are separated by at least 50 ft (15 m) or a full-height fire-resistive partition having a minimum fire resistance rating of 2 hours is located between the systems. [**55:**7.6.3.2.110.3.4.2.1]

63.3.6.3.2.2 The separation distance between multiple systems of ~~3500~~ 5000 scf (~~99~~ 141.6 Nm^3) or less shall be permitted to be reduced to 25 ft (7.6 m) in buildings where the space between storage areas is free of combustible materials and protected with a sprinkler system designed for Extra Hazard, Group 1 occupancies in accordance with the requirements of ~~Section 6.10 of NFPA 55~~ 63.2.10. [**55:**10.3.4.2.2]

Table 63.3.7.2 **Distance to Exposures for Oxidizing Gases**

- Quantity of Gas Stored (at NTP) → ~~>~~ ≤ 100,001 scf, ~~>~~ ≤ 2833 Nm^3

63.4.1.1 Storage, use, and handling of cryogenic fluids shall be in accordance with Chapters 1 through 6 of NFPA 55 ~~Sections 63.1, 63.2,~~ and Section 63.4 as applicable.

63.4.2.3.3 **Support of Ancillary Equipment.**

63.4.2.4.7.2.2 **Multiple Pressure Relief Devices.** Shutoff valves controlling multiple pressure relief devices on a container shall be installed so that either the type of valve installed or the arrangement provides the full required flow through the ~~minimum number of required~~ relief devices at all times.

63.4.13.2.7.2 **Courts.** Stationary containers shall be sited so that they are open to the surrounding environment except that encroachment by building walls of unlimited height shall be permitted when in accordance with the distances specified by Table 63.4.7.2 or the material-specific tables in Chapters 9, 11, 13, and 16 ~~through 11~~ of NFPA 55

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63.4.14.1.4.1 Cryogenic fluid storage systems shall be inspected and maintained by a qualified representative of the equipment owner as required by the material-specific requirements of Chapters 9, 11, 13, and 16 ~~through 11~~ of NFPA 55.

~~63.4.14.1.6 **Cleaning and Purging of Gas Piping Systems**. Cleaning and purging of piping systems shall be in accordance with 63.3.1.19. [**55:**8.14.1.5]~~

63.4.14.11.1 **Indoor Use.** Indoor use of cryogenic fluids shall be in accordance with the material-specific provisions of Chapters 9, 11, 13, and 16 ~~through 11~~ of NFPA 55 or with ANSI/CGA P-18, *Standard for Bulk Inert Gas Systems at Consumer Sites,* and 63.4.14.2. [**55:**8.14.11.1]

63.4.14.11.2.1 **General.** Outdoor use of cryogenic fluids shall be in accordance with the material-specific provisions of Chapters 9, 11, 13, and 16 ~~through 11~~ of NFPA 55 or with ANSI/CGA P-18, *Standard for Bulk Inert Gas Systems at Consumer Sites,* and 63.4.14.2. [**55:**8.14.11.2.1]

63.4.14.11.2.2 **Separation.** Distances from property lines, buildings, and exposure hazards shall be in accordance with Table 63.4.7.2 and Table 63.4.7.3 and the material-specific provisions of Chapters 9, 11, 13, and 16 ~~through 11~~ of NFPA 55 or with ANSI/CGA P-18, *Standard for Bulk Inert Gas Systems at Consumer Sites*. [**55:**8.14.11.2.2]

63.4.14.11.3.3 **Vehicle Loading and Unloading Areas.** …Chapter 11 of NFPA 55 for liquid hydrogen, Chapter 13 of NFPA 55 for liquid carbon dioxide, and Chapter 16 of NFPA 55 for liquid nitrous oxide or ANSI/CGA P-18, *Standard for Bulk Inert Gas Systems at Consumer Sites,* for inert cryogenic fluids, as applicable. [**55:**8.14.11.3.3]

63.4.14.11.3.4 A noncombustible, delivery vehicle spill pad shall be provided when required by the material-specific requirements of Chapter 9 of NFPA 55 for liquid oxygen, Chapter 11 of NFPA 55 for liquid hydrogen, Chapter 13 of NFPA 55 for liquid carbon dioxide, and Chapter 16 of NFPA 55 for liquid nitrous oxide or ANSI/CGA P-18, *Standard for Bulk Inert Gas Systems at Consumer Sites*. [**55:**8.14.11.3.4]

63.5.2 **Cleaning and Purging of Gas Piping Systems.** Cleaning and purging of piping systems shall be in accordance with 63.3.1.19. [**55:**9.4.1.9]

63.6 **Gas ~~Bulk Gaseous~~ Hydrogen Systems.**
63.6.1 Bulk hydrogen compressed gas systems shall comply with NFPA 2, ~~*Hydrogen Technologies Code*~~, and Chapter 10 of NFPA 55.

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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_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_2 in pounds or cubic feet at normal temperature and pressure
(2) Location and total volume of the room where the liquid CO_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]

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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]

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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 (CO_2) 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 (CO_2) 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

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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**.

63.9.10.1 Carbon dioxide (CO_2) 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 CO_2 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 CO_2 gas, multiply the pounds by 8.741.
    (b) To convert gallons of liquid to volume (scf) of CO_2 gas, multiply the gallons by 74.04.
(2) Calculate the volume of the room containing the CO_2 containers, or the area where the CO_2 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) CO_2 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 CO_2 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.

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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]

63.9.12.4 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.

[**55:**13.7.1.2]

63.9.12.5 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.

[**55:**13.7.1.1.2.1]

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63.9.13 **Large Indoor Insulated Liquid Carbon Dioxide Systems. (Reserved)** 63.9.14 **Large Outdoor Insulated Liquid Carbon Dioxide Systems**. 63.9.14.1 **Location**. Outdoor stationary large insulated liquid carbon dioxide systems shall be located in accordance with Table 63.9.14.1. [**55:**13.9.1] Table 63.9.14.1 **Minimum Separation Distance Between Outdoor Stationary Large Insulated Liquid Carbon Dioxide Containers and Exposures.** 63.9.14.2 **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. [**55:**13.9.1.1] 63.9.14.3 **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. [**55:**13.9.2] 63.9.14.3.1 The fire barrier wall shall be without openings or penetrations. [**55:**13.9.2.1] 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]	
Chapter 64 – Corrosive Solids and Liquids	
Chapter 65 – Explosives, Fireworks, and Model Rocketry	
65.2.2 All storage of display fireworks shall comply with NFPA 1124.	

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65.5.1 The manufacture, transportation, or storage of fireworks shall comply with NFPA 1124	
Chapter 66 – Flammable and Combustible Liquids	
66.6.6.1 An approved means shall be provided for prompt notification of fire or other emergency to those identified in the emergency action plan in accordance with Section 66.6.8. ~~within the plant and to the available public or mutual aid fire department shall be provided.~~ 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-resistive materials shall be determined in accordance with Section 66.6.3 and 66.6.4 ~~this chapter~~. 66.6.9.2 Maintenance and operating practices shall be established and implemented to prevent and control leakage and spillage of flammable and combustible liquids. ~~66.9.2 **Reserved**.~~ 66.9.2 **Definitions Specific to Section 66.9**. 66.9.2.1* **Protected**. For the purposes of Section 66.9, this term shall apply to the storage of containers that meet the appropriate provisions of 66.16 or alternate provisions that have been approved by the authority having jurisdiction *(see 66.16.3.5 and Section 66.16.9)*. [**30:**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 66.9.2.1. [**30:**9.2.2] ~~66.9.3.3.1 Storage of liquids shall not physically obstruct a means of egress.~~ ~~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]~~ Check tables and figures	

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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:

- 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*
- Plastic or metal consumer-use containers meeting the requirements of, and used within the scope of, one or more of the following specifications:
    1. ASTM F852, *Standard Specification for Portable Gasoline Containers for Consumer Use*
    2. ASTM F976, *Standard Specification for Portable Kerosene and Diesel Containers for Consumer Use*
- Nonmetallic or metallic commercial/industrial safety cans meeting the requirements of, and used with the scope of, one or more of the following specifications:
    1. ANSI/UL 30, *Standard for Metal Safety Cans*
    2. ANSI/UL 1313, *Standard for Nonmetallic Safety Cans for Petroleum Products*
    3. FM Global *Approval Standard for Safety Containers and Filling, Supply, and Disposal Containers* — Class Number 6051 and 6052
- Plastic 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*
    2. 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*
- Fiber drums that meet the following:
    1. 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
    2. Requirements of, and containing liquid products authorized by, either the U.S. Department of

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Transportation Hazardous Materials Regulations in ~~Title 49, Code of Federal Regulations~~, 49 CFR Chapter I, or by U.S. Department of Transportation exemption

- *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, Parts~~ 49 CFR 100–199, or by Part 6 of the UN publication *Recommendations on the Transport of Dangerous Goods*
- 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
- Other nonmetallic intermediate bulk containers that comply with 66.9.4.1.1

66.9.4.1.1 For protected storage, nonmetallic intermediate bulk containers shall comply with Table 66.9.4.3 and shall be listed and labeled in accordance with UL 2389, *Standard for Fire Exposure Testing of Intermediate Bulk Containers or Flammable and Combustible Liquids;* FM Class 6020, *Approval Standard for Intermediate Bulk Containers*; or an equivalent test procedure. ~~As described in 66.9.4.1(5), shall be subjected to a standard fire test that demonstrates acceptable inside storage fire performance and shall be listed and labeled.~~

Table 66.9.4.3 **Maximum Allowable Size – Containers, Intermediate Bulk Containers (IBCs), and Portable Tanks**

- Container Type: Composite IBCs with flexible inner receptacle (UN31HZ2) ~~and~~ DOT/UN-approved flexible IBCs, and NMFC/ISTA-compliant IBCs; Combustible Liquids for both Class II and IIA = ~~NP~~ 331 gal (1300 L)

66.9.4.3.2 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*

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Combustible Liquids; FM Class 6020, *Approval Standard for Intermediate Bulk Containers*; or an equivalent test procedure. 66.9.5.3 Storage cabinets that meet at least one of the following sets of requirements shall be acceptable for storage of liquids: - 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. - Metal storage cabinets constructed in the following manner shall be acceptable: 1. The bottom, top, door, and sides of the cabinet shall be at least No. 18 gauge sheet steel and shall be double-walled, with 11⁄2 in. (38 mm) air space. 2. Joints shall be riveted, welded, or made tight by some equally effective means. 3. 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. - Wooden cabinets constructed in the following manner shall be acceptable: 1. 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. 2. All joints shall be rabbetted and shall be fastened in two directions with wood screws. 3. Where more than one door is used, there shall be a rabbetted overlap of not less than 1 in. (25 mm). 4. 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. 5. 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. - Listed storage cabinets that have been constructed and tested in accordance with ~~66.9.5.3(1)~~ UL 1275, *Standard for Flammable Liquid Storage Cabinets*; FM Class Number 6050,	Moved to 66.21.4.1.5

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Approval Standard for Storage Cabinets (Flammable and Combustible Liquids); or equivalent shall be acceptable.

66.9.17.3 ~~The following shall apply where oxidizers are in segregated storage with flammable and combustible liquids:~~

- ~~The oxidizer containers and flammable and combustible liquid containers shall be separated by at least 25 ft (7.6 m).~~
- ~~The separation shall be maintained by dikes, drains, or floor slopes to prevent flammable liquid leakage from encroaching on the separation. [**400:**15.2.11.13.1]~~

Flammable and combustible liquids shall be separated from oxidizers by at least 25 ft (7.6 m).

66.16.2.1 **Protected.** For the purposes of 66.16, this term shall apply to the storage of containers that meet the appropriate provisions of 66.16 or alternate provisions that have been approved by the authority having jurisdiction (*see 66.16.3.5 and Section 66.16.9*). ~~Flammable and combustible liquids storage that is protected in accordance with this section.~~

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 66.16.2.1.

66.16.3.4 Viscous liquids, as defined in 66.16.2.5, shall be permitted to be protected using either of the following, as applicable:

- ~~Criteria~~ 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)~~
- For nonmetallic containers, the criteria for Class IIIB liquids, as determined by Figure 66.16.4.1(b)
- ~~Criteria~~ 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 66.16.4.1(b).

66.16.3.7 To be considered protected by Table 66.16.5.2.9 and Table 66.16.5.2.10, rigid nonmetallic intermediate bulk containers shall be listed and labeled in accordance with UL 2368, *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. ~~Subjected to a standard fire test that demonstrates acceptable inside storage fire performance and shall be listed and labeled~~.

66.16.6.1.4 In-rack sprinklers shall meet the following requirements:

- In-rack sprinklers shall be ordinary temperature–rated quick-response sprinklers and shall have a nominal K-factor equal

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to or greater than 8.0. Intermediate-temperature sprinklers shall be used where ambient conditions require.

- In-rack sprinklers shall be installed below each barrier level.
- 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:

- 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.
- In-rack sprinklers shall be installed below each barrier level.
- 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).
- 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 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:

- 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.
- In-rack sprinklers shall be installed below each barrier level.
- 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

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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).

66.16.6.4 **Fire Protection System Design Scheme "E."**

66.16.6.4.1 Sprinklers and horizontal barriers shall be installed in accordance with Figure 66.16.6.4.1(a) or Figure 66.16.6.4.1(b), whichever is applicable. Horizontal barriers shall be of plywood having a minimum thickness of 3⁄8 in. (10 mm) or of sheet metal of minimum 22 gauge thickness. All liquid storage shall be located beneath a barrier. [**30:**16.6.4.1]

Figure 66.16.6.4.1(a) **Single-Row Rack Sprinkler Layout for Design Scheme "E."**

Figure 66.16.6.4.1(b) **Double-Row Rack Sprinkler Layout for Design Scheme "E."**

66.16.6.4.2 Vertical baffles shall not be installed between in-rack sprinklers. [**30:**16.6.4.2]

66.16.6.4.3 In-rack sprinklers shall meet the following requirements:

- 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.
- In-rack sprinklers shall be positioned in a transverse flue below each barrier level.
- In-rack sprinklers shall not be positioned within 3.5 ft (1 m) of a rack upright.
- The minimum in-rack sprinkler discharge pressure shall not be less than a gauge pressure of 30 psi (207 kPa).
- Where one level of in-rack sprinklers is installed, the design shall include the 3 most hydraulically remote sprinklers on a single line.
- 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.
- 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.

