



FIRE PROTECTION SUBPART L

Portable Fire Suppression Equipment

SCOPE, APPLICATION, AND DEFINITIONS - 1910.155

This subpart contains requirements for fire brigades, and all portable and fixed fire suppression equipment, fire detection systems, and fire and employee alarm systems installed to meet the fire protection requirements of 29 CFR 1910.

It applies to employment other than maritime, construction and agriculture.

This discussion will be limited to fire brigades and portable fire suppression equipment.

There are many important definitions included in Subpart L. Some of these are summarized below.

Class A fire. A fire involving ordinary combustible materials such as paper, wood, cloth, and some rubber and plastic materials.

Class B fire. A fire involving flammable or combustible liquids, flammable gases, greases and similar materials, and some rubber and plastic materials.

Class C fire. A fire involving energized electrical equipment where safety to the employee requires the use of electrically nonconductive extinguishing media.

Class D fire. A fire involving combustible metals such as magnesium, titanium,



zirconium, sodium, lithium and potassium.

Dry chemical. An extinguishing agent primarily composed of very small particles of chemicals; e.g., sodium bicarbonate, potassium bicarbonate, monoammonium phosphate.

Dry powder. A compound used to extinguish or control Class D fires.

Extinguisher rating. The numerical rating given to an extinguisher which indicates the extinguishing potential of the unit based on standardized tests developed by Underwriters' Laboratories Inc.

Fire brigade. An organized group of employees who are knowledgeable, trained, and skilled in at least basic fire fighting operations.

Halon 1211. A colorless, faintly sweet smelling, electrically nonconductive liquefied gas (CBrClF₂) which is a medium for extinguishing fires by inhibiting the chemical chain reaction of fuel and oxygen. It is also known as bromochlorodifluoromethane.

Halon 1301. A colorless, odorless, electrically nonconductive gas (CBrF₃) which is a medium for extinguishing fires by inhibiting the chemical chain reaction of fuel and oxygen. It is also known as bromotrifluoromethane.

Incipient stage fire. A fire which is in the initial or beginning stage and which can be controlled or extinguished by portable fire extinguishers, Class II standpipe or small hose systems without the need for protective clothing or breathing apparatus.

Interior structural fire fighting. The physical activity of fire suppression, rescue, or both, inside of buildings or enclosed structures which are involved in



a fire situation beyond the incipient stage.

Multipurpose dry chemical. A dry chemical which is approved for use on Class A, Class B and Class C fires.

Standpipe systems.

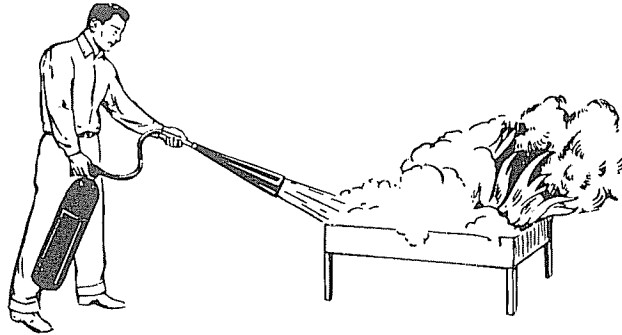
- Class I system means a 2-½" hose connection for use by fire departments and those trained in handling heavy fire streams.
- Class II system means a 1-½" hose system which provides a means for the control or extinguishment of incipient stage fires.
- Class III system means a combined system of hose which is for the use of employees trained in hose operations and which is capable of furnishing effective water discharge during the more advanced stages of fire (beyond the incipient stage) in the interior of workplaces. Hose outlets are available for both 1-½" and 2-½" hose.
- Small hose system means a system of hose (⅝" to 1-½" diameter) which is for the use of employees for the control or extinguishment of incipient stage fires.



FIRE BRIGADES - 1910.156

Scope and Application

This section contains requirements for the organization, training, and personal protective equipment of fire brigades whenever they are established by an employer. It should be noted that this regulation does not require an employer to establish fire brigades. If they are established, however, the requirements of this section must be met.



