Extinguishers Basics

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This section provides basic information on fire and fire extinguishers:

- Fire and extinguisher operation
- Types of fire extinguishers

Fire and extinguisher operation

Fire triangle

To understand how fire extinguishers work, you need to understand a little about fire. Fire is a very rapid chemical reaction between oxygen and a combustible material, which results in the release of heat, light, flames, and smoke.

For fire to exist, the following four elements must be present at the same time:

- Enough **oxygen** to sustain combustion,
- Enough **heat** to raise the material to its ignition temperature,
- Some sort of **fuel** or combustible material, and
- The chemical reaction that is fire.

How a fire extinguisher works

Portable fire extinguishers apply an extinguishing agent that will either cool burning fuel, displace or remove oxygen, or stop the chemical reaction so a fire cannot continue to burn. When the handle of an extinguisher is compressed, agent is expelled out the nozzle. A fire extinguisher works much like a can of hair spray.

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All portable fire extinguishers must be approved by a nationally recognized testing laboratory to verify compliance with applicable standards [29 CFR 1910.157(c)(2)]. Equipment that passes the laboratory's tests are labeled and given an alpha-numeric classification based on the type and size of fire it will extinguish.

Let's take a look at the label pictured. The classification is:

1-A:10-BC

The letters (A, B, and C) represent the type(s) of fire for which the extinguisher has been approved.

The number in front of the A rating indicates how much water the extinguisher is equal to and represents 1.25 gallons of water for every unit of one. For example, a 4-A rated extinguisher would be equal to five (4 x 1.25) gallons of water.

The number in front of the B rating represents the area in square feet of a class B fire that a non-expert user should be able to extinguish. Using the above example, a non-expert user should be able to put out a flammable liquid fire that is as large as 10 square feet.

Types of fire extinguishers

Different types of fire extinguishers are designed to fight different types of fire. The three most common types of fire extinguishers are: air pressurized water, CO_2 (carbon dioxide), and dry chemical. The following table provides information regarding the type of fire and which fire extinguisher should be used.

Extinguisher Type	Type of Fire
 **Water**	**Ordinary Combustibles** Fires in paper, cloth, wood, rubber, and many plastics require a water type extinguisher labeled A. 
 **CO_2** **OR**  **Dry Chemical**	**Flammable Liquids** Fires in oils, gasoline, some paints, lacquers, grease, solvents, and other flammable liquids require an extinguisher labeled B.  **Electrical Equipment** Fires in wiring, fuse boxes, energized electrical equipment, computers, and other electrical sources require an extinguisher labeled C. 
 **Multi-Purpose**	**Ordinary Combustibles, Flammable Liquids, or Electrical Equipment** Multi-purpose dry chemical is suitable for use on class A, B, and C. 

Class D	**Metals** Fires involving powders, flakes or shavings of combustible metals such as magnesium, titanium, potassium, and sodium require special extinguishers labeled D.

Class K **Use Flour or Sand to put out this fire if you don't have a Class K extinguisher.**	**Kitchen Fires** Fires involving combustible cooking fluids such as oils and fats. **Note:** Your present fire extinguishing equipment may not put out a fire involving vegetable oil in your deep fat fryer. 

Water - Air-pressurized water extinguishers (APW)

Water is one of the most commonly used extinguishing agents for type A fires. You can recognize an APW by its large silver container. They are filled about two-thirds of the way with ordinary water, then pressurized with air. In some cases, detergents are added to the water to produce a foam. They stand about two to three feet tall and weigh approximately 25 pounds when full.

APWs extinguish fire by cooling the surface of the fuel to remove the "heat" element of the fire triangle.

APWs are designed for Class A (wood, paper, cloth, rubber, and certain plastics) fires only.

Important:

- **Never use water to extinguish flammable liquid fires.** Water is extremely ineffective at extinguishing this type of fire and may make matters worse by the spreading the fire.
- **Never use water to extinguish an electrical fire.** Water is a good conductor and may lead to electrocution if used to extinguish an electrical fire. Electrical equipment must be unplugged and/or de-energized before using a water extinguisher on an electrical fire.

CO_2 or Dry Chemical - Carbon dioxide extinguishers

This type of extinguisher is filled with Carbon Dioxide (CO_2), a non-flammable gas under extreme pressure. These extinguishers put out fires by displacing oxygen, or taking away the oxygen element of the fire triangle. Because of its high pressure, when you use this extinguisher pieces of dry ice shoot from the horn, which also has a cooling effect on the fire.

You can recognize this type of extinguisher by its hard horn and absent pressure gauge.

CO_2 cylinders are red and range in size from five to 100 pounds or larger.

CO_2 extinguishers are designed for Class B and C (flammable liquid and electrical) fires only.

Important:

- CO_2 is not recommended for Class A fires because they may continue to smolder and re-ignite after the CO_2 dissipates.
- Never use CO_2 extinguishers in a confined space while people are present without proper respiratory protection.

Locations:
Carbon dioxide extinguishers will frequently be found in industrial vehicles, mechanical rooms, offices, computer labs, and flammable liquid storage areas.

