
Overview of Portable Fire Extinguishers

Course No: M03-013

Credit: 3 PDH

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OVERVIEW OF PORTABLE FIRE EXTINGUISHERS

Abstract

Portable fire extinguishers are designed to put out small fires in their incipient stage. A small fire, if not checked immediately, will soon spread out of control. The portable fire extinguisher is one of the most valuable fire-protection appliances in use today.

For a fire extinguisher to be effective, the following conditions must be met:

- The extinguisher must be right for the type of fire;
- It must be located where it can be easily reached;
- It must be in good working order;
- The fire must be discovered while it is still small;
- The person using the extinguisher must be trained to use it properly.

The provisions of fire protection extinguishers requirement's are subject to certain statutory requirements of Occupational Health and Safety Act (OSHA) and in accordance with the recommendations of National Fire Protection Association (NFPA). The National Fire Protection Association (NFPA) has established the requirements for the number, size, placement, performance, and maintenance of portable fire extinguishers. These requirements are contained in NFPA 10, "Standard for Portable Fire Extinguishers". Within this Standard it is stated that the selection of fire extinguishers for a given situation is determined by the character of the fires anticipated to be encountered, the construction and occupancy of the property to be protected, the ambient temperature of the area where the extinguisher will be located, and other factors that may dictate the selection of a particular type of extinguisher.

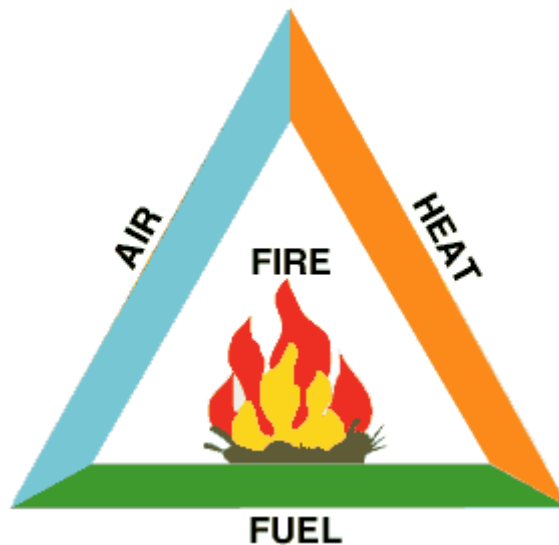
This course is derived from the extract information of NFPA 10 and is meant to help you with proper selection, proper use, and proper identification of fire extinguishers. It is not intended to abrogate the specific requirements of NFPA 10 and other standards.

OVERVIEW OF PORTABLE FIRE EXTINGUISHERS

For a fire to occur, all three of the following statements must be true:

- Flammable or combustible material is present (Fuel).
- The material is mixed with air in the proportions required to produce an ignitable mixture (oxygen - 16% or more).
- The release of energy is sufficient to ignite the mixture (Heat).

The above conditions constitute the well-known "fire triangle" (Figure below).



Remove any of these factors and the fire cannot occur or will extinguish itself if it is already burning.

FIRE EXTINGUISHING METHODS

Fires can be extinguished in one of four ways:

1. **By cooling:** Water is used to cool the burning material below the temperature at which it starts to burn
2. **By smothering:** Carbon dioxide (CO₂) or foaming agents are used to smother the burning material so that air is excluded
3. **By removing the fuel:** Fuel can be any combustible material-solid, liquid or gas. In place of usage you require these elements but definitely in event of fire a means to cut the fuel must be considered for instance "turning off a fuel line."
4. **By disrupting:** Interrupting the chemical chain reaction can extinguish the fire.

Portable fire extinguishers are intended as a first line of defense to cope with fires of limited size. The fire extinguishers work by either removing one of the three elements needed to sustain combustion or by interrupting the reaction between the elements. The minimum percentage of oxygen in the atmosphere required to sustain a fire is 16%.

CLASSIFICATION OF FIRES

To select the proper fire extinguisher, you must first become familiar with the different classes of fires.

NFPA classify fires into four basic categories - designated Class - A, B, C, and D as described below.

TYPES OF FIRES	
CLASS - A	Ordinary combustible materials such as wood, paper, cloth, rubber, trash, many plastics including FRP and other ordinary materials.
CLASS - B	Flammable / combustible* liquids and gases such as petroleum greases, tars, oils, paints, gasoline, solvents, lacquers, alcohols and flammable gases.
CLASS - C	Fires involving energized electrical equipment such as appliances, wiring, switches, panel boxes, outlets, lamps and power supplies.
CLASS - D	Combustible metals such as magnesium, titanium, zirconium, sodium, lithium and potassium. (Normally not for household use)
CLASS - K	Fires in cooking appliances that involve combustible cooking media such as vegetable or animal oils and fats.

Note that Class - A, B, and C categories are not subdivided any further, so it may be easier to think of them as (A) solids, (B) liquids, and (C) electrical fires.

*The difference between flammable and combustible is the temperature at which they give off vapors, their flashpoint. A flammable liquid will give off vapors at or below 100°F. A combustible liquid will give off vapors when over 100°F.

FIRE EXTINGUISHER TYPES & USES

It is vital to know what type of extinguisher you are using. Using the wrong type of extinguisher for the wrong type of fire can be life-threatening. For example, you spray water on a grease fire, the water will cause the grease to splatter and the fire may spread; similarly, if you douse live electrical equipment with water, you are putting yourself in danger of electrical shock. Turning off the electricity will change the status of a Class - C fire to a Class - A and/or B fire.

The effectiveness of a fire extinguisher on a particular fire depends on the amount and type of agent in the extinguisher. Matching the agent to the fire begins with an understanding of how fires are classified.

There are six different types of fire extinguishers and are classified by the type of fire on which they can be used. Each extinguisher and extinguishing agent has certain advantages and disadvantages associated with its use and limitations on what it can accomplish.

