NFPA No.
408



# AIRCRAFT HAND FIRE EXTINGUISHERS 1964

Fifty Cents



NATIONAL FIRE PROTECTION ASSOCIATION
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# National Fire Protection Association

International

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This is one of a large number of publications on fire safety issued by the Association. All NFPA codes, standards, and recommended practices are prepared by NFPA Technical Committees and adopted at an Annual Meeting of the Association. They are intended to prescribe reasonable measures for minimizing losses of life and property by fire.

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Adopted Jan. 23, 1964. Where variances to these definitions are found, efforts to eliminate such conflicts are in process.

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Standard on

# Aircraft Hand Fire Extinguishers

NFPA No. 408 — 1964

## 1964 Edition of NFPA No. 408

This standard was adopted at the 1964 NFPA Annual Meeting held in Dallas, Texas, May 18–22. It revises and replaces the 1956 edition following action by the sponsoring Sectional Committee on Aircraft Maintenance and Servicing to whom this project was assigned by the parent NFPA Committee on Aviation. The principal change in the 1964 Edition is the elimination of any recognition of vaporizing liquid extinguishers for aircraft cabin use, limitations on the use of dry chemical extinguishers in crew compartments, and recognition of the multi-purpose dry chemical extinguisher. A complete editorial revision was also achieved.

## Origin and Development of No. 408

Work on this standard started in 1947 after requests had been 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 criticism. In 1956 a revision was adopted incorporating an Appendix on air crew training.

It is the intent of this standard to supplement existing governmental regulations, as they may affect aircraft operators, in the provision for and selection of aircraft hand fire extinguishers. Where governmental regulations are not applicable, it is hoped that this standard will be a useful guide to those interested.

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Standard on

# Aircraft Hand Fire Extinguishers

NFPA No. 408

## 100. Scope

**110.** This Standard covers the type, capacity, location and quantity of aircraft hand fire extinguishers and accessory equipment provided essentially for the protection of aircraft compartments occupied by passengers and crew. Recommendations are also given for the daily inspection and periodic maintenance of aircraft hand fire extinguishers and a suggested air crew training outline is given in the Appendix.

## 200. Definitions

**210.** Aircraft hand fire extinguishers are fire extinguishing units, manually operated, which are sufficiently portable to permit the entire unit to be transported by hand without excessive effort on the part of the operator. An approved aircraft hand fire extinguisher is defined as a fire extinguisher which is approved by the Underwriters' Laboratories, Inc., Factory Mutual Engineering Division, Underwriters' Laboratories of Canada, or other nationally recognized fire testing laboratories.

**220.** For the purposes of this Standard, fires can be divided into three basic types:

**a.** Class A fires, defined as fires in ordinary combustible materials such as wood, cloth, paper, etc.

**b.** Class B fires defined as fires in flammable petroleum products or other flammable liquids, greases, etc.

**c.** Class C fires, defined as fires involving energized electrical equipment where the electrical nonconductivity of the extinguishing media is of importance. In most cases where electrical equipment is de-energized, extinguishers suitable for use on Class A or B fires may be employed effectively.

## 300. Basis for Recommendations

### 310. General

**311.** Aircraft hand fire extinguishers shall be of an approved type employing as extinguishing media only one of the following: carbon dioxide, a

dry chemical, or water (or water solution). The types and quantity shall be as specified in Section 400.

**312.** In selecting an extinguisher for use in aircraft, consideration must be given to:

**a.** Type of fires liable to be encountered.

**b.** The extinguishing ability of the agent.

**c.** Method and facilities for extinguishing agent application.

**d.** Corrosive and toxic properties of the extinguishing agent.

**e.** Gross weight of the unit.

**f.** Freezing point of the agent.

**g.** Maintenance requirements.*

## 320. Carbon Dioxide Extinguishers

**321.** Carbon dioxide extinguishers are principally suited for fires involving flammable liquids (Class B) and electrical equipment (Class C). They are of limited value for extinguishment of incipient fires involving ordinary combustible materials (Class A) such as paper, fabric, etc. Their principal action is to "blanket" the fire by excluding oxygen.

