NFPA®

408

Standard for Aircraft Hand Portable Fire Extinguishers

2017

NFPA®

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NFPA® 408

Standard for

Aircraft Hand Portable Fire Extinguishers

2017 Edition

This edition of NFPA 408, *Standard for Aircraft Hand Portable Fire Extinguishers,* was prepared by the Technical Committee on Portable Fire Extinguishers. It was issued by the Standards Council on July 19, 2016, with an effective date of August 8, 2016, and supersedes all previous editions.

This edition of NFPA 408 was approved as an American National Standard on August 8, 2016.

Origin and Development of NFPA 408

Work on NFPA 408 started in 1947 after requests were received by the National Fire Protection Association for recommendations on aircraft hand fire extinguishers. During the intervening years, prior to the adoption of the first draft of this text in 1955 by the Association, a number of proposals were prepared and circulated for comment and critique. In 1956, a revision was adopted incorporating an appendix on air crew training. Revisions were made in 1964, 1965, 1970, and 1973.

The 1984 document was completely revised to recognize state-of-the-art developments in extinguishing agents and to bring the document into conformance with the *Manual of Style for NFPA Technical Committee Documents*.

The 1989 edition was a reconfirmation of the 1984 edition. The 1994 edition was a partial revision. The 1999 edition was a reconfirmation of the 1994 edition.

Minimum requirements were added to the 2004 edition for halocarbon agent fire extinguishers because they had become acceptable for installation onboard aircraft, in lieu of halon extinguishers, per the U.S. Federal Aviation Administration (FAA).

In the 2010 edition, the technical committee enhanced crew and user safety by including requirements regarding the use of self-contained breathing apparatus (SCBA) and protective breathing equipment (PBE). The technical committee also addressed alternative extinguishing agents that could be used in training and onboard aircraft and still meet the set requirements. The requirements around the use and inclusion of halocarbons were reviewed extensively by the committee, and many changes were made to those requirements. The document also was updated for compliance with the *Manual of Style for NFPA Technical Committee Documents*.

In 2013, the Technical Committee on Aircraft Rescue and Fire Fighting voted to withdraw NFPA 408 as a standard. The committee argued that lack of adoption, as well as the limited amount of unique material pertaining to aircraft, had diminished the need for a standalone document. In response to public concern over the potential effects of withdrawal, NFPA 408 was not withdrawn, but responsibility for the document was transferred to the Technical Committee on Portable Fire Extinguishers.

The 2017 edition incorporates updated references and definitions. It also adds new support for water solution type hand fire extinguishers in accordance with the FAA's TSO C-19, “Portable Water Solution Type Hand Fire Extinguisher.”

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This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.

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 the installation, maintenance, and use of portable fire extinguishers and equipment. Does not apply to permanently installed fire extinguishing systems even though portions of those systems are portable, such as hose and nozzles, which may be attached to a fixed supply of extinguishing agent.

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NFPA 408

Standard for

Aircraft Hand Portable Fire Extinguishers

2017 Edition

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 B. 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 B.

Chapter 1 Administration

1.1 Scope. This standard specifies requirements for the type, capacity, rating, number, location, installation, and maintenance of aircraft hand portable fire extinguishers to be provided for the use of flight crew members or other occupants of an aircraft for the control of incipient fires in the areas of aircraft that are accessible during flight.

1.1.1 This standard also includes requirements for training flight crew members in the use of these extinguishers.

1.1.2 This standard does not cover fire detection and fixed fire-extinguishing systems installed in an aircraft or fire detection and fire-extinguishing systems for the protection of ground maintenance operations.

1.1.3 Specific protection for Class D fires and for fires in hazardous materials is beyond the scope of this standard.

1.2 Purpose. This standard is intended for use by those responsible for selecting, purchasing, installing, approving, and maintaining aircraft hand portable fire extinguishers and for those responsible for training personnel in their use.

1.2.1* The specific requirements established in this standard are intended for the particular environment of an aircraft where fire extinguishment must be the first priority.

1.2.2* Hand portable fire extinguishers have the general purpose of serving as first-aid fire-fighting appliances.

1.2.3 The requirements of Chapters 7 and 8 of NFPA 10 are applicable to the aviation environment and are supplemental to the specific requirements of this standard.

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 Publication. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 10, *Standard for Portable Fire Extinguishers,* 2013 edition.

2.3 Other Publications.

2.3.1 FAA Publications. Federal Aviation Administration, 800 Independence Avenue SW, Washington, DC 20591.

DOT/FAA/AR-01/37, "Development of a Minimum Performance Standard for Hand-Held Fire Extinguishers as a Replacement for Halon 1211 on Civilian Transport Category Aircraft," August, 2002.

TSO C-19, "Portable Water Solution Type Hand Fire Extinguisher," February, 2009.

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

UL 1093, *Standard for Halogenated Agent Fire Extinguishers*, 1995, Revised 2008.

ANSI/UL 1803, *Standard for Factory Follow-Up on Third Party Certified Portable Fire Extinguishers*, 2012.

