NFPA 10
Portable Fire Extinguishers
1984

National Fire Protection Association Batterymarch Park, Quincy, MA 02269

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Policy Adopted by NFPA Board of Directors on December 3, 1982

The Board of Directors reaffirms that the National Fire Protection Association recognizes that the toxicity of the products of combustion is an important factor in the loss of life from fire. NFPA has dealt with that subject in its technical committee documents for many years

There is a concern that the growing use of synthetic materials may produce more or additional toxic products of combustion in a fire environment. The Board has, therefore, asked all NFPA technical committees to review the documents for which they are responsible to be sure that the documents respond to this current concern. To assist the committees in meeting this request, the Board has appointed an advisory committee to provide specific guidance to the technical committees on questions relating to assessing the hazards of the products of combustion

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Statement on NFPA Procedures

This material has been developed under the published procedures of the National Fire Protection Association, which are designed to assure the appointment of technically competent Committees having balanced representation. While these procedures assure the highest degree of care, neither the National Fire Protection Association, its members, nor those participating in its activities accepts any liability resulting from compliance or noncompliance with the provisions given herein, for any restrictions imposed on materials or processes, or for the completeness of the text.

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Standard for

Portable Fire Extinguishers

NFPA 10-1984

1984 Edition of NFPA 10

This edition of NFPA 10, *Standard for Portable Fire Extinguishers*, was prepared by the Technical Committee on Portable Fire Extinguishers and acted on by the National Fire Protection Association, Inc. at its Annual Meeting held May 21-24, 1984 in New Orleans, Louisiana. It was issued by the Standards Council on June 14, 1984, with an effective date of July 5, 1984, and supersedes all previous editions.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

Origin and Development of NFPA 10

In 1918 and 1919 the NFPA Committee on Field Practice (predecessor of the present committee) was active in developing a standard on First Aid Protection. The earliest official NFPA standard on this subject was adopted in 1921. Revised editions were adopted by the Association in 1926, 1928, 1929, 1930, 1931, 1932, 1936, 1938, 1942, 1945, 1950, 1953, 1955, 1956, 1957, 1958, 1959, 1961, 1962, 1963, 1965, 1966, 1967, 1968, 1969, 1970, 1972, 1973, 1974, 1975, 1978, and 1981. In 1965 the previous editions were divided into two separate texts, one covering "installation" and the second covering "maintenance and use." The 1974 edition recombined all the information previously contained in NFPA 10 and 10A. A new appendix was added to the 1974 edition to include information about the selection of extinguishers for home hazards. Information on selection and distribution of extinguishers was added to the appendix of the 1978 edition. Major revisions to provide simplification and uniformity were made in the 1984 edition.

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This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred.

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.

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Standard for

Portable Fire Extinguishers

NFPA 10-1984

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

Information on referenced publications can be found in Chapter 6 and Appendix G.

Chapter 1 Introduction

1-1* Scope. The provisions of this standard apply to the selection, installation, inspection, maintenance and testing of portable extinguishing equipment. The requirements given herein are **MINIMUM**. Portable extinguishers are intended as a first line of defense to cope with fires of limited size. They are needed even though the property is equipped with automatic sprinklers, standpipe and hose, or other fixed protection equipment (*see 3-1.1, 3-1.4, 3-2.1, and 3-2.3*). They do not apply to permanently installed systems for fire extinguishment, even though portions of such systems may be portable (such as hose and nozzles attached to a fixed supply of extinguishing agent).[1]

1-2* Purpose. This standard is prepared for the use and guidance of persons charged with selecting, purchasing, installing, approving, listing, designing, and maintaining portable fire extinguishing equipment. The fire protection requirements of this standard are general in nature and are not intended to abrogate the specific requirements of other NFPA standards for specific occupancies.

Nothing in this standard shall be construed as a restriction on new technologies or alternative arrangements, provided that the level of protection as herein described is not lowered and is acceptable to the authority having jurisdiction.

1-3 Definitions.

Approved. Acceptable to the "authority having jurisdiction."

NOTE: 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 or 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 concerned with product evaluations which is in a position to determine compliance with appropriate standards for the current production of listed items.

Authority Having Jurisdiction. The "authority having jurisdiction" is the organization, office or individual responsible for "approving" equipment, an installation or a procedure.

NOTE: The phrase "authority having jurisdiction" 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, 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 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."

BTC. The Board of Transport Commissioners of Canada, which formerly had jurisdiction over compressed gas cylinders and cartridges.

Class A Fires. Class A fires are fires in ordinary combustible materials, such as wood, cloth, paper, rubber, and many plastics.

Class B Fires. Class B fires are fires in flammable liquids, oils, greases, tars, oil base paints, lacquers, and flammable gases.

Class C Fires. Class C fires are fires which involve energized electrical equipment where the electrical nonconductivity of the extinguishing media is of importance. (When electrical equipment is de-energized, extinguishers for Class A or B fires may be used safely.)

Class D Fires. Class D fires are fires in combustible metals, such as magnesium, titanium, zirconium, sodium, lithium, and potassium.

Compressed Gas Cylinders. For purposes of this standard, compressed gas cylinders and cartridges are those containing carbon dioxide, nitrogen, or compressed air.

CTC. The Canadian Transport Commission, which has jurisdiction over compressed gas cylinders and cartridges.

DOT. The U.S. Department of Transportation, which has jurisdiction over compressed gas cylinders and cartridges.

Factory Test Pressure. The pressure at which the shell was tested at time of manufacture. This pressure is shown on the nameplate.

ICC. The Interstate Commerce Commission, which formerly had jurisdiction over compressed gas cylinders and cartridges prior to 1967.

[1] Fixed systems are covered by the following NFPA standards: NFPA 11, *Low Expansion Foam and Combined Agent Systems*; NFPA 11A, *Medium and High Expansion Foam Systems*; NFPA 12, *Carbon Dioxide Extinguishing Systems*; NFPA 12A, *Halon 1301 Fire Extinguishing Systems*; NFPA 12B, *Halon 1211 Fire Extinguishing Systems*; NFPA 13, *Installation of Sprinkler Systems*; NFPA 14, *Installation of Standpipe and Hose Systems*; NFPA 15, *Water Spray Fixed Systems*; NFPA 16, *Deluge Foam-Water Sprinkler Systems and Foam-Water Spray Systems*, NFPA 17, *Dry Chemical Extinguishing Systems*; and NFPA 96, *Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment*.

Inspection. A "quick check" that an extinguisher is available and will operate. It is intended to give reasonable assurance that the extinguisher is fully charged and operable. This is done by seeing that it is in its designated place, that it has not been actuated or tampered with, and that there is no obvious or physical damage or condition to prevent operation.

Labeled. Equipment or materials to which has been attached a label, symbol or other identifying mark of an organization 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.

Listed. Equipment or materials included in a list published by an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of listed equipment or materials and whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

NOTE: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which 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.

Maintenance. A "thorough check" of the extinguisher. It is intended to give maximum assurance that an extinguisher will operate effectively and safely. It includes a thorough examination and any necessary repair or replacement. It will normally reveal the need for hydrostatic testing.

Mild Steel Shell. Except for stainless steel and steel used for compressed gas cylinders, all other steel shells are defined as "mild steel" shells.

Portable Fire Extinguisher. A portable device containing powder, liquid, or gases which can be expelled under pressure for the purpose of suppressing or extinguishing a fire.

Recharging. The replacement of the extinguishing agent and also includes the expellant for certain types of extinguishers.

Service Pressure. The normal operating pressure as indicated on the gage and nameplate.

Servicing. Servicing includes one or more of the following: (1) maintenance, (2) recharging, and (3) hydrostatic testing.

Shall. Indicates a mandatory requirement.

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

1-4 Classification, Ratings and Performance of Fire Extinguishers.

1-4.1 Portable fire extinguishers are classified for use on certain classes of fires and rated for relative extinguishing effectiveness at a temperature of plus 70°F (21.1°C) by testing laboratories. This is based upon the preceding classification of fires and the fire-extinguishment potentials as determined by fire tests.

1-4.2* The classification and rating system described in this standard is that of Underwriters Laboratories Inc., and Underwriters' Laboratories of Canada and is based on extinguishing preplanned fires of determined size and description as follows:

CLASS A RATING – Wood and excelsior.

CLASS B RATING – Two-in. (5.1-cm) depth n-heptane fires in square pans.

CLASS C RATING – No fire test. Agent must be a nonconductor of electricity.

CLASS D RATING – Special tests on specific combustible metal fires.

1-4.3 Portable fire extinguishers used to comply with this standard shall be listed and labeled and meet or exceed the requirements of one of the fire test standards and one of the appropriate performance standards shown below:

(a) Fire Test Standards: ANSI/UL 711, CAN4-S508-M83

(b) Performance Standards:

1. CO_2 Types: ANSI/UL 154, CAN4-S503.-M83
2. Dry Chemical Types: ANSI/UL 299, ULC-S504
3. Water Types: ANSI/UL 626, CAN4-S507.-M83
4. Halon Types: ANSI/UL 1093, ULC-S512
5. Foam Types: ANSI/UL 8

1-4.4* The identification of the listing and labeling organization, the fire test, and performance standard which the extinguisher meets or exceeds shall be clearly marked on each extinguisher.

Exception: Extinguishers manufactured prior to January 1, 1986.

1-5 Classification of Hazards.

1-5.1 Light (Low) Hazard. Locations where the total amount of Class A combustible materials, including furnishings, decorations and contents, is of minor quantity. These may include buildings or rooms occupied as offices, classrooms, churches, assembly halls, etc. This classification anticipates that the majority of contents items are either noncombustible or so arranged that a fire is not likely to spread rapidly. Small amounts of Class B flammables used for duplicating machines, art departments, etc., are included provided that they are kept in closed containers and safely stored.

1-5.2 Ordinary (Moderate) Hazard. Locations where the total amount of Class A combustibles and Class B flammables are present in greater amounts than expected under Light (Low) Hazard occupancies. These occupancies could consist of offices, classrooms, mercantile shops

and allied storage, light manufacturing, research operations, auto showrooms, parking garages, workshop or support service areas of Light (Low) Hazard occupancies and warehouses containing Class I or Class II commodities as defined by NFPA 231, *Standard for Indoor General Storage*.

1-5.3 Extra (High) Hazard. Locations where the total amount of Class A combustibles and Class B flammables are present, in storage, production use and/or finished product over and above those expected and classed as ordinary (moderate) hazards. These occupancies could consist of woodworking, vehicle repair, aircraft and boat servicing, individual product display showrooms, product convention center displays, storage and manufacturing processes such as painting, dipping, coating, including flammable liquid handling. Also included is warehousing of, or in-process storage of other than Class I and Class II commodities.

1-6 General Requirements.

1-6.1 The classification of extinguishers shall consist of a LETTER which indicates the class of fire on which an extinguisher has been found to be effective, preceded by a rating NUMERAL (Class A and B only) which indicates the relative extinguishing effectiveness.

Exception: Extinguishers classified for use on Class C or D hazards shall not be required to have a numeral preceding the classification letter.

1-6.2 Portable extinguishers shall be maintained in a fully charged and operable condition, and kept in their designated places at all times when they are not being used.

1-6.3 Extinguishers shall be conspicuously located where they will be readily accessible and immediately available in the event of fire. Preferably they shall be located along normal paths of travel, including exits from an area.

1-6.4 Cabinets housing extinguishers shall not be locked.

Exception: Where extinguishers are subject to malicious use, locked cabinets may be used provided they include means of emergency access.

1-6.5 Extinguishers shall not be obstructed or obscured from view.

Exception: In large rooms, and in certain locations where visual obstruction cannot be completely avoided, means shall be provided to indicate the location.

1-6.6* Extinguishers shall be installed on the hangers or in the brackets supplied, mounted in cabinets, or set on shelves unless the extinguishers are of the wheeled type.

1-6.7 Extinguishers installed under conditions where they are subject to dislodgement shall be installed in brackets specifically designed to cope with this problem.

1-6.8 Extinguishers installed under conditions where they are subject to physical damage shall be protected from impact.

1-6.9 Extinguishers having a gross weight not exceeding 40 lb (18.14 kg) shall be installed so that the top of the extinguisher is *not more* than 5 ft (1.53 m) above the floor. Extinguishers having a gross weight greater than 40 lb (18.14 kg) (except wheeled types) shall be so installed that the top of the extinguisher is *not more* than 3½ ft (1.07 m) above the floor. In no case shall the clearance between the bottom of the extinguisher and the floor be less than 4 in. (102 mm).

1-6.10 Operating instructions shall be located on the front of the extinguisher. Other labels and markings shall not be placed on the front.

Exception: In addition to manufacturers' labels, other labels that specifically relate to operation, classification or warning information shall be permitted on the front.

1-6.11 Extinguishers mounted in cabinets or wall recesses or set on shelves shall be placed in a manner such that the extinguisher operating instructions face outward. The location of such extinguishers shall be marked conspicuously (*see 1-6.5*).

1-6.12* Where extinguishers are installed in sealed cabinets which are exposed to elevated temperatures, cabinets shall be provided with screened openings and drains.

1-6.13* Water type (water, foam, AFFF, wetting agent, and soda-acid) extinguishers shall not be installed in areas where temperatures are outside the range of 40°F to 120°F (4°C to 49°C). All other types shall not be installed in areas where temperatures are outside the range of 40°F to 120°F (40°C to 49°C).

Exception No. 1: When extinguishers are installed in locations subject to temperatures outside these ranges, they shall be of a type approved and listed for the temperature to which they are exposed, or they must be placed in an enclosure capable of maintaining the stipulated range of temperatures.

Exception No. 2: Extinguishers containing plain water only can be protected to temperatures as low as −40°F (−40°C) by the addition of an antifreeze stipulated on the extinguisher nameplate. Calcium chloride solutions shall not be used in stainless steel extinguishers.

Exception No. 3: Some extinguishers that use nitrogen as an expellant gas rather than carbon dioxide are approved or listed for temperatures as low as −65°F (−54°C).

1-6.14 An extinguisher instruction manual shall be provided to the owner or his agent giving condensed instructions and cautions necessary to the installation, operation, inspection, and maintenance. The manual may be specific to the extinguisher involved or it may cover many types. The manual shall refer to this standard as a source of detailed instruction.

1-7 Units. Metric units of measurement in this standard are in accordance with the modernized metric system known as the International System of Units (SI). One unit (liter), outside of but recognized by SI, is commonly used in international fire protection. The units are listed in Table 1-7 with conversion factors.

Table 1-7

Name of Unit	Unit Symbol	Conversion Factor
liter	L	1 gal = 3.785 L
cu decimeter	dm^3	1 gal = 3.785 dm^3

For additional conversions and information see ASTM E380, *Standard for Metric Practice*.

1-7.1 If a value for measurement as given in this standard is followed by an equivalent value in other units, the first stated is to be regarded as the requirement. A given equivalent value may be approximate.

1-7.2 The conversion procedure for the SI units has been to multiply the quantity by the conversion factor and then round the result to the appropriate number of significant digits.

Chapter 2 Selection of Extinguishers

2-1* General Requirements. The selection of extinguishers for a given situation shall be determined by the character of the fires anticipated, the construction and occupancy of the individual property, the vehicle or hazard to be protected, ambient-temperature conditions, and other factors. (*See Table A-2-1, Appendix A.*) The number, size, placement, and limitations of use of extinguishers required shall be determined by using Chapter 3.

2-2 Selection by Hazard.

2-2.1 Extinguishers shall be selected for the specific class or classes of hazards to be protected in accordance with the following subdivisions.

2-2.1.1* Extinguishers for protecting Class A hazards shall be selected from the following: water, antifreeze, soda-acid, foam, aqueous film forming foam (AFFF), wetting agent, loaded stream, multipurpose dry chemical, and bromochlorodifluoromethane (Halon 1211).

2-2.1.2 Extinguishers for protection of Class B hazards shall be selected from the following: bromotrifluoromethane (Halon 1301), bromochlorodifluoromethane (Halon 1211), carbon dioxide, dry chemical types, foam, and aqueous film forming foam (AFFF).

2-2.1.3* Extinguishers for protection of Class C hazards shall be selected from the following: bromotrifluoromethane (Halon 1301), bromochlorodifluoromethane (Halon 1211), carbon dioxide, and dry chemical types.[1]

[1]Carbon dioxide extinguishers equipped with metal horns are not considered safe for use on fires in energized electrical equipment and, therefore, are not classified for use on Class C hazards.

2-2.1.4* Extinguishers and extinguishing agents for the protection of Class D hazards shall be of types approved for use on the specific combustible-metal hazard.

2-3 Application for Specific Hazards.

2-3.1 Class B Fire Extinguishers for Pressurized Flammable Liquids and Pressurized Gas Fires. Fires of this nature are considered to be a special hazard. Class B fire extinguishers containing agents other than dry chemical are relatively ineffective on this type of hazard due to stream and agent characteristics. Selection of extinguishers for this type of hazard shall be made on the basis of recommendations by manufacturers of this specialized equipment. The system used to rate extinguishers on Class B fires (flammable liquids in depth) is not applicable to these types of hazards. It has been determined that special nozzle design and rates of agent application are required to cope with such hazards. Caution: It is undesirable to attempt to extinguish this type of fire unless there is reasonable assurance that the source of fuel can be promptly shut off.

2-3.2 Fire Extinguisher Size and Placement for Cooking Grease Fires. Extinguishers provided for the protection of cooking grease fires shall be only of the sodium bicarbonate or potassium bicarbonate dry chemical type. Installation shall be in accordance with Table 3-3.1 for Extra (High) Hazard.

2-3.3 Three-dimensional Class B Fires. A three-dimensional Class B fire involves Class B materials in motion such as pouring, running, or dripping flammable liquids and generally includes vertical as well as one or more horizontal surfaces. Fires of this nature are considered to be a special hazard. Selection of extinguishers for this type of hazard shall be made on the basis of recommendations by manufacturers of this specialized equipment. The system used to rate extinguishers on Class B fires (flammable liquids in depth) is not directly applicable to this type of hazard.

NOTE: The installation of fixed systems should be considered when applicable.

2-3.4 Water Soluble Flammable Liquid Fires. Foam and AFFF type fire extinguishers shall not be used for the protection of water soluble flammable liquids, such as alcohols, acetone, esters, ketones, etc., unless specifically referenced on the extinguisher nameplate.

2-3.5* Electronic Equipment Fires. Extinguishers for the protection of delicate electronic equipment shall be selected from the following: bromotrifluoromethane (Halon 1301), bromochlorodifluoromethane (Halon 1211) and carbon dioxide.

Chapter 3 Distribution of Extinguishers

3-1 General Requirements.

3-1.1* The minimum number of fire extinguishers needed to protect a property shall be determined as outlined in Chapter 3. Frequently, additional extinguishers may be installed to provide more suitable protection. Extinguishers having ratings less than specified in Tables 3-2.1 and 3-3.1 may be installed provided they are not used in fulfilling the minimum protective requirements of this chapter.

3-1.2* Fire extinguishers shall be provided for the protection of both the building structure, if combustible, and the occupancy hazards contained therein.

3-1.2.1 Required building protection shall be provided by fire extinguishers suitable for Class A fires.

3-1.2.2* Occupancy hazard protection shall be provided by fire extinguishers suitable for such Class A, B, C, or D fire potentials as may be present.

3-1.2.3 Extinguishers provided for building protection may be considered also for the protection of occupancies having a Class A fire potential.

3-1.2.4 Combustible buildings having an occupancy hazard subject to Class B and/or Class C fires shall have a standard complement of Class A fire extinguishers for building protection, plus additional Class B and/or Class C extinguishers. Where fire extinguishers have more than one letter classification (such as 2-A:20-B:C), they may be considered to satisfy the requirements of each letter class.