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- Foam-water sprinkler protection shall be permitted to be substituted for water sprinkler protection, provided the same design criteria is used, and that the sprinkler is listed for use with foam.

[**30:**16.6.4.3]

66.16.6.4.4 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. [**30:**16.6.4.4]

66.16.6.4.5 Ceiling sprinkler demand shall not be included in the hydraulic calculations for in-rack sprinklers. [**30:**16.6.4.5]

66.16.6.4.6 Water demand at point of supply shall be calculated separately for in-rack and ceiling sprinklers and shall be based on the greater demand. [**30:**16.6.4.6]

1. 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/ft^2 over 3000 ft^2 (8 mm/min over 270 m^2) when supplied with water. Design area can be reduced to 2000 ft^2 when using a preprimed foam-water system installed in accordance with NFPA 16 and maintained in accordance with NFPA 25.
- 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.

[**30:**16.6.4.7]

66.16.6.4.8 A 500 gpm (1900 L/min) hose stream allowance shall be provided. [**30:**16.6.4.8]

66.16.6.5 **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:

- Where Layout 7 is required, in-rack sprinklers shall be installed in accordance with Figure 66.16.6.5(a),
- Where Layout 8 is required, in-rack sprinklers shall be installed in accordance with Figure 66.16.6.5(b) or Figure 66.16.6.5(c).

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- Where Layout 9 is required, in-rack sprinklers shall be installed in accordance with Figure 66.16.6.5(d), or Figure 66.16.6.5(e), whichever is applicable. [**30:**16.6.416.6.5]

66.17.10.1 ~~Emergency drainage systems shall be provided to direct liquid leakage and fire protection water to a safe location~~ A facility shall be designed and operated to prevent the discharge of liquids to public waterways, public sewers, or adjoining property.

66.17.10.2 Emergency drainage systems ~~if connected to public sewers or discharged into public waterways, shall be equipped with traps or separators.~~ shall be provided to direct liquid leakage and fire protection water to a safe location

66.17.10.3 ~~A facility shall be designed and operated to prevent the discharge of liquids to public waterways, public sewers, or adjoining property~~ Emergency drainage systems, if connected to public sewers or discharged into public waterways, shall be equipped with traps or separators.

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.

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. [**30:**18.5.4]~~ 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:

(1) The amount required to supply incidental operations for one continuous 24-hour period, provided the hazard analysis required in Section 66.6 accounts for these quantities

(2) The aggregate sum of the quantities provided in Table 66.18.5.4

- ~~25 gal (95 L) of Class IA liquids in containers~~
- ~~120 gal (454 L) of Class IB, Class IC, Class II, or Class III liquids in containers~~
- ~~1585 gal (6000 L) of any combination of the following:~~
  - ~~Class IB, IC, II, or IIIA liquids in metal portable tanks or metal intermediate bulk containers, each not exceeding 793 gal (3000 L)~~
  - ~~Class II or Class IIIA liquids in nonmetallic intermediate bulk containers, each not exceeding 793 gal (3000 L)~~

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~~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.**

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. [**30:**18.5.4.1]

66.18.5.4.2 Control areas shall be in accordance with Section 66.9. [**30:**18.5.4.2]

~~66.18.5.4.1 The maximum quantity of liquids permitted for incidental operations in a single fire area shall not exceed the greater of the following:~~

- ~~*The amount required to supply incidental operations for one continuous 24-hour period~~
- ~~The aggregate sum of the following:~~
  - ~~25 gal (95 L) of Class IA liquids in containers~~
  - ~~120 gal (454 L) of Class IB, Class IC, Class II, or Class III liquids in containers~~
  - ~~1585 gal (6000 L) of any combination of the following:~~
    - ~~Class IB, IC, II, or IIIA liquids in metal portable tanks or metal intermediate bulk containers, each not exceeding 793 gal (3000 L)~~
    - ~~Class II or Class IIIA liquids in nonmetallic intermediate bulk containers, each not exceeding 793 gal (3000 L)~~
  - ~~20 portable tanks or intermediate bulk containers each not exceeding 793 gal (3000 L) of Class IIIB liquids~~

66.19.7.2.2.2 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:~~

~~Tanks shall be listed for use with cooking oil, unless otherwise approved.~~

~~Tanks shall not exceed 200 gal (757 L) per tank.~~

66.19.7.3.2.1 Tanks ~~Tank supports~~ shall be secured to prevent the tank from tipping over. ~~For a flat-bottom tank resting directly on the~~

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~~floor, the tank shall be secured to the floor to prevent the tank from tipping over.~~

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 66.21.4.1.4, or of combustible materials in accordance with 66.21.4.1.1 and 66.21.4.1.3 through 66.21.4.1.5.

~~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:~~

~~- Underground installation~~
~~- Use where required by the properties of the liquid stored~~
~~- Aboveground storage of Class IIIB liquids in areas not exposed to a spill or leak of Class I or Class II liquid~~
~~- Storage of Class IIIB liquids inside a building protected by an approved automatic fire-extinguishing system~~

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 IIIB liquids in areas not exposed to a spill or leak of Class I or Class II liquid
(4) Storage of Class IIIB liquids inside a building protected by an approved automatic fire-extinguishing system

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~~ 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 .5 psi (3.5 kPa) except as permitted in 66.21.4.2.1.3 and 66.21.4.2.1.4.

66.21.4.3.4 Atmospheric storage tanks shall be vented so as not to ~~prevent the development of vacuum or pressure above the~~ exceed the tank's design operating pressure or a gauge pressure pf 1.0 psi (6.9 kPa), ~~maximum operating pressure~~ whichever is less, and shall be vented to prevent the development of vacuum.

66.21.6.5.5 Emergency procedures shall be kept available in an operating area. The procedures shall be reviewed and updated in accordance with 66.6.4.2.

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66.22.4.2.4.2 Where flammable or combustible liquid storage tanks are within a diked area, the LP-Gas containers shall be outside the diked area and at least 10 ~~3~~ ft (3 ~~0.9~~ m) away from the centerline of the wall of the diked area. 66.27.5.2 **Flexible Connectors.** Flexible connectors shall be listed and labeled in accordance with UL 2039, *Standard for Flexible Connector Pipe for Fuels*, and shall be installed in accordance with 66.27.5.3	
Chapter 67 – Flammable Solids	
Chapter 68 – Highly Toxic and Toxic Solids and Liquids	
Chapter 69 – Liquefied Petroleum Gases and Liquefied Natural Gases	
69.2.1.1.1 …of the U.S. Department of Transportation (DOT 49 CFR); Federal Aviation Administration (FAA 14 CFR) the ASME *Boiler and Pressure Vessel Code*…	
69.2.1.1.3 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, ~~Table 5.9.2.5(A),~~ and Annex D of NFPA 58.)* 69.2.1.1.9 Dispensing systems ~~Containers~~ 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 m^2). [**58:**5.2.1.9] 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]	

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~~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)]~~

~~69.2.1.3.2.2 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~~

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~~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 shell. [**58:**5.2.7.3]~~

69.2.2 **Reserved**. [58:5.2]

69.2.3 **Reserved**. [58:5.3]

69.2.4 **Reserved**. [58:5.4]

69.2.5 **Reserved**. [58:5.5]

69.2.6 **Containers with Attached Supports**.

69.2.6.1 **Vertical ASME Containers**. Vertical ASME containers of over 125 gal (0.5 m^3) 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]

69.2.6.1.1 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]

69.2.6.1.2 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]

69.2.6.1.3 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:**5.6.1.3]

69.2.6.2 **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]

69.2.6.3 **Porta-Pacs**.

69.2.6.3.1 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]

69.2.6.3.2 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.

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(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 69.2.1.2.
(4) Movable fuel storage tenders shall be secured to the trailer support structure for the service involved.

[**58:**5.6.3.2]

69.2.7 **Reserved**.

69.2.8 **Reserved**.

69.2.9 **Container Appurtenances ~~and Regulators~~**

69.2.9.1 **Materials**.

69.2.9.1.1 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.~~

(A) The following materials shall not be used:
(1) Gray cast iron
(2) Nonmetallic materials for bonnets or bodies of valves or regulators

[**58:**5.9.1.1]

69.2.9.1.2* 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 m^3) water capacity or less

[**58:**5.9.1.2]

69.2.9.1.3 Container appurtenances shall have a service pressure of at least 250 psig (1.7 MPag). [**58:**5.9.1.3]

69.2.9.1.4 Gaskets used to retain LP-Gas in containers shall be resistant to the action of LP-Gas. [**58:**5.9.1.4]

69.2.9.1.4.1 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. [**58:**5.9.1.4(A)]

69.2.9.1.4.2 When a flange is opened, the gasket shall be replaced. [**58:**5.9.1.4(B)]

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69.2.9.1.4.3 Aluminum O-rings and spiral-wound metal gaskets shall be permitted. [**58:**5.9.1.4(C)]

69.2.9.1.4.4 Gaskets for use with approved or listed liquid level gauges for installation on a container of 3500 gal (13.2 m^3) water capacity or less shall be exempt from the minimum melting point requirement. [**58:**5.9.1.4(D)]

69.3.1* **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
(5) Installation of equipment
(6) Testing of piping systems
(7) Location of containers not connected for use

69.3.2 **Nonapplication**. This chapter does not apply to the following:

(1) Refrigerated containers
(2) Installation of systems used in the highway transportation of LP-Gas

69.3.4 **Location of Containers Not Connected for Use**.

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

69.3.4.2 ASME containers of 4,000 gal (15.2 m^3) or less that have been removed from service but that contain LP-Gas shall be stored outside of buildings in accordance with either 69.3.4.2(1) or 69.3.4.2(2):

(1) Containers shall be located either at a bulk plant or in an approved area.
(2) Containers not complying with 69.3.4.2(1) shall comply with the following:
    (a) Containers shall be located in a manner that will minimize exposure to physical damage.
    (b) Containers shall be oriented so that the pressure relief valve remains in communication with the vapor space.
    (c) Containers shall not be located on roofs of buildings.
    (d) Valve outlets on ASME containers shall be plugged or capped.

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(e) 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.

(f) The location of ASME containers shall comply with the "Aboveground Containers" column and the "Between Containers" column of Table 69.3.5.1.1 with respect to important buildings and lines of adjoining property that can be built upon.

(g) Where the provisions of 69.3.4.2(2)(f) are impractical, alternative storage locations for containers shall be approved by the authority having jurisdiction.

69.3.5.3.1 The minimum separation distances specified in Table 69.3.5.1.1 between containers and buildings of ~~other than wood-frame~~ noncombustible construction devoted exclusively to gas manufacturing and distribution operations shall be reduced to 10 ft (3 m). [**58:**6.34.3.1]

69.3.6.2.4 The sides of adjacent containers shall be separated in accordance with Table 69.3.5.1.1 but shall not be separated by less than 3 ft (1 m). [**58:**6.4.2.4]

69.3.6.2.5 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]

69.3.6.2.6 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]

~~69.3.6.3 **General Requirements**.~~

~~69.3.6.3.1 The sides of adjacent containers shall be separated in accordance with Table 69.3.5.1.1 but shall not be separated by less than 3 ft (1 m). [**58:**6.4.3.1]~~

~~69.3.6.3.2 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]~~

~~69.3.6.3.3 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]~~

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~~69.3.6.4.14 Refrigerated LP-Gas containers shall be located within an impoundment in accordance with Section 12.5 of NFPA 58. [**58:**6.4.4.14]~~

Table 69.3.7.2.1 **Distance Between Point of Transfer and Exposures**

- Part F, (1) From points of transfer ~~in~~ for LP-Gas dispensing ~~stations and at vehicle fuel dispensers~~ systems
- Part L, Stored or accumulated combustible materials, Minimum Horizontal Distance = 10 ft, 3.1 m

69.3.9.4.1 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

69.3.11* **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/m^2), piping, regulators, meters, and other equipment installed in the piping system shall be protected from the forces of accumulated snow. [**58:**6.166.18.1]

69.3.14.3.1.3 The capacity of individual LP-Gas containers on highway nonpassenger vehicles shall be 1000 gal (3.8 m^3) or in accordance with ~~Table 69.3.14.3.1.3~~ U.S. Department of Transportation regulations.

~~Table 69.3.14.3.1.3 **Maximum Capacities of Individual LP-Gas Containers Installed on LP-Gas Highway Vehicles**~~

69.3.14.3.1.4 The capacity of cargo tank motor vehicles shall not be limited by this code

~~69.3.14.8 **General Precautions.**~~

~~69.3.14.8.1 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:**6.24.8.1]~~

~~69.3.14.8.2 Where fire extinguishers have more than one letter classification, they can be considered as meeting the requirements of each letter class. [**58:**6.24.8.2]~~

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69.3.15 **Vehicle Fuel Dispenser and Dispensing ~~Stations~~ Systems.**

69.3.15.3.5 ~~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~~ 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 to the liquid piping.

69.3.15.3.13.2 Equivalent protection in lieu of guard posts shall be a minimum of 3 ft (900 mm) in height and shall resist a force of 6000 ~~12,000~~ lb (26.690 ~~53.375~~ N) applied 3 ft (900 mm) above the adjacent ground surface. [**58:**6.256.27.3.13(B)]

69.3.15.4.3 ~~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 or Class II liquids.
(2) Low-emissions transfer systems in accordance with Section 6.30.5 of NFPA 58 shall be at least 5 ft (2 m) from any dispensing device for Class I or Class II liquids

69.4.2.2.10 **Reserved.**
69.4.2.2.11 **Reserved.**
69.4.2.2.14 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.

