Fire Extinguishers & Foam Agents

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Section II - Engine Company Operations

Classifications of Fire

Fire Extinguishing Agents

Fire Extinguisher Ratings, Markings & Operation

SDFD Fire Extinguishers

Foam Extinguishing Agents

Revised - December 2018

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Objectives

- Identify the five classes of fire and state the materials associated with them.
- Identify the four basic methods for extinguishing fires and the extinguishing agents in use today, and the classes of fire they are used against.
- Identify any special hazards that can be found when fighting specific classes of fire.
- Explain the basic operating principles of fire extinguishers.
- Explain the U.L. fire extinguisher rating system.
- Identify the markings used to classify a fire extinguisher's appropriate use.
- Describe the types of portable fire extinguishers found on SDFD fire apparatus.
- Describe the daily maintenance and checks to be done on portable fire extinguishers on SDFD apparatus.
- Know the fire extinguisher complements found on SDFD apparatus.
- Know the basic considerations concerning location and inspection of fire extinguishers encountered during F.C.I.P.
- Know the proper procedures for dealing with deficient fire extinguishers encountered during F.C.I.P.
- Describe the various types of obsolete fire extinguishers which may be encountered in private use.
- Describe components of firefighting foam
- Explain the differences between Class A and Class B foam
- Describe a compressed air foam system or CAFS

Introduction

Figure 10-1 Soda Acid Fire Extinguisher

History

Soon after man invented fire, someone probably fell asleep who should have been watching that fire. When it spread to the nearest blanket, a quick thinking caveman kicked dirt on that fire, and the first extinguisher was invented. As technology progressed, so did the fire extinguisher. From gourds and buckets to carry water to throw on fire all the way to today's highly effective hand-held extinguishers, man has constantly sought out new and better ways to stop incipient fires from growing out of control. The modern fire extinguishers began during the 17th century and progressed from pearl-ash with compressed air to soda-acid, Figure 10-1, to carbon tetrachloride fire grenades made out of glass. Today's portable fire extinguishers can still use water and compressed air, but modern chemical families such as halocarbon-based agents continue to be developed in the attempt to keep the small fires from growing out of control.

Fire Extinguishers Today

Firefighters have many tools available to them to complete whatever tasks are at hand. Portable fire extinguishers are a good choice for attacking incipient fires that may be difficult to access with hose lines and where quick action can stop them from growing bigger. They are also a good tool to bring when investigating reported fires that may be a distance from the apparatus, especially in high rise structures and industrial buildings. Not only can they help to extinguish small fires, but in case a larger fire is found, they may be the tool needed for quick protection, allowing for the chance to back out and get hose lines in place. For these reasons, firefighters need to be knowledgeable in the use and maintenance of the basic extinguishers found on engines, trucks and brush rigs in SDFD. In addition, throughout one's career, one will find specialty extinguishers in use on chemical pick-ups, on crash rigs, and for use at haz-mat situations. It is important to have a good working knowledge of all extinguishers used by SDFD.

According to the NFPA, 98% of all fires can be extinguished by a portable fire extinguisher if the correct type is quickly put into service and properly used. Firefighters need to be familiar with not just fire extinguishers in use in the department, but also extinguishers found during fire inspections (F.C.I.P.'s) and the codes that govern them. Knowing how to inspect extinguishers for proper maintenance, location and access will give the public the chance to use them properly to limit property damage and possibly save lives.

Classification of Fire

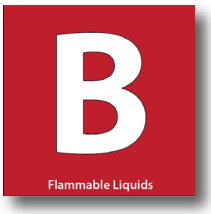
Fires have been divided into five separate classes based on the type of fuel involved and any special hazards and considerations. Knowing these classes allows the firefighters to not only select the best type of extinguisher to use in fighting that fire, but also recognize specific dangers present in order to be as safe as possible.

Class A (Green Triangle)

Class A fires involve ordinary combustibles. These materials are wood, paper, cloth and most plastics. Fires in homes, workshops, businesses, places of assembly and also wildfires in the urban-interface environment are typically considered Class A.

The primary extinguishing agent for these types of fires is water. When water is turned to steam by the fire, it will take the heat energy out of the material, thus cooling it to below its ignition temperature. Class A foam agents, or "wet water," can greatly assist in extinguishing deep seated fires, such as those in hay bales, dumpsters, collapsed structures or other bulky materials. These additives reduce the surface tension of water, allowing it to penetrate more easily into piles of materials. Keep in mind that Class A fires are difficult to extinguish using oxygen-excluding methods like CO2 flooding or coating with foam because those methods do not provide the necessary cooling effects needed for total extinguishment. Cooling is the best method for extinguishing Class A fires.

