GENERAL STANDARD

FOR

HAND AND WHEEL TYPE

FIRE EXTINGUISHERS

ORIGINAL EDITION

OCT. 1996

This standard specification is reviewed and updated by the relevant technical committee on Feb. 2001. The approved modifications are included in the present issue of IPS.

CONTENTS : PAGE No.

PART II WHEEL TYPE FIRE EXTINGUISHERS

SECTION (1) DRY CHEMICAL POWDER EXTINGUISHERS

SECTION (2) "CARBON DIOXIDE (Co_2) EXTINGUISHERS" 45

APPENDICES :

0. INTRODUCTION

The provision of this standard apply to three types of portable "Hand and Wheel Type" fire extinguishers The duration of full discharge of hand extinguishers is as short as 8 seconds, therefore they act as first aid and are suitable for small fires.

The duration of wheel type extinguishers is a maximum of three minutes and are placed and used in plants or locations where portable extinguishers are not capable to extinguish larger size of fires.

To gain maximum effectiveness, the available quantity of fire fighting agent must not be wasted. Trained fire fighting personnel in the use of these extinguishers is essential.

Inspection of all types of extinguishers shall be done at regular intervals to ensure that they are in operating condition.

Parts or internal chemicals may deteriorate in time and need replacement. Extinguishers are pressure vessels, in most cases and so must be treated with respect and handled with care.

The hydrostatic test is a prime factor and since containers are subject to high pressure they shall be tested in accordance with the manufacturer's instructions.

Note:

The use of chloroflurocarbon (CFC'S) containing cleaning fluids for consumer application has been banned by 71 nations, prohibiting the use of ozone-depleting chemicals.

1. SCOPE

This standard specifies the minimum requirements for portable fire extinguishers used for protection of all plants, areas and premises of (Iranian Oil Gas and Petrochemical Industries) where there is a risk of fire, and covers material, operation, tests and inspections of three types as follows:

PART I HAND TYPE FIRE EXTINGUISHERS

SECTION (1) Water Type Extinguishers

SECTION (2) Dry Chemical Powder Extinguishers

SECTION (3) Carbon Dioxide (Co_2) Extinguishers

PART II WHEEL TYPE FIRE EXTINGUISHERS

SECTION (1) Dry Chemical Powder Extinguishers

SECTION (2) Carbon Dioxide (Co_2) Extinguishers

Note:

This standard specification is reviewed and updated by the relevant technical committee on Feb. 2001. The approved modifications by T.C. were sent to IPS users as amendment No. 1 by circular No 144 on Feb. 2001. These modifications are included in the present issue of IPS.

2. REFERENCES

Throughout this Standard the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

IPS (IRANIAN PETROLEUM STANDARD)

IPS-E-SF-100 "Classification of Fire and Fire Hazard Properties"

UL (UNDERWRITER LABORATORIES)

UL 252 (1984) "Compressed Gas Regulators"

UL 404 (1979) "Gases, Indicating Pressure for Compressed Gas Service"

UL 92 (1982) "Fire Extinguisher and Booster Hose"

UL 1439 (1989) "Determination of Sharpness of Edge on Equipment"

UL 154 (1995) 8th "Edition"

BSI (BRITHISH STANDARD INSTITUTION)

BS 5423 (1987) "Portable Fire Extinguishers"

ASTM (AMERICAN STANDARD FOR TESTING MATERIAL)

ASTM A 370-88	"Test Methods and Definition for Mechanical Testing of Steel Products"
ASTM B 209-89	"Specification for Aluminum and Aluminum Alloy Sheet and Plate"

3. DEFINITIONS AND TERMINOLOGY

For the purpose of this Standard the following definitions shall apply:

3.1 Body

The body shell (see 3.3) complete with body fittings (see 3.2).

3.2 Body Fittings

Those parts of the extinguisher that, under normal working conditions, are permanently attached to the body shell and are subject to the working pressure.

3.3 Body Shell

The unfinished outer case of the extinguisher usually comprising a cylindrical part with dished ends, and containing an aperture or apertures for charging the extinguisher or for subsequent fitting of components such as nozzles, pressure gages and closures.

3.4 Charge

The mass or volume of the extinguishing medium contained in the extinguisher expressed in kilograms (powder or carbon dioxide) or litres (water), or the mass of propellant in a gas cartridge expressed in grams.

3.5 Closure

A component, other than a safety device or pressure indicator, subject to the working pressure and used to close off and seal the filling or pressurizing openings, or both, in the body.

3.6 Controllable Discharge Extinguisher

An extinguisher fitted with a device to interrupt the discharge of medium.

3.7 Design Burst (P_B) Pressure

A pressure of not less than 3.375 times of working pressure or 50 bar whichever is the greater. The term is applied to low pressure extinguishers and cartridges, and to high pressure extinguishers except carbon dioxide types.

3.8 Design Test (P_s) Pressure

The pressure equal to 1.35 P_s (see 3.31) rounded to the next higher integral value. The term is applied to low pressure extinguishers and cartridges and to high pressure extinguishers except carbon dioxide types.

3.9 Extinguishing Medium

The substance, including any admixture such as corrosion inhibitor, freezing point depressant or blowing agent, contained in the extinguisher that causes extinction.

3.10 Filling Density

A term applicable to the charge of a carbon dioxide extinguisher, or a gas cartridge. It is the mass in kilograms of charge per litre of container volume, as fitted for use, i.e. complete with valve and internal fittings.

3.11 Fire Extinguisher

An appliance containing an extinguishing medium that can be expelled by the action of internal pressure and be directed on to a fire. This pressure may be stored pressure or be obtained by chemical reaction or by the release of gas from a separate pressure container.

Note:

This is referred to throughout this Standard as 'extinguisher'.

3.12 Fire Extinguisher, Carbon Dioxide

An extinguisher containing liquid carbon dioxide (Co_2) that is released as a gas on the actuation of the extinguisher.

3.13 Fire Extinguisher, Powder (Gas Cartridge)

An extinguisher containing powder that is expelled by pressure released from a gas cartridge (see 3.17).

3.14 Fire Extinguisher, Powder (Stored Pressure)

An extinguisher containing powder that is expelled by the release of pressure stored within the body.

3.15 Fire Extinguisher, Water (Gas Cartridge)

An extinguisher from which the water is expelled by pressure released from a gas cartridge.

3.16 Fire Extinguisher, Water (Stored Pressure)

An extinguisher from which the water is expelled by the release of pressure stored within the body.

3.17 Gas Cartridge (Pressure Container)

A pressure vessel that fits into, or is attached to, the fire extinguisher and that contains either compressed or liquefied gas that, on operation, is used to expel the extinguishing medium.

Note:

This is referred to throughout this Standard as "gas cartridge".

3.18 Gas Cartridge

A pressure container that fits into, or is attached to, the fire extinguisher and that contains the propellant (see 3.25). If the pressure does not exceed 35 bar at 20°C, the pressure container is designated a low pressure type, and if the pressure exceeds this value, it is designated a high pressure type.

3.19 Gas Cartridge Extinguisher

An extinguisher in which the propellant is contained in a gas cartridge, not in the body as a whole.

3.20 High Pressure Extinguisher

An extinguisher whose working pressure (P_s) (see 3.31) exceeds 25 bar.

3.21 Head (Operating Head)

The component that carries the primary, or only, operating mechanism of the extinguisher.

3.22 Low Pressure Extinguisher

An extinguisher whose working pressure (P_s) (see 3.31) does not exceed 25 bar.

3.23 Portable Extinguisher

An extinguisher which is designed to be carried and operated by hand and which in working order has a mass of not more than 23 kg.

3.24 Primary Sealed Stored Pressure Extinguisher

A stored pressure extinguisher in which the operating head and valve to control the flow of medium during discharge can be detached from the body of the extinguisher without releasing propellant or medium, which are retained in the body by a closure that is ruptured on operation.

3.25 Propellant

A gas in a liquefied or compressed state, that provides the internal pressure used to expel the extinguishing medium.

3.26 Range

The range of discharge of a water extinguisher (jet or spray) is the mean discharge length and is the distance from the nozzle to the point on the ground beyond which 50% of the discharge falls.

3.27 Rechargeable Extinguisher

An extinguisher designed to be recharged after use.

3.28 Stored Pressure Extinguisher

An extinguisher in which the propellant gas is stored with the extinguishing medium in the body as a whole and in which the extinguisher body is permanently pressurized.

3.29 Valve Operated Stored Pressure Extinguisher

A stored pressure extinguisher in which a single valve serves both to retain the propellant and extinguishing medium before operation of the extinguisher, and to control the flow of medium during discharge.

3.30 Water Extinguisher

An extinguisher containing an aqueous extinguishing medium, which achieves only a class A rating.

3.31 Working (P_s) Pressure

The equilibrium pressure developed within the extinguisher or cartridge when filled with the nominal charge (see 3.4) and at a temperature of 60°C.

Note:

The actual charge of an extinguisher shall be the nominal charge within the limits:

a) For water extinguishers 5% by volume.

b) For powder extinguishers up to and including 1 kg nominal charge ± 5% by mass.

More than 1 kg and less than 3 kg nominal charge 3% by mass more than 3 kg nominal charge 2% by mass.

c) For carbon dioxide extinguishers ± 5% by mass.

4. UNITS

This standard is based on International System of Units (SI), except where otherwise specified.

5. GENERAL REQUIREMENTS

5.1 Condition of Operation

5.1.1 Extinguishers shall be operated by piercing, opening and/or breaking a sealing device and thus releasing the contents. The method of operation shall be readily sound & clear and movement of the actuating mechanism or mechanisms should not be necessary to be repeated in order to initiate discharge.

5.1.2 Extinguishers shall be so designed that it should prove whether or not they have been operated.

5.1.3 Extinguishers shall incorporate a device to prevent inadvertent operation which shall be so constructed that any unaided manual attempt to initiate discharge will not deform or break any part that would prevent the subsequent discharge of the extinguisher.

5.1.4 Extinguishers shall incorporate a controllable discharge device to enable the discharge to be interrupted.

5.2 Classification of Fires

5.2.1 Fires are classified in four different groups as follows:

Class A : Fire involves materials such as wood, cloth, ...
Class B : Fire involves flammable liquids, oil, ...
Class C : Fire involves gasses.
Class D : Fire in combustible metals, such as Magnesium Titanium, ...

For full details of the above classification reference shall be made to IPS-E-SF-100.

PART I

HAND TYPE FIRE EXTINGUISHERS

SECTION (1)

"WATER TYPE EXTINGUISHERS"

6. MATERIAL

6.1 Shells

6.1.1 The shell used in an extinguisher shall be fabricated of a material having rigidity, durability, and resistance to corrosion at least equivalent to an austenitic stainless steel, such as American Iron and Steel Institute (AISI) Type 304L, having a maximum carbon content of 0.03 percent and having a minimum thickness of 0.65 mm.

6.1.2 A container assembled, complete with permanently attached fittings, shall resist any corrosive influence of the extinguishing agent.

6.1.3 Stainless steel domes or bottoms shall be drawn from fully annealed stock.

6.1.4 Extinguisher shells fabricated from stainless steel materials that may be susceptible to stress corrosion cracking shall be subjected to the Salt Spray Corrosion Test, except that the test duration shall be 100 days, and the shells shall display no signs of stress cracking as evidenced by both a metallographic examination and withstanding the hydrostatic test. Containers using domes and bottoms fabricated from AISI Type 304L stainless steel with an ellipsoidal or hemispherical shape shall meet this requirement. See Fig. 1.

6.1.5 The internal surfaces of a shell shall be thoroughly cleaned of foreign materials.

6.1.6 An opening in a metallic shall be punched or cut so that the metal will fit closely to the body of a fitting.

6.1.7 A shell of an extinguisher formed of metal shall be designed and constructed so that the stress in the weakest part of the shell shall not exceed 80 percent of the yield strength of the material when the extinguisher is pressurized to twice its intended charging pressure at 21°C for 1 minute. See paragraph (6.1.10).

6.1.8 The value of the yield strength to be used shall be the value specified in the appropriate ASTM standard for fully annealed stock.

If the metal used is not specified in an ASTM standard or if the mode of use or construction is such that the specifications given are not appropriate, tensile test samples should be taken from stock material or finished parts, in accordance with the Mechanical Testing of Steel Products, ASTM A370-88, if possible. Pull tests should be conducted to determine the yield and ultimate strengths of the material.

The values to be used in the equations for the design of the shell are to be based on a sufficiently large set of tests to develop the needed level of confidence in the results. The initial test series is to include at least 15 different shells with not more than two coupons from each cylinder, if shells are to be used as the source of the test samples.

6.1.9 The design concepts discussed in paragraphs (6.1.7), (6.1.10) and Fig. 1 are based on materials that have an ultimate strength that is approximately twice the yield strength. Materials that do not exhibit this relationship will be subject to an investigation to determine equivalency.

6.1.10 To determine the material thickness to permit a design stress Sf equal to 80 percent of the material yield stress, the formulas specified in Fig. 1 are to be used. See paragraph (6.1.1).