The requirements of this section apply to fire brigades, industrial fire departments and private or contractual fire departments. This section does not apply to airport crash rescue or forest fire fighting operations.

Organization

The employer shall prepare and maintain a written policy statement which:

- Establishes the fire brigade and its organizational structure;
- Defines the functions to be performed; and
- States training program requirements.

The employer must assure that employees who are expected to do interior structural fire fighting are physically capable of performing duties which may be assigned to them during emergencies.



Training and Education

Training shall be conducted prior to assignment and at least annually for all fire brigade members. Quarterly training or education sessions are required for those fire brigade members expected to perform interior structural fire fighting.

Some sources of qualified training instructors are:

- Local Fire Department
- State Fire Marshal's Office
- State University Extension Service
- International Society of Fire Service Instructors
- Community College Fire Science Programs

Fire Fighting Equipment

The employer shall maintain and inspect, at least annually, fire fighting equipment to assure safe operational condition of the equipment. Portable fire extinguishers and respirators shall be inspected at least monthly.

Protective Clothing

These requirements apply to those employees who perform interior structural fire fighting. The requirements do not apply to employees who use fire extinguishers or standpipe systems to control or extinguish fires only in the incipient stage.

Requirements for protective clothing are specified for the following components:

- Foot and leg protection
- Body protection



- Hand protection
- Head, eye and face protection

Respiratory Protection Devices

The employer shall assure that respiratory protection devices worn by fire brigade members meet the requirements of 1910.134 and the requirements contained in this section. These respirators must also be certified under 30 CFR Part 11.



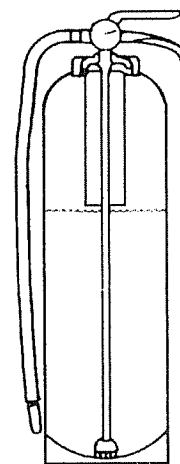
PORTABLE FIRE EXTINGUISHERS - 1910.157

Scope and Application

The requirements of this section apply to the placement, use, maintenance, and testing of portable fire extinguishers provided for the use of employees.

The selection and distribution requirements of this section do not apply to extinguishers provided for employee use on the outside of workplace buildings or structures.

Where extinguishers are provided but are not intended for employee use and the employer has an emergency action plan and a fire prevention plan which meet the requirements of 1910.38, then only the requirements of this section dealing with inspection, maintenance and testing apply.



Exemptions

The standard does not require the employees to use extinguishers. Where the employer has a total evacuation policy and an emergency action plan and a fire prevention plan which meet the requirements of 1910.38, and extinguishers are not available in the workplace, the employer is exempt from all requirements of this section unless a specific standard in Part 1910 requires that a portable extinguisher be provided.

Where the employer has an emergency action plan meeting the requirements of 1910.38 which establishes fire brigades and requires all other employees to evacuate, the employer is exempt from the distribution requirements of this section.



General Requirements

General requirements regarding portable fire extinguishers include:

- Mount, locate and identify extinguishers so that they are readily accessible to employees.
- Only approved extinguishers shall be used.
- Carbon tetrachloride or chlorobromomethane extinguishing agents are prohibited.
- Maintain extinguishers in a fully charged and operable condition and keep in their designated places at all times except during use.
- Soldered or riveted shell inverting type extinguishers shall be permanently removed from service.

Selection and Distribution

Extinguishers shall be provided for employee use and selected and distributed based on the classes of anticipated workplace fires and on the size and degree of hazard which would affect their use.

Extinguishers shall be distributed so that the following maximum travel distances apply:

Class A . . . 75 feet

Class B . . . 50 feet

Class C . . . Based on appropriate pattern for existing Class A or B hazards.

Class D . . . 75 feet



Inspection, Maintenance and Testing

Extinguishers shall be visually inspected monthly, maintained annually, and hydrostatically tested periodically as per Table L-1 of this standard.

Training and Education

- Employees shall be educated in use of extinguishers and associated hazards upon initial employment and at least annually thereafter.
- Employees designated to use fire fighting equipment shall be trained.