Type of Extinguisher: Stored-pressure water Extinguishers

Suitability: Class - A fires

Features: Stored pressure water type extinguishers contain water under pressure and are usually quite large and heavy. Use this type is recommended when burning combustibles require a cooling and wetting action. Water extinguishers are effective against fires involving: wood, paper, plastic, rubber or textiles.

You cannot use a water extinguisher for a Class -B fire, (flammable liquids), as flammable liquids are lighter than water and will float on the surface of the water. This will simply aid in the spread of the fire.

You cannot use a water extinguisher on a Class - C fire, (electrical fire), because you run the risk of receiving an electrical shock. Water is an electrical conductor so as the water spreads out, the chance of electrocution increases. A stored pressure distilled

water mist extinguisher is safe to use around energized electrical fires provided that you do not place any portion of the extinguisher within ten inches (10") of the electrical source. The misting nozzle provides safety from electric shock and reduces the scattering of burning materials.

Type of Extinguisher: Carbon-dioxide (CO₂) Extinguishers

Suitability: Class - B & C fires

Features: The use of CO₂ as an extinguishing agent is based on the principle of lowering the percentage of oxygen within the fire area. The fire is extinguished by a reduction of the oxygen content from the normal 21 percent to 15 percent. Since CO₂ is heavier than air, it has the ability to penetrate into loose material and confined spaces. The rapid expansion of the gas on discharging produces a refrigerating effect, as indicated by the CO₂ snow, which has a temperature of minus 79°C (-110°F). This snow turns into gas and in the process absorbs heat from the surrounding atmosphere.

Uses: Carbon Dioxide (CO₂) extinguishers are used for Class - B and C fires. CO₂ extinguishers have an advantage over other extinguishers (e.g. dry chemical type) since they don't leave a harmful residue - a good choice for electrical machinery and apparatus, and any situation where water would be damaging to the material after the fire is extinguished. It is however not as effective outdoors as it is indoors due to the effect of wind on the agent.

Precautions in Using CO₂: The characteristics of carbon dioxide are such that certain precautionary measures are necessary:

- So far as safety to life is concerned, CO₂, if not breathed in excessive amounts, is not dangerous; however, a concentrated atmosphere inhaled for several minutes will produce suffocation. Inhaling CO₂ at concentration above 9 percent can render a person helpless almost immediately. As CO₂ design concentrations for fire extinguishing generally exceed 25 percent, it is potentially dangerous for personnel to be in an area protected by a CO₂ system.
- When carbon dioxide (CO₂) converts from its liquid state in a fire extinguisher, to its vapour state in the atmosphere, static electricity is created. The hose and horn assembly of the extinguisher is designed to conduct and dissipate this static charge to prevent harm to the operator and the generation of a

static electrical spark. The spark will take place if the extinguisher's grounding state is altered during operation; that is, if you place the extinguisher on the ground while operating the unit or if you come into contact with another grounded object while operating the unit. The preferred way to operate this extinguisher is to drag the extinguisher into and out of the fire area while discharging the unit; thus the extinguisher remains grounded at all time.

- CO₂ is stored in a liquid state under very high pressure; and when discharged, the rapid expansion produces a refrigerating effect to the extent that one may obtain a "burn," or frostbite from coming in contact with a metal part through which the gas has passed. The discharge pressure is so great that it is not uncommon for bits of dry ice to shoot out the nozzle. They don't work very well on class-A fires because they may not be able to displace enough oxygen to put the fire out, causing it to re-ignite.

Type of Extinguisher: Dry chemical Extinguishers

Suitability: Class - A, B and C fires

Features: Dry-chemical extinguishers expel a finely powdered dry chemical which, on striking flame, releases many times its volume in nontoxic fire-extinguishing gases similar to CO₂. The powder consists principally of bicarbonate of soda which has been chemically processed to make it free-flowing. The extinguishers contain a cartridge of CO₂ or nitrogen (depending on size) to expel the dry chemical. These extinguishers can be used for electrical fires, both in rotating machinery and other equipment. However, the powder remaining after the fire is extinguished is difficult to clean from motor or generator windings. These extinguishers are effective on fires of flammable liquids in vats and pools, spilled fires on floors, or in any situation where the compound stream can be swept across the burning surface.

Dry chemical extinguishers have an advantage over CO₂ extinguishers since they leave a non-flammable substance on the extinguished material, reducing the likelihood of re-ignition.

These extinguishers are the most versatile type of portable extinguishers, effective in Class - A, B and C fires. Use of a dry chemical extinguisher is not affected by wind like CO₂ extinguishing agents.

The compact nature of these fire extinguishers, ranging from the 0.9kg domestic model up to the 9kg industrial model, enables them to be utilized in numerous applications.

Type of Extinguisher: Multipurpose Extinguishers

Suitability: Class - A, B, C & D fires

Features: Multipurpose powders fall into three distinct groups:

1. BC Type
2. ABC Type
3. D Type (powder)

BC Type: These are based on sodium bicarbonate or potassium bicarbonate compounds. These are effective on Class - B (flammable liquid/liquefiable solids) and Class - C (flammable gas) fires. The BC variety leaves a mildly corrosive residue which must be cleaned immediately to prevent any damage to materials.

Potassium bicarbonate BC Powder (often called Purple K) is twice more effective than sodium bicarbonate powder. Urea based Potassium Bicarbonate BC Powder (commonly known as Monnex) is still more effective. The unique property of Monnex is that within the combustion zone, the high temperature causes the powder to explode and break into minute particles giving a very large surface area which affects the extinction of the flames instantaneously.

