NFPA® 407

Standard for Aircraft Fuel Servicing

2017

NFPA®

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NFPA® 407

Standard for

Aircraft Fuel Servicing

2017 Edition

This edition of NFPA 407, *Standard for Aircraft Fuel Servicing*, was prepared by the Technical Committee on Aircraft Fuel Servicing. It was issued by the Standards Council on May 13, 2016, with an effective date of June 2, 2016, and supersedes all previous editions.

This document has been amended by one or more Tentative Interim Amendments (TIAs) and/or Errata. See "Codes & Standards" at www.nfpa.org for more information.

This edition of NFPA 407 was approved as an American National Standard on June 2, 2016.

Origin and Development of NFPA 407

Active work by NFPA leading toward the development of this standard began in 1951. Since then, the technical committee responsible has made every effort to keep the text up-to-date, and subsequent editions were published almost every year from 1955 to 1975. The 21st edition was issued in 1980, and the technical committee completed a partial revision in 1984.

The 1990 edition was a complete rewrite that reorganized the design and operational requirements into separate chapters. The requirements for grounding were deleted, and the requirements for bonding were clarified.

The 1996 edition was a partial revision. Requirements for self-service fueling and rapid refueling of helicopters were added.

The 2001 edition included new requirements for nondriven hydrant carts.

The 2007 edition was a partial revision.

The 2012 edition added new requirements for vehicles with diesel particulate filters.

The 2017 edition is a complete reorganization of the material, designed to make the document easier to use. The new format includes a general chapter that applies to all types of aircraft fueling facilities and four specific chapters that apply to aviation fueling facilities, airport fueling vehicles, rooftop heliports, and self-service aircraft fueling. Each of those four chapters is split into a design section and an operation section, and each uses consistent numbering to locate similar topics. This edition incorporates many technical revisions, aimed at clarifying existing requirements, addressing gaps, and updating old or obsolete material. Requirements for rapid refueling of fixed-wing aircraft also have been added.

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NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on fire safe procedures, equipment, and installations for aircraft fuel servicing.

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NFPA 407

Standard for

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2017 Edition

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in mandatory sections of the document are given in Chapter 2 and those for extracts in informational sections are given in Annex C. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced publications can be found in Chapter 2 and Annex C.

Chapter 1 Administration

1.1 Scope. This standard applies to the fuel servicing of all types of aircraft using liquid petroleum fuel.

1.1.1 This standard does not apply to any of the following:

(1) In-flight fueling
(2) Fuel servicing of flying boats or amphibious aircraft on water
(3) Draining or filling of aircraft fuel tanks incidental to aircraft fuel system maintenance operations or manufacturing

1.1.2* This document is not intended to be used as the sole standard for design, construction, operation, and maintenance of fuel storage and transfer facilities, as it does not address requirements for environmental protection, fuel quality, or other issues not directly related to fire safety.

1.2* Purpose.

1.2.1 The purpose of this standard is to establish reasonable minimum fire safety requirements for procedures, equipment, and installations for the protection of persons, aircraft, and other property during ground fuel servicing of aircraft using liquid petroleum fuels. These requirements are based upon sound engineering principles, test data, and field experience.

1.2.2 The fire hazard properties of aviation fuels vary; however, for the purpose of this standard, the same fire safety precautions are specified for all types.

1.3 Retroactivity. The provisions of this standard reflect a consensus of what is necessary to provide an acceptable degree of protection from the hazards addressed in this standard at the time the standard was issued.

1.3.1 Unless otherwise specified, the design and installation provisions of this standard shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the standard.

1.3.2 Unless otherwise specified, operations and maintenance activities shall meet the current standard.

1.3.3 In those cases where the authority having jurisdiction determines that the existing situation presents an unacceptable degree of risk, the authority having jurisdiction shall be permitted to apply retroactively any portions of this standard deemed appropriate.

1.3.4 The retroactive requirements of this standard shall be permitted to be modified if their application clearly would be impractical in the judgment of the authority having jurisdiction, and only where it is clearly evident that a reasonable degree of safety is provided.

1.4 Equivalency. Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, rating, and safety over those prescribed by this standard.

1.4.1 Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

1.4.2 The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

1.5 Units. Where the value for a measurement as specified in this standard is followed by an equivalent value in other units, the first value shall be regarded as the requirement. The equivalent value could be approximate.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 10, *Standard for Portable Fire Extinguishers,* 2017 edition.
NFPA 30, *Flammable and Combustible Liquids Code,* 2015 edition.
NFPA 70®, *National Electrical Code*®, 2017 edition.

NFPA 385, *Standard for Tank Vehicles for Flammable and Combustible Liquids,* 2017 edition.

NFPA 410, *Standard on Aircraft Maintenance,* 2015 edition.

NFPA 415, *Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways,* 2016 edition.

NFPA 418, *Standard for Heliports,* 2016 edition.

NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response,* 2017 edition.

2.3 Other Publications.

2.3.1 ASME Publications. ASME Technical Publishing Office, Two Park Avenue, New York NY 10016-5990.

ASME B31.3, *Process Piping*, 2014.

2.3.2 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM D380, *Standard Test Methods for Rubber Hose*, 1994, reapproved 2012.

2.3.3 AWS Publications. American Welding Society, 8669 NW 36 Street, # 130, Miami, FL 33166-6672.

AWS A5.10, *Welding Consumables — Wire Electrodes, Wires, and Rods for Welding of Aluminum and Aluminum Alloys — Classification*, 2012.

2.3.4 EI Publications. Energy Institute, 61 New Cavendish Street, London W1G 7AR, United Kingdom.

EI 1529, *Aviation Fueling Hose and Hose Assemblies*, 7th edition, 2014.

EI 1540, *Design, Construction, Commissioning, Maintenance and Testing of Aviation Fuelling Facilities*, 5th Edition, 2014.

EI 1542, *Identification Markings for Dedicated Aviation Fuel Manufacturing and Distribution Facilities, Airport Storage, and Mobile Fueling Equipment*, 2012.

2.3.5 FAA Publications. Federal Aviation Administration, U.S. Department of Transportation, Distribution Unit, M-494.3, Washington, DC 20590.

FAA AC-150/5300, *Airport Design*, Rev. 13A, 2012.

2.3.6 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 913, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III Division 1, Hazardous (Classified) Locations*, 8th edition, 2013.

2.3.7 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20402.

Title 49, Code of Federal Regulations, Part 172.504, "General Placarding Requirements."

Title 49, Code of Federal Regulations, Part 178.345, "General Design and Construction Requirements Applicable to Specification DOT 406."

2.3.8 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 30, *Flammable and Combustible Liquids Code,* 2015 edition.

NFPA 385, *Standard for Tank Vehicles for Flammable and Combustible Liquids,* 2017 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3.2.4* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.5 Shall. Indicates a mandatory requirement.

3.2.6 Should. Indicates a recommendation or that which is advised but not required.

3.2.7 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 General Definitions.

3.3.1 Aircraft. A vehicle designed for flight that is powered by liquid petroleum fuel.

3.3.2 Aircraft Fuel Servicing. See 3.3.28.1.

3.3.3 Aircraft Fuel Servicing Hydrant Vehicle (Hydrant Vehicle). See 3.3.36.1.

3.3.4 Aircraft Fuel Servicing Ramp or Apron. An area or position at an airport used for the fuel servicing of aircraft.

3.3.5 Aircraft Fuel Servicing Tank Vehicle (Fueler). See 3.3.36.2.

3.3.6 Aircraft Fueling Vehicle. See 3.3.36.3.

3.3.7 Airport Fueling System. An arrangement of aviation fuel storage tanks, pumps, piping, and associated equipment, such as filters, water separators, hydrants and station, or aircraft fuel servicing vehicles, installed at an airport and designed to service aircraft at fixed positions.

3.3.8* Aviation Fuel. Any petroleum fuel for use in aircraft engines.

3.3.9 Bulkhead. A liquidtight transverse closure between compartments of a cargo tank.

3.3.10 Burst Pressure. See 3.3.25.1.

3.3.11* Cargo Tank. A container used for carrying fuels and mounted permanently or otherwise secured on a tank vehicle.

3.3.12 Cathodic Protection. A method of controlling or impressing an electrical current to prevent corrosion of metal components of airport fueling systems that are in contact with the ground.

3.3.13 Deadman Control. A device that requires a positive continuing action of a person to allow the flow of fuel.

3.3.14 Electric Hand Lamp. A portable lamp other than a flashlight.

3.3.15 Emergency Fuel Shutoff. A function performed to stop the flow of fuel in an emergency.

3.3.16* Fuel Servicing Station. A unit that includes all necessary equipment to enable the transfer of fuel into or from an aircraft or fueler.

3.3.17 Fueler. See 3.3.36.2.

3.3.18 Fueling Point. The location on an aircraft where fuel enters the aircraft from an external source.

3.3.19 Head. A liquidtight transverse closure at the end of a cargo tank.

3.3.20 Hydrant Cart. A non-driven vehicle used to deliver fuel from a hydrant to an aircraft.

3.3.21 Hydrant Valve. An outlet of an airport fueling system that includes a deadman-controlled valve and adapter assembly to which a coupler on a hose or other flexible conduit on an aircraft fuel servicing vehicle can be connected.

3.3.22 Hydrant Vehicle. See 3.3.36.4.

3.3.23 Misfueling. The accidental fueling of an aircraft or refueling vehicle tank with an incorrect grade of product.

3.3.24 Overshoot. The fuel that passes through a valve after the deadman control is released or another flow control device is activated.

3.3.25 Pressure.

3.3.25.1 ***Burst Pressure.*** The pressure at which a component fails due to stresses induced as a result of the pressure.

3.3.25.2 ***Test Pressure.*** The pressure to which a system or a component of a system is subjected to verify the integrity of the system or component.

3.3.25.3 ***Working Pressure.*** The maximum allowable pressure, including momentary surge pressure, to which a system, hose, or other component can be safely subjected while in service.

3.3.26 Pressure Fuel Servicing. See 3.3.28.3.

3.3.27 Self-Service Fueling. The dispensing of aviation fuels into aircraft fuel tanks by persons other than the facility owner/operator.

3.3.28 Servicing.

3.3.28.1 ***Aircraft Fuel Servicing.*** The transfer of fuel into or from an aircraft.

3.3.28.2 ***Overwing Fuel Servicing.*** A system used to fuel an aircraft through an opening in the aircraft fuel tank using a hose with a hand-held nozzle.

3.3.28.3 ***Pressure Fuel Servicing.*** A system used to fuel an aircraft by closed coupled connection under pressure.

3.3.29 Tank Baffle. A nonliquidtight transverse partition in a cargo tank.

3.3.30 Tank Compartment. A liquidtight division in a cargo tank.

3.3.31 Tank Full Trailer. A vehicle that is not self-propelled and that has a cargo tank for the transportation of aviation fuel mounted thereon or built as an integral part thereof. It is so constructed that its weight and load rest on its own wheels.

3.3.32 Tank Semitrailer. A vehicle that is not self-propelled and that has a cargo tank for the transportation of aviation fuel mounted thereon or built as an integral part thereof. It is so constructed that when drawn by a tractor by means of a fifth wheel connection, some of its load and weight rests upon the towing vehicle.

3.3.33 Tank Truck. Any single self-propelled motor vehicle equipped with a cargo tank mounted thereon and used for the transportation of flammable and combustible liquids or asphalt. [**385,** 2017]

3.3.34 Tank Vehicle. See 3.3.36.5.

3.3.35 Test Pressure. See 3.3.25.2.

3.3.36 Vehicle.

3.3.36.1 ***Aircraft Fuel Servicing Hydrant Vehicle (Hydrant Vehicle).*** A vehicle equipped with facilities to transfer fuel between a fuel hydrant and an aircraft.

3.3.36.2 ***Aircraft Fuel Servicing Tank Vehicle (Fueler).*** A vehicle having a cargo tank (tank truck, tank full trailer, tank semitrailer) designed for or used in the transportation and transfer of fuel into or from an aircraft.

3.3.36.3 ***Aircraft Fueling Vehicle.*** A fuel servicing hydrant vehicle, hydrant cart, or an aircraft fuel servicing tank vehicle.

3.3.36.4 ***Hydrant Vehicle.*** See 3.3.36.1.

3.3.36.5 ***Tank Vehicle.*** Any tank truck, tank full trailer, or tractor and tank semitrailer combination.

3.3.37 Vent Point. The location on the exterior of an aircraft where fuel vapors are released from the aircraft's fuel system.

3.3.38 Working Pressure. See 3.3.25.3.

Chapter 4 General Requirements

4.1 Design and Construction.

4.1.1 General Requirements.

4.1.1.1 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.