6.1.11 If the pressure is applied to the convex side of an ellipsoidal or torispherical dome or bottom, the material thickness of the dome and bottom computed as specified in paragraph (6.1.10) is to be

multiplied by a factor of 1.67.

6.1.12 The material of the dome and bottom of a metal extinguisher shall be of the same material as the sidewall of the container and shall have a thickness after forming equal to or greater than the wall thickness of the cylinder.

6.1.13 If a torispherical form dome or bottom is used, the knuckle radius "r" shall be not less than 6 percent of the inside dish radius "L" and the cylinder diameter "d" shall be equal to or larger than the inside dish radius "L". See item D of Fig. 1.

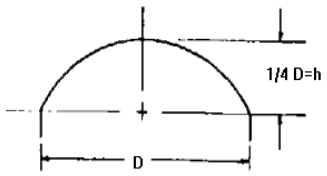
6.1.14 A stainless steel shell shall be fabricated to reduce the risk of stress corrosion and carbide precipitation. All shell surfaces shall be free of abrasive marks.

STRESS DETERMINATION FORMULAS

A. Cylindrical Container Walls

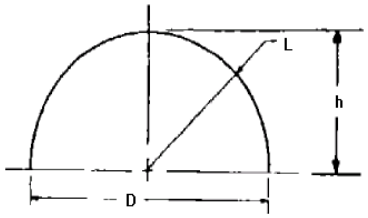
$$S = \frac{Pd}{2t}$$

$$S = \frac{Pd}{4t} \text{ (sphere)}$$



B. Ellipsoidal Dome or Bottom

$$S = \frac{PD}{2t}$$

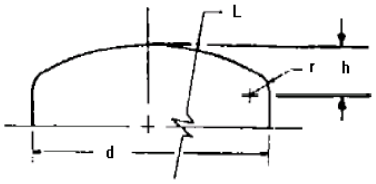


C. Hemispherical Dome or Bottom

$$S = \frac{PL}{2t}$$

D. Torispherical Dome or Bottom

$$S = \frac{0.885\,PL}{t}$$



Where:

t	=	Material thickness, mm.
P	=	Proof test kPa.
S	=	Stress at proof test pressure, kPa.
D	=	Inside diameter of dome or bottom, mm.
d	=	Inside diameter (cylindrical portion of shell), mm.
L	=	Inside spherical radius or dish radius, mm.
r	=	"knuckle" radius, mm.
h	=	Distance from outside crest of head to tangent point with sidewall.

Fig. 1

6.2 Pressure Relief

6.2.1 If a pressure relief is provided, the maximum pressure at which it will function shall not be more than three times the intended charging pressure. The minimum pressure at which it will function shall not be less than the pressure measured at 71°C on an extinguisher, under closed nozzle conditions, charged as intended and pressurized at 21°C. If a fusible metal plug is used, it shall melt within the specified temperature range.

6.3 Joints

6.3.1 A joint shall be mechanically secure and not leak. See Hydrostatic Pressure Test, Section (8.2).

6.3.2 A joint of a stainless steel shell shall be electrically seamwelded or inert-gas shielded arc-welded.

6.3.3 Brazing alloys having a melting point in excess of 260°C shall not be used on stainless steel shells.

6.3.4 A repair weld shall not be made on a stainless steel shell.

6.4 Fill Openings

6.4.1 A collar of a stainless steel extinguisher shall be made of a material equivalent to the material of the shell. For shells made of materials other than stainless steel, the collar material shall be compatible with the material of the shell. See paragraph (6.1.1).

6.4.2 The inside diameter of a fill opening shall not be less than 19 mm. If a collar with external threads is used, it shall have sufficient height to prevent the cap from reaching the dome or from bottoming when the gasket is removed.

6.4.3 If a collar is attached by welding or brazing, it shall fit closely into the opening in the dome.

6.4.4 A container shall be provided with a filling indicator to indicate the amount of extinguishing agent to be used when recharging so that the air space above the liquid is sufficient to permit the intended quantity of expellant gas to be introduced to result in the intended operating characteristics.

6.4.5 If the inside diameter of the collar is 57 mm or larger, the indicator may be a sheet metal angle soldered or spotwelded in place, or it may be an embossed bead positioned partly or entirely around the circumference of the shell.

6.4.6 If the inside diameter of the collar is between 57 mm and 38 mm, the indicator may be a sheet metal piece soldered or spot-welded in place, or it may be an antioverfill tube.

6.4.7 If a sheet metal angle type of indicator is used, it shall be of such size as to be seen clearly through the fill opening and it shall be marked to indicate its function, using words such as "Fill to Here" or "Fill Mark".

6.4.8 If the inside diameter of the collar is less than 38 mm, the filling indicator shall be in the form of an antioverfill tube.

6.5 Antioverfill Tubes

6.5.1 An antioverfill tube shall have a minimum inside diameter of 19 mm and be fabricated of a corrosion-resistant material such as austenitic stainless steel, rubber, or polymeric material. Plated steel is not considered a corrosionresistant material with respect to the preceding requirement.

6.5.2 An antioverfill tube shall be constructed so that it forms an airtight joint between the collar and the tube when installed.

6.5.3 An antioverfill tube shall be removable unless some means other than the fill opening provides access for cleaning out the shell.

6.6 Caps and Closures

6.6.1 A threaded cap shall engage the collar or the threaded opening by at least four full threads with the gasket in place.

6.6.2 A cap or other closure shall withstand the Hydrostatic Pressure Test. All valves, plugs and other components or closures intended to be removable, except pressure gages, shall be provided with a means for relieving pressure should they be removed while the container is still under pressure. The pressure shall be relieved with not less than two threads engaged.

6.7 Discharge Valves

6.7.1 An extinguisher shall be provided with a self closing discharge valve located on the extinguisher container at the inlet end of the discharge hose.

6.7.2 A valve body and operating parts (lever, handle, valve stem, plunger pin, springs, bushings, and the like) shall be made of non-ferrous metal, austenitic stainless steel, or other material having equivalent functional strength and corrosion resistance. Equivalent corrosion resistance is to be determined by the Salt Spray Corrosion Test, clause (8.2.1).

6.8 Gaskets and "O" Rings

6.8.1 A gasket or an "O" ring shall be retained in a recess or the equivalent, in the cap or collar. A cap or a head gasket of a rubberlike material shall be of sufficient thickness to provide a compression-type seal and shall fit snuggly against the cap or head.

6.9 Siphon Tubes

6.9.1 A siphon tube shall be constructed of a material that is resistant to the corrosive effects, if any, of the extinguishing agent with which it is to be used.

6.10 Strainers

6.10.1 A strainer shall be securely attached to the bottom of the pickup tube.

6.10.2 The strainer shall be made of nonferrous metal or austenitic stainless steel not less than 0.64 mm thick and not less than 0.56 mm thick after forming, or of polymeric material complying with these requirements. The total area of the strainer openings shall not be less than 20 times the free area of the nozzle orifice. The largest dimension of any opening shall be smaller than the nozzle orifice diameter by 0.40 mm or more.

6.11 Pressure Gages

6.11.1 An extinguisher shall be equipped with a pressure gage to register the pressure within the extinguisher.

6.11.2 A pressure gage shall resist corrosion.

6.11.3 If either beryllium copper or bronze is used for the Bourdon tube of the pressure gage on a loaded-stream* extinguisher, the pressure connection of the gage shall incorporate a restriction orifice and the Bourdon tube shall be completely filled with an acceptable oil.

6.11.4 The range of a dial shall be approximately twice the indicated charging pressure at 21°C. A gage dial shall indicate the operable pressure range of the extinguisher in a color differing from that of the remainder of the dial. The zero, charging, and maximum gage pressures shall be shown in numerals with a mark at the designated charging pressure. The arc of the dial from the zero pressure point to the lower end of the operable range shall be colored red and shall read "RECHARGE".

6.11.5 The operable pressure range is to be determined by the maximum and minimum pressures resulting from variations in temperature throughout the recognized temperature range.

*** Loaded stream: hand extinguishers of this type have been made with liquid capacities from 4 to 9.5 liter having fire extinguishing ratings of 1-A: 1B. Due to limited effectiveness, these extinguishers are no longer recognized for use on class "B" fires. The chemical used is a solution of an alkali-metal-salt that will not freeze at temperature as low as minus 40°C.**

6.11.6 The pressure gage face shall be marked to indicate:

******

"Use With _____ Only".

6.11.7 The pressure gage shall be marked with the gage manufacturer's identifying mark. The pressure gage shall also be marked according to the following, as applicable, using a line extending as wide as and of the same stroke thickness as the manufacturer's identifying mark:

a) To indicate galvanic compatibility with aluminum valve bodies a horizontal line(-)above the manufacturer's identifying mark;

b) to indicate galvanic compatibility with brass valve bodies a horizontal line(-)below the manufacturer's identifying mark;

c) to indicate galvanic compatibility with aluminum and brass valve bodies a line above (-) and a line below(-) the manufacturer's identifying mark, or the manufacturer's identifying mark by itself.

6.12 Locking Devices and Seals

6.12.1 The operating mechanism(s) of an extinguisher shall be provided with a corrosion-resistant stainless steel or nonferrous locking pin or other device to reduce the risk of unintentional discharge. Means shall be provided to retain the locking device and to indicate tampering with or use of the extinguisher. A locking device retainer shall be made of corrosion-resistant material.

6.12.2 A nonferrous wire and lead seal, or the equivalent, that can be broken by a force of 67 N or less, applied as intended, and as installed with no external load on a locking device, shall be provided to retain the locking device and to indicate tampering with or use of the extinguisher.

If the construction of the extinguisher is such that the breaking of the seal is accomplished by taking the action needed to start discharge of the extinguisher, or if there is an internal load constantly

applied to the release mechanism, the applied force, as intended, required to accomplish discharge or release of the internal load shall not exceed 133 N.

6.12.3 The tamper indicator shall be designed so that it must be broken to operate the extinguisher. Other forms of such devices are clips, clamps, levers, or nozzle restrainers. Most tamper indicators (such as wire and lead seals) will break with removal of the restraining device.

6.12.4 The locking pin or other device shall be visible from the front of the extinguisher mounted on the wall in its bracket or on its mounting hook. However, the locking pin may be on the back side if pictographic operating instructions on the front illustrate the intended means of operation.

6.13 Hose

6.13.1 A hose shall have a nominal internal diameter of not less than 10 mm and the overall length of the hose plus it's nozzle assembly should not be less than 80% of the extinguisher body, and it can withstand for one minute the hydrostatic pressure of 35 kPa/s and not more than 115 kPa/s (As Specified in BS. 5423 (1987)) without rupture or leakage. The hose shall be capable of a 90° bend on the length used without kinking or cracking.

6.13.2 A hose shall be attached to the discharge valve so that it can be removed and replaced as intended.

6.13.3 When the hose is hanging vertically, the tip of the nozzle shall clear any plane surface on which the extinguisher is placed by at least 13 mm but not more than 64 mm.

6.13.4 The free end of an extinguisher hose shall be maintained in position by a holding device when not in use, or the hose shall be performed and have sufficient rigidity to provide an equivalent function.

**** For example, water, antifreeze, loaded stream, and the like.**

6.14 Couplings

6.14.1 A hose coupling shall be made of corrosion-resistant material. The coupling shall be threaded or provided with equivalent means for its attachment to the outlet of the discharge valve.

6.14.2 Continued use of the hose shall not cause loosening or detachment of the coupling, and there shall be no projections to catch on objects or otherwise interfere with pulling of the hose.

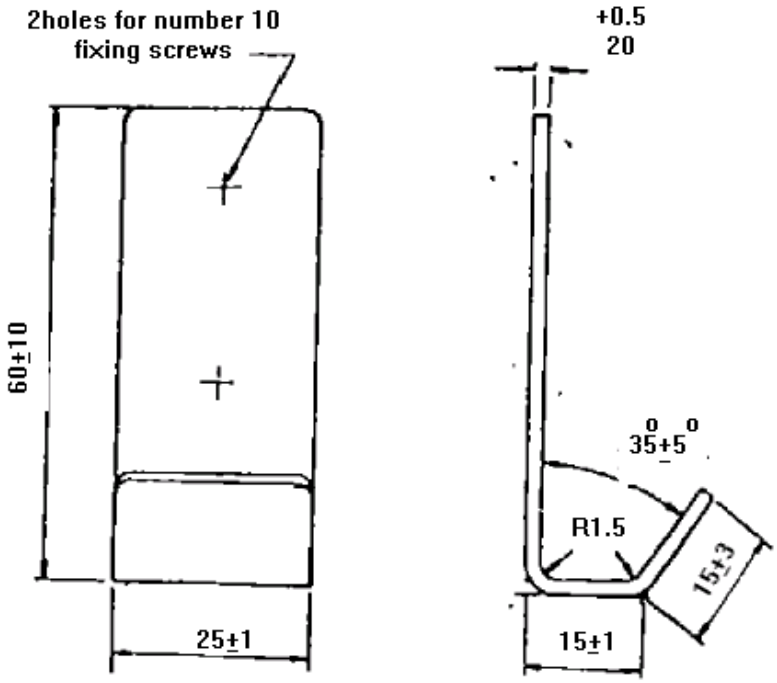
6.15 Nozzle

6.15.1 A nozzle shall be made of a corrosion-resistant material such as a lead-tin alloy or a polymeric material.

6.15.2 A nozzle shall have no blow holes, cracks, or other imperfections. The interior shall be finished smoothly and tapered toward the orifice.