3-1.3 Rooms or areas shall be classified generally as light (low) hazard, ordinary (moderate) hazard, or extra (high) hazard. Limited areas of greater or lesser hazard shall be protected as required.

3-1.4 The type, size, number, and placement for special storage occupancies is covered by NFPA 231, *Indoor General Storage*, NFPA 231C, *Rack Storage of Materials*, and NFPA 231D, *Storage of Rubber Tires*.

3-2 Fire Extinguisher Size and Placement for Class A Hazards.

3-2.1 Minimal sizes of fire extinguishers for the listed grades of hazards shall be provided on the basis of Table 3-2.1 except as modified by 3-2.3. Extinguishers shall be located so that the maximum travel distances shall not exceed those specified in Table 3-2.1, except as modified by 3-2.3.

3-2.1.1 Certain smaller extinguishers which are charged with multipurpose dry chemical or Halon 1211 are rated on Class B and Class C fires, but have insufficient effectiveness to earn the minimum 1-A rating even though they have value in extinguishing smaller Class A fires. They shall not be used to meet the requirements of 3-2.1.

Table 3-2.1

	Light (Low) Hazard Occupancy	Ordinary (Moderate) Hazard Occupancy	Extra (High) Hazard Occupancy
Minimum rated single extinguisher	2-A	2-A	4-A*
Maximum floor area per unit of A	3,000 sq ft	1,500 sq ft	1,000 sq ft
Maximum floor area for extinguisher	11,250 sq ft**	11,250 sq ft**	11,250 sq ft**
Maximum travel distance to extinguisher	75 ft	75 ft	75 ft

*Two 2½ gal (9.46 L) water type extinguishers can be used to fulfill the requirements of one 4-A rated extinguisher

**See Appendix E-3-3.

NOTE: 1 ft = 0.305 m
1 sq ft = 0.0929 m²

3-2.2 Up to one-half of the complement of extinguishers as specified in Table 3-2.1 may be replaced by uniformly spaced 1½-in. (3.81-cm) hose stations for use by the occupants of the building. When hose stations are so provided they shall conform to NFPA 14, *Installation of Standpipe and Hose Systems*. The location of hose stations and the placement of fire extinguishers shall be in such a manner that the hose stations do not replace more than every other extinguisher.

3-2.3 Where the floor area of a building is less than that specified in Table 3-2.1, at least one extinguisher of the minimum size recommended shall be provided.

3-2.4 The protection requirements may be fulfilled with extinguishers of higher rating provided the travel distance to such larger extinguishers shall not exceed 75 ft (22.7 m).

3-2.5 For Class A extinguishers rated under the rating classification system used prior to 1955, their equivalency shall be in accordance with Table 3-2.5.

Table 3-2.5

All Water & Loaded Stream Types	Pre-1955 Rating	Equivalency
1¼ to 1¾ gal	A-2	1-A
2½ gal	A-1	2-A
4 gal	A-1	3-A
5 gal	A-1	4-A
17 gal	A	10-A
33 gal	A	20-A

NOTE: 1 gal = 3.785 L.

3-3 Fire Extinguisher Size and Placement for Class B Fires Other than for Fires in Flammable Liquids of Appreciable Depth.

3-3.1 Minimal sizes of fire extinguishers for the listed grades of hazard shall be provided on the basis of Table 3-3.1. Extinguishers shall be located so that the maximum travel distances shall not exceed those specified in the table used.

Exception: Extinguishers of lesser rating, desired for small specific hazards within the general hazard area, may be used, but shall not be considered as fulfilling any part of the requirements of Table 3-3.1.

Table 3-3.1

Type of Hazard	Basic Minimum Extinguisher Rating	Maximum Travel Distance to Extinguishers (Ft)	(m)
Light (low)	5B	30	9 15
	10B	50	15 25
Ordinary (moderate)	10B	30	9 15
	20B	50	15 25
Extra (high)	40B	30	9 15
	80B	50	15.25

NOTE 1 The specified ratings do not imply that fires of the magnitudes indicated by these ratings will occur, but rather to give the operators more time and agent to handle difficult spill fires that may occur.

NOTE 2: For fires involving water soluble flammable liquids see 2-3.6

NOTE 3. For specific hazard applications see Section 2-3

3-3.2 Two or more extinguishers of lower rating shall not be used to fulfill the protection requirements of Table 3-3.1.

Exception No. 1: Up to three foam extinguishers of at least 2½ gal (9.46 L) capacity may be used to fulfill light (low) hazard requirements.

Exception No. 2: Up to three AFFF extinguishers of at least 2½ gal (9.46 L) capacity may be used to fulfill extra (high) hazard requirements.

3-3.3 The protection requirements may be fulfilled with extinguishers of higher ratings provided the travel distance to such larger extinguishers shall not exceed 50 ft (15.25 m).

3-3.4 For Class B extinguishers rated under the rating classification system used prior to 1955, their equivalency shall be in accordance with Table 3-4.5.

3-4 Fire Extinguisher Size and Placement for Class B Fires in Flammable Liquids of Appreciable Depth.[1]

3-4.1* Portable fire extinguishers shall not be installed as the sole protection for flammable liquid hazards of appreciable depth [greater than ¼ in. (0.64 cm)] where the surface area exceeds 10 sq ft (0.93 m²).

[1]For dip tanks containing flammable or combustible liquids exceeding 150 gal (568 L) liquid capacity or having a liquid surface exceeding 4 sq ft (0.38 m²), see NFPA 34, *Dip Tanks*, for requirements of automatic extinguishing facilities.

Exception: Where personnel who are trained in extinguishing fires in the protected hazards, or a counterpart, are available on the premises, the maximum surface area shall not exceed 20 sq ft (1.86 m²).

3-4.2 For flammable liquid hazards of appreciable depth such as in dip or quench tanks, a Class B fire extinguisher shall be provided on the basis of at least two numerical units of Class B extinguishing potential per sq ft (0.0929 m²) of flammable liquid surface of the largest tank hazard within the area.

Exception No. 1: Where approved automatic fire protection devices or systems have been installed for a flammable liquid hazard, additional portable Class B fire extinguishers may be waived. Where so waived, Class B extinguishers shall be provided as covered in 3-3.1 to protect areas in the vicinity of such protected hazards.

Exception No. 2: Foam or AFFF type extinguishers may be provided on the basis of 1B of protection per sq ft of hazard.

3-4.3 Two or more extinguishers of lower ratings shall not be used in lieu of the extinguisher required for the largest tank.

Exception: Up to three foam or AFFF extinguishers of 2½ gal (9.46 L) capacity may be used to fulfill these requirements.

3-4.4 Travel distances for portable extinguishers shall not exceed 50 ft (15.25 m).

3-4.4.1 Scattered or widely separated hazards shall be individually protected. An extinguisher in the proximity

Table 3-4.5

Type and Capacity	Pre-1955	Equivalency
Foam		
2½ gal	B-1	2-B
5 gal	B-1	5-B
17 gal	B	10-B
33 gal	B	20-B
Carbon Dioxide		
Under 7 lb	B-2	1-B
7 lb	B-2	2-B
10 to 12 lb	B-2	2-B
15 to 20 lb	B-1	2-B
25 to 26 lb	B-1	5-B
50 lb	B-1	10-B
75 lb	B-1	10-B
100 lb	B	10-B
Dry Chemical		
4 to 6¼ lb	B-2	2-B
7½ lb	B-2	5-B
10 to 15 lb	B-1	5-B
20 lb	B-1	10-B
30 lb	B-1	20-B
75 lb and up	B	40-B

NOTE 1 1 gal = 3.785 L 1 lb = 0.454 kg

NOTE 2 Vaporizing liquid extinguishers (carbon tetrachloride or chlorobromomethane base) are not recognized in this standard

of a hazard shall be carefully located so as to be accessible in the presence of a fire without undue danger to the operator.

3-4.5 For Class B extinguishers rated under the rating classification system used prior to 1955, their equivalency shall be in accordance with Table 3-4.5.

3-5 Fire Extinguisher Size and Placement for Class C Hazards. Extinguishers with Class C ratings shall be required where energized electrical equipment may be encountered which would require a nonconducting extinguishing medium. This will include fire either directly involving or surrounding electrical equipment. Since the fire itself is a Class A or Class B hazard, the extinguishers are sized and located on the basis of the anticipated Class A or B hazard.

NOTE: Electrical equipment should be de-energized as soon as possible to prevent reignition

3-5.1 For extinguishers classified under the system used prior to 1955, the pre-1955 classifications of "C-2," "C-1," and "C" shall be equivalent to the current "C" designation.

Exception No. 1: Carbon dioxide extinguishers with metallic horns shall not carry any "C" classification.

Exception No. 2: Vaporizing liquid extinguishers (carbontetrachloride or chlorobromomethane base) are not recognized in this standard.

3-6 Size and Placement for Class D Hazards.

3-6.1 Extinguishers or extinguishing agents with Class D ratings shall be provided for fires involving combustible metals.

3-6.2 Extinguishing equipment shall be located not more than 75 ft (22.7 m) from the Class D hazard.

3-6.3 Size determination shall be on the basis of the specific combustible metal, its physical particle size, area to be covered and recommendations by the extinguisher manufacturer on data from control tests conducted.

Chapter 4 Inspection, Maintenance, and Recharging

4-1 General.

4-1.1 This chapter is concerned with the rules governing inspection, maintenance, and recharging of extinguishers. These factors are of prime importance in ensuring operation at the time of a fire.

4-1.2 The procedure for inspection and maintenance of fire extinguishers varies considerably. Minimal knowledge is necessary to perform a monthly "quick check" or inspection in order to follow the inspection procedure as outlined in Section 4-3. A trained person who has undergone the instructions necessary to reliably perform maintenance and has the manufacturer's service manual shall service the fire extinguishers not more than one year apart, as outlined in Section 4-4.

4-1.3 The owner or occupant of a property in which extinguishers are located shall be responsible for such inspection, maintenance, and recharging.

4-1.4* Maintenance, servicing and recharging shall be performed by trained persons having available the appropriate servicing manual(s), the proper types of tools, recharge materials, lubricants, and manufacturer's recommended replacement parts.

4-2 Definitions.

4-2.1 Inspection. Inspection is a "quick check" that an extinguisher is available and will operate. It is intended to give reasonable assurance that the extinguisher is fully charged and operable. This is done by seeing that it is in its designated place, that it has not been actuated or tampered with, and that there is no obvious or physical damage or condition to prevent operation.

4-2.2 Maintenance. Maintenance is a "thorough check" of the extinguisher. It is intended to give maximum assurance that an extinguisher will operate effectively and safely. It includes a thorough examination and any necessary repair or replacement. It will normally reveal the need for hydrostatic testing.

4-2.3 Recharging. Recharging is the replacement of the extinguishing agent and also includes the expellant for certain types of extinguishers.

4-3 Inspection.

4-3.1* Frequency. Extinguishers shall be inspected monthly, or at more frequent intervals when circumstances require.

4-3.2 Procedures. Periodic inspection of extinguishers shall include a check of at least the following items:

(a) Located in designated place.

(b) No obstruction to access or visibility.

(c) Operating instructions on nameplate legible and facing outward.

(d) Seals and tamper indicators not broken or missing.

(e) Determine fullness by weighing or "hefting."

(f) Examine for obvious physical damage, corrosion, leakage, or clogged nozzle.

(g) Pressure gage reading or indicator in the operable range or position.

4-3.3 Corrective Action. When an inspection of any extinguisher reveals a deficiency in any of the conditions listed in (a) and (b) of 4-3.2, immediate corrective action shall be taken.

4-3.3.1 Rechargeable Extinguishers. When an inspection of any rechargeable extinguisher reveals a deficiency in any of the conditions listed in (c), (d), (e), (f), and (g) of 4-3.2, it shall be subjected to applicable maintenance procedures.

4-3.3.2 Nonrechargeable. When an inspection of any nonrefillable disposable extinguisher reveals a deficiency in any of the conditions listed in (c), (e), (f), and (g) of 4-3.2, it shall be discharged and removed from service.

4-3.4 Recordkeeping.

4-3.4.1 Personnel making inspections shall keep records for those extinguishers that were found to require corrective actions.

4-3.4.2 At least monthly, the date the inspection was performed and the initials of the person performing the inspection shall be recorded.

4-4* Maintenance.

4-4.1 Frequency. Extinguishers shall be subjected to maintenance not more than one year apart or when specifically indicated by an inspection. Maintenance procedures shall be performed in accordance with 4-4.2.

4-4.1.1 Stored pressure types containing a loaded stream agent shall be disassembled on an annual basis and subjected to a complete maintenance. Prior to disassembly the extinguisher shall be fully discharged to check the operation of the discharge valve and pressure gage.

4-4.1.2* A conductivity test shall be conducted on all carbon dioxide hose assemblies. Hose assemblies found to be nonconductive shall be replaced.

4-4.1.3 Every six years, stored pressure extinguishers that require a 12-year hydrostatic test shall be emptied and subjected to the applicable maintenance procedures. When the applicable maintenance procedures are performed during periodic recharging or hydrostatic testing, the six-year requirement shall begin from that date.

Exception No. 1: Extinguishers having nonrefillable disposable containers are exempt.

4-4.1.4 Extinguishers out of service for maintenance or recharge shall be replaced by spare extinguishers of the same type and at least equal rating.

4-4.2* Procedures. Maintenance procedures shall include a thorough examination of the three basic elements of an extinguisher:

(a) mechanical parts,

(b) extinguishing agent, and

(c) expelling means.

Exception No. 1: It is not necessary during the annual maintenance to internally examine CO_2 or stored pressure extinguishers equipped with pressure indicators or gages except for those types specified in 4-4.1.1. HOWEVER, such extinguishers shall be thoroughly examined externally in accordance with the applicable items of 4-4.2(a).

Exception No. 2: Factory sealed ("disposable type") extinguishers shall be inspected and maintained only in accordance with the nameplate instructions.

4-4.3* Recordkeeping. Each extinguisher shall have a tag or label securely attached that indicates the month and year the maintenance was performed and shall identify the person performing the service.[1] The same record tag or label shall indicate if recharging was also performed.

4-4.3.1 For the six-year requirement of 4-4.1.3, this information shall be included on the maintenance tag or label. This information shall be transferred to each subsequent maintenance tag or label.

4-4.3.2 Labels indicating inspection, maintenance, hydrostatic retests, and six-year maintenance shall not be placed on the front of the extinguisher.

4-5 Recharging.

4-5.1* General. All rechargeable type extinguishers shall be recharged after use or as indicated by an inspection or when performing maintenance. When performing the recharging, the recommendations of the manufacturers shall be followed. For recharge chemicals, see 4-5.3.1.

4-5.2 Frequency.

4-5.2.1 Soda-Acid, Foam, and Pump-Tank. Every 12 months, soda-acid, foam, pump-tank water, and pump-tank calcium chloride base antifreeze types of extinguishers shall be recharged with new chemicals or water, as applicable.

4-5.2.2 Wetting Agent. The agent in stored pressure wetting agent (wet chemical) extinguishers shall be replaced annually.

NOTE: Only the agent specified on the nameplate shall be used for recharging. The use of water or other agents is prohibited.

4-5.2.3 AFFF. The agent, liquid or solid charge type, in AFFF (aqueous film forming foam) extinguishers shall be replaced at least once every five years.

4-5.3 Procedures.

4-5.3.1* Recharge Chemicals. Only those materials specified on the nameplate, or materials proven to have equal chemical composition and physical characteristics, shall be used. Tests shall be conducted to assure equal performance.

4-5.3.2* Mixing of Agents. Multipurpose dry chemicals shall not be mixed with alkaline based dry chemicals.

4-5.3.3 Topping Off. The remaining agent in a partially discharged dry chemical extinguisher shall be thoroughly checked for the proper type, contamination and condition. Dry chemical found to be of the wrong type, or contaminated, shall be removed.

4-5.3.4 Dry Powder. Pails or drums containing dry powder agents for scoop or shovel application for use on metal fires shall be kept full and covered at all times. The dry powder shall be replaced if found damp. (*See A-4-5.3.1.*)

[1]Under special circumstances or when local requirements are in effect, additional information may be desirable or required on record tags.

4-5.3.5* Replacement pressure gages shall have the proper indicated charging (service) pressure, be marked for use with the agent in the extinguisher and be compatible with the extinguisher valve body material. The gage used to set the regulated source of pressure shall be calibrated at least annually.

4-5.3.6 Precautionary Pressurization Measures. A rechargeable stored pressure type extinguisher shall be pressurized only to the charging pressure specified on the extinguisher nameplate. A regulated source of pressure, set no higher than 25 psi (172 kPa) above the operating (service) pressure, shall be used to pressurize fire extinguishers.

NOTE: An unregulated source of pressure such as a nitrogen cylinder without a pressure regulator should never be used because the extinguisher could be overpressurized and possibly rupture.

4-5.3.7* Pressurizing Gas. Only standard industrial grade nitrogen with a dew point of -70°F (-57°C) or lower shall be used to pressurize stored pressure dry chemical and Halon type fire extinguishers. Compressed air through moisture traps shall not be used for pressurizing even though so stated in the instructions on older extinguishers.

4-5.3.8 Conversion of Extinguisher Types. No extinguisher shall be converted from one type to another, nor shall any extinguisher be converted to use a different type of extinguishing agent.

4-5.3.9* Removal of Moisture. For all nonwater types of extinguishers any moisture shall be removed before recharging.

4-5.3.10* Carbon Dioxide Recharging. The vapor phase of carbon dioxide shall not be less than 99.5 percent carbon dioxide. The water content of the liquid phase shall not be more than 0.01 percent by weight [-30°F (-34.4°C) dew point]. Oil content of the carbon dioxide shall not exceed 10 ppm by weight.

4-5.3.11* Leak Test. After recharging, a leak test shall be performed on stored pressure and self-expelling types.

4-5.3.12 Recharging Water Types. When recharging stored pressure extinguishers, overfilling will result in improper discharge. The proper amount of liquid agent shall be determined by using one of the following:

(a) exact measurement in gallons, or by weight

(b) use of an antioverfill tube when provided, or

(c) use of a fill mark on extinguisher shell, if provided.

Chapter 5 Hydrostatic Testing

5-1 General.

5-1.1 Hydrostatic testing shall be performed by persons trained in pressure testing procedures and safeguards, and having available suitable testing equipment, facilities and appropriate servicing manual(s).

5-1.2 If, at any time, an extinguisher shows evidence of corrosion or mechanical injury, it shall be hydrostatically tested, subject to the provisions of 5-1.3 and 5-1.4.

Exception No. 1: Pump tanks do not require a hydrostatic test.

Exception No. 2: Extinguishers having nonrefillable disposable containers shall be discharged and discarded.

5-1.3 Examination of Cylinder Condition. When an extinguisher cylinder or shell has one or more conditions listed in this subdivision, it shall not be hydrostatically tested but shall be destroyed by the owner or at his direction:

(a) When there exists repairs by soldering, welding, brazing, or use of patching compounds.

NOTE: For welding or brazing on mild steel shells, consult the manufacturer of the extinguisher.

(b) When the cylinder or shell threads are damaged.

(c) When there exists corrosion that has caused pitting, including under removable nameplate band assemblies.

(d) When the extinguisher has been burned in a fire.

(e) When a calcium chloride type of extinguishing agent was used in a stainless steel extinguisher.

(f) When the shell is of copper or brass construction joined by soft solder or rivets.

