Slide 1

Unit 8 - Fire Extinguishers

Slide 2

CHAPTER 8
Portable Fire Extinguishers

Slide 3

Fire Fighter I Objectives
• State the primary purposes of fire extinguishers.
• Define Class A fires.
• Define Class B fires.
• Define Class C fires.
• Define Class D fires.
• Define Class K fires.
• Explain the classification and rating system for fire extinguishers.

Slide 4

Fire Fighter I Objectives
• Describe the types of agents used in fire extinguishers.
• Describe the types of operating systems in fire extinguishers.
• Describe the basic steps of fire extinguisher operation.
• Explain the basic steps of inspecting, maintaining, recharging, and hydrostatic testing of fire extinguishers.
• Select the proper class of fire extinguisher.
Portable Fire Extinguishers

- Portable fire extinguishers are required in a variety of occupancies.
- Vary in size and type of agent used
- Designed for different purposes

Fire Extinguishers

Portable fire extinguishers are required in a variety of occupancies. Citizens are encouraged to keep fire extinguishers in their home, particularly in their kitchen. Most extinguishers are easy to operate with a minimal amount of training.

Extinguishers vary in size and type of extinguishing agent used.

- Agents include water, water with additives, dry chemicals, dry powders, and gaseous agents.
- Each agent is suitable for specific types of fires.

Extinguishers are designed for different purposes; selecting the appropriate extinguisher and knowing how to safely operate it are critical.

Poor table fire extinguishers can be large or small.

- A wheeled extinguisher.
- A one-hand fire extinguisher.

Firefighters use extinguishers to control small fires that do not require the use of a hose line. Portable backpack-type fire extinguisher used to control and overhaul a wildland fire. Special types of fire extinguishers are appropriate for situations where the application of water would be dangerous, ineffective, or undesirable.
Purposes of Fire Extinguishers

Introduction to Purposes of Fire Extinguishers

Primary uses

- Extinguish incipient fires
- Control fires where traditional methods are not recommended
- Provide discharge patterns for specific fuels

Fire extinguishers are placed in many locations so that they will be available for immediate use on small, incipient fires. A trained individual with a suitable fire extinguisher could easily control this type of fire. As the flames spread beyond the area of origin, the fire becomes increasingly difficult to control with only a portable fire extinguisher. Fire extinguishers are also used to control fires where traditional extinguishing methods are not recommended. Using water on fires that involve energized electrical equipment increases the risk of electrocution to fire fighters. Special extinguishing agents are also required for fires that involve flammable liquids, cooking oils, and combustible metals. Extinguishers are designed to provide effective discharge patterns for fires of specific fuels. Improper fire extinguishers for the job can spread burning material. Appropriate types of extinguishers need to be available in areas containing flammable materials.

Use of Portable Fire Extinguishers

Most fire department vehicles carry at least one fire extinguisher; many vehicles carry two or more extinguishers of different types. Fire fighters often use these portable extinguishers to control incipient fires quickly. One advantage of fire extinguishers is their portability. The primary disadvantage of fire extinguishers is that they are “one-shot” devices.
Special Extinguishing Agents

As a fire fighter, you must know:
- Which fires require special agents
- What type should be used
- How to operate the different types

Wet-chemical agents are used for commercial kitchen fires that involve cooking oils in deep-fat fryers.

Dry-chemical agents are used for residential kitchen fires.

“Clean” agents are used for electronic equipment.

Portable extinguishers are sometimes used in combination with other techniques.

Certain types of portable extinguishers can be helpful in overhauling a fire.

Classes of Fires

It is essential to match the appropriate type of extinguisher to the type of fire. Fires and fire extinguishers are grouped into classes according to their characteristics.

Some extinguishing agents work more efficiently than others on certain types of fires. In some cases, selecting the proper extinguishing agent will mean the difference between extinguishing a fire and being unable to control it.

More importantly, in some cases it is dangerous to apply the wrong extinguishing agent to a fire.

Using a water extinguisher on an electrical fire can cause an electrical shock and a short circuit in the equipment.

A water extinguisher should never be used to fight a grease fire.

Before selecting a fire extinguisher, ask yourself, “Which class of fire am I fighting?”
Class A Fires

Class A Fires Involve ordinary combustibles, such as wood, paper, cloth, rubber, household rubbish, and some plastics. Natural vegetation, such as grass and trees, is also Class A material. Water is the most commonly used extinguishing agent for Class A fires, although several other agents can be used effectively.

Class B Fires

Class B Fires Involve flammable or combustible liquids, such as gasoline, oil, grease, tar, lacquer, oil-based paints, and some plastics. Fires involving flammable gases, such as propane or natural gas, are also categorized as Class B fires. Several different types of extinguishing agents are approved for Class B fires.

Class C Fires

Class C Fires Involve energized electrical equipment, which includes any device that uses, produces, or delivers electrical energy. A Class C fire could involve building wiring and outlets, fuse boxes, circuit breakers, transformers, generators, or electric motors. Power tools, lighting fixtures, household appliances, and electronic devices, such as televisions, radios, and computers, could be involved in Class C fires. The equipment must be plugged in or connected to an electrical source, but not necessarily operating. Electricity does not burn, but electrical energy can generate tremendous heat that could ignite nearby Class A or B materials. As long as the equipment is energized, it must be treated as a Class C fire. Agents that will not conduct electricity, such as dry chemicals or carbon dioxide, must be used on Class C fires.
Class D Fires
Class D Fires Involve combustible metals, such as magnesium, titanium, zirconium, sodium, lithium, and potassium
Special techniques and extinguishing agents are required to fight combustible metals fires.
Normal extinguishing agents can react violently, even explosively, if they come in contact with burning metals.
Violent reactions also can occur when water strikes burning combustible metals.
Class D fires are most often encountered in industrial occupancies, such as machine shops and repair shops, and in fires involving aircraft and automobiles.
Because of the chemical reactions that could occur during a Class D fire, it is important to select the proper extinguishing agent and application technique.
Choosing the correct fire extinguisher for a Class D fire requires expert knowledge and experience.

Class K Fires
Class K Fires Involve combustible cooking oils and fats
The use of high-efficiency modern cooking equipment and the trend toward using vegetable oils instead of animal fats to fry foods required the development of a new class of extinguishing agents.
Many restaurants are still using extinguishing agents that were approved for Class B fires.

Classification of Fire Extinguishers
Portable fire extinguishers are classified and rated based on their characteristics and capabilities. This information is important for selecting the proper extinguisher to fight a particular fire.
It is also used to determine what type or types of fire extinguishers should be placed in a given location so that incipient fires can be quickly controlled.
In the United States, Underwriters Laboratories, Inc., is the organization that developed the standards, classification, and rating system for portable fire extinguishers.
Each fire extinguisher has a specific rating that identifies the class or classes of fires for which it is both safe and effective.
Classification of Fire Extinguishers

The classification system for fire extinguishers uses letters and numbers. The letters indicate the class or classes of fire for which the extinguisher can be used. The numbers indicate its effectiveness.

Fire extinguishers that are safe and effective for more than one class will be rated with multiple letters. Class A and Class B fire extinguishers also include a number, indicating the relative effectiveness of the fire extinguisher in the hands of a nonexpert user.

On Class A extinguishers, the number is related to an amount of water.
An extinguisher that is rated 1-A contains the equivalent of 1.25 gallons (4.75 L) of water.
A typical Class A extinguisher contains 2.5 gallons (9.5 L) of water and has a 2-A rating.
The higher the number, the greater the extinguishing capability of the extinguisher.