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
(3) Engines for industrial (and forklift) trucks powered by LP-Gas used in buildings as provided in Section 11.13 of NFPA 58

Table 69.5.4.1.2 **Distances from Cylinders in Storage and Exposures**

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

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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). 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 ~~in accordance with 69.5.5.3.1 and 69.5.5.3.2.~~ within 50 ft (15 m) travel distance of the propane storage location. ~~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]~~ 69.5.5.4 The storage of cylinders awaiting resale shall be exempt from the electrical classification requirements of NFPA 58. ~~Where fire extinguishers have more than one letter classification, they shall be considered to satisfy the requirements of each letter class~~. 69.6.1.2.1 Each truck or trailer transporting portable containers in accordance with 69.6.1.1 or ~~9.3.3~~ 69.6.1.2 shall be equipped with at least one 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~~. ~~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.~~	
Chapter 70 – Oxidizer Solids and Liquids	
Chapter 71 – Pyrophoric Solids and Liquids	
Chapter 72 – Unstable (Reactive) Solids and Liquids	
Chapter 73 – Water-Reactive Solids and Liquids	

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Chapter 74 – Ammonium Nitrate	
Chapter 75 – Organic Peroxide Solids and Liquids	
Annex A – Explanatory Material	
A.1.3.2.2 This section provides a basis for regulating an occupancy or hazard not specifically regulated by NFPA 1 or its referenced standards (e.g., retail sales and associated storage of consumer fireworks; wind turbines; amusement structures not defined as special amusement buildings, such as outdoor roller coasters and water slides). The AHJ has the authority to use any available resource and its own discretion to develop an appropriate protection scheme, including use of the provisions of Chapter 1, Administration; Chapter 4, Goals and Objectives; Chapter 5, Performance-Based Option; or other nationally recognized standards as indicated in 1.3.2.2 to regulate such occupancies or hazards. A.1.4.1.1 New editions of referenced publications incorporate advances in knowledge, best practices, and technology. Therefore, if an owner or contractor provides compliance with a new edition of a referenced publication that is specified by this *Code*, the AHJ should accept the new edition as evidence of full compliance with the *Code*. A.1.4.1.1.1 The intent of 1.4.1.1 and 1.4.1.1.1 is that an AHJ should approve the use of subsequent editions of referenced publications only when the entire new edition of the referenced standard is used. This paragraph is not intended to permit the use of "cherry-picking" specific sections of one edition of a referenced standard but to use the entire subsequent edition of the referenced standard. A.1.4.1.1.2 In circumstances where the AHJ is requested to use a specific section in a subsequent edition of a referenced publication and not the entire subsequent edition, the AHJ should require technical documentation submitted in compliance with 1.4.1 or 1.4.2. Before approving the use of specific sections of subsequent editions of referenced documents and not the entire edition of the subsequent edition, the AHJ should ensure that other changes did not occur to the subsequent edition that might affect the overall level of fire and life safety protection. A.1.7.7.1 New construction and existing occupancy inspection services should comply with NFPA 1730. A.1.14.6 The AHJ should consider the risk, complexity of the design, qualifications of the AHJ's review staff, and state registration laws/rules to determine if requiring plans/design documents to be prepared by a registered design professional is appropriate. A.1.17 The schedule of fees should be established to cover the cost of services required to enforce this *Code* by conducting plans review	

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and inspection services. The level of service provided is discussed in detail within NFPA 1730. If fees do not cover the cost of services, then the jurisdiction can choose to subsidize such fees by funding the inspection and plans review services from the general fund or other revenue funding mechanism.

A.2.1.1 New editions of referenced publications incorporate advances in knowledge, best practice, and technology. Therefore, if an owner or contractor provides compliance with a new edition of a referenced publication that is specified by this *Code*, the AHJ should accept the new edition as evidence of full compliance with the *Code*.

A.2.1.1.1 The intent of 2.1.1 and 2.1.1.1 is that an AHJ should approve the use of subsequent editions of referenced publications only when the entire new edition of the referenced standard is used. This paragraph is not intended to permit the use of "cherry-picking" specific sections of one edition of a referenced standard but to use the entire subsequent edition of the referenced standard.

A.2.1.1.2 In circumstances where the AHJ is requested to use a specific section in a subsequent edition of a referenced publication and not the entire subsequent edition, the AHJ should require technical documentation submitted in compliance with 1.4.1 or 1.4.2. Before approving the use of specific sections of subsequent editions of referenced documents and not the entire edition of the subsequent edition, the AHJ should ensure that other changes did not occur to the subsequent edition that might affect the overall level of fire and life safety protection.

~~A.3.3.19 **Available Height for Storage.** For new sprinkler installations, the maximum height of storage is the height at which commodities can be stored above the floor where the minimum required unobstructed space below sprinklers is maintained. For the evaluation of existing situations, the maximum height of storage is the maximum existing height if space between the sprinklers and storage is equal to or greater than required. [**13:**A.3.9.1.1]~~

A.3.3.116.4 **Interior Wall Finish.** Such partitions are intended to include washroom water closet partitions. [***101*:**A.3.3.95.4]

A.3.3.130 **Fireworks.** Toy caps for use in toy pistols, toy canes, toy guns, and novelties and trick noisemakers are not considered to be fireworks *(see Annex C of NFPA 1124)*. The regulations referred to limit the explosive content of each toy cap to not more than an average of 0.25 gr (16.2 mg). Also, each package containing such caps has to be labeled to indicate the maximum explosive content per cap. For information on the use of model rockets and model rocket motors, see NFPA 1122. For information on the use of high

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power rockets and high power rocket motors, see NFPA 1127. Model rockets, model rocket motors, high power rockets, and high power rocket motors designed, sold, and used for the purpose of propelling recoverable aero models are not considered to be fireworks. [**1124,** 2017]

A.3.3.130.1 **Display Fireworks.** Display fireworks are described as Fireworks, UN0335 and are classified as Explosives, 1.3G by the U.S. Department of Transportation (U.S. DOT) *(see Annex C of NFPA 1124)*.

Display fireworks include, but are not limited to, the following:

(1) Salutes or firecrackers containing more than 2 gr (130 mg) of explosive composition (salute powder)
(2) Aerial shells containing more than 2.1 oz (60 g) of total pyrotechnic and explosive composition
(3) Other display pieces that exceed the limits for classification as consumer fireworks

Such fireworks are also described as fireworks, 49 CFR 172 by the U.S. DOT.

A.3.3.140.6 **Inert Gas.** …For example, xenon combines with fluorine to form various fluorides and with oxygen to form oxides; the compounds formed are crystalline solids. Radon is inert under the definition provided, but because it is radioactive, it is not considered inert for the purposes of NFPA 55.

A.3.3.144 **Gaseous Hydrogen (GH_2) System.**

A.3.3.187 **Mobile or Temporary Cooking.** Mobile or temporary cooking can include self-propelled trucks and vehicles; trailered units; push carts; equipment located under cover of awnings canopies, or pop-up tents; or other structures for which a building permit has not been issued.

A.3.3.192.1 **Ambulatory Health Care Occupancy.** …Rather it is the intent to address treatment ~~emergency care~~ centers that receive patients who have been rendered incapable…

A.3.3.192.12 **High-Risk Occupancy.** Examples of high-risk occupancies are apartment buildings, hotels, dormitories, lodging and rooming, assembly, child care, detention, educational, and health care.

A.3.3.192.18 **Low-Risk Occupancy.** Examples of low-risk occupancies are storage, mercantile, and business.

A.3.3.192.21 **Moderate-Risk Occupancy.** Examples of moderate-risk occupancies are ambulatory health care, and industrial.

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A.3.3.206 **Pressure Vessel**. Pressure vessels of any type can be subject to additional regulations imposed by various states or other legal jurisdictions. Users should be aware that compliance with DOT or ASME requirements might not satisfy all of the required regulations for the location in which the vessel is to be installed or used. ~~Pressure vessels may be constructed to meet requirements of other regulatory agencies, including regulations for Transport, Canada (TC) or various ANSI standards that may be applicable for specific uses.~~ [~~**400:**A.3.3.19.15~~ **55:**A.8.2]

~~A.3.3.260.1 **Occupiable Story.** A story occupied by people on a regular basis.~~

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]

A.3.3.267.1 **Bulk Hydrogen Compressed Gas System.** The bulk system terminates at the source valve, which is the point where the gas supply, at service pressure, first enters the supply line, or at a piece of equipment that utilizes the hydrogen gas, such as a hydrogen dispenser. The containers are either stationary or movable, and the source gas for the system is stored as a compressed gas.

Bulk hydrogen compressed gas systems can include a bulk storage source, transfer piping and manifold system, compression system, and other components. The gaseous source can include a tube trailer, tube bank, or other high pressure storage vessels used to serve the piping system that transports hydrogen to the end user. Compressors can be installed downstream of the storage supply to boost the pressure of the source gas, and intermediate high pressure storage might be present. This is done where the end use requires hydrogen at a pressure higher than that of the bulk supply. In these instances, there may be intermediate storage vessels used to store the gas at elevated pressures. It is not uncommon for the bulk supply as delivered to be furnished at nominal gauge pressure of 3000 psi (20,684 kPa), and the intermediate high pressure storage to be stored at gauge pressures up to 15,000 psi (103,421 kPa). See Figure A.3.3.258.1(a) through Figure A.3.3.258.1(f).

Figure A.3.3.258.1(a) **Symbol Legend for Figure A.3.3.258.1(b) through Figure A.3.3.258.1(f).**

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Figure A.3.3.258.1(b) **Typical Tube Trailer**. [55:Figure A.3.3.9.4.9.1(b)]

Figure A.3.3.258.1(c) **Typical Bulk Compressed Gaseous Storage System**. [55:Figure A.3.3.9.4.9.1(c)]

Figure A.3.3.258.1(d) **Typical Tube Trailer Discharge Stanchion and Pressure Control Manifold**. [55:Figure A.3.3.9.4.9.1(d)]

Figure A.3.3.258.1(e) **Typical Chemical Energy Storage Module** (CESM). [55:Figure A.3.3.9.4.9.1(e)]

Figure A.3.3.258.1(f) **Typical Compressor Module**. [55:Figure A.3.3.9.4.9.1(f)]

A.3.3.259.4 **Portable Tank ~~(Compressed Gases and Cryogenic Fluids)~~.** A portable tank does not include any cylinder having less than 1000 lb (453.5 kg) water capacity, cargo tank, tank car tank, or trailers carrying cylinders of over 1000 lb (453.5 kg) water capacity. [**55:**A.3.3.95.1]

A.3.3.274 **Transfilling.** Transfilling usually occurs from a bulk container to a smaller container, such as filling a small compressed gas cylinder.

A.3.3.282 See also A.3.3.27.

A.3.3.289 **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. [**1144:**A.3.3.26]

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]

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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.

A.10.11.1 An additional means to identify the locations of new and existing buildings is to co-geolocate each building with U.S. National Grid 108 ft^2 (10 m^2) coordinates to the primary entrance.

A.10.11.1.3 E911, or Enhanced 911, attempts to automatically associate a location with a call's origin. The location could be a physical address or a geographic reference point. When E911 is in place, the address or geographic reference point (PSAP). Paragraph 10.11.1.xx ensures that telecommunications equipment that is part of the transmission path is programmed to communicate correct address information to the E911 PSAP. It is not the intent of this provision to require E911 capability of the telecommunications equipment where the PSAP is not capable of receiving such data.

A.11.12.2.1.1 To clarify what the labels described in the text of 11.12.2.1.1 should look like, this annex information provides a pictorial depiction of the sign to be similarly replicated for compliance with 11.12.2.1.1. Figure A.11.12.2.1.1(a) depicts the sign required by 11.12.2.1.1.1. Figure A.11.12.2.1.1(b) depicts the sign required by 11.12.2.1.1.2.

Figure A.11.12.2.1.1(a) **Sign Required by 11.12.2.1.1.1**

Figure A.11.12.2.1.1(b) **Sign Required by 11.12.2.1.1.2**

~~A.11.12.2.1.3 Markings are intended to alert emergency responders to avoid inadvertent cutting through the conduits, raceways, or cable assemblies during fire-fighting operations.~~

~~A.11.12.2.1.3.2 Materials used for marking should be in compliance with ANSI/UL 969, *Marking and Labeling System Standard*~~

~~A.11.12.3.1 The zoning regulations of the jurisdiction setback requirements between buildings or property lines, and accessory structures may apply.~~

A.12.2.1 *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

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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 4.5.4 of NFPA 220 and shall comply with the allowable dimensions of 4.5.5 of NFPA 220. [**220:**4.5.1]

Type V (111 or 000) Construction. Type V (111 or 000) construction shall be that type in which structural elements, walls, arches, floors, and roofs are entirely or partially of wood or other approved material. [**220:**4.6]

A.12.3.3

Fire-resistive construction also includes fire-resistive coatings and sprayed fire-resistive materials, as well as membrane and through-penetration firestops and fire-resistive joint systems. It is important to conduct periodic inspections of fire-resistive construction, especially these elements and components that are directly visible or readily accessible for inspection.

Inspections of sprayed fire-resistive materials and coatings are especially important since they can be subject to delamination, removal, physical abuse, deterioration, and degradation over time. Periodic inspections should be able to identify apparent deficiencies, especially where they crumble or fall off when touched. When such conditions are identified, they should be further inspected or tested by qualified third parties to verify their integrity and effectiveness. Where they are found to be deficient, appropriate corrective action should be taken to restore them to their original condition.

Tested and listed firestop systems should be installed to the listing in order to perform as expected. Systems installed in accordance with an engineering judgment (EJ) should be installed in accordance with the EJ. The firestop systems should be inspected periodically to assure continued performance. To inspect firestops, the listed system design or EJ should be accessible. Firestop installations are only able to be identified by the listing design, the

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listing references, the materials to be used, and installation parameters. Without the listing, neither the inspector, building owner, nor building management company has any idea how to inspect or repair the firestop systems.

Firestop systems can be marked at the location of the installation using a variety of methods from paper labels to complex plastic tear-away labels, ceramic fiber, or metal tags. These can be attached to the assembly or to the penetrating item(s). A variety of marking methods can be used and they should provide important information, such as the listing number, date, manufacturer, and installing contractor.

A.12.4.2 No fire test standard requirement currently exists to which fabric fire safety curtain assemblies can be tested. Only the curtain fabric is tested in accordance with ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, or ANSI/UL 263, *Standard for Fire Tests of Building Construction and Materials*. The perimeter and internal framework and all supporting, guide, and operating components used in specific applications are not tested. Variations in size of proscenium openings and the amount of side and head clearances available for individual stages dictate the number of variations in design of the assemblies.

