NFPA

10

PORTABLE FIRE EXTINGUISHERS 1978

NATIONAL FIRE PROTECTION ASSOCIATION

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NOTICE

All questions or other communications relating to this document should be sent only to NFPA Headquarters, addressed to the attention of the Committee responsible for the document.

For information on obtaining Formal Interpretations of the document, proposing Tentative Interim Amendments, proposing amendments for Committee consideration, and appeals on matters relating to the content of the document, write to the Assistant Vice President–Standards, National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.

Statement on NFPA Procedures

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NFPA has no power or authority to police or enforce compliance with the contents of this document and any certification of products stating compliance with requirements of this document is made at the peril of the certifier.

See Official NFPA Definitions at the back of this pamphlet.

Tentative Interim Amendments

TIAs to NFPA 10 and NFPA 70 now in effect

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a Proposal of the proponent for the next edition of the standard; as such, it then is subject to all the procedures of the standards-making process.

Pursuant to Section 15 of the NFPA Regulations Governing Projects, NFPA has issued the following Tentative Interim Amendments. Both were approved for release by the Standards Council on April 2, 1981.

NFPA 10 — 1978
Installation, Maintenance and Use of Portable Fire Extinguishers

Add the following new paragraph between 1-4.3 and 1-4.4 to read as follows:

Cabinets housing extinguishers shall not be locked.

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

(Note: This TIA also applies to the 1981 Edition, as adopted at the 1981 Annual Meeting.)

NFPA 70 — 1981
National Electrical Code

1. Change the first sentence of fine print note following the first paragraph of Section 501-5 to read: "Seals are provided in conduit and cable systems to minimize the passage of gases and vapors and prevent the passage of flames from one portion of the electrical installation to another through the conduit."

2. Add the following sentences to fine print note following the first paragraph of Section 501-5: "Unless specifically designed and tested for the purpose, conduit and cable seals are not intended to prevent the passage of liquids, gases or vapors at a continuous pressure differential across the seal. Even at differences in pressure across the seal equivalent to a few inches of water, there may be a slow passage of gas or vapor through a seal, and through conductors passing through the seal. See 501-5(e)(2). Temperature extremes and highly corrosive liquids and vapors can affect the ability of seals to perform their intended function. See 501-5(c)(2)."

3. Change the second sentence of Section 501-5(a)(4) to read: "The sealing fitting shall be permitted on either side of the boundary of such location but shall be so designed and installed to minimize the amount of gas or vapor which may have entered the conduit system within the Division 1 location from being communicated to the conduit beyond the seal."

4. Change the second sentence to Section 501-5(b)(2) to read: "The sealing fitting shall be permitted on either side of the boundary of such location but shall be so designed and installed to minimize the amount of gas or vapor which may have entered the conduit system within the Division 2 location from being communicated to the conduit beyond the seal."

5. Change the heading of Section 501-5(f)(3) to "Canned Pumps, Process Connections, etc."

6. Change Section 501-5(f)(3) to read: "For canned pumps, process connection for flow, pressure, or analysis measurement, etc. that depend on a single seal diaphragm or tube to prevent process fluids from entering the electrical conduit system an additional approved seal, barrier or other means shall be provided to prevent the process fluid from entering the conduit system beyond the additional devices or means, if the primary seal fails.

"The additional approved seal or barrier and interconnecting enclosure shall meet the pressure and temperature requirements of the primary seal unless other approved means are provided to accomplish the purpose above.

"Drains, vents or other devices shall be provided so that primary seal leakage will be obvious."

7. At the end of the fine print note to 501-5(f)(3), delete the period and add "and fine print note to Section 501-5."

Technical Committee Announcements

Responses to the following announcements should be sent to Richard E. Stevens, Vice President and Chief Engineer, NFPA.

Non-Nuclear Power

The Non-Nuclear Power Committee is soliciting public proposals for a new standard, NFPA 850, to be titled Fire Protection Requirements for Gas, Oil and Coal Fired Steam Electric Generating Plants. Closing date for receipt of proposals is Sept. 1, 1981.

Electronic Computer Systems

The Technical Committee on Electronic Computer Systems has received a request to write a document on computers for industrial processes.

The Committee is seeking comments on the need for such a document, on resources on the subject matter, the names of those interested in participating on a Subcommittee to prepare such a document (if established), and the names of other organizations actively involved with this subject.

Light Hazard Occupancies — Automatic Sprinklers

The Subcommittee for Light Hazard Occupancies of NFPA 13 is now commencing work on a revision to NFPA 13D-1980. One of the things the Subcommittee is exploring is the expansion of the scope of the current standard 13D or writing a new standard on sprinklers in residential and light hazard occupancies other than one- and two-family dwellings and mobile homes. The Subcommittee welcomes comments on either the expansion of existing NFPA 13D or a possible new document.

Standard for

Portable Fire Extinguishers

NFPA 10 — 1978

1978 Edition of NFPA 10

This standard was prepared by the NFPA Committee on Portable Fire Extinguishers and this present edition was adopted by the Association on May 18, 1978, at its Annual Meeting in Anaheim, California. It was released by the Standards Council for publication on June 6, 1978. This edition supersedes all previous editions.

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, and 1975. In 1965 the previous editions were divided in 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 has been added to the appendix of the 1978 edition.

Committee on Portable Fire Extinguishers

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Marshall E. Petersen, *Vice Chairman*
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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.

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Standard for...

Portable Fire Extinguishers

NFPA 10 — 1978

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

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, 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).†

*1-2 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.

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†Fixed systems are covered by the following NFPA standards: NFPA 11, *Foam Extinguishing Systems;* NFPA 11A, *High Expansion Foam Systems;* NFPA 11B, *Synthetic Foam and Combined Agent Systems;* NFPA 12, *Carbon Dioxide Extinguishing Systems;* NFPA 12A, *Halogenated Extinguishing Agent Systems — Halon 1301;* NFPA 12B, *Halogenated Fire Extinguishing Agent Systems — Halon 1211;* NFPA 13, *Installation of Sprinkler Systems;* NFPA 14, *Installation of Standpipe and Hose Systems;* NFPA 15, *Water Spray Fixed Systems;* NFPA 16, *Foam-Water Sprinkler Systems and Foam-Water Spray Systems;* and NFPA 17, *Dry Chemical Extinguishing Systems.* (*See Appendix G.*)

1-3 Definitions.