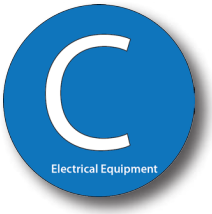
Class B (Red Square)



Class B fires involve flammable and combustible liquids and gases such as gasoline, alcohol, paint or pressurized flammable gases. These fires can be found in industrial areas, at traffic accidents, fueling stations, or at the tank farm in Mission Valley.

The best method to extinguish these fires is oxygen exclusion. This is achieved by blanketing the burning material with a layer of foam or wet or dry chemicals. The development of additional types of extinguishing agents has given firefighters other options in combating these fires as well. Purple K, a dry chemical agent, and halogenated agents can interrupt the chemical chain reaction and help to extinguish Class B fires. Another method, and one that should be used in conjunction with extinguishment, is the removal of additional fuel from the fire. Shutting off the gas to a kitchen-stove fire would be an example of this method.

Class C (Blue Circle)



A Class C fire is one where electrical energy is creating heat. Electrical heat that causes arcing can create temperatures in excess of 2000 degrees Fahrenheit and actually cause metals to melt or fuse. The same heat can obviously heat and ignite nearby Class A or B materials. Household appliances, computers, electrical transformers and overhead transmission lines are all examples of potential Class C fires.

The control of a Class C fire starts with control of the electricity. Once the electrical source or power has been removed, firefighting efforts can be made towards the remaining Class A or B materials. If the source of electricity cannont be shut-off, certain extinguishing agents may be used that have been tested and found to be non-conductive. Non-conductive extinguishing agents include halon, dry chemicals, or carbon dioxide. It is very important to realize, however, that if the source of electricity is not secured, there is a dangerous hazard still present even if the active fire has been controlled. Additionally, the use of water should not be utilized on a Class C fire as it can present an extreme shock hazard while the fire is still electrically energized.

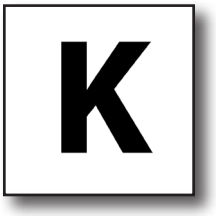
Class D (Yellow Star)

Class D fires involve combustible and pyrophoric metals such as magnesium, titanium, sodium and potassium and are usually found in industrial or storage facilities. Pyrophoric refers to materials that can ignite spontaneously in dry or moist air. These metals are often reactive to water and will appear to explode when hit with a water stream, Figure 10-2.

Figure 10-2 A large Class D fire reacting with water (LAFD 2010)

There is no one agent effective in controlling Class D fires. A priority in dealing with this type of fire is identifying the material that is burning. Special extinguishing agents are available for controlling these fires once the material has been identified. These agents can be applied by covering the burning material. They cool the material to below the ignition temperature, and occlude oxygen from the fire. Care should be taken to not disturb the protective crust placed over these fires and to wait until the material has cooled before you are ready to properly dispose of the material as the fire can reignite if exposed to air.

Class K (Black Pan)



Class K began being used in 1998 to cover fires in combustible cooking fuels, such as animal and vegetable oils and grease. The extinguishing agents used for Class K fires are usually wet chemicals that blanket the fire and exclude oxygen as well as cool the fuel. Class K extinguishers are exclusive to kitchens and are found primarily in commercial and industrial kitchens in fixed systems as well as portable fire extinguishers. However, Class K portable extinguishers can also be found in homes where high-temperature deep fryers are used. Class K fires, although similar to Class B fires, have special hazards. Cooking oils burn at extremely high temperatures and the use of water streams directly onto these fires can make the situation worse by spreading the oils and fire over a larger area.

Fire Extinguisher Agents

There are four basic methods for extinguishing fires.

- Cooling - Cooling is the most common method and is achieved by reducing the burning material below its ignition temperature.
- Smothering - Smothering is also a common method and works by excluding the oxygen from the fire.
- Saponification - Saponification is similar to smothering in that this method excludes oxygen from the fire, however, saponification is specific to agents that smother with a soapy foam.
- Breaking The Chemical Chain Reaction - Breaking the chemical chain reaction requires the extinguishing agent to react with the burning material on a molecular level to prevent combustion from continuing.