The effectiveness of Class B extinguishers is based on the approximate area (measured in square feet) of burning fuel they are capable of extinguishing.
A 10-B rating indicates that a nonexpert user should be able to extinguish a fire in a pan of flammable liquid that is 10 ft² (0.9 m²) in surface area.
An extinguisher rated 40-B should be able to control a flammable liquid pan fire with a surface area of 40 ft² (3.6 m²).

Numbers are used to rate an extinguisher’s effectiveness only for Class A and Class B fires. If the fire extinguisher can also be used for Class C fires, it contains an agent proven to be nonconductive to electricity and safe for
use on energized electrical equipment. For instance, a fire extinguisher that carries a 2-A:10-B:C rating can be used on Class A, Class B, and Class C fires. It has the extinguishing capabilities of a 2-A extinguisher when applied to Class A fires, the capabilities of a 10-B extinguisher for Class B fires, and can be used safely on energized electrical equipment.

**Classification of Fire Extinguishers**
Standard test fires are used to rate the effectiveness of fire extinguishers. The testing may involve different agents, amounts, application rates, and application methods. Fire extinguishers are rated for their ability to control a specific type of fire and for the extinguishing agent’s ability to prevent rekindling. Some agents can successfully suppress a fire but are unable to prevent the material from reigniting. A rating is only given if the extinguisher completely extinguishes the standard test fire and prevents rekindling.

**Labeling of Fire Extinguishers**
Introduction to the Labeling of Fire Extinguishers Fire extinguishers that have been tested and approved by an independent laboratory are labeled to clearly designate the class or classes of fire the unit is capable of extinguishing safely. The traditional lettering system has been used for many years and is still found on many fire extinguishers. Recently, however, a universal pictograph system, which does not require the user to be familiar with the alphabetic codes for the different classes of fires, has been developed.

**The Traditional Lettering System**
Extinguishers suitable for use on Class A fires are identified by the letter A on a solid green triangle. Extinguishers suitable for use on Class B fires are identified by the letter B on a solid red square. Extinguishers suitable for use on Class C
fires are identified by the letter C on a solid blue circle. Extinguishers suitable for use on Class D fires are identified by the letter D on a solid yellow five-pointed star. Extinguishers suitable for use on Class K (combustible cooking oil) fires are identified by a pictograph showing a fire in a frying pan. Because the Class K designation is new, there is no traditional system alphabet graphic for it.

Labeling of Fire Extinguishers

Pictograph Labeling System Uses symbols rather than letters on the labels.

This system also clearly indicates whether an extinguisher is inappropriate for use on a particular class of fire. The pictographs are all square icons that are designed to represent each class of fire. The icon for Class A fires is a burning trashcan beside a wood fire. The Class B fire extinguisher icon is a flame and a gasoline can. The Class C icon is a flame and an electrical plug and socket. Extinguishers rated for fighting Class K fires are labeled with an icon showing a fire in the frying pan.

Under this pictograph labeling system, the presence of an icon indicates that the extinguisher has been rated for that class of fire. A missing icon indicates that the extinguisher has not been rated for that class of fire. A red slash across an icon indicates that the extinguisher must not be used on that type of fire because doing so would create additional risk.
Fire Extinguisher Placement

Introduction to Fire Extinguisher Placement

Fire codes and regulations require the installation of fire extinguishers in many areas so that they will be available to fight incipient fires.

NFPA Standard 10 lists the recommendations for placing and mounting portable fire extinguishers and the recommended mounting heights.

The regulations for each type of occupancy specify the maximum floor area that can be protected by each extinguisher, the maximum travel distance from the closest extinguisher to a potential fire, and the types of fire extinguishers that should be provided.

Fire Extinguisher Placement

Two key factors must be considered when determining which type of extinguisher should be placed in each area: the class of fire that is likely to occur and the potential magnitude of an incipient fire.

Fire Extinguisher Placement

Extinguishers should be mounted so they are readily visible and easily accessed. According to NFPA Standard 10, the recommended mounting heights for the placement of fire extinguishers are:

- Fire extinguishers weighing up to 40 lb (18 kg) should be mounted so that the top of the extinguisher is not more than 5’ (2 m) above the floor.
- Fire extinguishers weighing more than 40 lb (18 kg) should be mounted so that the top of the extinguisher is not more than 3’ (1 m) above the floor.
- The bottom of an extinguisher should be at least 4” (10 cm) above the floor.
Classifying Area Hazards
Classifying Area Hazards
Areas are divided into three risk classifications—light, ordinary, and extra hazard—according to the amount and type of combustibles that are present, including building materials, contents, decorations, and furniture.

Occupy use category does not necessarily determine the appropriate hazard classification.

The recommended hazard classifications for different types of occupancies are guidelines based on typical situations.

The hazard classification for each area should be based on the actual amount and type of combustibles that are present.

Light or Low Hazard
Light (low) hazard Areas where most materials are noncombustible or arranged so that a fire is not likely to spread

Light hazard environments usually contain limited amounts of Class A combustibles, such as wood, paper products, cloth, and similar materials.

A light hazard environment might also contain some Class B combustibles (flammable liquids and gases), such as copy machine chemicals or modest quantities of paints and solvents, but all Class B materials must be kept in closed containers and stored safely.

Examples of common light hazard environments are most offices, classrooms, churches, assembly halls, and hotel guest rooms.
Ordinary or Moderate Hazard
Ordinary (moderate) hazard contains more Class A and Class B materials than are found in light hazard locations.

Typical examples of ordinary hazard locations include retail stores with on-site storage areas, light manufacturing facilities, auto showrooms, parking garages, research facilities, and workshops or service areas that support light hazard locations, such as hotel laundry rooms or restaurant kitchens.

Ordinary hazard areas also include warehouses that contain Class I and Class II commodities.

Class I commodities include noncombustible products stored on wooden pallets or in corrugated cartons that are shrink-wrapped or wrapped in paper.

Class II commodities include noncombustible products stored in wooden crates or multilayered corrugated cartons.

Extra or High Hazard
Extra (high) hazard locations contain more Class A combustibles and/or Class B flammables than are found in ordinary hazard environments.

Typical examples of extra hazard areas include woodworking shops; service or repair facilities for cars, aircraft, or boats; and many kitchens and other cooking areas that have deep fryers, flammable liquids, or gases under pressure.

In addition, areas used for manufacturing processes, such as painting, dipping, or coating, and facilities used for storing or handling flammable liquids are classified as extra hazard environments.

Warehouses containing products that do not meet the definitions of Class I and Class II commodities are also considered extra hazard locations.
Determining the Appropriate Placement of Fire Extinguisher

Determine the Most Appropriate Placement of Fire Extinguishers

Several factors must be considered when determining the number and types of fire extinguishers that should be placed in each area of an occupancy.

Among these factors are the types of fuels found in the area and the quantities of those materials. Some areas may need extinguishers with more than one rating or more than one type of fire extinguisher.

Most buildings require extinguishers that are suitable for fighting Class A fires because ordinary combustible materials, such as furniture, partitions, interior finish materials, and paper and packaging products, are so common.

One multipurpose extinguisher is generally less expensive than two individual fire extinguishers and eliminates the problem of selecting the proper extinguisher for a particular fire.

However, it is sometimes more appropriate to install Class A extinguishers in general use areas and to place extinguishers that are especially effective in fighting Class B or Class C fires near those hazards.