4.1.1.2 Aviation fueling facilities shall also comply with the requirements of Chapter 5.

4.1.1.3 Aircraft fueling vehicles and carts shall also comply with the requirements of Chapter 6.

4.1.1.4 Rooftop heliport fueling facilities shall also comply with the requirements of Chapter 5 and Chapter 7.

4.1.1.5 Self-service aviation fueling facilities shall also comply with the requirements of Chapter 5 and Chapter 8.

4.1.2 Fuel Storage Tanks. (Reserved)

4.1.3 Fuel Dispensing Systems.

4.1.3.1 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).

4.1.3.2 The deadman flow control in the nozzle shall be permitted for overwing fueling.

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

4.1.3.4 Nozzles for underwing fueling shall be designed to be attached securely to the aircraft adapter before the nozzle can be opened.

4.1.3.5 Disengaging the nozzle from the aircraft adapter shall not be possible until the nozzle is fully closed.

4.1.3.6 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.

4.1.3.7 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.

4.1.3.8 The working pressure of any system component shall equal or exceed any pressure to which it could be subjected.

4.1.4* Fueling Hose.

4.1.4.1 Performance Requirements. Hose and couplings shall comply with the requirements of EI 1529.

4.1.4.2 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.

4.1.4.3 Additional Requirements.

4.1.4.3.1 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.

4.1.4.3.2 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

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

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

4.1.4.3.5 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.

4.1.4.3.6* Lengths of hose shall not be spliced together.

4.1.4.3.7 Hydrostatic Testing. Hydrostatic testing shall be in accordance with ASTM D380.

4.1.4.3.7.1 Following a hydrostatic test, all the water shall be drained and the hose shall be dried internally.

4.1.4.3.7.2 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.

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

4.1.4.3.8 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.

4.1.5 Electrostatic Hazards and Bonding.

4.1.5.1 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.

4.1.5.2 The maximum resistance between the bonding cable clip and the fueling system framework shall not exceed 25 ohms.

4.1.5.3 Bonding cables shall be constructed of conductive, durable, and flexible material.

4.1.5.4 Bonding connections shall be electrically and mechanically firm.

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

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

4.1.5.7 EI 1529 Type A hose that does not have a semiconductive cover shall not be used.

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

4.1.5.9* 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.

4.1.5.9.1 The relaxation period required by 4.1.5.9 shall not apply to the actual refueling of an aircraft.

4.1.5.9.2 The relaxation period required by 4.1.5.9 shall not apply to fuels with static dissipater additives.

4.1.6 Electrical Systems. (Reserved)

4.1.7 Control of Fuel Flow. (Reserved)

4.1.8 Filters and Ancillary Equipment.

4.1.8.1 Filter vessels used in aviation fuel service shall have a functional automatic air vent (AAV) or automatic air eliminator (AAE).

4.1.8.2 The AAV or AAE shall discharge to a closed system.

4.1.9 Emergency Fuel Shutoff Systems. (Reserved)

4.1.10 Fire Extinguishers.

4.1.10.1* During fueling operations, fire extinguishers shall be available on aircraft servicing ramps or aprons, in accordance with NFPA 410.

4.1.10.2 All fire extinguishers shall conform to the requirements of NFPA 10.

4.1.10.3* 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.

4.1.11 Marking and Labeling.

4.1.11.1 Each emergency fuel shutoff station location shall be placarded EMERGENCY FUEL SHUTOFF in letters at least 50 mm (2 in.) high.

4.1.11.2 The method of operation shall be indicated by an arrow or by the word PUSH or PULL, as appropriate.

4.1.11.3 Any action necessary to gain access to the shutoff device (e.g., BREAK GLASS) shall be shown clearly.

4.1.11.4 Lettering shall be of a color contrasting sharply with the placard background for visibility.

4.1.11.5 Placards shall be weather resistant.

4.1.12 Aircraft Fueling Ramps.

4.1.12.1 Aircraft Radar Equipment.

4.1.12.1.1 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.

4.1.12.1.2 Weather-mapping radar equipment in aircraft shall not be operated while the aircraft in which it is mounted is undergoing fuel servicing.

4.1.12.2* Ground Radar Equipment.

4.1.12.2.1 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).

4.1.12.2.2 Aircraft fuel servicing shall not be conducted within the 90 m (300 ft) distance established by 4.1.12.2.1.

4.1.12.2.3 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).

4.1.12.2.4 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.

4.1.12.3 Emergency Fire Equipment Accessibility. Accessibility to aircraft by emergency fire equipment shall be considered in establishing aircraft fuel servicing positions.

4.1.12.4 Ramp and Apron Drainage. Aircraft servicing ramps or aprons shall be sloped and drained in accordance with NFPA 415.

4.1.12.4.1 The ramp or apron shall slope away from the rim or edge of fueling hydrants or fueling pits to prevent flooding.

4.1.12.4.2 Fueling hydrant boxes or fueling pits that are connected to a ramp drainage system shall be fitted with vapor-sealing traps.

4.2 Operations.

4.2.1 Security. (Reserved)

4.2.2 Training.

4.2.2.1* 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.

4.2.2.2* Fuel servicing personnel shall be trained in the use of the available fire-extinguishing equipment they could be expected to use.

4.2.3* Prevention and Control of Spills.

4.2.3.1 Following fueling of an aircraft or fuel servicing vehicle, all hoses shall be removed, including those from hydrant systems if applicable.

4.2.3.2 All hoses shall also be properly stowed.

4.2.3.3 Fuel nozzles shall not be dragged along the ground.

4.2.3.4 Approved pumps, either hand operated or power operated, shall be used where aircraft are fueled from drums.

4.2.3.4.1 Pouring or gravity flow shall not be permitted from a container with a capacity of more than 19 L (5 gal).

4.2.3.5 Fuel Spill Procedures.

4.2.3.5.1 Where a spill is observed, the fuel servicing shall be stopped immediately by release of the deadman controls.

4.2.3.5.2 In the event that a spill continues, the equipment emergency fuel shutoff shall be actuated.

4.2.3.5.3 In the event that a spill continues from a hydrant system, the system emergency fuel shutoff shall be actuated.

4.2.3.5.4 The supervisor shall be notified immediately.

4.2.3.5.5 Cleaning operations shall be performed by personnel trained in accordance with 4.2.2.1.

4.2.3.5.6 Operation shall not be resumed until the spill has been cleared and conditions are determined to be safe.

4.2.3.5.7 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.

4.2.3.5.8 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.

4.2.3.5.9 Corrective measures identified by the spill investigation shall be implemented as required by the authority having jurisdiction.

4.2.3.6 Transferring fuel by pumping from one tank vehicle to another tank vehicle within 61 m (200 ft) of an aircraft shall not be permitted.

4.2.3.7 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.

4.2.4 Emergency Fuel Shutoff.

4.2.4.1 Emergency fuel shutoff control stations shall be accessible at all times.

4.2.4.2 A procedure shall be established to notify the fire department serving the airport in the event of a control station activation.

4.2.4.3 If the fuel flow stops for an unknown reason, the emergency fuel shutoff system shall be checked first.

4.2.4.4 The cause of the shutoff shall be identified and corrected before fuel flow is resumed.

4.2.4.5 Emergency fuel shutoff systems shall be operationally checked at intervals not exceeding 6 months.

4.2.4.6 Each individual device shall be checked at least once during every 12-month period.

4.2.4.7 Suitable records shall be kept of tests required by this section.

4.2.5* Bonding.

4.2.5.1 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.

4.2.5.1.1 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.

4.2.5.1.2 Grounding for the sole purpose of aircraft fueling shall not be permitted.

4.2.5.2 Bonding for Overwing Fueling. In addition to the requirements in 4.2.5.1, where fueling overwing, the nozzle shall be bonded to a metallic component of the aircraft that is metallically connected to the tank filler port.

4.2.5.2.1 The bond connection shall be made before the filler cap is removed.

4.2.5.2.2 If a nozzle bond cable and plug receptacle or means for attaching a clip is available, the operator shall attach the nozzle bond cable before removing the cap in order to equalize the potential between the nozzle and the filler port.

4.2.5.2.3 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.

4.2.5.2.4 The nozzle spout shall be kept in contact with the filler neck until the fueling is completed.

4.2.5.3 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.

4.2.5.3.1* Only metal funnels shall be used.

4.2.5.4 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.

4.2.5.5 Bonding and fueling connections shall be disconnected in the reverse order of connection.

4.2.5.6 Conductive hose shall be used to prevent electrostatic discharge but shall not be used to accomplish required bonding.

4.2.6 Control of Fuel Flow.

4.2.6.1 Fuel flow shall be controlled by use of a deadman control device.

4.2.6.2 The use of any means that defeats the deadman control shall be prohibited.

4.2.7 Fire Protection.

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

4.2.7.2* Extinguishers shall be kept clear of elements such as ice and snow.

4.2.7.3 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.

4.2.7.4 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.*)

4.2.8 Maintenance.

4.2.8.1 Fuel servicing equipment shall be maintained in safe operating condition.

4.2.8.2 Malfunctioning equipment shall be removed from service.

4.2.8.3 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.

4.2.8.4 The tag/lock shall not be removed until the operation is completed.

4.2.8.5 All inspection and maintenance activities shall be recorded.

4.2.8.6 Inspection and maintenance records shall be retained for a minimum of 12 months.

4.2.9* Aircraft Fueling Hose. Any hose found to be defective, in accordance with 4.2.9.1 through 4.2.9.4, shall be removed from service.

4.2.9.1 Suitable records shall be kept of required inspections and hydrostatic tests.

4.2.9.2 Aircraft fueling hose shall be removed from service after 10 years from the date of manufacture.

4.2.9.3 Aircraft fueling hose not placed into service within 2 years of the date of manufacture shall not be used.

4.2.9.4 Daily Inspection. Aircraft fueling hose shall be inspected before use each day.

4.2.9.4.1 The hose shall be extended as it normally would be for fueling.

4.2.9.4.2 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

4.2.9.5 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.

4.2.9.5.1* The hose couplings and the hose shall be examined for structural weakness or soft spots.

4.2.9.5.2 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.

4.2.9.6 Quarterly Inspection.

4.2.9.6.1 The nozzle screens shall be examined for evidence of hose deterioration.

4.2.9.7 Kinks or short loops in fueling hose shall be avoided.

4.2.10* 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.

4.2.11 Aircraft Fuel Servicing.

4.2.11.1 Location of Aircraft During Fuel Servicing.

4.2.11.1.1 Aircraft fuel servicing shall be performed outdoors.

4.2.11.1.2 Aircraft fuel servicing incidental to aircraft fuel system maintenance operations shall comply with the requirements of NFPA 410.

4.2.11.1.3* 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 enclosed passenger concourse other than a loading walkway.

4.2.11.1.4 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.

4.2.11.1.5 Accessibility to aircraft by emergency fire equipment shall be maintained for aircraft fuel servicing positions.

4.2.11.2 Aircraft Occupancy During Fuel Servicing.

4.2.11.2.1 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.

4.2.11.2.1.1 A clear area for emergency evacuation of the aircraft shall be maintained at not less than one additional exit.

4.2.11.2.1.2 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.

4.2.11.2.1.3 Aircraft operators shall establish specific procedures covering emergency evacuation under such conditions for each type of aircraft they operate.

4.2.11.2.1.4 All "no smoking" signs shall be displayed in the cabin(s), and the no smoking rule shall be enforced.

4.2.11.2.2 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.

4.2.11.2.2.1 Controls shall be established so that passengers avoid such areas.

4.2.12 Fire Hazards on Aircraft Fuel Servicing Ramps.

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

4.2.12.1.1 Battery chargers on any fueling equipment shall not be connected or disconnected while fuel servicing is performed on an aircraft.

4.2.12.1.2* Aircraft ground-power generators or other electrical ground-power supplies shall not be connected or disconnected while fuel servicing is performed on the aircraft.

4.2.12.1.3 Electric tools or similar tools likely to produce sparks or arcs shall not be used while fuel servicing is performed on an aircraft.

4.2.12.1.4 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.

4.2.12.1.5* 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.

4.2.12.2 Open Flames on Aircraft Fuel Servicing Ramps.

4.2.12.2.1 Entrances to fueling areas shall be posted with “no smoking” signs.

4.2.12.2.2 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.

4.2.12.2.3 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
(5) Flare pots or other open-flame lights

4.2.12.2.4 The authority having jurisdiction can establish other locations where open flames and open-flame devices shall not be permitted.

4.2.12.2.5 Personnel shall not carry lighters, matches, or electronic cigarettes on their person while engaged in fuel servicing operations.