2.3.3 ULC Publications. Underwriters' Laboratories of Canada, 7 Underwriters Road, Toronto, Ontario M1R 3A9, Canada.

CAN/ULC-S512, *Standard for Halogenated Agent Hand and Wheeled Fire Extinguishers,* 2005, Reaffirmed 2007.

2.3.4 UL/ULC Publications. The following publications are binational harmonized standards for Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096, Underwriters' Laboratories of Canada, 7 Underwriters Road, Toronto, Ontario M1R 3A9, Canada.

ANSI/UL 8, CAN/ULC-S554, *Water Based Agent Fire Extinguishers*, 2011.

ANSI/UL 154,CAN/ULC-S503, *Standard for Carbon Dioxide Fire Extinguishers*, 2014.

ANSI/UL 299, CAN/ULC-S504, *Standard for Dry Chemical Fire Extinguishers*, 2012.

ANSI/UL 626, CAN/ULC-S507, *Standard for Water Fire Extinguishers*, 2012.

ANSI/UL 711, CAN/ULC-S508, *Standard for Rating and Fire Testing of Fire Extinguishers*, 2013.

ANSI/UL 2129, CAN/ULC-S566, *Standard for Halocarbon Clean Agent Fire Extinguishers,* 2014.

2.3.5 Other Publications. *Merriam-Webster's Collegiate Dictionary*, 11th edition, Meriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 402, *Guide for Aircraft Rescue and Fire-Fighting Operations,* 2013 edition.

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

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services,* 2013 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 the main text of thatis 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.

3.3.1.1 ***Cargo Aircraft.*** An aircraft that is configured solely to carry cargo and no personnel other than the flight crew and any additional crew required for the care of the cargo.

3.3.1.2 ***COMBI.*** An aircraft designed to transport both passengers and cargo on the same level within the fuselage. [**402**, 2013]

3.3.1.3 ***Passenger Aircraft.*** An aircraft designed for the primary function of carrying passengers.

3.3.2 Aircraft Hand Portable Fire Extinguisher. An approved, portable device that is carried and operated by hand and contains an extinguishing agent that can be expelled under pressure for the purpose of suppressing or extinguishing fire.

3.3.3 Bar. See 3.3.11, Galley.

3.3.4 Buffet. See 3.3.11, Galley.

3.3.5 Cargo/Baggage Compartment. An enclosed compartment within, or attached to, an aircraft fuselage that is separate from the passenger and flight crew areas and that is almost always accessible only from the exterior of the fuselage.

3.3.6 Cockpit. See 3.3.10, Flight Deck.

3.3.7 Extinguisher. See 3.3.2, Aircraft Hand Portable Fire Extinguisher.

3.3.8 Fire Classifications.

3.3.8.1* ***Class A Fire.*** A fire in ordinary combustible materials, such as wood, cloth, paper, rubber, and many plastics.

3.3.8.2 ***Class B Fire.*** A fire in flammable liquids, combustible liquids, petroleum greases, tars, oils, oil-based paints, solvents, lacquers, alcohols, and flammable gases.

3.3.8.3* ***Class C Fire.*** A fire that involves energized electrical equipment where the electrical nonconductivity of the extinguishing media is of importance.

3.3.8.4 ***Class D Fire.*** A fire in combustible metals, such as magnesium, titanium, zirconium, sodium, lithium, and potassium.

3.3.9 Flight Crew. Members of the aircraft crew whose responsibilities include the operation and management of the aircraft flight controls, engine(s), and systems, including, but not limited to, pilot in command (captain), first officer (co-pilot), second officer (flight engineer).

3.3.10* Flight Deck. The area of the aircraft arranged for use of the pilot and flight crew operating the aircraft.

3.3.11* Galley. An area of an aircraft used for storing, refrigerating, heating, and dispensing food and beverages. [**410**, 2015]

3.3.12* Halogenated Agents. As referenced in this standard, halons, and mixtures of Halon 1211 and Halon 1301 (Halon 1211/1301), or halocarbon agents.

3.3.12.1* ***Halocarbons.*** Halocarbon agents, such as hydrochlorofluorocarbon (HCFC), hydrofluorocarbon (HFC), perfluorocarbon (PFC), fluoroiodocarbon (FIC), and other halocarbon agents that are found acceptable under the U.S. Environmental Protection Agency (EPA) Significant New Alternatives Policy (SNAP) program.

3.3.12.2* ***Halon 1211.*** A halogenated agent whose chemical name is bromochlorodifluoromethane (CF_2BrCl).

3.3.12.3* ***Halon 1301.*** A halogenated agent whose chemical name is bromotrifluoromethane ($CBrF_3$).

3.3.13 Hand Fire Extinguisher. See 3.3.2, Aircraft Hand Portable Fire Extinguisher.

3.3.14* Maximum Certificated Occupant Capacity. The maximum number of persons that can be carried for each specific aircraft model as certified by the authority having jurisdiction.