Some facilities present a variety of conditions. In these occupancies, each area must be individually evaluated so that extinguisher installation is tailored to the particular circumstances.

Methods of Fire Extinguishment

Understanding the nature of fire is key to understanding how extinguishing agents work and how they differ from each other.

All fires require three basic ingredients: fuel, heat, and oxygen.

Scientifically, burning is called rapid oxidation.

It is a chemical process that occurs when a fuel is combined with oxygen, resulting in the formation of ash or other waste products and the release of energy as heat and light.

The combustion process begins when the fuel is heated to its kindling temperature (also known as the kindling point or ignition point)—the temperature at which it begins to burn.

The energy that initiates the process can come from many different sources, including a spark or flame, friction, electrical energy, or a chemical reaction.

Once a substance begins to burn, it will generally continue burning as long as there are adequate supplies of oxygen and fuel to sustain
Methods of Fire Extinguishment
Most extinguishers stop the burning by cooling the fuel below its kindling temperature, by cutting off the supply of oxygen, or by combining these two techniques. Some extinguishing agents interrupt the complex system of molecular chain reactions that occur between the heated fuel and the oxygen.

Cooling the Fuel
If the temperature of the fuel falls below its ignition point or kindling temperature, the combustion process will stop.
Water extinguishes a fire using this method.

Cutting off the Supply of Oxygen
Creating a barrier that interrupts the flow of oxygen to the flames will also extinguish a fire.
Putting a lid on a pan of burning food is an example of this technique.
Applying a blanket of foam to the surface of a burning liquid is another example.
Surrounding the fuel with a layer of carbon dioxide can also cut off the supply of oxygen necessary to sustain the burning process.

Interrupting the Chain Reactions
Some extinguishing agents work by interrupting the molecular chain reactions required to sustain combustion.
Types of Extinguishing Agents

Introduction to Types of Extinguishing Agents

An extinguishing agent is the substance contained in a portable fire extinguisher that puts out a fire. Various different chemicals, including water, are used in portable fire extinguishers. The best extinguishing agent for a particular hazard depends on several factors, including the types of materials involved and the anticipated size of the fire.

Types of Extinguishing Agents

Portable fire extinguishers use seven basic types of extinguishing agents:

- Water
- Dry chemicals
- Carbon dioxide
- Foam
- Wet chemicals
- Halogenated agents
- Dry powder
Water

Water is an efficient, plentiful, and inexpensive extinguishing agent.

- When applied to fire, water converts from liquid into steam, absorbing heat in the process.
- Water is very effective for extinguishing Class A fires.
- Many Class A fuels absorb water, which lowers the temperature of the fuel and prevents rekindling.
- Water is a much less effective extinguishing agent for other fire classes.

Applying water to hot cooking oil can cause splattering, which can spread the fire and possibly endanger the extinguisher operator. Burning flammable liquids will float on top of water.

Because water conducts electricity, it is dangerous to apply a stream of water to any fire that involves energized electrical equipment.

If water is applied to a burning combustible metal, a violent reaction can occur. Because of these limitations, plain water is only used in Class A fire extinguishers.

One disadvantage of water is that it freezes at 32°F (0°C).

In areas that are subject to freezing, loaded-stream extinguishers can be used. These extinguishers combine an alkali metal salt and water.

The salt lowers the freezing point of water, so the extinguisher can be used in much colder areas.

Wetting agents can also be added to the water in a fire extinguisher. These agents reduce the surface tension of the water, allowing it to penetrate more effectively into many fuels, such as baled cotton or fibrous materials.

Water can be applied through a water mist. Contain distilled water

Used when regular extinguishers may cause excessive damage

Used in museums, books, and hospital operating rooms
Dry Chemical

Dry Chemical fire extinguishers deliver a stream of very finely ground particles onto a fire. Different chemical compounds are used to produce extinguishers of varying capabilities and characteristics. The dry chemical extinguishing agents work in two ways:

First, the dry chemicals interrupt the chemical chain reactions that occur within the combustion process.
Second, the tremendous surface area of the finely ground particles allows them to absorb large quantities of heat.

Dry Chemical

Dry chemical extinguishing agents offer several advantages over water extinguishers: They are effective on Class B (flammable liquids and gases) fires. They can be used on Class C (energized electrical equipment) fires because the chemicals are nonconductive. They are not subject to freezing.

The first dry chemical extinguishers were introduced during the 1950s and were rated only for Class B and C fires. The industry term for these B:C-rated units is “ordinary dry chemical” extinguishers. During the 1960s “multipurpose dry chemical” extinguishers were introduced. These extinguishers are rated for Class A, B, and C fires.

The chemicals in these extinguishers form a crust over Class A combustible fuels to prevent rekindling. Multipurpose dry chemical extinguishing agents are in the form of fine particles and are treated with other chemicals to help maintain an even flow when the extinguisher is being used.
Dry Chemical

Additives prevent packing and caking.
Disadvantage: Chemicals are corrosive.

Primary compounds:
- Sodium bicarbonate
- Potassium bicarbonate
- Urea-based potassium carbonate
- Potassium chloride
- Ammonium phosphate

Additional additives prevent them from absorbing moisture, which could cause packing or caking and interfere with the discharge.

One disadvantage of dry chemical extinguishers is that the chemicals, particularly the multipurpose dry chemicals, are corrosive and can damage electronic equipment, such as computers, telephones, and copy machines.

The fine particles are carried by the air and settle like a fine dust inside the equipment. During a period of months, the residue can corrode metal parts, causing considerable damage.

If electronic equipment is exposed to multipurpose dry chemical extinguishing agents, it should be cleaned professionally within 48 hours after exposure.

The five primary compounds used as dry chemicals extinguishing agents are:
- Sodium bicarbonate (rated for Class B and C fires only)
- Potassium bicarbonate (rated for Class B and C fires only)
- Urea-based potassium bicarbonate (rated for Class B and C fires only)
- Potassium chloride (rated for Class B and C fires only)
- Ammonium phosphate (rated for Class A, B, and C fires)

Although ordinary dry chemical extinguishers can also be used against Class A (common combustibles) fires, a water dousing is also needed to extinguish any smoldering embers and prevent rekindling.

Which dry chemical extinguisher to use depends on the compatibility of different agents with each other and with products they might contact.

Some dry chemical extinguishing agents cannot be used in combination with particular types of foam.
Carbon Dioxide

Carbon dioxide is a gas that is 1.5 times heavier than air.

When carbon dioxide is discharged on a fire, it forms a dense cloud that displaces the air surrounding the fuel. This interrupts the combustion process by reducing the amount of oxygen that can reach the fuel. A blanket of carbon dioxide over the surface of a liquid fuel can also disrupt the fuel’s ability to vaporize.

Carbon Dioxide

In portable fire extinguishers, carbon dioxide is stored under pressure as a liquid. It is colorless and odorless. It is discharged through a hose and expelled on the fire through a horn.

When it is released, the carbon dioxide is very cold and forms a visible cloud of “dry ice” because moisture in the air will freeze when it comes into contact with the carbon dioxide.

Carbon dioxide is rated for Class B and C fires only. It does not conduct electricity and has two significant advantages over dry chemical agents: it is not corrosive and it does not leave any residue.

Carbon Dioxide

Carbon dioxide also has several limitations and disadvantages.

Weight: Carbon dioxide extinguishers are heavier than similarly rated extinguishers that use other extinguishing agents.