**322.** In using extinguishers of this type best results are obtained by directing the discharge close to the fire, applying first at edge and bottom of the fire and progressing forward and upward, moving discharge horn slowly from side to side. Continuous discharge after the fire has been extinguished to achieve cooling and prevent reflash is recommended, especially where flammable liquids are involved. On electrical fires, to eliminate the primary source of trouble and to reduce the hazard of rekindling, the power to the appliance or wiring should be disconnected first wherever possible.

**323.** Carbon dioxide hand type extinguishers *of the capacity recommended herein* can normally be used without danger of ill effects to the occupants. The carbon dioxide vapor cloud will, however, often reduce visibility temporarily in an enclosed space. The agent is noncorrosive and will not injure fabric or food.

**324.** Where temperatures below minus 40° F. are encountered, carbon dioxide extinguishers should be winterized in an approved manner to assure maximum operational efficiency.

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*See also NFPA Standard for the Installation, Maintenance and Use of Portable Fire Extinguishers (No. 10).

**325.** The agent does not deteriorate with age and the extinguisher needs to be refilled only after use. Periodic checks should be made by weighing the unit to assure full charge (correct full weight stamped on all approved types).

NOTE: Full details on the maintenance of these extinguishers are covered in the NFPA Standard for the Installation, Maintenance, and Use of Portable Fire Extinguishers (No. 10).

## 330. Dry Chemical Extinguishers

**331.** There are two basic types of dry chemical extinguishers. One type employs either a specially treated dry chemical principally suited for fires involving flammable liquids (Class B) and electrical equipment (Class C). The other type, commonly referred to as "multi-purpose," contains an agent suitable for extinguishing Class A fires in ordinary combustibles (when the extinguisher has adequate quantity of agent) as well as being suitable for use on fires involving flammable liquids (Class B) and electrical equipment (Class C).

NOTE: Extinguishers employing the "multi-purpose" dry chemical type of agent of the size normally used in aircraft may *not* have adequate capacity of agent to be labeled for Class A fires but the label on each device should be checked to determine its capability.

**332.** In using a dry chemical extinguisher on flammable liquid fires, best results are obtained by directing the discharge at the base of the flames, although not directly into a pool of burning flammable liquids. The nozzle should be moved rapidly from side to side to sweep the flames from the surface. On electrical fires, to eliminate the primary source of trouble and to reduce the hazard of rekindling, the power to the appliance or wiring should be disconnected first wherever possible. When using "multi-purpose" dry chemicals on ordinary combustibles, the same basic technique is employed as with flammable liquids except that it is particularly important that discharge should be continued to coat any hot surfaces and any glowing material even after the fire has apparently been extinguished to prevent possible reflash.

**333.** Dry chemical extinguishers of the capacity recommended herein can be used without danger of suffocation to the occupants although a powder cloud will often reduce visibility temporarily. The agent is nontoxic. The use of dry chemical extinguishers in aircraft cockpits on either electrical or electronic equipment is *not* recommended because the powder residues are nonconductive and when deposited on electrical contacts may interfere with the continued, safe operation of such equipment.

NOTE: The "multi-purpose" dry chemical powder has corrosive properties on some metals (including aluminum) which may require special attention following use as to clean-up procedures.

**334.** Discharge pressure may be from a compressed gas cartridge or from stored pressure. Where temperatures below minus 40° F. are encountered, special approved low-temperature extinguishers should be used.

**335.** The agent does not deteriorate or cake with age or humidity when sealed in the extinguisher and the unit needs to be refilled only after use. Periodic checks should be made to assure full charge. Only dry chemical specified by the manufacturer of the extinguisher should be used for recharging.

NOTE: Full details on the maintenance of these extinguishers are covered in the NFPA Standard for the Installation, Maintenance and Use of Portable Fire Extinguishers (No. 10).