6.16 Handle and Mounting Devices

6.16.1 An extinguisher shall have a carrying handle and a means for mounting on a wall. A handle shall be made of nonferrous metal, austenitic stainless steel, carbon steel protected against corrosion. The mounting means shall hold the extinguisher firmly in place as shown in Fig. 2 or equivalent.



linear dimensions are in milimitres

SPECIAL TYPE OF BRACKET

Fig. 2

6.16.2 A side handle or hanger loop shall be located so that the operating instructions face outward when the extinguisher is supported by the mounting means.

6.16.3 A handle shall not be less than 90 mm long.

6.16.4 There shall be a clearance of at least 25 mm from the undersurface of the handle to the nearest surface of the extinguisher when the handle is in the raised or carrying position.

7. OPERATION

7.1 The construction of an extinguisher shall be such that the method of operation is obvious.

7.2 The construction of an extinguisher shall be such that after discharge of the agent is initiated, the operator of the extinguisher is not required to take further manual actions to maintain the maximum possible flow of agent.

7.3 A material for an extinguisher part, the deterioration of which would cause the extinguisher to become inoperable or cause risk of injury to persons, shall not be subject to stress corrosion.

7.4 Operating Instructions

7.4.1 For the purpose of this section, the "operating instructions" are defined as those necessary to accomplish intended discharge of the extinguishing agent.

7.4.2 The operating instructions shall face outward and not cover more than a 120-degree area on the extinguisher body when the extinguisher is mounted on a wall.

7.4.3 The operating instructions shall be arranged as follows:

a) The word "INSTRUCTIONS" shall be at the top of the nameplate. The minimum letter height shall be 6 mm.

b) The operating instructions shall be in the form of numerically sequenced pictographs. A single pictograph may include two instructions.

c) The sequence of pictographs shall illustrate, with both pictures and words, the recommended actions necessary for intended operation of the extinguisher. The words shall be all capitals in a plain, block-style, sans serif type face. The words in "Farsi" shall be in a bold style. The sequence shall be as follows:

1) Readying the extinguisher by disengaging the locking device, tamper seal, or both.

2) Aiming the extinguisher at the base of the fire, including the recommended distance from the fire at which to begin discharge, and indicating the intended operating attitude of the extinguisher.

3) Taking whatever action necessary to initiate intended discharge of the extinguisher.

4) Describing the intended method of applying the extinguishing agent on the fire.

7.4.4 The pictographs shall occupy a minimum area of 78 cm².

7.4.5 The height of the words used in the pictographs shall be 3 mm minimum to 8 mm maximum.

7.5 Used Code Symbols

7.5.1 Used code symbols shall be positioned directly below the operating instructions. A verbal description for each symbol shall be included as part of the code. For more detail refer to NFC No. 10, 1992.

7.5.2 All three used code symbols A,B, and C shall be placed on the extinguisher. Used code symbols for classifications with which the extinguisher is not intended to be used shall be identified by a red diagonal slash from the top left corner to the bottom right corner of the used code symbol.

7.5.3 The manufacturer’s name or trade name may be placed below the used code symbols, but it shall not contain any other information that would distract attention from the operating instructions, such as an address or telephone number.

7.5.4 Recharging instructions

7.5.4.1 The recharging instructions on the nameplate shall state (1) the intended quantity of the charge that shall be used in recharging the extinguisher, (2) the intended charging pressure, kilopascal (kPa), and (3) the method of recharging, which shall be obvious.

7.5.4.2 The recharging instructions on the nameplate of a water or loaded-stream extinguisher shall state that the extinguisher must not be exposed to freezing temperatures unless an antifreeze or loadedstream charge is used.

7.5.4.3 The nameplate on stainless steel shells shall contain a statement worded to prevent the use of calciumchloride charges.

7.5.4.4 Detailed recharge instructions for the antifreeze charge do not need to be included on the nameplate if reference is made by the name or model number of the charge used and the detailed instructions on the recharge package or container.

7.5.4.5 Reference shall be made on the nameplate of a rechargeable extinguisher to the manufacturer's servicing instructions for the intended equipment and technique to be used in recharging the extinguisher.

7.5.5 All other types of fire extinguishers shall not be installed in areas where temperatures are outside the range of 40°C to 49°C. unless they are of the approved type 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 temperature.

7.5.6 Extinguishers containing plain water only can be protected to temperature as low as -40°C by the addition of an antifreeze stipulated on the extinguisher nameplate.

Notes:

1) Calcium chloride solutions shall not be used in stainless steel extinguishers.

2) Some extinguishers with nitrogen expellant gas are approved or listed for temperature as low as -54°C.

7.6 Installation

7.6.1 Portable fire extinguishers shall be maintained in fully charged and operable condition.

7.6.2 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 areas or premises.

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

7.6.4 Under any circumstances extinguishers shall not be obstructed or obscured from view. Extinguishers shall be installed on the hangers or in the brackets supplied, and if they are subject to dislodgment they shall be installed in brackets specifically designed for them.

7.6.5 If physical damage to the extinguishers are foreseeable, they shall be protected from impact.

7.6.6 As a general rule extinguishers having a gross weight not exceeding 18 kg shall be so installed that the top of the extinguisher is not more than 1.50 m above the floor or ground. For extinguishers having a gross weight more than 18 kg (except wheeled types) shall be so installed that the top of the extinguisher is not more than 1.0 m above the floor or ground. In no case shall the clearance between the bottom of the extinguisher and the floor or ground be less than 1.0 m.

7.6.7 Considering the weight of portable fire extinguishers, the mounting on walls need the following attention:

a) Walls should be solid to withstand the weight of extinguishers.

b) Adequately sized hardware such as screws, bolts, rivets should be strong and rigid for installation.

c) Mounting test shall be done in accordance with UL 626 (1984).

7.7 Fire Extinguisher Size and Placement for classes A, B, C and D

7.7.1 General requirements are given in Appendix A.

8. TESTS

8.1 User's Tests

8.1.1 Hydrostatic test

At intervals not exceeding five years stored pressure water, loaded stream, and/or antifreeze extinguishers shall be hydrostatically tested.

8.1.2 Hose assemblies

A hydrostatic test shall be performed on extinguisher hose assemblies equipped with a shut-off nozzle at the end of the hose. The test interval shall be at every five years.

8.1.3 Cylinder condition

When an extinguisher cylinder or shell has one or more conditions mentioned below, it shall not be hydrostatically tested, but shall be destroyed at once:

a) When there exist repairs by soldering, welding, brazing, or use of patching compounds;

b) when the cylinder or shell threads are damaged;

c) when there exist corrosion that has caused pitting, including under removable nameplate band assemblies;

d) when the extinguisher has been burned in a fire;

e) when a calcium chloride type of extinguishing agent was used in a stainless steel extinguisher;

f) when the shell is copper or brass construction joined by soft solder or rivets;

g) for procedures of hydrostatic pressure test see UL 626 (1984) "2 ½ gallon stored pressure water type fire extinguishers".

8.2 Manufacturing and Production Tests

8.2.1 The manufacturer shall provide the necessary production tests as well as quality control and inspection tests in accordance with UL 626 (1984). The tests shall include the following:

a	=	Operation test.
b	=	Discharge duration test.
c	=	Discharge range test.
d	=	Vibration tests.
e	=	Resistance to internal pressure.
f	=	Burst pressure.
g	=	Test for minimum burst pressure.
h	=	Test orientation.
i	=	Variable frequency test.
j	=	Endurance test.
k	=	Pressure retention.
l	=	Calibration test-gages.
m	=	Pull pin tests.
n	=	Burst strength test-gages.
o	=	Pressure gage relief test.
p	=	Hydrostatic pressure test.
q	=	Discharge valves test.
r	=	Aging test-polymeric materials.
s	=	Salt spray corrosion test.

t = Discharge valve pressure test.
u = Gasket and "O" ring tests.
v = Extinguishers with plastics linings.

9. INSPECTIONS

9.1 General

9.1.1 Inspection in general 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 physical damage or condition to prevent operation.

9.1.2 Extinguishers shall be inspected when initially placed in service and thereafter at approximately thirty days intervals. Extinguishers shall be inspected at more frequent intervals when circumstances require, and record with initials of the inspection being kept.

9.1.3 Periodic inspection of extinguishers shall include a check of at least the following items:

a) Located in designated place;

b) no obstruction to access or visibility;

c) operating instructions on nameplate legible and facing outward;

d) seals and tamper indicators not broken or missing;

e) determine fullness by weighing or "HEFTING".

f) examine for obvious physical damage, corrosion, leakage, or clogged nozzle;

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

9.1.4 When an inspection of any extinguisher reveals a deficiency in any of the conditions listed in (a) and (b) of (9.1.3) immediate corrective action shall be taken.

9.1.5 When an inspection of any rechargeable extinguisher reveals a deficiency in any of the conditions listed in (c), (d), (e), (f) and (g) of (9.1.3), it shall be subjected to applicable maintenance procedures.

9.1.6 Personnel making inspections shall keep records of those extinguishers that were found to require corrective actions, and register the data of those that were last examined.

9.1.7 The user should ensure that extinguishers, gas cartridges and replacement charges are inspected, serviced and maintained. The procedures should be carried out by a competent person capable of conducting them according to this section of standard and any special procedures recommended by manufacturers. This should be done at least every three months.

9.1.8 Any extinguisher, gas cartridge, replacement charge or parts thereof which is damaged, corroded or otherwise defective to an extent that make it hazardous to be used should be removed from service immediately.

9.1.9 Any stored pressure extinguisher or gas cartridge which is sustained a loss of content greater than 10% of it’s liquid capacity, or a loss of pressure greater than that recommended by the manufacturer as being in consistent with satisfactory performance, and cannot be repressurized should be prominently marked "unsafe for service" and shall not be used.

9.1.10 The following safety measures are required when opening any extinguisher:

a) Ensure that there is no residual pressure in any hose and/or nozzle assembly, and then;

b) unscrew the head or valve assembly slowly for two or three turns only, to allow any residual pressure to escape via the venting arrangement and do not unscrew it further until all pressure is released.

If pressure is not released after unscrewing the head of valve assembly two or three turns, then do

not unscrew it further without taking appropriate safety measures. Any sudden release of pressure may eject parts of the contents of the extinguisher.

9.2 Water (Gas Cartridge) Extinguishers

9.2.1 Water (gas cartridge) extinguishers should be inspected at least once a year and the following maintenance carried out:

a) Open the extinguisher, (see 9.1.10), note the liquid level and pour the liquid into a clean container;

b) examine the extinguisher body externally, and also internally using an illuminating probe, for corrosion or damage;

c) examine the gas cartridge externally for corrosion or damage. Weigh the gas cartridge and check the mass against that marked on the cartridge (see 9.1.9);

d) examine the vent holes (or other venting device) in the cap and clean if necessary;

e) examine the nozzle, strainer and (where fitted) the internal discharge tube and breather valve, and clean if necessary;

f) check the operating mechanism and discharge valve, if fitted, for free movement and, if necessary clean, rectify or replace;

g) examine sealing washers and hose (if fitted) and replace if not in good condition;

Note:

(1) Immerse the fire extinguisher horizontally into the water tank (at least 500 mm water should be above the outside surface of cylinder's body) and slowly unscrew the head or valve until the bubbles runs through. Then wait for a minute or two and check for continuation of bubbles, if bubbles are stopped running through, then with care up-right the extinguisher and take it out from water tank and leave it on the side, and with care unscrew the head.

h) return the original charge to the extinguisher, topping up any loss with water, or replacing with fresh water as necessary. In the case of special solutions (for example antifreeze or corrosion inhibitor), recharge extinguishers as recommended by the manufacturer;

i) replace the safety clip (device to prevent inadvertent operation) and/or fit a new wire seal (or equivalent as originally fitted).

9.3 Water (Stored Pressure) Extinguishers

9.3.1 Water (stored pressure) extinguishers should be checked by mass according to the manufacturer's instructions before being put into service, and the maintenance described in (a) to (g) below carried out at least once a year:

a) examine and verify that the pressure indicating device (where fitted) is reading the internal pressure correctly, or where a device is not fitted, that the internal pressure is correct. If the extinguisher shows a loss of pressure of more than 10% or more than the manufacturer's recommended maximum loss, whichever is the greater, refer to the manufacturer's instructions for appropriate action;

b) examine the extinguisher body externally for corrosion or damage;

c) weigh the extinguisher (with or without the operating mechanism according to the manufacturer's instructions) or use suitable alternative means to check that it contains the correct mass of liquid. Check the mass against the mass recorded when it was first put into service;

d) examine the nozzle and hose and clean if necessary;

e) examine the hose for wear and replace if not in good condition;

f) where extinguishers are designed to have the operating mechanism removed, check the operating mechanism and discharge control (where fitted) for free movement, clean, rectify or replace if necessary;

g) replace the safety clip (device to prevent inadvertent operation) or fit new wire seal (or equivalent as originally fitted).

