Aircraft
Hand Fire Extinguishers

June
1956

Twenty-five Cents*

NATIONAL FIRE PROTECTION ASSOCIATION
International
60 Batterymarch Street Boston 10, Mass.

2M-6-56-FP *Discount for quantities Printed in U.S.A.

National Fire Protection Association

International

Executive Office: 60 Batterymarch St., Boston 10, Mass.

The National Fire Protection Association was organized in 1896 to promote the science and improve the methods of fire protection and prevention, to obtain and circulate information on these subjects and to secure the cooperation of its members in establishing proper safeguards against loss of life and property by fire. Its membership includes nearly two hundred national and regional societies and associations (list on outside back cover) and more than sixteen thousand individuals, corporations, and organizations. Anyone interested may become a member; membership information is available on request.

This pamphlet is one of a large number of publications on fire safety issued by the Association including periodicals, books, posters and other publications; a complete list is available without charge on request. All NFPA standards adopted by the Association are published in six volumes of the **National Fire Codes** which are re-issued annually and which are available on an annual subscription basis. The standards, prepared by the technical committees of the National Fire Protection Association and adopted in the annual meetings of the Association, are intended to prescribe reasonable measures for minimizing losses of life and property by fire. All interests concerned have opportunity through the Association to participate in the development of the standards and to secure impartial consideration of matters affecting them.

NFPA standards are purely advisory as far as the Association is concerned, but are widely used by law enforcing authorities in addition to their general use as guides to fire safety.

Definitions

The official NFPA definitions of shall, should and approved are:

SHALL is intended to indicate requirements.

SHOULD is intended to indicate recommendations, or that which is advised but not required.

APPROVED refers to approval by the authority having jurisdiction.

Units of measurements used here are U. S. standard. 1 U. S. gallon = 0.83 Imperial gallons = 3.785 liters.

Approved Equipment

The National Fire Protection Association does not "approve" individual items of fire protection equipment, materials or services. The standards are prepared, as far as practicable, in terms of required performance, avoiding specifications of materials, devices or methods so phrased as to preclude obtaining the desired results by other means. The suitability of devices and materials for installation under these standards is indicated by the listings of nationally recognized testing laboratories, whose findings are customarily used as a guide to approval by agencies applying these standards. Underwriters' Laboratories, Inc., Underwriters' Laboratories of Canada and the Factory Mutual Laboratories test devices and materials for use in accordance with the appropriate standards, and publish lists which are available on request.

Aircraft Hand Fire Extinguishers

NFPA No. 408—1956

Foreword

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. This 1956 edition incorporates changes in the 1955 text that had been suggested affecting Paragraphs 334 and 421.a, adds new Paragraphs 423.a.b. and c., new Sections 430, 440 and 450, and a new Appendix covering a Suggested Air Crew Training Outline. This 1956 edition was adopted at the 60th Annual Meeting of the Association held in Boston, Mass., June 4–8, 1956.

It is the intent of these recommendations 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 these recommendations will be a useful guide to those interested. If these recommendations differ from specific regulations issued by an authority having jurisdiction over such equipment, those concerned are advised that these recommendations represent only the considered opinion of the Association acting in its capacity as a non-governmental and non-profit technical and educational organization to promote the science and improve the methods of fire protection.

Suggestions for improvement of the text of this standard will always be welcomed by the National Fire Protection Association and the sponsoring Committee. Copies of all suggestions should be submitted to the Executive Office of the Association and to the Sub-Committee Chairman.

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*Serving in a personal capacity in accordance with Par. 11-b-2 of the Regulations on Technical Committee Procedure.

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The following Subcommittee of the NFPA Committee on Aviation and Airport Fire Protection has been active during the past year in the preparation of these revisions to the NFPA Standard on Aircraft Hand Fire Extinguishers (NFPA No. 408).

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NFPA No. 408

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NFPA No. 408 — 1956

100. Scope

110. These recommendations cover 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 Laboratories, Underwriters' Laboratories of Canada, other nationally recognized fire testing laboratories, or, in the United States, by the Administrator, Civil Aeronautics Administration.

300. Basis for Recommendations

310. General.

311. Aircraft hand fire extinguishers of current commercial availability employ one or more of the following agents: bromochloromethane, carbon dioxide, carbon tetrachloride, dry chemical, methyl bromide and water or water solutions.

312. In selecting the agent for use in aircraft, consideration must be given to:

a. Type of fires liable to be encountered.

b. Ratio of agent's extinguishing ability to the quantity required.

c. Method and facilities for extinguishing agent application.

d. Agent's toxicity[1] and corrosive properties.

e. Gross weight of the unit.

f. Freezing point of the agent.

g. Maintenance requirements.[2]

320. Carbon Dioxide Extinguishers.

321. Carbon dioxide extinguishers are principally suited for fires involving flammable liquids and electrical equipment.

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[1]Extinguishing agents which have an Underwriters' Laboratories, Inc. rating for toxicity of Group 4 or under are not recommended for use in aircraft hand fire extinguishers. The Laboratories ratings for some of the commonly known fire extinguishing chemicals are as follows:

Bromochloromethane	Group 3*
Bromotrifluoromethane	Group 6***
Carbon dioxide	Group 5**
Carbon tetrachloride	Group 3**
Dibromodifluoromethane	Group 4***
Methyl bromide	Group 2**

* See Page 1235, NFPA Handbook of Fire Protection (Eleventh Edition)

** See Page 349, NFPA Handbook of Fire Protection (Eleventh Edition)

*** Unpublished data

[2]More detailed information on extinguishers is available in NFPA Standards for the Installation, Maintenance and Use of First Aid Fire Appliances (NFPA No. 10) published in National Fire Codes, Vol. IV and in separate pamphlet form.