Water

Water is the most common extinguishing agent. It is inexpensive and readily available and is effective on most fires encountered. Water works by cooling the burning material. Water should not be used on Class B, C, D or K fires.

Dry Chemicals

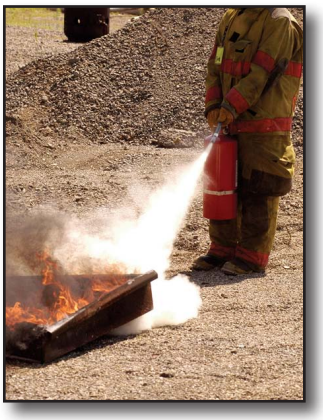


Figure 10-3 Dry Chemical extinguisher on a Class B fire

Dry chemical agent extinguishers work primarily by interrupting the chemical chain reactions that occur. Chemical agents can also act to smother and cool the burning materials, Figure 10-3. Dry chemical agents are mixed with small amounts of additives that make the agents moisture resistant and prevent them from caking. The agents themselves are nontoxic and generally considered safe to use. Be aware, however, that these agents will generate a cloud of chemicals that may reduce visibility and create respiratory problems.

There are five types of dry chemical agents, each with its own advantages and disadvantages.

Multi-purpose

- Ammonium phosphate compounds are considered multi-purpose because they are the only dry chemical agents that can be used on Class A, B and C fires. In addition to halting the chemical chain reaction of the fires, multi-purpose base agents will melt and flow at around 350 F creating a smothering effect and extinguishing Class A materials. Multi-purpose base is corrosive to metals.

Ordinary

- Sodium bicarbonate, potassium bicarbonate (Purple K), urea-potassium bicarbonate and potassium chloride (Super K) are the ordinary base agents. They are effective on Class B and C fires only. As with multi-purpose

agents, these interrupt the chemical chain reaction to extinguish fires. Potassium and urea-potassium base bicarbonate agents typically are preferred to sodium bicarbonate due to their greater firefighting capabilities. Potassium chloride base agents are also sometimes used but they have the disadvantage of being more corrosive and no better in firefighting than the potassium bicarbonate agents.

Carbon Dioxide

These extinguishers have the advantage of not leaving any residue after use, which is useful in Class C fires around delicate and costly electronic equipment. This is also an advantage in food preparation areas and other industrial or commercial areas. Carbon dioxide is a self-expelling extinguisher and is under pressure in the cylinder at between 800 and 900 psi. The gas will expand 400 to 500 times when released. CO2 will smother the fire by excluding the oxygen from the burning material.

Care should be used when discharging inside small and confined spaces as CO2 displaces oxygen, presenting a suffocation hazard. When CO2 is discharged, it comes out very cold and can cause frostbite if directed at exposed skin, Figure 10-4. Gloves should be worn when using CO2 extinguishers because the handle will also get very cold and can develop frost. CO2 is also easily dispersed by wind and has limited ranges outside.

Figure 10-4 Gloves must be worn when discharging CO2 extinguishers

Halogenated Agents

Halogenated agents are very effective in fighting fires. They work by inhibiting the chemical chain reaction of the fires and are called “Clean Agents.” Like CO2, they leave no residue after they have been discharged, Figure 10-5. NFPA 2001, “Standard on Clean Agent Fire Extinguishing Systems” defines a “clean agent” to be “an electrically non-conducting volatile, or gaseous fire extinguishant that does not leave a residue upon evaporation.”

Halogens are the agent of choice for fire extinguishers in the aviation and many shipboard applications. Unlike CO2, halogenated agents operate with low concentrations (5% to 8%), and while they do exclude oxygen from the burning material, they do not reduce the concentration of oxygen to the point that could cause suffocation. That being said, breathing these agents should be avoided. These clean agents have other advantages over CO2. They do not discharge at the low temperatures of CO2, and they discharge as a rapidly evaporating liquid, so they have a greater range and are less affected by wind.

Halon 1211

Halon 1211 (bromochlorodifluoromethane) is at least twice as effective as CO2 on a weight-to-agent basis and has about twice the range of CO2. Halon 1211 is also effective on Class A fires, as well as Class B and C. When discharged, the agent is in the combined form of a gas/mist with about twice the range of CO2. Although less affected by wind than CO2, extinguishment will still be difficult in windy conditions due to rapid dispersal of the agent. The biggest disadvantage of Halon 1211 is its detrimental effects on the environment. Halon 1211 has the unintended consequence of depleting the ozone layer and is currently banned from most new production, but not from use as an extinguishing agent.