As this type of extinguisher is pressurized, it can be opened for inspection after discharge only. It should be discharged every 4 years. In addition the maintenance described herein should be carried out.

- Discharge the extinguisher completely, checking the pressure indicating device or tell-tale indicator before and after discharge to see that the indicator is functioning properly.
- Examinations and checkings as given in (a) to (i) of clause (9.2.1).

10. SERVICE MANUAL

10.1 The manufacturer shall furnish five service manual for each model fire extinguisher. It shall be made available upon request and shall:

a) contain (1) necessary instructions, warnings, and cautions, (2) a description of servicing equipment, and (3) description of recommended procedures for intended servicing;

b) provide a list of part numbers of all replaceable parts;

c) indicate that (1) the pressure gage attached to the extinguisher shall not be used to determine when the intended charging pressure has been reached, and (2) a pressure regulator shall be used if the pressure source is a tank of high pressure gas.

11. MARKING

11.1 The operating, recharging, and inspection and maintenance instructions shall be in the form of an etched or embossed metal nameplate, band, or a pressure-sensitive nameplate permanently attached to the side of the shell or in the form of silk screening of paint directly on the shell. The nameplate shall identify the type of extinguisher (water, antifreeze, loaded-stream, and the like), and shall include the classification of the fire extinguisher.

11.2 The nameplate shall include a statement that the extinguisher shall not be used on live electrical equipment.

11.3 The year of manufacture, or the last two digits of the calendar year, and the factory test pressure in kilopascal (kPa) shall be permanently marked on the extinguisher nameplate that contains the inspection and maintenance instructions. Extinguishers manufactured in the last three months of a calendar year may be marked with the following year as the date of manufacture, and extinguishers manufactured in the first three months of a calendar year may be marked with the previous year as the date of manufacture.

11.4 The nameplate shall include a statement that the extinguisher is to be installed, inspected, maintained, and tested in accordance with the Standard for Portable Fire Extinguishers, of the built country.

11.5 The following statement or the equivalent shall be included on the nameplate: "Recharge immediately after any use."

11.6 A nameplate or the valve of each extinguisher shall be marked with its (1) exact gross weight or (2) minimum and maximum gross weight, which may be expressed by a tolerance.

The gross weight shall include the weight of the charged extinguisher and discharge assembly unless marked to indicate that the gross weight does not include the discharge assembly.

11.7 The manufacturer’s name or the equivalent designation and the model number shall be

permanently marked on each embossed metal nameplate, band, or pressure-sensitive nameplate.

SECTION (2)

"DRY CHEMICAL POWDER FIRE EXTINGUISHERS"

12. MATERIAL

12.1 Shells

12.1.1 The shells used for an extinguisher shall be fabricated of a material having rigidity, durability, and resistance to corrosion at least equivalent to:

a) an aluminum alloy such as 6061-T6 or 6351-T6 (see the Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate, ASTM B209-73) having a minimum thickness of 0.71 mm (0.028 in.);

b) an aluminum alloy, such as 1100, 1170, or 3003 having a minimum thickness of 0.71 mm (0.028 in.);

c) a mild steel alloy, such as SAE 1010, having a minimum thickness of 0.71 mm (0.028 in.).

12.1.2 A shell assembled complete with permanently attached fittings shall be resistant to any corrosive influence of the extinguishing agent.

12.1.3 The internal surfaces of a shell shall be free of foreign materials and be completely dried.

12.1.4 The shell of an extinguisher shall be constructed such that the stress in any part of the shell will not exceed 80 percent of the yield strength of the material, or 50 percent of the ultimate tensile strength of the material, when the extinguisher is subjected to the proof test pressure.

12.1.5 A shell assembled complete with permanently attached fittings shall be resistant to any corrosive influence of the extinguishing agent.

12.1.6 The material of the dome and bottom of a metal shell shall be of the same material as the cylinder of the shell and shall have a thickness after forming equal to or greater than the minimum wall thickness of the cylinder unless the dome or bottom is formed integral with the sidewall. If the dome or bottom is formed integral with the sidewall, the sidewall may be not greater than 15 percent thicker than the dome or bottom to allow for the reduction in thickness which may result from the forming process, if the resulting thickness exceeds that required by paragraphs (12.1.1) and (12.1.7).

12.1.7 To determine the stress that is acting on the shell at the specified proof test pressure, the formulas specified in Part 1 Fig. 1 (of water type fire extinguisher) shall be used.

12.1.8 If the pressure is applied to the convex side of an ellipsoidal or torispherical dome or bottom, the material thickness of the dome and bottom, as used in the stress determination formulas referenced in paragraph (12.1.7), is to be multiplied by a factor of 1.67.

12.1.9 If either a flat dome or flat bottom is of a one-piece construction with the sidewall, the minimum thickness of the thinnest section of the dome or bottom shall be twice the minimum sidewall thickness. The minimum inside knuckle radius shall be 2.5 percent of the inside diameter of the shell. The minimum wall thickness referred to above is the measured minimum thickness, not the calculated minimum thickness. Shells using a flat dome or bottom shall have a minimum dome or bottom burst pressure of eight times the rated working pressure.

12.1.10 A dome or bottom is considered to be integral with the sidewall if the distance from the tangent point between the sidewall and the head to the nearest circumferential joint (excluding the collar) is greater than the radius of the circumferential portion of the shell.

12.1.11 If a torispherical form dome or bottom is used, the knuckle radius r shall not be less than 6 percent of the inside dish radius L, and the cylinder diameter d shall be equal to or larger than the inside dish radius L. See item D of Fig. 1 Section 1.

12.1.12 The thickness of the cylindrical portion is to be measured on uncoated metal. The thickness

of the dome and of the bottom is to be measured at various points after forming and before coating.

12.2 Joints

12.2.1 The minimum width of a brazed joint on a cylinder wall shall be at least four times the thickness of the sidewall.

12.3 Caps, Valves, and Closures

12.3.1 The fill opening of a rechargeable hand-portable extinguisher shall have a minimum inside diameter of 19 mm.

12.3.2 A collar with external threads shall have sufficient height so that the cap does not contact the dome or the bottom when the gasket is removed.

12.3.3 A threaded cap, closure, or valve shall engage the collar or the threaded opening by not less than four full threads with the gasket in place.

12.3.4 A cap, valve or closure shall withstand the hydrostatic pressure test as specified for the cylinder.

12.3.5 A cap, plug, or other component except a pressure gage, shall be provided with a means of relieving pressure if it is removed while the dry-chemical chamber is still under pressure. The pressure shall be relieved with not less than two threads engaged.

12.4 Gaskets and "O" Rings

12.4.1 For gaskets and "O" rings refer to Part (I) Section (1) Clause (8.6) of water type fire extinguishers.

12.5 Gas Cartridges and Cylinders

12.5.1 A seated-valve type gas cylinder assembly, as provided on a hand extinguisher, shall be provided with a corrosion-resistant locking device to reduce the risk of unintentional discharge. An appropriate sealing device that can be broken with a force not exceeding 67 N, as installed with no external load on the locking device, shall be provided to retain the locking device and to indicate tampering with or use of the gas cylinder assembly.

12.6 Pressure Gages and Indicators

12.6.1 A rechargeable extinguisher, of the stored pressure type employing a single chamber for both the dry chemical and the expellant gas shall be equipped with a pressure gage to show the amount of pressure in the chamber whether the valve is opened or closed, except as provided in paragraph (12.6.3). The operating range of the gage shall reflect operating temperature-pressure relationship of the extinguisher, except that the minimum operating pressure line may be higher than the pressure that corresponds to the minimum operating temperature.

12.6.2 The pressure gage face shall indicate the appropriate units for which the gage is calibrated, such as kPa or kg/cm².

12.6.3 The maximum indicated gage pressure shall be between 150 and 250 percent of the indicated charging pressure at 21°C. The gage dial shall indicate, in green, the operable pressure

range of the extinguisher. The zero, charging, and maximum indicated gage pressure shall be shown in numerals and with marks. The background of the gage face above a horizontal line through the lowest required markings shall be red.

The arc of the dial from the zero pressure point to the lower end of the operable range shall read "Recharge". The arc of the dial from the higher end of the operable range to the maximum indicated pressure shall read "Overcharged:.

All numerals, letters and characters in the recharge, operable, and overcharge portion of the dial shall be white. Pointers shall be yellow, and the tip of the pointer shall end in the arc of the pressure indicating dots, and shall have a maximum tip radius of 0.25 mm. The minimum length of the pointer, form the centerpoint of the dial to the tip, shall be 9.5 mm measured at the zero pressure point. The minimum length of the arc from zero pressure to the indicated charging pressure shall be 13 mm measured from the centerline of the indicated charging pressure mark.

12.6.4 The mark used to indicate the charging pressure at 21°C shall not be less than 0.6 mm and not more than 1.0 mm wide.

12.6.5 The pressure gage shall be marked with the gage manufacturer's identifying mark. The pressure gage shall also be marked according to the following, as applicable, using a line extending as wide as, and of the same stroke thickness as, the manufacturer's identifying mark:

a) to indicate galvanic compatibility with aluminum valve bodies a horizontal line above(-) the manufacturer's identifying mark;

b) to indicate galvanic compatibility with brass valve bodies a horizontal line below(-) the manufacturer's identifying mark;

c) to indicate galvanic compatibility with aluminum and brass valve bodies a line above and a line below (-) the manufacturer's identifying mark, or the manufacturer's identifying mark by itself without additional lines.

12.6.6 The pressure gage face shall be marked, "Use With Dry Chemical Only".

12.7 Puncturing Mechanisms

12.7.1 The parts of a puncturing mechanism, with the exception of unexposed springs and pins, shall be made of nonferrous metal or corrosion-resistant stainless steel.

12.8 Locking Devices and Seals

12.8.1 For locking devices and seals refer to Part (1) Section (1) clause (6.12).

12.9 Hose

12.9.1 An extinguisher having a gross weight of more than 5.4 kg shall be equipped with a hose to direct the discharge. The length of the hose shall be such that restriction of the dry-chemical discharge, by kinking of the hose or other means, will not occur when the extinguisher is operated in the various positions in which it may be held in service. See also clause (12.9.2).

12.9.2 An extinguisher having a rating of 2A or higher, 20B or higher, or both shall be equipped with a hose to direct the discharge.

12.9.3 An extinguisher having a gross weight of 5.4. kg or less may be provided with a hose.

12.9.4 A hose shall have a nominal internal diameter of not less than 9.5 mm and shall comply with the requirements of the Standard for Fire Extinguisher and Booster Hose, (UL 92).

12.9.5 A hose, when required, shall be attached so that it can be removed and replaced as

intended.

12.9.6 For a hand-portable extinguisher, a holding device shall maintain a hose in a position within 25.4 mm of the cylinder when the hose is not in use, or the hose shall be preformed and have sufficient rigidity to provide the equivalent spacing from the cylinder. The distance is to be measured from the cylinder to the nearest edge of the hose.

12.10 Couplings

See Part (I) Section (1) Clause (6.14).

12.11 Nozzles and Discharge Valves

See Part (I) Section (1) Clause (6.15).

12.12 Siphon Tubes

12.12.1 A siphon tube shall be constructed of a material that is resistant to the corrosive effects of the extinguishing agent with which it is to be used.

12.12.2 Press-fit-type joints between the siphon tube, valve, and other mating parts of the discharge system shall not completely disengage during use.

The siphon tube shall be notched, scarfed, or otherwise prevented from restricting discharge in an unintended manner when the tip of the siphon tube is resting on the bottom of the shell. The tip of a nonmetallic siphon tube shall not be displaced from the vertical axis during assembly.

12.13 Handles and Mounting Devices

12.13.1 A hand-portable extinguisher having a gross weight of 1.5 kg or more and having a cylinder of 76. mm or less shall have a carrying handle. A handle shall not be less than 90 mm long for an extinguisher of 8.5 kg or more gross weight and not less than 76 mm long for an extinguisher of less than 8.5 kg gross weight.

12.13.2 A mounting bracket shall not permit the extinguisher to drop to the floor when the strap is opened.

The clamp releasing device shall be of a color contrasting with that of the immediate extinguisher background and shall be visible, and the method of release shall be obvious when viewing the front of the extinguisher.

12.13.3 For further details concerning the handles and mounting devices refer to Part (I) Section (1), Clause (6.16).

12.14 Expellant Gases

12.14.1 The expellant gas used in a stored-pressure extinguisher or in the cartridge or cylinder of an extinguisher so provided shall be compressed air or an inert gas. The gas shall have a dew point of minus 40°C or less.

Only propellants listed in Table 1, or mixtures thereof, shall be used in extinguishers, whether of the store pressure or gas cartridge type. The maximum water content shall be as specified in Table 1 except when used in store pressure water extinguishers.