1-3.1 The basic types of fires are Classes A, B, C, and D as defined in the following subsections.

1-3.1.1 Class A fires are fires in ordinary combustile materials, such as wood, cloth, paper, rubber, and many plastics.

1-3.1.2 Class B fires are fires in flammable liquids, oils, greases, tars, oil base paints, lacquers, and flammable gases.

1-3.1.3 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.)

1-3.1.4 Class D fires are fires in combustible metals, such as magnesium, titanium, zirconium, sodium, lithium, and potassium.

1-3.2 Classification and Ratings of Fire Extinguishers.

1-3.2.1 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 nationally recognized testing laboratories. This is based upon the preceding classification of fires and the fire-extinguishment potentials as determined by fire tests.

*1-3.2.2 The classification and rating system described in this standard is that used by 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.

1-3.3 Classification of Hazards.

1-3.3.1 Light (Low) Hazard. Where the amount of combustibles or flammable liquids present is such that fires of small size may be expected. These may include offices, schoolrooms, churches, assembly halls, telephone exchanges, etc.

1-3.3.2 Ordinary (Moderate) Hazards. Where the amount of combustibles or flammable liquids present is such that fires of moderate size may be expected. These may include mercantile storage and display, auto showrooms, parking garages, light manufacturing, warehouses not classified as extra hazard, school shop areas, etc.

1-3.3.3 Extra (High) Hazards. Where the amount of combustibles or flammable liquids present is such that fires of severe magnitude may be expected. These may include woodworking, auto repair, aircraft servicing, warehouses with high-piled (over 15 ft [4.51 m] in solid piles, over 12 ft [3.66 m] in piles that contain horizontal channels) combustibles, and processes such as flammable liquid handling, painting, dipping, etc.

1-4 General Requirements.

1-4.1 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 preceeding the classification letter.

1-4.2 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.

1-4.3 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.

1-4.4 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.

*1-4.5 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.

1-4.6 Extinguishers installed under conditions where they are subject to dislodgement shall be installed in brackets specifically designed to cope with this problem.

1-4.7 Extinguishers installed under conditions where they are subject to physical damage, shall be protected from impact.

1-4.8 Extinguishers having a gross weight not exceeding 40 lbs (18.14 kg) shall be installed so that the top of the extinguisher is *not more* than five ft (1.53 m) above the floor. Extinguishers having a gross weight greater than 40 lbs (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 four inch.

1-4.9 Portable extinguishers manufactured after June 1, 1979 shall have only the operating instructions and use-classification(s) on the outward face of the extinguisher. Other labels and markings shall not be placed on the front of the extinguisher.

Exception: The manufacturer's name or brand may appear below the operating instructions and use-classification(s) provided the letter height is not greater than that used for the operating instructions or occupies more than 25 percent of the outward face of the extinguisher.

1-4.10 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 1–4.4*).

***1-4.11** Water type (water, foam, AFFF, 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 1: When extinguishers are installed in locations subject to temperatures outside these ranges, they should 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 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 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).

1-4.12 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 NFPA 10, *Portable Fire Extinguishers*, as a source of detailed instruction (*see Appendix G*).

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, and placement 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), 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.†

***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.

†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.

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 3-3.1.1 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 having 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 231B, *Storage of Cellular Rubber and Plastic Materials*, NFPA 231C, *Rack Storage of Materials*, and NFPA 231D, *Storage of Rubber Tires* (*see Appendix G*).

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.

Table 3-2.1

	Light (Low) Hazard Occupancy	Ordinary (Moderate) Hazard Occupancy	Extra (High) Hazard Occupancy
Minimum extinguisher rating	1A	2A	2A
Maximum floor area per unit of A	3000 sq.ft.	1500 sq.ft.	1000 sq.ft.
Maximum floor area per extinguisher	11250 sq.ft.*	11250 sq.ft.*	11250 sq.ft.*
Maximum travel distance to extinguisher	75 ft.	75 ft.	75 ft.

*11250 sq. ft. is considered a practical limit.

NOTE: 1 ft. = 0.305 m
1 sq. ft. = 0.0929 m^2

NOTE: 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.

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* (*see Appendix G*). 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 3–3.1.1. 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 3–3.1.1.

Table 3-3.1.1

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: 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.

3-3.2 Two or more extinguishers of lower rating shall not be used to fulfill the protection requirements of Table 3–3.1.1.

Exception 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 2: Up to three AFFF extinguishers of at least 2½ gal (9.46 l) capacity may be used to fulfill extra hazard (high) 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.†

***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)

Exception: Where personnel who are trained in extinguishing fires in the protected hazards, or its 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 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 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.

†For dip tanks containing flammable or combustible liquids exceeding 150 gal (568 *l*) liquid capacity or having a liquid surface exceeding four sq ft (0.38 m²), see NFPA 34, *Dip Tanks* (*see Appendix G*), for requirements of automatic extinguishing facilities.

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 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 June 1, 1969, their equivalency shall be in accordance with Table 3-4.5.

Table 3-4.5 Comparative Ratings

Type and Capacity	Pre-1955	1955 to 1969	June 1, 1969 -
Foam			
2½ gal	B-1	4-B	2-B
5 gal	B-1	6-B	5-B
17 gal	B	10-B	10-B
33 gal	B	20-B	20-B
Carbon Dioxide			
Under 7 lbs.	B-2	1-B	1-B
7 lbs.	B-2	2-B	2-B
10 to 12 lbs.	B-2	4-B	2-B
15 to 20 lbs.	B-1	4-B	2-B
25 to 26 lbs.	B-1	6-B	5-B
50 lbs.	B-1	10-B	10-B
75 lbs.	B-1	12-B	10-B
100 lbs.	B	12-B	10-B
Dry Chemical			
4 to 6¼ lbs.	B-2	4-B	2-B
7½ lbs.	B-2	6-B	5-B
10 to 15 lbs.	B-1	8-B	5-B
20 lbs.	B-1	16-B	10-B
30 lbs.	B-1	20-B	20-B
75 lbs. and up	B	40-B	40-B

NOTE: 1 gal. = 3.785 *l* 1 lb. = 0.454 kg

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

3-5 Class B Fire Extinguishers for Pressurized Flammable Liquids and Pressurized Gas Fires.