Multi-purpose - Dry chemical extinguishers

Dry chemical extinguishers put out fires by coating the fuel with a thin layer of fire retardant powder, separating the fuel from the oxygen. The powder also works to interrupt the chemical reaction, which makes these extinguishers extremely effective.

Dry chemical extinguishers are usually rated for class B and C fires and may be marked multiple purpose for use in A, B, and C fires. They contain an extinguishing agent and use a compressed, non-flammable gas as a propellant.

ABC fire extinguishers are red in color, and range in size from five pounds to 20 pounds.

Dry Chemical extinguishers will have a label indicating they may be used on class A, B, and/or C fires.

Locations:

These extinguishers will be found in a variety of locations including: public hallways, laboratories, mechanical rooms, break rooms, chemical storage areas, offices, commercial vehicles, and other areas with flammable liquids.

Class K - Dry and wet chemical extinguishers for kitchen fires

Due to the higher heating rates of vegetable oils in commercial cooking appliances NFPA 10, *Portable Fire Extinguishers*, now includes a Class K rating for kitchen fires extinguishers which are now required to be installed in all applicable restaurant kitchens. Once a fire starts in a deep fryer, it cannot always be extinguished by traditional range hoods or Class B extinguishers.

- Do not attempt to use a Class A extinguisher containing water or CO_2 on a deep fat fryer fire. An explosive type reaction may result.
- Place a placard near the Class K fire extinguisher which states: "In case of appliance fire, use this extinguisher only after the fixed fire suppression system has been actuated". Class K fire extinguishers are only intended to be used after the activation of a built-in hood suppression system. If no commercial cooking system hood and fire suppression system exists, Class K extinguishers are not required.
- Extinguishing agents in many Class K extinguishers are electrically conductive and should only be used after electrical power to the kitchen appliance has been shut off. Class K extinguishers use a variety of agents. Potassium bicarbonate is used in some Class K dry chemical extinguishers, and there are also Class K wet chemical extinguishers which spray a fine mist.
- Travel distance to a Class K extinguisher shall not exceed 30 feet.
- Install a 2-A water-type extinguisher or 6L wet chemical fire extinguisher for solid fuel cooking appliances with fire boxes.
- Inspect, test and maintain Class K fire extinguishers yearly.

Locations:

These extinguishers will be found in commercial cooking operations such as restaurants, cafeterias, and other locations where food would be served.

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Fire Extinguishers and Small Hose Lines

A fire extinguisher, rated not less than 2A, shall be provided for each 3,000 square feet of the protected building area, or major fraction thereof. Travel distance from any point of the protected area to the nearest fire extinguisher shall not exceed 100 feet.

One 55-gallon open drum of water with two fire pails may be substituted for a fire extinguisher having a 2A rating.

A ½-inch diameter garden-type hose line, not to exceed 100 feet in length and equipped with a nozzle, may be substituted for a 2A-rated fire extinguisher, providing it is capable of discharging a minimum of 5 gallons per minute with a minimum hose stream range of 30 feet horizontally. The garden-type hose lines shall be mounted on conventional racks or reels. The number and location of hose racks or reels shall be such that at least one hose stream can be applied to all points in the area.

One or more fire extinguishers, rated not less than 2A, shall be provided on each floor. In multistory buildings, at least one fire extinguisher shall be located adjacent to stairway.

Extinguishers and water drums, subject to freezing, shall be protected from freezing.

A fire extinguisher, rated not less than 10B, shall be provided within 50 feet of wherever more than 5 gallons of flammable or combustible liquids or 5 pounds of flammable gas are being used on the jobsite. This requirement does not apply to the integral fuel tanks of motor vehicles.

Carbon tetrachloride and other toxic vaporizing liquid fire extinguishers are prohibited.

Portable fire extinguishers shall be inspected periodically and maintained in accordance with *Maintenance and Use of Portable Fire Extinguishers*, NFPA No. 10A-1970. Fire extinguishers which have been listed or approved by a nationally recognized testing laboratory, shall be used to meet the requirements of this subpart.

Table F-1 in §1926.150(c)(1)(x) may be used as a guide for selecting the appropriate portable fire extinguishers.

Fixed Firefighting Equipment

Sprinkler Protection

If the facility being constructed includes the installation of automatic sprinkler protection, the installation shall closely follow the construction and be placed in service as soon as applicable laws permit following completion of each story.

During demolition or alterations, existing automatic sprinkler installations shall be retained in service as long as reasonable. The operation of sprinkler control valves shall be permitted only by properly authorized persons. Modification of sprinkler systems to permit alterations or additional demolition should be expedited so that the automatic protection may be returned to service as quickly as possible. Sprinkler control valves shall be checked daily at close of work to ascertain that the protection is in service.

A fire is the most common type of emergency for which small businesses must plan. A critical decision when planning is whether or not employees should fight a small fire with a portable fire extinguisher or simply evacuate. Small fires can often be put out quickly by a well-trained employee with a portable fire extinguisher. However, to do this safely, the employee must understand the use and limitation of a portable fire extinguisher and the hazards associated with fighting fires. Evacuation plans that designate or require some or all of the employees to fight fires with portable fire extinguishers increase the level of complexity of the plan and the level of training that must be provided employees.