TABLE 1 - PROPELLANTS

MATERIAL	MAXIMUM WATER CONTENT PERCENTAGE, m/m
Air	٠,٠٠٦
Carbon dioxide	0.015
Nitrogen	0.006

13. OPERATION

13.1 General

13.1.1 For operation of dry chemical fire extinguishers Clauses (7.1), (7.2) and (7.3) of Part (I) Section (1) are applicable in addition to the following:

13.1.2 An extinguisher having a volume in excess of 2.5 L shall be capable of standing in the upright position without support.

13.1.3 An extinguisher shall operate as intended from the minimum storage temperature 52°C, inclusive. Currently recognized minimum storage temperature is minus 40°C.

13.1.4 The edges and surfaces of a valve, cap, closure, hose, shell, handle, mounting device, and the like, shall not be sufficiently sharp to constitute a risk of injury to persons in intended maintenance and use. Whenever referance for measurements are necessary, the method described in the requirements for determination of sharpness of edges on equipment, UL 1439, is to be employed.

13.1.5 A hand portable extinguisher shall have a gross weight not exceeding 23 kg.

13.1.6 A pressurizing adaptor for a rechargeable stored pressure type extinguisher shall have threads or other mechanical means for securement to the valve assembly.

14. PERFORMANCE

14.1 Operating Delay

14.1.1 Unless otherwise specified, an interval of 5 seconds is permitted after the cartridge is punctured in a cartridgeoperated type extinguisher to permit pressure build-up before discharge of powder is initiated.

14.2 Operating Instructions

14.2.1 Reference shall be made to Part (I) Section (1) Clause (7.4)

14.2.2 The operating instructions shall face outward and cover not more than a 120-degree arc on the extinguisher body. The marking required by Clause (7.4.3) shall together occupy a minimum area of 77 cm^2 for an extinguisher having a diameter greater than 82 mm and 52 cm^2 for an extinguisher having a diameter of 82 mm or less.

14.2.3 The height of the words used in the pictographs shall be at least 3 mm high.

14.3 Use of Code Symbols

Except for extinguishers classified for use on class D fires, all three code symbols (A, B, C and D)

shall be placed on the extinguisher. Use code symbols for classifications with which the extinguisher is not intended to be used shall be identified by a red diagonal slash from the top left corner to the bottom right corner of the used code symbol.

14.4 Instruction Manual

14.4.1 An instruction manual shall be provided with each extinguisher. This manual shall contain the necessary instructions, warnings, and cautions for the intended installation, operation, recharging, inspection, and maintenance of the extinguisher.

14.5 Service Manual

14.5.1 The manufacturer shall furnish five service manual for each model fire extinguisher identical to Part (1) Section (2) Clause (12).

14.6 Installation

14.6.1 For installation refer to Part (1) Section (1) Clause (7.6).

14.7 Fire Extinguisher Size and Placement for ClassesA,B,C, and D

14.7.1 General requirements are given in Appendix A.

15. TESTS

15.1 User's Tests

15.1.1 Fire test

15.1.1.1 An extinguisher, charged with its rated capacity of dry chemical and expellant gas and conditioned at the minimum storage temperature for 24 hours, shall extinguish a Class B test fire having a square meter area numerically equal to the "B" rating of the extinguisher. (Refer to Appendix A).

15.1.2 Hydrostatic test

15.1.2.1 At intervals not exceeding:

a) five years, dry-chemical with stainless steel shells;

b) twelve years, dry-chemical, stored pressure, with mild steel shells, brazed brass shells or aluminum shells;

c) twelve years, dry powder, stored pressure, cartridge or cylinder operated, with mild steel shells.

15.1.2.2 Test pressures for hose assemblies dry chemical and dry powder hose assemblies with

nozzle requiring a hydrostatic pressure test shall be tested at 2070 kPa or at service pressure, whichever is higher.

15.1.3 Cylinder condition

Refer to Part (1) Section (1) Clause (8.1.3).

15.2 Manufacturing and Production Tests

15.2.1 The manufacturer shall provide the necessary production tests as well as quality control and inspection tests in accordance with UL 299 (1984) and BS 5423 (1987). The tests shall include the following:

a) operation test;
b) discharge range test;
c) discharge duration test;
d) operating temperature limits test;
e) pressure-retention test;
f) 30-day elevated temperature test;
g) high temperature exposure test;
h) packed hose and chamber test;
i) temperature cycling test;
j) rate of flow test;
k) intermittent discharge test;
l) vibration test;
m) mounting of test sample;
n) orientation, variable frequency and endurance tests;
o) calibration test-gages and indicators;
p) aging tests-polymeric materials;
q) hydrostatic pressure test-shells and tanks;
r) two-year leakage test;
s) hydrostatic pressure test-Hoses and couplings;
t) pull pin tests;
u) gasket and "O" ring tests;
v) extinguishing agent tests;
w) elevated temperature test;
x) hygroscopicity test;
y) dielectric strength test. (Static Electricity);
z) salt spray corrosion test;
aa)handle and mounting device test;
bb)servicing test.

16. INSPECTIONS

16.1 General

16.1.1 For the purpose of inspection of dry chemical fire extinguishers Clauses 9.1 thru 9.1.10 "Inspection of hand portable type water fire extinguishers" shall apply together with the following:

16.2 Powder (Gas Cartridge) Extinguishers

16.2.1 Precautions

Before any powder extinguisher is opened it should be ascertained that, during inspection and maintenance, the precautions described in this clause will be observed.

Powder extinguishers should be opened only in the driest available conditions and for the minimum time necessary for examination, to minimize the effect of atmospheric moisture on the powder. Powder will absorb deleterious amounts of moisture if exposed to air of high relative humidity, or if the powder is colder than the ambient air. It is even more important that mixing or cross-contamination of different types of powder be avoided.

Some types of powder are capable of reacting with other types to produce water and carbon dioxide. This reaction often does not become apparent until after a delay of weeks during which no apparent reaction occurs. The water causes caking and, in a closed container the carbon dioxide causes a pressure rise that might be dangerous.

Only extinguishers containing the same type of powder should be opened and examined at any one time.

16.3 Inspection and Maintenance

Powder (gas cartridge) extinguishers should be inspected at least once a year and the maintenance described in (a) to (e) carried out:

a) Weigh the extinguisher to check that it contains the correct mass of powder. Check the mass against the mass recorded when it was first put into service. In the event of a loss in content of more than 10%, recharge the extinguisher;

b) open the extinguisher see (9.1.10 and 16.2.1) and examine the powder in the extinguisher to check that there are no visual sings of caking, lumps or foreign bodies. Agitate the powder by inverting and shaking the extinguisher taking care to avoid spillage. If there is any evidence of caking, lumps or foreign bodies, or if it is not free flowing or if there is any doubt discard all the powder, and recharge the extinguisher;

c) examine the nozzle, hose and internal discharge tube for blockage and clean, rectify or replace if necessary;

d) examine all washers, diaphragms and hose, and replace if not in good condition;

e) for the rest of the tests refer to Part (I) Section (1) of this Standard and follow the procedure given in Clause (9.2) items (b), (c), (f) and (i) of water (gas cartridge) extinguishers.

16.4 Powder (Stored Pressure) Extinguishers

16.4.1 Precautions

The precautions set out in (16.2.1) apply equally to extinguishing powder (stored pressure) extinguishers.

16.5 Inspection and Maintenance

Powder (stored pressure) extinguishers should be checked by mass in accordance with the manufacturer's instructions before being put into service, and the maintenance described in (a) and (b) carried out at least once a year:

a) weigh the extinguisher (with or without the operating mechanism according to the manufacturer's instructions) to check that it contains the correct mass of powder. Check the mass against the mass recorded when it was first put into service;

b) for the rest of the tests refer to Part (I) Section (1) of this Standard and follow the procedure given in Clause (9.3) item (a), (b), (d), (e), (f) and (g) of water (stored pressure) extinguishers.

As this type of extinguisher is pressurized, it can be opened for inspection only after discharge see Part (I) Section (1) Clause (9.1.10) and the maintenance procedure described in (a) to (e) of (9.2.1)

carried out.

16.6 Inspection Instructions

16.6.1 For extinguishers of the cartridge-operated type the inspection instructions shall state that:

a) the extinguisher shall be inspected monthly, or at more frequent intervals when circumstances require;

b) the hose, if any, and nozzle shall be examined to ascertain that they are unobstructed;

c) the tamper indicator shall be intact;

d) the extinguisher shall be examined annually or more frequently by removing and weighing the gas cartridge, ascertaining that the dry chemical flows freely, and;

e) the discharge valve shall be unobstructed and in working order.

16.6.2 For extinguishers of the stored-pressure or cylinder-operated type, the inspection instructions shall state that:

a) the extinguisher shall be inspected monthly, or at more frequent intervals when circumstances require;

b) the hose, if any, and nozzle shall be examined to ascertain that they are unobstructed;

c) the extinguisher shall be pressurized as intended, and;

d) the tamper indicator shall be intact.

16.7 Record Tag

16.7.1 Except for an extinguisher having a capacity not exceeding 2 kg of dry-chemical and marked to indicate that it is intended for use in a home, an extinguisher shall be provided with a record tag that will afford ample space for recording the date on which the extinguisher was last inspected and the name or initials of the person making the inspection or recharge.

Supplementary tags necessary for additional instructions may be provided. The tags shall be made of sized linen or material of equivalent strength and durability.

17. MARKING

17.1 The operating, recharging, and inspection and maintenance instructions shall be in the form of an etched or embossed metal nameplate, band, or a pressure-sensitive nameplate attached to the side of the shell, or in the form of silkscreening of paint directly on the shell. The nameplate shall identify the extinguisher as to type of dry chemical, and shall include the classification of the fire extinguisher.

17.2 The term "Multi-Purpose" or similar terms, such as "All-Use," "ABC", "Triple Use," or "Tri-Purpose," shall be employed on the extinguisher only if the agent warrants "A," "B", and "C" classification. The basis for determining that an agent is capable of recognition as a multipurpose agent is that the agent has been used in an extinguisher that has obtained a rating of at least 1-A: 10-B:C with not more than 1.4 kg of the agent.

17.3 The fully charged weight of the gas cartridge shall be permanently stamped on the cartridge, cartridge nut, or the cartridge valve body. In addition, the gas cartridge shall be stenciled or marked to indicate the following:

a) model designation of the extinguisher;

b) permissible weight loss before recharging;

c) name of extinguisher manufacturer.

17.4 The above information may be placed on the cartridge in the form of a decalcomania transfer if the cartridge is mounted on the outside of the dry-chemical chamber. If the cartridge is mounted inside the drychemical chamber, this information shall be stenciled or stamped on the cartridge.

17.5 The following applicable statement or the equivalent shall be included on the nameplate:

a) For rechargeable extinguishers-"Recharge immediately after any use".

17.6 Further informations are available in Part (I) Section (2) Clause (11) of this Standard.

SECTION (3)

"CARBON DIOXIDE (Co_2) FIRE EXTINGUISHERS"

18. MATERIAL

18.1 Shells

18.1.1 The shell used for carbon dioxide extinguisher shall have a minimum service pressure of 12 MPa.

18.1.2 A shell shall be threaded at the valve opening to accommodate a discharge valve.

18.1.3 The thread strength of the valve opening shall withstand not less than ten times the maximum cylinder pressure permitted by the pressure-relief mechanism. See Clause (18.8). The valve opening may be provided with internal or external threads.

18.1.4 An extinguisher having a capacity of more than 2.5 kg of carbon dioxide shall be capable of standing in an upright position without support.

18.2 Capacities

18.2.1 The capacity of a shell shall be such that, when charged with the extinguisher's rated capacity plus the allowable tolerance of carbon dioxide, the weight of carbon dioxide does not exceed 68 percent of the water capacity, by weight, of the shell.

18.3 Discharge Valves

18.3.1 A shell of a hand-portable extinguisher having a capacity of 9.0 kg mass or less shall be fitted with a manually opened, selfclosing type valve. A shell having a capacity greater than 9.0 kg shall be fitted with a manually opened valve having a manually or automatically operated locking mechanism, or other means, to maintain the valve in the open position throughout the effective duration of the extinguisher discharge.

18.3.2 A shell-mounted valve shall be constructed of a material that is compatible with the material of the shell with respect to the galvanic corrosion thread wear, or "galling" characteristics.

18.3.3 The discharge end of a hose of an extinguisher having a capacity greater than 9.0 kg shall be fitted with a discharge valve of the self-closing type.

18.3.4 A discharge valve shall be gas tight when closed, shall form a gastight connection with the components of the fire extinguisher to which it is intended to be attached, and shall operate as intended in atmospheric temperatures as high as 49°C.

18.3.5 The design of a cylinder-mounted discharge valve shall be such that the extinguisher can be recharged as intended after use.

18.3.6 Operating parts of a discharge valve (valve stem, plunger pin, springs, bushings, and the like) shall be made of nonferrous metal or stainless steel resistant to corrosive influences encountered during intended use. A self-closing type valve shall not be subject to wear that will impair the operation of the extinguisher.