4.2.12.2.6 Lighters, matches, or electronic cigarettes shall not be permitted on or in fueling equipment.

4.2.12.2.7 Equipment performing aircraft servicing functions shall not be positioned within a 3 m (10 ft) radius of aircraft fuel system vent openings.

4.2.12.3 Operation of Aircraft Engines and Heaters.

4.2.12.3.1 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.

4.2.12.3.2 Aircraft auxiliary power units (APUs) that direct exhaust away from the fueling operation shall be permitted to operate during fuel servicing.

4.2.12.3.3 Combustion heaters on aircraft (e.g., wing and tail surface heaters, integral cabin heaters) shall not be operated during fueling operations.

4.2.13 Defueling of Aircraft.

4.2.13.1 All requirements of this standard shall apply to defueling operations.

4.2.13.2 Each operator shall establish procedures to prevent the overfilling of the tank vehicle, which is a special hazard when defueling.

4.2.14 Rapid Refueling.

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

(1) Helicopters
(2) Agricultural aircraft actively engaged in aerial application duties
(3) Medical aircraft actively engaged in the transport of medical patients
(4) Fire-fighting and search-and-rescue aircraft actively engaged in emergency operations

4.2.14.2 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.

4.2.14.3 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

4.2.14.4 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 4.2.14.4(3).
(3) Patients on board medical transport aircraft shall be permitted to remain on board the aircraft with medical personnel during rapid refueling operations if, in the opinion of the medical provider, removal from the aircraft would be detrimental to the patient’s condition.
(4) Passengers shall not board or deboard during rapid refueling operations.
(5) Only designated personnel, properly trained in rapid refueling operations, shall operate the equipment. Written procedures shall include the safe handling of the fuel and equipment.
(6) All doors, windows, and access points allowing entry to the interior of the aircraft that are adjacent to, or in the immediate vicinity of, the fuel inlet ports shall be closed and shall remain closed during refueling operations.

(7) Fuel shall be permitted to be dispensed by one of the following methods:
   (a) Into an open port from approved deadman-type nozzles with a flow rate not to exceed 227 L/min (60 gpm)
   (b) Through close-coupled pressure fueling ports
(8) Where fuel is dispensed from fixed piping systems, the hose cabinet shall not extend into the rotor space.
(9) Clearance between aircraft fuel servicing vehicles and rotating components shall be maintained by one of the following methods:
   (a) A curb or other approved barrier shall be provided to restrict the fuel servicing vehicle from coming within 3 m (10 ft) of any aircraft rotating components.
   (b) Fuel servicing vehicles shall be kept 6 m (20 ft) away from any aircraft rotating components, and a trained person shall direct fuel servicing vehicle approach and departure.

Chapter 5 Aviation Fueling Facilities

5.1 Design and Construction.

5.1.1 General Requirements.

5.1.1.1 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.

5.1.1.2 The system and each of its components shall be designed for the working pressure of the system.

5.1.1.3 The emergency fuel shutoff system shall be designed and installed as an integral part of the airport fuel system.

5.1.1.4 Operating controls for emergency fuel shutoff of the system shall be located to be readily accessible in the event of an accident or spill.

5.1.1.5 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.

5.1.1.6 System Design and Approval.

5.1.1.6.1 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.

5.1.1.6.2 System Approval. The authority having jurisdiction shall inspect and approve the completed system before it is put into service.

5.1.1.6.3 Hydrostatic Test.

5.1.1.6.3.1 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.

5.1.1.6.3.2 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.

5.1.2 Fuel Storage Tanks.

5.1.2.1* Fuel storage tanks shall conform to the applicable requirements of NFPA 30.

5.1.2.2 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.

5.1.3 Pumps and Piping Systems.

5.1.3.1 Underground piping or impact-protected aboveground piping shall be used in the vicinity of aircraft operating areas.

5.1.3.2 Piping shall be laid on firm supports using clean, noncorrosive backfill.

5.1.3.3 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.

5.1.3.3.1 The casing shall extend beyond the building.

5.1.3.3.2 The casing shall terminate at a low point(s) with an automatic leak detection system.

5.1.3.3.3 The casing shall be capable of being drained to a safe location.

5.1.3.4 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.

5.1.3.5 Cast-iron, copper, copper alloy, and galvanized steel piping, valves, and fittings shall not be permitted.

5.1.3.6 Ductile iron valves shall be permitted.

5.1.3.7 Aluminum piping, valves, and fittings shall be used only where specifically approved by the authority having jurisdiction.

5.1.3.8 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

5.1.3.9 Gaskets in flanged connections shall resist fire temperatures for a duration comparable to the temperature resistance of the flange and bolts.

5.1.3.10 Flanges and their associated bolts shall be steel or stainless steel.

5.1.3.10.1 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.

5.1.3.10.2* 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]

5.1.3.11 Allowances shall be made for thermal expansion and contraction by the use of pipe bends, welded elbows, or other flexible design.

5.1.3.12 Pressure relief valves shall be provided in lines that can be isolated.

5.1.3.13 Welded joints shall be made by qualified welders in accordance with the standards of the American Welding Society and ANSI/ASME B31.3.

5.1.3.14* Isolation valves or devices shall be provided to facilitate dismantling portions of the fueling system.

5.1.3.15 Isolation valves shall be capable of being locked closed.

5.1.3.16 Buried flanges and valves shall not be permitted.

5.1.3.17* All fueling systems with underground piping shall have cathodic protection to mitigate corrosion.

5.1.3.18 A heat-actuated shutoff valve shall be provided in the piping immediately upstream of loading hoses or swing arm connections.

5.1.4 Hose and Nozzles. (Reserved)

5.1.5 Bonding. (Reserved)

5.1.6 Electrical Systems.

5.1.6.1 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.

5.1.7 Control of Fuel Flow.

5.1.7.1* Deadman Controls.

5.1.7.1.1 The valve that controls the flow of fuel to an aircraft or fueling vehicle shall have a deadman control.

5.1.7.1.2 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

5.1.7.1.3 Deadman controls shall be designed to preclude defeating their intended purpose.

5.1.7.2 Pressure Fuel Servicing System Controls.

5.1.7.2.1 The system shall be designed to minimize surge pressure.

5.1.7.2.2* The overshoot shall not exceed 5 percent of actual flow rate in L/min (gal/min) at the time the deadman is released.

5.1.7.2.3 The control valve shall be located and designed so that it will not be rendered inoperative by a surface accident, power failure, or spill.

5.1.7.2.4 The control valve shall be fail-safe by closing completely in the event of control power loss.

5.1.7.3* Hydrant Valves. Hydrant valves shall be designed so that the flow of fuel shall shut off when the hydrant coupler is closed.

5.1.7.3.1 Hydrant valves shall be of the self-closing, dry-break type.

5.1.7.4 Flow Control Valves. The flow control valve shall be an integral part of the hydrant valve or coupler.

5.1.7.4.1 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.

5.1.7.4.2 The fuel control system shall be designed to minimize overshoot.

5.1.7.4.3 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.

5.1.7.4.4 A screen shall be provided ahead of the valve to trap foreign material that could interfere with complete closure of the valve.

5.1.7.4.5 The hydrant valve that allows the flow of fuel to the aircraft shall have a deadman control.

5.1.7.4.6 The use of any means that allows fuel to flow without the operator activating the deadman shall not be permitted.

5.1.7.4.7 The deadman control shall be arranged so that the fueling operator can observe the operation while activating the control.

5.1.7.4.8 Wireless deadman controls shall be permitted.

5.1.7.5* 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.

5.1.8 Filters and Ancillary Equipment.

5.1.8.1 All sections of the filtering system shall have electrical continuity with adjoining piping and equipment.

5.1.8.2 In freezing climates, filter separator sumps and associated piping that could contain water shall be protected to prevent freezing and bursting.

5.1.8.3 Heaters shall be constructed of noncorrosive materials.

5.1.8.4 Piping, valves, meters, filters, air eliminators, connections, outlets, fittings, and other components shall be designed to meet the working pressure requirements of the system.

5.1.9 Emergency Fuel Shutoff Systems.

5.1.9.1 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.

5.1.9.2 The emergency fuel shutoff system shall shut down the flow of fuel in the entire system or in sections of the system.

5.1.9.3 The emergency fuel shutoff system shall be of a fail-safe design.

5.1.9.4* 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.

5.1.9.5 The emergency fuel shutoff system shall include shut-off 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.

5.1.9.6* At least one emergency shutoff control station shall be accessible to each fueling vehicle loading position or aircraft fueling position.

5.1.9.7 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.

5.1.9.8 Emergency fuel shutoff systems shall be designed so that they shut off the flow of fuel if the operating power fails.

5.1.9.9 Emergency fuel shutoffs shall not be located beneath piping, pumps, vents, or other components containing fuel or fuel vapors.

5.1.10 Fire Protection. At least one fire extinguisher with a minimum rating of 40-B:C and a minimum capacity of 9.0 kg (20 lb) of dry chemical agent shall be provided at each fueling vehicle loading position or rack.

5.1.11 Marking and Labeling.

5.1.11.1 Emergency fuel shutoff signs shall be located at least 2.1 m (7 ft) above grade, measured to the bottom of the placard.

5.1.11.2 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).

5.1.11.3 Systems provided with impressed current cathodic protection shall have appropriate signs, located at points of entry, warning against separation of units without prior de-energization or without proper jumpers across the sections to be disconnected.

5.1.11.4 Fuel storage tanks shall be labelled in accordance with the requirements of NFPA 704.

5.1.11.5 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.

5.1.12 Aircraft Fuel Servicing Vehicle Loading and Unloading Racks.

5.1.12.1 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.

5.1.12.2 All fuel servicing tank vehicle primary shutdown systems shall be compatible with the system utilized at the loading rack.

5.1.12.3 The automatic secondary shutoff control shall not be used for normal filling control.

5.1.12.4 New and existing loading systems shall comply with 5.1.12.1 through 5.1.12.3 within 5 years of the effective date of this edition.

5.1.13 Fuel Servicing Hydrants, Pits, and Cabinets.

5.1.13.1 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.

5.1.13.2 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).

5.2 Operations.

5.2.1* Security. Access to fuel storage and fuel vehicle loading areas shall be secured.

5.2.2 Personnel. (Reserved)

5.2.3 Prevention and Control of Spills. (Reserved)

5.2.4 Emergency Fuel Shutoff. (Reserved)

5.2.5 Bonding. (Reserved)

5.2.6 Control of Fuel Flow. If a wireless deadman control is used, the operator shall be located at the fueling point during the fueling operation.

5.2.7 Fire Protection. During fueling operations, fire extinguishers shall be available on aircraft servicing ramps or aprons, in accordance with NFPA 410.

5.2.8 Maintenance. (Reserved)

5.2.9 Aircraft Fueling Hose. (Reserved)

Chapter 6 Airport Fueling Vehicles

6.1 Design and Construction.

6.1.1 General Requirements.

6.1.1.1 Aircraft fuel servicing tank vehicles that are operated on public roadways shall comply with the requirements of NFPA 385.

6.1.1.2 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.

6.1.1.3 Magnesium shall not be used in the construction of any portion of an aircraft fuel servicing vehicle or cart.

6.1.1.4 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.

6.1.2 Tanks.

6.1.2.1 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.

6.1.2.2 Cargo tanks shall be constructed in accordance with 49 CFR 178.345, DOT 406, or other equivalent standard for international application.

6.1.2.3 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 E-GM50A (5356 alloy) in accordance with AWS A5.10.

6.1.2.4 Tank outlets shall be of substantial construction.

6.1.2.5 Tank outlets shall be attached securely to the tank.

6.1.2.6 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).

6.1.2.6.1 The cross-sectional area of each baffle shall be not less than 80 percent of the cross-sectional area of the tank.

6.1.2.6.2 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.

6.1.2.7 Venting shall be in accordance with 49 CFR, DOT 406.

6.1.2.8 Cargo draw-off valves or faucets projecting beyond the frame of a tank vehicle shall be protected against damage.

6.1.2.9 Fill Openings and Top Flashings.

6.1.2.9.1 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 spillage or leakage from overturn and to prevent water entry.

6.1.2.9.2 Dome covers shall automatically close and latch with the forward motion of the vehicle.

6.1.2.9.3 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.

6.1.2.9.4 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.

6.1.2.9.5 Overturn protection shall be braced adequately to prevent collapse.

6.1.2.9.6 Overturn protection shall be designed to channel rainwater, snow, or fuel to the exterior of the cargo tank and away from vehicle exhaust components.

6.1.2.10 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.

6.1.2.10.1 Tanks shall be substantially protected by their location.

6.1.2.10.2 Fill pipes shall not project beyond the vehicle profile.

6.1.2.10.3 Tanks and containers shall vent away from sources of ignition during filling.

6.1.2.10.4 Any arrangement not protected by location shall be listed for such use.

6.1.2.10.5 The fuel tank arrangement shall allow for drainage without the tank's removal from its mountings.

6.1.2.11 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 tanks are compartmented) for a period of at least 5 minutes.