3-5.1 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.

3-5.2 Travel distances for hand portable extinguishers used to protect pressurized flammable liquids or pressurized gas hazards shall not exceed 50 ft (15.25 m).

3-6 Three-dimensional Class B Fires.

3-6.1 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.

3-6.2 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. The installation of fixed systems should be considered when applicable.

3-6.3 Travel distances for hand portable extinguishers used to protect three-dimensional, Class B hazards shall not exceed 50 ft (15.25 m).

3-7 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 media. 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.

3-7.1 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 1: Carbon dioxide extinguishers with metallic horns shall not carry any "C" classification.

Exception 2: Vaporizing liquid extinguishers (carbontetrachloride or chlorobromomethane base) are not recognized in this standard.

3-8 Size and Placement for Class D Hazards.

3-8.1 Extinguishers or extinguishing agents with Class D ratings shall be provided for fires involving combustible metals.

3-8.2 Extinguishing equipment shall be located not more than 75 ft (22.7 m) from the Class D hazard.

3-8.3 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 owner or occupant of a property in which extinguishers are located shall be responsible for such inspection, maintenance, and recharging.

4-1.3 Inspection is normally performed by employee personnel designated by the owner or occupant.

*__4-1.4__ Maintenance and recharging shall be performed by trained persons having available 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.

4-3.2.1 The extinguisher shall be in its designated place.

4-3.2.2 Access to, or visibility of, the extinguisher shall not be obstructed.

4-3.2.3 The operating instructions on the extinguisher nameplate shall be legible and face outward.

4-3.2.4 Any seals or tamper indicators that are broken or missing shall be replaced.

4-3.2.5 For water types without gages, their fullness shall be determined by "hefting."

4-3.2.6 Any obvious physical damage, corrosion, leakage, or clogged nozzles shall be noted.

4-3.2.7 Pressure gage readings when not in the operable range shall be noted.

4-3.3 Corrective Actions. When an inspection reveals that tampering has occurred, or that the extinguisher is damaged, impaired, leaking, under or overcharged, or has obvious corrosion, the extinguisher shall be subjected to applicable maintenance procedures.

4-3.4 Record Keeping.

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 yr. apart or when specifically indicated by an inspection.

Exception 1: It is not necessary during the annual maintenance to internally examine 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 4–4.2.

Exception 2: Factory sealed ("disposable type") extinguishers shall be inspected and maintained only in accordance with the nameplate instructions.

4-4.1.1 Stored pressure types containing a loaded stream type of agent shall be disassembled on an annual basis and sub-

jected 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 Every six yrs., stored pressure extinguishers that require a 12-yr. hydrostatic test shall be emptied and subjected to the applicable maintenance procedures.

Exception 1: Extinguishers having nonrefillable disposable containers are exempt.

Exception 2: When periodic recharging or hydrotesting is performed, the six-yr. requirement shall begin from that date.

4-4.1.3 Extinguishers out of service for maintenance or recharge shall be replaced by spare extinguishers having the same classification 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.

*4-4.3 **Record Keeping.** 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.† The same record tag or label shall indicate if recharging was also performed.

4-4.3.1 For the six-yr. requirement of 4–4.1.1, 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-yr. maintenance shall not be placed on the front of the extinguisher.

4-5 Recharging.

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

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

4-5.2 Frequency.

4-5.2.1 Annual Recharging. 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.

4-5.3 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** Multipurpose dry chemicals shall not be mixed with alkaline based dry chemicals.

4-5.3.3 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.

4-5.3.4 Precautionary Pressurization Measures. The pressure regulator shall be set not to exceed 25 psi (172 kPa) above the operating (service) pressure of the extinguisher.

4-5.3.5 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.

***4-5.3.6 Removal of Moisture.** For all nonwater types of extinguishers any moisture shall be removed before recharging.

***4-5.3.7 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 (minus 30°F [minus 34.4°C] dew point). Oil content of the carbon dioxide shall not exceed 10 p.p.m. by weight.

***4-5.3.8 Leak Test.** After recharging, a leak test shall be performed on stored pressure and self-expelling types.

Chapter 5 Hydrostatic Testing

5-1 General.

5-1.1 Hydrostatic testing shall be performed by persons having a practical knowledge of pressure testing procedures and safeguards, and having available suitable testing equipment and facilities.

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: Pump tanks do not require a hydrostatic test.

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 hydrostically 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.

5-1.4 Copper/Brass Soft Solder Shell Construction. Extinguishers having shell construction of copper or brass joined by soft solder (including riveted) shall be removed from service no later than five yrs. from the last hydrostatic test date.[1]

5-2 Definitions.

5-2.1 Service Pressure. The service pressure is the normal operating pressure as indicated on the gage and nameplate.

5-2.2 Factory Test Pressure. The factory test pressure is the pressure at which the shell was tested at time of manufacture. This pressure is shown on the nameplate.

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[1] The reliability and safety of this type of construction cannot be determined by standard hydrostatic test methods.

5-2.3 Mild Steel Shell. Except for stainless steel and steel used for compressed gas cylinders, all other steel shells are defined as "mild steel" shells.

5-2.4 Compressed Gas Cylinders. For purposes of this standard, compressed gas cylinders and cartridges are those containing carbon dioxide, nitrogen, or compressed air.

5-2.5 DOT. DOT is the U. S. Department of Transportation, which has jurisdiction over compressed gas cylinders and cartridges as of 1967.

5-2.6 ICC. ICC is the Interstate Commerce Commission, which formerly had jurisdiction over compressed gas cylinders and cartridges prior to 1967.

5-2.7 CTC. CTC is the Canadian Transport Commission, which has jurisdiction over compressed gas cylinders and cartridges.

5-2.8 BTC. BTC is the Board of Transport Commissioners of Canada, which formerly had jurisdiction over compressed gas cylinders and cartridges.

5-3 Frequency. At intervals not exceeding those specified in Table 5–3, extinguishers shall be hydrostatically tested.