3.3.15 Protective Breathing Equipment (PBE). Equipment designed to cover the eyes, nose, and mouth of the wearer, or the nose and mouth where accessory equipment is provided to protect the eyes, and to protect the wearer from the effects of smoke, carbon dioxide, or other harmful gases.

3.3.16* Rated/Rating. A numerical value assigned to an extinguisher based on its fire-extinguishing capability.

3.3.17* Self-Contained Breathing Apparatus (SCBA). An atmosphere-supplying respirator that supplies a respirable air atmosphere to the user from a breathing air source that is independent of the ambient environment and designed to be carried by the user. [**1981**, 2013]

Chapter 4 Types and Capacities

4.1 General.

4.1.1 Hand portable fire extinguishers shall meet or exceed all of the requirements of one of the fire test standards and one of the appropriate performance standards in 4.1.2.

4.1.2 Hand portable fire extinguishers used to comply with this standard shall be listed and labeled and meet or exceed all the requirements of one or more of the applicable fire test standards and one of the applicable performance standards as follows:

(1) Fire test standards as follows:
   (a) For halons, halocarbons, carbon dioxide, dry chemical, water, and film-forming foam, use ANSI/UL 711 and CAN/ULC-S508.
   (b) For halocarbon types for civilian transport category aircraft, use DOT/FAA/AR-01/37.

(2) Performance standards as follows:
   (a) For carbon dioxide types, use ANSI/UL 154, CAN/ULC-S503.
   (b) For dry chemical types, use ANSI/UL 299, CAN/ULC-S504.
   (c) For water types, use TSO-C19 or ANSI/UL 626, CAN/ULC-S507.
   (d) For halon types, use UL 1093 and CAN/ULC-S512.
   (e) For film-forming foam types, use ANSI/UL 8, CAN/ULC-S554.
   (f) For halocarbon types, use ANSI/UL 2129, CAN/ULC-S566.

4.1.3 Listing and Labeling Organization.

4.1.3.1 Identification of the listing and labeling organization, with ratings and classifications, including the performance standard that the extinguisher meets or exceeds, shall be marked on each extinguisher.

4.1.3.2 An organization that lists, labels, and marks extinguishers used to comply with the requirements of this standard shall utilize a third-party certification program for hand portable fire extinguishers that meets or exceeds the requirements of ANSI/UL 1803.

4.1.3.3 The requirement of 4.1.3.2 shall not apply to the following:

(1) Extinguishers manufactured prior to January 1, 1989
(2) Certification organizations accredited by the Standards Council of Canada

4.1.4* All aircraft hand portable fire extinguishers shall function as designed by the manufacturer at temperature ranges from -40°C to 49°C (-40°F to 120°F).

4.1.5* Water extinguishers that have a capacity of 2 L (0.53 gal) and that have approval of the authority having jurisdiction shall not be required to be labeled and shall comply with 4.1.1, 4.1.2, 4.1.3, and 4.1.4.

4.2 Water.

4.2.1 Water-based extinguishers shall have a minimum rating of 1-A and shall be equipped with either a spray or straight-stream nozzle or be in accordance with TSO-C19.

4.2.2 Water-based extinguishers shall not be used on Class B, Class C, or Class D fires.

4.2.3 Cargo compartments shall have one or more water-based extinguishers with a minimum rating of 2-A.

4.2.4 Halogenated agent extinguishers with a minimum rating of 5-B:C can be used in place of required TSO C19 water extinguishers if it can be shown that the halogenated agent extinguisher has comparable or better Class A performance.

4.3 Halogenated Agents.

4.3.1* General.

4.3.1.1 Halogenated agents specified in this standard shall be used in hand portable fire extinguishers in aircraft.

4.3.1.2 Halocarbon extinguishers shall be not less than the quantity required to achieve a 5-B:C rating and conform with the requirements specified in DOT/FAA/AR-01/37 *(see 4.1.2).*

4.3.2* Halon 1211 and Halocarbon Agent Extinguishers.

4.3.2.1 Occupied Spaces.

4.3.2.1.1* For occupied spaces on aircraft, Halon 1211 extinguishers shall be not less than 1.2 kg (2.5 lb) capacity nor more than 2.3 kg (5 lb) capacity.

4.3.2.1.1.1 The extinguishers specified in 4.3.2.1.1 shall have a minimum rating of 5-B:C, shall have not less than an 8-second discharge time, shall have not less than a 3 m (10 ft) liquid range, and shall be permitted to be equipped with a discharge hose.

4.3.2.1.2* For occupied spaces on small aircraft only, with a maximum certificated occupant capacity of one to four persons including the pilot, a Halon 1211 or halocarbon extinguisher with a minimum rating of 2-B:C shall be permitted to be used.

4.3.2.2 For accessible cargo compartments of COMBI aircraft and cargo aircraft, Halon 1211 extinguishers shall be not less than 5.9 kg (13 lb) capacity and shall have a minimum rating of 2-A:40-B:C.

4.3.2.2.1 Halocarbon extinguishers with a minimum rating of 2-A:10-B:C shall be permitted in the application outlined in 4.3.2.2.