A.12.4.4 For requirements on the installation of hoistway doors for elevators and dumbwaiters, see the applicable sections of ASME A17.1 CSA B44-2010, *Safety Code for Existing Elevators and Escalators*, or ASME A17.3/ CSA B44-13, *Safety Code for Existing Elevators and Escalators*.

A.12.4.5 The fire performance evaluation of these assemblies is tested in accordance with ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, or ANSI/UL 263, *Standard for Fire Tests of Building Construction and Materials*, for horizontal access doors, NFPA 252, ~~Standard Methods of Fire Tests of Door Assemblies~~ for fire doors and shutters, NFPA 257, ~~*Standard on Fire Test for Window and Glass Block Assemblies*~~, for fire windows and glass block, and NFPA 288, ~~*Standard Methods of Fire Tests of Horizontal Fire Door Assemblies Installed in Horizontal Fire Resistance-Rated Assemblies*~~, for doors in horizontal fire-rated assemblies. It is not the intent of this section to establish the degree of protection required or to constitute the approval of any product. These are determined by the AHJ. [**80:**A.1.1.4]

A.12.4.6.6.1 Field modifications beyond the scope of the prescriptive allowances permitted by 4.1.3.2 through 4.1.3.42.5 of NFPA 80 typically result in voiding the fire rating of the assembly. Paragraph ~~12.4.6.4.1~~ 5.1.4.1 of NFPA 80 provides an alternative method whereby proposed modifications can be documented and

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presented to the labeling agency prior to work commencing. Where the proposed modification(s) are within the parameters of the manufacturer's procedures and will not degrade the fire resistance of the assembly, the labeling agency is permitted to authorize such modifications without a requirement for a subsequent field inspection.

Generally, the replacement of hardware components on swinging doors (hinges, pivots, door closers, etc.) is not considered to be a field modification, provided the replacement hardware does not require additional cutting, mortising, or boring into the doors and frames and the hardware meets the criteria specified elsewhere in NFPA 80. Likewise, the installation of surface-mounted items like protection plates is not considered to be field modifications. Cutting doors for vision panels, enlarging existing cutouts for vision panels, and trimming doors in height or width are examples of field modifications. Similarly, installing hardware components that require additional cutting and mortising of the doors or frames are examples of field modifications.

A.12.4.6.6.1

A.12.4.6.8.2.5 Existing fire door assemblies that have been repaired should be inspected and tested immediately upon completion of the repair work to ensure that they are in compliance with NFPA 80.

A.12.4.6.10 See Annex J of NFPA 80 for information regarding performance-based inspection, testing, and maintenance options for fire door assemblies.

A.12.4.6.11.9 Existing fire door assemblies that have been repaired should be inspected and tested immediately upon completion of the repair work to ensure that they are in compliance with this standard. Records of maintenance work should be maintained with the periodic inspections and testing records for the facility.

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. [**101:**A.10.2]

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]

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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, bubbling, and blistering of paint can result in an accelerated rate of flame spread. [***101:***A.10.2.1]~~ 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, bubbling, and blistering of paint can result in an accelerated rate of flame spread. [***101:***A.10.2.1]

~~A.12.5.2.5 Such partitions are intended to include washroom water closet partitions. [**101:**A.10.2.1.4]~~

A.12.5.3 ~~Table A.12.5.3 provides a compilation of the interior finish requirements of the occupancy chapters (Chapters 12 through 42 of NFPA *101*). [***101:***A.10.2.2]~~ 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.**

- Class A interior wall and ceiling finish — flame spread index, 0–25 (new applications); smoke developed index, 0–450.
- Class B interior wall and ceiling finish — flame spread index, 26–75 (new applications); smoke developed index, 0–450.
- Class C interior wall and ceiling finish — flame spread index, 76–200 (new applications); smoke developed index, 0–450.

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- Class I interior floor finish — critical radiant flux, not less than 0.45 W/cm^2.
- Class II interior floor finish — critical radiant flux, not more than 0.22 W/cm^2, but less than 0.45 W/cm^2.
- 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.
- Exposed portions of structural members complying with the requirements for heavy timber construction are permitted.

~~Table A.12.5.3(b) **Interior Finish Classification Limitations.**~~

- Class A interior wall and ceiling finish — flame spread 0–25, (new applications) smoke developed 0–450.
- Class B interior wall and ceiling finish — flame spread 26–75, (new applications) smoke developed 0–450.
- Class C interior wall and ceiling finish — flame spread 76–200, (new applications) smoke developed 0–450.
- Class I interior floor finish — critical radiant flux, not less than 0.45 W/cm^2.
- Class II interior floor finish — critical radiant flux, not more than 0.22 W/cm^2, but less than 0.45 W/cm^2.
- 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 with a rating of Class B 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 critical radiant flux rating is required where Class II is required. These provisions do not apply to new detention and correctional occupancies.
- Exposed portions of structural members complying with the requirements for heavy timber construction are permitted. *See corresponding chapters for details. [***101*:** Table A.10.2.2]

A.12.5.3.2 ~~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. [***101*:**A.10.2.2.2]~~ This paragraph recognizes that traditional finish

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floors and floor coverings, such as wood flooring and resilient floor coverings, have not proved to present an unusual hazard. [***101***:A.10.2.2.2]

A.12.5.4 ~~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.12.5.5.1. [***101***:A.10.2.3]~~ 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.12.5.5.4.1.)* [***101***:A.10.2.3]

12.5.4.3 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*. [***101***:A.10.2.3.3]

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/yd^2 (700 g/m^2), while NFPA 701 Test 2 applies to fabrics with an areal density greater than 21 oz/yd^2 (700 g/m^2), 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. [***101***:A.10.2.3.3]

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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. [***101***:A.10.2.3.3]

The 450 smoke developed index limit is based solely on obscuration. (*See A.10.2.4.4 of NFPA 101)* [***101***:A.10.2.3.3]

~~A.12.5.4.4 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*.~~
~~[***101***:A.10.2.3.4]~~

~~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.~~
~~[***101***:A.10.2.3.4]~~

~~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/yd^2 (700 g/m^2) while NFPA 701 Test 2 applies to fabrics with an areal density greater than 21 oz/yd^2 (700 g/m^2), 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. [***101***:A.10.2.3.4]~~

~~Prior to 1978, the test report described by ASTM E84 included an evaluation of the fuel contribution as well as the flame spread rating and the smoke development value. 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~~

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~~normally reported. Classification of interior wall and ceiling finish thus relies only on flame spread index and smoke development value. [***101:***A.10.2.3.4]~~

~~The 450 smoke development value limit is based solely on obscuration. *(See A.12.5.5.1.)* [***101:***A.10.2.3.4]~~

~~A.12.5.4.7 The methodology specified in NFPA 265 includes provisions for measuring smoke obscuration. Such measurement is considered desirable, but the basis for specific recommended values is not currently available. *(See A.12.5.5.1.)* [***101:***A.10.2.3.7]~~

~~A.12.5.5.1 Previous editions of NFPA *101* have regulated textile materials on walls and ceilings using NFPA 255. Full-scale room/corner fire test research has shown that flame spread indices produced by might not reliably predict all aspects of the fire behavior of textile wall and ceiling coverings. [***101:***A.10.2.4.1]~~

~~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 NFPA 255, which only allows 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 NFPA 255 is not necessary. [***101:***A.10.2.4.1]~~

~~The test results from NFPA 255 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.10.2.4.1]~~

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

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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.12.5.5.2 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.10.2.4.2]~~

~~A.12.5.5.3.1 See A.12.5.5.3.1.2. [***101***:A.10.2.4.3.1]~~

~~A.12.5.5.3.1.2 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.10.2.4.3.1.2]~~

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]

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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 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 NFPA *101* 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.10.2.4.4]~~

~~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 AHJ 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.10.2.4.4]~~
~~For additional information on light transmitting plastics, see Section 48.7 of *NFPA 5000*. [***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]

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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.12.5.7.1 It is the intent of NFPA 1 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

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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/cm^2 (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/cm^2. 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*

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Characteristic of Finished Textile Floor Covering Materials. [***101***:A.10.2.7.1] 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.12.5.9 The flooring radiant panel provides a measure of a floor covering's tendency to spread flames where 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/cm^2 (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/cm^2. 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]~~	

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~~A.12.5.9.1 Compliance with 16 CFR 1630, "Standard for the Surface Flammability of Carpets and Rugs" (FFI-70), is considered equivalent to compliance with ASTM D2859. [***101:***A.10.2.7.1]~~

~~A.12.5.9.2 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.12.5.9.3 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 ~~10.2~~ of this *Code*, and they should then be tested for flame spread index and smoke developed index values in accordance with ~~NFPA 101~~ ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ~~NFPA 255~~ 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 ~~NFPA 255~~ 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 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 10.2 of NFPA *101*, and they should then be tested for flame spread index and smoke developed index values in accordance with NFPA 255, *Standard Method of Test of 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~~

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~~values in accordance with NFPA 255 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 11⁄2 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.10.3.2.1]

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.

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(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.
[***101***:A.10.3.3]

~~A.12.6.3.1 The Class I requirement associated with testing per NFPA 260 and the char length of not more than 11/2 in. (38 mm) required with testing per 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. 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~~

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~~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.10.3.2.1]~~

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:

a) 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.

b) 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.

c) 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 E1590, *Standard Test Method for Fire Testing of Mattresses*, might be suitable for use as input into fire models for performance-based design. Furthermore, California Technical Bulletin 129, "Flammability Test Procedure for Mattresses for Use in Public Buildings," includes pass/fail criteria for a single mattress of 100 kW peak heat release rate and 25 MJ total heat release over the first 10 minutes of test.
[***101***:A.10.3.3.2]

~~A.12.6.3.2 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. U.S. federal regulations require mattresses in the United States to comply with 16 CFR 1632.~~
~~[***101:***A.10.3.2.2]~~

~~A.12.6.3.2.1 The intent of the provisions of 12.6.3.2.1 is as follows:~~

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~~(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 energy 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:~~

~~a) 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.~~

~~b) 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.~~

~~c) Only a sprinkler exception is permitted in lieu of the test because of the ability of the sprinkler system to control the fire.~~

~~[***101:***A.10.3.3]~~

~~Actual test results for heat, smoke, and combustion product release from ASTM E1537, *Standard Test Method of 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. [***101:***A.10.3.3]~~

~~A.12.6.3.2.2 The intent of the provisions of 12.6.3.2.2 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 energy 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~~

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~~released its heat in other than the usual measured scenario, and the following should also be noted:~~

~~a) 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.~~

~~b) 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.~~

~~c) Only a sprinkler exception is permitted in lieu of the test because of the ability of the sprinkler system to control the fire.~~

~~[***101:***A.10.3.4]~~

~~Actual test results for heat, smoke, and combustion product release from ASTM E1590, *Standard Test Method for Fire Testing of Mattresses*, might be suitable for use as input into fire models for performance-based design. Furthermore, California Technical Bulletin 129, "Flammability Test Procedure for Mattresses for Use in Public Buildings," includes pass/fail criteria for a single mattress of 100 kW peak heat release rate and 25 MJ total heat release over the first 10 minutes of the test. [***101:***A.10.3.4]~~

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. [***101:***A.10.3.6]

~~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. [***101:***A.10.3.7] 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. [***101:***A.10.3.7]~~

~~A.12.7.1(4) Walls in good condition with lath and plaster, or gypsum board of not less than 1⁄2 in. (13 mm) on each side, can be considered as providing a minimum 1⁄2-hour fire resistance rating. Additional information on archaic material assemblies can be found in Annex O of NFPA 914. [***101:***A.8.3.1.1(4)]~~

A.12.7.2 To ensure that a fire barrier is continuous, it is necessary to seal completely all openings where the fire barrier abuts other fire barriers, the exterior walls, the floor below, and the floor or ceiling above. In 8.3.1.2(2), the fire resistance rating of the bottom of the

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interstitial space is provided by that membrane alone. Ceilings of rated floor/ceiling and roof/ceiling assemblies do not necessarily provide the required fire resistance. [***101***:A.8.3.1.2]

~~A.12.7.3.2.3.1 In existing installations, it is important to be able to determine the fire protection rating of the fire door. However, steel door frames that are well set in the wall might be judged as acceptable even if the frame label is not legible. [***101***:A.8.3.3.2.3]~~

~~A.12.7.3.6 Some window assemblies have been tested to meet the conditions of acceptance of ASTM E119 or ANSI/UL 263. Where such assemblies are used, the provisions of 12.7.2 should be applied instead of those of 12.7.3.6. [***101***:A.8.3.3.6]~~

~~A.12.7.6.2.1 Some door assemblies have been tested to meet the conditions of acceptance of ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, or ANSI/UL 263, *Standard for Fire Tests of Building Construction and Materials*. Where such assemblies are used, the provisions of 12.7.5 should be applied instead of those of 12.7.6.2. [***101***:A.8.3.3.2]~~

A.12.7.6.3 Some door assemblies have been tested to meet the conditions of acceptance of ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, or ANSI/UL 263, *Standard for Fire Tests of Building Construction and Materials*. Where such assemblies are used, the provisions of 8.3.2 should be applied instead of those of 8.3.3.3.

In existing installations, steel door frames that are well set in the wall might be judged as acceptable even if the frame label is not legible. [***101***:A.8.3.3.3]

A.12.7.6.3.4 In existing installations, it is important to be able to determine the fire protection rating of the fire door. However, steel door frames that are well set in the wall might be judged as acceptable even if the frame label is not legible. [***101***:A.8.3.3.3.4]

A.12.7.6.5.3 Some doors and glazing assemblies have been tested to meet the conditions of acceptance of ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, or ANSI/UL 263, *Standard for Fire Tests of Building Construction and Materials*. Where such assemblies are used, the provisions of 8.3.2 should be applied instead of those of 8.3.3.6.6. [***101***:A.8.3.3.5.3]

A.12.7.6.6.6 Some window assemblies have been tested to meet the conditions of acceptance of ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, or ANSI/UL 263, *Standard for Fire Tests of Building Construction and Materials*.