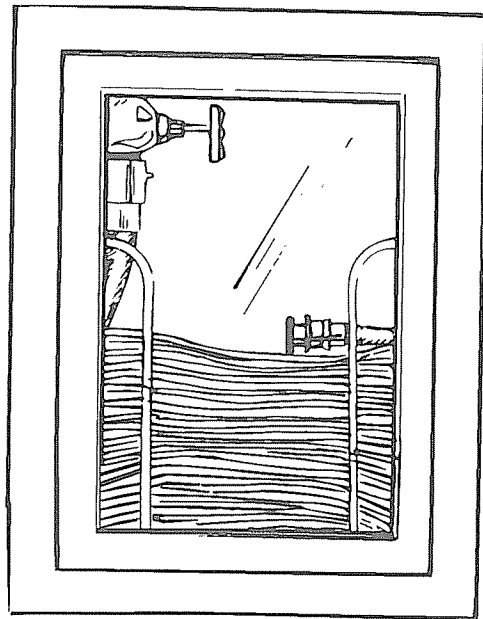


STANDPIPE AND HOSE SYSTEMS - 1910.158

This section applies to all small hose, Class II, and Class III standpipe systems required by other OSHA standards. It does not apply to Class I standpipe systems.

Protection of Standpipes

Standpipes shall be located or otherwise protected against mechanical damage. Damaged standpipes shall be repaired promptly.



Equipment

Hose Reels and Cabinets

Where reels or cabinets are provided to contain fire hose, the employer shall assure that they are designed to facilitate prompt use at the time of an emergency.

Hose Outlets and Connections

Hose outlets and connections must be located high enough above the floor to avoid being obstructed and to be accessible to employees.

Hose

Each required hose outlet shall be equipped with hose connected and ready for use.

Where hose may be damaged by extreme cold, it may be kept in a protected location as long as it is readily available to be connected for use.



Nozzles

The employer shall assure that standpipe hose is equipped with shut-off type nozzles. There are two basic nozzle types:

- Straight stream
- Fog (also referred to as variable stream, spray or combination)

While fog is generally preferred, straight stream is acceptable.

Water Supply

The minimum water supply for standpipe and hose systems, which are provided for the use of employees, shall be sufficient to provide 100 gallons per minute for at least thirty minutes.

Tests and Maintenance

Acceptance Tests

Piping and hose of Class II and Class III systems shall be hydrostatically tested before being placed in service.

Maintenance

The following maintenance items are required for standpipe and hose systems:

- Water supply tanks are to be kept filled except during repairs.
- Valves in the main piping connections to the automatic sources of water supply must always be kept fully open except during repairs.
- Hose systems must be inspected at least annually and after each use.
- Any unserviceable portion of the system must be removed immediately



and replaced with equivalent protection during repair.

- Hemp or linen hoses shall be unracked, inspected for deterioration, and re-racked using a different fold pattern at least annually. Defective hose shall be replaced.
- Trained persons shall be designated to conduct all these required inspections.



Fixed Fire Suppression Equipment

AUTOMATIC SPRINKLER SYSTEMS - 1910.159

Scope and Application

This section applies to all automatic sprinkler systems installed to meet a particular OSHA standard. Systems installed solely for property protection are not covered.

General Requirements

All automatic sprinkler designs must provide the necessary discharge patterns, densities, and water flow characteristics for complete coverage. Only approved equipment and devices shall be used.

Maintenance

Systems shall be properly maintained. A main drain flow test must be performed on each system annually. The inspector's test valve shall be opened at least every two years to assure proper operation of the system.

Acceptance Tests

New systems shall have proper acceptance tests conducted including:

- Flushing of underground connections;
- Hydrostatic tests of system piping;
- Air-tests in dry-pipe systems;
- Test of drainage facilities.



Water Supplies

Every automatic sprinkler system must be provided with at least one automatic water supply capable of providing design water flow for at least 30 minutes.

Sprinkler Spacing

In order to provide a maximum protection area per sprinkler and a minimum of interference to the discharge pattern, the vertical clearance between sprinklers and material below shall be at least 18 inches.