Table 5-3
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 5–1.4.*)

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

Exception 1: Nonrefillable factory-sealed disposable containers do not require hydrostatic testing.

Exception 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 3: For extinguishers not covered in Exceptions 1 and 2 the first retest may be conducted within 12 months of the specified test intervals.

5-3.1 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 yrs.

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 yrs. (see Appendix G).

5-3.2 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 extingisher on which the hose is installed.

5-4 Test Pressures.

5-4.1 Compressed Gas Cylinders.

5-4.1.1 Carbon dioxide extinguishers shall be tested at 5/3 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).

5-4.1.2 Nitrogen cylinders and carbon dioxide cylinders used with wheeled extinguishers shall be tested at 5/3 the service pressure as stamped into the cylinder.

5-4.2 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.

5-4.3 Self-generating and Cartridge Operated Types.

5-4.3.1 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 (2,413 kPa). (For those of copper/brass soft solder shell construction, see 5–1.4.)

5-4.3.2 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.

5-4.4 Test Pressures for Hose Assemblies.

5-4.4.1 Carbon dioxide hose assemblies requiring a hydrostatic pressure test shall be tested at 1,250 psi (8,619 kPa).

5-4.4.2 Dry chemical and dry powder hose assemblies requiring a hydrostatic pressure test shall be tested at 300 psi (2,068 kPa) or at service pressure, whichever is the highest.

5-5 Test Equipment and Procedures.

5-5.1 General.

5-5.1.1 Air or gas pressure shall not be used for pressure testing. The failure of an extinguisher shell may be violent and dangerous.

5-5.1.2 When extinguisher shells, cylinders, or cartridges fail a hydrostatic pressure test, they shall be destroyed by owner or at his direction.

5-5.2 Test Equipment for Compressed Gas Types.

5-5.2.1 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. (*See Appendix G.*)

5-5.2.2 Hose assemblies of carbon dioxide extinguishers that require a hydrostatic test shall be tested within a protective cage device.

*5-5.3 Test Equipment for Noncompressed Gas Types.

5-5.3.1 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.

*5-5.3.2 Drying equipment is required to dry all nonwater types of extinguishers that have passed the hydrostatic test.

5-6 Testing Procedures.

5-6.1 Compressed Gas Types.

5-6.1.1 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), published by the Compressed Gas Association. (*See Appendix G.*)

5-6.1.2 The hydrostatic testing of compressed gas cylinders and cartridges shall be in accordance with the procedures specified in pamphlet *Methods for Hydrostatic Testing of Compressed Gas Cylinders* (Pamphlet C–1), published by the Compressed Gas Association. (*See Appendix G.*)

*5-6.2 **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.

*5-6.3 **Testing Procedures for Hose Assemblies.** The testing procedures for hose assemblies requiring a hydrostatic test are detailed in Appendix A.

5-6.4 Recording of Tests.

5-6.4.1 **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.

*5-6.4.2 **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.

5-6.4.3 Hose assemblies passing a hydrostatic test do not require recording.

Appendix A

This appendix is not a part of this NFPA standard 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 he should give proper attention to the inspection, maintenance, and recharging of this fire protective equipment. He should also train his personnel in the correct use of fire extinguishers on the different types of fire which may occur on his 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. He 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-1-3.2.2 The classification and rating is found on the label of Underwriters Laboratories Inc. and Underwriters' Laboratories of Canada 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 Underwriters Laboratories Inc., and Underwriters' Laboratories of Canada 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 extinguisher 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 NFPA 10 (*see Appendix G*).

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 (*see Section 2–6*).

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-1-4.5 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-1-4.11 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 shall 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 shall 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, anti-freeze, soda-acid, loaded stream, AFFF, 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.*†)

Table A-2-1 Characteristics of Extinguishers.

The following Table 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-2-2.1.2 For exposed liquefied fat or oil in depth such as fat fryers, alkaline dry chemical types should be used having a rating no less than 20-B:C. (Alkaline types are sodium bicarbonate base or potassium bicarbonate base.) Acidic base dry chemical types, such as ammonium phosphate base multipurpose, impede saponification [*see NFPA 96, Standard on Vapor Removal from Cooking Equipment (see Appendix G).*]

†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	Stored Pressure	2½ gal.	30-40 ft.	1 min.	Yes	2-A
Water	Pump	1½ gal.	30-40 ft.	45 sec.	Yes	1-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 (Anti-freeze	Cartridge & Stored Pressure	1¼, 1½ gal.	30-40 ft.	30 sec.	No	1-A
Calcium Chloride)	Cartridge & Stored Pressure	2½ gal.	30-40 ft.	1 min.	No	2-A
	Cartridge & Stored Pressure	33 gal. (wheeled)	50 ft.	3 min.	No	20-A
Water (Wetting Agent)	Cartridge & Stored Pressure	25 gal. (wheeled)	35 ft.	1½ min.	Yes	10-A
	Cartridge & Stored Pressure	45 gal. (wheeled)	35 ft.	2 min.	Yes	30-A
Water (Soda Acid)	Chemically generated expellent	1¼, 1½ gal.	30-40 ft.	30 sec.	Yes	1-A
	Chemically generated expellent	2½ gal.	30-40 ft.	1 min.	Yes	2-A
	Chemically generated expellent	17 gal. (wheeled)	50 ft.	3 min.	Yes	10-A
	Chemically generated expellent	33 gal. (wheeled)	50 ft.	3 min.	Yes	20-A
Loaded Stream	Stored Pressure	2½ gal.	30-40 ft.	1 min.	No	2 to 3-A and 1-B
	Cartridge & Stored Pressure	33 gal. (wheeled)	50 ft.	3 min.	No	20-A

Table A-2-1 Characteristics of Extinguishers (continued).