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Where such assemblies are used, the provisions of 8.3.2 should be applied instead of those of 8.3.3.6.6. [***101***:A.8.3.3.6.6]

A.12.7.9.2 Materials used to protect joints become systems when installed to the listed joint system design from an accredited testing laboratory. Installation of joint materials to the listed system should meet all limitations of the system. [***101***:A.8.3.5.2]
There are management system–based contractor approval or qualification programs offered by third-party, independent companies that quantifiably qualify a company to install firestop materials that become systems after proper installation. In each program, there is an industry firestop exam that gives the company a basis to appoint a "Designated Responsible Individual." [***101***:A.8.3.5.2]

Then, the third-party firm audits the firestop company's product and systems documentation records in conjunction with the company's management system operational policies and procedures to verify company compliance. An audit also takes place on a project site to verify that the management system is working. [***101***:A.8.3.5.2]

Where the configuration of a joint is such that a listed system is determined to be nonexistent and reconfiguration of the joint or fire resistance–rated assembly is determined to be impractical or impossible, alternative methods for maintaining the integrity of the required fire resistance rating of the assembly should be permitted to be established using an engineering analysis based on a comparison of listed systems prepared by a manufacturer's technical representative of the systems specified, by the laboratory that conducted the original test, or by a professional engineer. [***101***:A.8.3.5.2]

On-site inspection of firestopping is important in maintaining the integrity of any vertical or horizontal fire barrier. Two standard practice documents were developed with the ASTM process to allow inspections of through-penetration firestops, joints, and perimeter fire barrier systems. ASTM E2393, *Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers*, provides guidance for the inspection of fire-resistive joints and perimeter fire barrier joint systems tested in accordance with the requirements of ASTM E1966, *Standard Test Method for Fire-Resistive Joint Systems*, or with ANSI/UL 2079, *Standard for Tests for Fire Resistance of Building Joint Systems*. ASTM E2393 contains a standardized report format, which would lead to greater consistency for inspections. [***101***:A.8.3.5.2]
Independent inspection paid for by the owner is in many specifications and referenced in this annex using ASTM E2393. As a result, there is an accreditation program available for firestop special inspection agencies. [***101***:A.8.3.5.2]

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A.12.7.9.4 The provisions of 8.3.5.4 are intended to restrict the interior vertical passage of flame and hot gases from one floor to another at the location where the floor intersects the exterior wall assembly. The requirements of 8.3.5.4 mandate sealing the opening between a floor and an exterior wall assembly to provide the same fire performance as that required for the floor. ASTM E2307, *Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-Story Test Apparatus*, is a test method for evaluating the performance of perimeter fire barrier systems. Some laboratories have tested and listed perimeter fire barrier systems essentially in accordance with the ASTM method. The ASTM test method evaluates the performance of perimeter fire barrier systems in terms of heat transfer and fire spread inside a building through the floor/exterior wall intersection. The current test method does not assess the ability of perimeter fire barrier systems to prevent the spread of fire from story to story via the exterior. However, some laboratories have included additional temperature measurement criteria in their evaluation of the exterior wall and evaluation of vision glass breakage as additional pass/fail criteria in an attempt to at least partially address this "leapfrog" effect. [***101*:**A.8.3.5.4]

A.12.8.1 The provision for terminating the smoke partition at the ceiling is not intended to prevent the wall from extending above the ceiling.

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.13.1.14 It is also recommended that fire protection and life safety systems be commissioned in accordance with NFPA 3.

A.13.2.2.2(3) Building height should be measured in accordance with the building code adopted in the jurisdiction.

~~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~~

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~~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.13.3.2.9.1 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 ft^2 (1120 m^2). [***101*:**A.14.3.5.1]~~

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.13.3.3.4.1.1.3 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.13.3.3.4.1.2 ~~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.13.3.3.4.1.6.2 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

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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.13.3.3.5.1.2.2 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.5.4.1.2.2]

A.13.4.5.2.3(3) The following signals should be monitored remotely from the controller:

(1) A common signal can be used for the following trouble indications: the items in 13.4.5.1.4(1) through 13.4.5.1.4(7) and loss of output of battery charger on the load side of the dc overcurrent protective device.
~~If there is no other way to supervise loss of power, the controller can be equipped with a power failure circuit, which should be time delayed to start the engine upon loss of current output of the battery charger.~~

(2) The arrangement specified in A.13.4.5.2.3(3) is only permitted only where approved by the AHJ in accordance with Section 1.5 of NFPA 20 and allows, upon loss of the ac power supply, the batteries to maintain their charge, activates ventilation in case conditions require cooling the engine, and/or maintains engine temperature in case conditions require heating the engine. *(See also A.4.6.4 and A.11.4.2.11.3.1 of NFPA 20.)*

[**20:**A.12.4.2.3(3)]

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]

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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, ~~data processing~~ telecommunications, 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 (NCl_3).~~ ~~[**10:**A.5.5.7.2]~~

(1) A.13.6.2.6.1 NFPA 77, *Recommended Practice on Static Electricity*
(2) NFPA 402, *Guide for Aircraft Rescue and Fire-Fighting Operations*
(3) NFPA 610, *Guide for Emergency and Safety Operations at Motorsports Venues*
(4) NFPA 850, *Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations*
~~NFPA 851, *Recommended Practice for Fire Protection for Hydroelectric Generating Plants*~~
(5) NFPA 921, *Guide for Fire and Explosion Investigations*
(6) NFPA 1452, *Guide for Training Fire Service Personnel to Conduct ~~Dwelling Fire Safety Surveys~~ Community Risk Reduction*

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

[**10:**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
~~Accessibility of a fire to close approach with portable fire extinguishers~~

A.13.6.3.1.3.3.2 ~~Acceptable~~ The primary means ~~of~~ for identifying locations of fire extinguishers should be by the installation of the fire extinguisher ~~locations could~~ signs that are specifically designed for

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that purpose. Examples of other means of identifying the fire extinguisher locations include arrows, lights, ~~signs~~, or coding of the wall or column. [**10:**A.6.1.3.3.2]

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.13.6.4.3.2.2 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 ~~on~~ is found to be missing from a nonrechargeable ~~fire~~ extinguisher., it should be removed from service. [**10:**A.7.3.2.2]

A.13.6.4.7.2 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.13.6.4.7.2(a)].*
2. Follow with a reverse loop over the hose supports so that the hose passes behind the loop *[see Figure A.13.6.4.7.2(b)]*.
3. Repeat steps (1) and (2), alternating standard loops and reverse loops, until all hose is coiled on the support *[see Figure A.13.6.4.7.2(c)].*
4. Adjust the coil so that the nozzle is in the downward position *[see Figure A.13.6.4.7.2(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.13.6.4.7.2(e)].*

[**10:**A.7.6.27.1.1]

~~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~~

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~~affected, for a single nonoperating device or appliance. [***101*:**A.9.6.1.5]~~

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.13.7.2.1.4.1(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.12.3.4.4.1]

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.13.7.2.25.5.2 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.13.7.3.4.6 The prime contractor should be aware of statutes, public agency regulations, or certifications regarding alarm systems that might be binding on the subscriber. The prime contractor should identify for the subscriber which agencies could be an AHJ and, if possible, advise the subscriber of any requirements or approvals being mandated by these agencies. [**72:**A.26.3.4.6]

The subscriber has the responsibility for notifying the prime contractor of those private organizations that are being designated as an AHJ. The subscriber also has the responsibility to notify the prime contractor of changes in the AHJ, such as where there is a change in insurance companies. Although the responsibility is primarily the subscriber's, the prime contractor should also take responsibility for seeking out these private AHJs through the subscriber. The prime contractor is responsible for maintaining

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current records on the AHJ for each protected premises. [**72:**A.26.3.4.6]

The most prevalent public agency involved as an AHJ with regard to alarm systems is the local fire department or fire prevention bureau. These are normally city or county agencies with statutory authority, and their approval of alarm system installations might be required. At the state level, the fire marshal's office is most likely to serve as the public regulatory agency. [**72:**A.26.3.4.6]

The most prevalent private organizations involved as AHJs are insurance companies. Others include insurance rating bureaus, insurance brokers and agents, and private consultants. It is important to note that these organizations have no statutory authority and become AHJs only when designated by the subscriber. [**72:**A.26.3.4.6]

With both public and private concerns to satisfy, it is not uncommon to find multiple AHJs involved with a particular protected premises. It is necessary to identify all AHJs in order to obtain all the necessary approvals for a central station alarm system installation. [**72:**A.26.3.4.6]

The phrase "in writing" can include any form of correspondence that can be verified upon request, such as a letter, fax, email or other means of documented transfer of information from one entity to another. [**72:**A.26.3.4.6]

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) 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.14.5.1.2 See 7.4.2.1.2 and 7.4.2.2.2 of NFPA *101* for door swing direction requirements for working space about electrical equipment.

~~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~~

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~~*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. [***101*:**A.7.2.1.6.2]~~

A.14.5.3.4 See 14.9.2.1.2 and 14.9.2.2.2 for door unlatching requirements for working space about electrical equipment. [***101*:**A.7.2.1.7]

A.14.5.5 Special-purpose horizontally sliding accordion or folding door assemblies installed in accordance with 7.2.1.14 of NFPA *101* should not be considered powered doors subject to the provisions of 14.5.5. 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 14.5.5.1 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

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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 14.5.3.4, 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 14.5.2.5 and door assemblies that are equipped with special locking arrangements in accordance with 14.5.3.3 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, 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.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

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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]

A.18.2.3.3 Access roads that are below the 100-year base flood elevation and roadways that could be blocked by frequent rail traffic are two conditions that could limit access in an emergency and warrant an additional access roadway. Requiring additional access roads because of possible congestion should be based on a traffic impact analysis of the proposed development. This type of analysis is typically conducted by a transportation or traffic engineer and occurs at the cost of the developer. This *Code* avoids establishing a specific threshold for mandating multiple-access roads; potential congestion conditions are so variable that prescriptive language is not justified. The AHJ has the authority to require a study of the traffic conditions resulting from a development and the subsequent need for additional access via Section 1.15.

A.18.2.3.5.1.1 Where parking is permitted along the access road, the unobstructed width is not intended to include the width of the parking.

A.18.2.3.5.1.2 One condition to consider in reducing access road width would be intended travel in one direction only.

A.18.2.3.5.2 It is not the intent of 18.2.3.5.2 to restrict the design of fire department access roads to traditional, non-permeable materials such as asphalt or concrete. Permeable materials, pavers, or other designs can be used if approved by the AHJ and meet the loading requirements in all weather conditions. In considering whether to approve non-traditional materials, the AHJ should consider maintenance issues due to weather and traffic.

The designer and AHJ should consider the point loads created by fire department aerial apparatus stabilizers in the design of fire department access roads. NFPA 1901 limits the pressure exerted over the ground contact under the apparatus stabilizer to 75 psi (517 kPa). The 75 psi (517 kPa) design specification, along with a safety margin, should be included in the design of fire department access roads that would be used as a base to operate fire department aerial apparatus.

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:

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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.

[***101***:A.16.1.1.7; ***101***:A.17.1.1.7]

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.21.3.4.7.1 Training on the operation of the fire protection system should be in accordance with Annex B of NFPA 418. [**418:**A.5.8.1]~~

~~A.21.3.4.7.2 It is acceptable for the rooftop landing pad to be viewed using video or other acceptable means. [**418:**A.5.8.2]~~

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]

~~Table A.34.2.5(a) **Alphabetized Listing of Commodity Classes.**~~
Table A.34.2.5(a) **Alphabetized Listing of Commodity Classes.**

A.34.10.4.1 Pallets staged outdoors at pallet manufacturing and recycling facilities should not be defined as idle (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.

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

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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.

A.34.10.4.10 The required fire flow should be based on available water supplies, fire department response capabilities, and exposure hazards.

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

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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.38.6.1.1.4 Examples of rooms using hazardous materials for extraction are those using flammable and combustible liquids and CO_2.

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 CO_2 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.

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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. 7. Equipment description. A list of all components and subassemblies of the system or equipment, indicating the materials, solvent compatibility, maximum temperature, and pressure limits. 8. 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. 9. Analysis of the vessel(s) if pressurized beyond standard atmospheric pressure. Analysis should include purchased and fabricated components. 10. Structural analysis for the frame system supporting the equipment. 11. Process safety analysis of the extraction equipment, from the introduction of raw product to the end of the extraction process. 12. 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.	

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13. Review of the assembly instructions, and operational and maintenance manuals provided by the manufacturer.
14. Findings and observations of the analysis.
15. 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.