5-1.4* Aluminum Shell/Cylinder. Extinguishers having aluminum cylinders or shells suspected of being exposed to temperatures in excess of 350°F (177°C) shall be removed from service and subjected to a hydrostatic test.

5-2 Frequency. At intervals not exceeding those specified in Table 5-2, extinguishers shall be hydrostatically tested.

Exception No. 1: Nonrefillable factory-sealed disposable containers do not require hydrostatic testing.

Exception No. 2: Extinguishers utilizing a cylinder that has DOT or CTC markings shall be hydrostatically tested, or replaced, according to the requirements of DOT or CTC.

Exception No. 3: For extinguishers not covered in Exceptions No. 1 and 2 the first retest may be conducted within 12 months of the specified test intervals.

5-2.1 Compressed Gas Cylinders and Cartridges. Nitrogen cylinders or cartridges used for inert gas storage used as an expellant for wheeled extinguishers shall be hydrostatically tested every five years.

Exception: Cylinders (except those charged with carbon dioxide) complying with Part 173.34 (e) 15, Title 49, Code of Federal Regulations, may be hydrostatically tested every 10 years.

5-2.2 Hose Assemblies. A hydrostatic test shall be performed on extinguisher hose assemblies which are equipped with a shutoff nozzle at the end of the hose. The test interval shall be the same as specified for the extinguisher on which the hose is installed.

Table 5-2

Hydrostatic Test Interval for Extinguishers

Extinguisher Type	Test Interval (Years)
Soda Acid	5
Cartridge-Operated Water and/or Antifreeze	5
Stored Pressure Water and/or Antifreeze	5
Wetting Agent	5
Foam	5
AFFF (Aqueous Film Forming Foam)	5
Loaded Stream	5
Dry Chemical with Stainless Steel Shells	5
Carbon Dioxide	5
Dry Chemical, Stored Pressure, with Mild Steel Shells, Brazed Brass Shells, or Aluminum Shells	12
Dry Chemical, Cartridge- or Cylinder-Operated, with Mild Steel Shells	12
Bromotrifluoromethane Halon 1301	12
Bromochlorodifluoromethane Halon 1211	12
Dry Powder, Cartridge- or Cylinder-Operated, with Mild Steel Shells	12

NOTE 1: All types of extinguishers with copper or brass shells joined by soft solder are prohibited from hydrostatic testing. (*See 5-1.3(f).*)

NOTE 2: Stored pressure water extinguishers with fiber glass shells (pre-1976) are prohibited from hydrostatic testing due to manufacturer's recall

5-3 Test Pressures.

5-3.1 Compressed Gas Cylinders.

5-3.1.1 Carbon dioxide extinguishers shall be tested at ⅝ the service pressure as stamped into the cylinder.

Exception: Carbon dioxide extinguishers having cylinder specification ICC3 shall be tested at 3,000 psi (20 685 kPa).

5-3.1.2 Nitrogen cylinders and carbon dioxide cylinders used with wheeled extinguishers shall be tested at ⅝ the service pressure as stamped into the cylinder.

5-3.2 Stored Pressure Types. All stored pressure and bromochlorodifluoromethane (Halon 1211) types of extinguishers shall be hydrostatically tested at the factory test pressure not to exceed two times the service pressure.

5-3.3 Self-Generating and Cartridge-Operated Types.

5-3.3.1 Self-generating types (soda acid and foam) of stainless steel construction and cartridge operated water type extinguishers of stainless steel construction shall be hydrostatically tested at 350 psi (2413 kPa). (For those of aluminum shell construction, see 5-1.4.)

5-3.3.2 Cartridge- or cylinder-operated dry chemical and dry powder types of extinguishers shall be hydrostatically tested at their original factory test pressure as shown on the nameplate or shell.

5-3.4 Test Pressures for Hose Assemblies.

5-3.4.1 Carbon dioxide hose assemblies requiring a hydrostatic pressure test shall be tested at 1,250 psi (8619 kPa).

5-3.4.2 Dry chemical and dry powder hose assemblies requiring a hydrostatic pressure test shall be tested at 300 psi (2068 kPa) or at service pressure, whichever is the higher.

5-4 Test Equipment and Procedures.

5-4.1 General.

5-4.1.1 Air or gas pressure shall not be used for pressure testing. The failure of an extinguisher shell may be violent and dangerous.

5-4.1.2 When extinguisher shells, cylinders, or cartridges fail a hydrostatic pressure test, they shall be destroyed by the owner or at his direction.

5-4.2 Test Equipment for Compressed Gas Types.

5-4.2.1 The equipment for testing cylinders and cartridges shall be of the water jacket type that meets the specifications of the pamphlet *Methods for Hydrostatic Testing of Compressed Gas Cylinders* (Pamphlet C-1), published by the Compressed Gas Association.

5-4.2.2 Hose assemblies of carbon dioxide extinguishers that require a hydrostatic test shall be tested within a protective cage device.

5-4.3* Test Equipment for Noncompressed Gas Types.

5-4.3.1 The equipment for testing noncompressed gas types consists of the following:

(a) A hydrostatic test pump, hand or power operated, to be capable of producing not less than 150 percent of the test pressure. It is to include appropriate check valves and fittings.

(b) A flexible connection for attachment to the test pump. It shall be provided with necessary fittings to test through the extinguisher nozzle, test bonnet, or hose outlet, as is applicable.

(c) A protective cage or barrier for personnel protection, designed to provide visual observation of the extinguisher under test.

5-4.3.2 Drying equipment is required to dry all nonwater types of extinguishers that have passed the hydrostatic test.

5-5 Testing Procedures.

5-5.1 Compressed Gas Types.

5-5.1.1 In addition to the visual examinations required prior to test as stated in 5-1.3, an internal examination shall be made prior to the hydrostatic test. The procedures for this internal examination shall be in accordance with the requirements of the *Standard for Visual Inspection of Compressed Gas Cylinders* (CGA C-6) and *Standard for Visual Inspection of High Pressure Aluminum Compressed Gas Cylinders* (CGA C-6.1), published by the Compressed Gas Association.

5-5.1.2 The hydrostatic testing of compressed gas cylinders and cartridges shall be in accordance with the procedures specified in the pamphlet *Methods for Hydrostatic Testing of Compressed Gas Cylinders* (Pamphlet C-1), published by the Compressed Gas Association.

5-5.2* Testing Procedures for Noncompressed Gas Types. The testing procedures for noncompressed gas cylinders and shells and hose assemblies are detailed in Appendix A of this standard.

5-5.3* Testing Procedures for Hose Assemblies. The testing procedures for hose assemblies requiring a hydrostatic test are detailed in Appendix A.

5-5.4 Recording of Tests.

5-5.4.1 Compressed Gas Types. For compressed gas cylinders and cartridges passing a hydrostatic test, the month and year shall be stamped into the cylinder in accordance with the requirements set forth by DOT or the Canadian Transport Commission.

NOTE: It is important that the recording (stamping) be placed only on the shoulder, top head, neck, or footring (when so provided) of the cylinder.

5-5.4.2* Noncompressed Gas Types. Extinguisher shells of the noncompressed gas types that pass a hydrostatic test shall have the test information recorded on a suitable metallic label or equally durable material. The label shall be affixed by a heatless process to the shell. These labels shall be self-destructive when removal from an extinguisher shell is attempted. The label shall include the following information:

(a) Month and year the test was performed, indicated by a perforation, such as by a hand punch.

(b) Test pressure used.

(c) Name or initials of person performing the test, or name of agency performing the test.

5-5.4.3 Hose assemblies passing a hydrostatic test do not require recording.

Chapter 6 Mandatory Referenced Publications

6-1 This chapter lists publications referenced within this document which, in whole or in part, are part of the requirements of the document.

6-1.1 NFPA Standards. The following standards are available from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269, and the year dates shown indicate the latest edition available.

NFPA 11-1983, *Standard for Low Expansion Foam and Combined Agent Systems*

NFPA 11A-1983, *Standard for Medium and High Expansion Foam Systems*

NFPA 12-1980, *Standard for Carbon Dioxide Extinguishing Systems*

NFPA 12A-1980, *Standard for Halon 1301 Fire Extinguishing Systems*

NFPA 12B-1980, *Standard for Halon 1211 Fire Extinguishing Systems*

NFPA 13-1983, *Standard for the Installation of Sprinkler Systems*

NFPA 14-1983, *Standard for the Installation of Standpipe and Hose Systems*

NFPA 15-1982, *Standard for Water Spray Fixed Systems*

NFPA 16-1980, *Standard for Deluge Foam-Water Sprinkler and Foam-Water Spray Systems*

NFPA 17-1980, *Standard for Dry Chemical Extinguishing Systems*

NFPA 18-1979, *Standard on Wetting Agents*

NFPA 34-1982, *Standard for Dip Tanks Containing Flammable or Combustible Liquids*

NFPA 96-1984, *Standard on Removal of Smoke and Grease-Laden Vapors from Cooking Equipment*

NFPA 231-1979, *Standard for Indoor General Storage*

NFPA 231C-1980, *Standard for Rack Storage of Materials*

NFPA 231D-1980, *Standard for Storage of Rubber Tires*

6-1.2 Other Publications.

6-1.2.1 ASTM Standard. This publication makes reference to the following ASTM standard and the year date indicates the latest edition available. It is available from the America Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM E380-1982, *Standard for Metric Practice*

6-1.2.2 CGA Publications. This publication makes reference to the following CGA publications and the year dates indicate the latest edition available. They are available from the Compressed Gas Association, 1235 Jefferson Davis Highway, Arlington, VA 22202.

CGA C-1-1975, *Methods of Hydrostatic Testing of Compressed Gas Cylinders*

CGA C-6-1975, *Standard for Visual Inspection of Compressed Gas Cylinders (Steel)*

CGA C-6.1-1980, *Standard for Visual Inspection of High Pressure Aluminum Compressed Gas Cylinders*

6-1.2.3 CAN Publications. This publication makes reference to the following CAN publications and the year dates indicate the latest edition available. They are available from the Standards Council of Canada, 350 Sparks Street, Ottawa, ONT K1R 7S8.

CAN4-S503-M83, *Standard for Carbon Dioxide Hand and Wheeled Fire Extinguishers*

CAN4-S504-77, *Standard for Dry Chemical and Dry Powder Hand and Wheeled Fire Extinguishers*

CAN4-S507-M83, *Standard for 9 Litre Stored Pressure Water Type Fire Extinguishers*

CAN4-S508-M83, *Standard for Rating and Fire Testing of Fire Extinguishers.*

6-1.2.4 ULC Publication. This publication makes reference to the following ULC publication and the year date indicates the latest edition available. It is available from Underwriters' Laboratories of Canada, 7 Crouse Road, Scarborough, ONT M1R 3A9.

ULC-S504-77, *Standard for Dry Chemical and Dry Powder Hand and Wheeled Fire Extinguishers.*

ULC-S512-77, *Standard for Halogenated Agent Fire Extinguishers.*

6-1.2.5 UL Publications. This publication makes reference to the following UL publications and the year dates indicate the latest edition available. They are available from Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062. Those preceded by the ANSI designation have been approved by the American National Standards Institute Inc., 1450 Broadway, New York, NY 10018.

ANSI/UL 8-1983, *Foam Fire Extinguishers*

ANSI/UL 154-1982, *Standard for Carbon Dioxide Fire Extinguishers*

ANSI/UL 299-1982, *Standard for Dry Chemical Fire Extinguishers*

ANSI/UL 626-1982, *Standard for 2½ Gallon Stored Pressure Water Type Fire Extinguishers*

ANSI/UL 711-1979, *Standard for Rating and Fire Testing Extinguishers*

ANSI/UL 1093-1982, *Standard for Halogenated Agent Fire Extinguishers.*

6-1.2.6 US Government Publication. This publication makes reference to the following US Government publication. It is available from the Superintendent of Documents, US Government Printing Office, Washington, DC 20402.

Code of Federal Regulations, Title 49-1979.

Appendix A

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

A-1-1 Principles of Fire Extinguishment. Many fires are small at origin and may be extinguished by the use of proper portable fire extinguishers. It is strongly recommended that the fire department be notified as soon as a fire is discovered. This alarm should not be delayed awaiting results of application of portable fire extinguishers.

Fire extinguishers can represent an important segment of any overall fire protection program. However, their successful functioning depends upon the following conditions having been met:

1. The extinguisher is properly located and in working order.

2. The extinguisher is of proper type for a fire which may occur.

3. The fire is discovered while still small enough for the extinguisher to be effective.

4. The fire is discovered by a person ready, willing, and able to use the extinguisher.

A-1-2 Responsibility. The owner or occupant of a property in which fire extinguishers are located has an obligation for the care and use of these extinguishers at all times. The name plate(s) and instruction manual should be read and thoroughly understood by all persons who may be expected to use extinguishers.

To discharge this obligation the owner or occupant should give proper attention to the inspection, maintenance, and recharging of this fire protective equipment and should also train personnel in the correct use of fire extinguishers on the different types of fire which may occur on the property.

An owner or occupant should recognize fire hazards on his property and plan in advance exactly how and with what a fire will be fought and must see that everyone knows how to call the Fire Department and stress that they should do so for every fire, no matter how small it may be.

On larger properties a private fire brigade should be established and trained. Personnel must be assigned to inspect each fire extinguisher periodically. Other personnel may have the duty of maintaining and recharging such equipment at proper intervals.

Portable fire extinguishers are appliances to be used by the occupants of a fire-endangered building or area. They are primarily of value for immediate use on small fires. They have a limited quantity of extinguishing material, and therefore must be used properly so this material is not wasted.

Extinguishers are mechanical devices. They need care and maintenance at periodic intervals to be sure they are ready to operate properly and safely. Parts or internal chemicals may deteriorate in time and need replacement. They are pressure vessels in most cases, and so must be treated with respect and handled with care.

A-1-4.2 The classification and rating is found on the label which is affixed to the extinguisher.

EXAMPLE: An extinguisher is rated and classified 4-A; 20-B:C. This indicates the following:

1. It should extinguish approximately twice as much Class A fire as a 2-A (2½-gal water) rated extinguisher.

2. It should extinguish approximately twenty times as much Class B fire as a 1-B rated extinguisher.

3. It is suitable for use on energized electrical equipment.

Currently, laboratories classify extinguishers for use on Class A fires with the following ratings: 1-A, 2-A, 3-A, 4-A, 6-A, 10-A, 20-A, 30-A, and 40-A. Effective June 1, 1969, extinguishers classified for use on Class B fires have the following ratings: 1-B, 2-B, 5-B, 10-B, 20-B, 30-B, 40-B, 60-B, 80-B, 120-B, 160-B, 240-B, 320-B, 480-B and 640-B. Ratings from 1-A to 20-A and 1-B to 20-B, inclusive, are based on indoor fire tests; ratings at or above 30-A and 30-B are based on outdoor fire tests.

Ratings of 4-B, 6-B, 8-B, 12-B, and 16-B, previously used to classify individual extinguishers for use on Class B fires, were not used for new extinguishers after June 1, 1969. Existing extinguishers having these ratings are acceptable if they have been properly inspected and maintained in accordance with this standard.

For Class B fires it must be recognized that the amount of fire which can be extinguished by a particular extinguisher is related to the degree of training and experience of the operator.

For fire extinguishers classified for use on Class C fires, no NUMERAL is used since Class C fires are essentially either Class A or Class B fires involving energized electrical wiring and equipment. The size of the different suitable extinguishers installed should be commensurate with the size and extent of the Class A or Class B components, or both, of the electrical hazard or containing equipment being protected.

For extinguishers classified for use on Class D fires, no NUMERAL is used. The relative effectiveness of these extinguishers for use on specific combustible metal fires is detailed on the extinguisher nameplate.

Extinguishers which are effective on more than one Class of fire have multiple LETTER and NUMERAL-LETTER classifications and ratings.

A-1-4.4 Authorities having jurisdiction should determine the acceptability and credibility of the organization listing or labeling extinguishers. Factors such as the structure of the organization, its principle fields of endeavor, its reputation and established expertise, its involvement in the standards-writing process and the extent of its follow up service programs should all be assessed before recognition is given.

A-1-6.6 In situations where extinguishers must be temporarily provided, a good practice is to provide portable stands, consisting of a horizontal bar on uprights with feet, on which the extinguishers may be hung.

A-1-6.12 Vented extinguisher cabinets should utilize tinted glass and be constructed to prevent the entrance of insects and the accumulation of water. Vented extinguisher cabinets constructed in this manner will lower the maximum internal temperature 10-15°F (5.6-8.3°C).

A-1-6.13 The following precautions should be noted where extinguishers are located in areas that have temperatures outside the range of 40°F to 120°F (4°C to 49°C).

(a) Soda-acid, foam and AFFF extinguishers cannot be protected against temperatures below 40°F (4°C) by adding an antifreeze charge because it will tend to destroy the effectiveness of the extinguishing agent.

(b) Plain water extinguishers should not be protected against temperatures below 40°F (4°C) with ethylene glycol antifreeze. Do not use calcium chloride solutions in stainless steel extinguishers.

(c) Extinguishers installed in machinery compartments, diesel locomotives, automotive equipment, marine engine compartments and hot processing facilities can easily be subjected to temperatures above 120°F (49°C). Selection of extinguishers for hazard areas with temperatures above the listed limits should be made on the basis of recommendations by manufacturers of this equipment.

A-2-1 Conditions of Selection.

A. Physical Conditions that Affect Selection.

(1) *Gross Weight.* In the selection of an extinguisher, the physical ability of the user should be contemplated. When the hazard exceeds the capability of a hand portable extinguisher, wheeled extinguishers or fixed systems (*see Section 1-1*) should be considered.

(2) *Corrosion.* In some extinguisher installations, there exists a possibility of exposing the extinguisher to a corrosive atmosphere. When this is the case, consideration should be given to providing the extinguishers so exposed with proper protection or providing extinguishers which have been found suitable for use in these conditions.

(3) *Agent Reaction.* The possibility of adverse reactions, contamination, or other effects of an extinguishing agent on either manufacturing processes or on equipment, or both, should be considered in the selection of an extinguisher.

(4) *Wheeled Units.* When wheeled extinguishers are used, consideration should be given to the mobility of the extinguisher within the area in which it will be used. For outdoor locations, the use of proper rubber-tired or wide-rimmed wheel designs should be considered according to terrain. For indoor locations, the size of doorways and passages should be large enough to permit ready passage of the extinguisher.

(5) *Wind and Draft.* If the hazard is subject to winds or draft, the use of extinguishers and agents having sufficient range to overcome these conditions should be considered.

(6) *Availability of Personnel.* Consideration should be given to the number of persons available to operate the extinguishers, the degree of training provided, and the physical capability of the operator.

B. Health and Safety Conditions that Affect Selection.

(1) In the selection of an extinguisher, consideration should be given to health and safety hazards involved in its maintenance and use, as described in the following paragraphs.

(2) Prominent caution labels on the extinguisher, warning signs at entry points to confined spaces, provision for remote application, extra-long-range extinguisher nozzles, special ventilation, provision of breathing apparatus and other personal protective equipment, and adequate training of personnel are among measures which should be considered to minimize the effects of these hazards.

(3) Bromotrifluoromethane (Halon 1301) and bromochlorodifluoromethane (Halon 1211) extinguishers contain extinguishing agents whose vapor has a low toxicity. However, their decomposition products can be hazardous. When using these extinguishers in unventilated places, such as small rooms, closets, motor vehicles, or other confined spaces, operators and others should avoid breathing the gases produced by thermal decomposition of the agent.

(4) Carbon dioxide extinguishers contain an extinguishing agent which will not support life when used in sufficient concentration to extinguish a fire. The use of this type of extinguisher in an unventilated space can dilute the oxygen supply. Prolonged occupancy of such spaces can result in loss of consciousness due to oxygen deficiency.