Figure 10-5 Halogenated agents are ideal for extinguishing fires in electrical and computer equipment rooms

Halotron I

New halocarbon agents, such as Halotron I, are being developed that do not have any ozone depleting effects. These new agents also work by interrupting the chemical chain reaction of fires but are not as effective as Halon. Halotron is discharged as a liquid that rapidly evaporates and has similar ranges to Halon.

Dry Powder – Class D

Dry powders, not to be confused with dry chemicals, are a special class of agents. Typically these agents work by combining smothering and cooling. There is no one Class D agent that will work on all metal fires. The important consideration with these fires is identifying the material burning. In addition, once the material has been covered and is out, do not disturb the protective crust that is formed by the agent. Wait until it has cooled and you are ready to properly dispose of the material.

Met-L-X

Met-L-X is the agent found in Class D extinguishers. It can also be found as a loose bulk agent in bins and barrels and applied with scoops and shovels. This is a sodium chloride salt with a thermoplastic material added. It is usable on fires involving sodium, potassium, magnesium, titanium, aluminum, and zirconium. Do not use this agent on very hot burning metal fires, such as lithium. Met-L-X works by using the salt to dissipate the heat of the fire and forming an oxygen excluding crust over the material as the thermoplastic melts and binds with the sodium chloride. Always reapply as necessary to cover any hot spots that could develop.

G-1

G-1 is dry powder, graded granular graphite to which phosphorous compounds have been added, improving its fire extinguishing effectiveness. When applied, the phosphorous produces a vapor that blankets the fire and excludes oxygen. The graphite conducts the heat and cools the material to below the ignition point. G-1 is useful on the same metals as Met-L-X. In addition, it can be used on the hotter burning lithium fires, as well as thorium, calcium, uranium, plutonium, zinc and iron.

Others

Other materials that can be used to combat Class D fires are soda ash, talcum powder and dry sand. These agents smother the fire. As with other Class D fires, leave undisturbed until the material cools and only use agents that you know are non-reactive with the burning material.

Wet Chemical – Class K

Wet chemical agents have been developed in recent years to combat kitchen fires. High-efficiency cooking equipment with high energy inputs and the widespread use of high temperature vegetable oils created fires that normal Class A and B extinguishers did not work well on. Class K fires presented two big problems. The burning oils had a tendency to be pushed by fire extinguishers, thus spreading the fires. And since these fires burn very hot, dry chemical agents did not cool them enough and they had re-flash hazards as soon as the smothering layer was disturbed, Figure 10-6.

Figure 10-6 Class K Fire

Class K agents are water-based solutions that are mixed with organic and inorganic salts. Potassium acetate is the primary salt used, but potassium carbonate and potassium citrate can also be found. Class K agents work through saponification. The agent is discharged in a fine mist that does not disturb the burning oils and fats. When the agent lands on the burning substances, it converts it to a non-combustible soap in an endothermic process that absorbs heat energy from the fire and cools the oils at the same time it creates a thick, heavy, long-lasting foam blanket on the cooking fire that seals out oxygen and prevents re-flashes. Class K agents can be used on Class A fires as well. When used in this way, they act as coolants.

Operation of Fire Extinguishers

Fire extinguishers are intended as a first line defense to cope with fires of limited size. They should only be used on incipient fires that are quickly controllable. Any fire that has reached to the ceiling or has a room fully involved should be handled with hose lines. However, portable fire extinguishers may still be useful in these cases to take some of the heat out of a fire and allow evacuation or protection until more effective means of extinguishment are put into use.

As with the case with every tool at your disposal, make sure that the fire extinguisher you choose is usable on the material burning. There are only three extinguishers available on most SDFD fire apparatus but there are many different types available on specialty rigs. Make sure you check your equipment at the beginning of your shifts so the choice will be easy when the time comes.

PASS

The use of portable fire extinguishers can be summed up with the PASS method. This is a simple technique that is effective and efficient. Pick up the extinguisher by its handle and carry it to the point of application. Be conscious of the type of material burning and the discharge range of the extinguisher. Also, if outside be aware of the effects wind can have on the reach of the extinguisher. Discharging too far away from the fire wastes agent and discharging too close to the fire can scatter lightweight solid fuel or penetrate the surface of liquid fuels. Apply agent so it reaches the fire but does not disturb the burning material.