Range: Carbon dioxide extinguishers have a short discharge range, which requires the operator to be close to the fire, increasing the risk of personal injury.

Weather: Carbon dioxide does not perform well at temperatures below 0°F (−18°C) or in windy or drafty conditions because it dissipates before it reaches the fire.

Confined spaces: When used in confined areas, carbon dioxide dilutes the oxygen in the air.

Suitability: Carbon dioxide extinguishers are not suitable for use on fires involving pressurized fuel or on cooking grease fires.
Foam

Foam fire extinguishers discharge a water-based solution with a measured amount of foam concentrate added.

The nozzles on foam extinguishers are designed to introduce air into the discharge stream, thus producing a foam blanket.

Foam extinguishing agents are formulated for use on either Class A or Class B fires.

Class A foam extinguishers for ordinary combustible fires extinguish fires in the same way that water extinguishes fires. This type of extinguisher can be produced by adding Class A foam concentrate to the water in a standard, 2.5-gallon (9.5-L), stored-pressure extinguisher.

The foam concentrate reduces the surface tension of the water, allowing for better penetration into the burning materials.

Class B foam extinguishers discharge a foam solution that floats across the surface of a burning liquid and prevents the fuel from vaporizing.

The foam blanket forms a barrier between the fuel and the oxygen, extinguishing the flames and preventing reignition.

These agents are not suitable for Class B fires that involve pressurized fuels or cooking oils.

The most common Class B additives are aqueous film-forming foam (AFFF) and film-forming fluoroprotein (FFFP) foam.

Both concentrates produce very effective foams. Which one should be used depends on the product’s compatibility with a particular flammable liquid and other extinguishing agents that could be used on the same fire.

Foam

Some Class B foam extinguishing agents are approved for use on polar solvents, which are water-soluble flammable liquids, such as alcohols, acetone, esters, and ketones. Only extinguishers that are specifically labeled for use with polar solvents should be used if these products are present.

Although they are not specifically intended for Class A fires, most Class B foams can also be used on ordinary combustibles.

The reverse is not true, however; Class A foams are not effective on Class B fires.

Foam extinguishers are not suitable for use on Class C fires and cannot be stored or used at freezing temperatures.
Wet Chemical

Wet chemical extinguishers are the only type of extinguisher to qualify under the new Class K rating requirements.

They use wet chemical extinguishing agents, which are chemicals applied as water solutions.

Before Class K extinguishing agents were developed, most fire extinguishing systems for kitchens used dry chemicals. The minimum requirement for a commercial kitchen was a 40-B-rated sodium bicarbonate or potassium bicarbonate extinguisher.

These systems required extensive clean-up after their use, which often resulted in serious business interruptions.

All new fixed extinguishing systems in restaurants and commercial kitchens now use wet chemical extinguishing agents. These agents are specifically formulated for use in commercial kitchens and food-product manufacturing facilities, especially where food is cooked in a deep fryer.

The fixed systems discharge the agent directly over the cooking surfaces. There is no numeric rating of their efficiency in portable fire extinguishers.

The Class K wet chemical agents include aqueous solutions of potassium acetate, potassium carbonate, and potassium citrate, either singly or in various combinations. The wet agents convert the fatty acids in cooking oils or fats to a soap or foam, a process known as saponification.

When wet chemical agents are applied to burning vegetable oils, they create a thick blanket of foam that quickly smothers the fire and prevents it from reigniting while the hot oil cools.
The agents are discharged as a fine spray, which reduces the risk of splattering. They are very effective at extinguishing cooking oil fires, and clean-up afterward is much easier, allowing a business to reopen sooner.

---

**Halogenated Agents**

Halogenated extinguishing agents are produced from a family of liquefied gases, known as halogens, that includes fluorine, bromine, iodine, and chlorine. Hundreds of different formulations can be produced from these elements with many different properties and potential uses. Although several of these formulations are very effective for extinguishing fires, only a few of them are commonly used as extinguishing agents. Halogenated extinguishing agents are called clean agents because they leave no residue and are ideally suited for areas that contain computers or sensitive electronic equipment. Per pound, they are approximately twice as effective at extinguishing fires as carbon dioxide.

There are two categories of halogenated extinguishing agents: halons and halocarbons. A 1987 international agreement, known as the Montreal Protocol, limits halon production because these agents damage the earth’s ozone layer. Halons have been replaced by a new family of extinguishing agents, halocarbons.
Halogenated Agents
The halogenated agents are stored as liquids and are discharged under relatively high pressure.
They release a mist of vapor and liquid droplets that disrupt the molecular chain reactions within the combustion process to extinguish a fire.
These agents dissipate rapidly in windy conditions, as does carbon dioxide, so their effectiveness is limited in outdoor locations. Because these agents also displace oxygen, they should be used with care in confined areas.
Halon 1211 (bromochlorodifluoromethane) should be used judiciously and only in situations where its clean properties are essential because of its environmental impact.
Small Halon 1211 extinguishers are rated for Class B and C fires but are unsuited for use on fires involving pressurized fuels or cooking grease.
Larger halon extinguishers are also rated for Class A fires.
Currently, four types of halocarbon agents are used in portable extinguishers: hydrochlorofluorocarbon, hydrofluorocarbon, perfluorocarbon, and fluoroiodocarbon.

Dry Powder
Dry powder extinguishing agents are chemical compounds used to extinguish fires involving combustible metals (Class D fires).
These agents are stored in fine granular or powdered form and are applied to smother the fire.
They form a solid crust over the burning metal to exclude oxygen and absorb heat. The most commonly used dry powder extinguishing agent is formulated from finely ground sodium chloride (table salt) plus additives to help it flow freely over a fire.
A thermoplastic material mixed with the agent binds the sodium chloride particles into a solid mass when they come into contact with a burning metal.
Another dry powder agent is produced from a mixture of finely granulated graphite powder and compounds containing phosphorus. This agent cannot be expelled from fire extinguishers; it is produced in bulk form and applied by hand, using a scoop or a shovel.
When applied to a metal fire, the phosphorus compounds release gases that blanket the fire and cut off its supply of oxygen.
The graphite absorbs heat from the fire, allowing the metal to cool below its ignition temperature.
point.
Other specialized dry powder extinguishing agents are available for fighting specific types of metal fires.
For details, see NFPA’s *Fire Protection Handbook*.

Class D agents must be applied very carefully so that the molten metal does not splatter.
No water should come in contact with the burning metal.
Fire Extinguisher Design

All portable fire extinguishers use pressure to expel their contents onto a fire. Many portable fire extinguishers rely on pressurized gas to expel the extinguishing agent. The gas can be stored with the extinguishing agent in the body of the extinguisher or externally in a separate cartridge or cylinder. With external storage, the extinguishing agent is put under pressure only as it is used. Some extinguishing agents, such as carbon dioxide, are called self-expelling agents. Most of these agents are normally gases, which are stored as liquids under pressure. When the confining pressure is released, the agent rapidly expands, causing it to self-discharge. Hand-operated pumps are used to expel the agent when water or water with additives is the extinguishing agent.