4.3.2.3* The total Halon 1211 agent present in all extinguishers in any single compartment, if discharged simultaneously, shall be capable of producing a concentration not greater than 2 percent by volume at 49°C (120°F) in the compartment.

4.4 Carbon Dioxide.

4.4.1 For occupied spaces on aircraft, carbon dioxide (CO_2) extinguishers shall not be used.

4.4.2 For cargo compartments of COMBI aircraft and cargo aircraft, CO_2 extinguishers shall not be used.

4.5 Dry Chemical.

4.5.1* For occupied spaces on aircraft, dry chemical extinguishers shall not be used.

4.5.2 For cargo compartments of COMBI aircraft and cargo aircraft, dry chemical extinguishers shall be not less than 4.5 kg (10 lb) capacity and shall have a minimum rating of 2-A:40-B:C.

4.6 Dry Powder.

4.6.1* For occupied spaces on aircraft, dry powder extinguishers for Class D fires shall not be used.

4.6.2 For accessible cargo compartments of COMBI aircraft and cargo aircraft, dry powder extinguishers for Class D fires shall be permitted to be provided in addition to required extinguishers specified in 5.2.2.

4.7 Other Agents. Hand portable fire extinguishers carrying non-halogenated-type agents that were developed to replace halon shall be listed and labeled.

Chapter 5 Distribution of Extinguishers

5.1 Passenger Aircraft.

5.1.1 Aircraft hand portable fire extinguishers shall be placed in occupied spaces on aircraft as specified in Table 5.1.1.

5.1.2 Where an extinguisher other than a water extinguisher is located within 1.5 m (5 ft) of, and on the same floor level as, a galley opening, an additional extinguisher shall not be required for the galley.

5.1.3 Where distances between extinguishers, as measured by standard aisle travel, exceed 18 m (60 ft), extinguishers in addition to those required by Table 5.1.1 shall be provided so that no travel distance to an extinguisher exceeds 9 m (30 ft).

5.1.4 Where aircraft passenger compartments, galleys, or lounge areas are on a separate level, such compartments or areas shall have extinguishers in accordance with Table 5.1.1.

5.1.5 Extinguishers in passenger compartments shall be immediately accessible, mounted for quick removal, and installed on bulkheads wherever possible.

5.1.5.1 Where installation is necessary in overhead storage spaces, extinguishers shall be located so that carry-on luggage cannot interfere with extinguisher accessibility.

5.1.5.2 Extinguisher locations shall be marked and shall be visible to occupants of the compartment.

5.1.6 Personal Breathing Equipment.

5.1.6.1 Personal breathing equipment (PBE) approved and maintained as specified by the authority having jurisdiction shall be provided.

5.1.6.2 The PBE shall be provided within 0.9 m (3 ft) laterally of all hand portable fire extinguishers.

5.2 Cargo Aircraft.

5.2.1 Occupied Spaces on Aircraft. The flight deck of cargo aircraft shall be provided with one halogenated agent extinguisher.

5.2.2 Cargo Compartment.

5.2.2.1 Where fixed extinguishing systems provide protection for the entire cargo compartment(s), or where the cargo compartment(s) is not accessible during flight, hand portable fire extinguishers shall not be required for the cargo compartment(s).

5.2.2.2* Where fixed extinguishing systems do not provide protection for the entire cargo compartment(s), the number of extinguishers, quantity of extinguishing agent, and ratings shall be in accordance with 4.3.2.2.

5.2.2.2.1 The hand portable fire extinguisher specified in 5.2.2.2 shall be located and accessible inside the cargo compartment at the interior access entry.

5.2.2.2.2 Any additional hand portable fire extinguishers provided for cargo compartment use shall also be located in the cargo compartment.

5.2.2.3 Self-Contained Breathing Apparatus.

5.2.2.3.1 A self-contained breathing apparatus (SCBA), approved and maintained as specified by the authority having jurisdiction, with a minimum rated service life of 15 minutes and equipped with a full facepiece shall be provided.

5.2.2.3.2 The SCBA shall be accessible in a marked location outside the cargo compartment positioned adjacent to the access entry point.

5.3 COMBI Aircraft.

5.3.1 Aircraft hand portable fire extinguishers shall be placed in the flight deck, passenger cabin, and cargo compartment on aircraft as specified in Table 5.1.1.