FIXED EXTINGUISHING SYSTEMS, GENERAL - 1910.160

Scope and Application

This section applies to all fixed extinguishing systems installed to meet a particular OSHA standard except for automatic sprinkler systems covered by 1910.159.

Certain paragraphs of this section also apply to fixed systems not installed to meet a particular OSHA standard, but which, by their operation, may expose employees to possible injury, death or adverse health consequences caused by the extinguishing agent.

Specific fixed extinguishing systems using dry chemical, gaseous agents, water spray and foam are regulated by 1910.161 through 1910.163.

General Requirements

Fixed extinguishing system components and agents must be designed and approved for use on the specific fire hazards they are expected to control.

If the system becomes inoperable, the employer shall notify employees and take the necessary temporary precautions to assure their safety until the system is restored to operating order.

Except where discharge is immediately recognizable, a distinctive alarm or signalling system which complies with 1910.165 and is capable of being perceived above ambient noise or light levels shall be provided on all extinguishing systems in those areas covered by the system.

Effective safeguards shall be provided to warn employees against entry into



discharge areas where the atmosphere remains hazardous to employee safety or health.

Hazard warning or caution signs shall be posted at the entrance to, and inside of, areas protected by systems which use agents in hazardous concentrations.

Fixed systems shall be inspected annually by a person knowledgeable in the design and function of the system.

The weight and pressure of refillable containers and the weight of nonrefillable containers shall be checked at least semi-annually.

Total Flooding Systems with Potential Health and Safety Hazards to Employees

The employer shall provide an emergency action plan per 1910.38 for each area protected by a total flooding system which provides agent concentrations exceeding the maximum safe levels specified in 1910.162(b)(5) and (b)(6).

All systems must have a pre-discharge alarm which complies with 1910.165 and is capable of being perceived above ambient light or noise levels, which will give the employees time to safely exit from the discharge area prior to discharge.

Automatic actuation of the system shall be provided by an approved fire detection device interconnected with the pre-discharge employee alarm system.



FIXED EXTINGUISHING SYSTEMS, DRY CHEMICAL - 1910.161

Scope and Application

This section applies to all fixed systems using dry chemical as the extinguishing agent, installed to meet a particular OSHA standard. These systems must also comply with 1910.160.

Specific Requirements

Dry chemical agents must be compatible with any foams or wetting agents with which they are used.

When dry chemical discharge may obscure vision, a pre-discharge employee alarm is required which complies with 1910.165 and which will give employees time to safely exit from the discharge area prior to system discharge.

The rate of application of dry chemicals must be such that the designed concentration of the system will be reached within 30 seconds of initial discharge.



FIXED EXTINGUISHING SYSTEMS, GASEOUS AGENT - 1910.162

Scope and Application

This section applies to all fixed extinguishing systems, using a gas as the extinguishing agent, installed to meet a particular OSHA standard. These systems shall also comply with 1910.160.

Specific Requirements

For total flooding systems, the designed extinguishing concentration must be reached within 30 seconds of initial discharge except for Halon systems which must achieve design concentration within 10 seconds.

For total flooding systems, a pre-discharge alarm is required on Halon 1211 and carbon dioxide systems with a design concentration of 4 percent or greater and for Halon 1301 systems with a design concentration of 10 percent or greater. The alarm must provide employees time to safely exit the discharge area prior to system discharge.

For total flooding systems using Halon 1301:

- Where egress from an area takes more than one minute, agent concentrations of more than 7 percent shall not be used.
- Where egress takes longer than 30 seconds, but less than one minute, concentrations are limited to 10 percent.
- Concentrations greater than 10 percent are only permitted in areas not normally occupied, provided that any employee in the area can escape within 30 seconds.



FIXED EXTINGUISHING SYSTEMS, WATER SPRAY AND FOAM - 1910.163

Scope and Application

This section applies to all fixed extinguishing systems, using water or foam solution as the extinguishing agent, installed to meet a particular OSHA standard. These systems must also comply with 1910.160. This section does not apply to automatic sprinkler systems which are covered under 1910.159.