P - Pull Pin

Extinguishers will have a thin wire or plastic seal holding the pin in place. Break this to remove the pin. If you pull the pin prior to arriving at the fire be careful not to discharge the extinguisher accidentally.

A - Aim Nozzle

Aim at the base of the fire. This is where the burning material is and putting agent there will do the job quickest. Avoid aiming the nozzle at the flames high above the fire, this will just waste extinguishing agent.

S - Squeeze Handle

Simply squeezing the handle together will discharge the extinguisher. Releasing the handle will stop the flow of the agent.

S - Sweep Agent

Start at the nearest point of the fire and sweep back and forth. Advance forward until the fire is out. After the fire is knocked down, move closer to achieve total extinguishment. With solid fuel fires that are still smoldering, it may

be overhauled by pulling it apart and continuing to apply the proper agent or bringing in a charged hose line to soak it well enough to achieve complete extinguishment.

When you are done with the extinguisher do not replace the pin. If you are not going to return it immediately to your apparatus, lay it on its side. This lets others know that it is empty and limits the chance of someone picking it up and approaching the fire with an empty extinguisher.

It is very important to be familiar with the characteristics of the fire extinguisher. Know the discharge duration, stream reach and discharge pattern. As with all other fire fighting operations, proper PPE must be worn. When it comes to fire extinguishers, there is the added hazard of being exposed to and possibly breathing the agent in the extinguisher as well as other products of combustion.

Fire Extinguisher Rating & Marking System

Underwriters Laboratories, Inc. or U.L., conducts standardized tests on fire extinguishers to establish the extinguishing potential for different sizes and types of extinguishers and agents. The rating system consists first of a letter corresponding to the class of fire the agent can extinguish; A, B, C, D, and K. In addition, for A and B, there will be a numerical rating according to their performance capability.

Class A Ratings

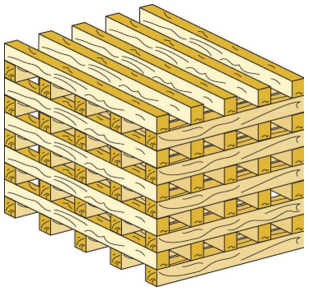


Figure 10-7 Wood crib for Class A fire rating test

Ratings for Class A extinguishers are based upon three different types of Class A fires that must be extinguished in order to establish a 1-A through 40-A rating. These tests are a wood crib fire, Figure 10-7, a wood panel fire, and an excelsior fire, which is a specific amount of fine curled wood shavings. For a Class A extinguisher to have a 1-A rating, it must be able to put out the same fire as one and one-fourth gallons of water. Each numerical addition equals another one and one-fourth gallons of water. A dry chemical extinguisher with a 10-A rating is equivalent to 12 ½ gallons of water. Class A extinguishers carry ratings from 1-A through 40-A.

Class B Ratings

Figure 10-8 Steel pan used for Class B fire rating test

Class B extinguishers are rated based on a test of extinguishing burning n-heptane, a Class B liquid, in a square steel pan, Figure 10-8. Each rating equals an area of 2.5 square feet of flammable liquid. These ratings will go from 1-B through 640-B. It is important to realize that the ratings are based on use by a trained person operating the extinguisher under test conditions. The assumption is that an untrained person would perform 40% as well. In addition, these ratings are approximations of the area of flammable liquid that can be

extinguished. Real world conditions are rarely ideal. Wind, weather and other factors can effect performance.

Class C Ratings

Class C extinguishers do not carry a numerical rating. These extinguishing agents have simply been tested for electrical non-conductivity. First they must receive an A, B, or A/B rating.

Class D Ratings

Class D extinguishers do not carry a numerical rating. These agents are tested for their reactivity with different combustible metals. It must be determinied that the agents will not react with the metals to produce toxic fumes, toxic products of combustion, and what the toxicity of the agent itself is. Class D extinguishers and agents include details regarding their specific use and should not be used on a burning metal for which they are not designed.

Class K Ratings

Class K extinguishers are tested on commercial deep fat fryers. They typically contain a potassium acetate based, low PH agent discharged as a mist that avoids oil and grease splash and prevents reignition of the fire while cooling the area.

Fire Extinguisher Markings

Extinguishers have identification markings that assist in selecting the proper extinguisher to combat the fire at hand. Past extinguishers were marked with the simple color, letter, and shape symbol to designate for which fire the extinguisher is to be used. All new fire extinguishers have a picture/symbol labeling system in place to assist in the proper selection of the extinguisher, Figure 10-9. Typically, it is a white symbol on a black background.