Table 5.1.1 Distribution of Extinguishers in Occupied Spaces on Aircraft

Maximum Certificated Occupant Capacity	Number of Extinguishers	Type of Extinguisher	Location
1–4 (including pilot)	1	Halogenated agent *(see 4.3.2.1.2, 4.3.2.3)*	Within reach of seated pilot
5–30	1	Halogenated agent	Within reach of seated pilot
	1	Halogenated agent	Cabin
31–60	1	Halogenated agent	Flight deck
	2	One water and one halogenated agent	Cabin
	1	Halogenated agent	Each galley*
61–120	1	Halogenated agent	Flight deck
	3	One water and two halogenated agents	Cabin
	1	Halogenated agent	Each galley*
121–200	1	Halogenated agent	Flight deck
	4	Two water and two halogenated agents	Cabin
	1	Halogenated agent	Each galley*
201–275	1	Halogenated agent	Flight deck
	5	Two water and three halogenated agents	Cabin
	1	Halogenated agent	Each galley*
276–400	1	Halogenated agent	Flight deck
	8	Four water and four halogenated agents	Cabin
	1	Halogenated agent	Each galley*
>400	1	Halogenated agent	Flight deck
	10	Five water and five halogenated agents	Cabin
	1	Halogenated agent	Each galley*
COMBI aircraft wide-body	1	Halogenated agent	Flight deck
	5	Two water and three halogenated agents	Cabin
	1	Halogenated agent	Each galley*
	6	Four halogenated agents and two water	Cargo (passenger level)
COMBI aircraft narrow-body	1	Halogenated agent	Flight deck
	4	Two water and two halogenated agents	Cabin
	1	Halogenated agent	Each galley*
	4	Two halogenated agents and two water	Cargo (passenger level)

*See 5.1.2.

5.3.2 Where an extinguisher other than a water extinguisher is located within 1.5 m (5 ft) of, and on the same floor level as, a galley opening, an additional extinguisher shall not be required for the galley.

5.3.3 The minimum number of hand portable fire extinguishers necessary for the cargo compartment shall be as specified in Table 5.1.1.

5.3.4 Hand portable fire extinguishers shall be placed adjacent to the entrance door of the passenger deck (cargo compartment) and adjacent to the rear exit door of the aircraft.

5.3.5 Hand portable fire extinguishers shall be provided in the flight crew rest facilities.

Chapter 6 Inspection, Maintenance, and Hydrostatic Testing

6.1 Preflight Inspection.

6.1.1 One or more members of the flight crew shall make a preflight inspection of all extinguishers.

6.1.2 The inspection shall determine that all required extinguishers are provided, prepared for use, in the assigned location, and secured.

6.1.3 Where provided, extinguisher pressure gauges shall indicate pressure, and seals and seal wires shall not be broken.

6.2 Maintenance.

6.2.1 Extinguishers shall be maintained in accordance with Chapter 7 of NFPA 10 and records shall be kept in accordance with those requirements.

6.2.2 Recharging procedures shall follow the requirements of Chapter 7 of NFPA 10.

6.2.3 Extinguishers that are out of service for maintenance or recharge shall be replaced with extinguishers having the same agent, rating, and operating procedure.

6.3 Hydrostatic Testing. Extinguisher shells and appurtenant devices such as nozzles, hoses, and pressure cartridges shall be hydrostatically tested in accordance with Chapter 8 of NFPA 10.

Chapter 7 Flight Crew Training

7.1 General.

7.1.1 Initially, before assignment, and at least annually thereafter, flight crew members shall receive theoretical and practical training in the basics of fire extinguishment.

7.1.1.1 Instruction on location and use of hand portable fire extinguishers on the aircraft for which flight crew members will be qualified shall be provided.

7.1.2 Training shall be conducted by instructors who are knowledgeable of the aircraft environment and experienced in the extinguishment of fire using hand portable fire extinguishers.

7.1.3 Training shall include the following:

(1) Classroom instruction
(2) Practical use of hand portable fire extinguishers
(3) Extinguishment of a hot fire
(4) Movement in a smoke-filled environment
(5) Wearing of PBE, within a replica of an aircraft cabin environment
(6) Wearing of SCBA (where required), within a replica of an aircraft cargo cabin environment

7.1.3.1 Halon shall not be discharged during training, as per 7.3.3.3.

7.1.3.2* Halocarbon extinguishers shall be permitted to be discharged during training, unless restricted by the authority having jurisdiction.

7.2* Classroom/Fire Scenario Instruction.

7.2.1 Classroom instruction concerning all types of extinguishers discussed in this standard shall be given to flight crews and shall include the following topics as a minimum:

(1) Chemistry of fire and fire extinguishment
(2) Severity potential of aircraft fires
(3) Types of combustibles present in aircraft
(4) Identification and choice of correct extinguisher
(5) Consequences of misapplication of extinguishers
(6) Usefulness of extinguishers
(7) Inspection requirements
(8) Health and operational safety concerns

7.2.2 Practical Smoke Training. On aircraft types in which it is provided, training shall be given on the use of appropriate PBE and SCBA (where provided) when using an extinguisher in a simulated smoke-filled environment.

7.3 Manipulative Skills Training.

7.3.1 Training shall include each flight crew member demonstrating operation and use of hand portable extinguishers.

7.3.2 Training shall be representative of an interior aircraft fire, using the relevant type of hand portable fire extinguishers carried on the aircraft.

7.3.3* Each flight crew member shall demonstrate the knowledge and skill required to select the appropriate hand portable fire extinguisher for various fire scenarios and to properly apply the agent.