## 340. Water (Water Solution) Extinguishers

**341.** Water (water solution) extinguishers are most suitable for fire involving ordinary combustible material (Class A) such as paper, fabric, etc., where the quenching and cooling effects of water or a solution containing water are of first importance. Water extinguishers are not recommended for use on flammable liquids or energized electrical equipment or wiring.

**342.** In using extinguishers of this type, best results are obtained by directing the discharge at the base of the flames and working around the burning area. Smoldering embers should be kept under scrutiny after the bulk of the fire is extinguished.

**343.** There is no danger of toxicity. Water (water solution) extinguishers of approved types are designed to eliminate any detrimental corrosive effects which would interfere with their proper operation.

**344.** A proper degree of anti-freeze protection should be provided where necessary to assure efficient operation. Anti-freeze protection should be accomplished only in accordance with the manufacturer's instructions and with the approval of the testing agency (see Section 210 and Paragraph 442).

**345.** Discharge pressure may be secured from a small compressed gas cartridge or stored pressure. The agent does not deteriorate or evaporate with age when properly sealed and needs to be refilled only after use. Periodic checks should be made to assure full charge.

NOTE: Full details on the maintenance of the extinguishers are covered in the NFPA Standard for the Installation, Maintenance and Use of Portable Fire Extinguishers (No. 10).

**346.** Normally additional water is available from buffet and washroom facilities which may be used for soaking smoldering materials and for supplementary fire control purposes involving ordinary combustible materials.

## 400. Recommendations

## 410. General

**411.** Selection of fire extinguishers shall be based upon the facts discussed in Section 300.

WARNING: It should be noted that almost all forms of combustion (fires) produce toxic vapors, the most serious practical danger being from carbon monoxide. Enclosed areas should be vented following *complete* extinguishment. Premature ventilation might supply fresh oxygen to a smoldering fire which might cause reignition and extreme care is therefore required.

## 420. Number, Capacity and Location of Fire Extinguishers:

The number, capacity and location of the extinguishers shall be as follows:

## 421. Crew Compartment:

**a.** Crew compartments shall contain at least one approved carbon dioxide hand extinguisher with a minimum rating of 2B:C* to be located so as to be immediately accessible to the cockpit crew and its location obvious by either its location or placarding.

**b.** Additional portable fire extinguishers, suitable for the type of hazard, shall be provided for protection of other locations in the crew compartment (such as cargo compartments, the flight engineer's panel, radio equipment, etc.) when the extinguisher required above is not easily accessible to such locations or is not of the proper type.

## 422. Passenger and Buffet Compartments:

**a.** In passenger compartments, the extinguishers specified in the following Subparagraphs *shall* be easily accessible at all times and *should* be clearly visible to the crew and passengers; however, if the extinguishers are not clearly visible to the crew and passengers, their location *shall* be indicated by a clearly legible placard or sign easily visible to the crew and passengers.

It is recommended that signs indicating location of extinguishers have letters at least $\frac{3}{8}$ inch in height mounted on a contrasting background.

*Extinguishers are rated in accordance with the NFPA Standard for the Installation, Maintenance, and Use of Portable Fire Extinguishers (No. 10). Carbon dioxide extinguishers having a 2B:C rating are available in sizes containing from 2 to 5 pounds of agent. Each extinguisher should be checked to determine its exact rating. Larger sizes should *not* be used in crew compartments unless the volume of the free air space and the natural ventilation available indicates that any carbon dioxide concentration which might result from the operation of such larger capacity devices presents no problem to the crew due to oxygen deficiency in the space or obstruction of vision.

**b.** Aircraft accommodating no more than 30 passengers shall contain a minimum of one approved water extinguisher.† In personal type aircraft where crew and passenger compartments are not segregated and 4 or more seats are provided, one approved water extinguisher† is recommended in addition to the carbon dioxide extinguisher recommended in Paragraph 421.a.