(5) Extinguishers not rated for Class C hazards (water, antifreeze, soda-acid, loaded stream, AFFF, wetting agent, foam, and including carbon dioxide with metal

horns) present a shock hazard if used on fires involving energized electrical equipment.

(6) Dry chemical extinguishers, when used in a small unventilated area, may reduce visibility for a period of up to several minutes. Dry chemical, discharged in an area, may also clog filters in air-cleaning systems.

(7) Most fires produce toxic decomposition products of combustion and some materials may produce highly toxic gases. Fires may also consume available oxygen or produce dangerously high exposure to convected or radiated heat. All of these may affect the degree to which a fire can be safely approached with extinguishers. (*See Underwriters Laboratories Inc., Bulletin of Research No. 53 - July, 1963.*[1])

Table A-2-1 Characteristics of Extinguishers.

Table A-2-1 on page 18 summarizes the characteristics of extinguishers and may be used as an aid in selecting extinguishers in accordance with Chapter 2. *The ratings given are those which were in effect at the time this standard was prepared. Current listings should be consulted for up-to-date ratings.*

A-2-2.1.1 It is recommended that inverting types of extinguishers be replaced with currently available models. Manufacture of inverting types of extinguishers and their listing by Underwriters Laboratories Inc. was discontinued in 1969. As the availability of suitable replacement parts and recharge materials diminishes, it will become increasingly difficult to maintain these types of extinguishers in a safe and reliable operating condition.

A-2-2.1.3 The use of dry chemical extinguishers on wet energized electrical equipment (such as rain-soaked utility poles, high voltage switch gear, and transformers) may aggravate electrical leakage problems. The dry chemical in combination with moisture provides an electrical path which can reduce the effectiveness of insulation protection. The removal of all traces of dry chemical from such equipment after extinguishment is recommended.

A-2-2.1.4 Extinguishers and Extinguishing Agents for Class D Hazards.

(1) Chemical reaction between burning metals and many extinguishing agents (including water) may range from explosive to inconsequential depending in part on the type, form, and quantity of metal involved. In general, the hazards from a metal fire are significantly increased when such extinguishing agents are applied.

NOTE: The advantages and limitations of a wide variety of commercially available metal fire extinguishing agents are discussed in Section 5, Chapter 18 of the NFPA *Fire Protection Handbook* (15th Edition).

(2) The agents and extinguishers discussed in this section are of specialized types and their use often involves special techniques peculiar to a particular combustible metal. A given agent will not necessarily control or extinguish all metal fires. Some agents are valuable in working with several metals; others are useful in combating only one type of metal fire. The authorities having jurisdiction should be consulted in each case to determine the desired protection for the particular hazard involved.

(3) Certain combustible metals and reactive chemicals require special extinguishing agents or techniques. If there is doubt, applicable NFPA standards should be consulted or reference made to NFPA 49, *Hazardous Chemicals Data*, or NFPA 325M, *Fire-Hazard Properties of Flammable Liquids, Gases, and Volatile Solids.*

(4) Reference should be made to the manufacturer's recommendations for use and special technique for extinguishing fires in various combustible metals.

(5) Fire of high intensity may occur in certain metals. Ignition is generally the result of frictional heating, exposure to moisture, or exposure from a fire in other combustible materials. The greatest hazard exists when these metals are in the molten state, in finely divided forms of dust, turnings, or shavings.

NOTE: The properties of a wide variety of combustible metals and the agents available for extinguishing fires in these metals are discussed in Section 4, Chapter 10 and Section 18, Chapter 5 of the NFPA *Fire Protection Handbook* (15th Edition).

A-2-3.5 Delicate electronic equipment includes but is not limited to data processing, computers, CAD, CAM, Robotics, and reproduction equipment. While use of other extinguishers and extinguishing agents may successfully extinguish a fire in this equipment, their use may render the equipment damaged beyond repair. Dry chemical residue will probably not be able to be completely and immediately removed and in addition, multipurpose dry chemical, when exposed to temperatures in excess of 250°F (121°C) or relative humidity in excess of 50 percent may cause corrosion.

A-3-1.1 Distribution Considerations. Items that affect distribution of portable fire extinguishers are: the area and arrangement of the building occupancy conditions, the severity of the hazard, the anticipated classes of fire, other protective systems or devices, and the distances to be traveled to reach extinguishers. In addition, anticipated rate of fire spread, the intensity and rate of heat development, the smoke contributed by the burning materials, and the accessibility of a fire to close approach with portable extinguishers should be considered. Wheeled extinguishers have additional agent and range and should be considered for areas where the additional protection is needed. Portable extinguishers offer the occupant a means to assist in evacuation of a building or occupancy. They are useful to knock down the fire if it occurs in the evacuation route. Whenever possible, the individual property should be surveyed for actual protection requirements.

A-3-1.2 Most buildings have Class A fire hazards. In any occupancy, there may be a predominant hazard with "special hazard" areas requiring supplemental protection. For example, a hospital will generally have need for Class A extinguishers covering patients' rooms, corridors, offices, etc., but will need Class B extinguishers in laboratories, kitchens and where flammable anesthetics are stored or handled, and Class C extinguishers in electrical switch gear or generator rooms.

[1]Survey of Available Information on the Toxicity of the Combustion and Thermal Decomposition Products of Certain Building Materials under Fire Conditions.

Table A-2-1 Characteristics of Extinguishers

Extinguishing Agent	Method of Operation	Capacity	Horizontal Range of Stream	Approximate Time of Discharge	Protection Required Below 40°F (4°C)	UL or ULC Classifications*
Water Antifreeze	Stored Pressure or Cartridge	2½ gal	30-40 ft	1 min	Yes	2-A
	Pump	2½ gal	30-40 ft	1 min	Yes	2-A
	Pump	4 gal	30-40 ft	2 min	Yes	3-A
	Pump	5 gal	30-40 ft	2-3 min	Yes	4-A
Water (Wetting Agent)	Stored Pressure	1½ gal	20 ft	30 sec	Yes	2-A
	Carbon Dioxide Cylinder	25 gal (wheeled)	35 ft	1½ min	Yes	10-A
	Carbon Dioxide Cylinder	45 gal (wheeled)	35 ft	2 min	Yes	30-A
	Carbon Dioxide Cylinder	60 gal (wheeled)	35 ft	2½ min	Yes	40-A
Water (Soda Acid)	Chemically generated expellant	2½ gal	30-40 ft	1 min	Yes	2-A
	Chemically generated expellant	17 gal (wheeled)	50 ft	3 min	Yes	10-A
	Chemically generated expellant	33 gal (wheeled)	50 ft	3 min	Yes	20-A
Loaded Stream	Stored Pressure or Cartridge	2½ gal	30-40 ft	1 min	No	2 to 3-A:1-B
	Carbon Dioxide Cylinder	33 gal (wheeled)	50 ft	3 min	No	20-A
Foam	Chemically generated expellant	2½ gal	30-40 ft	1½ min	Yes	2-A:4 to 6-B
	Chemically generated expellant	17 gal (wheeled)	50 ft	3 min	Yes	10-A:10 to 12-B
	Chemically generated expellant	33 gal (wheeled)	50 ft	3 min	Yes	20-A:20 to 40-B
AFFF	Stored Pressure	2½ gal	20-25 ft	50 sec	Yes	3-A:20 to 40-B
	Nitrogen Cylinder	33 gal	30 ft	1 min	Yes	20-A:160-B
Carbon Dioxide	Self Expelling	2½ to 5 lb	3-8 ft	8 to 30 sec	No	1 to 5 B:C
	**	10 to 15 lb	3-8 ft	8 to 30 sec	No	2 to 10-B:C
		20 lb	3-8 ft	10 to 30 sec	No	10-B:C
		50 to 100 lb (wheeled)	3-10 ft	10 to 30 sec	No	10 to 20-B:C
Dry Chemical (Sodium Bicarbonate)	Stored Pressure	1 to 2½ lb	5-8 ft	8 to 12 sec	No	2 to 10 B:C
	Cartridge or Stored Pressure	2¾ to 5 lb	5-20 ft	8 to 20 sec	No	5 to 20-B:C
	Cartridge or Stored Pressure	6 to 30 lb	5-20 ft	10 to 25 sec	No	10 to 160-B:C
	Nitrogen Cylinder or Stored Pressure	75 to 350 lb (wheeled)	15-45 ft	20 to 105 sec	No	40 to 320-B:C
Dry Chemical (Potassium Bicarbonate)	Cartridge or Stored Pressure	2 to 5 lb	5-12 ft	8 to 10 sec	No	5 to 20-B:C
	Cartridge or Stored Pressure	5½ to 10 lb	5-20 ft	8 to 20 sec	No	10 to 80-B:C
	Cartridge or Stored Pressure	16 to 30 lb	10-20 ft	8 to 25 sec	No	40 to 120-B:C
	Cartridge	48 lb	20 ft	30 sec	No	120-B:C
	Nitrogen Cylinder or Stored Pressure	125 to 315 lb (wheeled)	15-45 ft	30 to 80 sec	No	80 to 640-B:C
Dry Chemical (Potassium Chloride) Cartridge or	Stored Pressure	2 to 5 lb	5-8 ft	8 to 10 sec	No	5 to 10-B:C
	Stored Pressure	5 to 9 lb	8-12 ft	10 to 15 sec	No	20 to 40-B:C
	Stored Pressure	9½ to 20 lb	10-15 ft	15 to 20 sec	No	40 to 60-B:C
	Stored Pressure	19½ to 30 lb	5-20 ft	10 to 25 sec	No	60 to 80-B:C
	Stored Pressure	125 to 200 lb	15-45 ft	30 to 40 sec	No	160-B:C

Dry Chemical (Ammonium Phosphate)	Stored Pressure	1 to 5 lb	5-12 ft	8 to 10 sec	No	1 to 2-A† and 2 to 10-B:C
	Stored Pressure or Cartridge	2½ to 8½ lb	5-12 ft	8 to 15 sec	No	1 to 4-A and 10 to 40-B:C
	Stored Pressure or Cartridge	9 to 17 lb	5-20 ft	10 to 25 sec	No	2 to 20-A and 10 to 80-B:C
	Stored Pressure or Cartridge	17 to 30 lb	5-20 ft	10 to 25 sec	No	3 to 20-A and 30 to 120-B:C
	Cartridge	45 lb	20 ft	25 sec	No	20-A:80-B:C
	Nitrogen Cylinder or Stored Pressure	110 to 315 lb (wheeled)	15-45 ft	30 to 60 sec		20 to 40-A and 60 to 320-B:C
Dry Chemical (Foam Compatible)	Cartridge or Stored Pressure	4¾ to 9 lb	5-20 ft	8 to 10 sec	No	10 to 20-B:C
	Cartridge or Stored Pressure	9 to 27 lb	5-20 ft	10 to 25 sec	No	20 to 30-B:C
	Cartridge or Stored Pressure	18 to 30 lb	5-20 ft	10 to 25 sec	No	40 to 60-B:C
	Nitrogen Cylinder or Stored Pressure	150 to 350 lb (wheeled)	15-45 ft	20 to 150 sec	No	80 to 240-B:C
Dry Chemical (Potassium Chloride)	Cartridge or Stored Pressure	2½ to 5 lb	5-12 ft	8 to 10 sec	No	10 to 20-B:C
	Cartridge or Stored Pressure	9½ to 20 lb	5-20 ft	8 to 25 sec	No	40 to 60-B:C
	Cartridge or Stored Pressure	19½ to 30 lb	5-20 ft	10 to 25 sec	No	60 to 80-B:C
	Stored Pressure	125 to 200 lb (wheeled)	15-45 ft	30 to 40 sec	No	160-B:C
Dry Chemical (Potassium Bicarbonate Urea based)	Stored Pressure	5 to 11 lb	11-22 ft	13 to 18 sec	No	40 to 80-B:C
	Stored Pressure	9 to 23 lb	15-30 ft	17 to 33 sec	No	60 to 160-B:C
		175 lb (wheeled)	70 ft	62 sec	No	480-B:C
Halon 1301 (Bromotrifluoromethane)	Stored Pressure	2½ lb	4-6 ft	8 to 10 sec	No	2-B:C
Halon 1211 (Bromochlorodifluoromethane)	Stored Pressure	1 lb	6-10 ft	8 to 10 sec	No	1-B:C
		2 lb	6-10 ft	8 to 10 sec	No	2-B:C
		2½ lb	6-10 ft	8 to 10 sec	No	5-B:C
		5½ to 9 lb	9-15 ft	8 to 15 sec	No	1-A:10-B:C
		13 to 22 lb	14-16 ft	10 to 18 sec	No	1 to 4-A and 20 to 80-B:C
		150 lb	20-30 ft	30 to 35 sec	No	30-A:160-B:C

Notes to Table A-2-1

*UL and ULC ratings checked as of December 9, 1983. Readers concerned with subsequent ratings should review the pertinent "lists" and "supplements" issued by these laboratories. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062 or Underwriters' Laboratories of Canada, 7 Crouse Road, Scarborough, Ont., Canada M1R 3A9.

**Carbon dioxide extinguishers with metallic horns do not carry a "C" classification.

†Some small extinguishers containing ammonium phosphate base dry chemical do not carry an "A" classification.

NOTE: Vaporizing liquid extinguishers (carbon tetrachloride or chlorobromomethane base) are not recognized in this standard. Ratings of 4-8, 6-8, 8-8, 12-8 and 16-8 were eliminated June 1, 1969. See A-1-4.2.

A-3-1.2.2 If extinguishers intended for different classes of fires are grouped, their intended use should be marked conspicuously to aid in the choice of the proper extinguisher at the time of a fire. In an emergency the tendency is to reach for the closest extinguisher. If this extinguisher is of the wrong type, the user may well endanger himself and the property he is endeavoring to protect. Wherever possible, it is preferable to have only those extinguishers available that can be safely used on any type of fire in the immediate vicinity.

A-3-4.1 Where such personnel are not available, the hazard should be protected by fixed systems.

A-4-1.4 A fire equipment servicing agency is usually the most reliable means available to the public for having maintenance and recharging performed. Large industries may find it desirable to establish their own maintenance and recharge facilities training personnel to perform these functions. Service manuals and parts lists should be obtained from the extinguisher manufacturer.

A-4-3.1 Frequency of extinguisher inspections should be based on the need of the area in which extinguishers are located. The required monthly inspection is minimum and should be more frequent if any of the following exist:

(a) High frequency of fires in the past.

(b) Severe hazards.

(c) Susceptibility to tampering, vandalism, or malicious mischief.

(d) Possibility of, or experience with, theft of extinguishers.

(e) Locations that make extinguishers susceptible to mechanical injury.

(f) Possibility of visible or physical obstructions.

(g) Exposure to abnormal temperatures or corrosive atmospheres.

(h) Characteristics of extinguishers, such as susceptibility to leakage.

A-4-4 Maintenance. Persons usually performing maintenance operations come from two major groups:

(a) Extinguisher service agencies.

(b) Trained industrial safety or maintenance personnel.

Extinguishers owned by individuals are often neglected because there is no planned periodic follow-up program. It is recommended that such owners become familiar with their extinguishers so they can detect telltale warnings from inspection which may suggest the need for maintenance. When maintenance is indicated it should be performed by trained persons having proper equipment. (*See 4-1.4.*)

The purpose of a well-planned and well-executed maintenance program is to afford maximum probability that an extinguisher:

(1) Will operate properly between the time intervals established for maintenance examinations in the environment to which it is exposed, and

(2) Will not constitute a potential hazard to persons in its vicinity or to operators or rechargers of extinguishers.

Any parts needed for replacement should be obtained from the manufacturer or his representative.

A-4-4.1.2 Carbon dioxide hose assemblies have a continuous metal braid that connects to both couplings to minimize the static shock hazard. The reason for the conductivity test is to determine that the hose is conductive from the inlet coupling to the outlet orifice. A basic conductivity tester consists of a flashlight having an open circuit and a set of two wires with a conductor (clamps or probe) at each end.

A-4-4.2 Maintenance Procedures. For convenience, the following check lists are organized into two parts. The first is arranged by mechanical parts (components and containers) common to most extinguishers. The second is arranged by extinguishing material and expelling means and involves a description of the problems peculiar to each agent.

Mechanical Parts.

Any parts needed for replacement should be obtained from the manufacturer.

A-4-4.3 Recordkeeping. In addition to the required tag or label (*see 4-4.3*), a permanent file record should be kept for each extinguisher. This file record should include the following information as applicable:

(a) The maintenance date and the name of person or agency performing the maintenance.

(b) The date when last recharged and the name of person or agency performing the recharge.

(c) The hydrostatic retest date and the name of person or agency performing the hydrostatic test.

(d) Description of dents remaining after passing a hydrostatic test.

(e) The date of the six-year maintenance for stored pressure dry chemical and Halon 1211 types (*see 4-4.1.3*).

A-4-5.1 General Safety Guidelines for Recharging.

(a) Make sure all pressure is vented from extinguisher before attempting to remove valve body or fill closure. *Warning*: Do not depend on pressure indicating devices to tell if container is under pressure as they could malfunction.

(b) Use proper recharge materials in the refilling of a fire extinguisher. Mixing of some extinguishing agents could cause a chemical reaction resulting in a dangerous pressure build-up in the container.

(c) All sealing components should be cleaned and properly lubricated to prevent leakage after recharge.

(d) Check pressure indicating device to ascertain that it is reading properly.