Portable Fire Extinguisher Components

Most hand-held portable fire extinguishers have six basic parts:
- Cylinder or container
- Carrying handle
- Nozzle or horn
- Trigger
- Locking mechanism
- Pressure indicator

Cylinder or container The body of the extinguisher, known as the cylinder or container, holds the extinguishing agent. Nitrogen, compressed air, or carbon dioxide can be used to pressurize the cylinder to expel the agent. Stored-pressure extinguishers store both the extinguishing agent, in wet or dry form, and the expeller gas under pressure in the cylinder. Cartridge/cylinder extinguishers rely on an external cartridge of pressurized gas, which is only released when the extinguisher is to be used.
Portable Fire Extinguisher Components

Handle

- Used to carry an extinguisher and to hold it during use
- Extinguishers weighing more than 3 lb (1.35 kg) must have handles.
- Usually located below the trigger mechanism

Nozzle or horn

- Expels agent
- Attached directly to valve assembly or at the end of a short hose
- Foam extinguishers have a special aspirating nozzle.
- In some extinguishers, the nozzle is attached directly to the valve assembly at the top of the extinguisher.
- In other models, the nozzle is at the end of a short hose.
- Foam extinguishers have a special aspirating nozzle that introduces air into the extinguishing agent, creating the foam.
- Carbon dioxide extinguishers have a tubular or conical horn, which is often mounted at the end of a short hose.
- Pump tank extinguishers, which are non-pressurized, manually operated water extinguishers, usually have a nozzle at the end of a short hose.

Trigger

- Mechanism that is squeezed or depressed to discharge the extinguishing agent
- Usually a lever located above the handle
- Cartridge/cylinder models usually have a two-step operating sequence
Portable Fire Extinguisher Components

The locking mechanism is a simple quick-release device that prevents unintentional discharge of the extinguishing agent. The simplest form of locking mechanism is a stiff pin, which is inserted through a hole in the trigger to prevent it from being depressed. The pin usually has a ring at the end so that it can be removed quickly. A special plastic tie, called a tamper seal, is used to secure the pin. The tamper seal is designed to break easily when the pin is pulled. Removing the pin and tamper seal is best accomplished with a twisting motion. The tamper seal makes it easy to see whether the extinguisher has been used and not recharged. The seal also discourages people from playing or tinkering with the extinguisher.

Portable Fire Extinguisher Components

Pressure indicator The pressure indicator or gauge shows whether a stored-pressure extinguisher has sufficient pressure to operate properly. Over time, the pressure in an extinguisher may dissipate. Checking the gauge first will tell you whether the extinguisher is ready for use. Pressure indicators vary in design and sophistication. Most extinguishers use a needle gauge. Pressure may be shown in pounds per square inch or on a three-step scale (too low, proper range, too high). Pressure gauges are usually color-coded; a green area indicates the proper pressure zone. Extinguishers that are pressurized by a cartridge lack a pressure gauge. Some disposable fire extinguishers intended for home use have an even simpler pressure indicator.
Wheeled Fire Extinguishers
Wheeled fire extinguishers are large units mounted on wheeled carriages. Wheeled extinguishers typically contain between 150 and 350 lb (67.5-157.5 kg) of extinguishing agent. The wheeled design lets one person transport the extinguisher to the fire.

If a wheeled extinguisher is intended for indoor use, doorways and aisles must be wide enough to allow passage to every area where it could be needed.

Wheeled fire extinguishers usually have long delivery hoses, so the unit can stay in one spot as the operator moves around to attack the fire from more than one side. Usually, a separate cylinder containing nitrogen or some other compressed gas provides the pressure necessary to operate the extinguisher. Wheeled fire extinguishers are most often installed in special hazard areas.

Fire Extinguisher Characteristics
Introduction to Fire Extinguisher Characteristics
Portable fire extinguishers vary according to their extinguishing agent, capacity, effective range, and the time it takes to completely discharge their agent. They also have different mechanical designs. The seven types of extinguishers described include:

- Water extinguishers
- Dry chemical extinguishers
- Carbon dioxide extinguishers
- Class B foam extinguishers
- Halogenated-agent extinguishers
- Dry powder extinguishing agents
- Wet chemical extinguishers
Water Extinguishers
Water extinguishers are used to cool the burning fuel below its ignition temperature. Water extinguishers are intended for use primarily on Class A (common combustibles) fires. Class B foam extinguishers, which are a specific type of water extinguisher, are intended for flammable liquids fires. Water extinguishers include stored-pressure, loaded-stream, and wetting-agent models.

Water Extinguishers
Stored-pressure water-type extinguisher The most popular kind of stored-pressure water-type extinguisher is the 2.5-gallon (9.5-L) model with a 2-A rating. Many fire department vehicles carry this type of fire extinguisher for use on incipient Class A fires. This extinguisher expels water in a solid stream with a range of 35’ to 40’ (10.5-12 m) through a nozzle at the end of a short hose. The discharge time is approximately 55 seconds if the extinguisher is used continuously. A full extinguisher weighs approximately 30 lb (13.5 kg).

Because the contents of these extinguishers can freeze, they should not be installed in areas where the temperature is expected to drop below 32°F (0°C). Antifreeze models of stored-pressure water-type extinguishers, called loaded-stream extinguishers, are available. The loaded-stream agent will not freeze at temperatures as low as −40°F (−40°C). The recommended procedure for operating a stored-pressure water extinguisher

Set it on the ground, grasp the handle with one hand, and pull out the ring pin or release the locking latch with the other hand. The extinguisher can be lifted and used to douse the fire. Use one hand to aim the stream at the fire, and squeeze the trigger with the other hand. The stream of water can be made into a spray by putting a thumb at the end of the nozzle; this technique is often used after the flames have been extinguished to thoroughly soak the fuel. Stored-pressure water-type extinguishers can be recharged at any location that provides water.
and a source of compressed air. Follow the manufacturer’s instructions to ensure proper and safe recharging.

**Water Extinguishers**

Loaded-stream water-type extinguishers
Discharge a solution of water containing an alkali metal salt that prevents freezing at temperatures as low as –40°F (–40°C)
The most common model is the 2.5-gallon (9.5-L) unit, which is identical to a typical stored-pressure water extinguisher.
Hand-held models are available with capacities of 1 to 2.5 gallons (3.8-9.5 L) of water and are rated from 1-A to 3-A.
Larger units, including a 17-gallon (64.6-L) unit rated 10-A and a 33-gallon (125.4-L) unit rated 20-A, are also available.
Pressure for these extinguishers is supplied by a separate cylinder of carbon dioxide.
Wetting-agent and class A foam water-type extinguishers expel water that contains a solution to reduce its surface tension (the physical property that causes water to bead or form a puddle on a flat surface).
Reducing the surface tension allows water to spread over the fire and penetrate more efficiently into Class A fuels.
Class A foam extinguishers contain a solution of water and Class A foam concentrate.
Both wetting-agent and Class A foam extinguishers are available in the same configurations as water extinguishers, including hand-held stored-pressure models and wheeled units.
These extinguishers should not be exposed to temperatures below 40°F (4°C).
Water Extinguishers

Pump tank water-type extinguishers come in sizes ranging from 1-A rated, 1.5-gallon (5.7-L) units to 4-A rated, 5-gallon (19-L) units. The water in these units is not stored under pressure. The pressure to expel the water is provided by a hand-operated, double-acting, vertical piston pump, which moves water out through a short hose on both the up and the down strokes. This type of extinguisher sits upright on the ground during use. A small bracket at the bottom allows the operator to steady the extinguisher with one foot while pumping. Pump tank extinguishers can be used with antifreeze. The manufacturer should be consulted for details because some types of antifreeze (such as common salt) can corrode the extinguisher or damage the pump. Extinguishers with steel shells corrode more easily than those with copper or nonmetallic shells.
Water Extinguishers

- Backpack water-type
  - Used primarily for brush and grass fires
  - Wide mouth opening with filter allows easy refill.
  - Filter keeps contaminants from entering the tank

Backpack water-type extinguishers are used primarily outdoors for fighting brush and grass fires. Most of these units have a tank capacity of 5 gallons (19 L) and weigh approximately 50 lb (22.5 kg) when full. Backpack extinguishers are listed by Underwriters Laboratories, Inc., but do not carry numeric ratings.