ABC Type: ABC-rated extinguishers, commonly called multi-purpose or tri-Class - Extinguishers, are capable of fighting all three classes of fire. These are mixtures of ammonium phosphate and ammonium sulphate, ground to selected particle sizes and treated with flow promoting and moisture repellent additives. They are acidic in nature and are effective on Class - A (flammable solids), Class - B (flammable liquid/liquefiable solids) and Class - C (flammable gas) fires. They are electrically non-conductive.

In addition to the particle surface extinguishing effect of a Class - B powder, Class - ABC powders have low melting/decomposition points in the order of 150°C to 180°C. When these powders are applied to hot and smouldering surfaces, the particles fuse and swell to form a barrier which excludes oxygen and thereby completes the extinguishing process and prevents re-ignition. Different blends are available, the more ammonium phosphate, the more effective it is.

Class - D: Class -D powder is a special form of fire fighting agent that is used for combustible metal fires. Three main types are in use-

- Sodium Chloride for fires involving alkali metals such as sodium and potassium, also zirconium, uranium and powdered aluminium. It extinguishes a metal fire by fusing to form a crust.
- Copper extinguishing agent specially developed for fighting lithium and lithium alloy fires. The copper compound smothers the fire and provides an excellent heat sink for dissipating heat.
- Ternary Eutectic Chloride developed specifically for uranium fires works similar to Sodium Chloride. It is extremely toxic.

Caution:

- Although modern powders are non-toxic, the discharge of a powder extinguisher in a confined space can cause a sudden reduction of visibility which may temporarily jeopardize escape, rescue or other emergency action. Where there is a possibility that personnel may be exposed to a dry-chemical discharge, suitable safeguards shall be provided to ensure prompt evacuation of such locations, and also to provide means for prompt rescue of any trapped personnel.
- The agent is slightly corrosive and may damage sensitive computer/electronic equipment.
- Sodium Bicarbonate Powders, unless specially treated, are not compatible with foams.
- The chemical extinguishers have the drawback of often ruining sensitive equipment because it leaves behind the secondary residues. But since the priority is on safety the ABC multi-purpose extinguishers are widely used mainly because it not only reduces any confusion about what to use and where (saving time), but also covers the possibility that, for example, any Class - B fire that spreads from the stove to the curtains (Class - A) can be fought with the same extinguisher.
- The powder has no cooling properties, one of the reasons it is ineffective against class F fires as although it can extinguish the flame, the heat of the fat will cause immediate flashback. The lack of a securing blanket means there is a re-ignition risk.

Type of Extinguisher: Aqueous Foam Extinguishers

Suitability: Class - B fires

Features: Firefighting foam is a mass of gas-filled bubbles which is lighter than flammable liquids. The foam can float on all flammable liquids and produces a continuous layer of vapor-sealing, water-bearing material for purposes of halting or preventing combustion. Two main types of foam are available. These are low- and high-expansion foams:

Low-Expansion Foam - The normal expansion ratios for low expansion foam range from 4:1 to 12:1. The expansion ratio is the volume of foam generated, divided by the volume of solution used. The primary method of extinguishment with low-expansion foam is smothering, although cooling is a factor. The minimum foam depth for extinguishing a fire is about 6 mm (1/4 in) with an average depth of 76 mm (3 in) or more.

High-Expansion Foam - The normal expansion ratios for high- expansion foam range from 100:1 up to 1000:1. The primary method of extinguishment is the smothering and cooling effect of water. High-expansion foam is particularly suited as a flooding agent for use in confined spaces, for transporting wet foam masses to inaccessible places, and for volumetric displacement of vapor, heat, and smoke.

Limitations of Foam

Foams are primarily used for control and extinguishment of fires involving flammable or combustible liquids, and the following criteria must usually be met for the foam to be effective:

- The liquid must be below its boiling point at the ambient condition of temperature and pressure.
- If foam is applied to liquids with a bulk temperature higher than 100 EC (212 EF), the foam forms an emulsion of steam, air, and fuel. This may produce a fourfold increase in volume.
- The foam must not be highly soluble in the liquid to be protected, and the liquid must not be unduly destructive to the foam.
- The liquid must not be water reactive.
- The fire must be a horizontal surface fire as falling fuel fires cannot be extinguished by foam unless the fuel has a relatively high flashpoint and can

be cooled to extinguishment by the water in the foam. However, some foams are capable of following a flowing fuel fire.

The following general rules apply to the application and use of ordinary air foams:

- Most foams are adversely affected by contact with vaporizing liquid extinguishing agents and by many dry chemical agents. These materials should not be used simultaneously with air foams. Gases from decomposing plastic materials have a similar breakdown effect on foams.
 - Foam solutions are not recommended for use on electrical fires as the foam is conductive.
 - High-expansion foam can seem to completely submerge and apparently extinguish fires, while the fire continues to burn quietly beneath it. This can occur when burning vapors beneath the foam support the foam blanket on heated air.
 - Foam extinguishers are red with a blue-band or label.
-

Type of Extinguisher: Halon 1211 and halogenated agent-type stored

Suitability: Class - B fires

Features: Halon type extinguishers chemically interrupt the flaming process by displacing the oxygen from the fire. These extinguishers, like CO₂, are very popular for use around computer/electronic equipment, because they leave no residue. Unfortunately, halogenated extinguishing agents are chlorofluorocarbons, and are contributing to the depletion of atmospheric ozone. Because of international concerns of ozone depletion and their damaging effect on the environment, Halon fire extinguishers are banned and rarely used anymore.

To summarize, the table below will help you to match types of extinguishers to different classes of fire.

Some extinguishers are suitable for one class of fire only; others can fight two or even three classes of fire. However, no extinguisher is suitable to fight all four classes of fire.