~~A.40.3.2.1.1 Housekeeping for fugitive dusts is most important where the operational intent is that the dust accumulations are not normally present in the occupancy and the building has no deflagration protection features, such as damage limiting/explosion venting construction or classified electrical equipment, and~~

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~~additional personal protection from dust deflagration hazards is not provided. Factors that should be considered in establishing the housekeeping frequency include the following:~~

1. ~~Variability of fugitive dust emissions~~
2. ~~Impact of process changes and non-routine activities~~
3. ~~Variability of accumulations on different surfaces within the room (walls, floors, overheads)~~

~~[A.8.2.1.1]~~

~~A.40.3.2.1.3 Unscheduled housekeeping should be performed in accordance with Table A.40.3.2.1.3(a)to limit the time that a local spill or short-term accumulation of dust is allowed to remain before the local area is cleaned to less than the threshold dust mass/accumulation. Table A.40.3.2.1.3(b)shows approximate equivalent depths for the accumulation values in Table A.40.3.2.1.3(a)when the threshold dust mass/accumulation is 0.2 lb/ft^2 (1 kg/m^2). The owner/operator can use an approximate depth to facilitate communication of housekeeping needs. [**654:**A.8.2.1.3]~~

~~Table A.40.3.2.1.3(a)~~ ~~**Unscheduled Housekeeping.**~~

~~Table A.40.3.2.1.3(b)~~ ~~**Unscheduled Housekeeping.**~~

~~A.40.3.2.1.4 When 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, additional protective measures are necessary. This is a concept similar to the maximum allowable quantities established in the building codes. [**654:**A.8.2.1.4]~~

~~A.40.3.2.2.4 All of the listed precautions might not be required for limited use of compressed air for cleaning minor accumulations of dust from machines or other surfaces between shifts. A risk assessment should be conducted to determine which precautions are required for the specific conditions under which compressed air is being used. [**654:**A.8.2.2.4]~~

~~A.40.3.2.2.5 Items that should be included in the housekeeping procedure include the following:~~

1. ~~A risk analysis that considers the specific characteristics of the dust being cleaned (particle size, moisture content, MEC, MIE) and other safety risks introduced by the cleaning methods used~~
2. ~~Personal safety procedures, including fall protection when working at heights~~
3. ~~PPE, including flame-resistant garments in accordance with the hazard analysis required by NFPA 2113~~
4. ~~Cleaning sequence~~
5. ~~Cleaning methods to be used~~

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~~6. Equipment, including lifts, vacuum systems, attachments, and so forth~~

~~[**654:**A.8.2.2.5]~~

~~A.40.3.2.3.1 If a large quantity of material is spilled in an unclassified area, the bulk material should be collected by sweeping, by shoveling, or with a portable vacuum cleaner listed as suitable for Class II locations. Vacuum cleaners meeting the requirements in 40.3.2.3.2 can be used to clean up residual material after the bulk of the spill has been collected. [**654:**A.8.2.3.1]~~

~~These requirements for portable vacuum cleaners should be applied to the use of vacuum trucks for combustible dust as well. However, there can be other safety issues concerning vacuum truck applications that are not covered within this section. Given that this application might represent a change from normal procedures, operators should also consider the guidance found in conducting a management of change evaluation. [**654:**A.8.2.3.1]~~

~~A.40.3.2.3.1(6) Liquids or wet material can weaken paper filter elements, causing them to fail, which can allow combustible dust to reach the fan and motor. [**654:**A.8.2.3.1(6)]~~

A.40.4 See ANSI/AIHA Z10, *Occupational Health and Safety Management Systems.* [**652:**A.9.2]

~~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

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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]

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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
5. The necessity for proper functioning of related fire and explosion protection systems
6. Safe handling, use, storage, and disposal of hazardous materials used in the employees' work areas
7. The location and operation of fire protection equipment, manual pull stations and alarms, emergency phones, first-aid supplies, and safety equipment
8. Equipment operation, safe startup and shutdown, and response to upset conditions

[**652:**9.5.2.1]

A.40.7.2.3 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

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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. [**652:**A.9.5.2.3]

A.40.8.2 Qualified contractors should have proper credentials, which include applicable American Society of Mechanical Engineers (ASME) stamps, professional licenses, and so forth. [**652:**A.9.6.2]

A.40.8.3 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. [**652:**A.9.6.3]

A.40.8.3.3 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. [**652:**A.9.6.3.3]

A.40.9.1 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

[**652:**A.9.7.1]

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. [**652:**A.9.7.1]

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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. [**652:**A.9.7.1]

A.40.10 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). [**652:**A.9.8]
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. [**652:**A.9.8]

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. [**652:**A.9.8]

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. [**652:**A.9.8]

A system should be established to promptly address and resolve the incident report findings and recommendations. [**652:**A.9.8]

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. [**652:**A.9.8]

Reports produced by external investigation agencies should be acted upon in the same manner as internal investigations. [**652:**A.9.8]

Incident investigation reports should be made available to affected employees and their representatives at no cost. [**652:**A.9.8]

A.40.10.1 Events where there are injuries, equipment damage, or significant business interruption are subject to investigation. [**652:**A.9.8.1]

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

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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. [**652:**A.9.8.1]

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. [**652:**A.9.8.1]

A.40.10.4 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,

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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)]

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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 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]

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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]

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]

A.42.7.2.2.3.2 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. [**30A:**A.9.2.2.3.2]

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]

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]

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A.42.8.2.4 See A.12.2.3. [**30A:**A.12.2.4]

~~A.42.10.2.1.2.6 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. [A.4.1.2.6]~~

~~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.4.1.2.6]~~

~~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.4.1.2.6]~~

~~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 multihole 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.4.1.2.6]~~

~~Additionally, the inlet system of most aircraft tanks directs fuel towards 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.4.1.2.6]~~

~~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.4.1.2.6]~~

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A.42.10.2.1.4 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.42.10.2.1.5 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.4.1.4.2]~~

~~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 100 ft (30 m). (WARNING: Higher power radar equipment can require greater distances.) [**407:**A.4.1.4.2]~~

~~Airport surface detection radar operates under a peak power output of 50 kW. It is fixed rather than airborne equipment. [**407:**A.4.1.4.2]~~

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~~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.4.1.4.2]~~

~~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 500 ft (150 m) from any of the hazards described in the first paragraph. [**407:**A.4.1.4.2]~~

A.42.10.2.1.5.9 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

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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.42.10.2.1.10.3 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.42.10.2.1.12.2 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]

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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.42.10.2.2.2.1 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.42.10.2.2.2.2 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. [**407:**A.4.2.2.2]

A.42.10.2.2.3 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

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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

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(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 m^2 (50 ft^2) 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 m^2 (50 ft^2) 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.

[**407:**A.4.2.3]

~~A.42.10.2.2.4 Electrical equipment contained in aircraft fuel servicing vehicles or cart engine compartments and located 18 in. (460 mm) or more above ground can be permitted to be of the general purpose type. [**407:**A.4.3.7.4]~~

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A.42.10.2.2.5.3.1 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.42.10.2.2.7.1 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.42.10.2.2.7.2 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.42.10.2.2.9 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.42.10.2.2.9.5.1 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.42.10.2.2.10 Establishing precise rules for fueling is impossible when the electrical storms are in the vicinity of the airport. The

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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.42.10.2.2.11.1.3 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.42.10.2.2.12.1 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.42.10.2.2.12.1.2 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.42.10.2.2.12.1.5 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.42.10.3.1.2.1 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.42.10.3.1.3.14 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

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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]

Figure A.42.10.3.1.3.14 **Typical Fixed Airport Fueling System Isolation Valving Operating and Emergency Controls**.

A.42.10.3.1.3.17 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.42.10.3.1.7.1 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.42.10.3.1.7.2.2 The overshoot of pressure control release, *V* max, should be calculated by the following equation:

$$V_{max} = Q \times 1\ \text{min} \times 0.05$$ **[A.42.12.7.2.2]**

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.42.10.3.1.7.3 Hydrant valves and couplers should be in accordance with EI 1584. [**407:**A.5.1.7.3]

A.42.10.3.1.7.5 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.42.10.3.1.9.4 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

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should include a valve or valves located as close to the tank as practicable. [**407:**A.5.1.9.4]

A.42.10.3.1.9.6 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.42.10.3.2.1 The airport perimeter fence can be sufficient to meet this requirement. [**407:**A.5.2.1]

~~A.42.10.3.3.1 Where pressure tanks are used, details on construction, spacing, and location should be in accordance with industry good practice and approved by the AHJ. 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.4.4.4.1]~~

A.42.10.4.1.3.12.2.3 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.42.10.4.1.6.4 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.42.10.4.1.7.1 See A.5.1.7.1. [**407:**A.42.10.3.1.7.1]

A.42.10.4.1.7.4.2 See A.5.1.7.2.2. [**407:**A.42.10.3.1.7.2.2]

A.42.10.4.1.10.8.1 It is not the intent of 42.10.4.1.10.8.1 to prohibit 12 V power outlets. The intent is to prohibit glowing elements. [**407:**A.6.1.10.8.1]

A.42.10.4.1.13.1 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.). [**407:**A.6.1.13.1]

A.42.10.4.1.13.7 The requirement for spark-arresting exhaust systems is not intended to extend to diesel engines equipped with turbochargers. The USDA Forest Service, the governmental body that regulates the spark arrester standard, clearly identifies that all

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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.6.1.13.7]

A.42.10.4.2.1.3 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.42.10.4.2.10.4 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]

~~A.42.10.5.1.1 Records should be kept of personnel training. These records should be made available to the AHJ upon request. [**407:**A.5.1.1]~~

~~A.42.10.5.1.4 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 AHJ 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.5.1.4]~~

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~~A.42.10.5.2 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 hose, 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~~

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~~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 ignitible 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 100°F (38°C) 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 10 ft (3 m) in any dimension and covering an area of over 50 ft^2 (5 m^2) 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 10 ft (3 m) in any dimension and covering an area of over 50 ft^2 (5 m^2) 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~~

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~~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.~~

~~[**407:**A.5.2]~~

~~A.42.10.5.4 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 free-falling 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).~~

~~[**407:**A.5.4]~~

~~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. [**407:**A.5.4]~~

~~No amount of bonding or grounding prevents discharges from occurring inside of 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. [**407:**A.5.4]~~

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~~Grounding during aircraft fueling or refueler 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, then 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.~~

~~[**407:**A.5.4]~~

~~A.42.10.5.4.3 Ordinary plastic funnels or other nonconducting materials can increase static generation. The use of chamois as a filter is extremely hazardous. [**407:**A.5.4.3]~~

~~A.42.10.5.6.4.3 The size of the DPF regeneration area depends on the equipment being used (fleet size). The AHJ should designate the size and number of DPF regeneration pads and determine whether a centralized facility is advantageous. [**407:**A.5.6.4.3]~~

~~A.42.10.5.7 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.5.7]~~

~~A.42.10.5.7.2 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.5.7.2]~~

~~A.42.10.5.7.6 For further information on intrinsically safe apparatus, see ANSI/UL 913, FM Class 3610, ANSI/ISA 12.02.01, or ANSI/UL 60079-11. [**407:**A.5.7.6]~~

~~A.42.10.5.9 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~~

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~~suspend fueling operations temporarily. Experience and good judgment are the best guides. Sound travels approximately 1/5 mi/sec (322 m/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.5.9]~~

~~A.42.10.5.10.2 The precautions in 42.10.5.10.2 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.5.10.2]~~

~~A.42.10.5.13 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 in order for them to be of a 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 200 ft (60 m). 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 100 ft (30 m) 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 100 ft (30 m) from the aircraft being serviced. [**407:**A.5.13]~~

~~A.42.10.5.13.5 During inclement weather, extinguishers not in enclosed compartments can be permitted to be protected by canvas or plastic covers. If icing occurs, the extinguisher should be sprayed with deicing fluid. [**407:**A.5.13.5]~~

~~A.42.10.5.13.6 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~~

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~~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. [**407:**A.5.13.6]~~

~~A.42.10.5.16 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 pressure limits~~
~~4. Improper installation~~

~~[**407:**A.5.16]~~

~~A.42.10.5.21.2(2) If passengers remain onboard an aircraft during fuel servicing, at least one person trained in emergency evacuation procedures is required to be aboard It is not intended that the pilot in command perform this function. [**407:**A.5.21.2(2)]~~

~~A.42.11.2.4.4~~
~~See Figure A.42.11.2.4.4. [**58:**A.11.12.1.4]~~
~~Figure A.42.11.2.4.4 **Example of Vehicle Identification Marking**.~~
~~[58:Figure A.11.12.1.4]~~

A.43.1.2.1 Fires involving spray application operations and processes can be expected to develop rapidly and to generate copious quantities of heat and smoke. In sprinklered buildings, such fires can also result in the operation of a greater-than-normal number of sprinklers. ~~The following guidance is offered~~: Operations and equipment should be arranged and located so that there is adequate egress for personnel and adequate access for fire-fighting operations. Where spray application operations are extensive, they should be located in a separate building or in an area that is separated by fire-rated construction from all other operations or storage. [**33:**A.4.1]

- ~~Operations and equipment should be arranged and located so that there is adequate egress for personnel and adequate access for fire-fighting operations. Where spray application operations are extensive, they should be located in a separate building or in an area that is separated by fire-rated construction from all other operations or storage.~~
- ~~Spray application operations that incorporate assembly lines or conveyor systems present special problems. If conveyor~~

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~~systems extend between separate buildings, a noncombustible or limited-combustible, sprinkler-protected enclosure or passageway might be of value. If conveyor systems pass through floors, the openings should be surrounded by deep [greater than 18 in. (460 mm)] draft curtains on the underside of the floor deck and might even be provided with automatic high-velocity spray nozzles arranged to create a counterdraft. If conveyor systems pass through fire walls or fire partitions, it will be difficult to reliably protect the openings by means of automatic-closing fire doors. One option is to provide a noncombustible or limited-combustible, sprinkler-protected tunnel on both sides of the opening.~~

- ~~Rooms that house spray application operations should be separated from other occupancies or operations by construction that meets the requirements of 43.1.3.~~
- ~~In sprinklered buildings where spray application operations occupy one portion of an open area, the spray application operations should be surrounded by noncombustible or limited-combustible draft curtains extending downward at least 18 in. (460 mm) from the ceiling, but deeper if practical. The draft curtains will aid in minimizing the number of sprinkler heads that open beyond the area of primary concern. Additional consideration might be given to the use of heat and smoke vents to aid in fire control.~~
- ~~Sprinkler discharge should be drained to the outside of the building, to an internal drain system, or to some other suitable location. Properly designed and installed floor drains and scuppers of sufficient number and size to handle expected sprinkler discharge should be provided. Where spray application operations are located on an upper floor, they should not be located directly above goods or equipment that are subject to water damage. In addition, the floor should be made watertight and means should be provided to drain sprinkler discharge directly from the area.~~
- ~~Spray application operations should not be located in a basement area.~~

A.43.1.2.2 Spray application operations that incorporate assembly lines or conveyor systems present special problems. If conveyor systems extend between separate buildings, ~~a noncombustible or limited-combustible, sprinkler-protected enclosure or passageway might be of value~~ sprinklered, noncombustible, connecting passageway is advisable. If conveyor systems pass through floors, the openings should be surrounded by deep [greater than 18 in. (460 mm)] draft curtains on the underside of the floor deck and ~~might even~~ should be provided with automatic high-velocity spray nozzles arranged to create a counterdraft. If conveyor systems pass

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through fire walls or fire ~~partitions~~ barrier walls, it ~~will be difficult to reliably protect the openings by means of automatic-closing fire doors. One~~ is most desirable to provide a short gap in the conveyor to allow automatic fire doors to close. Interlocks might be necessary to stop conveyors moving toward the fire walls and clear the conveyors moving away from the fire walls in order to prevent fire doors from dropping on conveyed materials and thereby preventing complete closure. Another option is to provide a noncombustible or limited-combustible, sprinkler-protected tunnel on both sides of the opening. [**33:**A.4.2]