7.3.3.1 The overall training plan shall include representative aircraft fires of Class A, B, and C, as well as combined Class A and B fires.

7.3.3.2 Fire scenarios shall include galley, lavatory or closed compartment, flight deck, open cabins, and flammable liquid fires.

7.3.3.3 Extinguishers containing halon shall not be discharged during routine manipulative skills training.

7.3.3.4 Substitutes shall be permitted to be used for training with the approval of the authority having jurisdiction.

7.3.3.5 Any alternative agent approved by the authority having jurisdiction shall be listed and labeled.

7.4* COMBI Aircraft.

7.4.1 The following items shall form the basis of the required course of instruction for flight crew involving COMBI aircraft operations:

(1) Explanation of fire risks with COMBI operations
(2) Chemistry of fire
(3) Theory of extinguishing agents
(4) Aircraft layout
(5) Cargo loading requirements
(6) Hazardous cargo consignments
(7) Scale of COMBI fire-fighting equipment *(see Table 5.1.1)*
(8) Designated fire fighter duties including the following:
    (a) Preflight audit
    (b) Inflight inspection
    (c) Fire control techniques
    (d) Postfire information feedback
(9) Practical demonstration and use of hand portable fire extinguishers
(10) Practical exercises involving simulated fire situations

7.4.2 The facility used for training flight crews shall be representative of actual fire conditions and include the following:

(1) An enclosed environment in which the trainee experiences the effects of fire and heat
(2) A demonstration of the effectiveness of fire extinguishers when correctly applied to an actual fire
(3) A facility in which to demonstrate an electrical fire
(4) An exercise that includes dressing in the protective clothing and PBE provided onboard the aircraft and entering a simulated smoke-filled environment carrying a hand portable fire extinguisher as carried on the aircraft

7.5 Recurrent Training and Testing.

7.5.1* Recurrent training shall include discussions on recent onboard aircraft fire incidents.

7.5.2 Recurrent training shall be provided at intervals not exceeding 3 years.

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.1.2.1 In an aircraft fire, the integrity of the aircraft must be preserved and the flight crew must retain their physiological ability to fly the airplane (e.g., vision and consciousness). The overall threat to life must be held at the lowest possible level.

A.1.2.2 Additional information on the effectiveness and suitability of various aircraft hand portable fire extinguishers can be found in DOT/FAA/CT-82/42. Information regarding halocarbon extinguishers can be found in both NFPA 10 and DOT/FAA/AR-01/37.

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.3.3.8.1 Class A Fire. European fire class designations are as follows:

(1) Class A — Wood, paper, cloth, and so forth
(2) Class B — Flammable liquids
(3) Class C — Flammable gases
(4) Class D — Metal fires
(5) Class E — Electrical fires
(6) Class F — Cooking appliances

The classification of fire extinguishers consists of one or more capital letters that indicate the classes of fire on which an extinguisher has been found to be effective. The letters (A and B only) are preceded by a rating number that indicates the relative extinguishing effectiveness.

European nations use European Standard EN 3-7 to classify types of fires and establish test methods to assign performance ratings to fire extinguishers. It should be noted that European fire extinguisher numerical ratings and fire configurations differ from those in ANSI/UL 711, CAN/ULC-S508.

It should be noted that European fire extinguisher ratings are not comparable with U.S. or Canadian ratings.

A.3.3.8.3 Class C Fire. When electrical equipment is de-energized, fire extinguishers for Class A or B fires can be used safely.

A.3.3.10 Flight Deck. Berths, galleys, and lavatory facilities can be associated with the flight crew compartment but are not included in the term *flight deck*.

A.3.3.11 Galley. Such areas typically include areas for plastic trays, plastic dinnerware utensils, and paper napkins.

A.3.3.12 Halogenated Agents. Halon 1211 and Halon 1301 are included in the Montreal Protocol on Substances that Deplete the Ozone Layer signed September 16, 1987. The 1992 amendments to the protocol called for a cessation of production of Halon 1211 and Halon 1301 worldwide.

A.3.3.12.1 Halocarbon. These agents are multipurpose Class ABC-rated. The physical properties for these agents vary, and some will discharge as a mixed liquid and vapor stream while others will discharge primarily as a vapor.

Halocarbon agents that are approved for onboard aircraft use have various physical properties that impact throw range and fire-fighting technique, and are as follows:

(1) HCFC Blend B is an extinguishing agent that is a tertiary blend comprised primarily of the chemical 2,2-dichloro-1,1,1-trifluoroethane HCFC-123 (CF_3CHCl_2). The boiling point of the blend is 80.6°F (27°C). Due to its high boiling point, HCFC Blend B discharges primarily as a liquid stream that readily evaporates.
(2) HFC-227ea is an extinguishing agent that is comprised of the chemical 1,1,1,2,3,3,3-heptafluoropropane (CF_3CHCF_3). The boiling point of the agent is 2.5°F (–16.4°C). Due to this boiling point, HFC-227ea is discharged as a mixed liquid and vapor stream that readily evaporates.
(3) HFC-236fa is an extinguishing agent that is comprised of the chemical 1,1,1,3,3,3-hexafluoropropane ($CF_3CH_2CF_3$). The boiling point of the agent is +29.5°F (–1.4°C). Due to its relatively high boiling point, HFC-236a discharges predominately as a liquid stream that readily evaporates.