Fire Classification	Extinguisher Type
Extinguishers for Class - A Fires	The following extinguishers are suited to Class - A fires: • Water type • Distilled water mist • Multipurpose dry chemical type
Extinguishers for Class - B Fires	The following extinguishers are suited to Class - B fires: • Aqueous film-forming foam (AFFF) • Film-forming fluoroprotein foam (FFFP) • Carbon dioxide • Dry chemical type
Extinguishers for Class - C Fires	The following extinguishers are suited to Class - C fires: ▪ Dry chemical ▪ Carbon dioxide (CO₂) Caution: Carbon dioxide fire extinguishers equipped with metal horns are not considered safe for use on fires in energized electrical equipment.
Extinguishers for Class - D Fires	The Dry Powder extinguishers use specially designed chemical approved for use on the specific combustible metal.

These are only the common types of fire extinguishers. There are many others to choose from. Base your selection on the classification and the extinguisher's compatibility with the items you wish to protect. Multipurpose ABC type extinguishers, which use a chemical powder to smother the source of the fire, are the favored

choice today. Not only these are effective, it is easier for an inexperienced user to direct the discharge plume to the base of the flame from a safe distance.

EXTINGUISHER'S RATING

Along with the classification, the numerical rating of an extinguisher is an important factor in the proper selection of an extinguisher. The rating is a measure of the extinguishing potential of the fire extinguisher and is developed on the basis of comparative fire tests (Reference UL 711, Standard for Rating and Testing of Fire Extinguishers).

Class - A extinguisher rating refers to the amount of water that the extinguisher holds and, thus, the size of fire it is able to put out. You find Class A extinguishers with ratings such as 1-A, 2-A, 3-A, 4-A, 6-A, 10-A, 20-A, 30-A and 40-A. The 4-A extinguisher holds 4 gallons of water and is, thus, expected to put out twice as much fire as a 2-A extinguisher holding 2 gallons of water.

Class B extinguisher rating refers to the approximate number of square feet of a flammable liquid fire that a non-expert person can expect to extinguish. You find Class B extinguishers with ratings such as 1-B, 2-B, 5-B, 10-B, 20-B, 30-B, 40-B and up to 640-B. A 40-B extinguisher, for example, is effective for putting out a flammable liquid fire covering up to 40 square feet.

Fire extinguishers can also be made to extinguish more than one type of fire. For example, you might have an extinguisher with a label that reads 2A:5B. This would mean this extinguisher is good for Class - A fires with 2 gallon equivalence and it is also good for Class - B fires with a 5 square feet equivalency.

The higher the rating number, the more fire it can put out, but high-rated units are often the heavier models. Make sure you can hold and operate the extinguisher you are buying.

Note that only the Class - A and Class - B classifications carry numerical ratings. There are no numerical ratings associated with Class - C, D, or K classifications. In the typical rating of an extinguisher, for example 3A-40B: C, the 3 and the 40 indicate the extinguishing potential of the unit for a Class - A and Class - B fire respectively. The C indicates that the extinguishing agent will not conduct electricity, preventing shock to the user if used on energized electrical equipment.

Refer to NFPA-10 when determining the rating necessary for the floor area requiring protection.

SELECTION PROCESS

As it has been said, using the wrong extinguisher to fight a fire can have serious results. Selection of the best extinguisher for a given situation is based on a variety of factors.

- Nature of the combustibles or flammables that might be ignited.
- Potential severity (size, intensity, and speed of travel) in any resulting fire.
- Effectiveness of the fire extinguisher on that hazard.
- Ease of use.
- Availability of personnel to operate the extinguisher.
- Ambient temperature conditions and other special atmospheric considerations (wind, draft, or presence of fumes).
- Suitability of the fire extinguisher to its environment.
- Any anticipated adverse chemical reaction between the extinguishing agent and burning materials.
- Any health and operational safety concerns.
- Upkeep and maintenance requirements for the fire extinguisher.

Follow these steps in selecting your extinguishers:

Step # 1

Conduct an assessment to identify your fire hazards and determine the type of extinguishers needed. The extinguishers you select must match the classes of fire most likely to occur. Remember to check your material safety data sheets to identify materials that could catch fire. The section on fire fighting measures gives information on the type of extinguishing agent needed to put out a fire involving the material. The fire hazards could be classified into 3 broad categories:

- **Light (Low) Hazard:** Light hazard occupancies are locations where the total amount of Class - A combustible materials, including furnishings, decorations, and contents, is of minor quantity. This can include some buildings or rooms occupied as offices, classrooms, churches, assembly halls, guest room areas of hotels/motels, and so forth.

- **Ordinary (Moderate) Hazard:** Ordinary hazard occupancies are locations where the total amount of Class - A combustibles and Class - B flammables are present in greater amounts than expected under light (low) hazard occupancies. These occupancies could consist of dining areas, mercantile shops and allied storage, light manufacturing, research operations, auto showrooms, parking garages, workshop or support service areas of light (low) hazard occupancies, and warehouses containing Class I or Class II commodities as defined by NFPA 13, Standard for the Installation of Sprinkler Systems.
- **Extra (High) Hazard:** Extra hazard occupancies are locations where the total amount of Class - A combustibles and Class - B flammables present, in storage, production, use, finished product, or combination thereof, is over and above those expected in occupancies classed as ordinary (moderate) hazard. These occupancies could consist of woodworking; vehicle repair; aircraft and boat servicing; cooking areas; individual product display showrooms; product convention center displays; and storage and manufacturing processes such as painting, dipping, and coating, including flammable liquid handling.

Step # 2

Determine the size of potential fires in each area and how fast they could spread.

All fire extinguishers are rated according to the extinguishing agent's effectiveness in controlling one or more classes of fire.

- **Extinguishers for Class - A and Class - B** fires are rated for the size of fire they can handle. This rating appears on the label and is expressed as a number from 1 to 40 for Class - A fires and 1 to 640 for Class - B fires. The higher the number, the larger the fire the extinguisher can put out. However, higher the rating, the heavier shall be the extinguisher. Extinguishers rated 2A: 10B: C are suitable for home or office fires.