The water tank can be made of fiberglass, stainless steel, galvanized steel, nylon, canvas, or brass. Backpack extinguishers are designed to refill easily in the field, from a lake or a stream, through a wide-mouth opening at the top. A filter keeps dirt, stones, and other contaminants from entering the tank. Antifreeze agents, wetting agents, or other special water-based extinguishing agents can be used with backpack water-type extinguishers. Most backpack extinguishers have hand pumps. The most common design has a trombone-type, double-acting piston pump located at the nozzle, which is attached to the tank by a short rubber hose.

The operator holds the pump in both hands and moves the piston back and forth. Some models have a compression pump built into the side of the tank. It takes about 10 strokes of the pump handle to build the initial pressure, which is maintained through continuous slow strokes. The operator uses the other hand to control the discharge. A lever-operated shut-off nozzle is provided at the end of a short hose.
**Dry Chemical Extinguishers**

Dry Chemical Extinguishers Contain a variety of chemical extinguishing agents in granular form.

- Hand-held dry chemical extinguishers are available with capacities ranging from 1 to 30 lb (0.45-13.5 kg) of agent.
- Wheeled fire extinguishers are available with capacities up to 350 lb (157.5 kg) of agent.
- Ordinary dry chemical models can be used to extinguish Class B and C fires.
- Multipurpose dry chemical models are rated for use on Class A, B, and C fires.
- All dry chemical extinguishing agents can be used on Class C fires that involve energized electrical equipment; however, the residue left by the dry chemical can be very damaging to computers, electronic devices, and electrical equipment.
- Stored-pressure units expel the dry chemical agent in the same manner as a stored-pressure water extinguisher.
- The dry chemical agent in a cartridge/cylinder extinguisher is not stored under pressure.

**Dry Chemical Extinguishers**

Most small, hand-held dry chemical extinguishers are designed to discharge completely in as few as 8 to 20 seconds. Depending on the extinguisher’s size, the horizontal range of the discharge stream can be from 5’ to 30’ (1.5-9.0 m). The trigger allows the extinguisher to be discharged intermittently, starting and stopping the agent flow.

- Anytime a dry chemical extinguisher has been activated or partially used, the extinguisher must be serviced and recharged to replenish the extinguishing agent and restore the unit’s pressure.
- Dry chemical fire extinguishers can be stored and used in areas with temperatures below freezing.
Dry Chemical Extinguishers

Ordinary dry chemical extinguishers Available in hand-held models with ratings up to 160-B:C. Larger, wheeled units carry ratings up to 640-B:C. 

Multipurpose dry chemical extinguishers

Ammonium phosphate is commonly called a multipurpose dry chemical agent because it can be used on Class A, B, and C fires. Multipurpose dry chemical extinguishers are available in hand-held models with ratings ranging from 1-A to 20-A and from 10-B:C to 120-B:C. Larger, wheeled models have ratings ranging from 20-A to 40-A and from 60-B:C to 320-B:C. Multipurpose dry chemical extinguishers should never be used on cooking oil (Class K) fires. The ammonium phosphate–based extinguishing agent is acidic and will not react with cooking oils to produce the smothering foam needed to extinguish the fire. Worse, the acid will counteract the foam-forming properties of any alkaline extinguishing agent that is applied to the same fire.

Carbon Dioxide Extinguishers

Carbon Dioxide Fire Extinguishers Rated to fight Class B and C fires 

Carbon dioxide extinguishes a fire by enveloping the fuel in a cloud of inert gas, which reduces the oxygen content of the surrounding atmosphere and smothers the flames. Because the carbon dioxide discharge is very cold, it also helps to cool the burning materials and surrounding areas. Carbon dioxide gas is 1.5 times heavier than air, colorless, odorless, nonconductive, and inert. It is also noncorrosive and does not leave any residue.
Carbon Dioxide Extinguishers

Carbon dioxide is both an expelling agent and an extinguishing agent. The agent is stored under a pressure of 823 psi (1896 kPa), which keeps the carbon dioxide in liquid form at room temperatures. When the pressure is released, the liquid carbon dioxide rapidly converts to a gas. The expanding gas forces the agent out of the container. The carbon dioxide is discharged through a siphon tube that reaches to the bottom part of the storage cylinder. It is forced through a hose to a horn or cone-shaped applicator that is used to direct the flow of the agent. When discharged, the agent is very cold and contains a mixture of carbon dioxide gas and solid carbon dioxide, which quickly converts to gas.

Compared with other types of extinguishers, carbon dioxide extinguishers have relatively short discharge ranges of 3’ to 8’ (0.9-2.5 m). Depending on size, carbon dioxide extinguishers can discharge completely in 8 to 30 seconds. Carbon dioxide fire extinguishers are not recommended for outdoor use or for locations with strong air currents. Trigger mechanism allows intermittent operation. Extinguisher will have to be recharged after use. Extinguisher is weighed to determine how much agent is left in the storage cylinder.

Carbon dioxide extinguishers have a trigger mechanism that can be operated intermittently to preserve the remaining agent. The pressurized carbon dioxide will remain in the extinguisher, but the extinguisher will have to be recharged after use. The extinguisher is weighed to determine how much agent is left in the storage cylinder. The smaller carbon dioxide extinguishers contain from 2 to 5 lb (0.9-2.25 kg) of agent. These units are designed to be operated with one hand. The horn is attached directly to the discharge valve on the top of the extinguisher by a hinged metal tube. In larger models, the horn is attached at the end of a short hose. These models require two-handed operation.
Class B Foam Extinguishers
Aspirating nozzle discharges solution of water and aqueous film-forming foam and film-forming fluoroprotein agent.
Foam blanket floats over surface of liquid.
Effective for Class A and B fires but not suitable for Class C or K fires
Not effective at freezing temperatures
Class B Foam Extinguishers Very similar in appearance and operation to water extinguishers
Instead of plain water they discharge a solution of water and either AFFF or FFFP foam concentrate.
The agent is discharged through an aspirating nozzle, which mixes air into the stream.
They create a foam blanket that will float over the surface of a flammable liquid.
Class B foam agents are also very effective in fighting Class A fires.
They are not suitable for Class C fires or for fires involving flammable liquids or gases under pressure.
They are not intended for use on cooking oil fires, and only certain foam extinguishers can be used on fires involving polar solvents.
Detailed information on the use of AFFF and FFFP is available in NFPA Standard 11.
AFFF and FFFP hand-held stored-pressure extinguishers are available in two sizes: 1.6 gallons (6.1 L), rated 2-A:10-B, and 2.5 gallons (9.5 L), rated 3-A:20-B.
A wheeled model with a 33-gallon (125.4-kg) capacity is rated 20-A:160-B.
Foam extinguishing agents are not effective at freezing temperatures.