18.4 Discharge Tubes

18.4.1 If a hand-portable extinguisher is provided with a discharge tube, the tube shall be of heavy-walled tubular metal fastened to the discharge valve by a swivel joint and sealed against leakage.

The swivel shall be movable but sufficient friction shall be provided to maintain the discharge tube in the same fixed position with respect to the assembly when the extinguisher is held in any position.

18.4.2 The discharge end of the tube shall be equipped with an antirecoil device and shall be threaded to accept the discharge horn, unless the antirecoil device is an integral part of the valve and the swivel assembly is intended to be detached for recharging purposes.

18.4.3 When rotated to the vertical-down position, the outer end of the discharge horn shall not extend beyond the plane formed by the extinguisher bottom.

18.5 Discharge Horns

18.5.1 An extinguisher shall be equipped with a discharge horn of water-resistant, electrically nonconductive material.

18.5.2 An extinguisher equipped with a flexible hose shall be provided with a horn handle made of an insulating material (plastic or seasoned hard-wood) not less than 127 mm long. All surfaces of wooden handles shall be coated with a water-resistant paint or the equivalent.

18.5.3 An extinguisher equipped with a flexible hose shall be provided with a bracket to hold the discharge horn when not in use. The bracket shall securely hold the horn, but the horn shall be able to be readily disengaged for use.

18.6 Handles and Mounting Devices

18.6.1 For handles and mounting device see Part (I) Section (1) Clauses (6.16.1), (6.16.2), (6.16.3) and (6.16.4).

18.7 Antirecoil Devices

18.7.1 An antirecoil device shall be provided to reduce risk of personal injury from recoil at the point where the horn or the hose and horn assembly is detached for recharging.

18.8 Pressure Reliefs

18.8.1 A cylinder-mounted discharge valve shall be fitted with a pressure relief valve and be constructed or placed to reduce risk of injury to persons from recoil when the gas contents are vented.

18.9 Locking Devices and Seals

18.9.1 For locking devices and seals refer to Part (I) Section (1) Clauses (6.12.1) and (6.12.2).

18.10 Hose

18.10.1 An extinguisher having a capacity of more than 3 kg mass of carbon dioxide shall be equipped with a discharge hose. A hose shall be flexible and of sufficient length to allow the horn to be pointed in any direction.

18.10.2 A hose shall contain a metal wire braid and shall have either an outer wrapping of tightly woven high-grade yarn or a cover of natural or synthetic rubber. It shall be equipped with couplings of ferrous metal coated to resist corrosion, nonferrous metal, or stainless-steel threaded to accept the discharge fitting of the valve and the connector of the discharge horn. The hose shall be capable of being removed and replaced.

If the hose coupling incorporates a nozzle orifice, the threads or attachment means shall prevent the outlet end of the hose from being connected to the discharge valve outlet.

18.11 Gaskets and "O" Rings

18.11.1 Any gasket or "O" ring used in the shell or valve shall be retained in a recess or the equivalent. A gasket of rubber-like material shall be of sufficient thickness to provide a compression type seal and shall fit snuggly against the shell or valve.

18.12 Carbon-Dioxide Charges

18.12.1 An extinguisher shall be charged with one of the following before being shipped:

a) Standard charge

A commercial grade of carbon dioxide,that is free of water and other contaminants that might cause corrosion or interfere with the discharge of the extinguisher. The vapor phase shall not be less than 99.5 percent carbon dioxide with no detectable off-taste or odor. The water content shall not be more than 60 parts per million (ppm) by weight at minus 46.5°C dew point. Oil content shall not be more than 10 ppm by weight;

b) High-Temperature charge

A charge that is 90 percent of the standard charge. The charge shall be used in an extinguisher intended for hightemperature exposure [approximately 54.5°C maximum], and the nameplate instructions shall correspond with this condition of charging;

c) Low-Temperature charge

A special charge for use at temperatures below minus 40°C that may be provided for special applications. The nameplate instructions on the extinguisher shall correspond with this condition of charging.

19. OPERATION

19.1 General

19.1.1 The general specification given in Part (I) Section (1) Clauses (7.1), (7.2) and (7.3) are applicable for operation of carbon dioxide fire extinguishers plus the mentioned items below.

19.1.2 The construction of the extinguisher shall be such that the discharge valve need not be disassembled or removed to recharge the extinguisher.

19.1.3 An extinguisher of 9.0 kg or less capacity is designated, for the purpose of these requirements, as a handportable type.

19.2 Operating Instructions and Use Code Symbols

Reference shall be made to Part (I) Section (1) Clauses (7.5.1), (7.5.2) and (7.5.3).

19.3 Recharging Instructions

19.3.1 The recharging instructions on the nameplate of a rechargeable extinguisher shall state the intended weight of carbon dioxide that shall be used in recharging the intended expellant gas pressure. Reference shall be made to the manufacturer's servicing instructions for the intended equipment and technique to be used in recharging the extinguisher.

19.4 Service Manual

For service manual refer to Part (1) Section (2) Clause 10.

19.5 Installation

19.5.1 For installation refer to Part (I) Section (1) Clause (7.6); for fire extinguisher size and placement for classes A, B, C and D see Clause (7.7); and General requirements are given in Appendix A.

20. TESTS

20.1 User's Tests

20.1.1 Hydrostatic test

At intervals not exceeding five years carbon dioxide fire extinguishers shall be hydrostatically tested.

20.1.2 Test pressures for hose assemblies

Carbon dioxide hose assemblies requiring a hydrostatic pressure test shall be tested in accordance with NFPA-10 Clause A-5-5-3.

20.1.3 Cylinder condition

Refer to Part (I) Section (1) Clause (8.1.3).

20.2 Manufacturing and Production Tests

20.2.1 The manufacturer shall provide the necessary production tests as well as quality control and inspection test in accordance with UL 154 (1984) or BS 5423 (1987). The tests shall include the topics as outlined below:

a) discharge capacity test;

b) discharge duration test;

c) temperature range test;

d) intermittent operation test;

e) valve cycling test;

f) pressure relief test;

g) horn impact test;

h) vibration and vibration frequency tests;

i) extinguisher mounting and mounting of test sample;

j) orientation test;

k) pressure retention test;

l) operation test;

m) pull pin tests;

n) aging tests-polymeric materials;

o) salt spray corrosion test;

p) gasket and "O" rings tests;

q) carbon dioxide exposure;

v) discharge horn resistance test;

s) hydrostatic pressure test for hose;

t) discharge valve test.

20.2.2 Certification

The manufacturer shall certify that all three types of extinguishers given in this standard have been tested in accordance with UL 626 (1995) 7th Edition, UL 299(1995) 9th Edition, UL 154 (1995) 8th Edition and B.S 5423.

21. INSPECTIONS

21.1 General

21.1.1 For the purpose of inspection of portable carbon dioxide fire extinguishers clauses (9.1.1) thru (9.1.10) of Part (1) Section (1), (inspection of hand portable type water fire extinguishers) shall apply together with the following:

21.2 Carbon Dioxide Extinguishers

21.2.1 Carbon dioxide extinguishers should be checked by mass in accordance with the manufacturer's instructions before being put into service and the maintenance described in (a) to (e) carried out at least once a year.

a) examine the extinguisher body externally for corrosion or damage see Part (I) Section (1) Clauses (9.1.7), (9.1.8) and (9.1.9);

b) weigh the extinguisher and check the mass against that recorded when first put into service see Part (I) Section (1) Clauses (9.1.7), (9.1.8) and (9.1.9). In the event of a loss of content of more than 10%, recharge the extinguisher;

c) examine the horn, hose and valve assembly, and clean and replace if not in good condition;

d) where extinguishers are designed to have the operating mechanism removed, check the

operating mechanism and discharge control (where fitted) for free movement. Clean, rectify or replace if necessary;

e) replace the safety clip (device to prevent inadvertent operation) or fit a new wire seal (or equivalent as originally fitted).

21.3 Pressure Testing of Carbon Dioxide Cylinders

21.3.1 In some cases these cylinders can remain charged for long periods and unlikely to deteriorate seriously if they have been filled with dry gas as specified in BS 5423 and kept under suitable conditions. It is not considered advisable that these cylinders should remain charged for indefinite periods without inspection and hydraulic tests.

21.4 Inspection Instructions

21.4.1 The nameplate shall include inspection instructions stating:

a) that the extinguisher shall be inspected monthly, or at more frequent intervals when circumstances require;

b) that the hose, if any, and nozzle shall be examined to ascertain that they are unobstructed;

c) that the tamper indicator shall be intact;

d) that the weight shall be checked every 6 months;

e) that the extinguisher shall be recharged immediately after use;

f) that the extinguisher shall be recharged if its loss in weight is in excess of 10 percent of the charge;

g) the weight of the charge;

h) what is included in the weights stamped on the valve body.

21.4.2 Record tag

21.4.2.1 A record tag shall be provided with each extinguisher and shall provide ample space for recording the date on which the extinguisher was last inspected and the name or initials of the person making this inspection. Supplementary tags necessary for additional instructions may be provided.

22. MARKING

22.1 The operating, recharging, and inspection and maintenance instructions shall be in the form of an etched or embossed metal nameplate, band, or a pressure-sensitive nameplate attached to the cylinder. The nameplate shall identify the unit as a carbon-dioxide hand-portable fire extinguisher and shall include the classification of the fire extinguisher.

22.2 For more detail on marking refer to Part (I) Section (1) Clauses (11.3) to (11.6) of water type fire extinguishers.

22.3 Discharge Horn

22.3.1 The discharge horn shall be marked with the model or type designation of the extinguisher with which it is intended to be used.

22.3.2 The marking specified in clause (22.3.1) may be molded in the horn, stamped in the edge of the discharge end, or applied by means of a decalcomania transfer or other form of printed adhesive tape.

23. PACKAGING

23.1 Water Type Fire Extinguishers

23.1.1 Each extinguisher shall be packed in an individual carton. The hose may be detached from the extinguisher, but it shall be packed in the same carton with the extinguisher.

23.1.2 A bracket may or may not be shipped with each extinguisher at the option of the manufacturer. If bracket is not provided, a mounting hook shall be shipped with each extinguisher.

23.1.3 These extinguishers shall not be charged when shipped, and a "caution tag" reading as follows, or the equivalent, shall be attached to each extinguisher:

"Caution" This extinguisher is not charged. Follow instructions on the nameplate for charging.

23.2 Dry Chemical Fire Extinguishers

23.2.1 Each hand-portable extinguisher shall be charged with the intended amount and type of dry chemical and with the intended quantity of expellant gas. A gas cartridge if used, shall be assembled in place. The charged extinguisher with expellant gas or cartridge shall be packed in an individual carton.

An extinguisher equipped with a flexible hose may be packed with the hose and nozzle assembly detached from the extinguisher, but the hose and nozzle assembly shall be packed in the same carton with the extinguisher.

23.2.2 Bracket or mounting hook

Same as given in 23.1.2.

23.2.3 Extinguishers weighing less than 1.5 kg and having a shell diameter of 76 mm or less are not required to be supplied with either a mounting hook or bracket.

23.3 Carbon Dioxide Fire Extinguishers

23.3.1 Each extinguisher shall be fully charged and packed in an individual carton. An extinguisher not equipped with a flexible hose may be packed without the horn attached, but the horn shall be packed in the same carton with the extinguisher. An extinguisher equipped with a flexible hose may be packed with the hose and horn assembly detached from the extinguisher, but the hose and horn assembly shall be packed in the same carton with the extinguisher.

23.3.2 Bracket or mounting hook

Same as given in 23.1.2.

24. GUARANTEES

24.1 Manufacturer shall guarantee by letter of acceptance the satisfactory performance of the fire extinguishers in accordance with this specification. The manufacturer shall also guarantee to replace without charge any or all parts defective due to faulty material, design or poor workmanship for the period of 18 months after shipment.

PART II

WHEEL TYPE FIRE EXTINGUISHERS

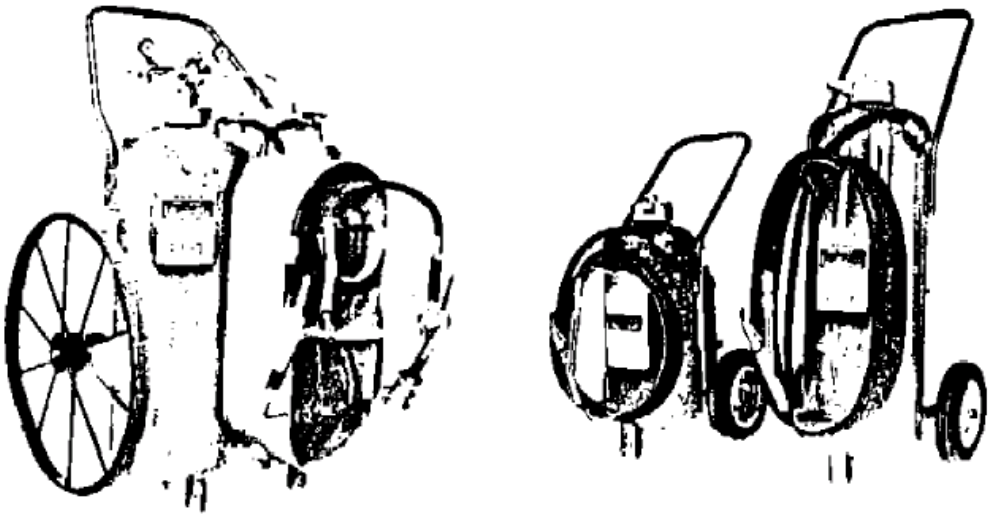
SECTION (1)

"DRY CHEMICAL POWDER EXTINGUISHERS"

25. GENERAL REQUIREMENTS

25.1 The selection of any type of wheeled type fire extinguisher is generally associated with a recognized need to provide additional protection for special hazards or large hazard areas. Where wheeled type extinguishers are to be installed, consideration should be given to mobility within the area in which it will be used for outdoor locations, models with rubber tires or wider 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. (See Fig. 3)

This type of extinguisher should be reserved for use by operators who have actually used the equipment, who have received special instructions on the use of the equipment, or who have used the equipment in live fire training.