(*: Refer the following Section 'Placement and Location of Fire Extinguishers" for further information.)

- **Extinguishers for Class - C** fires depend upon such factors as the size of the electrical equipment, how it is constructed, whether it is enclosed, and the nature of other combustible materials in the area.
- **Extinguishers for Class - D** fires should be carefully selected based on information in the material safety data sheet and the manufacturer's

recommendations. The amount of agent needed depends on the surface area of the metal, and its shape and form.

Consult the local fire authority or NFPA 10 to determine the number of fire extinguishers you need for your workplace.

Step # 3

Consider other factors that affect selection:

- Possible health and safety hazards from chemical reactions between the extinguishing agent and the burning materials, or when using certain types of extinguishers in unventilated areas. Extinguishers with long-range nozzles, for example, are available for use in confined spaces or other hazardous areas.
- Atmospheric conditions in areas where extinguishers are located. Extreme cold, for example, could make water-based extinguishers ineffective. Where there may be corrosive fumes, select fire extinguishers that can resist corrosion, or provide protection against corrosion.
- Physical abilities of the user. The size and weight of extinguishers should match the physical abilities of those who have to use them. Extinguishers shouldn't be too heavy for employees to handle.

Step # 4

Make sure that your extinguishers:

- Are approved by a recognized laboratory (replaced or new extinguishers must be approved by the Underwriters' Laboratories of Canada or ULC, and labelled as such);
- Do not contain carbon tetrachloride, methyl bromide, or other toxic vaporizing liquids.

Step # 5

Do a reassessment whenever you make changes in your workplace, e.g., when you change a work process or the materials you are using.

SIZE, PLACEMENT & LOCATION OF EXTINGUISHERS

No matter how carefully they are selected, fire extinguishers won't be of any use if they can't be reached in an emergency. Once the extinguisher choice is made based

on the classes of fires likely to occur in the immediate work area, the next important step is the placement of fire extinguishers. The placement should be such that they are readily accessible to workers without subjecting them to possible injury. Placement is best accomplished through a physical survey of the area to be protected. In general, selected locations should be visible, accessible, and uniformly distributed.

NFPA 10 (E3) requires that the minimum number of extinguishers be installed in a manner that fulfill both the distribution and travel distance requirements for a particular occupancy classification.

Class - A Fire Extinguisher Distribution

Table below is a guideline for determining the minimum number and rating of fire extinguishers for Class - A fire protection needs.

Criteria	Light Hazard	Ordinary Hazard	High Hazard
Minimum rated single extinguisher	2-A*	2-A*	4-A†
Maximum floor area per unit of A	3000 ft ²	1500 ft ²	1000 ft ²
Maximum floor area for extinguisher	11,250 ft ² ‡	11,250 ft ² ‡	11,250 ft ² ‡
Maximum travel distance to extinguisher	75 ft	75 ft	75 ft

*Up to two water-type extinguishers, each with 1-A rating can be used to fulfill the requirements of one 2-A rated extinguisher.

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

‡See E.3.3, NFPA 10 for details.

Source: Table 5.2.1 Fire Extinguisher Size and Placement for Class - A Hazards

Class - B Fire Extinguisher Distribution

For Class - B fires, the basic minimum distance is indicated in the table below:

Type of Hazard	Basic Minimum Extinguisher Rating	Maximum Travel Distance to Extinguishers	
		Ft	m
Light Hazard	5-B	30	9.15
	10-B	50	15.25
Ordinary Hazard	10-B	30	9.15
	20-B	50	15.25
High Hazard	40-B	30	9.15
	80-B	50	15.25

Courtesy Source: Table 5.3.1, Fire Extinguisher Size and Placement for Class - B Hazards

Class - C Fire Extinguisher Distribution

According to NFPA, extinguishers with Class - C ratings are required where fire either directly involves or surrounds electrical equipment. Since the fire itself is a Class - A or Class - B hazard, the fire extinguishers shall be sized and located on the basis of anticipated Class - A or Class - B hazard. The capacity of the fire extinguishers supplied for each major Class - C hazard situation should be individually judged according to the following factors:

1. Size of the electrical equipment
2. Configuration of the electrical equipment (particularly the enclosures of units) that influences agent distribution
3. Effective range of the fire extinguisher stream
4. Amount of Class - A and B material involved

Each of these factors influences the amount and type of agent needed. (Refer clause 5.5 and annexure E 5)

Class -D Fire Extinguisher Distribution

According to NFPA, Class - D fire extinguishers or extinguishing agents (media) shall be located not more than 75 ft (23 m) of travel distance from the hazard. The extinguishers shall be located in those work areas where combustible metal powders,

flakes, shavings, chips, or similarly sized products are generated. Size determination shall be on the basis of the specific combustible metal, its physical particle size, area to be covered, and recommendations by the fire extinguisher manufacturer (Refer clause 5.6)

For Class - E fires, NFPA 10 recommends: Maximum travel distance shall not exceed 30 ft (9.15 m) from the hazard to the extinguishers (Refer clause 5.7.2).

LOCATION GUIDELINES

Locate extinguishers where they can be readily reached for use while a fire is still small. However, don't locate them where they could be a hazard to employees, or where they could get damaged.

If not equipped with wheels, ensure that portable extinguishers weighing more than 18 kilograms (kg) or 39 pounds (lbs.) are installed so that the top is not more than 1.1 meters (m) or 3.6 feet (ft.) above the floor. Those weighing 18 kg or less must not be more than 1.5m (5 ft.) above the floor.

Here are some general pointers for where to locate extinguishers in your workplace.