(e) Most manufacturers recommend the use of dry nitrogen as an expellant gas for stored pressure extinguishers. Limiting charging pressure regulator setting to 25 psi (172 kPa) above service pressure as per 4-5.3.6 prevents gage damage and loss of calibration. *Warning:* Never connect the extinguisher to be charged directly to the high pressure source. Connecting directly to the high

Extinguisher Part, Check Points and Corrective Action

Shell	Corrective Action
1. Hydrostatic test date or date of manufacture	1. Retest if needed
2. Corrosion	2. Conduct hydrostatic test and refinish; or discard
3. Mechanical damage (denting or abrasion)	3. Conduct hydrostatic test and refinish; or discard
4. Paint condition	4. Refinish
5. Presence of repairs (welding, soldering, brazing, etc.)	5. Discard or consult manufacturer
6. Damaged threads (corroded, crossthreaded, or worn)	6. Discard or consult manufacturer
7. Broken hanger attachment, carrying handle lug	7. Discard or consult manufacturer
8. Sealing surface damage (nicks or corrosion)	8. Clean, repair, and leak test; or discard

Nameplate	Corrective Action
1. Illegible wording	1. Clean or replace
2. Corrosion or loose plate	2. Inspect shell under plate (see Shell Check Points) and reattach plate

Nozzle or Horn	Corrective Action
1. Deformed, damaged, or cracked	1. Replace
2. Blocked openings	2. Clean
3. Damaged threads (corroded, crossthreaded, or worn)	3. Replace
4. Aged (brittle)	4. Replace

Hose Assembly	Corrective Action
1. Damaged (cut, cracked or worn)	1. Replace
2. Damaged couplings or swivel joint (cracked or corroded)	2. Replace
3. Damaged threads (corroded, crossthreaded, or worn)	3. Replace
4. Inner tube cut at couplings	4. Repair or replace
5. Electrically nonconductive between couplings (CO_2 hose only)	5. Replace

Valve Locking Device	Corrective Action
1. Damaged (bent, corroded, or binding)	1. Repair and lubricate; or replace
2. Missing	2. Replace

Gage or Pressure-Indicating Device	Corrective Action
1. Immovable, jammed or missing pointer (pressure test)	1. Depressurize and replace gage
2. Missing, deformed, or broken crystal	2. Depressurize and replace gage
3. Illegible or faded dial	3. Depressurize and replace gage
4. Corrosion	4. Depressurize and check calibration, clean and refinish; or replace gage
5. Dented case or crystal retainer	5. Depressurize and check calibration; or replace gage
6. Immovable or corroded pressure-indicating stem (nongage type)	6. Replace head assembly, depressurize, and replace shell or complete extinguisher

Shell or Cylinder Valve	Corrective Action
1. Corroded, damaged, or jammed lever, handle, spring, stem, or fastener joint	1. Depressurize, check freedom of movement, and repair; or replace
2. Damaged outlet threads (corroded, crossthreaded, or worn)	2. Depressurize and replace

Nozzle Shutoff Valve	Corrective Action
1. Corroded, damaged, jammed or binding lever, spring, stem, or fastener joint	1. Repair and lubricate; or replace
2. Plugged, deformed, or corroded nozzle tip or discharge passage	2. Clean or replace

Puncture Mechanism	Corrective Action
1. Damaged, jammed or binding puncture lever, stem or fastener joint	1. Replace
2. Dull or damaged cutting or puncture pin	2. Replace
3. Damaged threads (corroded, crossthreaded, or worn)	3. Replace

Gas Cartridge	Corrective Action
1. Corrosion	1. Replace cartridge
2. Damaged seal disc (injured, cut, or corroded)	2. Replace cartridge
3. Damaged threads (corroded, crossthreaded, or worn)	3. Replace cartridge
4. Illegible weight markings	4. Replace cartridge

Gas Cylinders	Corrective Action
1. Hydrostatic test date or date of manufacture	1 Retest if needed
2. Corrosion	2. Conduct hydrostatic test and refinish or discard
3. Paint condition	3. Refinish
4. Presence of repairs (welding, soldering, brazing, etc.)	4. Discard or consult manufacturer
5. Damaged threads (corroded, crossthreaded, or worn)	5. Discard or consult manufacturer

Wheel Cap or Fill Cap	Corrective Action
1. Corroded, cracked, or broken	1. Replace
2. Damaged threads (corroded, crossthreaded, or worn)	2. Replace
3. Sealing surface damage (nicked, deformed, or corroded)	3. Clean, repair and leak test, or replace
4. Blocked vent hole or slot	4. Clean

Disposable Shell	Corrective Action
1. Corrosion	1. Depressurize and replace shell
2. Damaged seal disc (injured, cut, or corroded)	2. Depressurize and replace shell
3. Damaged threads (corroded, crossthreaded, or worn)	3. Replace shell
4. Illegible weight markings	4. Depressurize and replace shell

Carriage and Wheels	Corrective Action
1. Corroded, bent, or broken carriage	1. Repair or replace
2. Damaged wheel (buckled or broken spoke, bent rim or axle, loose tire, low pressure, jammed bearing)	2. Clean, repair, and lubricate; or replace

Carrying Handle	Corrective Action
1. Broken handle lug	1. Discard shell or valve; or consult manufacturer
2. Broken handle	2. Replace
3. Corroded, jammed, or worn fastener joint	3. Clean or replace

Seals or Tamper Indicator	Corrective Action
1. Broken or missing	1. Check under Agent and Expelling Means for specific action

Hand Pump	Corrective Action
1. Corroded, jammed, or damaged pump	1. Repair and lubricate; or replace
2. Improper adjustment of packing nut	2. Adjust

Inner Cage, Chamber Stopple, Acid Container, or Tube	Corrective Action
1. Corroded, damaged, bent, cracked, or distorted	1. Replace

Pressurizing Valve	Corrective Action
1. Leaking seals	1. Depressurize and replace valve or core

Gasket "O" Ring and Seals	Corrective Action
1. Damaged (cut, cracked, or worn)	1. Replace and lubricate
2. Missing	2. Replace and lubricate
3. Aged or weathered (compression set, brittle, cracked)	3. Replace and lubricate

Brackets	Corrective Action
1. Corroded, worn, or bent	1. Repair and refinish, or replace
2. Loose or binding fit	2. Adjust fit or replace
3. Worn loose, corroded, or missing screw or bolt	3. Tighten or replace
4. Worn bumper, webbing or grommet	4. Replace

Gas Tube and Siphon or Pickup Tube	Corrective Action
1. Corroded, dented, cracked, or broken	1. Replace
2. Blocked tube or openings in tube	2. Clean or replace

Safety Relief Device	Corrective Action
1. Corroded or damaged	1. Depressurize and replace or consult manufacturer
2. Broken, operated, or plugged	2. Depressurize and replace or repair

Pressure Regulators	Corrective Action
1. External condition (a) Damage (b) Corrosion	1. (a) Replace regulator (b) Clean regulator or replace
2. Pressure relief — corroded, plugged, dented, leaking, broken, or missing	2. Disconnect regulator from pressure source; replace pressure relief
3. Protective bonnet relief hole — tape missing or seal wire broken or missing	3. Check regulator in accordance with manufacturer's regulator test procedures
4. Adjusting screw — lock pin missing	4. Check regulator in accordance with manufacturer's regulator test procedures
5. Gages (a) Immovable, jammed, or missing pointer (b) Missing or broken crystal (c) Illegible or faded dial (d) Corrosion (e) Dented case or crystal retainer	5 (a) Disconnect regulator from pressure source; replace gage (b) Replace crystal (c) Replace gage (d) Check calibration, clean and refinish, or replace gage (e) Check calibration or replace gage
6. Regulator Hose (a) Cut, cracked, abraided, or deformed exterior (b) Corroded or cracked coupling (c) Corroded, crossthreaded, or worn coupling threads	6. (a) Conduct hydrostatic test or replace hose (b) Replace hose (c) Replace hose

Agent and Expelling Means.
Extinguisher Type and Part, Check Points and Corrective Action

Self-generating

Soda-Acid Water	Corrective Action
1. Recharging date due	1. Empty, clean, and recharge
2. Improper fill levels in acid bottle and shell	2. Empty, clean, and recharge
3. Agent condition (check for sediment)	3. Empty, clean, and recharge

Foam	Corrective Action
1 Recharging date due	1 Empty, clean, and recharge
2. Improper fill levels in inner container and shell	2. Empty, clean, and recharge
3. Agent condition (check for sediment)	3. Empty, clean, and recharge

Self-expelling

Carbon Dioxide	Corrective Action
1 Improper weight	1 Recharge to proper weight
2. Broken or missing tamper indicator	2 Leak test and weigh, recharge or replace indicator

Bromotrifluoromethane	Corrective Action
1. Punctured cylinder seal disc	1 Replace shell
2. Improper weight	2 Replace shell or return to manufacturer for refilling
3 Broken or missing tamper indicator	3 Examine cylinder seal disc, replace indicator

Mechanical Pump

Water and Antifreeze	Corrective Action
1 Improper fill level	1. Refill
2 Defective pump	2. Clean, repair, and lubricate, or replace

Hand Propelled — Bucket or Scoop

Water and Antifreeze	Corrective Action
1 Improper fill level	1. Refill
2 Antifreeze improper charge (check specific gravity or recharge record)	2 Recharge
3 Missing bucket	3 Replace

Dry Powder	Corrective Action
1 Improper fill level	1 Refill
2. Agent condition (contamination or caking)	2 Discard and replace
3. Missing scoop	3 Replace

Gas Cartridge or Cylinder

Dry Chemical Types and Dry Powder	Corrective Action
1. Improper weight or charge level	1 Refill to correct weight
2 Agent condition (contamination, caking, or wrong agent)	2. Empty and refill
3 (a) For cartridge	3 (a)
(1) Punctured seal disc	(1) Replace cartridge
(2) Improper weight	(2) Replace cartridge
(3) Broken or missing tamper indicator	(3) Examine seal disc, replace indicator
(b) For gas cylinder with gage	(b)
(1) Low pressure	(1) Replace cylinder
(2) Broken or missing tamper indicator	(2) Leak test replace indicator
(c) For gas cylinder without gage	(c)
(1) Low pressure (attach gage and measure pressure)	(1) Leak test. If normal, leak test and repair indicator. If low replace cylinder.
(2) Broken or missing tamper indicator	(2) Measure pressure leak test replace indicator

Water, Antifreeze, and Loaded Stream	Corrective Action
1. Improper fill level	1 Refill to correct level
2. (a) Agent condition	2. (a)
(1) Dirty, cloudy, or sediment	(1) Empty and refill
(2) If antifreeze or loaded stream improper charge (check specific gravity, recharge record or weigh)	(2) Recharge
3. Punctured cartridge seal disc	3. Replace cartridge
4. Improper cartridge weight	4 Replace
5. Broken or missing indicator	5. Examine seal disc replace indicator

Wetting Agent	Corrective Action
1. Improper fill level	1. Refill
2. Agent condition (sediment and incorrect surface tension) (*See* NFPA 18 *Wetting Agents.*)	2. Empty and refill
3. Improper cartridge weight	3. Replace
4. Broken or missing tamper indicator	4. Leak test cartridge weigh replace indicator

Stored Pressure

Dry Chemical Types	Corrective Action
1. Refillable	1.
(a) Improper extinguisher weight	(a) Refill to correct weight
(b) Improper gage pressure	(b) Repressurize and leak test
(c) Broken or missing tamper indicator	(c) Leak test and replace indicator
2. Disposable shell with pressure indicator	2.
(a) Punctured seal disc	(a) Replace shell
(b) Low pressure	(b) Depressurize, replace shell
(c) Broken or missing tamper indicator	(c) Check pressure check seal disc replace indicator
3. Disposable shell without pressure indicator	3.
(a) Punctured seal disc	(a) Replace shell
(b) Low weight	(b) Depressurize; replace shell
(c) Broken or missing tamper indicator	(c) Check seal disc replace indicator
4. Disposable extinguisher with pressure indicator	4.
(a) Low pressure	(a) Depressurize and discard extinguisher
(b) Broken or missing tamper indicator	(b) Leak test check pressure replace indicator

Bromochlorodifluoromethane	Corrective Action
1. Broken or missing tamper indicator	1. Weigh, leak test, and replace indicator
2. Improper gage pressure	2. Weigh, repressurize, and leak test
3. Improper weight	3. Leak test and refill to correct weight

Water, Antifreeze, and Loaded Stream	Corrective Action
1. Improper fill level (by weight or observation)	1. Refill to correct level
2. Agent condition if antifreeze or loaded stream. Improper charge (check recharge record or weigh)	2. Empty and refill
3. Improper gage pressure	3. Repressurize and leak test
4. Broken or missing tamper indicator	4. Leak test replace indicator

AFFF Liquid Charge	Corrective Action
1. Improper fill level (by weight or observation)	1. Empty and recharge with new solution
2. Agent condition (presence of precipitate or other foreign matter)	2. Empty and recharge with new solution
3. Improper gage pressure	3. Repressurize and leak test
4. Broken or missing tamper indicator	4. Leak test replace indicator

AFFF Solid Charge	Corrective Action
1. Improper fill level (by weight or observation)	1. Refill to correct level
2. Improper gage pressure	2. Repressurize and leak test
3. Broken or missing valve tamper indicator	3. Leak test replace indicator
4. Presence of liquid moisture in solid charge or housing	4. Replace solid charge and change tamper indicator tape
5. Missing charge housing seal plug	5. Inspect for all the above replace plug

pressure source could cause the container to rupture, resulting in injury. Never leave an extinguisher connected to the regulator of a high pressure source for an extended period of time. A defective regulator could cause container to rupture due to excess pressure.

(f) Use the manufacturer's recommended charging adaptor to prevent damage to valve and its components.

(g) When recharging separate expellant source extinguishers, make sure filled enclosure is in place and tightened down. Replace all safety devices prior to installing replacement cartridges.

(h) Only those gas cartridges recommended by the manufacturer should be used. Cartridge features such as pressure relief, puncturing capabilities, fill density and thread compatability are designed and approved to specific functional requirements.

(i) Use proper safety seals as other types, i.e., meter seals may not break at the prescribed requirements.

(j) Regulators utilized on wheeled extinguishers are factory pinned at the operating pressure and should not be field adjusted.

A-4-5.3.1 Recharge Materials. On properties where extinguishers are maintained by the occupant, a supply of recharging materials should be kept on hand. These materials should meet the requirements of 4-5.3.1.

The intent of this provision is to maintain the efficiency of each extinguisher as produced by the manufacturer and as labeled by one or more of the fire testing laboratories. For example, the extinguishing agent and the additives used in the various types of dry chemical extinguishers vary in chemical composition and in particle size and, thus, in flow characteristics. Each extinguisher is designed to secure maximum efficiency with the particular formulation used. Changing the agent from that specified on the extinguisher nameplate may affect flow rates, nozzle discharge characteristics, the quantity of available agent (as influenced by density), and would void the label of the testing laboratory.

Certain recharging materials deteriorate with age, exposure to excessive temperature, and exposure to moisture. Storage of recharge materials for long periods of time should be avoided.

Dry powder used for combustible metal fires (Class D) must not become damp as the powder will not be free flowing. In addition, when dry powder contains sufficient moisture, a hazardous reaction may result when applied to a metal fire.

A-4-5.3.2 Mixing multipurpose dry chemicals with alkaline based dry chemicals may result in a chemical reaction capable of developing sufficient pressures to rupture an extinguisher. Substituting a different formulation

for the one originally employed could cause malfunctioning of the extinguisher or result in substandard performance.

A-4-5.3.5 If it becomes necessary to replace a pressure gage on a fire extinguisher, in addition to knowing the charging pressure, it is important to know the type of extinguishing agent for which the gage is suitable as well as the valve body with which the gage is compatible. This information may be available in the form of markings on the dial face. Where the marking is provided, the extinguishing agent is indicated by references such as "Use Dry Chemicals Only" while the valve body compatibility is indicated as follows:

(a) Gages intended for use with aluminum or plastic valve bodies are marked with a line above the gage manufacturer's code letter.

(b) Gages intended for use with brass or plastic valve bodies are marked with a line below the manufacturer's code letter.

(c) Universal gages which can be used with aluminum, brass or plastic valve bodies are marked with lines above and below the manufacturer's code letter or by the absence of any line above or below the manufacturer's code letter.

Using the proper replacement gage as to pressure range, extinguishing agent and valve body compatibility is recommended to avoid or to reduce gage-related problems.

A-4-5.3.7 Pressurizing Gas. Shop compressors tend to deliver air with a high moisture content, which is only partly removed by mechanical separators known as "moisture traps." This presence of moisture will cause caking of dry chemical agents, hydrolysis of halogenated agents, clogging of pressure gages, and internal corrosion.

A-4-5.3.9 Moisture within a nonwater-type extinguisher creates both a serious corrosion hazard to the extinguisher shell and a probable inoperative extinguisher. Moisture may enter at the following times:

(1) After a hydrostatic test.

(2) When recharging is being performed.

(3) When the valve has been removed from the cylinder.

(4) By use of compressed air and a moisture trap for pressurizing nonwater types.

A-4-5.3.10 Dry Ice Converters. In general, carbon dioxide obtained by converting dry ice to liquid will not be satisfactory unless it is properly processed to remove excess water and oil. If dry ice converters are used, the following required steps must be taken:

(a) Employ moisture absorbent cartridges containing silica gel or activated alumina of adequate capacity. These cartridges need to be periodically reactivated by heating at 300°F (149°C) for two hours in an open vented condition in order to keep them in an absorbent condition. At temperatures below 32°F (0°C) the cartridges act as a filter and above 32°F (0°C) they absorb moisture directly. Various tell-tale compositions are available which, by means of color, indicate the degree of absorptivity still available in the gel.

(b) An extra operation is required to minimize the water within the converter. This operation consists of blowing off a short burst of liquid carbon dioxide from the bottom of the converter in order to blow off free water. This operation can only be performed above 32°F (0°C). With the converter contents colder than 32°F (°C) blowing off is ineffectual.

The preferred source of carbon dioxide for recharging extinguishers is from a low pressure (300 psi at 0°F) (2068 kPa at 17.8°C) supply, either directly or via dry cylinders used as an intermediary means.

A-4-5.3.11 Leak Tests. The leak test required for stored pressure and self-expelling types must be sufficiently sensitive to ensure that the extinguisher will remain operable for at least one year. Any tamper indicators or seals must be replaced after recharging.

A-5-1.4 Structural integrity of aluminum shells or cylinders is reduced when exposed to temperatures in excess of 350°F (177°C). These temperatures may occur under fire exposure without any visual evidence or during repainting operations where oven drying is utilized.

A-5-4.3 Test Equipment for Noncompressed Gas Types.

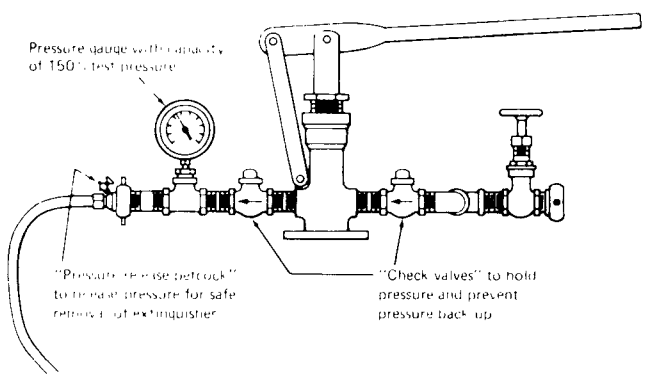


Figure A-5-4.3(a) Hydrostatic Hand Pump.

A-5-5.2 Testing Procedures for Noncompressed Gas Types.

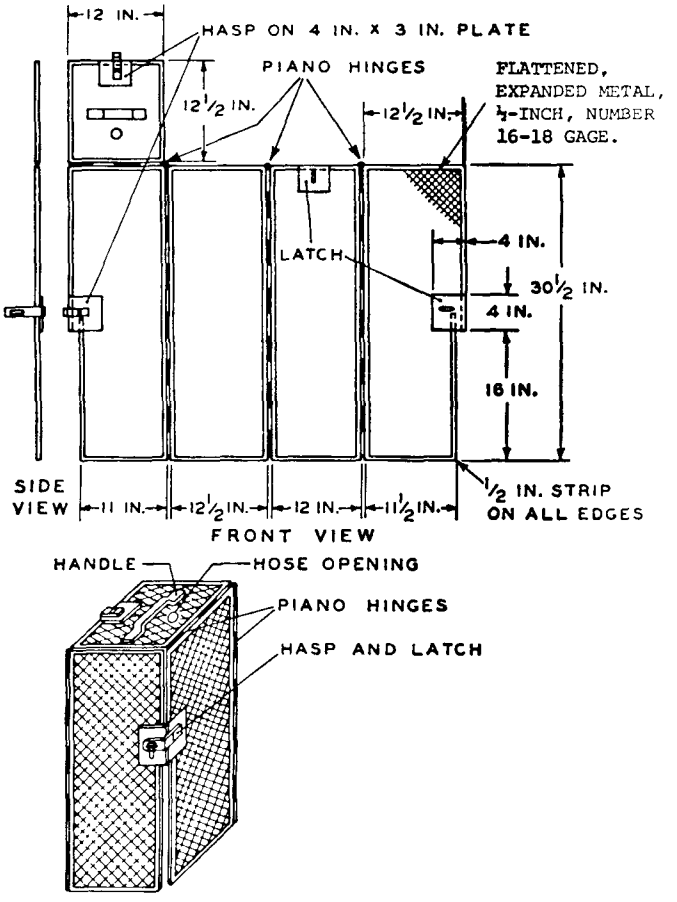
(a) All valves and internal parts must be removed and the extinguisher emptied.