CYLINDER-OPERATED DRY CHEMICAL TYPE

Fig. 3

25.2 Since plants are normally detached from cities and towns, therefore prompt assistance from public fire departments generally cannot be expected during the early periods of an emergency. Therefore, it is incumbent upon each plant to be equipped with large capacity extinguishing units. To reinforce the hand units, a minimum of two 68 kg dry chemical wheeled fire extinguishers should be available. Large plants may require more than two units or units larger than the 68 kg size.

It is advisable to locate these units so they will not be unduly exposed by plant equipment or vehicular traffic. They should, of course, be readily accessible at all times.

26. MATERIAL AND EQUIPMENT

26.1 Shells

For the specification of material refer to Part (1) Section (2) Clauses (12.1.1) Through (12.1.12).

26.2 Caps, Valves, and Closures

26.2.1 The fill opening of a wheeled extinguisher shall have a minimum inside diameter of 73.0 mm (nominal 76 mm thread).

26.2.2 Clauses (12.3.2) to (12.3.5) of hand fire extinguishers Part (I) Section (2) shall be followed for the above component parts.

26.3 Gaskets and "O" Rings

26.3.1 A valve of the hand wheel-type shall be so constructed that not more than one and one half turns are required to achieve the maximum flow of agent.

26.3.2 The regulator used on a wheeled extinguisher shall be factory preset and pinned or otherwise locked to reduce the risk of tampering or field adjustment. The regulator shall comply with the equirements for compressed gas regulators, UL 252.

26.4 Pressure Gage and Indicators

26.4.1 A rechargeable extinguisher, including a wheeled extinguisher, of the stored pressure type employing a single chamber for both the dry chemical and the expellant gas shall be equipped with a pressure gage to show the amount of pressure in the chamber whether the valve is opened or closed, except as provided in hand fire extinguisher Part I Section (2) Clause 12.6.3. The operating range of the gage shall reflect the operating temperature pressure relationship of the extinguisher, except that the minimum operating pressure line may be higher than the pressure that corresponds to the minimum operating temperature.

26.4.2 A cartridge-operated wheeled extinguisher provided with a nitrogen cylinder shall be provided with a gage capable of indicating cylinder pressure whether the valve is open or closed. The gage shall comply with the requirements for indicating pressure gages for compressed gas service, UL 404.

26.5 Locking Devices (Seals), Hose and Coupling

26.5.1 For the above parts refer to Part (I) Section (1) Clauses (6.12), (6.13) and (6.14).

26.6 Nozzles and Discharge Valves

26.6.1 A wheeled extinguisher shall have a shut off valve and nozzle at the end of the hose to permit intermittent discharge.

26.6.2 A discharge valve and nozzle shall have no blow holes, checks, or other imperfections.

26.6.3 Exposed valves, springs, and pins in a discharge valve shall be made of a corrosion resistant material.

26.7 Hose Retainers (Wheeled Extinguishers)

26.7.1 A hose retainer shall retain the hose and nozzle on the extinguisher so that neither the hose nor the nozzle strikes or rubs the wheels or the ground. The retainer shall permit the hose to be installed and withdrawn as intended when the extinguisher is placed in operation.

26.8 Running Gear (Wheeled Extinguishers)

The tank or container shall be secured to the running gear, consisting of the wheels, axle, tank bands, and the handle for hauling and manipulating the extinguisher.

26.9 Expellant Gases and Marking

For expellant gases and marking refer to Part (I) Section (2) Clauses (12.14) and (17).

27. OPERATION

27.1 General

Capacities of dry chemical models for Class B:C fires (refer to Appendix A) are from the range of 23 to 159 kg with the same types of agents used in the hand portable models. Listed rating vary from 40 B:C to 480 B:C, depending on the amount and type of agent. The effective horizontal range varies from 4.60 to 21.30 m with an approximate discharge time ranging from 30 to 150 sec. Multipurpose dry chemical models are usually from the capacities of 23 to 136 kg with listed ratings of 20 A to 40 A and 60 B:C to 240 B:C. The horizontal discharge range is from 4.60 to 12.70 m, and the discharge time is 30 to 60 sec.

27.2 Manufacturing and Production Tests

27.2.1 The manufacturer shall provide the necessary production tests as mentioned in hand fire extinguishers Part I Section 2 Clause 15.2, Plus the "Readability test".

27.3 Operating Instructions and Use of Code of Symbols

27.3.1 The operating instructions and use of code of symbols are the same as given in Part (I) Section (1) Clause (7.4), with the exception given below:

Exception:

A wheeled extinguisher need not have pictographic operating instructions if the same information is conveyed by words having a height of not less than 13 mm.

28. TESTS

28.1 User's Test

28.1.1 High pressure cylinders

Nitrogen cylinders used for inert gas storage used as an expellant for wheeled extinguishers shall be hydrostatically tested every five years.

28.1.2 Test pressure for high pressure cylinders. Nitrogen cylinders and carbon dioxide cylinders used with wheeled extinguishers shall be tested at 5/3 the service pressure as stamped on the cylinder.

29. INSPECTIONS

29.1 General

29.1.1 For yearly inspection of wheeled dry chemical fire extinguisher the procedure mentioned in Part (I) Section (1) Clause (9) for hand fire extinguishers shall be followed, and make certain that:

a) no visual signs of caking, lumps or foreign bodies exist into the extinguisher;

b) extinguisher body is free from damage, externally and internally and by using illuminating probe trace for corrosion or damage;

c) no physical damage to the gas cylinder which might cause corrosion, weigh the gas cylinder and check the mass against that marked on the cylinder;

d) vent holes (or other venting device) in the cap are clean;

e) the nozzle, hose and discharge tube are free from blockage and works properly;

f) all washers, diaphragms and hose(s) are in a good condition;

g) safety clip (device to prevent inadvertent operation) or equivalent is properly tight and not touched.

SECTION (2)

"CARBON DIOXIDE (Co_2) EXTINGUISHERS"

30. MATERIAL AND EQUIPMENT

30.1 General

30.1.1 For material and equipment specifications reference shall be made to UL 154 or BS 5423 for high pressure extinguishers.

31. OPERATION

31.1 General

31.1.1 For operation of wheeled type carbon dioxide fire extinguishers reference shall be made to UL 154 (1984) or BS 5423 (1987).

32. TESTS

32.1 User's Test

32.1.1 For user's test reference shall be made to Part (II) Section (1) Clause 28.

33. INSPECTIONS

33.1 General

33.1.1 For inspection of wheeled type carbon dioxide fire extinguishers reference shall be made to Part (I) Section (3) Clause (21).

APPENDIX A

DISTRIBUTION OF EXTINGUISHERS

A.1 General Requirements

A.1.1 The minimum requirement of the number of fire extinguishers needed to protect a property shall be determined as outlined in Appendix A of this Standard. Frequently, additional extinguishers may be installed to provide more suitable protection.

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

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

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

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

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

A.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.

A.1.4 On each floor level, the area protected and the travel distances are based on extinguishers installed in accordance with Tables A.2.1 and A.3.1.

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

A.2.1 Minimal sizes of fire extinguishers for the listed grades of hazards shall be provided on the basis of Table A.2.1. Extinguishers shall be located so that the maximum travel distances shall not exceed those specified in Table A.2.1.

TABLE A.2.1

	LIGHT (LOW) HAZARD OCCUPANCY	ORDINARY (MODERATE) HAZARD OCCUPANCY	EXTRA (HIGH) HAZARD OCCUPANCY
Minimum rated single extinguisher	٢.A	٢.A	٤.A*
Maximum floor area per unit of A	279 m^2	139 m^2	93 m^2
Maximum floor area for extinguisher	1045 m^2	1045 m^2	1045 m^2
Maximum travel distance to extinguisher	23 m	23 m	23 m

*** Two 9.5 L water-type extinguishers can be used to fulfill the requirements of one 4-A rated extinguisher.**

A.2.1.1 Certain smaller extinguishers that are charged with multipurpose dry chemical, 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 A.2.1.

A.2.2 Where the floor area of a building is less than that specified in Table A.2.1 at least one extinguisher of the minimum size recommended shall be provided.

A.2.3 The protection requirements may be fulfilled with extinguishers of higher rating provided the travel distance to such larger extinguishers shall not exceed 23 m.

A.2.4 For class A extinguishers rated under the rating classification system used prior to 1955, their equivalency shall be in accordance with Table A.2.5.

TABLE A.2.5

ALL WATER & LOADED STREAM TYPES	PRE-1955 RATING	EQUIVALENCY
٤,٥ to 6.5 L	A.2	١.A
9.5 L	A.1	2.A
15.0 L	A.1	3.A
19.0 L	A.1	4.A
64.5 L	A	10.A
125.0 L	A	20.A

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

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

Exception:

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

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

TABLE A.3.1

TYPE OF HAZARD	BASIC MINIMUM EXTINGUISHER RATING	MAXIMUM TRAVEL DISTANCE TO EXTINGUISHERS (m)
Light (low)	٥.B	٩
	10.B	15
Ordinary (moderate)	10.B	9
	20.B	15
Extra (high)	40.B	9
	80.B	15

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.

A.3.3 The protection requirements may be fulfilled with extinguishers of higher ratings provided the travel distance to such larger extinguishers shall not exceed 15 m.

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

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

A.4.1 Portable fire extinguishers shall not be installed as the sole protection for flammable liquid hazards of appreciable depth (greater than 0.65 cm) where the surface area exceeds 0.9 m^2.

Exception:

Where personnel who are trained in extinguishing fires in the protected hazards, or a counterpart, are available on the premises, the maximum surface area shall not exceed 1.90 m^2.

A.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 0.0929 m^2 of flammable liquid surface of the largest tank hazard within the area.

Exception:

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 A.3.1 to protect areas in the vicinity of such protected hazards.

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

A.4.4 Travel distances for portable extinguishers shall not exceed 15. m.

A.4.4.1 Scattered or widely separated hazards shall be individually protected. An extinguisher in the proximity of a hazard shall be carefully located to be accessible in the presence of a fire without undue danger to the operator.

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

1) For dip tanks containing flammable or combustible liquids exceeding 568 L liquid capacity or having a liquid surface exceeding 0.38 m^2 see NFPA 34, Standard for Dipping and Coating Processes Using Flammable or Combustible Liquids, for requirements of automatic extinguishing facilities.

TABLE A.4.5

TYPE AND CAPACITY	PRE. 1955	EQUIVALENCY
Carbon dioxide		
Under 3.0 kg	B-2	1-B
3.0 kg	B-2	2-B
4.5 to 5.50 kg	B-2	2-B
	B-1	2-B
11.5 to 12.0 kg	B-1	5-B
23.0 kg	B-10	10-B
34.0 kg	B-1	10-B
45.5 kg	B	10-B
Dry chemical		
2.0 kg to 3.0 kg	B-2	2-B
3.5 kg	B-2	5-B
4.5 kg to 7.0 kg	B-1	5-B

9.0 kg	B-1	10-B
13.5 kg	B-1	20-B
34.0 kg and up	B	40-B

A.5 Fire Extinguisher Size and Placement for Class C Hazards

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

Note:

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

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

Exception:

Carbon dioxide extinguishers with metal horns shall not carry any "C" classification.

A.6 Size and Placement for Class D Hazards

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

A.6.2 Extinguishing equipment shall be located not more than 23 m from the Class D hazard.

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

A.7 Classification

A.7.1 The classification and rating is found on the label 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 9.5 L water rated extinguisher.

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

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

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

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

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

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

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

A.8 Class A Extinguisher Distribution

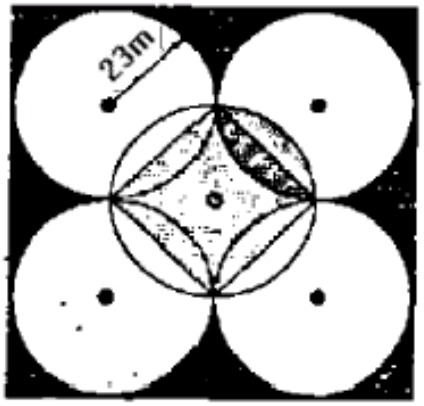
A.8.1 Table A.2.1 is a guideline for determining the minimum number and rating of extinguishers for Class A fire protection needs in accordance with the occupancy hazard. In certain instances, through a fire protection analysis of specific areas, process hazards, or building configurations, extinguishers with higher ratings may be required. This does not mean, however, that the recommended maximum travel distances can be exceeded.