Locate them:

- So that they are visible, along with their operating instructions and identification marks;
- Where they can be easily reached (i.e., they must not be blocked by machines or materials);
- In or near corridors or aisles leading to exits however, they must not block aisles;
- Close to potential fire hazards, but not so close that they could be damaged or cut off by a fire;
- Where they will not expose people using them to undue risk, e.g., using a halon extinguisher in an unventilated area;
- Where they will not be damaged by moving trucks, cranes or other work activities, or corroded by chemical processes;
- So that they are protected against the elements (if stored outdoors).

In special areas

Where highly combustible material is stored in small rooms or enclosed spaces:

- Locate the extinguisher outside of the room (this will force the potential user to exit the room and then decide whether to re-enter it to fight the fire).

For service rooms that contain electrical equipment:

- Locate extinguishers in or near the room.

On vehicles or in areas where extinguishers are subject to jarring or vibration:

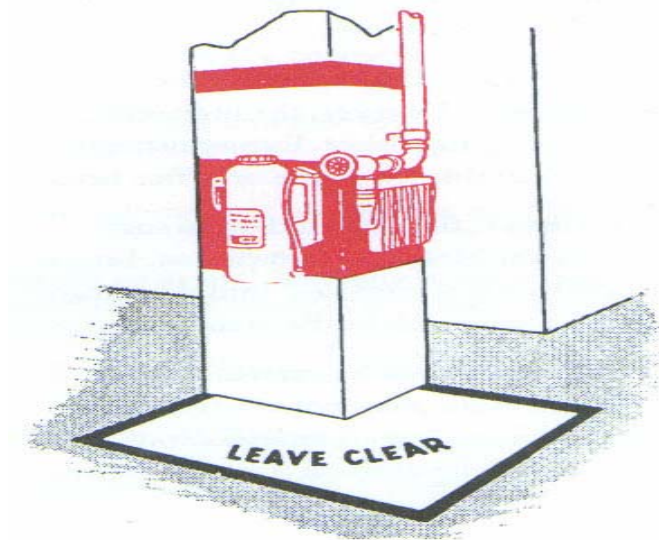
- Mount extinguishers on brackets designed to withstand vibration.
-

RECOMMENDED SIGNAGE

Post signs to show the locations of fire extinguishers, particularly in large floor areas where they could be easily blocked from view. The signs should be large enough to be seen clearly from a distance. Figure below gives an example of a fire extinguisher sign.



Identify walls or columns on which extinguishers are mounted with a red band. The band should be about 2.4 to 3 m (8 to 10 ft.) above the extinguisher. The background on which the extinguisher is mounted should also be painted red, as shown below:



IDENTIFICATION OF EXTINGUISHERS

Manufacturers place markings on extinguishers to indicate the class or classes of fire for which they are suitable. There are two sets of standard symbols used to label an extinguisher for the class or classes of fires on which it can be used. One or both of these symbol sets will appear on the label of all listed portable fire extinguishers.

The first system uses geometric shapes and colors with a class letter shown inside the shape. (On Class - A and B extinguishers a number is used in conjunction with the letter. This number represents the performance capability; a general rule of thumb is, the higher the number, the better the extinguisher will perform.) The other system uses pictographs to make selection easier.

Fire extinguishers have color-coded symbols on their faceplate to show their classification (A-**green** triangle, B-**red** square, C-**blue** circle, D-**yellow** star). Some extinguishers are marked with multiple ratings such as AB, BC or ABC. These extinguishers are capable of putting out more than one class of fire.

Figure: Symbol and Color Markings on Extinguishers

Extinguisher Type	Symbol#1	And/or Symbol #2
Class - A Extinguisher (Rated from 1A - 40A)		
Class - B Extinguisher (Rated from 1B - 640B)		
Class - C Extinguisher		
Class - D Extinguisher		
Class - E Extinguisher		

Extinguishers are labeled to indicate with which type of fire they are to be used. It is also very important that an extinguisher not be used on a fire that it is not rated for. Using the wrong extinguisher, or using it improperly, can cause spread of the fire, personal injury, or more serious consequences.

The recommended marking system combines the uses and non-uses of an extinguisher on a single label. This system also shows the types of fires that an extinguisher should not be used on. An example would be:

Example: The following extinguisher would be rated for Class - A and B fires but not Class - C.	
Example: The following extinguisher would be rated for Class - A only and not for Class - B and Class - C.	

Regardless of which labeling system is used, it is important that the extinguisher be mounted with the label facing out, and the markings clearly visible.

Note the color coding is optional but if used:

- A blue background indicates uses
- A black background with a bright red slash indicates non-uses

To make identification easier in an emergency, it is good idea to consider applying class ratings to wall panels near extinguishers. These markings should be easy to see from a distance of 4.5m (15 ft.).

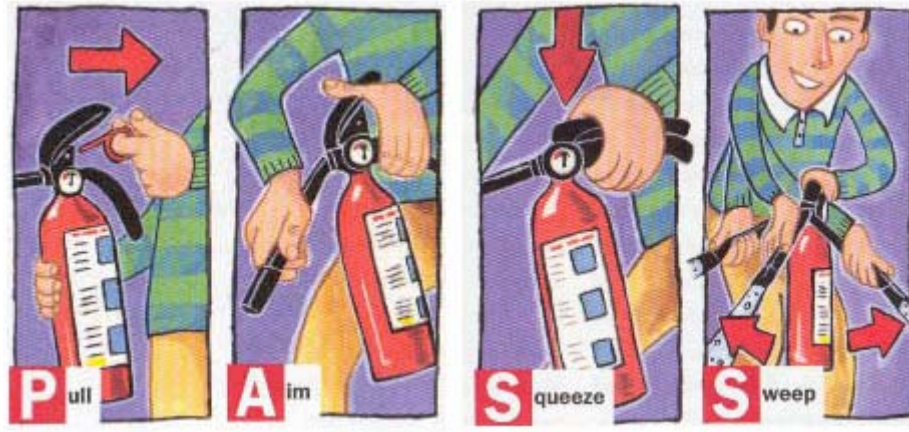
OPERATION

All personnel expected to use a fire extinguisher should be trained in its proper use.