6.1.2.11.1 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.

6.1.2.11.2 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.

6.1.2.11.3 Any leakage discovered by either of the methods described in 6.1.2.11.1 and 6.1.2.11.2, or by any other method, shall be considered evidence of failure to meet these requirements.

6.1.3 Pumps and Piping System.

6.1.3.1 All portions of the flammable liquid feed system shall be constructed and located to minimize the fire hazard.

6.1.3.2 Piping and plumbing shall be made of materials not adversely affected by the fluid or by other materials likely to be encountered.

6.1.3.3 Piping and plumbing shall be of adequate strength for the purpose.

6.1.3.4 Piping and plumbing shall be secured to avoid chafing or undue vibration.

6.1.3.5 Piping and plumbing shall be supported adequately.

6.1.3.6 Product piping shall be metal and rated for the system working pressure or at least 1030 kPa (150 psi), whichever is greater.

6.1.3.7 Except as provided in 6.1.3.8, all joints shall be welded.

6.1.3.8 Flanged connections or approved couplings shall be provided to avoid the need for cutting and welding where components are serviced or replaced.

6.1.3.9 Gaskets in flanged connections shall be of a material and design that resist fire exposure for a time comparable to the flange and bolts.

6.1.3.10 Gravity feed systems shall not be used.

6.1.3.11 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.

6.1.3.11.1 Hose connections shall be permitted to be plugged during this test.

6.1.3.12 Loading System.

6.1.3.12.1 Top Loading.

6.1.3.12.1.1 Drop tubes shall be used.

6.1.3.12.1.2 Splash filling shall be prohibited.

6.1.3.12.1.3 Drop tubes used in top loading or overhead loading of tank vehicles shall be designed to minimize turbulence.

6.1.3.12.1.4 Drop tubes shall be metallic.

6.1.3.12.1.5 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.

6.1.3.12.2 Bottom Loading.

6.1.3.12.2.1 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.

6.1.3.12.2.2 It shall not be possible to disconnect the hose coupler from the tank vehicle until the coupler valve is fully closed.

6.1.3.12.2.3* 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.

6.1.3.12.2.4 A float-actuated shutoff or other automatic sensing device shall be provided to close the bottom-loading valve when the tank is filled.

6.1.3.12.2.5 Any liquid bled from a sensing device during loading shall be piped to the bottom of the cargo tank.

6.1.3.12.2.6 The fill pipe and valving on bottom-loaded tank vehicles shall be arranged to prevent fuel spray and turbulence in the cargo tank.

6.1.3.12.2.7 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 5.1.12.

6.1.3.12.2.8 The cargo tank vehicle shall be equipped with an automatic secondary shutdown system that stops the tank loading operation when the tank is full.

6.1.3.12.2.9 The automatic secondary shutoff control shall not be used for normal filling control.

6.1.3.13 Each outlet valve shall be provided with a fusible device that causes the valve to close automatically in case of fire.

6.1.3.14 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.

6.1.3.15 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.

6.1.3.15.1 Unless the valves required in 6.1.3.15 are located inside the tank, they shall be equipped with a shear section as described in 6.1.3.14.

6.1.3.16 The operating mechanism for each tank outlet valve shall be adjacent to the fuel delivery system operating controls.

6.1.3.16.1 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.

6.1.3.16.2 A means shall be provided to assure proper operation.

6.1.4 Hose and Nozzles. (Reserved)

6.1.5 Bonding.

6.1.5.1 All metallic components and vehicle or cart chassis shall be electrically bonded to prevent a difference in their electrostatic potential.

6.1.5.2 Such bonding shall be inherent to the installation or by physical application of a suitable bonding mechanism.

6.1.5.3 A provision shall be provided on the vehicle to bond the tank to a fill pipe or loading rack as specified in 6.2.11.10.1.

6.1.5.4 Cables shall be provided on the vehicle or cart to allow the bonding operations specified in 4.2.5.

6.1.6 Electrical System.

6.1.6.1 Battery Compartments. Batteries that are not in engine compartments shall be securely mounted in compartments to prevent accidental arcing.

6.1.6.1.1 The compartment shall be separate from fueling equipment.

6.1.6.1.2 Suitable shielding shall be provided to drain possible fuel spillage or leakage away from the compartment.

6.1.6.1.3 The compartment shall be provided with a vent at the top of the compartment.

6.1.6.2 Wiring. Wiring shall be of adequate size to provide the required current-carrying capacity and mechanical strength.

6.1.6.2.1 Wiring shall be installed to provide protection from physical damage and from contact with spilled fuel either by its location or by enclosing it in metal conduit or other oil-resistant protective covering.

6.1.6.2.2 All circuits shall have overcurrent protection.

6.1.6.2.3 Junction boxes shall be weatherproofed.

6.1.6.2.4 The vehicle shall be equipped with a battery disconnect switch.

6.1.6.3 Spark plugs and other exposed terminal connections shall be insulated to prevent sparking in the event of contact with conductive materials.

6.1.6.4* 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.

6.1.6.5 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.

6.1.6.6 Lamps, switching devices, and electronic controls, other than those covered in 6.1.6.4 and 6.1.6.5, shall be of the enclosed, gasketed, weatherproof type.

6.1.6.7 Other electrical components not covered in 6.1.6.4 through 6.1.6.6 shall be of a type listed for use in accordance with *NFPA 70*, Class I, Division 2, Group D locations.

6.1.6.8 Electronic equipment shall not be installed in compartments with other equipment that can produce flammable vapors, unless permitted by *NFPA 70*.

6.1.6.9 Tractor Trailer Wiring. Electrical service wiring between a tractor and trailer shall be designed for heavy-duty service.

6.1.6.9.1 The connector shall be of the positive-engaging type.

6.1.6.9.2 The trailer receptacle shall be mounted securely.

6.1.7 Control of Fuel Flow.

6.1.7.1* The valve that controls the flow of fuel to an aircraft shall have a deadman control.

6.1.7.2 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

6.1.7.3 Deadman controls shall be designed to preclude defeating their intended purpose.

6.1.7.4 Pressure Fuel Servicing System Controls.

6.1.7.4.1 The system shall be designed to minimize surge pressure.

6.1.7.4.2* The overshoot shall not exceed 5 percent of actual flow rate in L/min (gal/min) at the time the deadman is released.

6.1.7.4.3 The control valve shall be located and designed so that it will not be rendered inoperative by a surface accident, power failure, or spill.

6.1.7.4.4 The control valve shall be fail-safe by closing completely in the event of control power loss.

6.1.7.5 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 6.1.7.1 are arranged to be normally closed and to open only when the brakes are set and the pump is engaged.

6.1.7.6 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.

6.1.8 Filters and Ancillary Equipment.

6.1.8.1 Cabinets.

6.1.8.1.1 All cabinets, other than those housing electronic equipment, shall be vented to prevent the accumulation of fuel vapors. *(See 6.1.6.)*

6.1.8.1.2 All cabinets, other than those housing electronic equipment, shall be constructed of noncombustible materials. *(See 6.1.6.)*

6.1.8.2 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.

6.1.9 Emergency Fuel Shutoff Systems.

6.1.9.1 The vehicle shall have at least two emergency shutoff controls, one mounted on each side of the vehicle.

6.1.9.2 The emergency fuel shutoff controls shall be quick-acting to close the outlet valve in case of emergency.

6.1.9.3 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.

6.1.9.4 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.

6.1.10 Fire Protection.

6.1.10.1 Each aircraft fuel servicing tank vehicle shall have two listed fire extinguishers, each having a rating of at least 40-B:C and a minimum capacity of 9.0 kg (20 lb) of dry chemical agent, with one extinguisher mounted on each side of the vehicle.

6.1.10.2 One listed fire extinguisher having a rating of at least 40-B:C and a minimum capacity of 9.0 kg (20 lb) of dry chemical agent shall be installed on each hydrant fuel servicing vehicle or cart.

6.1.10.3 Extinguishers shall be readily accessible from the ground.

6.1.10.4 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.

6.1.10.5 Extinguishers shall be kept clear of elements such as ice and snow.

6.1.10.6 Extinguishers located in enclosed compartments shall be readily accessible.

6.1.10.7 The locations of extinguishers in enclosed compartments shall be marked clearly in letters of a contrasting color at least 50 mm (2 in.) high.

6.1.10.8 Smoking Equipment.

6.1.10.8.1* Smoking equipment, such as cigarette lighter elements and ashtrays, shall not be provided.

6.1.10.8.2 If a vehicle includes smoking equipment, it shall be removed or rendered inoperable.

6.1.10.8.3 Subsection 6.1.10.8.2 shall be retroactive to existing vehicles.

6.1.11 Marking and Labeling.

6.1.11.1 Aircraft fueling vehicles shall be marked with the name of the operator or the responsible organization.

6.1.11.2 The marking shall be approved, legible signs on both sides of the exterior of the vehicle.

6.1.11.3 Signage. Each aircraft fuel servicing vehicle or cart shall have a signage viewable from all sides of the vehicle.

6.1.11.3.1 Signs shall have letters at least 75 mm (3 in.) high.

6.1.11.3.2 Signs shall be of a color contrasting sharply with the sign background for visibility.

6.1.11.3.3 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.

6.1.11.4 Emergency Fuel Shutoff Signs.

6.1.11.4.1 Each emergency fuel shutoff station location shall be placarded EMERGENCY FUEL SHUTOFF in letters at least 50 mm (2 in.) high.

6.1.11.4.2 The method of operation shall be indicated by an arrow or by the word PUSH or PULL, as appropriate.

6.1.11.4.3 Any action necessary to gain access to the shutoff device (e.g., BREAK GLASS) shall be shown clearly.

6.1.11.4.4 Lettering shall be of a color contrasting sharply with the placard background for visibility.

6.1.11.4.5 Placards shall be weather resistant.

6.1.11.5 A "NO SMOKING" sign shall be posted prominently in the cab of every aircraft fuel servicing vehicle.

6.1.11.6 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.

6.1.12 Drive Train.

6.1.12.1 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.

6.1.12.2 The engine air intake shall retain the manufacturer's configuration to prevent the emission of flame in case of backfiring.

6.1.12.3 Where provided, the sediment bowl in the fuel supply line shall be of steel or material of equivalent fire resistance.

6.1.12.4 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.

6.1.12.5 All full trailers and semitrailers, including tow carts with a GVWR under 1360 kg (3000 lb), shall be equipped with parking brakes.

6.1.12.6 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.

6.1.12.7 The vehicle shall have a means to override the system or device required by 6.1.12.6 so that the vehicle can be moved during an emergency.

6.1.12.7.1 The override control shall be clearly marked and accessible.

6.1.12.7.2 A light to indicate activation of the override shall be located in the cabin and visible outside.

6.1.12.7.3 The override control shall be secured in the normal position with a breakaway seal.

6.1.12.7.4 The override control shall deactivate the fueling system.

6.1.13 Exhaust System.

6.1.13.1* 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

6.1.13.2 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.

6.1.13.3 Suitable shielding shall be provided to drain possible fuel spillage or leakage away from exhaust system components safely.

6.1.13.3.1 Diesel particulate filter (DPF) regeneration system piping shall be shielded from the engine discharge manifold to the outlet at the tailpipe.

6.1.13.3.2 DPF regeneration–equipped vehicles shall have a listed diffuser installed at the outlet of the exhaust tailpipe.

6.1.13.4 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.

6.1.13.4.1 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.

6.1.13.5 A muffler (or silencer) cutout shall not be provided.

6.1.13.6 Carbureted gasoline-powered engines on fuel servicing vehicles shall be provided with flame- and spark-arresting exhaust systems.

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

6.2 Operations.

6.2.1 Security.

6.2.1.1 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

6.2.1.2 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

6.2.1.3* The authority having jurisdiction shall determine the suitability of tunnels, enclosed roadways, or other limited access areas for use by fuel servicing vehicles.

6.2.2 Training. (Reserved)

6.2.3 Prevention and Control of Spills. (Reserved)

6.2.4 Emergency Fuel Shutoff. (Reserved)

6.2.5 Bonding. (Reserved)

6.2.6 Control of Fuel Flow.

6.2.6.1 The fueling operator shall monitor the fueling operation.

6.2.6.2 During overwing fueling, the operator shall monitor the fill port.

6.2.7 Fire Protection. (Reserved)

6.2.8 Maintenance.

6.2.8.1 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.