Specific Requirements

The foam and water spray systems must be designed to be effective in at least controlling fire in the protected area or on protected equipment.

Drainage of water spray systems must be directed away from areas where employees are working and no emergency egress is permitted through the drainage path.



FIRE DETECTION SYSTEMS - 1910.164

Scope and Application

This section applies to all automatic fire detection systems installed to meet a particular OSHA standard.

Installation and Restoration

Only approved devices and equipment may be used.

All fire detection systems and components shall be restored to normal operating condition as soon as possible after each test or alarm.

Maintenance and Testing

All systems must be maintained in an operable condition except during repairs or maintenance.

Fire detectors and fire detection systems (unless factory calibrated) must be tested and adjusted as often as needed to maintain proper reliability and operating condition.

Servicing, maintenance and testing of fire detection systems must be performed by a trained person knowledgeable in the operations and functions of the system.

Protection of Fire Detectors

Fire detection equipment installed outdoors or in the presence of corrosive atmospheres shall be protected from corrosion.



Detection equipment must be located and/or protected from mechanical or physical impact.

Response Time

Fire detection systems installed for the purpose of actuating fire extinguishment or suppression systems shall be designed to operate in time to control or extinguish a fire.

Detection systems installed for the purpose of employee alarm and evacuation must be designed and installed to provide a warning for emergency action and safe escape of employees.

Number, Location, and Spacing of Detecting Devices

The number, location, and spacing of fire detectors must be based upon design data obtained from field experience, or tests, engineering surveys, manufacturer's recommendations, or a recognized testing laboratory listing.



EMPLOYEE ALARM SYSTEMS - 1910.165

Scope and Application

This section applies to all emergency employee alarms installed to meet a particular OSHA standard.

General Requirements

The employee alarm system shall provide warning for necessary emergency action as called for in the emergency action plan, or for the reaction time for safe escape of employees.

The employee alarm shall be capable of being perceived above ambient noise or light levels by all employees in the affected portions of the workplace.

The alarm must be distinctive and recognizable as a signal to evacuate the work area or to perform actions designated under the emergency action plan.

The employer shall explain to each employee the preferred means of reporting emergencies, such as manual pull box alarms, public address systems, radio or telephones.

Installation and Restoration

All devices, components and systems installed to comply with this standard must be approved.

All employee alarm systems must be restored to normal operating condition as promptly as possible after each test or alarm.



Maintenance and Testing

All employee alarm systems shall be maintained in operating condition except when undergoing repairs or maintenance.

A test of the reliability and adequacy of non-supervised employee alarm systems must be made every two months. A different actuation device shall be used in each test of a multi-actuation device system so that no individual device is used for two consecutive tests.

All supervised employee alarm systems must be tested at least annually for reliability and adequacy.

Servicing, maintenance and testing of systems must be done by persons trained in the designed operation and functions necessary for reliable and safe operation of the system.

Manual Operation

Manually operated actuation devices for use in conjunction with employee alarms shall be unobstructed, conspicuous and readily accessible.

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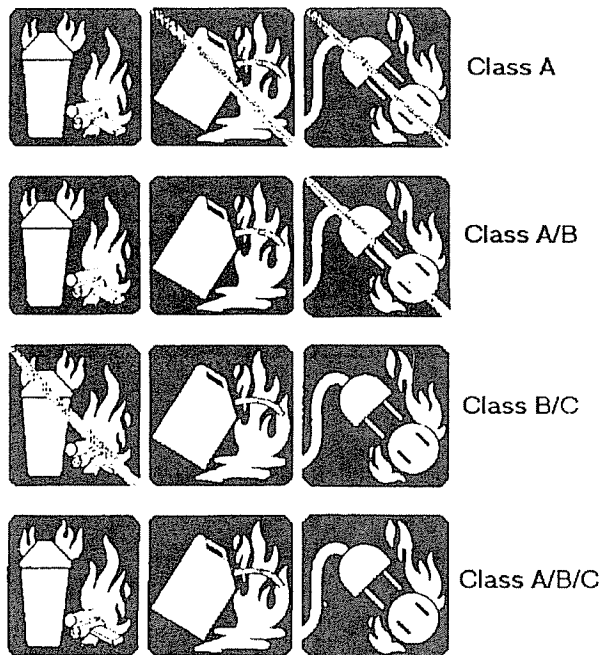