1. Recognize the unit as the appropriate extinguisher for the type of fire. This step requires permanent marking on the unit to indicate purpose, content, and usage.
2. Test that the extinguisher works before you approach the fire.
3. Transport the extinguisher to the fire. The extinguisher should be located so that it can be easily removed in a fire emergency and brought to the site of a fire as quickly as possible. Take care. Speed is essential but it is more important to be cautious.
4. Basic operation involves four standard steps:

Most extinguishers have printed or visual how-to instructions for use. Make sure to understand them before a fire breaks out. There is no time to read directions during an emergency.

The extinguishers are powered by internal pressure, and most are relatively easy to operate. There are four basic steps to operating a portable fire extinguisher. An easy way to remember the procedure is to think of the word **P-A-S-S**. It stands for Pull, Aim, Squeeze, and Sweep.



PULL - Pull the pin to unlock the handle: Holding the extinguisher with the nozzle pointing away from you, release the locking mechanism. A twisting and pulling motion works the best. In most cases, this means pulling out the pin located below the discharge lever.

AIM - Aim the nozzle, horn or hose low at the base of the fire: Extinguishers must be operated in an upright position. Always hold the extinguisher vertically. Never cradle it horizontally.

SQUEEZE - Squeeze the handle to release the extinguishing agent. Squeeze the discharge lever slowly and evenly. This will release the extinguishing agent and expel it through the nozzle.

SWEEP - Sweep the unit from side to side. As the extinguishing agent is expelled, sweep the nozzle from side to side until it appears to be out.

Keep your back to the exit at all times and stand 2 to 2.4m (6 to 8 ft.) away from the fire. After the fire appears to be extinguished, watch the fire area. Be aware that there is always a possibility that the material will reignite, so be very careful. If the fire breaks out again, repeat the process. Once an extinguisher has been discharged, it should be discarded and replaced with a new one. Keep in mind that the discharge time of a portable extinguisher can be very short. If you cannot extinguish the fire completely, leave the area immediately and wait for the fire department to arrive. Most portable extinguishers work according to these directions. Each unit carries specific directions for its use printed on the extinguisher case. It is important to be familiar with these instructions before an emergency.

EXTINGUISHER USE

In the event of an uncontrolled fire in your facility, your first course of action should be to "Activate the fire alarm". By activating the fire alarm or directing another individual to do so, will let everyone in the building know that there is a problem. Evacuation can commence, response team members where applicable can assemble as guided by your emergency action plan, and the local fire department will be summoned to your site. Even a "small" fire warrants the activation of the fire alarm system; delayed notification of the fire department increases the chances of injury, property damage, and potentially the loss of a job to go back to after the fire is out.

As soon as a fire is discovered:

- Sound the alarm and start to evacuate
- Call the fire department

These are important steps for everyone's safety, even if you feel the fire can be brought under control by using an extinguisher.

SHOULD YOU FIGHT THE FIRE?

Before you begin to fight a fire, make sure:

- Everyone has left, or is leaving the building
- The fire department has been called
- The fire is confined to a small area and is not spreading
- There is an unobstructed escape route to which the fire will not spread
- The extinguisher is the right type for the fire
- The person using the fire extinguisher knows how to use it

Portable fire extinguishers can be a useful component of a home fire safety plan, but they aren't the only component. A comprehensive home fire safety plan should include smoke detectors and an evacuation plan. And it's smart to talk about fire safety with your family regularly to re-enforce the evacuation plan and to check whether your smoke detectors' batteries are working. Reviewing where your fire extinguishers are kept, and how to use them.

WHEN NOT TO FIGHT A FIRE

Fire extinguishers are intended for use on incipient fires. They are NOT designed to fight a large or spreading fire. Even against small fires, they are useful only under certain conditions. The following is a list of situations that you should not attempt to fight a fire:

- The extinguisher is not rated for the class of fire
- The extinguisher is not large enough to put out the fire or is not fully charged. Most portable extinguishers discharge completely in as few as eight seconds.
- The fire is spreading beyond the spot where it started.
- You can't fight the fire with your back to an escape exit
- The fire can block your only escape

TESTING

The NFPA 10 standard for portable fire extinguishers requires a monthly inspection, annual maintenance, and proper recharging procedures so that a portable fire extinguisher is ready for its intended use. NFPA 10 does not require an engineer or fire inspector for the monthly inspection -- a building owner, occupant, or a designated representative can do it.

Either a fire extinguisher service agency representative or a trained industrial safety or maintenance person should conduct annual maintenance.

These people should have access to the manufacturer's service manuals. General repairs or replacement of damaged components should be a part of this examination.

Fire extinguishers must be inspected when initially placed in service and at 30-day intervals after that time. The inspection requires a check of the following items:

- Location in designated place
- No obstruction to access or visibility
- Operating instructions on nameplate legible and facing outward
- Safety seals and tamper indicators not broken or missing
- Fullness determined by weight or "hefting"

- Examination for obvious physical damage, corrosion, leakage, or clogged nozzle
- Pressure gauge reading or indicator in the operable range or condition
- Condition of tires, wheels, carriage (for wheeled units), hose, and nozzle checked
- Hazardous materials identification systems (HMIS) label in place.
- Check your extinguishers pressure gauge every three months; to make sure that it is still in operable range. If not, have it serviced or replace it with a new one.

When an inspection reveals a deficiency in location, access or visibility, condition, or labeling, immediate corrective action must be taken.

A fire extinguisher should be "listed" and "labeled" by an independent testing laboratory such as FM (Factory Mutual) or UL (Underwriters Laboratory). Do not buy a portable fire extinguisher if it does not carry the label of an independent testing lab.