A.3.3.12.2 Halon 1211. Due to its relatively high boiling point of 4°C (25°F), Halon 1211 discharges as an 85 percent liquid stream, offering long agent throw range.

A.3.3.12.3 Halon 1301. Halon 1301 offers limited Class A capability when used in hand portable fire extinguishers.

A.3.3.14 Maximum Certificated Occupant Capacity. In the United States, the authority having jurisdiction is the Federal Aviation Administration (FAA).

A.3.3.16 Rated/Rating. The rating is required to be in accordance with ANSI/UL 711, CAN/ULC-S508.

A.3.3.17 Self-Contained Breathing Apparatus (SCBA). This device provides protection for the face and eyes as well as has suitable strapping or ties for donning the devices and 15 minutes of air supply. (*See NFPA 1981.*)

A.4.1.4 Aircraft hand portable fire extinguishers must perform in an environment substantially more varied and more critical than those approved for use in most land surface applications. Design considerations for extinguisher body, valves, fittings, and associated hardware, including mounting brackets, also should include pressure variations, positive and negative accelerations, vibration, corrosion, and ambient temperature variations.

A.4.1.5 In the United States, the authority having jurisdiction (AHJ) is the Federal Aviation Administration (FAA). The AHJ in Europe is the European Aviation Safety Agency, and the AHJ in Canada is Transport Canada.

A.4.3.1 Exposure to decomposed halogenated agents could produce varied central nervous system effects, depending on exposure concentration and time. Halogenated agents also decompose into products of greater toxicity when subjected to flame or to hot surfaces at approximately 482°C (900°F). See NFPA 2001 for detailed information.

The expected potential exposure of decomposition products resulting from the application of approved halocarbon agent extinguishers to flames or hot surfaces was also addressed and found to be within acceptable limits in DOT/FAA/AR-01/37.

A.4.3.2 Halon 1211 and halocarbon extinguishers have their greatest effectiveness on Class B and Class C fires. Halon 1211 extinguishers with 4 kg (9 lb) or greater capacity also are rated for Class A fires. Extinguishers with capacity of less than 4 kg (9 lb), although not rated for use on Class A fires, have been shown to be effective in extinguishing surface Class A fires. The same is true for halocarbon extinguishers, wherein smaller heldheld sizes are rated for Class B and C fires and larger handheld extinguishers are rated for Class A, B, and C fires.

A.4.3.2.1.1 Halon 1211 extinguishers of less than 4 kg (9 lb) capacity are not always furnished with a discharge hose. However, for access to underseat, overhead, and other difficult-to-reach locations, consideration should be given to using extinguishers with a discharge hose of a minimum length of 304 mm (12 in.). Also, an extinguisher with a discharge hose is more likely to be properly held in an upright position during use.

A.4.3.2.1.2 For occupied spaces on small aircraft where natural state halon concentrations will be approaching allowable limits, Halon 1301 is preferred over Halon 1211 for the following reasons:

(1) Halon 1211 decomposes when exposed to flame, producing some toxic products of decomposition that are not produced by Halon 1301 and is, therefore, also considered more toxic in the decomposed state.
(2) The following health and safety advantages associated with similar-volume occupied spaces on larger aircraft (flight decks) do not usually exist for the smaller aircraft:
    (a) Forced ventilation system
    (b) Availability of oxygen masks
    (c) Availability of a second individual capable of flying the aircraft

A.4.3.2.3 Halocarbon extinguisher toxicity has been demonstrated by Federal Aviation Administration (FAA) modeling and test procedures to be no greater than that of Halon 1211 based on agent quantities discharged to meet the requirements for fire test standards ANSI/UL 711, CAN/ULC-S508, and DOT/FAA/AR-01/37 *(see 4.1.2)*.

A.4.5.1 Dry chemical agent causes visibility problems in occupied spaces and potentially severe contamination of aircraft electrical components.

A.4.6.1 Dry powder agent causes visibility problems in occupied spaces and potentially severe contamination of aircraft electrical components.

A.5.2.2.2 The hose or wand provides effective reach of the contents of the extinguisher to any part of the cargo.

A.7.1.3.2 Since the ban on the use of Halon 1211 during training, many organizations have switched from teaching employees how to use the actual agent available to them onboard the aircraft. Approved halon alternatives can be discharged for training, which should improve the training being offered as well as the outcome of in-flight fire events. Additionally, the fire-fighting technique for each halocarbon agent is different due to the physical property differences, and it is important the employee understands these differences when fighting a fire.

A.7.2 Discussion of health and safety aspects should include hazards and warnings concerning toxicity of combustion products, as well as the effects of short-, intermediate-, and long-term exposure to the undecomposed agents.