Wet Chemical Extinguishers
Used to protect Class K installations
Commercial facilities use fixed, automatic systems.
Portable extinguishers available.
No numerical ratings
Wet Chemical Extinguishers Used to protect Class K installations, which include cooking oils, deep fryers, and grills
Many commercial cooking installations use fixed, automatic fire-extinguishing systems as their first line of defense.
Portable Class K wet chemical extinguishers are currently available in two sizes, 1.5 gallons (5.7 L) and 2.5 (9.5 L) gallons.
There are no numerical ratings for these extinguishers.
Halogenated-Agent Extinguishers

Halogenated-Agent Extinguishers Include both halon agents and halocarbon agents. Because halon agents can destroy the earth’s protective ozone layer, their use is strictly controlled.

The halocarbons are not subject to the same environmental restrictions. Both types of agents are available in hand-held extinguishers rated for Class B and C fires. Larger capacity models are also rated for use on Class A fires.

The agent is discharged as a streaming liquid, which can be directed at the base of a fire. The discharges from these extinguishers have a horizontal stream range of 9’ to 15’ (2.7-4.5 m). The halogenated agents are nonconductive and leave no residue that can damage electrical equipment.

Halon 1211 (bromochlorodifluoromethane) is available in hand-held stored-pressure extinguishers with capacities that range from 1 lb (0.45 kg), rated 1-B:C, to 22 lb (9.9 kg), rated 4-A:80-B:C.

Wheeled Halon 1211 models are available with capacities up to 150 lb (67.5 kg) with a rating of 30-A:160-B:C.

The wheeled fire extinguishers use a nitrogen booster charge from an auxiliary cylinder to expel the agent.
Dry Powder Extinguishing Agents

Dry Powder Extinguishing Agents Intended for fighting Class D fires involving combustible metals.

The extinguishing agents and the techniques required to extinguish Class D fires vary greatly and depend on the specific fuel, the quantity involved, and the physical form of the fuel, such as grindings, shavings, or solid objects. The agent and the application method must be suited to the particular situation.

Each dry powder extinguishing agent is listed for use on specific combustible metal fires. This information and recommended application methods are printed on the container. Consult the manufacturer’s recommendations for information about Class D agents and extinguishers and NFPA’s Fire Protection Handbook.

Dry powder fire extinguishers Sodium chloride–based agents are available with 30-lb (13.5-kg) capacity in either stored-pressure or cylinder/cartridge models. Wheeled models are available with 150-lb (67.5-kg) and 350-lb (157.5-kg) capacities.

Dry powder extinguishers have adjustable nozzles that allow the operator to vary the flow of the extinguishing agent. When the nozzle is fully opened, the hand-held models have a range of 6’ to 8’ (1.8-2.4 m). Extension wand applicators are available to direct the discharge from a more distant position.

Bulk dry powder agents
Available in 40-lb (18-kg) and 50-lb 22.5-kg) pails and 350-lb (157.5-kg) drums

The same sodium chloride–based agent that is used in portable fire extinguishers can be stored in bulk form and applied by hand.

Another dry powder extinguishing agent for Class D fires, graded granular graphite mixed with compounds containing phosphorus, cannot be expelled from a portable fire extinguisher. This agent must be applied manually from a pail or other container using a shovel or scoop.
Use of Fire Extinguishers

Fire extinguishers should be simple to operate. An individual with only basic training should be able to use most fire extinguishers safely and effectively.

Every portable extinguisher should be labeled with printed operating instructions.

There are six basic steps in extinguishing a fire with a portable fire extinguisher:

1. Locate the fire extinguisher.
2. Select the proper classification of extinguisher.
3. Transport the extinguisher to the location of the fire.
4. Activate the extinguisher to release the extinguishing agent.
5. Apply the extinguishing agent to the fire for maximum effect.
6. Ensure your personal safety by having an exit route.

Although these steps are not complicated, practice and training are essential for effective fire suppression.

Tests have shown that the effective use of Class B portable fire extinguishers depends heavily on user training and expertise.

A trained expert can extinguish a fire up to twice as large as a nonexpert can, using the same extinguisher.

As a fire fighter, you should be able to operate any fire extinguisher that you might be required to use, whether it is carried on your fire apparatus, hanging on the wall of your firehouse, or placed in some other location.

Locating a Fire Extinguisher

Fire fighters should know what types of fire extinguishers are carried on department apparatus and where each type of extinguisher is located.

You should also know where fire extinguishers are located in and around the fire station and other work places.

You should have at least one fire extinguisher in your home and another in your personal vehicle and you should know exactly where they are located.
Selecting the Proper Extinguisher
Selecting the Proper Extinguisher
This requires an understanding of the classification and rating system for fire extinguishers. Knowing the different types of agents, how they work, the ratings of the fire extinguishers carried on your fire apparatus, and which extinguisher is appropriate for a particular fire situation is also important. Fire fighters should be able to assess a fire quickly, determine if the fire can be controlled by an extinguisher, and identify the appropriate extinguisher. Using an extinguisher with an insufficient rating may not completely extinguish the fire, which can place the operator in danger of being burned or otherwise injured. If the fire is too large for the extinguisher, you will have to consider other options, such as obtaining additional extinguishers or making sure that a charged hose line is ready to provide back-up. Fire fighters should also be able to determine the most appropriate type of fire extinguisher to place in a given area, based on the types of fires that could occur and the hazards that are present. In some cases, one type of extinguisher might be preferred over another.

Transporting a Fire Extinguisher
Transporting a Fire Extinguisher
The best method of transporting a hand-held portable fire extinguisher depends on the size, weight, and design of the extinguisher. Hand-held portable fire extinguisher can weigh as little as 1 lb (0.45 kg) to as much as 50 lb (22.5 kg). Extinguishers with a fixed nozzle should be carried in the favored or stronger hand. This enables the operator to depress the trigger and direct the discharge easily. Extinguishers that have a hose between the trigger and the nozzle should be carried in the weaker or less favored hand so that the favored hand can grip and aim the nozzle. Heavier extinguishers may have to be carried as close as possible to the fire and placed upright on the ground. The operator can depress the trigger with one hand, while holding the nozzle and directing the stream with the other hand.
Basic Steps of Fire Extinguisher Operation

Activating a fire extinguisher to apply the extinguishing agent is a single operation in four steps.

The PASS acronym is a helpful way to remember these steps:
- Pull the safety pin.
- Aim the nozzle at the base of the flames.
- Squeeze the trigger to discharge agent.
- Sweep the nozzle across the base of the flames.

Most fire extinguishers have very simple operation systems.

Practice discharging different types of extinguishers in training situations to build confidence in your ability to use them properly and effectively.

Ensure Your Personal Safety

When using a fire extinguisher, always approach the fire with an exit behind you.

If the fire suddenly expands or the extinguisher fails to control it, you must have a planned escape route.

Never let the fire get between you and a safe exit. After suppressing a fire, do not turn your back on it.

Always watch and be prepared for a rekindle until the fire has been fully overhauled.

If outside, keep the wind at your back.

As a fire fighter, you should wear your personal protective clothing and use appropriate personal protective equipment (PPE).

If you must enter an enclosed area where an extinguisher has been discharged, wear full PPE and use self-contained breathing apparatus.

The atmosphere within the enclosed area will probably contain a mixture of combustion products and extinguishing agents.

The oxygen content within the space may be dangerously low.
Care of Fire Extinguishers
Fire extinguishers must be regularly inspected and properly maintained so they are available for use in an emergency. Records must be kept to ensure that the required inspections and maintenance have been performed on schedule. The individuals assigned to perform these functions must be properly trained and must always follow the manufacturer’s recommendations for inspecting, maintaining, recharging, and testing the equipment.