6.2.8.2 Leaking vehicles or carts shall be removed from service, defueled, and parked in a safe area until repaired.

6.2.8.3 Maintenance and servicing of aircraft fuel servicing vehicles and carts shall be performed outdoors or in a building approved for the purpose.

6.2.8.4 At least monthly the operator shall perform a check to ensure complete closure of the bottom-loading valve on the tank vehicle.

6.2.9 Aircraft Fueling Hose. (Reserved)

6.2.10 Exhaust System.

6.2.10.1 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.

6.2.10.2 DPF regeneration shall be performed only in area(s) designated by the authority having jurisdiction.

6.2.10.3 DPF regeneration shall not be performed within 30 m (100 ft) of any aircraft refueling operations.

6.2.10.4* Vehicle Regeneration Area.

6.2.10.4.1 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.

6.2.10.4.2 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.

6.2.10.4.3 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.

6.2.10.5 The regeneration cycle shall be performed only by trained personnel, who shall remain with the vehicle until the regeneration cycle is complete.

6.2.10.6 The vehicle shall be visually inspected for any signs of fluid leaks under or around the vehicle before regeneration is initiated.

6.2.10.7 DPF regeneration shall not be initiated if there are any signs of any fluid leaks on or beneath the vehicle.

6.2.10.8 Once a regeneration cycle is started, it shall be completed without interruption.

6.2.10.9 After the regeneration process is successfully completed, the vehicle shall be permitted to return to normal service.

6.2.10.10 Problems occurring during the regeneration cycle shall be corrected prior to the vehicle returning to normal service.

6.2.10.11 Aircraft refueling operations shall not be initiated if the regenerative system indicates regeneration is required.

6.2.11 Loading and Unloading.

6.2.11.1 Aircraft fuel servicing tank vehicles shall be loaded only at an approved loading rack.

6.2.11.2 Aircraft fuel servicing tank vehicles shall not be loaded from a hydrant pit, unless permitted by the authority having jurisdiction under emergency circumstances.

6.2.11.3 Filling of the vehicle cargo tank shall be under the observation and control of a qualified and authorized operator at all times.

6.2.11.4 The required deadman and automatic overfill controls shall be in normal operating condition during the filling operation.

6.2.11.5 The controls shall not be blocked open or otherwise bypassed.

6.2.11.6 The engine of the tank vehicle shall be shut off before starting to fill the tank.

6.2.11.7 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.

6.2.11.7.1 No cargo tank or compartment shall be loaded above the rated net capacity, as specified by the manufacturer's data plate.

6.2.11.7.2 Space for thermal expansion, in no case less than 3 percent of the tank volume, shall be provided to prevent leakage.

6.2.11.8 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.

6.2.11.8.1 Delivery hose, when attached to a tank vehicle, shall be considered to be a part of the tank vehicle.

6.2.11.9 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.

6.2.11.10 Top Loading.

6.2.11.10.1 Where loading tank trucks through open domes, a bond shall be established between the loading piping and the cargo tank to equalize potentials.

6.2.11.10.2 The bond connection shall be made before the dome is opened and shall be removed only after the dome is closed.

6.2.11.10.3 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.

6.2.11.10.4 Splash filling shall be prohibited.

6.2.11.10.5 The flow rate into the tanks shall not exceed 25 percent of the maximum flow until the outlet is fully covered.

6.2.11.10.6 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.

6.2.11.10.7 The level in the tank shall be visually monitored at all times during top loading.

6.2.11.11 Bottom Loading.

6.2.11.11.1 A bonding connection shall be made between the cargo tank and the loading rack before any fuel connections are made and shall remain in place throughout the loading operation.

6.2.11.11.2 The operator shall initiate fuel flow by means of a deadman control device.

6.2.11.11.3 The operator shall ensure that the automatic high-level shutoff system is functioning properly for each compartment shortly after flow has been initiated.

6.2.12 Positioning of Aircraft Fuel Servicing Vehicles and Carts During Fueling.

6.2.12.1 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.

6.2.12.2 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.

6.2.12.3 Aircraft fuel servicing vehicles or carts shall not be positioned within a 3 m (10 ft) radius of aircraft fuel system vent openings.

6.2.12.4 Parking brakes and chocks shall be set on all fuel servicing vehicles or carts before operators begin the fueling operation.

6.2.12.5 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.

Chapter 7 Rooftop Heliports

7.1 Design and Construction.

7.1.1 General Requirements.

7.1.1.1 System Design and Approval.

7.1.1.1.1 Fueling on rooftop heliports shall be permitted only where approved by the authority having jurisdiction.

7.1.1.1.2 In addition to the special requirements in this chapter, the heliport shall comply with the requirements of NFPA 418.

7.1.1.1.3 Facilities for dispensing fuel with a flash point below 37.8°C (100°F) shall not be permitted at any rooftop heliport.

7.1.1.1.4 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.

7.1.1.1.5 The entire system shall be designed so that no part of the system is subjected to pressure above its working pressure.

7.1.2 Fuel Storage Tanks.

7.1.2.1 Fuel storage tanks and components shall comply with the requirements of NFPA 30.

7.1.2.2 The fuel storage system shall be located at or below ground level.

7.1.3 Pumps and Piping Systems.

7.1.3.1 Pumps and piping systems shall comply with the requirements of NFPA 30.

7.1.3.2 Pumps shall be located at or below ground level.

7.1.3.3 Relay pumping shall not be permitted.

7.1.3.4 Pumps installed outside of buildings shall be located not less than 1.5 m (5 ft) from any building opening.

7.1.3.5 Pumps shall be anchored and protected against physical damage from collision.

7.1.3.6 Pumps installed within a building shall be in a separate room with no opening into other portions of the building.

7.1.3.7 The pump room shall be adequately ventilated.

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

7.1.3.9 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.

7.1.3.9.1 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.

7.1.3.9.2 All pipe casings, ducts, and chases shall be drained.

7.1.3.10 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.

7.1.3.11 An isolation valve shall be installed on the suction and discharge piping of each pump.

7.1.3.12 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.

7.1.3.13 Piping within buildings shall comply with 5.1.3.3.

7.1.4 Hose and Nozzles. (Reserved)

7.1.5 Electrostatic Bonding. (Reserved)

7.1.6 Electrical Systems. (Reserved)

7.1.7 Control of Fuel Flow. (Reserved)

7.1.8 Filters and Ancillary Equipment. (Reserved)

7.1.9 Emergency Fuel Shutoff Systems.

7.1.9.1 At least two emergency fuel shutoff stations located on opposite sides of the heliport at exitways or at similar locations shall be provided.

7.1.9.2 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).

7.1.10 Fire Protection. Fire protection shall conform to the requirements of NFPA 418.

7.1.11 Marking and Labeling. (Reserved)

7.2 Operations.

7.2.1 Security. (Reserved)

7.2.2 Personnel. All heliport personnel shall be trained in the use of the available fire extinguishers and fixed extinguishing systems.

7.2.3 Prevention and Control of Spills. (Reserved)

7.2.4 Emergency Fuel Shutoff. All heliport personnel shall be trained in the operation of emergency fuel shutoff controls.

7.2.5 Bonding. (Reserved)

7.2.6 Monitoring of Fuel Flow. (Reserved)

7.2.7 Fire Protection. (Reserved)

7.2.8 Maintenance. (Reserved)

7.2.9 Aircraft Fueling Hose. (Reserved)

Chapter 8 Self-Service Aircraft Fueling

8.1 Design and Construction.

8.1.1 General Requirements.

8.1.1.1 System Design and Approval. Self-service fueling shall be permitted, subject to the approval of the authority having jurisdiction.

8.1.1.2 Dispensing devices shall be located on an island to protect against collision damage or shall be protected with pipe bollards or other approved protection.

8.1.2 Fuel Storage Tanks. In addition to the special requirements of this chapter, the fuel storage system shall comply with the requirements of NFPA 30.

8.1.3 Pumps and Piping Systems.

8.1.3.1 In addition to the special requirements of this chapter, the piping and dispensing system shall comply with the requirements of NFPA 30.

8.1.3.2 Listed or approved dispensing devices shall be used.

8.1.4 Hose and Nozzles. (Reserved)

8.1.5 Electrostatic Bonding. (Reserved)

8.1.6 Electrical Systems. (Reserved)

8.1.7 Control of Fuel Flow. (Reserved)

8.1.8 Filters and Ancillary Equipment. (Reserved)

8.1.9 Emergency Fuel Shutoff Systems.

8.1.9.1 The controls shall be designed to allow only authorized personnel to reset the system after an emergency fuel shutoff.

8.1.9.2 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.

8.1.9.3 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.

8.1.9.4 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.

8.1.9.5 The emergency shutoff valve also shall incorporate a shear section that automatically shuts off the flow of fuel due to severe impact.

8.1.9.6 The emergency shutoff valve shall be rigidly mounted at the base of the dispenser in accordance with the manufacturer's instructions.

8.1.10 Fire Protection.

8.1.10.1 Each facility shall have a minimum of one fire extinguisher with a rating of at least 40-B:C and a minimum capacity of 9.0 kg (20 lb) of dry chemical agent located at the dispenser.

8.1.10.2 At least one fire extinguisher with a rating of at least 40-B:C and a minimum capacity of 9.0 kg (20 lb) of dry chemical agent shall be provided at each emergency fuel shutoff control.

8.1.11 Marking and Labeling.

8.1.11.1 Emergency instructions shall be conspicuously posted in the dispensing area and at the emergency fuel shutoff control.

8.1.11.2 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).

8.1.11.3 Operating Instructions. Operating instructions shall be posted.

8.1.11.4 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

8.2 Operations.

8.2.1 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.

8.2.2 Training. (Reserved)

8.2.3 Prevention and Control of Spills. (Reserved)

8.2.4 Emergency Fuel Shutoff. (Reserved)

8.2.5 Bonding. (Reserved)

8.2.6 Monitoring of Fuel Flow. (Reserved)

8.2.7 Fire Protection. (Reserved)

8.2.8 Maintenance. (Reserved)

8.2.9 Occupancy. The aircraft shall not be occupied during self-service fueling.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.1.2 Additional guidance can be obtained from other documents, including, but not limited to: A4A Spec 103, ASTM MNL5, API 607, API RP 1595, API RP 2003, EI 1529, EI 1540, EI 1550, EI 1581, EI 1583, EI 1590, EI 1596, JIG 4, NATA *Refueling and Quality Control Procedures for Airport Service and Support Operations*, NIST Handbook 44, PEI RP-1300, PEI RP100, PEI RP200, PEI RP800, OSHA regulations in 29 CFR, FAA AC-150-5230, and/or EPA regulations in 112 (Oil Pollution Prevention) and 280 (Underground Tanks).

A.1.2 Aircraft fuel servicing involves the transfer of a flammable or combustible liquid fuel between a bulk storage system and the fuel tanks of an aircraft. It includes both fueling and defueling. The transfer is usually accomplished by using a tank vehicle, a hydrant vehicle, a hydrant cart, a fuel servicing cabinet, or a fueling pit. Drums and pumps sometimes are used. The movement of the fuel through the pumps, piping, and filters of the transfer system causes the fuel to be charged electrostatically. If the charge on the fuel is sufficiently high when it arrives at the fuel tank, a static spark could occur that can ignite the fuel vapor.

During overwing fueling, the fuel is discharged into an opening in the aircraft fuel tank using a hose with a hand-held nozzle. The flow and splashing of fuel causes the generation of static electricity and the production of flammable mists and vapors. Top loading of tank vehicles creates similar hazards.

Underwing servicing, hydrant servicing, and bottom loading of tank vehicles use hoses or flexible connections of metal tubing or piping, as well as devices to allow temporary connection of fuel transfer lines. These methods minimize the charge generation and misting hazards associated with overwing fueling and top loading.

Other potential sources of ignition that could present a hazard during aircraft fuel servicing include the following:

(1) Operating aircraft engines, auxiliary power units, and heaters
(2) Operating automotive or other internal combustion engine servicing equipment in the vicinity
(3) Arcing of electrical circuits
(4) Open flames
(5) Energy from energized radar equipment
(6) Lightning

The autoignition temperatures of turbine fuels *(see Annex B)* are such that the residual heat of aircraft turbine engines after shutdown or the residual heat of turbine aircraft brakes following hard use can ignite such fuels if they are spilled or sprayed on these surfaces before they have cooled below the autoignition temperatures of the fuels.

Aircraft fuel tank vents usually are located some distance above ground level. Under normal conditions, fuel vapors from the vents are quickly dissipated and diluted safely. Fuel spilling from the vents of an overfilled tank is a much more serious hazard. Spills resulting from leaks or equipment failure also are a hazard.

Fire prevention measures in aircraft fuel servicing are directed principally toward the following:

(1) Prevention of fuel spillage
(2) Elimination or control of potential ignition sources

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.8 Aviation Fuel. See Annex B.

