

EXTINGUISHER

INTRODUCTION

Fire extinguishers are essential fire suppression tools that firefighters use in the initial stage of a fire and against this background, it is important to be knowledgeable of the innumerable types and be able to determine the most suitable type for different situations. It is ideally important to be familiar with the various parts and their functions. Primarily, fires generally start small and with the proper know-how and application, an extinguisher can be used to prevent what could be a major conflagration. Extinguishers also prevent water and other damages which may occur in fighting small fires.

Aim Of Module

The purpose of this module is to sensitize firefighters on the subject of extinguishers.

Module Objectives

On completion of this module trainees will be able to:

- state what is an extinguisher
- describe how the extinguishing media in extinguisher are expelled
- state the different types of extinguishers
- explain the advantages and disadvantages of the different extinguishing media
- outline and describe the production of foam in extinguishers
- list the different types of vaporizing liquids
- list the chemicals used in dry chemical powder extinguishers
- name the principal parts of an extinguisher
- identify the principal parts of an extinguisher
- recommend the ideal extinguishers for the different types of fire
- explain the operation of a fire extinguisher
- demonstrate the use of a typical fire extinguisher

EXTINGUISHERS

A fire extinguisher is a portable metal storage container for extinguishing agents such as water, dry chemical powder, foam etc. They are labeled A, B or C to the classification of the fires they are designed to be used on and are particularly effective in the incipient (early) stage of a fire.

The extinguishing agent is expelled either by:

- a. *CHEMICAL REACTION* - pressure provided by a chemical reaction occurring.
- b. *GAS CARTRIDGE* - pressure provided by the piercing of an inert gas cartridge
- c. *STORED PRESSURE* - pressure is stored in the extinguisher

Each extinguisher will the following marked on it:

- i. the words "Fire Extinguisher"
- ii. method of operation
- iii. description of contents
- iv. year of manufacture
- v. testing pressure and working pressure
- vi. the standard based on certification by an accredited organization eg. Bureau of Standards
- vii. the type (gas cartridge, stored pressure or chemical reaction).
- viii. the temperature range over which the extinguisher will operate satisfactorily
- ix. whether the extinguisher is to be recharged or discarded after use.

Fire extinguishers may be classified by *contents* and by *method of operation* as shown in table (i).

Table (i)

		CONTENTS				
		Water	Foam	Powder	Halon	Co ₂
Method of Operation	Chemical	*	*			
	Gas cartridge	*	*	*		
	Stored pressure	*	*	*	*	*

WATER (STORED PRESSURE) EXTINGUISHER

It consists of welded body that is plastic lined to prevent corrosion (as pressure tends to speed up corrosion) and has a screwed cap containing the valve assembly. It is filled with water and then pressurized by compressed air to 4 – 10 bars. The pressure is identified by means of a gauge. The method of operation usually follows the basic procedure illustrated.

WATER (GAS CARTRIDGE) EXTINGUISHER

Water is contained in a steel container, lined to prevent corrosion. The head cap assembly incorporates a plunger device and connection for 57g CO₂ cartridge. The cartridge allows the CO₂ to pressure the extinguisher and force the water through the discharge tube:

Advantages:

- i. Often quickest for first attack
- ii. Requires only one person to operate it
- iii. Self contained
- iv. Reliable
- v. Instantaneous

Disadvantages:

- i. Conductor of electricity
- ii. Not ideal for inaccessible fires

CHEMICAL FOAM EXTINGUISHER

Chemical foam extinguishers consist of an inner container within an outer extinguisher body. When the contents of the two are mixed together, a chemical reaction occurs producing foam and carbon dioxide CO₂. The CO₂ fills the bubbles and also acts as an expellant.

Contents:

Outer container	-	Sodium Bicarbonate Solution
Stabilizer	-	Saponin, Liquorices, Turkey-red oil
Inner container	-	Aluminum Sulphate Solution

More modern types containing self-aspiration foam have largely replaced these.

MECHANICAL FOAM EXTINGUISHERS

Foam concentrate is contained in solution in the extinguisher body. When expelled, the foam is aerated by means of a small foam-making branch at the end of the extinguisher hose. The foam is expelled by a gas cartridge or stored pressure.

Advantages: These are similar to water-type extinguisher

- i. Coats surface and exclude oxygen
- ii. Heat resisting qualities acts as insulator, preventing re-ignition
- iii. Not affected by draughts
- iv. Floats on liquids

Disadvantages:

- i. Some fires require alcohol resistant foam
- ii. Some foam reacts with dry chemical and are broken down
- iii. Chemical and mechanical foam have harmful effects on each other (do not use together)

When using foam, it should not be allowed to strike the surface of the burning material directly, but should be allowed to strike a vertical wall or side of the container so that it may run down and form a blanket which will spread over the liquid. If the liquid is not confined, allow the foam to fall gently over the surface of the liquid.