Class A is a burning trashcan and pile of wood. The old symbol is a green triangle.

- Class B is a gas can and a burning puddle. The old symbol is a red square.
- Class C is an electric plug and a burning electrical outlet. The old symbol is a blue circle.
- Class D is a burning gear and bearing. The old symbol is a yellow star.
- Class K is a burning pan. There is no old symbol for Class K.

Be aware that extinguishers can have the picture/symbol for the class of fire that they can be used against, or they can also have a black line drawn through the picture/symbol of the classes of fires that they cannot be used against.

In addition, fire extinguishers tend to be colored depending on the use and type of agent used. Most extinguishers are red; water-based extinguishers are silver, Class D extinguishers are yellow and Class K extinguishers found in commercial kitchens are silver as well, Figure 10-11.

For extinguishers that can be serviced and recharged, there will be a hydrostatic test sticker on the extinguisher and a fire marshal tag, Figure 10-10.

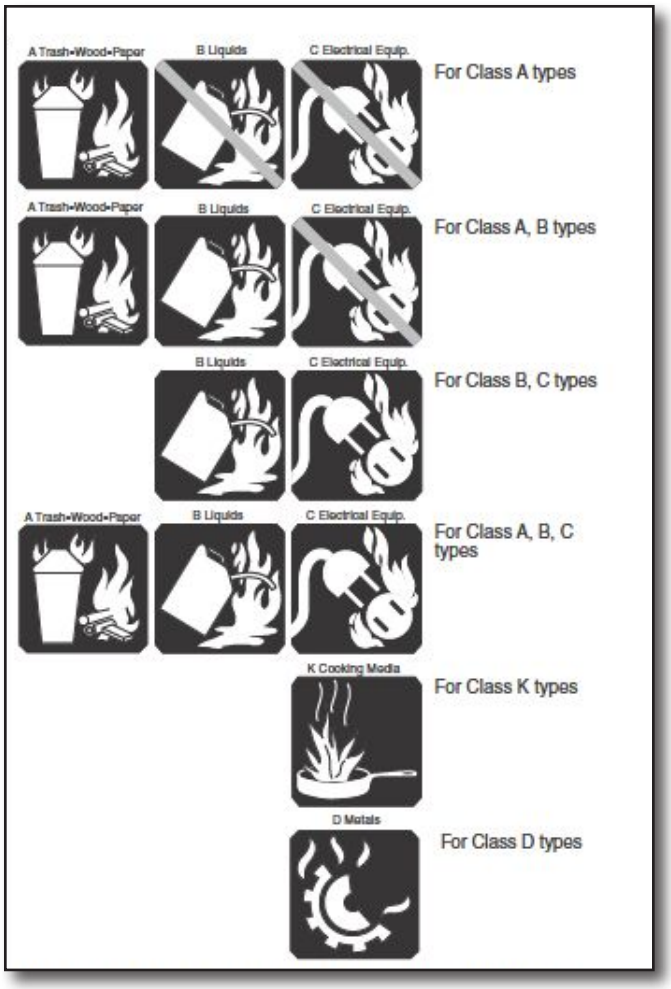


Figure 10-9 NFPA fire extinguisher markings

Figure 10-10 Fire ext. service tag

Figure 10-11 Fire extinguishers carried on HAZ-MAT-1

SDFD Fire Extinguishers

Stored Pressure Water Extinguisher

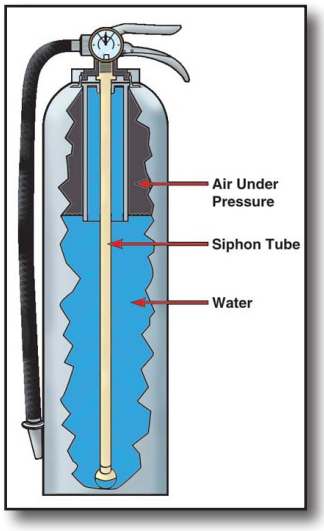


Figure 10-12 Water extinguisher (above 2 images)

Pressurized water extinguishers store water in a tank that is expelled by compressed air pressure. Stored pressure water extinguishers, also referred to as "water cans," are carried on SDFD engines, trucks, brush rigs and chemical utility pickups.