A.3.3.11 Cargo Tank. The term *cargo tank* does not apply to any container used solely for the purpose of supplying fuel for the propulsion of the vehicle on which it is mounted.

A.3.3.16 Fuel Servicing Station. This unit can be installed in a cabinet above or below ground.

A.4.1.4 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).

EI 1529 deals with all aspects of hose safety, including the couplings that are acceptable.

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.

A.4.1.4.3.6 Splicing of a hose with couplings alters the design bend radius of the hose, creating two kinks when the hose is wound on a drum.

A.4.1.5.9 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.

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.)

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.

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.

Additionally, the inlet system of most aircraft tanks directs fuel toward the bottom of the tank to avoid splashing that generates more charge. Finally, while the hoses that connect the fueler to the aircraft provide only a few seconds of residence time for charge relaxation at high rates of flow, the actual relaxation volume in the system is significantly greater where a coated screen is used as a second stage water barrier. In this case, the vessel's volume after the first stage filter coalescer could represent an additional 15 seconds of residence time for charge relaxation. (The coated screen, unlike other water barriers, does not generate charge.)

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.

A.4.1.10.1 Carbon dioxide extinguishers should not be selected due to their limited range and effectiveness in windy conditions.

A.4.1.10.3 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.

A.4.1.12.2 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.

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.

Airport surface detection radar operates under a peak power output of 50 kW. It is fixed rather than airborne equipment.

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.

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.

A.4.2.2.1 Records should be kept of personnel training. These records should be made available to the authority having jurisdiction upon request.

A.4.2.2.2 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.

A.4.2.3 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 should be taken as necessary before it is returned to normal operational service.
(2) The airport fire crew should be notified if the spill presents a fire hazard. The only routine exceptions are for small spills. Supervisory personnel should be notified to ensure that operations in progress can be continued safely or halted until the emergency is past and that corrective measures can be taken to prevent recurrence of a similar accident.
(3) It could be necessary to evacuate the aircraft if the spill poses a serious fire exposure to the aircraft or its occupants. Walking through the liquid area of the fuel spill should not be permitted. Persons who have been sprayed with fuel or had their clothing soaked with fuel should go to a place of refuge, remove their clothing, and wash. Individuals whose clothing has been ignited should be wrapped in blankets, coats, or other items or should be told to or forced to roll on the ground.
(4) Mobile fueling equipment and all other mobile equipment should be withdrawn from the area or left as is until the spilled fuel is removed or made safe. No fixed rule can be made as fire safety varies with circumstances. Shutting down equipment or moving vehicles can provide a source of ignition if no fire immediately results from the spillage.
(5) Aircraft, automotive, or spark-producing equipment in the area should not be started before the spilled fuel is removed or made safe. If a vehicle or cart engine is running at the time of the spill, it normally is good practice to drive the vehicle away from the hazard area unless the hazard to personnel is judged too severe. Fuel servicing vehicles or carts in operation at the time of the spill should not be moved until a check is made to verify that any fuel hose that could have been in use or connected between the vehicle and the aircraft is safely stowed.
(6) If any aircraft engine is operating at the time of the spill, it normally is good practice to move the aircraft away from the hazard area unless air currents set up by operating power plants would aggravate the extent or the nature of the existing vapor hazard.
(7) If circumstances dictate that operating internal combustion engine equipment within a spill area that has not ignited should be shut down, engine speeds should be reduced to idle prior to cutting ignition in order to prevent backfire.

(8) The volatility of the fuel can be a major factor in the initial severity of the hazard created by a spill. Gasoline and other low flash point fuels at normal temperatures and pressures produce vapors that are capable of forming ignitable mixtures with the air near the surface of the liquid, whereas this condition does not normally exist with kerosene fuels (JET A or JET A-1) except where ambient temperatures are 38°C (100°F) or above or where the liquid has been heated to a similar temperature.

(9) Spills of gasoline and low flash point turbine fuels (JET B) greater than 3 m (10 ft) in any dimension and covering an area of over 5 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.

A.4.2.5 Hydrocarbon fuels, such as aviation gasoline and JET A, generate electrostatic charge when passing through the pumps, filters, and piping of a fuel transfer system. (The primary electrostatic generator is the filter/separator that increases the level of charge on a fuel by a factor of 100 or more as compared with pipe flow.) Splashing, spraying, or 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).

The amount of charge on a fuel when it arrives at the receiving tank, and hence its tendency to cause a spark discharge, depends on the nature and amount of impurities in the fuel, its electrical conductivity, the nature of the filter media (if present), and the relaxation time of the system [i.e., the residence time of the fuel in the system between the filter (separator) and the receiving tank]. The time needed for this charge to dissipate is dependent upon the conductivity of the fuels; it could be a fraction of a second or several minutes.

No amount of bonding or grounding prevents discharges from occurring inside a fuel tank. Bonding ensures that the fueling equipment and the receiving tank (aircraft or fueler) are at the same potential and provides a path for the charges separated in the fuel transfer system (primarily the filter/separator) to combine with and neutralize the charges in the fuel. Also, in overwing fueling and in top loading of cargo tanks, bonding ensures that the fuel nozzle or the fill pipe is at the same potential as the receiving tank, so that a spark does not occur when the nozzle or fill pipe is inserted into the tank opening. For this reason, the bonding wire has to be connected before the tank is opened.

Grounding during aircraft fueling or fuel servicing vehicle loading is no longer required because of the following:

(1) Grounding does not prevent sparking at the fuel surface *(see NFPA 77)*.
(2) Grounding is not required by NFPA 77.
(3) The static wire might not be able to conduct the current in the event of an electrical fault in the ground support equipment connected to the aircraft and could constitute an ignition source if the wire fuses. If ground support equipment is connected to the aircraft or if other operations are being conducted that necessitate electrical earthing, separate connections should be made for this purpose. Static electrical grounding points can have high resistance and, therefore, are unsuitable for grounding. For a more complete discussion of static electricity in fuels, see NFPA 77.

A.4.2.5.3.1 Ordinary plastic funnels or other nonconducting materials can increase static generation. The use of chamois as a filter is extremely hazardous.

A.4.2.7.1 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.

A.4.2.7.2 During inclement weather, extinguishers not in enclosed compartments can be permitted to be protected by canvas or plastic covers.

A.4.2.9 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

A.4.2.9.5.1 Particular attention should be paid to the 305 mm (12 in.) adjacent to the couplings. These areas are prone to premature failure.

A.4.2.10 Establishing precise rules for fueling is impossible when the electrical storms are in the vicinity of the airport. The distance of the storm from the airport, the direction in which it is traveling, and its intensity are all factors to be weighed in making the decision to suspend fueling operations temporarily. Experience and good judgment are the best guides. Sound travels approximately 322 m/sec (1⁄5 mi/sec). The approximate number of miles to the storm can be determined by counting the seconds between a flash of lightning and the sound of thunder and dividing by 5.

A.4.2.11.1.3 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.

A.4.2.12.1 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.

A.4.2.12.1.2 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.

A.4.2.12.1.5 For further information on intrinsically safe apparatus, see ANSI/UL 913, FM Class 3610, or ANSI/UL 60079-11.

A.5.1.2.1 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.

A.5.1.3.10.2 It is expected that some joints may leak under fire exposure; however, the joint itself should not come apart.

A.5.1.3.14 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.5.1.3.14)*:

(1) At each storage tank
(2) At each pump
(3) At each filter separator
(4) At each hydrant or on each hydrant lateral
(5) At each flow regulator or pressure control valve

A.5.1.3.17 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

A.5.1.7.1 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.

A.5.1.7.2.2 The overshoot of pressure control release, V_{max}, should be calculated by the following equation:

[A.5.1.7.2.2]

$$V_{max} = Q \times 1 \text{ min} \times 0.05$$

where:
Q = actual fuel flow rate, L/min (gal/min)

Example

If the actual fuel flow rate at the time of deadman control release is 1500 L/min (400 gpm), total overshoot must not exceed 75 L/min (20 gal/min).

A.5.1.7.3 Hydrant valves and couplers should be in accordance with EI 1584.

A.5.1.7.5 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.

A.5.1.9.4 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 should include a valve or valves located as close to the tank as practicable.

A.5.1.9.6 The operation of the emergency shutoff control should sound an alarm at the airport fire crew station and at the fuel storage facility.

A.5.2.1 The airport perimeter fence can be sufficient to meet this requirement.

A.6.1.3.12.2.3 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.

A.6.1.6.4 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.

A.6.1.7.1 See A.5.1.7.1.

A.6.1.7.4.2 See A.5.1.7.2.2.

A.6.1.10.8.1 It is not the intent of 6.1.10.8.1 to prohibit 12 V power outlets. The intent is to prohibit glowing elements.

A.6.1.13.1 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.).

A.6.1.13.7 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 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.

A.6.2.1.3 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

A.6.2.10.4 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.

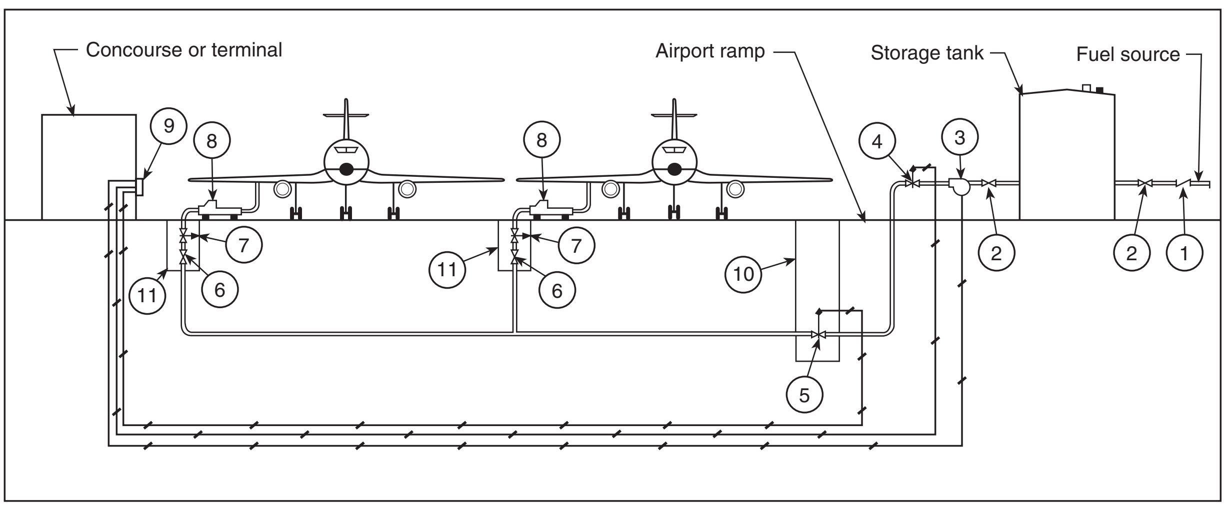
Annex B Aviation Fuel

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

B.1 General. The fire hazard properties of aviation fuels are best described by analyzing the factors described in B.2 and B.3.

B.2 Susceptibility to or Ease of Ignition.

B.2.1 Flash Point. The flash point of standard grades of aviation gasoline has been established at approximately −46°C (−50°F) at sea level by the Tag closed-cup method. The flash point of JET B turbine fuel is not regulated by specification, but samples have been tested by the closed-cup method and have been found to be as low as −23°C (−10°F) at sea level. JET A– or kerosene-grade turbine fuels have a minimum flash point of 38°C (100°F).



Note: No dimensional relationship exists between elements in this figure. Refer to this standard; NFPA 30, *Flammable and Combustible Liquids Code*; *NFPA 70*, *National Electrical Code;* and FAA Regulations for separations and clearances.

Key:
1. Check valve at tank inlet
2. Isolation valve at tank inlet/outlet
3. Pumping system
4. Pump discharge control valve or hydrant system shutoff valve (alternate location)
5. Hydrant system shutoff valve (alternate location)
6. Hydrant shutoff valve
7. Hydrant pit valve
8. Hydrant fueling servicing vehicle
9. Emergency fuel shutoff station
10. Valve box
11. Hydrant pit

FIGURE A.5.1.3.14 Typical Fixed Airport Fueling System Isolation Valving Operating and Emergency Controls.

Aviation gasoline and JET B turbine fuels produce large volumes of vapor and are capable of forming ignitible mixtures with air even at very low temperatures. Kerosene grades of turbine fuel (JET A) do not produce ignitible mixtures with air at normal temperatures and pressures, but when a JET A turbine fuel is heated above its flash point (or exists in the form of a mist), the mixture can be ignited. This condition can develop where temperatures are 38°C (100°F) or higher.