Rooms that house spray application operations should be separated from other occupancies or operations by construction that meets the requirements of 43.1.3. [**33:**A.4.2]

In sprinklered buildings where spray application operations occupy one portion of an open area, the spray application operations should be surrounded by noncombustible or limited-combustible draft curtains extending downward at least 18 in. (460 mm) from the ceiling, but deeper if practical. The draft curtains ~~will~~ aid in ~~minimizing the number of sprinkler heads that open beyond the area of primary concern~~ preventing the activation of sprinklers outside the area enclosed by the curtains and tend to confine the discharge of water to the immediate area of the fire. Additional consideration might be given to the use of heat and smoke vents to aid in fire control. [**33:**A.4.2]

Sprinkler discharge should be drained to the outside of the building, to an internal drain system, or to some other suitable location. Properly designed and installed floor drains and scuppers of sufficient number and size to handle expected sprinkler discharge should be provided. Where spray application operations are located on an upper floor, they should not be located directly above goods or equipment that are subject to water damage. In addition, the floor should be made watertight and means should be provided to drain sprinkler discharge directly from the area. [**33:**A.4.2]

A.43.1.4.1.5 There should be no open flames, hot surfaces, or spark-producing equipment in the spray area or in any area where they might be exposed to combustible residues. Open flames or spark-producing equipment should not be located where they can be exposed to deposits of combustible residues. Some residues can be ignited at low temperatures, such as those produced by steam pipes, incandescent ~~light fixtures~~ luminaires, and power tools. In powder coating applications, the temperature of the object or material being coated should be maintained at least 50° F (28° C) below the autoignation temperature of the powder. [**33:**A.6.2.5]

A.43.1.4.2.1.1 This classification usually includes the following locations:

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(1) Where volatile flammable liquids or liquefied flammable gases are transferred from one container to another
(2) Interiors of spray booths and areas in the vicinity of spraying and painting operations where volatile flammable solvents are used
(3) Locations containing open tanks or vats of volatile flammable liquids
(4) Drying rooms or compartments for the evaporation of flammable solvents
(5) All other locations where ignitible concentrations of flammable vapors or gases are likely to occur in the course of normal operations

[**33:**A.6.3.1.1]

In some Division 1 locations, ignitible concentrations of flammable gases or vapors may be present continuously or for long periods of time. Examples include the following:

(1) The inside of inadequately vented ~~tanks~~ enclosures containing ~~volatile flammable liquids~~ instruments normally venting flammable gases or vapors to the interior of the enclosure
(2) Inadequately ventilated areas within spraying or coating operations using volatile flammable fluids
(3) The interior of an exhaust duct that is used to vent ignitible concentrations of vapors

[**33:**A.6.3.1.1]

A.43.1.4.4.4(2) Access doors into a spray area that must be closed to allow normal automated spray application operations to occur should not be considered an opening. The door should be considered a maintenance access and never open while a hazardous condition exists in the booth. Therefore, the area outside the door/maintenance access should be considered unclassified. [**33:**A.6.5.4(2)]

A.43.1.5.5.1(6) If recirculated air is used for make-up air for occupied spaces, including spray areas, spray booths, spray rooms, and other process areas, the requirements for decontamination and maximum allowable concentrations of solvents are far more stringent than those required by this standard for fire and explosion prevention. Refer to appropriate occupational safety and health and industrial hygiene standards for permissible exposure limits. One such standard is ANSI/AIHA Z9.7, *Recirculation of Air from Industrial Process Exhaust Systems*. [**33:**A.7.5(6)]

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:

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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.

A.50.2.1.1.1 ~~See ANSI/UL 710B~~. 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. [**96:**A.4.1.1.1]

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

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

[**96:**A.11.1.4]

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

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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]

~~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.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.

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

1. The name of the certification company
2. The license number, certificate of fitness number or other applicable identifying number that demonstrates the certification company is approved to install, inspect, and maintain LP-Gas systems
3. The corporate name of the mobile food service business
4. The identifying name on the side of the mobile food vehicle
5. Date of inspection
6. Vehicle tag number and VIN 7.
7. A signed statement by the agent for the certification company that reads: The LP-Gas system has been inspected for compliance with the current edition of NFPA 58 and found to be in compliance with the provisions of the code. In addition, leak detection has been conducted on the LP-Gas system piping and the piping has been found to maintain integrity.

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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.

A.50.7.2.4.1 Typical nonengine 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.6.26.1]

A.50.7.2.4.7.6 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.6.26.7.6]

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

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

~~A.50.7.2.4.11(3) The intent of the emergency discharge control system is to prevent the discharge of product in the event of a complete hose separation. Compliance with the requirement for emergency discharge control can be accomplished using a mechanical, pneumatic, or electronic device or any combination thereof. [**58:**A.6.21.2.6(3)]~~

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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.52.3 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,

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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

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.

A.61.3.4.3.1.2 The maximum quantity of storage of plastic aerosol X products is limited to what is provided in 61.3.4.3.1.2 because no demonstrated protection criteria are available.

A.63.1.1.4(6) The storage and use of compressed gases and cryogenic fluids outside the boundaries of laboratory work areas are covered by NFPA 55. [**55:**A.1.1.2(6)]

A.63.1.4.1 Not all hazardous materials are placed into the high hazard category, and some of these materials have been recognized as being of low ordinary hazard, depending on their nature in a fire. Inert compressed gases and cryogenic fluids are one example; there are others. Compressed gases and cryogenic fluids represent the gas phase of an array of hazardous materials. As the genre of hazardous materials is expanded, there are other materials in hazard categories or hazard classes that may in fact be high hazard materials by definition, but which in some cases do not have a MAQ and, therefore, are not required to comply with the requirements for high hazard occupancies. Examples of such materials are Class IIIB combustible liquids, Class 1 unstable reactive materials (including gases), Class 1 water-reactive solids and liquids, Class 1-3 water-reactive gases, Class 1 oxidizing solids and liquids, and Class IV and V organic peroxides. [**55:**A.5.1.1]

A.63.2.5 Bulk hydrogen compressed gas systems terminate at the source valve. In cylinder filling or packaging operations, cylinders

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located on filling manifolds located downstream of the source valve are not considered to be part of the bulk gas system. For definitions of source valve and bulk hydrogen compressed gas system, see 3.3.89 and 3.3.94.9.1 [of NFPA 55]. Additional requirements for source valves can be found in 63.2.19. [**55:**A.6.5]

A.63.2.16.8.2 Examples of gases that are heavier than air include, but are not limited to, carbon dioxide, argon, and nitrous oxide. [**55:**A.6.16.4.2]

A.63.2.16.8.3 Examples of gases that are lighter than air include, but are not limited to, hydrogen, helium, and methane. [**55:**A.6.16.4.3]

A.63.3.1.11.2.5 Analysis of gas mixtures often includes the analysis of individual cylinders that have been disconnected from the filling manifolds. The analysis procedure is a production step where cylinders of many different types and contents are processed. It is not unusual for an individual gas mixture to contain gases otherwise deemed to be incompatible in the pure state. For example, a mixture of hydrogen and air is routinely manufactured for use as a calibrating gas mixture used to validate the operation of flammable gas detection systems. Analytical operations involving incompatible gases, which may be located within an individual laboratory, typically require that the gases being analyzed be connected to individual work stations or analytical instruments as the process is conducted. The typical analytical process is an attended process where technicians have "hands on" control of the cylinder under examination, which serves to mitigate events that may otherwise occur in unattended operations, including storage or the use of an unattended source of supply. [**55:**A.7.10.2.5]

~~A.63.3.3.1.12.1 An approved means of leak detection and emergency shutoff is one way of meeting the requirements for excess flow control. [**55:**A.7.3.1.12.1]~~

~~A.63.3.3.1.12.1.2 When distributed systems are employed, the excess flow control system located at the bulk source may be sized to operate at a release rate greater than any single point of use or branch connection. Additional points of excess flow control may be required throughout the system in order to provide shutdown in the event of a failure in any single system branch. Such systems will generally be designed to operate when flow exceeds the capacity of the point(s) of use served. [**55:**A.7.3.1.12.1.2]~~

A.63.3.6.1.1 All liquefied and nonliquefied flammable compressed gases are regulated by 63.3.6 unless they are specifically indicated as not applicable in accordance with 63.1.1.4. [**55:**A.7.6.1.1]

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A.63.4.2.4.7.2.1 The ASME *Boiler and Pressure Vessel Code* requires that full-area stop valves be locked open and provided with manual vent valves for maintaining pressure during maintenance operations. Further, the ASME Code requires that if the full-area stop valve is closed, an operator must be present at all times to maintain the vessel pressure within acceptable limits and must lock the full-area stop valve in the open position before leaving the station. See the ASME *Boiler and Pressure Vessel Code* for complete details and requirements. [**55:**A.8.2.4.7.2.1]

A.65.1.1 Chapter 65 does not contain any prescriptive technical provisions to address the retail sale and associated storage of consumer fireworks. The AHJ can utilize 1.3.2.2 to develop a protection approach for new and existing consumer fireworks retail sale and storage facilities.

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]

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]

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]

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]

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]

A.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*. [**30:**A.21.4.2.1.1]

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A.66.21.4.3.4 Tanks intended for normal operation at pressures greater than a gauge pressure of 1.0 psi (6.9 kPa) are designed in accordance with 66.21.4.2.3. It is recognized that a slight vacuum is necessary to operate a vacuum vent. [**30:**A.21.4.3.4] A.69.2.9.1.2 Materials with melting points exceeding 1500°F (816°C) include steel, ductile (nodular) iron, malleable iron, or brass, as follows: 1. Ductile iron should meet the requirements of ASTM A395/A395M, *Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures,* or equivalent and malleable iron should meet the requirements of ASTM A47/A47M, *Standard Specification for Ferritic Malleable Iron Castings,* or equivalent. 2. Approved or listed variable liquid level gauges used in containers of 3500 gal (13.2 m^3) 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.69.3.4.4.14 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]~~	
Annex B – Hazardous Materials Classifications	
B.5.2.4 Class 3 Oxidizers. The following are typical Class 3 oxidizers: 1. Ammonium dichromate 2. Calcium hypochlorite (over 50 percent by weight unless covered in other formulations in B.5.2) 3. Calcium hypochlorite (over 50 percent by weight) 4. Chloric acid (10 percent maximum concentration) 5. Hydrogen peroxide solutions (greater than 52 percent up to 91 percent) 6. Mono-(trichloro)-tetra-(monopotassium dichloro)-penta-s-triazinetrione 7. Nitric acid, fuming (more than 86 percent concentration) 8. Perchloric acid solutions (60 percent to 72 percent by weight) 9. Potassium bromate 10. Potassium chlorate	

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11. Potassium dichloro-s-triazinetrione (potassium dichloroisocyanurate) 12. Sodium bromate 13. Sodium chlorate 14. Sodium chlorite (over 40 percent by weight) ~~Sodium dichloro-s-triazinetrione anhydrous (sodium dichloroisocyanurate anhydrous)~~	
B.5.3.1 **General.** The assignment of the organic peroxide formulation classifications shown in the tables in this annex are based on the container sizes shown. A change in the container size could affect the classification. The information in this annex was collected from the Organic Peroxides Producers (Society of the Plastics Industry-Organic Peroxide Producers Safety Division). For an alphabetical listing of typical organic peroxide formulations, see Table B.5.3.1. **[400:** F.1]	
Table B.5.3.1 **Organic Peroxide Formulations** ~~Table B.5.3.1 **Typical Organic Peroxide Formulations**~~	Reorganized Table
B.5.3.2.1 **Fire Hazard Characteristics.** Class I formulations present a deflagration hazard through easily initiated, rapid explosive decomposition. Large-scale burn rates ≥300 kg/min can be expected. Class I includes some formulations that are relatively safe only under closely controlled temperatures. Either excessively high or low temperatures can increase the potential for severe explosive decomposition and/or rapid burning. [**400:** F.2.1]	
Table B.5.3.2.3 **Typical Class I Formulations.** ~~Table B.5.3.2.3 **Typical Class I Formulations.**~~	Reorganized Table
B.5.3.3.1 **Fire Hazard Characteristics.** Class II formulations present a severe fire hazard similar to Class I flammable liquids. The decomposition is not as rapid, ~~violent, or complete~~ or violent as that produced by Class I organic peroxide formulations. As with Class I formulations, this class includes some formulations that are relatively safe when under controlled temperatures or when diluted. Many of the formulations in this class might require controlled temperature or might contain diluents to maintain their safety and stability. [**400:**F.3.1]	
Table B.5.3.3.3 **Typical Class II Formulations.** ~~Table B.5.3.3.3 **Typical Class II Formulations.**~~	Reorganized Table
B.5.3.4.1 **Fire Hazard Characteristics.** Class III formulations present a fire hazard similar to Class II combustible liquids. They are characterized by rapid burning and high heat liberation due to decomposition. Large-scale burn rates of <60 kg/min but ≥10 kg/min	

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are expected for these organic peroxide formulations. These organic peroxides are typically less reactive or contain much higher levels of diluent than the Class I and Class II formulations. [**400:**F.4.1] Table B.5.3.4.3 **Typical Class III Formulations.** ~~Table B.5.3.4.3 **Typical Class III Formulations.**~~ B.5.3.5.1 **Fire Hazard Characteristics.** Class IV formulations present fire hazards that are easily controlled. Reactivity has little effect on fire intensity. Large-scale burn rates of these organic peroxide formulations are <10 kg/min. [**400:** F.5.1] Table B.5.3.4.3 **Typical Class IV Formulations.** ~~Table B.5.3.4.3 **Typical Class IV Formulations.**~~ Table B.5.3.4.3 **Typical Class V Formulations.** ~~Table B.5.3.4.3 **Typical Class V Formulations.**~~	 Reorganized Table Reorganized Table Reorganized Table
Annex C – Sample Ordinance Adopting the NFPA 1, Fire Code	
Annex D – Hazardous Materials Management Plans and Hazardous Materials Inventory Statements	
Annex E – Fire Fighter ~~Safety Building Marking~~ Breathing-Air Replenishment System	
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*. F.1.1 **NFPA Publications.** - NFPA 3, *Recommended Practice for Commissioning of Fire Protection and Life Safety Systems*, 2015 edition. - edition. - NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2017 edition. - NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*, 2017 edition. - NFPA 54, *National Fuel Gas Code* , 2018 edition. - NFPA 61, *Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities* , 2017 edition. - NFPA 90B, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems*, 2018 edition. - NFPA 402, *Guide for Aircraft Rescue and Fire-Fighting Operations* , 2013 edition.	