VAPORIZING LIQUIDS

Extinguisher may also contain substances called vaporizing liquids. These are Halogenated Hydro Carbons (Halon). The more common types are:

- i. Bromochlorodifluoromethane (BCF)
- ii. Bromotrifluoromethane (BTM)
- iii. Chlorobromomethane (CBM)

These extinguishers are generally stored pressure types using CO₂ or nitrogen as pressure agents. This extinguishing medium has an "inhibitory factor". This is the proportion of extinguishing medium which is required to be resented in air in order to prevent combustion. Because of their negatives impact on the environment, these extinguishers are being phased out.

DRY POWDER EXTINGUISHER

Various chemicals are used in dry powder extinguishers, depending on the job they are intended. For example:

- Sodium Bicarbonate - for flammable liquids (class B)
- Potassium Bicarbonate - used in the USA for class B fires
- Ammonium Phosphates - "General Purpose" for class A & B fires
- Ternary Eutectic Chloride - (TEC) for Uranium, Plutonium and Magnesium Alloys

All dry powders are treated to improve their "flow" properties and reduce "caking". This treatment may involve the adding of a small portion of very fine silica to the contents.

CARBON DIOXIDE EXTINGUISHERS

These consist basically of a pressure cylinder with a valve for releasing the gas and a discharge horn. The gas is maintained in liquid form at a pressure of 50 bars (750 psi). The discharge horn allows the gas to expand at a ratio of 450:1 and when it is directed into the fire, prevents air from being pulled along entrainment by reducing the velocity of gas. The average discharge time is 16 – 30 seconds.

Points to note:

- The gas makes considerable noise, this however indicates that the extinguisher is working.
- CO₂ forms a dense vapor that may impair visibility in a confined space.
- CO₂ has not cooling effect so there is risk of re-ignition.
- If the orifice at the sealing disc freezes, preventing discharge of the gas, it may be cleared in most models by closing and opening the control valve.

Advantages:

- i. Rapid in action, independent of atmospheric temperature.
- ii. It is an inert gas which quickly disperses, leaving no trace.
- iii. It is a non-conductor of electricity.
- iv. Can be used in the incipient (first) stage of highly flammable liquid fires.
- v. Penetrates inaccessible places

Disadvantages:

- i. The total weight in relation to the contents is considerable
- ii. There is no visible way to check the contents

Testing is usually in accordance with the manufacturer's instruction and at the times specified. In addition to these hand-held extinguishers, there are also what is known as *trolley units* and *fixed installations*.

WET CHEMICAL (K CLASS) EXTINGUISHERS

Due to new and improved cooking appliances, higher heating rates and industry trends toward using more unsaturated oils, the potential for severe restaurant fires is greater than ever. A new “K Class Extinguisher” rated to specifically identify and address these commercial “combustible cooking media” fire hazard in the kitchen is developed. It contains a special Potassium Acetate based, Potassium Carbonate base or Potassium Citrate base with water. This extinguisher extinguishes the fires by removing the heat of the fire triangle and prevents re-ignition by creating a barrier between the oxygen and fuel elements. Wet chemical or “Class K” extinguisher developed for modern, high efficiency deep fat fryers in commercial cooking operations may also be used on “Class A” fires (involving wood, paper, cloth, trash etc.) in commercial kitchen. This extinguisher can be obtained under different brand names.

METAL / SAND EXTINGUISHERS

These extinguishers are for flammable metals (class D fires) and work by simply smothering the fire with powdered copper metal or sodium chloride (NaCl).

- The copper extinguishing agent is preferred for fires involving lithium and lithium alloys. It is the only known lithium firefighting agent which will cling to a vertical surface thus making it the preferred agent on three dimensional and flowing fires.
- Sodium Chloride works well for metal fires involving magnesium, sodium (spills and in depth) potassium alloys, uranium and powdered aluminum. Heat from the fires causes the agent to cake and form a crust that excludes air and dissipates heat.

HALOTRON 1 EXTINGUISHERS

Like carbon dioxide units, these are used on Class B and US Class C fires. Halogen 1 is an ozone-friendly replacement for Halogens (which is banned by international agreements starting in 1994). This “clean agent” discharge a liquid, has high visibility during discharge, does not cause static shock, leaves no residue and is a non-conductor of electricity. These properties make it ideal for computer rooms, telecommunication equipment and electronics. The superior properties of Halotron come at a high cost to carbon dioxide.