Exception: On some dry chemical and dry powder extinguishers (cartridge-operated), the manufacturer recommends that certain internal parts not be removed.

(b) All dry chemical and dry powder types of extinguishers must have all traces of extinguishing materials removed from inside the shell before filling with water.

(c) On all dry chemical and dry powder extinguishers having an externally mounted gas cartridge for creating discharge pressure, the cartridge (and some cartridge receivers) must be removed and a suitable plug inserted into the shell opening at the point of removal.

(d) On wheeled extinguishers of the soda-acid, stored-pressure water, loaded stream, cartridge-operated, or foam types, the discharge nozzle must be removed and the complete remaining assembly, including the hose, then tested.



For SI Units: 1 in. = 25.4 mm.

Figure A-5-4.3(b) This illustrates a low-pressure, portable hydrostatic test cage useful to protect service personnel during such operations. It is used for hydrostatic tests of extinguishers of the type described in section 5-5. It is not used for hydrostatic testing of compressed gas cylinders. The cage should not be anchored to the floor during test operations. Such cages can be made by any metal fabricator.

(e) On all wheeled dry chemical, dry powder, and carbon dioxide extinguishers equipped with a shutoff nozzle at the outlet end of the hose, the hose (complete with couplings but without the discharge nozzle) must be removed and tested separately.

NOTE: To conduct maintenance or a hydrostatic test on wheeled extinguishers equipped with a regulator(s), disconnect the regulator or low pressure hose from the agent container. Test the regulator in accordance with procedures stated in A-4-4.2 of the Maintenance Check List.

(f) On all wheeled stored pressure dry chemical extinguishers, the head assembly is to be removed and be replaced with a suitable test bonnet.

(g) The hose of the hydrostatic test pump is then attached by the flexible connection to the discharge nozzle, hose assembly, test bonnet, or test fitting, as is applicable. In the case of wheeled dry chemical and dry powder extinguishers, procedures and fittings should be those recommended by the manufacturer.

(h) The extinguisher is then placed in the protective test cage or barrier or, in the case of wheeled units, placed behind the protective shield before applying the test pressure.

(i) The water supply to the test pump is to be turned on and the extinguisher then filled to the top of its collar.

(j) For extinguishers tested with their cap in place, the cap must be tightened SLOWLY while the water supply remains open. When all of the entrapped air within the shell has been bled off and after water emerges, the cap must be tightened fully.

(k) For extinguishers tested with a test bonnet or fitting, the bonnet or fitting must be tightened FULLY while the water supply remains open. When all of the entrapped air within the shell has been bled off and after water emerges, the vent must be closed tightly.

(l) Pressure is then applied at a rate-of-pressure rise so the test pressure is reached within one minute. This test pressure is maintained for another full minute. Observations are made at this time to note any distortion or leakage of the extinguisher shell.

(m) If no distortion or leakage is noted and if the test pressure has not dropped, the pressure on the extinguisher shell may be released. The extinguisher is then considered to have passed the hydrostatic test.

(n) All traces of water and moisture must be removed from all dry chemical, dry powder, and halogenated agent extinguishers by use of a cylinder dryer. If a heated air stream is used, the temperature within the shell must not exceed 150°F (66°C).

(o) Any extinguisher shell that fails this hydrostatic test must be destroyed.

A-5-5.3 Testing Procedures — Hose Assemblies.

(a) The discharge nozzle must be removed from the hose assembly without removal of any hose couplings.

(b) For dry chemical and dry powder types, all traces of dry chemical or dry powder must be removed.

(c) The hose assembly is then placed into a protective device, whose design will permit visual observation of the test.

(d) The hose must be completely filled with water before testing.

(e) Pressure then is applied at a rate-of-pressure rise to reach the test pressure within one minute. The test pressure is to be maintained for one full minute. Observations are then made to note any distortion or leakage.

(f) If no distortion or leakage is noted, or the test pressure has not dropped, or the couplings have not moved, the pressure is then to be released. The hose assembly is then considered to have passed the hydrostatic test.

(g) Hose assemblies passing the test must then be completely dried internally. If heat is used for drying, the temperature must not exceed 150°F (66°C).

(h) Hose assemblies failing a hydrostatic test must be destroyed.

A-5-5.4.2 Hydrostatic Test Label. Figure A-5-5.4.2 is a guide as to the design of a hydrostatic test label.

	JAN.	FEB.	MAR.	APR.	MAY	JUNE	
			HYDRO TESTED BY				
TESTED TO (PSI)	hundreds		1 2 3 4 5 6 7 8 9 0				H.T. by 1977-1978-1979-1980
	tens		1 2 3 4 5 6 7 8 9 0				
	units		1 2 3 4 5 6 7 8 9 0				
	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	

Figure A-5-5.4.2

Appendix B Recommended Markings to Indicate Extinguisher Suitability According to Class of Fire

This Appendix is not a part of the requirements of this NFPA document but is included for information purposes only

B-1 General.

B-1-1 Markings should be applied by decalcomanias that are durable and color fade resistant.

B-1-2 Markings should be located on the front of the extinguisher shell. Size and form should permit easy legibility at a distance of 3 ft (1 m).

B-1-3 Where markings are applied to wall panels, etc., in the vicinity of extinguishers, they should permit easy legibility at a distance of 15 ft (4.6 m).

Table B-2-1

Typical Pictorial Extinguisher Marking Labels

*NOTE: Recommended colors, per PMS (Pantone Matching System):
(BLUE-299)
(RED-*Warm Red*)

FOR CLASS "A" TYPES

For all Water Base Types

FOR CLASS "A,B" TYPES

(1) AFFF
(2) Foam

FOR CLASS "B,C" TYPES

(1) Carbon Dioxide
(2) Dry Chemical
(3) Halon 1211
(4) Halon 1301

FOR CLASS "A,B,C" TYPES

(1) Halon 1211
(2) Multipurpose Dry Chemical

Color Separation identification (picture symbol objects are white; background borders are white)

Blue* – background for "YES" symbols
Black – background for symbols with slash mark ("NO"),
– class of fire symbols and wording
Red* – slash mark for black background symbols

B-2 Recommended Marking System.

B-2-1 The recommended marking system is a pictorial concept that *combines* the uses and nonuses of extinguishers on a single label (*see Table B-2-1*).

B-2-2 Letter-shaped symbol markings, as previously recommended, are shown in Table B-2-2.

Table B-2-2

1. Extinguishers suitable for "Class A" fires should be identified by a triangle containing the letter "A." If colored, the triangle shall be colored green.*

2. Extinguishers suitable for "Class B" fires should be identified by a square containing the letter "B." If colored, the square shall be colored red.*

3. Extinguishers suitable for "Class C" fires should be identified by a circle containing the letter "C." If colored, the circle shall be colored blue.*

4. Extinguishers suitable for fires involving metals should be identified by a five-pointed star containing the letter "D." If colored, the star shall be colored yellow.*

Extinguishers suitable for more than one class of fire should be identified by multiple symbols placed in a horizontal sequence.

NOTE: Recommended colors from the PMS (Pantone Matching System) are:

Green – Basic Green
Red – 192 Red
Blue – Process Blue
Yellow – Basic Yellow

Appendix C Extinguisher Selection

This Appendix is not a part of the requirements of this NFPA document but is included for information purposes only

C-1 Principles of Selecting Extinguishers.

C-1-1 Selection of the best portable fire extinguisher for a given situation depends on:

(a) the nature of the combustibles which might be ignited,

(b) the potential severity (size, intensity, and speed of travel) of any resulting fire,

(c) effectiveness of the extinguisher on that hazard,

(d) the ease of use of the extinguisher,

(e) the personnel available to operate the extinguisher and their physical abilities and emotional reactions as influenced by their training,

(f) the ambient temperature conditions and other special atmospheric considerations (wind, draft, presence of fumes),

(g) suitability of the extinguisher for its environment,

(h) any anticipated adverse chemical reactions between the extinguishing agent and the burning materials,

(i) any health and operational safety concerns (exposure of operators during the fire control efforts), and

(j) the upkeep and maintenance requirements for the extinguisher.

C-1-2 Portable fire extinguishers are designed to cope with fires of limited size, and are necessary and desirable even though the property may be equipped with automatic sprinkler protection, standpipe and hose systems, or other fixed fire protective equipment.

C-1-3 A fire incident creates conditions of stress and intense excitement. Under these conditions the choice of a correct extinguisher must be made quickly. The protection planner can help to secure selection of the correct extinguisher by (1) locating the extinguisher near fire hazards for which they are suitable, (2) by use of extinguishers suitable for more than one class of fire, (3) by clearly marking the intended use (*see Appendix B*), and (4) by training of employees in the use of proper extinguishers. The use of conspicuous markings to readily identify an extinguisher's suitability is particularly important where extinguishers are grouped or where multiple fire hazards are present in an area.

C-2 Matching Extinguishers to the Hazard.

C-2-1 The first step in evaluating the selection of an extinguisher for the protection of a property is to determine the nature of the materials which might be ignited. Some extinguishers are suitable for only one class of fire, others for two, and still others for three. For example, a plain water extinguisher is suitable for Class A fires only.

C-2-2 The successful use of a Class A extinguisher on an incipient fire is directly related to the quantity of combustible material (contents and interior finish or both) involved. The amount of combustibles is sometimes referred to as the "fire loading" of a building, figured as the average pounds of combustibles per square foot of area. The larger the amount of combustibles, the greater the fire loading and the greater the potential fire hazard that the extinguisher may be called upon to combat. Based on this concept, Class A fire extinguishers are allocated according to the average fire loading which may be encountered in the occupancy to be protected.

C-2-3 Virtually every structure, even if of fire-resistive or noncombustible construction, has some combustible building components in the form of interior finish, partitions, etc. Thus, for building protection, extinguishers suitable for Class A fires are standard. Likewise, in virtually every situation, whether it be a building, a vehicle, or an outdoor exposure, ordinary combustible materials are found.

C-2-4 It is also true that where ordinary combustibles are present, there may be the need for extinguishers suitable for use on Class B and C fires (i.e., in a restaurant the principal combustibles present are wood, paper, and fabrics; in the kitchen area the essential hazard involves cooking greases, and a Class B extinguisher should be installed).

C-2-5 As another example, although in hospitals there is a general need for Class A extinguishers to cover spaces such as the patient's rooms, corridors, offices, etc., Class B:C extinguishers should be available in the laboratories, kitchens, areas where flammable anesthetics are stored or handled, or in electrical switchgear or generator rooms. Each area should be surveyed for its actual fire extinguisher requirements, keeping in mind the variety of conditions that exist in that particular area.

C-2-6 In connection with Class B (flammable liquid) fires, four basic conditions may exist: (1) flammable liquid fires of appreciable depth [¼ in. (6 mm) or more] such as those occurring in dip tanks and quench tanks in industrial plants, (2) spill fires or running fires where the depth of the liquid does not accumulate appreciably, (3) pressurized flammable liquid or gas fires from damaged vessels or product lines and (4) cooking grease fires of appreciable depth such as those occurring in deep fat fryers.

Each of these four conditions presents significantly different problems in extinguishment which can be further complicated by variations between indoor and outdoor conditions.

C-2-7 The selection of Class B extinguishers to be used on pressurized flammable liquids and pressurized gas fires require special consideration. Fires of this nature are considered to be a special hazard and only dry chemical types of extinguishers should be employed. Other types of Class B rated fire extinguishers are relatively ineffective on these hazards. It has been determined that special dry chemical nozzle designs and rates of application are required to cope with such hazards.

CAUTION: It is undesirable to attempt to extinguish this type of fire unless there is reasonable assurance that the source of fuel can be promptly shut off.

C-2-8 The Class B ratings given by testing laboratories are based on flammable liquid fires of appreciable depth.

The numeral thus derived is an approximate indication of the relative fire extinguishing potential of the extinguisher.

C-2-9 The size and type of the Class C extinguisher selected should be based on the construction features of the electrical equipment, the degree of agent contamination that can be tolerated, the size and extent of Class A and Class B components, or both, that are a part of the equipment and the nature and amount of combustible materials in the immediate vicinity. For example, large motors and power panels will contain a considerable amount of Class A insulating materials as compared to the Class B material in an oil-filled transformer.

C-2-10 Once an analysis is made of the nature of the combustibles present and their potential fire severity, a study is made of the various candidate extinguishers which might be provided to meet fire protection needs.

C-3 Selecting the Right Extinguisher.

C-3-1 Selecting the right extinguisher for the class of hazard depends upon a careful analysis of the advantages and disadvantages (under various conditions) of the various types available. The following paragraphs review some of the points that should be considered.

C-3-2 Water-type Extinguishers.

C-3-2.1 The most popular type is the 2½ gal (9.46 L) stored pressure water extinguisher. These extinguishers are being used to replace inverting types of water extinguishers (soda-acid and cartridge-operated water) which are no longer manufactured. An important advantage of the stored pressure water type, as opposed to inverting types, is its ability to be discharged intermittently. Some models are suitable for use at freezing conditions when charged as specified on the nameplate.

C-3-2.2 Since the pump-tank extinguisher (hand-carry type) cannot be operated while being carried, it is considered somewhat more difficult to use. However, it does possess some advantages over stored pressure under certain applications. It is an excellent choice for use as a standby extinguisher on welding or cutting operations, protecting buildings in remote locations, and for use by the construction industry. It can easily be filled from any convenient, relatively clean water supply, can be used without the need for pressurization, and can be easily maintained. For freezing conditions, chemical additives containing corrosion inhibitors can be used; however, copper tank models are recommended because they will not corrode as easily. The back-pack style of pump-tank, which can be carried and operated at the same time, is ideally suited for use in combating brush fires.

C-3-3 AFFF Extinguishers.

C-3-3.1 AFFF (aqueous film forming foam) type extinguishers are rated for use on both Class A and Class B fires. They are not suitable for use in freezing temperatures. An advantage of this type on Class B flammable liquid fires of appreciable depth is the ability of the agent to secure the liquid surface which helps to prevent reignition.

C-3-4 Carbon Dioxide Extinguishers.

C-3-4.1 The principal advantage of CO_2 (carbon dioxide) extinguishers is that the agent does not leave a residue after use. This may be a significant factor where protection is needed for delicate and costly electronic equipment. Other typical applications are food preparation areas, laboratories, and printing or duplicating areas. Since the agent is discharged in the form of a gas snow cloud, it has a relatively short range of 3 to 8 ft (1 to 2.4 m). This type of extinguisher is not recommended for outdoor use where windy conditions prevail, or for indoor use in locations which are subject to strong air currents because the agent may rapidly dissipate and prevent extinguishment.

C-3-5 Halogenated Agent Extinguishers.

C-3-5.1 In general, bromotrifluoromethane (Halon 1301) and bromochlorodifluoromethane (Halon 1211) extinguishers have features and characteristics similar to CO_2 extinguishers. The bromotrifluoromethane (Halon 1301) extinguisher has never been available in a size larger than 2½ lb (1.1 kg). It had a listed rating of 2-B:C, which is below the minimum requirements of this standard.

C-3-5.2 The bromochlorodifluoromethane (Halon 1211) extinguisher has an agent that is similar to CO_2 in that it is suitable for cold weather installation and leaves no residue. Some Halon 1211 extinguishers are listed for use on Class A as well as Class B and C fires. Compared to CO_2 on a weight-of-agent basis, bromochlorodifluoromethane (Halon 1211) is at least twice as effective. When discharged, the agent is in the combined form of a gas mist with about twice the range of CO_2. To some extent, windy conditions or strong air currents may make extinguishment difficult by causing the rapid dispersal of the agent.

C-3-6 Dry Chemical Extinguishers.

C-3-6.1 Due to the different designs and the various types of dry chemical agents, choosing the most suitable dry chemical extinguisher requires careful evaluation. Hand portable models have a discharge stream which ranges from 10 to 30 ft (3 to 9 m) depending on extinguisher size. Compared with carbon dioxide or halogenated agent extinguishers, they will also perform better under windy conditions.

C-3-6.2 Dry chemical extinguishers are available in two basic styles: stored pressure, and cartridge-operated. The stored-pressure (rechargeable) type is the most widely used and is best suited where infrequent use is anticipated and where skilled personnel with professional recharge equipment are available. The cartridge-operated type has the advantage of being quickly refilled in remote locations without the need for special equipment. Some dry chemical models can be equipped with long-range (high velocity) nozzles or applicators which are beneficial in applying the agent under certain special fire fighting conditions.

C-3-6.3 There are five available types of dry chemical agent and each has certain advantages and disadvantages. These advantages and disadvantages should be reviewed by potential users.

C-3-6.4 The potassium and urea-potassium base bicarbonate agents are selected in preference to sodium bicarbonate, principally because of their greater fire extinguishing capabilities. If corrosion that could be caused by agent residue is not a factor, potassium chloride can also be included in this group. However, the potassium chloride base agent is not widely used and does not have any specific extinguishing characteristics that are superior to the potassium bicarbonate base agents.

C-3-6.5 The monoammonium phosphate base agent (multipurpose) is the only one that is suitable for Class A protection.

C-3-6.6 Where dry chemical extinguishers are utilized for Class C protection, it is important to consider that the residue of potassium chloride is somewhat more corrosive than other dry chemicals and that a multipurpose base agent will be more difficult to remove because it hardens when it cools. Any of the other dry chemical agents, depending upon protection requirements, may prove to be a more practical choice for Class C protection.

C-3-7 Wheeled Extinguishers.

C-3-7.1 The selection of any type of wheeled extinguisher is generally associated with a recognized need to provide additional protection for special hazards or large, extra-hazard areas. Where wheeled extinguishers are to be installed, consideration should be given to mobility within the area in which it will be used.

C-3-7.2 For outdoor locations, models with rubber tires or wide-rim wheels will be easier to transport. For indoor locations, doorways, aisles, and corridors need to be wide enough to permit the ready passage of the extinguisher. Because of the magnitude of the fire it will generally be used on, this type of extinguisher should be reserved for use by operators who have actually used the equipment, who have received special instructions on the use of the equipment, or who have used the equipment in live fire training.

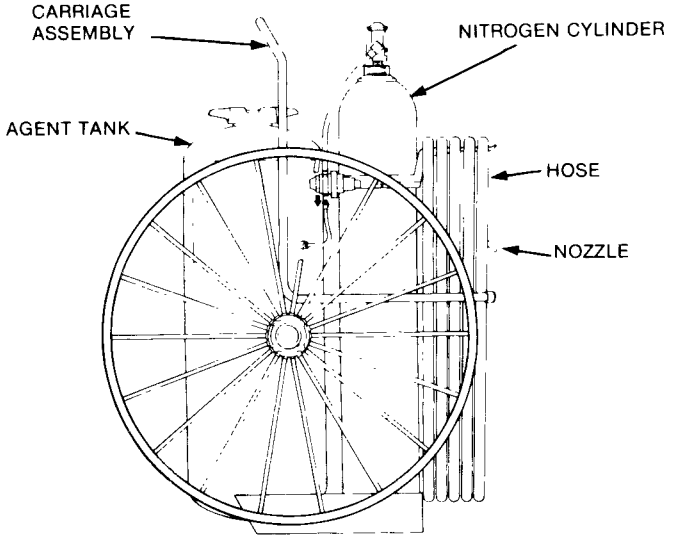


Figure C-3-7(a) Cylinder-Operated Dry Chemical Type.