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*
Foam	Pressurized	21 oz.	4-6 ft.	24 sec.	Yes	1-B
Foam	Chemically generated expellent	1¼, 1½ gal.	30-40 ft.	40 sec.	Yes	1-A; 2-B
	Chemically generated expellent	2½ gal.	30-40 ft.	1½ min.	Yes	2-A:4-B to 2-A:6-B
	Chemically generated expellent	5 gal.	30-40 ft.	2 min.	Yes	4-A:6-B
	Chemically generated expellent	17 gal. (wheeled)	50 ft.	3 min.	Yes	10-A:10-B to 10-A:12-B
	Chemically generated expellent	33 gal. (wheeled)	50 ft.	3 min.	Yes	20-A:20-B to 20-A:40-B
AFFF	Stored Pressure	2½ gal.	20-25 ft.	50 sec.	Yes	3-A; 20-B
Carbon Dioxide **	Self Expellent	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 lb.	5-8 ft.	8 to 10 sec.	No	1 to 2-B:C
	Stored Pressure	1½ to 2½ lb.	5-8 ft.	8 to 12 sec.	No	2 to 5-B:C
	Cartridge and Stored Pressure	2¾ to 5½ lb.	5-20 ft.	8 to 20 sec.	No	5 to 10-B:C
	Cartridge and Stored Pressure	7½ to 30 lb.	5-20 ft.	10 to 25 sec.	No	10 to 120-B:C
	Nitrogen cylinder or Stored Pressure	75 to 350 lb. (wheeled)	15 to 45 ft.	20 to 105 sec.	No	40 to 240-B:C

Table A-2-1 Characteristics of Extinguishers (continued).

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*
Dry Chemical (Potassium Bicarbonate)	Stored Pressure	1 to 2 lb.	5-8 ft.	8 to 10 sec.	No	1 to 5-B:C
	Stored Pressure	2¼ to 5 lb.	5-12 ft.	8 to 10 sec.	No	5 to 20-B:C
	Cartridge or Stored Pressure	5½ to 10 lbs.	5-20 ft.	8 to 20 sec.	No	10 to 60-B:C
	Cartridge or Stored Pressure	16 to 30 lbs.	10-20 ft.	8 to 25 sec.	No	40 to 120-B:C
	Nitrogen cylinder or Stored Pressure	125 to 300 lbs. (wheeled)	15-45 ft.	30 to 60 sec.	No	80 to 480-B:C
Dry Chemical (Potassium Chloride)	Stored Pressure	2 to 2½ lbs.	5-8 ft.	8 to 10 sec.	No	5 to 10-B:C
	Cartridge or Stored Pressure	5 to 10 lbs.	5-20 ft.	8 to 25 sec.	No	20 to 40-B:C
	Cartridge or Stored Pressure	19½ to 30 lbs.	15-45 ft.	8 to 25 sec.	No	60 to 80-B:C
	Nitrogen cylinder or Stored Pressure	50 to 160 lbs. (wheeled)	15-45 ft.	30 to 60 sec.	No	120 to 160-B:C
Dry Chemical (Ammonium Phosphate)	Stored Pressure †	1 to 5 lbs.	5-12 ft.	8 to 10 sec.	No	1 to 2-A and 2 to 10-B:C
Dry Chemical (Ammonium Phosphate)	Stored Pressure or Cartridge	2½ to 8½ lbs.	5-12 ft.	8 to 12 sec.	No	1 to 3-A and 10 to 40-B:C
	Stored Pressure or Cartridge	9 to 17 lbs.	5-20 ft.	10 to 25 sec.	No	2 to 10-A and 10 to 60-B:C
	Stored Pressure or Cartridge	17 to 30 lbs.	5-20 ft.	10 to 25 sec.		3 to 20-A and 30 to 80-B:C
	Nitrogen Cylinder or Stored Pressure	50 to 315 lbs. (wheeled)	15-45 ft.	30 to 60 sec.		20 to 40-A and 60 to 320-B:C

Table A-2-1 Characteristics of Extinguishers (continued).

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*
Dry Chemical	Cartridge and Stored Pressure	4¾ to 9 lbs.	5-20 ft.	8 to 10 sec.	No	10 to 20-B:C
(Foam Compatible)	Cartridge and Stored Pressure	9 to 27 lbs.	5-20 ft.	10 to 25 sec.	No	20 to 30-B:C
	Cartridge and Stored Pressure	18 to 30 lbs.	5-20 ft.	10 to 25 sec.	No	40 to 60-B:C
	Nitrogen cylinder and Stored Pressure	150 to 350 lbs. (wheeled)	15-45 ft.	20 to 150 sec.	No	80 to 240-B:C
Dry Chemical	Cartridge and Stored Pressure	2½ to 5 lbs.	5-12 ft.	8 to 10 sec.	No	10 to 20-B:C
(Foam Compatible)	Cartridge and Stored Pressure	9½ to 20 lbs.	5-20 ft.	8 to 25 sec.	No	40 to 60-B:C
(Potassium Chloride)	Cartridge and Stored Pressure	19½ to 30 lbs.	5-20 ft.	10 to 25 sec.	No	60 to 80-B:C
	Nitrogen cylinder and Stored Pressure	50 lbs. (wheeled)	15-45 ft.	30 sec.	No	120-B:C
Dry Chemical (Foam Compatible)	Stored Pressure	5 to 11 lbs.	11-22 ft.	13 to 18 sec.	No	40 to 80-B:C
(Potassium Bicarbonate Urea based)	Stored Pressure	9 to 23 lbs. 175 lbs. (wheeled)	15-30 ft. 70 ft.	17 to 33 sec. 62 sec.	No No	60 to 160-B:C 480-B:C
Bromotrifluoromethane	Self Expellent	2½ lbs.	4-6 ft.	8 to 10 sec.	No	2-B:C
	Stored Pressure	4½ lbs.	6-10 ft.	8 to 10 sec.	No	5-B:C
Bromochlorodifluoromethane	Stored Pressure	2 to 4 lbs.	8-12 ft.	8 to 12 sec.	No	2 to 5-B:C
		5½ to 9 lbs.	9-15 ft.	8 to 15 sec.	No	1-A and 10-B:C
		16 to 22 lbs.	14-16 ft.	10 to 18 sec.	No	1 to 2-A and 20 to 80-B:C

See notes to Table A-2-1 on the following page.

Note: 1 oz. = 29.6 ml; 1 lb. = 0.454 kg; 1 ft. = 0.305 m; 1 gal. = 3.785 l

Notes to Table A-2-1

*UL and ULC ratings checked as of December 27, 1974. Readers concerned with subsequent ratings should review the pertinent "Lists" and "Supplements" issued by these Laboratories: (Write Underwriters Laboratories Inc., 207 East Ohio St., Chicago, Illinois 60611, 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 dry chemical do not carry an "A" classification.