**c.** Aircraft providing space for 31 through 60 passengers shall contain a minimum of one approved water extinguisher† and one additional extinguisher which may be a carbon dioxide or dry chemical unit having a minimum 2B:C rating.**

**d.** Aircraft accommodating 61 or more passengers shall have a minimum of two approved water extinguishers† and one additional extinguisher which may be a carbon dioxide or dry chemical unit having a minimum 2B:C rating.** The two water extinguishers shall be located remote from each other in the compartment.

**e.** Passenger compartments or lounges, other than lavatories, separate and individually located from other passenger-occupied compartments shall have a minimum of one approved water extinguisher.† A passenger compartment or lounge shall be considered separately and individually located when it is divided from other occupied portions of the aircraft by a door, curtained opening, stairwell, or other arrangement which obscures vision or impairs air circulation, except that a berth in a sleeper plane shall not be considered a separate compartment.

**f.** Where cooking facilities are provided in a buffet or galley, one approved carbon dioxide or one approved dry chemical extinguisher having a minimum rating of 2B:C** shall be provided and this may be the "additional extinguisher" referenced in Paragraphs 422.c. and d. above.

WARNING: See Paragraph 333 warning against use of dry chemical extinguishers while airborne on electrical and electronic equipment essential to safe continued flight.

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†A minimum one quart (nominal) size is recommended. The Underwriters' Laboratories, Inc. lists a special loaded-stream water solution extinguisher for aircraft use.

**Extinguishers are rated in accordance with the NFPA Standard for the Installation, Maintenance, and Use of Portable Fire Extinguishers (No. 10). Carbon dioxide extinguishers having a 2B:C rating are available in sizes containing 2 to 5 pounds of agent. Each extinguisher should be checked to determine its exact rating. Larger sizes should *not* be used unless the volume of free air space and the natural ventilation available indicates that any carbon dioxide concentration which might result from the operation of such larger capacity devices presents no problem due to oxygen deficiency in the space. Dry chemical extinguishers having a 2B:C rating are available in sizes containing 1½ to 2½ pounds of agent. (Some approved dry chemical extinguishers containing 2½ pounds of agent have a 4B:C rating.) Each extinguisher should be checked to determine its exact rating. "Multi-purpose" dry chemical extinguishers may be used where it is desired to gain maximum Class A as well as Class B and C fire suppression capability.

### 423. Baggage and Cargo Compartments:

**a.** Baggage or cargo compartments of passenger-carrying aircraft accessible to crew members in flight may be provided with one approved water extinguisher† where desired. Normally the water extinguishers provided in the passenger compartment will be available and accessible for use in such accessible baggage or cargo compartments and an extra extinguisher specifically for such compartments is not mandatory.

**b.** No hand fire extinguishers are required for baggage or cargo compartments of passenger-carrying aircraft which are not accessible to crew members in flight.

**c.** Crew compartments of all-cargo type aircraft shall be provided with extinguishers as specified in Paragraph 421. Protection of cargo compartments of all-cargo type aircraft requires individual study as to the desirability and practicality of providing hand fire extinguishers. It is not considered practical to attempt to carry sufficient hand fire extinguishers to deal with a major cargo fire. The accessibility of the cargo, the internal air circulation, the facilities for depressurization, the insulation of the cargo compartment, the nature of the cargo, and the provision of fixed fire extinguishing equipment and the availability of fire detection equipment in such spaces influence the need for and type of hand fire extinguishers which might be required.

### 430. Daily Inspections of Aircraft Hand Fire Extinguishers

**431.** The daily inspections shall include: (1) a check that aircraft hand fire extinguishers are in their proper location, (2) that seal wires are in place, and (3) that pressure gage indicates proper pressurization on stored-pressure type equipment.

### 440. Other Maintenance Procedures for Aircraft Hand Fire Extinguishers

**441.** Aircraft hand fire extinguishers shall be maintained in accordance with the provisions of the NFPA Standard for the Installation, Maintenance and Use of Portable Fire Extinguishers (No. 10) in so far as applicable.