WATER MIST EXTINGUISHERS

These extinguishers are ideal for Class A fires. Unlike an ordinary water extinguisher, the misting nozzle provides safety from electrical shock and reduces scattering of burning materials. This is ideal for protection of hospital environments, books, documents and clean room facilities.

EXTINGUISHERS FOR CLASS A FIRES

Class A fires extinguishers are generally water-based. Water provides a heat-absorbing (cooling) effect on the burning material to extinguish the fire. These are primarily stored pressure or gas cartridge.

EXTINGUISHERS FOR CLASS B FIRES

Class B fires are extinguished by excluding air, by slowing down the release of flammable vapors or by interrupting the chain reaction of the combustion. Three (3) types of extinguishing agents are: carbon dioxide, dry chemical and foam. They are used for fire involving flammable liquids, greases and oils. Carbon dioxide is a compressed gas agent that prevents combustion by displacing the oxygen in the air surrounding the fire. The two types of dry chemical extinguishers include one that contains ordinary sodium or potassium bicarbonate, urea potassium bicarbonate, and potassium chloride based agent. The second, multi-purpose type contains ammonium phosphate based. The multipurpose extinguisher can be used on class A B and C fires. Most dry chemical extinguishers use stored pressure to discharge the agent and the fire is extinguished mainly by the interruption of the combustion chain reaction. Foam extinguisher use an aqueous film forming foam (AFFF) agent that expels a layer of foam when it is discharged through a nozzle. It acts as a barrier to exclude oxygen from the fire.

EXTINGUISHERS FOR CLASS C FIRES

Class C fires involves gases or liquefied gases in the form of a gas leakage. Usually, these gases when compressed in containers (cylinders) are often in a liquid state. However, when expelled it changes its state from a liquid to a gas. Example – butane, methane etc. Foam CO₂ and dry chemical powders are good extinguishing medium.

EXTINGUISHERS FOR CLASS D FIRES

A heat-absorbing extinguishing medium is needed for fires in combustible metals. Also, the heat-extinguishing medium must not react with the burning metal. The extinguishing agents, known as dry powders, cover the burning metal and provide a smothering blanket. Carbon dioxide because of its sluggish, lazy and non-reactive abilities would also be a good media to extinguish these fires. Examples of class D fires: Uranium, Plutonium and Magnesium alloy.

METHOD OF OPERATION

A typical gas cartridge extinguisher operates by:

- i. Removing a safety pin plug
- ii. Applying pressure to the operating lever this cause a pressure disc on the cartridge to be pierced and at the same time opens a control valve. The release of gas exerts pressure (10 bar) on the surface of the extinguishing medium (foam, water, chemical powder), forcing it up the discharge tube and out through the hose and nozzle.
- iii. Controlling the discharge via the operating.

The difference with the stored pressure extinguisher is that the whole container is pressurized. Air or nitrogen is pumped into it through a special adapter in the operating head until the pressure reaches about ten (10) bars. Removing the safety pin or plug and squeezing the lever, operates the extinguisher. This opens the control valve and allows the pressurized air to expel the contents. Again, the discharge can be controlled by lever.

METHODS OF OPERATION OF A TYPICAL FIRE EXTINGUISHER

Pull-Aim-Squeeze-Sweep (PASS)

A typical fire extinguisher is operated by:

- **Pull** Pull the safety pin. Some units require the releasing of a lock latch, pressing a puncture lever inversion or the other motion.

- **Aim** Aim the extinguisher nozzle (hose or horn) at the base of the fire.
- **Squeeze** Squeeze or press the operating lever
- **Sweep** Sweep from side to side at the base of the fire. Watch for re-flash. Discharge the contents of the extinguisher.

CARE AND MAINTENANCE OF EXTINGUISHERS

It is recommended that extinguishers be checked periodically to ensure that:

- the extinguisher is not blocked by equipment, coats or other objects that could interfere with access in an emergency.
- the pressure is at the recommended level for stored pressure extinguishers equipped with a gauge.
- the nozzle or other parts are not obstructed.
- the safety pin, latch or lock are intact.
- there are not dents, leaks, rust, chemical deposits or other signs of abuse or wear. Wipe off any corrosive chemicals, oil gunk etc. that may have landed on the extinguisher.
- the dry chemical extinguisher does not cake or settle. Some manufactures recommended these be shaken periodically.
- the cartridges the gas cartridge extinguisher be punctured.
- fire extinguishers should be pressure tested (a process called hydro testing) after a number of years to ensure that the container is safe to use.

If an extinguisher is damaged or needs recharging, it is to be noted, promptly reported and replaced. It is advisable to recharge all extinguishers immediately after use regardless of how much was used.