A.8.2 Where the floor area of a building is less than 279 m^2, at least one extinguisher of the minimum size recommended should be provided.

The first step in calculating Class A fire extinguisher needs is to determine the proper class of occupancy (light, ordinary, or extra hazard). Depending on the rating of the extinguisher (1-A to 40-A), the maximum area that it will protect can be determined. For example, each 9.5L stored pressure water extinguisher (rated 2-A) will protect an area of 279 m^2 in an ordinary hazard occupancy. The requirements in Table A-2.1 also specify that the travel distance (actual walking distance) from any point to the nearest extinguisher shall not exceed 23 m. It is necessary to select extinguishers that fulfill both the distribution and travel distance requirements for a particular occupancy classification.

A.8.3 If a building floor area was unobstructed and circular in shape with a radius of 23 m it would be possible to place one extinguisher at the center without exceeding the 23 m travel distance. In that case an area of 1644 m^2 could be assigned to one extinguisher of adequate A rating, e.g., Light Hazard 6-A, Ordinary Hazard 20-A (no 12-A extinguisher ratings), Extra Hazard 20-A (no 18-A extinguisher ratings). However, as buildings are usually rectangular in shape, the largest square area that can be formed with no point more than 23 m from the center is 1045 m^2 which is the area of a square 32 × 32 m inscribed within a 23 m radius circle (see Fig. A-8.3).

A.8.4 The following examples of distribution illustrate the number and placement of extinguishers according to occupancy type and rating. The sample building is 46 × 138 m giving a floor area of 6348 m^2. Although several different ways of placing extinguishers are given, a number of other locations could have been used with comparable results.



THE DOTTED SQUARES SHOW THE MAXIMUM AREA 1 045 m² THAT AN EXTINGUISHER CAN PROTECT WITHIN THE LIMITS OF THE 23 m RADIUS

Fig. A.8.3

The area that can be protected by one extinguisher with a given A rating is shown in Table A.8.4. These values are determined by multiplying the maximum floor area per unit of A shown in Table A.2.1 by the various A ratings, until a value of 1045 m² is exceeded.

TABLE A.8.4 - MAXIMUM AREA TO BE PROTECTED PER EXTINGUISHER, m²

CLASS A RATING SHOWN ON EXTINGUISHER	LIGHT (LOW) HAZARD OCCUPANCY	ORDINARY (MODERATE) OCCUPANCY	EXTRA (HIGH) HAZARD OCCUPANCY
1A	---	---	---
2A	557	279	---
3A	836	418	---
4A	1045	557	372
6A	1045	836	557
10A	1045	1045	929
20A	1045	1045	1045
30A	1045	1045	1045
40A	1045	1045	1045

Note:

1045 is considered a practical limit.

A.8.5 The first example demonstrates placement at the maximum protection area limits 1045 m² allowed in Table A.2.1 for each class of occupancy. Installing extinguishers with higher ratings will not affect distribution or placement.

Example 1:

$$\frac{6270}{1045} = 6$$

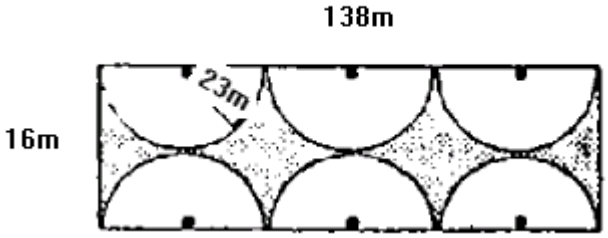
4.A Extinguishers for Light Hazard Occupancy

10.A Extinguishers for Ordinary Hazard Occupancy

20.A Extinguishers for Extra Hazard Occupancy

A.8.6 This placement, along outside walls, would not be acceptable because the travel distance rule

is clearly violated (see Fig. A.8.6). Relocation and/or additional extinguishers are needed.



A DIAGRAMMATIC REPRESENTATION OF EXTINGUISHERS LOCATED ALONG THE OUTSIDE WALLS OF A 138- BY 46-m BUILDING. (THE DOTS REPRESENT EXTINGUISHERS.) THE SHADED AREAS INDICATE "VOIDS" WHICH ARE FARTHER THAN 23 m TO THE NEAREST EXTINGUISHER

Fig. A.8.6

A.8.7 Examples 2 and 3 are for extinguishers having ratings which correspond to protection areas of 577 and 279 m^2 Respectively. the examples show only one of many ways these extinguishers could be placed. As the number of lower rated extinguishers increases, meeting the travel distance requirement generally becomes less of a problem. Similar examples could be worked out for protection areas of (372 and 418 m^2), as required by Table A.2.1.

Example 2:

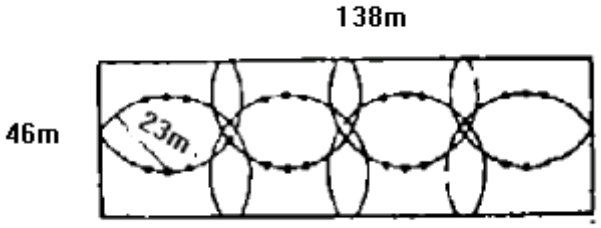
$\frac{6270}{557} = 12$

2.A Extinguishers for Light Hazard Occupancy

4.A Extinguishers for Ordinary Hazard Occupancy

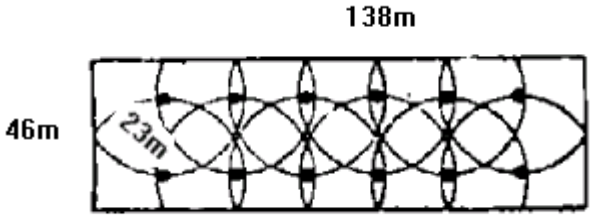
6.A Extinguishers for Extra Hazard Occupancy

A.8.8 Extinguishers could be mounted on exterior walls or, as shown in Fig. A.8.8(a), on building columns or interior walls, and conform to both distribution and travel distance rules.



REQUIREMENTS FOR BOTH TRAVEL DISTANCE AND EXTINGUISHER DISTRIBUTION ARE MET IN THIS CONFIGURATION REPRESENTING 12 EXTINGUISHERS MOUNTED ON BUILDING COLUMNS OR INTERIOR WALLS

Fig. A.8.8(a)



EXTINGUISHERS GROUPED TOGETHER

Fig. A.8.8(b)

Example 3:

$\frac{6270}{279} = 24$

1.A Extinguishers for Light Hazard Occupancy

2.A Extinguishers for Ordinary Hazard Occupancy

3.A Extinguishers for Extra Hazard Occupancy

A.8.9 This arrangement, illustrated in Fig. A.8.8(b), shows extinguishers grouped together on building columns or interior walls in a manner that still conforms to distribution and travel distance rules.

A.9 Class B Extinguisher Distribution

A.9.1 Normal Class B fire hazards fall into two quite different general categories regarding requirements for extinguishers. One condition is where the fire does not involve flammable liquids in appreciable depth, such as spilled fuel on an open surface, a fire involving vapors issuing from a container or piping system, or a running fire from a broken container.

A.9.2 The other condition is where the fire involves flammable liquids in appreciable depth [defined as a depth of liquid greater than 63 cm, such as fires involving open tanks of flammable liquids commonly found in industrial plants (dip tanks used for coating, finishing, treating, or similar processes)].

A.9.3 In situations where flammable liquids are not in appreciable depth, extinguishers should be provided according to Table A.3.1.

Once the type of hazard is determined, the selected Class B extinguisher must have a rating equal to or greater than that specified, and be so located that the maximum travel distance is not exceeded.

A.9.4 The reason the basic maximum travel distance to Class B extinguishers is 15.25 m as opposed to 23 m for Class A extinguishers is that flammable liquid fires reach their maximum intensity almost immediately. It is imperative that the extinguisher be brought to the fire in a much shorter period of time than allowed for a slower developing Class A fire.

A.9.5 Even though Table A.3.1 specifies maximum travel distances for Class B extinguisher placement, judgment should be exercised in actually establishing them. The extinguisher may be placed closer to the hazard it is protecting, up to a point where the extinguisher itself might be involved in the fire or access to it made difficult because of flame, heat, or smoke.

A.9.6 Where an entire room or area is judged to be a Class B hazard (such as an automobile repair garage), extinguishers should be placed at regular intervals so that the maximum walking distance from any point to the nearest extinguisher does not exceed the travel distances specified in Table A.3.1. For fires in flammable liquids of appreciable depth, a Class B fire extinguisher is provided on the basis of two numerical units of Class B extinguishing potential per 0.0929 m2 of flammable

liquid surface for the largest tank within the area. The travel distance requirements in Table A.3.1 should also be used to locate extinguishers for spot hazard protection; however, the type of hazard and the availability of the extinguisher must be carefully evaluated.

A.9.7 One extinguisher can be installed to provide protection against several hazards, provided travel distances are not exceeded. Where hazards are scattered or widely separated and travel distances are exceeded, then individual protection should be installed according to the square meter rule.

A.9.8 When fixed Class B extinguishing systems are installed, the provision of portable fire extinguishers may be waived for that one hazard, but not for the structure, other special hazards, or the rest of the contents. Sometimes a burning tank can result in burning liquid spills outside the range of the fixed equipment, or the fire may originate adjacent to the tank rather than in its liquid content. Therefore, having portable extinguishers available is desirable, even though hazards of this type are protected with fixed extinguishing systems.

A.9.9 The selection of the proper type and size of Class B extinguishers for fires in pressurized fuels is made on the basis of the recommendations of the manufacturers of this specialized equipment available for that type of hazard. Special nozzle design and rates of agent application are necessary in order to be able to cope with hazards of this magnitude. Also, it is generally undesirable to attempt to extinguish pressurized fuel fires unless there is reasonable assurance that the source of fuel can be promptly shut off, thus avoiding a possible explosion. The travel distances for hand portable extinguishers should not exceed those specified in Table A.3.1.

A.10 Class C Extinguisher Distribution

A.10.1 To protect extinguisher operators in situations where live electrical equipment may be encountered, extinguishers with Class C ratings are required. Extinguishers so rated utilize a nonconducting extinguishant. Types of extinguishers possessing Class C ratings employ carbon dioxide, dry chemical agents.

A.10.2 When the power to a piece of electrical equipment is cut off, the fire changes character to that of a Class A, Class B, or a combined Class A and B fire depending on the nature of the burning electrical components and any material burning in the immediate vicinity.

A.10.3 De-energizing electrical equipment eliminates the possibility of shock hazards to the extinguisher operator should the operator accidentally come into physical contact with the equipment, or should the operator bring any conductive part of an extinguisher within arcing distance. De-energizing also eliminates fault currents from prolonging the fire or from being a source of reignition. Switches or circuit breakers that cut electric power to specific equipment can prevent hazardous side effects (e.g., plunging an entire multistory building into darkness or shutting down the essential electric power that supplies life support equipment, etc.). Often, fires involving an electrical component are relatively minor and, by a short application of a Class C extinguishant, can be effectively extinguished without disturbing electrical continuity.

A.10.4 The capacity of the extinguishers supplied for each major Class C hazard situation must be individually judged according to:

a) The size of the electrical equipment;

b) the configuration of the electrical equipment (particularly the enclosures of units) that influences agent distribution;

c) the effective range of the extinguisher stream;

d) the amount of Class A and B material involved.

Each of these factors influences the amount and type of agent needed, the desired rate of agent discharge, the associated duration of application, and the potential wastage factors.

A.10.5 For large installations of electrical apparatus where the power continuity is critical, fixed fire protection is desirable. At locations where such fixed systems are installed, it is practical to also provide Class C portable fire extinguisher units to handle quickly discovered fires: obviously, the

number and size of these units can be reduced under such conditions.

A.11 Class D Extinguisher Distribution

A.11.1 For Class D hazards, the availability of special portable extinguishers (or equivalent equipment to contain or extinguish any fire developing in a combustible metal) is particularly important. Extinguishing equipment for such fires should be located no more than 23 m from the hazard.

A.11.2 Use of the wrong extinguisher can instantly increase or spread the fire. Quantitatively, the amount of agent needed is normally measured by the surface area of combustible metals that might become involved, plus the potential severity of the fire as influenced by the shape and form of the metal. Because fires in magnesium fines are more difficult to extinguish than fires involving magnesium scrap, the amount of agent needed to handle fires in magnesium fines is correspondingly greater. Extinguishers labeled for Class D fires are not necessarily equally effective on all combustible metal fires, extinguishers so labeled might be hazardous when used on some metal fires. Unless the effect of the extinguishing agent is known for the metal being considered, tests should be made with representative material.