**442.** Water extinguishers that are protected from freezing by corrosive additives (such as calcium chloride or alkali metal salt solutions) shall be discharged every six months to determine that they operate properly unless the manufacturer certifies that no corrosion hazard exists and this is substantiated by the tests of a nationally recognized fire testing laboratory.

†See footnote on page 408–10.

## 450. Air Crew Training on Aircraft Hand Fire Extinguishers

**451.** Initially, before assignment, and annually thereafter, air crews shall receive training in the use of aircraft hand fire extinguishers. A suggested training outline is given in the Appendix.

## 460. Accessory Equipment

**461.** It is also recommended that a device be provided suitable for ripping cabin wall linings and seat upholstery in event of a concealed or smoldering fire in such areas.

**462.** Where extinguishers recommended above operate by carbon dioxide cartridges, one extra cartridge for each such unit should be carried aboard the aircraft where recharges of the basic extinguishing agent are also available. (This applies particularly to water type devices.)

## Appendix

## Suggested Air Crew Training Outline

## On Use of

## Aircraft Hand Fire Extinguishers

**A-10.** In compliance with Paragraph 451 aircraft crew members should be given opportunities to use the aircraft hand fire extinguishers provided so that they might become proficient in the use of these devices and be able to judge in actual fire situations the best type or types of extinguishers which might be used with maximum efficiency. A recurrent training program should be established.

**A-20.** Aircraft hand fire extinguishers recommended herein include those employing carbon dioxide, dry chemical, and water (water solution). Aircraft crews should be given training using the types of appliances actually provided on the aircraft they operate and serve.

**A-30.** The following outline to provide aircraft crews with the desired familiarity with aircraft hand fire extinguishers may be helpful.

WARNING: Instructors should practice these test fires beforehand and know what to anticipate. Be sure to light gasoline fires from the upwind side and prearrange method of ignition of fires to assure safety.

**A-31.** Training with extinguishers designed for Class B fires (see Sections 320 and 330) should be as follows:

**a.** Materials needed:

(1) Gasoline (in safety can).

(2) One metal pan or tub about 18 inches in diameter and 4 inches high.

(3) A supply of shredded paper.

(4) One 15-pound carbon dioxide or dry chemical extinguisher and a 2½-gallon water extinguisher *for emergency use.*

(5) One or more of the aircraft carbon dioxide (or dry chemical) and water extinguishers to be used for the tests.

**b.** Test fire suggestions:

(1) In a safe location outdoors, spill some gasoline along the ground in a narrow strip (4 or 5 inches wide) for a distance of about 5 feet. Light one end and have trainees extinguish with either the aircraft carbon dioxide or dry chemical extinguisher in the manner described in Paragraph 322 or 332.

(2) In a safe location outdoors, pour some gasoline in a metal pan or tub about 18 inches in diameter and 4 inches high. (The gasoline may be floated on water to conserve the fuel. Leave at least one-inch "freeboard.") Ignite the gasoline and have trainees extinguish with either the aircraft carbon dioxide or dry chemical extinguisher in the manner described in Paragraph 322 or 332.

(3) In a safe location outdoors, put a quantity of shredded paper on the ground (shielded from wind or in an open cardboard box like one for a suit of clothes). Ignite the material and allow it to kindle thoroughly. Have trainees use the aircraft carbon dioxide extinguisher until visible flame disappears. Usually, the fire will rekindle in a few moments. Have trainees then use the aircraft water extinguisher.

NOTE: It is generally not practical to try to demonstrate the use of these extinguishers on electrical fires. Explain that carbon dioxide and dry chemical extinguishers are satisfactory for use on electrical fires since the agents are nonconductive. Warn *against* the airborne use of dry chemical agents on electrical and electronic equipment essential to continued flight.

**A-32.** Training with extinguishers designed for Class A fires (see Paragraph 331 and Section 340) should be as follows:

**a.** Material needed:

(1) A wastebasket and a supply of shredded paper.

(2) Gasoline (in a safety can).