CLASSIFICATION OF PORTABLE FIRE EXTINGUISHERS

Portable fire extinguishers are classified to indicate their ability to handle specific classes and sizes of fires. Labels on extinguishers indicate the class and relative size of fire that they can be expected to handle.

Class A extinguishers are used on fires involving ordinary combustibles, such as wood, cloth, and paper. Class B extinguishers are used on fires involving liquids, greases, and gases. Class C extinguishers are used on fires involving energized electrical equipment. Class D extinguishers are used on fires involving metals such as magnesium, titanium, zirconium, sodium, and potassium.

The recommended marking system to indicate the extinguisher suitability according to class of fire is a pictorial concept that combines the uses and non-uses of extinguishers on a single label. This system is illustrated in the accompanying figure. The first set (row) of symbols illustrated in the figure is a label for use on a Class A extinguisher. The symbol at the left (which depicts a Class A fire) is blue. Since the extinguisher is not recommended for use on Class B or C fires, the remaining two symbols (which depict Class B and Class C fires) are black, with a diagonal red line through them. The second set (row) of symbols illustrated in the figure is a label for use on a Class A/B extinguisher. The two left symbols are blue. Since the extinguisher is not recommended for use on Class C fires, the symbol on the far right (which depicts a Class C fire) is black, with a diagonal red line through it. The third set of symbols is a label for use on Class B/C extinguishers. The two right symbols are blue. Since the extinguisher is not recommended for use on Class A fires, this symbol is black, with a diagonal red line through it. The fourth set of symbols is a label for use on Class A/B/C extinguishers. All symbols on this label are blue.



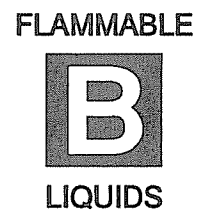


Letter-shaped symbol markings are also used to indicate extinguisher suitability according to class of fire.

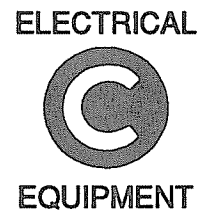
Extinguishers suitable for Class A fires should be identified by a triangle containing the letter "A." If colored, the triangle should be green.



Extinguishers suitable for Class B fires should be identified by a square containing the letter "B." If colored, the square shall be colored red.



Extinguishers suitable for Class C fires should be identified by a circle containing the letter "C." If colored, the circle should be colored blue.



Extinguishers suitable for fires involving metals should be identified by a five-pointed star containing the letter "D." If colored, the star shall be colored yellow.



Extinguishers suitable for more than one class of fire should be identified by multiple symbols placed in a horizontal sequence.

Class A and Class B extinguishers carry a numerical rating to indicate how large a fire an experienced person can put out with the extinguisher. The ratings are based on reproducible physical tests conducted by Underwriters' Laboratories, Inc. Class C extinguishers have only a letter rating because there is no readily measurable quantity for Class C fires which are essentially Class A or B fires involving energized electrical equipment. Class D extinguishers likewise do not



have a numerical rating. Their effectiveness is described on the faceplate.

Class A Ratings

An extinguisher for Class A fires could have any one of the following ratings: 1-A, 2-A, 3-A, 4-A, 6-A, 10-A, 20-A, 30-A, and 40-A. A 4-A extinguisher, for example, should extinguish about twice as much fire as a 2-A extinguisher.

Class B Ratings

An extinguisher for Class B fires could have any one of the following ratings: 1-B, 2-B, 5-B, 10-B, 20-B, 30-B, 40-B, and up to 640-B.