Vaporizing liquid extinguishers (Carbon tetrachloride or chlorobromomethane base) are not recognized in this standard.

Ratings of 4-B, 6-B, 8-B, 12-B, and 16-B were eliminated June 1, 1969. See Table 3-4.5 and A-1-3.2.2 in Appendix A.

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 limitation of a wide variety of commercially available metal fire extinguishing agents are discussed in Section 13, Chapter VI of the NFPA's *Fire Protection Handbook* (14th Edition). (*See Appendix G.*)

(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, appli-

cable 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* (*see Appendix G*).

(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 13, Chapter VI of the NFPA *Fire Protection Handbook* (14th Edition). (*See Appendix G.*)

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.

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, he may well endanger him-

self 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 men 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 responsible for performing maintenance operations come from three major groups:

(a) Trained industrial safety or maintenance personnel.

(b) Extinguisher service agencies.

(c) Individual owners (e.g., self-employed, home owner, boat owner, car owner, etc.).

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. Another alternative is to have the dealer from whom the extinguisher was purchased establish an annual follow-up program to perform the maintenance for the owner.

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

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

(b) 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-4-4.2 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.

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. Hydrotest and refinish; or discard
3. Mechanical damage (denting or abrasion)	3. Hydrotest 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

Restraining or 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 (tap to check)	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. Hydrotest 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, cross-threaded, or worn coupling threads	6. (a) Hydrotest 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

Self-expelling (Con't)

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
3. Water condition (dirty, cloudy, or sediment)	3. Recharge
4. Antifreeze condition (check specific gravity, or recharge record or weigh — check for sediment)	4. Recharge

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

Gas Cartridge or Cylinder (Con't)

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

Wet Water	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

Stored Pressure (Con't)

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	Corrective Action
1. Improper fill level (by weight or observation)	1. Empty and recharge with new solution
2. Agent condition (presence of precipate 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

A-4-4.3 Record Keeping. 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-yr. maintenance for stored pressure dry chemical and Halon 1211 types (*see 4–4.1.1*).

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 4–5.3.4 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 pressure source could cause the container to rupture resulting in injury.

(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 fill enclosure is in place and tighten 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 nationally recognized 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 effect 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-4-5.3.6 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) By entering a cylinder when the valve has been removed.

A-4-5.3.7 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 hrs. 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 (0°C) blowing off is ineffectual.

The preferred source of carbon dioxide for recharging extinguishers is from a low pressure (300 psi at 0°F) (2,068 kPa at −17.8°C) supply, either directly or via dry cylinders used as an intermediary means.

A-4-5.3.8 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 yr. Any tamper indicators or seals must be replaced after recharging.

A-5-5.3 Test Equipment for Noncompressed Gas Types.

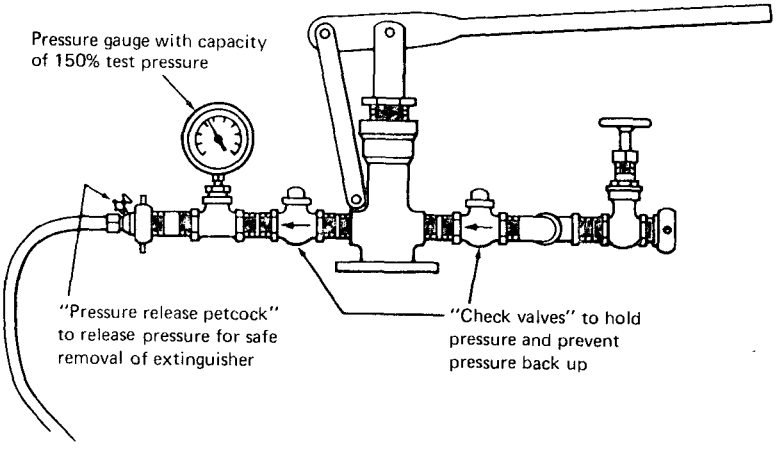


Figure A-5-5.3(a) Hydrostatic Hand Pump.

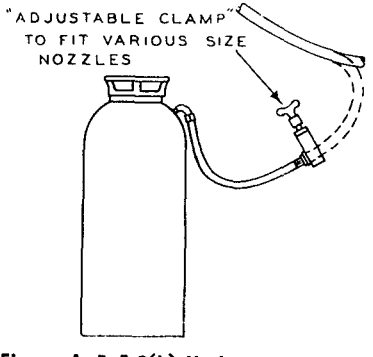


Figure A-5-5.3(b) Hydrostatic Testing of Extinguisher Through Hose.

FOR THE FOLLOWING TYPES:

Soda-acid.
Foam.
Inverting Type Cartridge-operated Water and/or Antifreeze.
Inverting Type Cartridge-operated Loaded Stream.
Wetting agent.