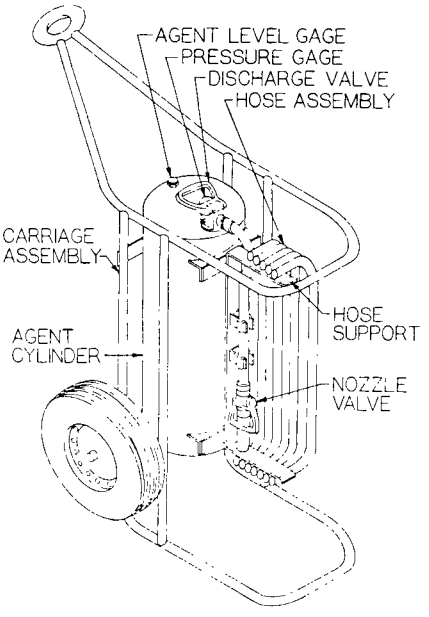


Figure C-3-7(b) Stored Pressure Halon 1211 Type.

Appendix D Operation and Use

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

D-1 General.

D-1-1 Persons who are expected to use an extinguisher should be made familiar with all information contained in the manufacturer's nameplate(s) and the instruction manual. Proper operation of a fire extinguisher requires the operator to execute several basic steps in a certain sequence. The extinguisher designer, the approval agencies, the installer, and the protection planner can influence significantly the ease and likelihood of these steps being accomplished properly.

D-1-1.1 Fire extinguishers will be used by one or more of the following groups of people, listed in descending order of their probable skill:

Fire departments (municipal or industrial) (trained).

Employees (business or industrial) (trained or untrained).

Private owners (home, car, boat, etc.) (untrained).

The general public (untrained).

D-1-1.2 Where employees have not been trained, operation of extinguishers may be seriously delayed, the extinguishing material may be wasted, and more extinguishers may have to be used, or the fire may not be extinguished.

D-1-1.3 It is not enough for the protection planner to determine the hazard of a location or area within a building and then select a proper type and size of fire extinguisher to fit the hazard. He must take into account any problems of getting the extinguisher into action, and the difficulty of properly applying the extinguishing agent. He should also consider which of the above groups is the most likely to use the extinguisher, and estimate the degree of skill or training they may have.

D-1-2 Methods of Extinguisher Operation.

D-1-2.1 The methods of operation of extinguishers are most conveniently arranged by grouping extinguishers according to their expelling means. Six methods are in common use.

(a) *Self-generating.* Actuation causes gases to be generated that provide expellant energy.

(b) *Self-expelling.* The agents have sufficient vapor pressure at normal operating temperatures to expel themselves.

(c) *Gas Cartridge or Cylinder.* Expellent gas is confined in a separate pressure vessel until an operator releases it to pressurize the extinguisher shell.

(d) *Stored Pressure.* The extinguishing material and expellant gas are kept in a single container.

(e) *Mechanically Pumped.* The operator provides expelling energy by means of a pump and the vessel containing the agent is not pressurized.

(f) *Hand Propelled.* The material is applied with scoop, pail, or bucket.

D-1-2.2 Several different extinguishing materials are handled by each of these expelling means. Table D-1-2 lists the agent and expelling means combinations that are or have been in use.

Table D-1-2

Extinguisher Operation and Methods of Expelling

	Expelling Methods					
Extinguishing Materials	Self-Generating	Self-Expelling	Cartridge or N_2 Cylinder	Stored Pressure	Pump	Hand
Water and Antifreeze			x	x	x	x
Soda-Acid (Water)	x					
Wetting Agent			x	x		
Foam	x					
AFFF			x	x		
Loaded Stream			x	x		
Multipurpose Dry Chemical			x	x		
Carbon Dioxide		x				
Dry Chemical			x	x		
Bromotrifluoromethane — Halon 1301				x		
Bromochlorodifluoromethane — Halon 1211				x		
Dry Powder (Metal Fires)			x			x

D-2 Basic Steps to Operate Extinguishers. The basic steps necessary to put an extinguisher into operation are:

Recognition as an extinguisher.

Selection and suitability of an extinguisher.

Transport of an extinguisher to the fire.

Actuation of the extinguisher.

Application of the extinguishing agent to the fire.

D-2-1 Recognition as an Extinguisher. The following will help a person to recognize an extinguisher.

D-2-1.1 Approval agencies require permanent marking on the front of fire extinguishers indicating their purpose, content and usage.

D-2-1.2 Additional markings, not a part of the device, may be needed to indicate the location of an extinguisher. These should preferably be standardized throughout the property so all extinguishers are easily "spotted." These markings may be in the form of electric lights, placards, mounting boards, overhead signs, color panels or stripes, or cabinets -- they may be distinctively colored by painting or reflective taping.

D-2-1.3 If extinguishers are located along the normal exit paths from an area, personnel are more inclined to take them and return to the site of a fire.

D-2-2 Transport of an Extinguisher to the Fire.

D-2-2.1 An extinguisher should be mounted and located so it can be easily removed in a fire emergency and brought to the site of the fire as fast as possible. It should be readily accessible without need for moving or climbing over stock, materials, or equipment.

D-2-2.2 Portability is affected by the weight of the extinguisher, travel distance to a possible fire, the need for carrying the unit up or down stairs or ladders, the need for using gloves, the over-all congestion of the premises, and physical ability of the operators.

D-2-2.3 In the case of wheeled extinguishers, the width of aisles and doorways and the nature of the flooring and outside grounds over which the extinguisher must be moved should be taken into account.

D-2-3 Actuation of the Extinguisher.

D-2-3.1 Once the extinguisher has been transported to the fire site, it must be placed into operation without delay. Employees should be familiar with any steps which are needed to actuate any extinguisher. Here is where previous training is most valuable, since there is little time to stop and read operating instructions on the nameplate.

D-2-3.2 To actuate an extinguisher, one or more of the following steps are required:

POSITION FOR OPERATION — The intended position for operation is usually marked on the extinguisher. When the position of operation is obvious (such as when one hand holds the extinguisher and the other hand holds the nozzle) this information may be omitted.

REMOVAL OF RESTRAINING OR LOCKING DEVICES Many extinguishers have an operation safeguard or locking device that prevents accidental actuation. The most common device is a lock pin or ring pin which must be withdrawn before operation.

Other forms of such devices are clips, cams, levers, or hose or nozzle restrainers. Most tamper indicators (such as wire and lead seals) will break with removal of the restraining device.

On some extinguishers the restraining device is arranged to disengage when the unit is normally handled. No separate motion is required. This type of restraining device is especially suited for use by private owners and the general public since prior instruction is seldom possible.

START OF DISCHARGE This requires one or more of several actions such as inverting, bumping, turning or squeezing a valve handle or lever, pushing a lever, or pumping. These may cause a gas to be generated, release a gas from a separate container, open a normally closed valve, or create a pressure within the container.

AGENT APPLICATION This act involves direction of the stream of extinguishing agent onto the fire. Nameplate information has advisory notes regarding the application of the agent to different types of fires. Specific application techniques are described in Section D-3.

D-2-4 Expellant Gas/Pressure.

D-2-4.1 Many of the extinguishers described in this appendix are of the stored-pressure or cartridge-operated type. Since the operating characteristics of these two types are similar, regardless of agent used, they are described generally in the following paragraphs.

D-2-4.2 In stored-pressure models, the expellant gas and extinguishing agent are stored in a single chamber and the discharge is controlled by a shutoff valve or nozzle.

D-2-4.3 In cartridge-operated models, the expellant gas is stored in a separate cartridge or may be stored in an expellant-gas cylinder (wheeled models), located within or adjacent to the shell containing the extinguishing agent. These extinguishers are actuated by releasing the expellant gas which expels the agent. In most models, the discharge may subsequently be controlled by a shutoff valve or nozzle.

D-3 Application Techniques.

D-3-1 General.

D-3-1.1 Many fire extinguishers deliver their entire quantity of extinguishing material in 8 to 10 seconds (although some take 30 seconds or longer to discharge). The agent must be applied correctly at the outset since there is seldom time for experimentation. In many extinguishers the discharge may be started or stopped by a valve. In using some extinguishers on flammable liquid fires the fire may "flare up" momentarily when the agent is initially applied.

D-3-1.2 The best technique of applying the extinguisher discharge on a fire varies with the type of extinguishing material.

D-4 Extinguisher Characteristics.

D-4-1 Water Types. This includes water, antifreeze, soda-acid, wetting agent, and loaded-stream extinguishers. These extinguishers are intended primarily for use on Class A fires. The stream should be directed at the base of the flames, and after extinguishment of flames, directed generally at smoldering or glowing surfaces. Application should begin as close as possible to the fire. Deep-seated fires should be thoroughly soaked and may need to be "broken apart" to effect complete extinguishment.

D-4-1.1 Stored-pressure Water. Hand extinguishers of this type are usually available in 2½-gal (9.46-L) capacity with a fire extinguishment rating of 2-A. Since the agent used is fresh water, this extinguisher cannot be installed in areas subjected to temperatures below 40°F (4°C). This same type of extinguisher is also manufactured in an antifreeze model charged with an approved solution which will afford protection to temperatures as low as -40°F (-40°C). The extinguisher weighs about 30 lb (14 kg) and has a solid stream range of approximately 35 to 40 ft (10.7 to 12.2 m) horizontally. This extinguisher can be operated intermittently, but under continuous use, it has a discharge time of about 55 seconds. The operating lever is held in a locked position to prevent accidental discharge while being carried. Most manufacturers use a ring pin which must be pulled out before the operating lever can be depressed. To do this, it is best to set the extinguisher on the ground and, while loosely holding the combination handle in one hand, pull out the ring pin (or release a small latch) with the other hand. Then, grasp the hose and nozzle in one hand and squeeze the discharge lever with the other.

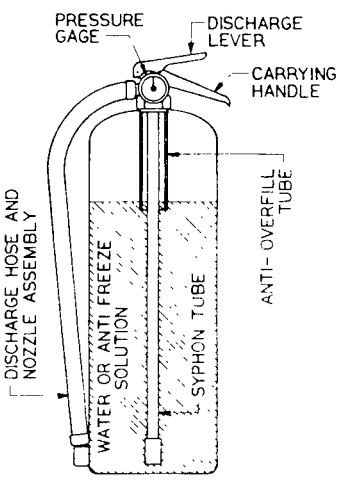


Figure D-4-1.1 Stored-pressure Water Extinguisher.

D-4-1.2 Loaded Stream. Hand extinguishers of this type have been made with liquid capacities from 1 to 2½ gal (3.8 to 9.46 L) having fire extinguishing ratings of 1-A:1-B to 3-A:1-B. Due to limited effectiveness, these extinguishers are no longer recognized (listed) for use on

Class B fires. Wheeled extinguishers have been made having liquid capacities of 17 and 33 gal (64 and 125 L) [trade designations 20 and 40 gal (76 and 151 L)] having fire extinguishment ratings of 10-A to 20-A. The chemical used is a solution of an alkali-metal-salt which will not freeze at temperatures as low as -40°F (-40°C).

D-4-1.3 Pump Tank. Extinguishers of this type have been made in 1½- to 5-gal (5.7- to 19-L) capacities with fire extinguishment ratings of 1-A to 4-A. The most common type is 2½ gal (9.46 L) rated at 2-A. These extinguishers have cylindrical metal containers and carrying handles. In some models, the carrying handle is combined with the pump handle, and in others it is attached to the container. A built-in, hand-operated vertical piston pump, to which a short rubber hose and nozzle is attached, provides the means for discharging the water onto the fire. The pump is of the double-acting type which discharges a stream of water on both the up and down strokes. When brought to a fire, the pump-tank is placed on the ground and, to steady the unit, the operator puts one foot on a small extension bracket attached to the base. To force the water through the hose, the operator then pumps the handle up and down. To work around the fire, or to move closer to the fire as the flames subside, the operator must stop pumping and carry the extinguisher to a new location. The force, range, and duration of the stream are dependent, to a degree, on the operator.

They can be filled with either plain water or antifreeze charges recommended by the extinguisher manufacturer. Common salt or other freezing depressants may corrode the extinguisher damage the pump assembly, or affect the fire extinguishing capability. Copper shell models do not corrode as easily as steel and are recommended for use in conjunction with antifreeze agents.

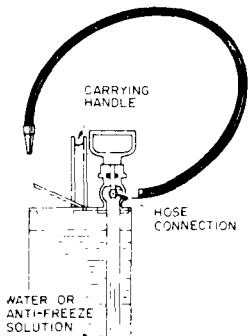


Figure D-4-1.3 Pump Tank Fire Extinguisher.

D-4-1.4 Back Pack. This type of pump extinguisher is primarily used for fighting outdoor fires in brush and wildlands. The tank has a capacity of 5 gal (19 L) and weighs approximately 50 lb (23 kg) when full. Although it is listed by UL it does not have a designated rating. Generally, plain water is used as the extinguishant. However, antifreeze agents, wetting agents, or other special water base agents may be used. The tank may be constructed of fiberglass, stainless steel, galvanized steel, or brass. As its name implies, it is designed to be carried on the operator's back. The back pack extinguisher has a large opening for fast refilling as well as a tight fitting filter to prevent foreign material from entering and clogging the pump. This design permits convenient refilling from nearby water sources such as ponds, lakes, or streams. The most commonly used model has a trombone-type, double-acting piston pump connected to the tank by a short length of rubber hose. Discharge occurs when the operator, holding the pump in both hands, moves the piston section back and forth. Models have also been manufactured with compression pumps mounted on the right side of the tank. Expellent pressure is built up with about 10 strokes of the handle, and then maintained by continual slow, easy pumping strokes. Discharge is controlled with the left hand by means of a lever-operated shut-off nozzle attached to the end of the hose.

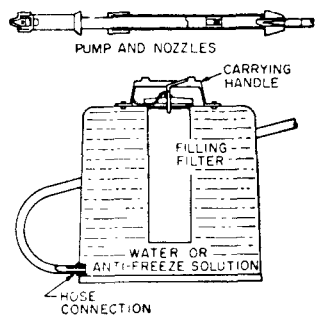


Figure D-4-1.4 Pump Tank Back Pack Fire Extinguisher.

D-4-1.5 Soda-acid. This extinguisher was most commonly manufactured in the 2½-gal (9.46-L) size, weighing approximately 30 lb (14 kg) fully charged, with a listed rating of 2-A. Some models were manufactured in the hand portable sizes of 1¼ and 1½ gal (4.7 and 5.7 L) and in wheeled models with liquid capacities of 17 and 33 gal (64 and 125 L) [trade designations, 20 and 40 gal (76 and 151 L)] having fire extinguishment ratings of 10-A and 20-A. These extinguishers are now generally considered obsolete since their manufacture, in the United States, was discontinued in 1969; they should be replaced with currently available models. As its name implies, this extinguisher contains two chemicals: sodium bicarbonate and sulfuric acid. To operate, the extinguisher must be inverted which causes intermixing of these products to produce a chemical reaction that forms carbon dioxide gas to expell the extinguishing agent, consisting principally of water in a neutral state. Once the extinguisher is inverted it is carried by a handle recessed in the bottom of the shell. The discharge time for this extinguisher is approximately 55 seconds. This extinguisher cannot be installed in locations that are subjected to temperatures below 40°F (4°C). Antifreeze additives cannot be added for protection.

D-4-1.6 Cartridge-operated Water. This type of extinguisher closely resembles the soda-acid extinguisher. In general, their operational and fire fighting characteristics are very similar. The most common model manufactured was the 2½-gal (9.46-L) size which had a listed rating of 2-A. Some 1¼-gal (4.7-L) models rated at

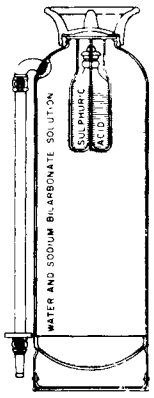


Figure D-4-1.5 Soda-acid Fire Extinguisher.

A-1 were also manufactured. This extinguisher is now generally considered obsolete since its manufacture, in the United States, was discontinued in 1969; they should be replaced with currently available models. The extinguisher shell contains water, with a small cylinder of carbon dioxide gas that provides the expellant force to discharge the water. Models were also manufactured which employed an approved antifreeze agent in place of water. For locations subjected to temperatures below 40°F (4°C), the antifreeze model should be used. To operate, invert the extinguisher and bump it gently on the ground (hard surface) while holding the recessed bottom handle. In some models, bumping may not be necessary because the weight of the gas cartridge causes it to fall against a puncturing device. Sometimes this model must be lightly bumped on the ground in order to break the seal.

Figure D-4-1.6 Cartridge-operated Water Fire Extinguisher.

D-4-1.7 Wetting Agent. Extinguishers of this type are usually available in hand portable models of 1½ gal (5.7 L) and in wheeled models having liquid capacities of 45 and 60 gal (170 and 228 L). These extinguishers have ratings of 2-A, 30-A and 40-A respectively. The extinguishing agent used is a surface-active material added to water in proper quantities to materially reduce the surface tension of the water and thus increase penetrating and spreading characteristics (*see NFPA 18, Wetting Agents*). Hand portable models are of the stored-pressure design and are operated essentially the same as other stored-pressure types. Wheeled extinguishers are operated by a separate carbon dioxide cartridge containing the expellant gas which, when released, expels the agent through the hose nozzle. These extinguishers must be protected from exposure to temperatures below 40°F (4°C).

D-4-1.8 Fire Pails, Drums with Pails and Bucket Tanks.

D-4-1.8.1 Small water supplies applied with fire pails are of limited fire-extinguishing value. The following combinations are considered as possessing two units of extinguishing potential (2-A) for Class A fires.

(a) Five 12-qt (11-L) water-filled standard fire pails.

(b) Six 10-qt (9-L) water-filled standard fire pails.

(c) Drum, cask, or barrel of approximately 55-gal (208-L) capacity, with at least three standard fire pails attached.

(d) Bucket tanks of 25- to 55-gal (95- to 208-L) capacity, with standard fire pails [either (a) or (b) above] immersed therein.

D-4-1.8.2 Standard fire pails shall be made of galvanized steel of at least No. 24 USS gage, with a flat bottom welded in place or otherwise suitably reinforced, furnished with stamped ears welded in place and with strong wire bail and loose-fitting metal cover to exclude debris and retard evaporation.

D-4-1.8.3 Casks, drums, or barrels should preferably be of metal of No. 24 USS gage thickness or better, and should have covers. Fire pails may be hung on sides of the containers or immersed therein. Pails, casks, drums, or bucket tanks should be painted bright red with the word "FIRE" stenciled in large letters on their outside with black or other contrasting colored paint. If antifreezing solution is used, the surfaces of pails, drums, or bucket tanks should be coated with red lead or oil, followed by a coat of asphalt-base paint casks should be heavily coated with pitch.

D-4-1.8.4 When located where continued temperatures below 40°F (4°C) may be encountered, containers should be filled with an antifreeze solution consisting of 75 to 80 percent calcium chloride (free from magnesium chloride) dissolved in water. Table D-4-1.8.4 shows approximately the temperature at which the solutions will freeze.

Table D-4-1.8.4

To make 10 Gallons Antifreeze Solution*

Approx. Freezing Temp. °F	°C	Water, Gal	L	Calcium Chloride lb	kg	Specific Gravity	Degrees Baume
10	12	9	34	20	9 1	1 139	17 7
0	18	8½	32	25	11	1 175	21.6
10	23	8	30	29½	13	1 205	21 7
20	29	8	30	33½	15	1 228	26 9
30	34	8	30	36½	17	1 246	28.6
40	40	8	30	40	18	1 263	30 2

*This solution should not be used in extinguishers. Only solutions supplied by the manufacturers should be used in stored-pressure and cartridge-operated water extinguishers and in pump-tank extinguishers where an antifreeze solution is desired.