Class C Ratings

Extinguishers rated for Class C fires are tested only for electrical conductivity. However, no extinguisher gets a Class C rating without a Class A and/or Class B rating.

Class D Ratings

Class D extinguishers are tested on metal fires. The agent used depends on the metal for which the extinguisher was designed. Check the extinguisher faceplate for the unit's effectiveness on specific metals.



COMMON FIRE EXTINGUISHING AGENTS

- Water
- Carbon dioxide
- Dry chemical
- Multipurpose dry chemical
- Halon 1301
- Halon 1211



WATER

- Removes heat
- Effective on Class A fires
- Inexpensive
- Plentiful
- Non-toxic

Disadvantages:

- Conducts electricity
- May spread Class B fires
- Freezes in cold climates
- May carry pollutants as run-off water



CARBON DIOXIDE (CO₂)

- Reduces oxygen to less than 15%
- Effective on Class B and C fires
- No residue
- Relatively inert

Disadvantages:

- Generally >35% concentration by volume required for total flooding systems
- Toxic to humans at >4% by volume
- Not the best agent for smoldering deep-seated fires (maintain concentration for >20 minutes)
- Dissipates rapidly - allows reflash
- Has a cooling/chilling effect on some electronic components
- Vapor density = 1.5 (collects in pits and low areas)



DRY CHEMICAL

- Interrupts chemical reactions
- Sodium bicarbonate (baking soda)
- Very effective on Class B and C fires
- Not considered toxic

Disadvantages:

- Leaves a residue
- Obscures vision
- Not good on deep-seated Class A fires
- Absorbs moisture and may "cake" within container
- May be irritating
- Nozzle pressure may cause burning liquids to splash



MULTIPURPOSE DRY CHEMICAL

- Interrupts chemical reactions
- Ammonium phosphate
- Effective on Class A, B, and C fires
- Non-conductive

Disadvantages:

- Obscures vision
- More irritating than ordinary dry chemical
- Nozzle pressure may cause burning liquids to splash



HALON TERMINOLOGY

Halon 104: Carbon tetrachloride (CCl₄)

Halon 1211: Bromochlorodifluoromethane (CBrClF₂)

Halon 1301: Bromotrifluoromethane (CBrF₃)

C	F	Cl	Br
1	0	4	-
1	2	1	1
1	3	0	1



HALON 1301

- Interrupts chemical reactions
- Bromotrifluoromethane
- Effective on Class A, B, and C fires
- Not acutely toxic at <10% by volume
- Generally used at <7% by volume
- No residue
- No chilling effect on electronic parts and components

Disadvantages:

- Acutely toxic at >10% by volume (anesthetic and cardiac effects)
- Delayed effects and effects of chronic exposure not well known
- Toxic decomposition products are generated by fire
- Vapor density = 5 (collects in pits and low areas)
- Production restricted per Montreal Protocol due to depletion of ozone layer



HALON 1301 DECOMPOSITION PRODUCTS

- Hydrogen fluoride (HF)
- Hydrogen bromide (HBr)
- Bromine (Br₂)
- Carbonyl Fluoride (COF₂)
- Carbonyl Bromide (COBr₂)



HALON 1211

- Interrupts chemical reactions
- Bromochlorodifluoromethane
- Effective on Class A, B, and C fires
- No residue
- May be sprayed (Boiling Point = 25°F)
- Used in portable fire extinguishers

Disadvantages:

- Acutely toxic at >4% by volume (dizziness, impaired coordination and cardiac effects)
- Must be used at >5% by volume
- Toxic decomposition products are generated by fire
- Vapor density = 5.7 (collects in pits and low areas)
- Production restricted per Montreal Protocol due to depletion of ozone layer



HALON 1211 DECOMPOSITION PRODUCTS

- Hydrogen bromide (HBr)
- Hydrogen chloride (HCl)
- Hydrogen fluoride (HF)
- Bromine (Br₂)
- Chlorine (Cl₂)
- Fluorine (F₂)
- Carbonyl bromide (COBr₂)
- Carbonyl chloride (COCl₂)
- Carbonyl fluoride (COF₂)