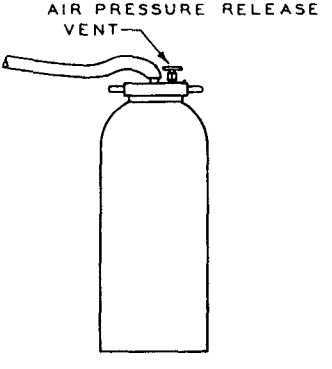
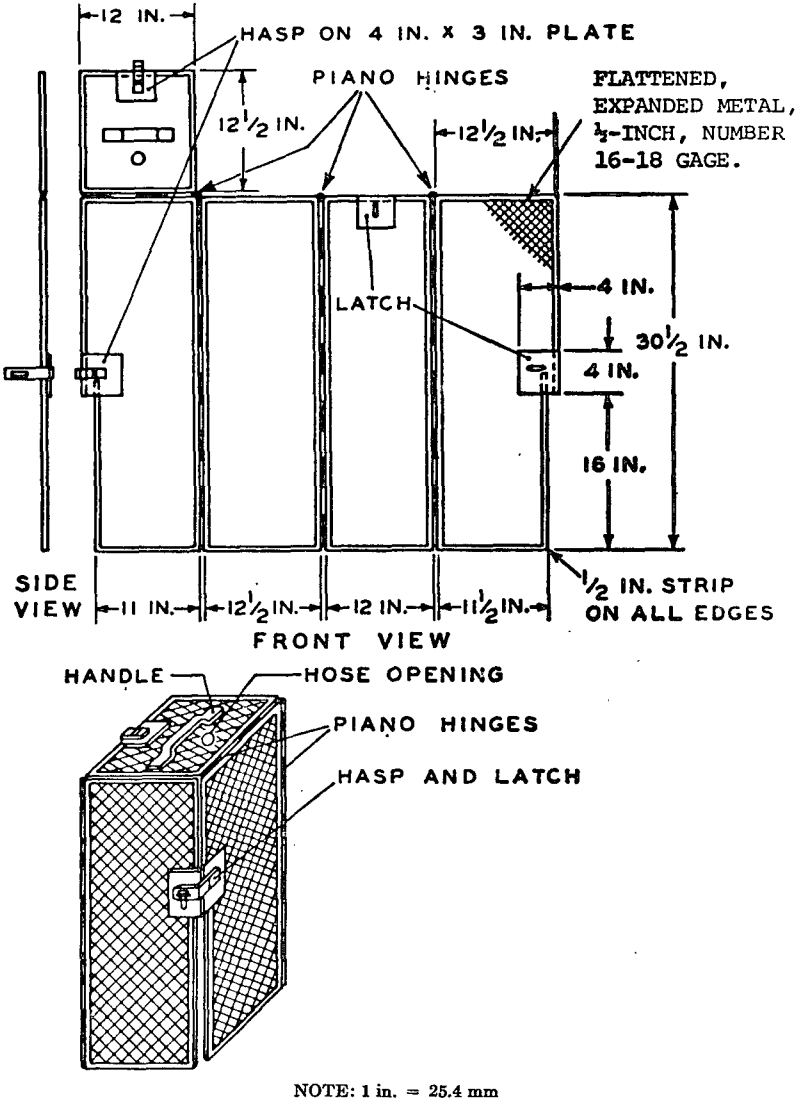


Figure A-5-5.3(c) Hydrostatic Testing of Extinguisher with Test Bonnet.

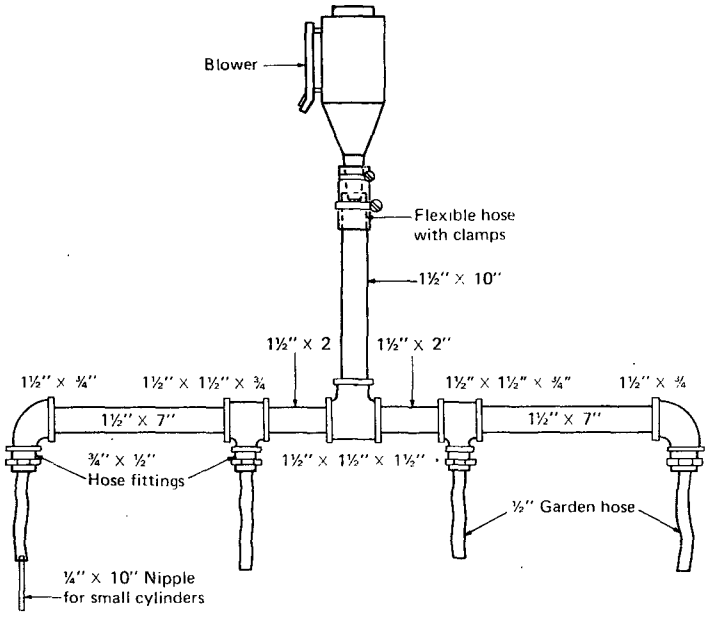
FOR THE FOLLOWING TYPES:

Stored Pressure Water and/or Antifreeze.
Stored Pressure Loaded Stream.
Noninverting Type Cartridge-operated Water and/or Antifreeze.
Noninverting Type Cartridge-operated Loaded Stream.
Dry Chemical.
Dry Powder.
Halon 1211.
AFFF



NOTE: 1 in. = 25.4 mm

Figure A-5-5.3(d) 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 (See 5-2.4). The Cage Should Not Be Anchored to the Floor During Test Operations. Such Cages Can Be Made by Any Metal Fabricator.



NOTE: 1 in. = 25.4 mm

Figure A-5-5.3.2 Cylinder Drying Device.

A-5-6.2 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.

(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 [*see Figure A–5–5.3(b)*], 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 [*see Figure A–5–5.3(c)*], 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 min. This test pressure is maintained for another full min. 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 Halon extinguishers by use of a cylinder dryer (*see Figure A–5–5.3.2*). 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-5-6.3 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 min. The test pressure is to be maintained for one full min. 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-5-6.4.2 Hydrostatic Test Label. Figure A-5-6.4.2 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-5-6.4.2

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

This appendix is not a part of this NFPA standard 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 three ft (one 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).

B-2 Recommended Marking System.

B-2-1 The most recent 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 recommended for the past several years, are recommended in the interim prior to conversion to the newer pictorial concept. Letter-shape symbol markings are shown in Table B-2-2.

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")
RED * — slash mark for black background symbols

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 five 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 this NFPA standard 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 shape-color-symbol code in 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, three basic conditions may exist: (1) flammable liquid fires of appreciable depth [¼ in. (six mm) or more] such as those found 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, and (3) pressurized flammable liquid or gas fires from damaged vessels or product lines. Each of these fire 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 requires special consideration. Fires of this nature are considered to be a special hazard. Some extinguishers containing wetting agents or carbon dioxide which are classified for Class B fires are relatively ineffective on this hazard due to stream and agent characteristics. Selection of extinguishers for this type of hazard should 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.

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-base Extinguishers.

C-3-2.1 When the manufacture of all inverting types of extinguishers (soda-acid, cartridge operated water, and foam) was discontinued, the remaining selection of water types for Class A fires diminished to stored-pressure and pump tanks. It is recommended that inverting types of extinguishers be replaced with currently available models.

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 Carbon Dioxide Extinguishers.

C-3-3.1 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 three to eight ft (one 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-3-4 Halogenated Agent Extinguishers.