Inspection
According to NFPA Standard 10, an inspection is a “quick check” to verify that a fire extinguisher is available and ready for immediate use. Fire extinguishers on fire apparatus should be inspected once per month as part of the regular equipment checks mandated by your department. The fire fighter charged with inspecting the extinguishers should:
- Ensure that tamper seals are intact.
- Determine fullness by weighing or “hefting” the extinguisher.
- Examine all parts for signs of physical damage, corrosion, or leakage.

Care of Fire Extinguishers
- Extinguishers must be regularly inspected and properly maintained.
- Records keep inspections and maintenance on schedule.
- Proper training required.
- Follow manufacturer’s recommendations.

Inspection
- Check extinguishers on apparatus once per month.
- Check tamper seals.
- Weigh or “heft” to determine fullness.
- Examine for obvious physical damage, corrosion, or leaks.

Inspection
- Check pressure gauge.
- Confirm proper identification.
- Check hose and nozzle for damage or obstructions.
- Check the hydrostatic test date.

Inspection
- Check the pressure gauge to be sure it is in the operable range. Ensure that the extinguisher is properly identified by type and rating.
- Check the hose and nozzle for damage or obstruction by foreign objects.
- Check the hydrostatic test date of the extinguisher.
- If an inspection reveals any problems, the extinguisher should be removed from service until the required maintenance procedures are performed.
- The pressure gauge on a stored-pressure extinguisher indicates whether the pressure is sufficient to expel the entire agent.
- The weight of the extinguisher and the presence of an intact tamper seal should indicate that it is full of extinguishing agent.
Maintenance
- Includes internal inspections and repairs
- Must be performed periodically
- Only qualified personnel can perform maintenance.

Maintenance
The maintenance requirements and intervals for various types of fire extinguishers are outlined in NFPA Standard 10. Maintenance includes an internal inspection and any repairs that may be required. Maintenance procedures must be performed periodically, depending on the type of extinguisher. An inspection may also reveal the need to perform maintenance procedures. Maintenance procedures must always be performed by a qualified person.

Common Indicators of Need for Maintenance
- Pressure gauge reads outside normal range
- Inspection tag is out-of-date
- Broken tamper seal
- Any indication that unit is not full
- Obstructed hose or nozzle assembly
- Physical damage, corrosion, or rust
- Leakage around the discharge valve or nozzle assembly

Common Indicators of Need for Maintenance
Common indications that an extinguisher needs maintenance include: The pressure gauge reading is outside the normal range. The inspection tag is out of date. The tamper seal is broken, especially in extinguishers with no pressure gauge. There is any indication that the extinguisher is not full of extinguishing agent. The hose or nozzle assembly is obstructed. There are signs of physical damage, corrosion, or rust. Signs of leakage around the discharge valve or nozzle assembly can be seen.
**Recharging**

A fire extinguisher must be recharged after each and every use, even if it was not completely discharged. The only exceptions are nonrechargeable extinguishers, which should be replaced after any use. All performance standards assume that an extinguisher will be fully charged when it has to be used.

Immediately after any use, an extinguisher should be taken out of service until it has been properly recharged. This also applies to any extinguisher that leaks or has a pressure gauge reading above or below the proper operating range. When an extinguisher is recharged, the extinguishing agent is refilled and the system that is provided to expel the agent is fully charged.

Both the quantity of the agent and the pressurization must be verified. A tamper seal is installed after recharging.

Typical 2.5-gallon (9.5-L) stored-pressure water extinguishers can be recharged by fire fighters using water and a source of compressed air. Before the extinguisher is refilled, all remaining stored pressure must be discharged so that the valve assembly can be safely removed. Water is added up to the water-level indicator, and the valve assembly is replaced. Compressed air is then introduced to raise the pressure to the level indicated on the gauge.

**Hydrostatic Testing**

Most fire extinguishers are pressure vessels, designed to hold a steady internal pressure. The ability of an extinguisher to withstand this internal pressure is measured by periodic hydrostatic testing. The hydrostatic testing requirements for fire extinguishers are established by the US Department of Transportation and can be found in NFPA Standard 10. The test is conducted in a special test facility and involves filling the extinguisher with water and applying above-normal pressure.
Hydrostatic Testing

- Must indicate most recent test on the outside of the extinguisher
- All out-of-date extinguishers must be tested at an appropriate facility.

Summary

- Fire extinguishers put out hundreds of fires every day. **Firefighters use fire extinguishers to control small fires.**
- Portable fire extinguishers are used for two reasons:
  - Extinguish incipient-stage fires
  - Control fires where traditional methods are not recommended
- Fire extinguishers are one time use only.
- The five classes of fires are: Class A, B, C, D, and K.
- Portable fire extinguishers are classified and rated based on their characteristics and capabilities.
- Fire extinguisher classification uses both letters and numbers.

Hydrostatic Testing

Must indicate most recent test on the outside of the extinguisher
All out-of-date extinguishers must be tested at an appropriate facility.
Each extinguisher has an assigned maximum interval between hydrostatic tests, usually 5 or 12 years, depending on the construction material and vessel type. The date of the most recent hydrostatic test must be indicated on the outside of the extinguisher.
An extinguisher may not be refilled if the date of the most recent hydrostatic test is not within the prescribed limit.
Any extinguisher that is out of date should be removed from service and sent to the appropriate maintenance facility for hydrostatic testing.

Summary

Fire extinguishers put out hundreds of fires every day. Firefighters use fire extinguishers to control small fires.
**Portable fire extinguishers are used for two reasons:**
Extinguish incipient-stage fires
Control fires where traditional methods are not recommended
Fire extinguishers are one time use only. The five classes of fires are: Class A, B, C, D, and K.
**Portable fire extinguishers are classified and rated based on their characteristics and capabilities.**
Fire extinguisher classification uses both letters and numbers.
Summary
Traditional lettering system for fire extinguishers are:
- Class A: letter A on solid green triangle
- Class B: letter B on solid red square
- Class C: letter C on solid blue circle
- Class D: letter D on solid yellow, five-pointed star
- Class K: pictograph showing a fire in a frying pan

The pictograph system uses symbols rather than letters for classifying fire extinguishers.

NFPA 10 lists requirements for placing and mounting portable fire extinguishers.

There are three risk classifications based on the fire risk associated with materials in those areas.

Extinguishers stop fire by cooling fuel below ignition point, cutting off supply of oxygen, or a combination of the two.

Portable fire extinguishers use seven basic types of extinguishing agents.

Hand-held portable fire extinguishers have six basic parts.

Portable fire extinguishers vary according to their extinguishing agent, capacity, effective range, and the time it takes to discharge the extinguishing agent.

Summary
There are six basic steps in extinguishing a fire with a portable fire extinguisher.
- There are four steps to activating a fire extinguisher.
- Use a fire extinguisher with an exit and the wind at your back.
- Inspect and maintain fire extinguishers.
- Firefighters inspecting extinguishers should follow specific guidelines.
- There are common indications that an extinguisher needs maintenance.
- A fire extinguisher must be recharged after every use.
- Most fire extinguishers are pressurized vessels.

Inspection and maintenance ensure fire extinguisher availability.

Firefighters inspecting extinguishers should follow specific guidelines.

There are common indications that an extinguisher needs maintenance.

A fire extinguisher must be recharged after every use.

Most fire extinguishers are pressurized vessels.