They are of limited value for the extinguishment of fires involving ordinary combustible materials 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 as close to the fire as possible, 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.

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.

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).

330. Dry Chemical Extinguishers.

331. Dry chemical extinguishers are principally suited for fires involving flammable liquids and electrical equipment. They are of limited value for the extinguishment of fires involving ordinary combustible materials such as paper, fabric, etc.

332. In using extinguishers of this type, best results are obtained by directing the discharge at the base of the flames (although not directly into burning flammable liquids) and moving the nozzle rapidly from side to side to sweep the flames from the surface. Discharge should be continued after the fire has been extinguished to prevent possible reflash by coating the hot surfaces and any glowing material present.

333. Dry chemical extinguishers of the capacity recommended herein can be used without danger of suffocation to the occupants. The dust cloud will often reduce visibility temporarily. The use of dry chemical extinguishers in compartments occupied

by crew members is not recommended because of interference with visibility during discharge and the nonconductive powder residues that may be deposited on flight operational electrical contacts. The agent is noncorrosive, nontoxic, will not injure fabrics, and is nonpoisonous on food.

334. Discharge pressure may be secured from a small compressed gas cartridge or 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. Cartridges should be weighed or pressure checked and dry chemical content examined. Only dry chemical specified by the manufacturer of the extinguisher should be used for recharging.

340. Water Extinguishers.

341. Water extinguishers are most suitable for fires involving ordinary combustible materials such as paper, fabric, etc., where the cooling effect is essential and where the fire might smolder if attacked solely by such agents as carbon dioxide or dry chemical. Water extinguishers (of the kinds currently on the market) are not recommended for flammable liquid or electrical fires.

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 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. Cartridges should be weighed or pressure checked and water content examined.

350. Vaporizing Liquid Extinguishers.

351. Some vaporizing liquid type extinguishers employ bromochloromethane, carbon tetrachloride, dibromodifluoromethane and methyl bromide as the extinguishing agents. These chemicals have an Underwriters' Laboratories toxicity rating of Group 4 or under and therefore extinguishers employing these agents are not recommended for use as aircraft hand fire extinguishers. (See footnote, Paragraph 312.d.)

352. Other vaporizing liquid type extinguishers utilizing agents having an Underwriters' Laboratories toxicity rating of Group 5 or higher may be substituted, if desired, for the carbon dioxide or dry chemical extinguishers recommended in Section 420, if approved and given the same or better rating as to extinguishing effectiveness. Operating and maintenance instructions recommended by the approval authority should be followed.

400. Recommendations

410. General.

411. Selection of fire extinguishers should be based upon the facts discussed in Part 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 recommended follow:

421. Crew Compartment:

a. Crew compartments shall contain at least one approved carbon dioxide hand extinguisher[3] 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 or is not of the proper type.

422. Passenger and Galley Compartments:

a. In passenger compartments, the extinguishers specified in the following sub-paragraphs *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 ⅜ inch in height mounted on a contrasting background.

b. Aircraft accommodating no more than 30 passengers shall contain a minimum of one approved water extinguisher.[4] In

[3]The approved carbon dioxide and dry chemical extinguishers recommended herein should have a minimum 1-B, C rating (see NFPA Pamphlet No. 10). Such devices are available in a variety of sizes ranging in agent capacities from about 2 pounds (operated by a self closing lever or a pistol grip trigger) to about 6 pounds.

[4]See footnote next page.

personal type aircraft where crew and passenger compartments are not segregated and 4 or more seats are provided, one approved water extinguisher[4] 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[4] and one additional extinguisher suitable for the type of hazard.

d. Aircraft accommodating 61 or more passengers shall have a minimum of two approved water extinguishers[4] and one additional extinguisher suitable for the type of hazard. 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 type extinguisher.[4] 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 galley, one approved carbon dioxide[3] or one approved dry chemical extinguisher[3] shall be provided and this may constitute the "one additional extinguisher" referenced in Paragraphs 422.c. and d. above.

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.

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[4]A minimum one quart (nominal) size is recommended. (In the U. S. A., Technical Standard Order C-19a, issued by the Civil Aeronautics Administration, recommends an extinguisher constructed in compliance with Society of Automotive Engineers Aeronautical Standard 245 which specifies a 1⅜ quart extinguisher.)

[3]See footnote previous page.

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 availability or lack of fire detection equipment in such spaces influence the need for and type of hand fire extinguishers which might or might not be desired.

430. Daily Inspections of Aircraft Hand Fire Extinguishers.

431. Check that aircraft hand fire extinguishers are in their proper location. Check seal wire. Check pressure gauge for proper pressurization on stored pressure type equipment.

440. Maintenance of Aircraft Hand Fire Extinguishers.

441. Aircraft hand fire extinguishers shall be maintained in accordance with the provisions of the NFPA Standards on First Aid Fire Appliances (NFPA 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.

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. 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-20. Aircraft hand fire extinguishers recommended herein include those employing carbon dioxide, dry chemical, water, or (under the limiting conditions explained in Paragraphs 351 and 352) a vaporizing liquid, as the extinguishing agent. 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. Carbon dioxide and dry chemical extinguishers are principally suited for fires involving flammable liquids and electrical equipment and have limited value for extinguishing fires