A.7.3.3 Live fire training on representative aircraft fires is highly recommended for all flight crew members during both initial and recurrent training sessions. Live fire training provides flight crews with psychological conditioning, fire-fighting techniques, and knowledge of extinguishing agent capabilities and limitations under actual fire situations. The live fires used should be the scenarios required in 7.3.3.2.

Training should cover FAA Advisory Circular AC 120-80, which discusses the hazards of in-flight fires, including hidden fires, and how to effectively handle these events. While this advisory circular focuses on halon extinguishers, the information will also pertain to halocarbon agents.

A.7.4 On completion of the course, flight deck crews and flight attendants should be confident about the procedures and practical use of equipment while working under conditions of smoke and heat. Numbers of personnel receiving training at any one time should be limited in order to ensure that each individual receives adequate practical experience and that his or her performance can be assessed by instructional staff.

A.7.5.1 These discussions are particularly important when crews are assigned to more than one aircraft type.

Annex B Informational References

B.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.

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

NFPA 10, *Standard for Portable Fire Extinguishers*, 2013 edition.

NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*, 2015 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, 2013 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, 2015 edition.

B.1.2 Other Publications.

B.1.2.1 European Publications. European Committee for Standardization, Management Centre, Rue de Stassart, 30 B-1050 Brussels.

European Standard EN 3-7, *Portable Fire Extinguishers — Part 7: Characteristics, Performance Requirements and Test Methods*, 2004 A1:2007.

B.1.2.2 FAA Publications. Federal Aviation Administration, 800 Independence Avenue SW, Washington, DC 20591.

FAA Advisory Circular AC 120-80, "In-Flight Fires," 2004.

DOT/FAA/AR-01/37, "Development of a Minimum Performance Standard for Hand-Held Fire Extinguishers as a Replacement for Halon 1211 on Civilian Transport Category Aircraft," August, 2002.

DOT/FAA/CT-82/42, "Study of Hand-Held Fire Extinguishers Aboard Civil Aviation Aircraft," L. M. Krasner, Final Report, June, 1982. Available from FM Global Research, 270 Central Avenue, P.O. Box 7500, Johnston, RI 02919.

B.1.2.3 UL/ULC Publications. The following publications are binational harmonized standards for Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096, and Underwriters' Laboratories of Canada, 7 Underwriters Road, Toronto, ON, M1R 3A9, Canada.

ANSI/UL 711, CAN/ULC-S508 *Safety Rating and Testing of Fire Extinguishers*, 2013.

B.1.2.4 Additional References. United Nations Environment Programme, Montreal Protocol on Substances that Deplete the Ozone Layer — Final Act 1987, UNEP/RONA, Room DC2-0803, United Nations, New York, NY, 10017.

B.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.

B.2.1 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM D5632/D5632M-12e1, *Standard Specification for Halon 1301, Bromotrifluoromethane (CF_3Br)*, 2012.

ASTM D6064-11, *Standard Specification for HFC-227ea, 1,1,1,2,3,3,3-Heptafluoropropane (CF_3CHFCF_3)*, 2011.

ASTM D6541-11, *Standard Specification for HFC-236fa, 1,1,1,3,3–Hexafluoropropane*, ($CF_3CH^2CF_3$), 2011.

ASTM D7122-11, *Standard Specification for HCFC Blend B (CF_3CCl_2H, Ar, and CF_4)*, 2011.

ASTM D7673/D7673M-15, *Standard Specification for Halon 1211, Bromochlorodifluoromethane (CF_2BrCl)*, 2015.

B.2.2 FAA Publications. Federal Aviation Administration, 800 Independence Avenue SW, Washington, DC 20591.

Advisory Circular 20-42D, "Hand Fire Extinguishers for Use in Aircraft," 2011.

DOT/FAA/CT-83/30, "Extinguisher Agent Behavior in a Ventilated Small Aircraft," 1984.

DOT/FAA/CT-86/5, "Halon Extinguisher Agent Behavior in a Ventilated Small Aircraft," 1986.

DOT/FAA/CT-86/26, "Halon Extinguishment of Small Aircraft Instrument Panel Fires," 1986.

DOT/FAA/CT-89/31, "Smoke and Extinguisher Agent Dissipation in a Small Pressurized Fuselage," 1990.

B.2.3 Other Publications.

"The Development of a Hidden Fire Test for Aircraft Hand Extinguisher Applications," CAA Paper 95013, Kidde International.

"Modeling Cardiac Sensitization of Humans Exposed to Halon 1301 or Halon 1211 Aboard Aircraft," *Aviation, Space, and Environmental Medicine*, Vol. 72, No. 10, October 2001.

"Test and Evaluation of Halon 1211 Hand-Portable Fire Extinguishers for Use in Habitable and Cargo Compartments of USAF Aircraft," J. Walker and R. N. Vickers, Final Report, November, 1981, Engineering Services Laboratory, Air Force Engineering and Services Center, Tyndall Air Force Base; Report Number ESL-TR-81-22.

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

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