B.2.2 Flammability Conditions. The lower limit represents the minimum concentration while the upper limit defines the maximum amount of fuel vapors in air that allows combustion. The generally accepted flammability range by volume for most gasolines is 1.4 percent to 7.6 percent. The average range for JET B turbine fuels is 1.16 percent to 7.63 percent. The average range for kerosene-grade (JET A) turbine fuels is 0.74 percent to 5.32 percent.

More significant than the strict flammability range is the temperature range in which it is possible for such flammable vapor–air mixtures to form. At sea level in a storage tank, such a temperature range for aviation gasoline is approximately −46°C to −1°C (−50°F to 30°F); for JET B turbine fuels, the range is approximately −23°C to 27°C (−10°F to 80°F); and, for kerosene-grade (JET A) turbine fuels, the range is approximately 38°C to 74°C (100°F to 165°F). It is evident that JET B turbine fuels represent the most serious practical hazard under normal temperature conditions.

Air enters as vented tanks are drained, and, during such periods, the flammable vapor conditions can change drastically. The same change occurs when the aircraft descends in altitude. These facts are important in assessing the degree of hazard that could exist in a tank containing any of these volatile products during or after such air mixing.

Under aircraft crash impact conditions where fuel mists are created following tank failures, all of the fuels are readily ignitible at essentially all ambient temperatures. Under these conditions, fuel in mist form presents a hazard equal to fuel in vapor form with respect to flammability limits.

B.2.3 Vapor Pressure. The vapor pressure of these fuels is the pressure of the vapor at any given temperature at which the vapor and liquid phases of the substance are in equilibrium in a closed container. Such pressures vary with the temperature, but, most commonly, information on hydrocarbon mixtures is obtained using the Reid method, in which the pressures are measured at 38°C (100°F) *(see ASTM D323).* The Reid vapor pressures of average grades of aviation gasoline have a range of 38 kPa to 48 kPa (5.5 psi to 7.0 psi). For JET B turbine fuels, the Reid vapor pressure range is 14 kPa to 21 kPa (2.0 psi to 3.0 psi). JET A (kerosene-grade) turbine fuels have a Reid vapor pressure range of approximately 0.7 kPa (0.1 psi).

The practical significance of this characteristic of the three grades of fuel is that the standard grades of aviation gasoline do produce flammable vapors in ignitible amounts at normal temperatures and pressures. However, where these vapors are confined, the vapor–air mixture over the liquid surface most often is too rich to be ignited by sparks, since it is above the upper flammability limit. With JET B turbine fuel, due to its relatively low vapor pressure, the vapor–air mixture above the liquid surface under normal temperature and pressure conditions frequently is within the flammability range. This means that ignition of JET B turbine fuel vapors either within or exterior to a tank can cause violent combustion within the confined space if flame enters. The JET A (kerosene-grade) turbine fuels do not produce flammable vapors in ignitible amounts unless the fuel temperature is above 38°C (100°F).

B.2.4 Autoignition Temperature. The autoignition temperature is the minimum temperature of a substance that will initiate or cause self-sustained combustion independently of any sparks or other means of ignition.

Under one set of test conditions, standard grades of aviation gasoline have ignition temperatures of approximately 449°C (840°F). Turbine fuels have ignition temperatures among the lowest found for hydrocarbons and are considerably lower than those for aviation gasoline. For example, the autoignition temperature of a JET B turbine fuel was measured using the same test procedure at approximately 249°C (480°F). A JET A (kerosene-grade) turbine fuel tested under the same method was found to have an autoignition temperature of approximately 246°C (475°F). Temperatures in this range can exist for a considerable period in turbine engines after shutdown or on brake surfaces following hard use.

It should be noted that these temperatures are derived from reproducible laboratory test procedures, whereas, in actual field conditions, these ignition temperatures could be higher.

B.2.5 Distillation Range. The initial and the end boiling points of standard grades of aviation gasoline are approximately 43°C and 163°C (110°F and 325°F), respectively. The initial boiling point of JET B turbine fuels is approximately 57°C (135°F), and the end point is approximately 252°C (485°F). The only marked difference in the distillation ranges of the three fuels under consideration occurs in the JET A or kerosene-grades of turbine fuels that have initial boiling points of approximately 163°C (325°F) and end points of approximately 300°C (572°F). Note that initial and end boiling points should be determined by ASTM D86.

The boiling range, along with the flash points and vapor pressures of the fuels, indicates the relative volatility of the fuels; the initial and end boiling points indicate the overall volatility of a fuel through its entire distillation range; the flash point and vapor pressures measure the initial tendency of the fuel to vaporize.

B.3 Fire Severity After Ignition.

B.3.1 Heat of Combustion. The net heat of combustion of gasoline normally is quoted as approximately 44.19 kJ/kg (19,000 Btu/lb). For JET B turbine fuels, the average is approximately 43.50 kJ/kg (18,700 Btu/lb), while for JET A (kerosene-grade) turbine fuels it is approximately 43.26 kJ/kg (18,600 Btu/lb).

These figures for heat of combustion clearly indicate that there is little difference in the heats of combustion for these various hydrocarbons that are of significance with regard to fire safety.

B.3.2 Rate of Flame Spread. Where fuel is spilled, there is a marked difference in the rates of flame spread over pools of JET A– or kerosene -grade turbine fuels as compared with the other two types. Under these conditions, a direct relationship exists between the rate of flame spread and the vapor pressures of the materials. A report, entitled *An Evaluation of the Relative Fire Hazards of JET A and JET B for Commercial Flight* (N74-10709) [Hacker and Hibbard, 1973], states that the rate (of flame spread) for JP-4 (JET B) is about 30 times greater than for aviation kerosene (JET A) at the temperatures most often encountered. This is an important factor in evaluating the severity of the fire hazard encountered under these conditions and also is a factor that affects the ease of fire control under similar conditions.

This slower rate of flame propagation for JET A– or kerosene-grade turbine fuels does not occur, however, where the fuel is released as a fuel mist, as frequently results in aircraft impact accidents or where the fuels are heated to or above their flash point. If a flammable or combustible liquid exists in mist form or is at a temperature above its flash point, the speed of flame spread in the mist or vapor is essentially the same, regardless of the liquid spilled.

B.4 Fire Control Factors.

B.4.1 Relative Density. The relative density of a material is commonly expressed as related to water at 16°C (60°F). All these fuels are lighter than water; the relative density of aviation gasolines is normally quoted at about 0.70, JET B turbine fuels at about 0.78, and the JET A (kerosene-grade) fuels at about 0.81.

This means that, with respect to fire control, all of the fuels float on water. This can be a handicap during fire-fighting operations under certain conditions where sizable quantities of spilled fuel are involved.

B.4.2 Solubility in Water. All three of the fuels are essentially nonsoluble in water. Fires involving all three fuels can be handled with regular foam concentrates (as opposed to alcohol types).

The amount of water that is entrained in the fuel due to water contamination is not particularly significant from a fire hazard viewpoint, except for the fact that the amount of water increases the static generation hazard of the fuel.

B.4.3 Standard Grades of Aviation Fuels. Standard grades of aviation fuels include the following:

(1) Aviation gasoline (AVGAS) includes all gasoline grades of fuel for reciprocating engine–powered aircraft of any octane rating. It has the general fire hazard characteristics of ordinary automotive gasoline (MOGAS).
(2) JET A and JET A-1 are kerosene grades of fuel for turbine engine–powered aircraft, whatever the trade name or designation. JET A has a −40°C (−40°F) freezing point (maximum); JET A-1 incorporates special low-temperature characteristics for certain operations having a −47°C (−53°F) freezing point (maximum). JP-8 (identical to JET A except for the additive package) and JP-5 (slightly less volatile than either JET A or JET A-1) are used by certain U.S. military forces. JET A and JP-8 are known in the United Kingdom and in many former U.K. areas of influence as AVTUR, whereas JP-5 is similar to the U.K.-designated AVCAT.
(3) JET B is a blend of gasoline and kerosene grades of fuel for turbine engine–powered aircraft, whatever the trade name or designation. JET B is a relatively wide boiling range volatile distillate having a –51°C (–60°F) freezing point (maximum). JP-4 is one grade of JET B fuel used by U.S. military forces; JP-4 has identical specifications to JET B as they relate to fire hazards. This fuel is known in the United Kingdom as AVTAG.

Annex C Informational References

C.1 Referenced Publications. The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

C.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 70®, *National Electrical Code*®, 2017 edition.

NFPA 77, *Recommended Practice on Static Electricity*, 2014 edition.

NFPA 415, *Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways*, 2016 edition.

C.1.2 Other Publications.

C.1.2.1 A4A Publications. Airlines for America, 1301 Pennsylvania Avenue, NW, Suite 1100, Washington, DC 20004.

Spec 103: *Standard for Jet Fuel Quality Control at Airports*, 2009.

C.1.2.2 API Publications. American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005-4070.

API RP 1595, *Design, Construction, Operation, Maintenance, and Inspection of Aviation Pre-Airfield Storage Terminals*, 2012.

API RP 2003, *Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents*, 2008.

API STD 607, *Fire Test for Quarter-Turn Valves and Valves Equipped With Nonmetallic Seats*, 2010.

C.1.2.3 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM D86, *Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure*, 2012.

ASTM D323, *Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method)*, 2008, reapproved 2014.

ASTM MNL5, *Aviation Fuel Quality Control Procedures:* 4th Edition, 2009.

C.1.2.4 CRC Publications. Coordinating Research Council Inc., 5755 North Point Parkway, Suite 265, Alpharetta, GA 30022.

CRC Report No. 583, *Aircraft and Refueler Bonding and Grounding Study*, 1993.

C.1.2.5 EI Publications. Energy Institute, 61 Cavendish Street, London W1G 7AR, UK.

EI 1529, *Aviation Fueling Hose and Hose Assemblies*, 2014.

EI 1540, *Design, Construction, Operation, and Maintenance of Aviation Fueling Facilities*, 2014.

EI 1550, *Handbook on Equipment Used for the Maintenance and Delivery of Clean Aviation Fuel*, 2014.

EI 1581, *Specification and Qualification Procedures for Aviation Jet Fuel Filter/Separators*, 2011.

EI 1583, *Laboratory Tests and Minimum Performance Levels for Aviation Fuel Filter Monitors*, 2012.

EI 1590, *Specifications and Qualification Procedures for Aviation Fuel Microfilters*, 2014.

EI 1596, *Design and Construction of Aviation Fuel Filter Vessels*, 2013.

C.1.2.6 FAA Publications. Federal Aviation Administration, U.S. Department of Transportation, Distribution Unit, M-494.3, Washington, DC 20590.

FAA AC-150-5230, *Aircraft Fuel Storage, Handling, Training, and Dispensing on Airports*, Rev 4B, 2012.

C.1.2.7 FM Publications. FM Global, 270 Central Avenue, P.O. Box 7500, Johnston, RI 02919.

FM Approval 3610, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III Division 1, Hazardous (Classified) Locations,* 2010.

C.1.2.8 Joint Inspection Group Publications. Joint Inspection Group, P.O. Box 33094, 6A Foscote Mews, London, W9 2YX United Kingdom.

JIG 4, *Guidelines for Aviation Fuel Quality Control & Operating Procedures for Smaller Airports,* 2014.

C.1.2.9 NATA Publications. National Air Transportation Association, 4226 King Street, Alexandria, VA 22302.

Refueling and Quality Control Procedures for Airport Service and Support Operations, 2011.

C.1.2.10 NIST Publications. National Institute of Standards and Technology, 100 Bureau Drive, Stop 1070, Gaithersburg, MD 20899-1070.

NIST Handbook 44, *Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices*, 2012.

C.1.2.11 NTIS Publications. National Technical Information Service, 5301 Shawnee Road, Alexandria, VA 22312.

Hacker, P.T., R. R. Hibbard, *An Evaluation of the Relative Fire Hazards of JET A and JET B for Commercial Flight* (N7410709), 1973.

C.1.2.12 PEI Publications. Petroleum Equipment Institute, 6931 S. 66th E. Ave., Suite 200, Tulsa, OK 74133.

PEI RP100, *Installation of Underground Liquid Storage Systems*, 2011.

PEI RP200, *Installation of Aboveground Storage Systems*, 2013.

PEI RP800, *Design and Installation of Bulk Storage Plants*, 2013.

PEI RP1300, *Aviation Fueling Systems*, 2013.

C.1.2.13 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 913, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III Division 1, Hazardous (Classified) Locations*, 2013.

ANSI/UL 60079-11, *Explosive Atmospheres — Part 11: Equipment Protection by Intrinsic Safety 'i'*, 2013.

C.1.2.14 U.S. Government Publications. U.S. Government Publishing Office, Washington, DC 20402.