INSPECTION AND MAINTENANCE

Portable extinguishers shall be maintained in a fully charged and operable condition, and kept in their designated place at all times when they are not with a tag for registering inspection date. Aluminum tags on which the date can be punched are preferred for a lasting record.

Inspection

Inspection is a quick check that an extinguisher is available and will operate.

Extinguishers shall be inspected monthly, and the following items shall be checked:

- The extinguisher shall be in its designated place.
- Access to, or visibility of, the extinguisher shall not be obstructed.
- The operation instructions on the extinguisher nameplate shall be legible and face outward.
- Any seals or tamper indicators that are broken or missing shall be replaced.
- Any obvious physical damage, corrosion, leakage, or clogged nozzles shall be noted.

- Pressure-gauge readings when not in the operable range shall be noted.

The date the inspection was performed and the initials of the person performing the inspection shall be recorded. When an inspection reveals that tampering has occurred, or that the extinguisher is damaged, impaired, leaking, under-or overcharged, or has obvious corrosion, the extinguisher shall be subjected to applicable maintenance procedures.

Maintenance

Maintenance is a "thorough check" of the extinguisher intended to give maximum assurance that an extinguisher will operate effectively and safely. A carbon dioxide extinguisher, for example, can build up a high static charge if it is used when there is a breakdown of the insulation around the discharge horn. This can cause electric shock.

Maintenance shall be performed at regular intervals, not more than 1 year apart or when specifically indicated by an inspection. Any extinguishers removed from the premises to be recharged shall be replaced by spare extinguishers during the period they are gone. Refill all extinguishers as soon as they are used. Disposable fire extinguishers can be used only once and must be replaced after one use or 12 years from the date of manufacture.

Testing and servicing is usually carried out by a service agency. Certification records include the date of the test, the signature of the person who performed the test and the serial number of the fire extinguisher that was tested. These records should be kept until the extinguisher is hydrostatically retested at the required time interval or until the extinguisher is taken out of service.

Stored pressure-dry chemical extinguishers that require a 12-year hydrostatic test will be emptied and subjected to applicable maintenance procedures every 6 years. Dry chemical extinguishers having non-refillable, disposable containers are exempt from this requirement.

Hydrostatic Tests

If, at anytime, an extinguisher shows evidence of corrosion or mechanical injury, it should be subjected to hydrostatic pressure tests or replaced. In addition, the hydrostatic test intervals for extinguishers listed below should be followed. (Refer NFPA No. 10 for test methods). Extinguishers requiring discharge for hydrostatic testing or refueling should be utilized for demonstration purposes, giving each

employee an opportunity to handle an extinguisher and apply the extinguishing agent to a fire.

Extinguisher Type	Hydrostatic Test Interval (Years)
Stored Pressure Water Extinguisher	5
Foam	5
Dry chemical with Stainless Steel shells or soldered brass shells	5
Dry chemical, cartridge operated with mild steel shells	12
Carbon-dioxide	5

SERVICING

Completely examine each extinguisher at least once a year, and whenever your monthly inspections indicate that this may be needed.

Replace defective parts and extinguishers, recharge extinguishers as needed, and ensure that hydrostatic tests are carried out according to the manufacturer's instructions.

Set up a maintenance schedule for extinguishers so that they are not all out of service at the same time.

RECORD KEEPING

Attach a durable tag to each extinguisher that shows:

- Dates of monthly inspections, recharging, and servicing
- Name of servicing agency
- Signature of person who performed the service

Maintain a permanent record for each fire extinguisher that shows:

- Serial number and type of extinguisher
- Location of extinguisher

- Inspection date
 - Description of maintenance work or hydrostatic tests carried out
 - Date of next inspection
 - Date of scheduled annual servicing
 - Inspector's comments
 - Inspector's signature
-

TRAINING

Safety should be everybody's concern. If extinguishers are to be used by employees, then training needs to take place upon initial employment and at least annually thereafter. If extinguishers are not intended for employee use and the employer has an emergency action plan and a fire prevention plan, then training is not required.

Training should cover:

- Extinguisher locations
- Classes of fire most likely to break out in your workplace and the proper extinguishers to use
- Markings on extinguishers
- When and how to use extinguishers
- Importance of sounding the alarm
- Health and safety hazards
- Personal protective equipment

Use lectures and demonstrations, and provide opportunity to practice using extinguishers. Consider having them practice on extinguishers that need recharging. With increased confidence, a person is more likely to respond effectively to fire emergencies.

GENERAL SPECS

- Quality designed - manufactured to exacting standards under ISO - 9002. U/L and U.S. Coast Guard approved
- Rugged construction - easy and less costly maintenance and service

- User friendly bar coded labels for inventory control and extinguisher locator programs
 - Complete range of sizes for all hazard requirements
 - Extinguishers may be used indoors where winds and drafts do not affect discharge or where a clean extinguisher agent is required.
 - Nonconductive, non-corrosive clean extinguishing agent. Low carbon steel shell with fluted base resists impact, vibration, and corrosion.
 - Simple operation and maintenance
 - Rechargeable
 - Manufactured of durable high quality materials
 - Large, easy-to-read pressure gauge
 - Rust free Aluminum Cylinders as an option- up to 30% lighter than steel for use in corrosive environments
 - Compliance: UL listed FM approved
 - Meets or exceeds requirements of ANSI/UL 1093 and 711
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Course Summary

To provide the best protection of life and property from the destructive force of fire, it is critical that the proper fire extinguisher selection be made. The Classification and Rating of an extinguisher are vital pieces of information for making that selection.

Using NFPA 10 for guidance, matching the right fire extinguisher to the potential hazard, providing a sufficient number of extinguishers for the area to be protected, locating the extinguishers for maximum visibility and accessibility, and personnel trained in the use and maintenance of the extinguisher will significantly lessen the risk of loss.