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- NFPA 850, *Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations*, 2015 edition.
- NFPA 851, *Recommended Practice for Fire Protection for Hydroelectric Generating Plants* , 2010 edition.
- NFPA 1035, *Standard ~~for Professional Qualifications for~~ on Fire and Life Safety Educator, Public Information Officer, ~~and Juvenile~~ Youth Firesetter Intervention Specialist, and Youth Firesetter Program Manager Professional Qualifications*, ~~2010~~ 2016 edition.
- NFPA 1124, *Code for the Manufacture, Transportation, Storage, and Retail Sales of Fireworks and Pyrotechnic Articles*, 2017 edition.
- NFPA 1730, *Standard on Organization and Deployment of Fire Prevention Inspection and Code Enforcement, Plan Review, Investigation, and Public Education Operations*, 2016 edition.

F.1.2.1 **AlCheE Publications.** American Institute of Chemical Engineers, Three Park Avenue, New York, NY 10016-5991.
Guidelines for Safe Warehousing of Chemicals, 1998.
Guidelines for Pressure Relief and Effluent Handling Systems, 1998.
~~*Testing the Suitability of FIBCs for Use in Flammable Atmospheres*.~~

F.1.2.2 **ANSI Publications.**
- ~~ANSI/FM 4950, *Evaluating Welding Pads, Welding Blankets and Welding Curtains for Hot Work Operations*, 2007.~~
- ~~ANSI/ISA 12.02.01~~ ANSI/ISA-61241-10 (12.10.05), *Electrical Apparatus for ~~use in Class I, Zones 0, 1 & 2 Hazardous (Classified) Locations - Intrinsic Safety~~ Use in Zone 20, Zone 21, and Zone 22 Hazardous (Classified) Locations — Classification of Zone 20, Zone 21, and Zone 22 Hazardous (Classified) Locations*, 20022004.
- ~~ANSI/ISA 61241, (12.10.02), *Electrical Apparatus for Use in Zone 20, Zone 21 and Zone 22 Hazardous (Classified) Locations - General Requirements*, 2006.~~

F.1.2.3 **API Publications.**
- *API-ASME Code for Unfired Pressure Vessels for Petroleum Liquids and Gases, Pre-July 1, 1961.*
- *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.*
- *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.*

For State Adoption Use Only

- API RP 1621, *Bulk Liquid Stock Control at Retail Outlets*, 2001.
- API 1632, *Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems*, 3rd edition, 1996, reaffirmed 2010.
- 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 2214, *Spark Ignition Properties of Hand Tools*, 4th edition, 2004.
- ~~API RP 1621, *Bulk Liquid Stock Control at Retail Outlets*, 2001.~~
- ~~API 2003, *Protection Against Ignition Arising Out of Static, Lightning, and Stray Currents*, 7th Editionedition, 2008.~~

F.1.2.6 **ASTM Publications.**

- ASTM C1055, *Standard Guide for Heated System Surface Conditions that Produce Contact Burn Injuries*, 2003 (reapproved 2014).
- ASTM D4956, *Standard Specification for Retroreflective Sheeting for Traffic Control*, 2013.
- ASTM E648, *Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source*, 2014c.
- ASTM E1515, *Standard Test Method for Minimum Explosible Concentration of Combustible Dusts*, 2007.
- ASTM E2393, *Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers*. 2010a.
- ASTM F1870, *Standard Guide for Selection of Fire Test Methods for the Assessment of Upholstered Furnishings in Detention and Correctional Facilities*, 2011.

F.1.2.8 **AWWA Publications.**

American Water Works Association Inc., 6666 West Quincy Avenue, Denver, CO 80235.

AWWA M14, ~~*Recommended Practice for Backflow Prevention and Cross-Connection Control*~~ *Backflow Prevention and Cross-Connection Control: Recommended Practices*, ~~2004 edition~~ 4th edition, 2015.

F.1.2.10. **CSFM Publications.**

California State Fire Marshal Publications, Office of the State Fire Marshal, 1131 S Street, Sacramento, CA 95811.

"*Rings of Fire:* ~~*Fire Prevention & Suppression of Waste Tire Piles*~~ *Tire Fire Prevention and Suppression*," 2005.

For Code Adoption Use Only

F.1.2.11 **FAA Publications.**
Federal Aviation Administration, U.S. Department of Transportation, 800 Independence Avenue, SW, Washington, DC 20591.
~~FAA A/C 150/5390-2B~~ FAA AC 150/5390-2B, *Heliport Design Advisory Circular*, April 24, 2004.

F.1.2.13 **IEC Publications.**
International Electrotechnical Commission, 3, rue de Varembé, P.O. Box 131, CH-1211 Geneva 20, Switzerland.
IEC 61340-4-4, *Electrostatics—Part 4-4: ~~Standard Test Methods for Specific Applications — Electrostatic Classification of Flexible Intermediate Bulk~~ Standard Test Methods for Specific Applications — Electrostatic Classification of Flexible Intermediate Bulk Containers (FIBC)*, ~~2005~~ 2012.

F.1.2.14 **IEEE Publications**.
IEEE, Three Park Avenue, 17th Floor, New York, NY 10016-5997.
IEEE 1635/ASHRAE 21, *Guide to Battery Room Ventilation and Thermal Management*, 2012.

F.1.2.16 **ISO Publications.**
International Organization for Standardization 1, ch. de la Voie-Creuse, case postale 56, CH-1211 Geneva 20, Switzerland.
ISO 8115, *Cotton Bales — Dimensions and Density,* 1986.
ISO 13732-1, *Ergonomics of the Thermal Environment — Methods for the Assessment of Human Responses to Contact with Surfaces, Part 1: Hot Surfaces*, 2006.

F.1.2.17 **PEI Publications.**
- PEI/RP500, *Recommended Practices for Inspection and Maintenance of Motor Fuel Dispensing Equipment*, 2005.
- PEI RP600, *Recommended Practices for Overfill Prevention for Shop-Fabricated Aboveground Tanks*, 2012.

F.1.2.19 **California Department of Consumer Affairs Publications.**
Bureau of Home Furnishings and Thermal Insulation, 3485 Orange Grove Avenue, North Highlands, CA 95660-5595.
Technical Bulletin CA TB 129, ~~*Flammability Test Procedure for Mattresses for Use in Public Buildings*~~" Flammability Test Procedure for Mattresses for Use in Public Buildings," 1992.

F.1.2.22 **UL Publications.**
- ANSI/UL 79, *Standard for Power-Operated Pumps for Petroleum Dispensing Products*, 2005, revised 2014.
- UL 87, *Standard for Power-Operated Pumps for Petroleum Dispensing Products*, 2001, revised 2008.

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- 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 299, *Dry Chemical Fire Extinguishers*, 2002, revised 2009.~~
- ANSI/UL 330, *Standard for Hose and Hose Assemblies for Dispensing Flammable Liquids*, 2009, revised 2013.
- ANSI/UL 558, *Standard for Safety Industrial Trucks, Internal Combustion Engine-Powered*, 1996, revised 2010.
- ANSI/UL 567, *Standard for Emergency Breakaway Fittings, Swivel Connectors and Pipe-Connection Fittings for Petroleum Products and LP-Gas*, 2014.
- UL 647, *Standard for Unvented Kerosene-Fired Room Heaters and Portable Heaters*, 1993.
- ANSI/UL 710B, *Standard for Recirculating Systems*, 2014.
- ANSI/UL 842, *Standard for Valves for Flammable Fluids*, 2015.
- ANSI/UL 1278, *Standard for Movable and Wall- or Ceiling-Hung Electric Room Heaters*, 2000, revised 2011.
- ANSI/UL 2586, *Standard for Hose Nozzle Valves*, 2011, revised 2014.
- ANSI/UL 60079-11, *Explosive Atmospheres — Part 11: Equipment Protection by Intrinsic Safety 'i'*, 2013
- ~~UL Subject 2436, *Outline of Investigation for Spill Containment For Stationary Lead Acid Battery Systems*, 2006.~~

F.1.2.24 **U.S. Government Publications.**

- Title 21, Code of Federal Regulations, "GMP for Medical Devices."
- Title 28, Code of Federal Regulations, Part 36, Appendix A, "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities."
- ~~Title 33, Code of Federal Regulations, Part 154.~~
- Title 29, Code of Federal Regulations, Part 1910.1200.
- ~~Title 49, Code of Federal Regulations, U.S. Department of Transportation, Hazardous Materials Regulations.~~
- Title 30, Code of Federal Regulations, Part 36, "Approved Requirements for Permissible Mobile Diesel-Powered Transportation Equipment."
- Title 33, Code of Federal Regulations, Part 154, Appendix A.
- Title 40, Code of Federal Regulations, Part 355.
- Title 49, Code of Federal Regulations, Parts 105–110.
- Title 49, Code of Federal Regulations, Part 171.8.
- Title 49, Code of Federal Regulations, Part 172.
- Title 49, Code of Federal Regulations, Part 172.102.
- Title 49, Code of Federal Regulations, Part 173.120.
- Title 49, Code of Federal Regulations, Part 173.137.

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- Title 49, Code of Federal Regulations, Part 173.150. F.1.2.25 **Other Publications.** - ~~Blue Book.~~ - ~~Britton, *Avoiding Static Ignition Hazards*.~~ - Fire Equipment Manufacturers' Association, "Recommendations for Protection of Curtained Limited Finishing Workstations." - ~~Hirschler, 1992: "Heat release from plastic materials".~~ - ~~Fire Equipment Manufacturers' Association, "Recommendations for Protection of Curtained Limited Finishing Workstations."~~ - ~~FM Data Sheet 7–76, "Operations and Maintenance."~~ - Hirschler, 1992: "Heat release from plastic materials." - *International Building Code*. - ~~P. J. Wakelyn and S. E. Hughs, "Evaluation of the Flammability of Cotton Bales," *Fire and Materials* Volume 26, pages 183–189 (2002).~~ - ~~Specifications and Standards (Marine Standards).~~ - ~~"Cotton Ginners Handbook," Agricultural Handbook Number 503, W. S. Anthony and W. D. Mayfield, editors, 1994.~~ - *Standard Building Code*. - *Uniform Building Code*. - Wakelyn, P. J., and S. E. Hughs, "Evaluation of the Flammability of Cotton Bales," *Fire and Materials*, Vol. 26, pp. 183–189, 2002. F.2 **References for Extracts.** - ~~NFPA 99, *Health Care Facilities Code*, 2015 edition.~~ - ~~NFPA 102, *Standard for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures*, 2011 edition.~~ - NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, 2017 edition.	
Annex G – Informational References	
G.1.2.2 **ANSI Publications.** - ~~ICC/ANSI A117.1, *Accessible and Usable Buildings and Facilities*, 2009.~~ - ~~ANSI/CMA Z129.1. *American National Standard for Hazardous Industrial Chemicals — Precautionary Labeling*, 2006.~~ - ~~ANSI/AIHA Z9.7, *Recirculation of Air from Industrial Process Exhaust Systems*, 2007.~~ - ICC/ANSI A117.1, *Accessible and Usable Buildings and Facilities*, 2009. - ANSI/AIHA Z9.7, *Recirculation of Air from Industrial Process Exhaust Systems*, 2007.	

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- ANSI Z400.1/Z129.1, *Hazardous Workplace Chemicals — Hazard Evaluation and Safety Data Sheet and Precautionary Labeling Preparation*, 2010.

G.1.2.3 **API Publications.**

- ~~"An Engineering Analysis of the Effects of Oxygenated Fuels on Marketing Vapor Recovery Equipment," September 1990.~~
- ~~API-ASME *Code for Unfired Pressure Vessels for Petroleum Liquids and Gases*, Pre-July 1, 1961.~~
- "An Engineering Analysis of the Effects of Oxygenated Fuels on Marketing Vapor Recovery Equipment," September 1990.
- API-ASME *Code for Unfired Pressure Vessels for Petroleum Liquids and Gases*, Pre-July 1, 1961.

G.1.2.6 **ASTM Publications.**

~~*Manual on Flash Point Standards and Their Use*, 1992.~~

G.1.2.12 **FM Publications.**

- FM Global, 1301 Atwood Avenue, P.O. Box 7500, Johnston, RI 02919.
- ANSI/FM 4996, *Classification of Pallets and Other Material Handling Products as Equivalent to Wood Pallets*, 2013.

G.1.2.13 **IAPMO Publications.**

International Association of Plumbing and Mechanical Officials, 20001 Walnut Drive South, Walnut, CA 91789.
UPC, *Uniform Plumbing Code* , 2015.

G.1.2.19 **NACE Publications**.

NACE International, 15835 Park Ten Place, Houston, Texas 77084.
NACE SP0169-2013, *Control of External Corrosion of Underground or Submerged Metallic Piping Systems*, 2013.

G.1.2.23 **STI Publications.**

- ~~STI RP 01-69, *Recommended Practice for Control of External Corrosion of Underground or Submerged Metallic Piping Systems.*~~
- ~~STI RP 1632, *Cathodic Protection of Underground Petroleum Storage and Piping Systems.*~~

G.1.2.25 **UL Publications.**

UL 2335, *Standard for Fire Tests of Storage Pallets*, 2010.
~~UL Subject 2728, *Outline of Investigation for Pellet Fuel Burning Cooking Appliances*, 2009.~~
UL Subject 2436, *Outline of Investigation for Spill Containment for Stationary Lead Acid Battery Systems*, 2006.

G.2 **References for Extracts.**

For Code Adoption Use Only

NFPA 1124, *Code for the Manufacture, Transportation, and Storage of Fireworks and Pyrotechnic Articles*, 2017 edition. NFPA 1730, *Standard on Organization and Deployment of Fire Prevention Inspection and Code Enforcement, Plan Review, Investigation, and Public Education Operations*, 2016 edition.	

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