OSHA, Title 29, Code of Federal Regulations.

EPA, Title 40, Code of Federal Regulations, Part 112, "Oil Pollution Prevention."

EPA, Title 40, Code of Federal Regulations, Part 280, "Underground Tanks."

C.1.2.15 Other Publications.

Bachman, K. C., and W. G. Dukek, *Static Electricity in Fueling Superjets,* 1972. Esso Research & Eng. Co. Brochure, Linden, NJ.

C.2 Informational References. The following documents or portions thereof are listed here as informational resources only. They are not a part of the requirements of this document.

C.2.1 API Publications. American Petroleum Institute, 1220 L Street, N.W., Washington, DC 20005-4070.

API STD 2000, *Venting Atmospheric and Low-Pressure Storage Tanks*, 2014.

C.2.2 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM D910, *Standard Specification for Aviation Gasolines*, 2013A.

ASTM D1655, *Standard Specification for Aviation Turbine Fuels*, 2014.

C.3 References for Extracts in Informational Sections. (Reserved)

Index

-A-

Sequence of Events for the Standards Development Process

Once the current edition is published, a Standard is opened for Public Input.

Step 1 – Input Stage

- Input accepted from the public or other committees for consideration to develop the First Draft
- Technical Committee holds First Draft Meeting to revise Standard (23 weeks); Technical Committee(s) with Correlating Committee (10 weeks)
- Technical Committee ballots on First Draft (12 weeks); Technical Committee(s) with Correlating Committee (11 weeks)
- Correlating Committee First Draft Meeting (9 weeks)
- Correlating Committee ballots on First Draft (5 weeks)
- First Draft Report posted on the document information page

Step 2 – Comment Stage

- Public Comments accepted on First Draft (10 weeks) following posting of First Draft Report
- If Standard does not receive Public Comments and the Technical Committee chooses not to hold a Second Draft meeting, the Standard becomes a Consent Standard and is sent directly to the Standards Council for issuance (see Step 4) or
- Technical Committee holds Second Draft Meeting (21 weeks); Technical Committee(s) with Correlating Committee (7 weeks)
- Technical Committee ballots on Second Draft (11 weeks); Technical Committee(s) with Correlating Committee (10 weeks)
- Correlating Committee Second Draft Meeting (9 weeks)
- Correlating Committee ballots on Second Draft (8 weeks)
- Second Draft Report posted on the document information page

Step 3 – NFPA Technical Meeting

- Notice of Intent to Make a Motion (NITMAM) accepted (5 weeks) following the posting of Second Draft Report
- NITMAMs are reviewed and valid motions are certified by the Motions Committee for presentation at the NFPA Technical Meeting
- NFPA membership meets each June at the NFPA Technical Meeting to act on Standards with "Certified Amending Motions" (certified NITMAMs)
- Committee(s) vote on any successful amendments to the Technical Committee Reports made by the NFPA membership at the NFPA Technical Meeting

Step 4 – Council Appeals and Issuance of Standard

- Notification of intent to file an appeal to the Standards Council on Technical Meeting action must be filed within 20 days of the NFPA Technical Meeting
- Standards Council decides, based on all evidence, whether to issue the standard or to take other action

Notes:

1. Time periods are approximate; refer to published schedules for actual dates.
2. Annual revision cycle documents with certified amending motions take approximately 101 weeks to complete.
3. Fall revision cycle documents receiving certified amending motions take approximately 141 weeks to complete.

Committee Membership Classifications[1,2,3,4]

The following classifications apply to Committee members and represent their principal interest in the activity of the Committee.

1. M *Manufacturer:* A representative of a maker or marketer of a product, assembly, or system, or portion thereof, that is affected by the standard.
2. U *User:* A representative of an entity that is subject to the provisions of the standard or that voluntarily uses the standard.
3. IM *Installer/Maintainer:* A representative of an entity that is in the business of installing or maintaining a product, assembly, or system affected by the standard.
4. L *Labor:* A labor representative or employee concerned with safety in the workplace.
5. RT *Applied Research/Testing Laboratory:* A representative of an independent testing laboratory or independent applied research organization that promulgates and/or enforces standards.
6. E *Enforcing Authority:* A representative of an agency or an organization that promulgates and/or enforces standards.
7. I *Insurance:* A representative of an insurance company, broker, agent, bureau, or inspection agency.
8. C *Consumer:* A person who is or represents the ultimate purchaser of a product, system, or service affected by the standard, but who is not included in (2).
9. SE *Special Expert:* A person not representing (1) through (8) and who has special expertise in the scope of the standard or portion thereof.

NOTE 1: "Standard" connotes code, standard, recommended practice, or guide.

NOTE 2: A representative includes an employee.

NOTE 3: While these classifications will be used by the Standards Council to achieve a balance for Technical Committees, the Standards Council may determine that new classifications of member or unique interests need representation in order to foster the best possible Committee deliberations on any project. In this connection, the Standards Council may make such appointments as it deems appropriate in the public interest, such as the classification of "Utilities" in the National Electrical Code Committee.

NOTE 4: Representatives of subsidiaries of any group are generally considered to have the same classification as the parent organization.

Submitting Public Input / Public Comment Through the Online Submission System

Soon after the current edition is published, a Standard is open for Public Input.

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a. Click on Sign In at the upper right side of the page.
b. Under the Codes and Standards heading, click on the "List of NFPA Codes & Standards," and then select your document from the list or use one of the search features.

OR

a. Go directly to your specific document information page by typing the convenient shortcut link of www.nfpa.org/document# (Example: NFPA 921 would be www.nfpa.org/921). Sign in at the upper right side of the page.

To begin your Public Input, select the link "The next edition of this standard is now open for Public Input" located on the About tab, Current & Prior Editions tab, and the Next Edition tab. Alternatively, the Next Edition tab includes a link to Submit Public Input online.

At this point, the NFPA Standards Development Site will open showing details for the document you have selected. This "Document Home" page site includes an explanatory introduction, information on the current document phase and closing date, a left-hand navigation panel that includes useful links, a document Table of Contents, and icons at the top you can click for Help when using the site. The Help icons and navigation panel will be visible except when you are actually in the process of creating a Public Input.

Once the First Draft Report becomes available there is a Public Comment period during which anyone may submit a Public Comment on the First Draft. Any objections or further related changes to the content of the First Draft must be submitted at the Comment stage.

To submit a Public Comment you may access the online submission system utilizing the same steps as previously explained for the submission of Public Input.

For further information on submitting public input and public comments, go to: http://www.nfpa.org/publicinput.

Other Resources Available on the Document Information Pages

About tab: View general document and subject-related information.

Current & Prior Editions tab: Research current and previous edition information on a Standard.

Next Edition tab: Follow the committee's progress in the processing of a Standard in its next revision cycle.

Technical Committee tab: View current committee member rosters or apply to a committee.

Technical Questions tab: For members and Public Sector Officials/AHJs to submit questions about codes and standards to NFPA staff. Our Technical Questions Service provides a convenient way to receive timely and consistent technical assistance when you need to know more about NFPA codes and standards relevant to your work. Responses are provided by NFPA staff on an informal basis.

Products & Training tab: List of NFPA's publications and training available for purchase.

Information on the NFPA Standards Development Process

I. Applicable Regulations. The primary rules governing the processing of NFPA standards (codes, standards, recommended practices, and guides) are the NFPA *Regulations Governing the Development of NFPA Standards (Regs)*. Other applicable rules include NFPA *Bylaws*, NFPA *Technical Meeting Convention Rules*, NFPA *Guide for the Conduct of Participants in the NFPA Standards Development Process*, and the NFPA *Regulations Governing Petitions to the Board of Directors from Decisions of the Standards Council*. Most of these rules and regulations are contained in the *NFPA Standards Directory*. For copies of the *Directory*, contact Codes and Standards Administration at NFPA Headquarters; all these documents are also available on the NFPA website at "www.nfpa.org."

The following is general information on the NFPA process. All participants, however, should refer to the actual rules and regulations for a full understanding of this process and for the criteria that govern participation.

II. Technical Committee Report. The Technical Committee Report is defined as "the Report of the responsible Committee(s), in accordance with the Regulations, in preparation of a new or revised NFPA Standard." The Technical Committee Report is in two parts and consists of the First Draft Report and the Second Draft Report. (See *Regs* at Section 1.4.)

III. Step 1: First Draft Report. The First Draft Report is defined as "Part one of the Technical Committee Report, which documents the Input Stage." The First Draft Report consists of the First Draft, Public Input, Committee Input, Committee and Correlating Committee Statements, Correlating Notes, and Ballot Statements. (See *Regs* at 4.2.5.2 and Section 4.3.) Any objection to an action in the First Draft Report must be raised through the filing of an appropriate Comment for consideration in the Second Draft Report or the objection will be considered resolved. [See *Regs* at 4.3.1(b).]

IV. Step 2: Second Draft Report. The Second Draft Report is defined as "Part two of the Technical Committee Report, which documents the Comment Stage." The Second Draft Report consists of the Second Draft, Public Comments with corresponding Committee Actions and Committee Statements, Correlating Notes and their respective Committee Statements, Committee Comments, Correlating Revisions, and Ballot Statements. (See *Regs* at 4.2.5.2 and Section 4.4.) The First Draft Report and the Second Draft Report together constitute the Technical Committee Report. Any outstanding objection following the Second Draft Report must be raised through an appropriate Amending Motion at the NFPA Technical Meeting or the objection will be considered resolved. [See *Regs* at 4.4.1(b).]

V. Step 3a: Action at NFPA Technical Meeting. Following the publication of the Second Draft Report, there is a period during which those wishing to make proper Amending Motions on the Technical Committee Reports must signal their intention by submitting a Notice of Intent to Make a Motion (NITMAM). (See *Regs* at 4.5.2.) Standards that receive notice of proper Amending Motions (Certified Amending Motions) will be presented for action at the annual June NFPA Technical Meeting. At the meeting, the NFPA membership can consider and act on these Certified Amending Motions as well as Follow-up Amending Motions, that is, motions that become necessary as a result of a previous successful Amending Motion. (See 4.5.3.2 through 4.5.3.6 and Table 1, Columns 1-3 of *Regs* for a summary of the available Amending Motions and who may make them.) Any outstanding objection following action at an NFPA Technical Meeting (and any further Technical Committee consideration following successful Amending Motions, see *Regs* at 4.5.3.7 through 4.6.5.3) must be raised through an appeal to the Standards Council or it will be considered to be resolved.

VI. Step 3b: Documents Forwarded Directly to the Council. Where no NITMAM is received and certified in accordance with the Technical Meeting Convention Rules, the standard is forwarded directly to the Standards Council for action on issuance. Objections are deemed to be resolved for these documents. (See *Regs* at 4.5.2.5.)

VII. Step 4a: Council Appeals. Anyone can appeal to the Standards Council concerning procedural or substantive matters related to the development, content, or issuance of any document of the NFPA or on matters within the purview of the authority of the Council, as established by the Bylaws and as determined by the Board of Directors. Such appeals must be in written form and filed with the Secretary of the Standards Council (see *Regs* at Section 1.6). Time constraints for filing an appeal must be in accordance with 1.6.2 of the *Regs*. Objections are deemed to be resolved if not pursued at this level.

VIII. Step 4b: Document Issuance. The Standards Council is the issuer of all documents (see Article 8 of *Bylaws*). The Council acts on the issuance of a document presented for action at an NFPA Technical Meeting within 75 days from the date of the recommendation from the NFPA Technical Meeting, unless this period is extended by the Council (see *Regs* at 4.7.2). For documents forwarded directly to the Standards Council, the Council acts on the issuance of the document at its next scheduled meeting, or at such other meeting as the Council may determine (see *Regs* at 4.5.2.5 and 4.7.4).

IX. Petitions to the Board of Directors. The Standards Council has been delegated the responsibility for the administration of the codes and standards development process and the issuance of documents. However, where extraordinary circumstances requiring the intervention of the Board of Directors exist, the Board of Directors may take any action necessary to fulfill its obligations to preserve the integrity of the codes and standards development process and to protect the interests of the NFPA. The rules for petitioning the Board of Directors can be found in the *Regulations Governing Petitions to the Board of Directors from Decisions of the Standards Council* and in Section 1.7 of the *Regs*.

X. For More Information. The program for the NFPA Technical Meeting (as well as the NFPA website as information becomes available) should be consulted for the date on which each report scheduled for consideration at the meeting will be presented. To view the First Draft Report and Second Draft Report as well as information on NFPA rules and for up-to-date information on schedules and deadlines for processing NFPA documents, check the NFPA website (www.nfpa.org/docinfo) or contact NFPA Codes & Standards Administration at (617) 984-7246.