D-4-2 Foam Types. These extinguishers are intended for use on Class A and Class B fires. On flammable liquid fires of appreciable depth, best results are obtained when the discharge from the extinguisher is played against the inside of the back wall of the vat or tank just above the burning surface, so as to permit the natural spread of the foam back over the burning liquid. If this cannot be done, the operator should stand far enough away from the fire to allow the foam to fall lightly upon the burning surface — the stream should not be directed into the burning liquid. Where possible, the operator should walk around the fire while directing the stream so as to get maximum coverage during the discharge period. For fires in ordinary combustible materials the foam may be used to coat the burning surface directly. For flammable-liquid spill fires the foam may be flowed over a burning surface by bouncing it off the floor just in front of the burning area. Foam is not effective on flammable liquids and gases escaping under pressure. The type of foam produced is not suitable for fires involving ethers, alcohols, esters, acetone, lacquer thinners, carbon disulfide and other flammable liquids which either break down or penetrate the foam blanket.

D-4-2.1 AFFF. Extinguishers of this type are usually available in hand portable models of 2½ gal (9.46 L) liquid solution or solid charge types and in wheeled models having a liquid capacity of 33 gal (125 L). These extinguishers have ratings of 3A:20B, 3A:40B and 20A:160B, respectively. The extinguishing agent is a solution of aqueous film forming surfactant in water which forms mechanical foam when discharged through an aspirating nozzle. On Class A fires, the agent acts as both a coolant and penetrant to reduce temperatures below the ignition level. On Class B fires, the agent acts as a barrier to exclude air or oxygen from the fuel surface.

These extinguishers are not suitable for the protection of water soluble flammable liquids, such as alcohols, acetone, esters, ketones, etc., unless specifically referenced on the nameplate.

Specific information and limitations of the properties of AFFF are contained in NFPA 11, *High Expansion Foam and Combined Agent Systems*.

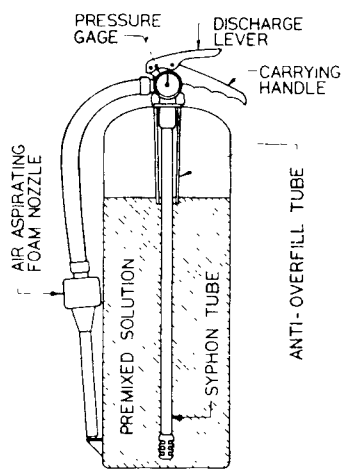


Figure D-4-2.1(a) Stored-pressure AFFF Liquid Extinguisher.

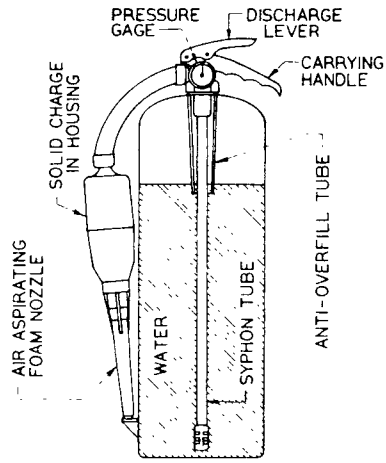


Figure D-4-2.1(b) Stored-pressure AFFF Solid Charge Extinguisher.

The hand portable models closely resemble stored-pressure water extinguishers except for the special types of nozzles. They are available in two basic types. One type contains a liquid solution of AFFF in the tank, Figure D-4-2.1(a). The other type contains plain water in the tank and a replaceable charge of solid AFFF in a compartment of the nozzle, Figure D-4-2.1(b). Both types are placed into operation by the same procedure used for water extinguishers. Wheeled types are operated by a separate nitrogen cylinder containing the expellant gas which, when released, pressurizes the agent container. The discharge is controlled by a special aspirating shut-off type of nozzle at the end of the hose assembly. These types of extinguishers can be used only in locations not subject to freezing conditions.

D-4-2.2 Foam (Chemical). Foam extinguishers are similar in external appearance to soda-acid extinguishers. They were most commonly manufactured in the 2½-gal (9.46-L) size, weighing about 30 lb (14 kg) fully charged. A typical listed rating for the 2½-gal (9.46-L) size was 2-A:4-B. Other sizes manufactured included 1¼-gal (4.7-L) and 1½-gal (5.7-L) hand portables and wheeled models with liquid capacities of 17 and 33 gal (64 and 125 L) [trade designations, 20 and 40 gal (76 and 151 L)] having fire extinguishment ratings from 10-A:12-B to 20-A:40-B. These extinguishers are now generally considered obsolete since their manufacture, in the United States, was discontinued in 1969; they should be replaced with currently available models. The extinguisher has an inner chamber or cylinder, fitted with a loose stopple, which contains an aluminum sulfate solution. The main extinguisher shell is filled with a solution of sodium bicarbonate and a foam-stabilizing agent. To operate, the extinguisher must be inverted which allows the intermixing of these agents. Carbon dioxide gas is formed to expell the liquid foam extinguishant which expands at the ratio of about one to eight. These extinguishers cannot be installed in locations that are subjected to temperatures below 40°F (4°C).

Antifreeze additives cannot be used to provide protection against freezing temperatures. The general method of placing this extinguisher into operation is the same as for the soda-acid extinguisher.

D-4-3 Compressed Gas Type. This type of extinguisher is primarily intended for use on Class B and Class C fires. They have a limited range and are affected by draft and wind; thus, initial application must start reasonably close to the fire. On all fires, the discharge should be directed at the base of the flames. The discharge should be applied to the burning surface even after the flames are extinguished, to allow added time for cooling and to prevent possible reflash. The most commonly used method of agent application on contained flammable liquid fires is to start at the near edge and direct the discharge in a slow, side-to-side sweeping motion, gradually progressing toward the back of the fire. The other method is called overhead application. The discharge horn is directed in a dagger or downward position (at an angle of about 45 degrees) toward the center of the burning area. Generally, the horn is not moved, as in the other method, because the discharge stream enters the fire from above and spreads out in all directions over burning surface. For spill fires, the side-to-side sweeping motion may give better results.

On fires involving electrical equipment, discharge should be directed at the source of the flames. It is important to de-energize the equipment as soon as possible, to eliminate the potential of reignition.

The compressed gas agent extinguishes by diluting the surrounding atmosphere with an inert gas, so that oxygen levels are kept below the percentage required for combustion. When this type of extinguisher is used in an unventilated space, such as a small room, closet, or other confined area, prolonged occupancy of that space can result in the loss of consciousness due to oxygen deficiency.

D-4-3.1 Carbon Dioxide. Hand extinguishers of this type are usually available at capacities from 2½ to 20 lb (1.1 to 9.1 kg) having fire extinguishment ratings from 1-to 10-B:C. Wheeled carbon dioxide extinguishers are usually available in capacities from 50 to 100 lb (23 to 45 kg) having fire extinguishment ratings from 10- to 20-B:C. The carbon dioxide is retained under its own pressure in a fluid condition at room temperature. The agent is self-expelling and is discharged by operation of a valve which causes the carbon dioxide to be expelled through a horn in its vapor and solid phase. To operate, the extinguisher is held in an upright position, the locking ring pin is pulled, and the operating lever is squeezed. On the smaller 2- to 5-lb (.91- to 2.3-kg) models, the discharge horn is attached to the valve assembly by a metal tube/swing joint connector. The smaller models are designed to be operated with one hand. On the larger hand portables, the discharge horn is attached to several feet of flexible hose. These extinguishers require a "two hand" operation. The minimum discharge time for hand portables varies from 8 to 30 seconds depending upon size. The maximum range of the discharge stream is from 3 ft (1 m) to 8 ft (2.4 m).

D-4-4 Halogenated Agent Types. Halon 1211 types are rated for use on Class B and Class C fires. Larger models also are rated for Class A fires. Halon 1301 extinguishers are intended primarily for use on Class B and Class C fires. On flammable liquid fires, best results are obtained when the discharge from the extinguisher is employed to sweep the flame off the burning surface, applying the discharge first at the near edge of the fire and gradually progressing toward the back of the fire by moving the discharge nozzle slowly from side to side. In using extinguishers of this type in unventilated places, such as small rooms, closets or confined spaces, operators and other persons should avoid breathing the extinguishing agent or the gases produced by thermal decomposition.

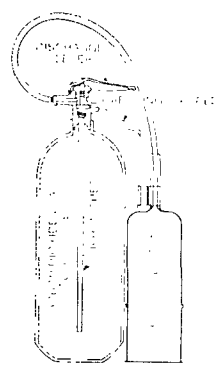


Figure D-4-3.1(a) Carbon Dioxide Extinguisher.

Figure D-4-3.1(b) Carbon Dioxide Extinguisher.

D-4-4.1 Bromochlorodifluoromethane — Halon 1211. Stored-pressure extinguishers of this type are available in capacities from 2 to 22 lb (.91 to 10 kg) having fire extinguishment ratings from 2-B:C to 4-A:80-B:C and wheeled models with a capacity of 150 lb (68 kg) and a fire extinguishment rating of 30-A:160 BC. Although the agent is retained under pressure in a liquid state, and is self-expelling, a booster charge of nitrogen is added to ensure proper operation. Upon actuation, the vapor pressure causes the agent to expand so that the discharge stream consists of a mixture of liquid droplets and vapor. The smaller sizes have a horizontal stream range of 9 to 15 ft (2.7 to 4.6 m) which is not affected by wind as much as carbon dioxide or Halon 1301. Deep-seated Class A fires may need to be broken apart to effect complete extinguishment. On Class B fires, the discharge is applied in a side-to-side motion gradually progressing toward the back of the fire. Extinguisher should be discharged initially from not closer than 8 ft (2.4 m) to prevent splashing when applied to depths of flammable liquid.

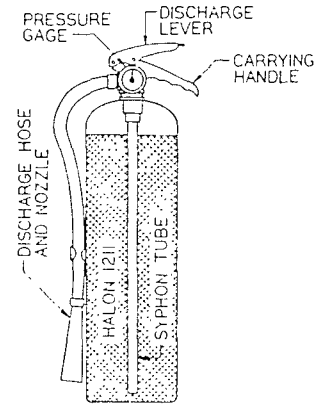


Figure D-4-4.1 Halon 1211 Stored-pressure Fire Extinguisher.

D-4-4.2 Bromotrifluoromethane — Halon 1301. This type of extinguisher was manufactured in a model having a capacity of 2½ lb (1.1 kg) and a fire extinguishment rating of 2-B:C. Although this extinguisher has been withdrawn from the commercial market, it is still available under special order. The design, operation characteristics and fire fighting techniques are virtually the same as for the 2½-lb (1.1-kg) carbon dioxide extinguisher. It has a discharge time of 8 to 10 seconds with a stream range of 4 to 6 ft (1.2 to 1.8 m). Although the agent has a high vapor pressure and is self-expelling, a booster charge of nitrogen is added to improve operation.

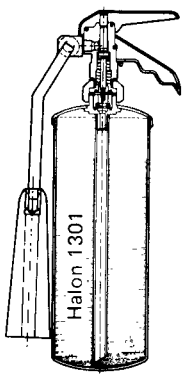


Figure D-4-4.2 Halon 1301 Fire Extinguisher.

D-4-5 Dry Chemical Types. Dry chemical extinguishers (sodium bicarbonate, potassium bicarbonate, potassium bicarbonate urea base, bicarbonate urea base or potassium chloride base) are intended primarily for use on Class B and Class C fires. Dry chemical extinguishers (multipurpose ammonium phosphate base) are intended for use on Class A, Class B, and Class C fires. There are two methods whereby a dry chemical agent can be discharged from an extinguisher shell depending upon the basic design of the extinguisher. They are the cartridge/cylinder-operated method and the stored-pressure method. Regardless of extinguisher design, the method of agent application is basically the same. Stored-pressure extinguishers are available in capacities from 1 to 30 lb (0.5 to 14 kg) for hand extinguishers and 125 to 250 lb (57 to 113.5 kg) for wheeled extinguishers. Cartridge/cylinder-operated extinguishers are available in capacities from 4 lb (1.8 kg) to 30 lb (14 kg) for hand extinguishers and 45 to 350 lb (20 to 159 kg) for wheeled extinguishers.

Dry chemical extinguishers are also available with disposable nonrefillable types which contain the agent and expellant gas in a single, nonreuseable, factory-filled container. Most dry chemical extinguishers having ratings of 20-B and less will discharge their contents in eight to 20 seconds. Extinguishers with higher ratings may take as long as 30 seconds. Therefore, since there is little time for experimentation, it is important that the operator be prepared to correctly apply the agent at the outset. All dry chemical extinguishers can be carried and operated simultaneously, and can be discharged intermittently. The discharge stream has a horizontal range of 5 to 30 ft (1.5 to 9.2 m) depending on extinguisher size. When used on outdoor fires, maximum effectiveness can be achieved when the direction of the wind is on the back of the operator.

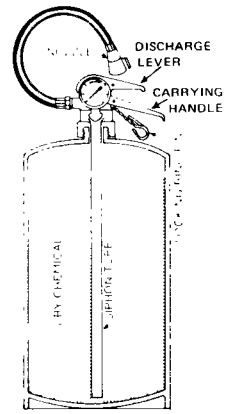


Figure D-4-5(a) Stored-pressure Dry Chemical Extinguisher.

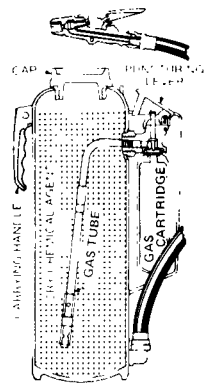


Figure D-4-5(b) Cartridge-operated Dry Chemical Extinguisher.

Special long-range nozzles are available where potential fire fighting conditions may require greater distance. These nozzles are also useful on pressurized gas or liquid fires, or where strong winds prevail. All dry chemical agents can be used at the same time that water (straight stream or fog) is being applied. The use of dry chemical extinguishers on wet energized electrical equipment (such as rain-soaked utility poles, high voltage switch gear, and transformers) may aggravate electrical leakage problems. The dry chemical, in combination with moisture, provides an electrical path which can reduce the effectiveness of insulation protection. The removal of all traces of dry chemical from such equipment after extinguishment is recommended.

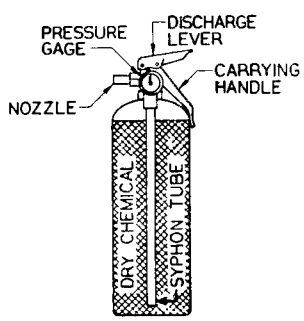


Figure D-4-5(c) Stored-pressure Dry Chemical with Fixed Nozzle.

D-4-5.1 Ordinary Dry Chemical Extinguishers (Class B and Class C Fires). Hand extinguishers of this type are available with fire extinguishing ratings of 1-B:C to 160-B:C and wheeled models having fire extinguishing ratings from 80-B:C to 640-B:C. The fire extinguishing agent used is a specially treated material in a finely divided form. Types of agents available are: sodium bicarbonate base, potassium bicarbonate base, potassium chloride base or potassium bicarbonate urea base. Some formulations of these agents are specially treated to be relatively compatible for use with air foam (mechanical foam). For use on flammable liquid fires, the stream should be directed at the base of the flame. Best results are generally obtained by attacking the near edge of the fire and progressing towards the back of the fire by moving the nozzle rapidly with a side-to-side sweeping motion. Care must also be taken not to direct the initial discharge directly at the burning surface at close range [less than 5 to 8 ft (1.5 to 2.4 m)] because the high-velocity of the stream may cause splashing and/or scattering of the burning material. Although not listed for use on Class A fires, ordinary dry chemical may be used to rapidly knock down the flames. Once the flames are extinguished, the operator can kick or poke apart the fire debris. This will assist and hasten the natural cooling of the burning embers. Hot spots or small areas that reignite can be controlled with short intermittent bursts of agent. Water should then be applied to extinguish burning embers or deep-seated hot spots. It is recommended that this method of extinguishment be attempted only if the operator has had training and previous experience in this technique.

D-4-5.2 Multipurpose Dry Chemical Extinguishers (Class A, Class B and Class C Fires). Extinguishers of this type contain an ammonium phosphate base agent. Hand extinguishers are available with fire extinguishment ratings of 1-A to 20-A and 10- to 120-B:C and wheeled models with fire extinguishment ratings of 20- to 40-A and 60- to 320-B:C. Multipurpose agents are used in exactly the same manner as ordinary dry chemical agents on Class B fires. For use on Class A fires, the multipurpose agent has the additional characteristic of softening and sticking when in contact with hot surfaces. In this way, it can adhere to burning materials and form a coating which will smother and isolate the fuel from air. When applying the agent, it is important to try and coat all burning areas in order to eliminate or minimize the number of small embers which may be a potential source of reignition. The agent itself has little cooling effect and cannot penetrate below the burning surface. For this reason, extinguishment of deep-seated fires may not be accomplished unless the agent is discharged below the surface or the material is broken apart and spread out.

D-4-6 Dry Powder Types. These extinguishers and agents are intended for use on Class D fires and specific metals, following special techniques and manufacturer's recommendations for use. The extinguishing agent may be applied from an extinguisher or by scoop and shovel. The technique of applying the agent to the fire may vary with the type and form of the agent and combustible metal. The application of the agent should be of sufficient depth to adequately cover the fire area and provide a smothering blanket. Additional applications may be necessary to cover any hot spots which may develop. The material should be left undisturbed until the mass has cooled before disposal is attempted. Care should be taken to avoid scattering the burning metal. Fires in finely divided combustible metal or combustible metal alloy scrap which is moist, wet with water or water-soluble machine lubricants, or on water-wetted surfaces, is likely to burn rapidly and violently. They may even be of an explosive nature. They can develop so much heat that they cannot be approached closely enough to permit proper application of the extinguishing medium. Where the burning metal is on a combustible surface, the fire should be covered with dry powder, then a 1- or 2-in. (25 or 51 mm) layer of powder spread out nearby and the burning metal shoveled into this layer with more dry powder added as needed.

D-4-6.1 Dry Powder Extinguisher. Dry powder extinguishers are available in a hand portable, 30-lb (14-kg) cartridge-operated model and 150-lb (68-kg) and 350-lb (159-kg) cylinder-operated wheeled models. The extinguishing agent is composed of sodium chloride, with additives to render it free flowing in order to cause it to form a crust over the fire. A thermoplastic material is added to bind the sodium chloride particles into a solid mass when applied on burning metals. Other specialized dry powder agents are available for use in fighting specific types of metal fires. With the nozzle fully opened, the hand portable models have a range of 6 to 8 ft (1.8 to 2.4 m). The method of agent application depends on the type of metal, the quantity which is burning, and its physical form. In the case of a very hot fire, initial discharge should be started at maximum range with the nozzle fully opened. Once control is established, the nozzle valve should be partially closed to produce a soft heavy flow so that complete and safe coverage can be done at close range. The nozzle is designed so that the operator can throttle or reduce the rate and force of the agent discharge. Since combustible metal fires can produce complex and difficult fire fighting conditions, it is advisable to get specific details on equipment use from the manufacturer.

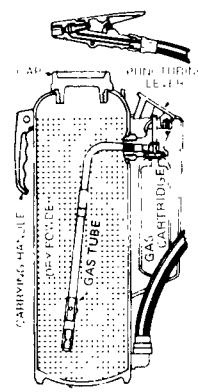


Figure D-4-6.1 Dry Powder Extinguisher.

D-4-6.2 Bulk Dry Powder Agent. In bulk form, dry powder extinguishing agents are available in 40- and 50-lb (18- and 23-kg) pails and 350-lb (159-kg) drums. In addition to the sodium chloride base agent, a dry powder material called G-1 is also available. This material