C-3-4.1 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 lbs (1.1 kg). It had a listed rating of 2-B:C, which is below the minimum requirements of this standard.

C-3-4.2 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-3-5 Dry Chemical Extinguishers.

C-3-5.1 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 (three to nine m) depending on extinguisher size. Compared with carbon dioxide or halogenated agent extinguishers, they will also perform better under windy conditions.

C-3-5.2 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-3-5.3 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-3-5.4 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-3-5.5 The monoammonium phosphate base agent (multipurpose) is the only one that is suitable for Class A protection.

C-3-5.6 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-3-6 Wheeled Extinguishers.

C-3-6.1 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-3-6.2 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 either used the equipment, who have received special instructions on the use of the equipment, or who have used the equipment in live fire training.

Appendix D Operation and Use

This appendix is not a part of this NFPA standard 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 expellent 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 expellent 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
Suitability and Methods of Expelling

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

†NOTE: Certain types or sizes of these extinguishers are not recognized for use on these classes of fires. (See *Chapter* 3.)

D-2 Basic Steps to Operate Extinguishers.

D-2-1.1 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-2-1.2 Recognition as an Extinguisher. The following will help a person to recognize an extinguisher.

D-2-1.3 Approval agencies require permanent marking on the front of fire extinguishers indicating their purpose, content and usage.

D-2-1.4 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-2-1.5 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 pump.

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 Expellent 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 expellent 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 expellent gas is stored in a separate cartridge or may be stored in an expellent-gas cylinder (wheeled models), located within or adjacent to the shell containing the extinguishing agent. These extinguishers are actuated by releasing the expellent 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 eight to 10 sec (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 smouldering 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 lbs (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 sec. 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.

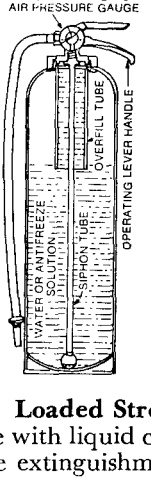


Figure D-4-1.1 Stored-pressure Water Extinguisher.

D-4-1.2 Loaded Stream. Hand extinguishers of this type have been made with liquid capacities from one to 2½ gals (3.8 to 9.46 *l*) having fire extinguishment 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 gals (64 and 125 *l*) [trade designations 20 and 40 gals (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 five-gal (5.7 to 19 *l*) capacities with fire extinguishment ratings of 1-A to 4-A. The most common type is 2½ gals (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, from 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.

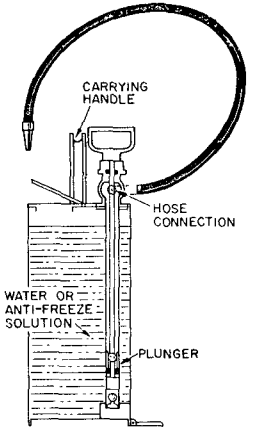


Figure D-4-1.3 Pump Tank Fire Extinguisher.

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 five gals (19 *l*) and weighs approximately 50 lbs (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

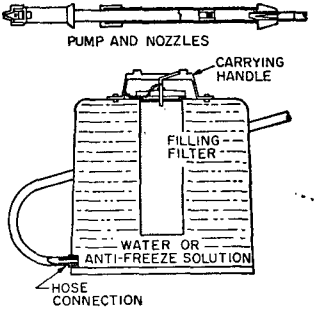


Figure D-4-1.4 Pump Tank Backpack Fire Extinguisher.

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.

D-4-1.5 Soda-acid. This extinguisher was most commonly manufactured in the 2½-gal (9.46 *l*) size, weighing approximately 30 lbs (14 kg) fully charged, with a listed rating of 2-A. Some models were manufactured in the hand portable sizes of 1¼ and 1½ gals (4.7 and 5.7 *l*) and in wheeled models with liquid capacities of 17 and 33 gals (64 and 125 *l*) [trade designations, 20 and 40 gals (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

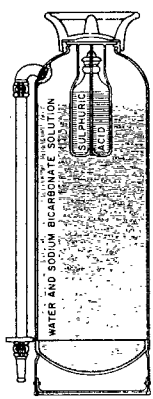


Figure D-4-1.5 Soda-acid Fire Extinguisher.

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 secs. 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 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 wheeled models having liquid capacities of 20 and 45 gals (76 and 170 *l*) and having fire extinguishment ratings from 10-A to 20-A. 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 (see Appendix G)*]. These extinguishers are operated by a separate carbon dioxide cartridge containing the expellent gas which, when released, expells 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*

Approximate Freezing Temperature, Degrees F	Degrees C	Water, Gallons	Liters	Calcium Chloride, Pounds	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	24.7
−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 disulphide and other flammable liquids which either break down or penetrate the foam blanket.

D-4-2.1 AFFF. Extinguishers of this type are available in 2½-gal (9.46 *l*) stored-pressure models rated at 3-A:20-B. 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. Specific information and limitations on the properties of AFFF are contained in NFPA 11B. This type of extinguisher closely resembles the stored-pressure water extinguisher except for the special type of nozzle. The same procedures for placing the extinguisher into operation can be followed. This type of extinguisher can only be installed in locations that are not subjected to temperatures below 40°F (4°C).

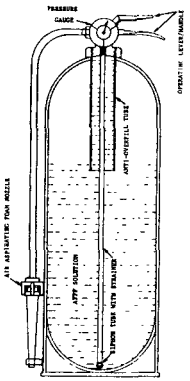


Figure D-4-2.1 Stored-Pressure AFFF Extinguisher.

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 lbs (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- (4.7 *l*) and 1½-gal (5.7 *l*) hand portables, and wheeled models with liquid capacities of 17 and 33 gals (64 and 125 *l*) [trade designations, 20 and 40 gals (76 and 151 *l*)] having fire extinguishment ratings from 10-A:12-B to 20-A:40-B. These ex-

tinguishers 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 sulphate 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).

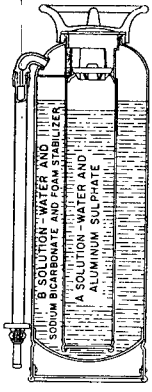


Figure D-4-2.2 Foam-type Fire Extinguisher.

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 dis-