- Size: 2-A, 2 ½ gallons
- Application: Class A fires only
- Stream Reach: Solid stream up to 40 feet.
- Discharge Duration: Up to 60 seconds

Operation Procedure

- Carry and operate upright only.
- P.A.S.S.
- Thumb may be held over stream to convert from a straight to a broken, or fog type, pattern.
- After the fire has been extinguished, pull the smoldering material apart and apply more water to effect complete extinguishment.

Maintenance

- Check pressure gauge daily to ensure proper charge and pressurize as needed.
- Check cylinder for damage.
- Check hose for cracking or damage and ensure nozzle is clear.
- Ensure annual State Fire Marshal tag is up to date.

Recharge Procedure

This is the only extinguisher that can be re-filled and charged at the station.

- Relieve air pressure from extinguisher by inverting and squeezing handle.
- Unscrew collar and remove pick-up tube assembly.
- Fill tank with fresh water to bottom of anti-overfill device.
- Replace pick-up tube assembly and screw collar down hand tight.
- Charge extinguisher with air pressure while watching pressure gauge.

Stored Pressure Dry Chemical

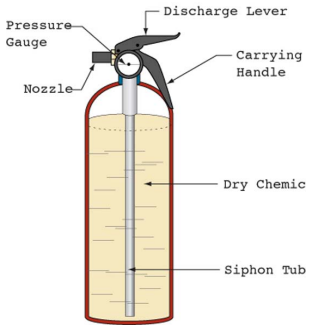


Figure 10-13 Stored Pressure Dry Chemical Ext.

These internally pressurized extinguishers are found on most SDFD apparatus, Figure 10-13. They can be found with two different dry chemicals; multi-purpose or ordinary. As described previously, the type of dry chemical found in the extinguisher changes the class of fire that can be fought with it. There are few outward signs to distinguish what type of agent is inside so it is important at the beginning of your shift to make sure you know what capabilities your dry chemical extinguishers have.

Most of the time you will have a multi-purpose extinguisher that is usable on Class A, B, and C fires. Engines, trucks and brush rigs carry the multi-purpose dry chemical extinguishers. You can also find them on Haz-Mat 1, 2 and on the chemical utility pickups.

The ordinary dry chemical extinguishers, usable on Class B and C fires, should only be found on Haz-Mat 1 and 2 and all crash rigs. However, because these extinguishers look very similar, you should check to make sure you know what you have before you need to use them.

- Size
  - Multi-purpose – 20A:120B/C
  - Ordinary Base – 120B/C
- Application
  - Multi-purpose - Class A, B, and C fire
  - Ordinary Base – Class B and C fires
- Stream Reach: Up to 20 feet.
- Discharge Duration: Up to 20 seconds

Operation Procedure

- Use the PASS method and attack the fire near the edge.
- Sweep the nozzle side to side and progress forward.
- Be careful not to discharge the extinguisher too close to a Class B fire to prevent splashing.
- Continue to apply agent even after flames are extinguished to prevent the possible reignition of the fire.

Figure 10-14 External cartridge (L) & stored pressure Dry Chemical Extinguishers (R)

Maintenance

- Check pressure gauge daily to ensure charge.
- Check cylinder for damage.
- Check hose for cracking or damage and ensure nozzle is clear.
- Ensure annual State Fire Marshal and hydrostatic testing tags are up to date.
- Return to Storeroom 42 for replacement and recharging.

Cartridge Pressure – Dry Chemical, Ordinary

Very few cartridge pressure extinguishers remain in SDFD's inventory. Typically they are found on Haz-Mat 1 and 2 and some crash rigs. They are the same as the stored pressure dry chemical extinguishers except that instead of having pressure stored in the cylinder with the agent, they have a cartridge of nitrogen gas that needs to be activated to discharge the agent, Figure 10-14.

Prior to reaching the fire, depress the puncturing lever on top of the cartridge chamber. This allows the propellant to enter the cylinder. Once this has been done, the application of the agent is controlled at the discharge nozzle.

Carbon Dioxide

Figure 10-15 CO2 extinguisher

These self-expelling extinguishers are found on trucks, Haz-Mat 1 and 2 and some Crash Rigs. When using these extinguishers be aware of the suffocation effects, especially if being discharged in a confined space. Always wear gloves to protect your hands from the frost that can develop and do not discharge toward exposed skin. CO2 extinguishers are easily recognizable by the large nozzle or discharge horn attached to the hose, Figure 10-15.

- Size: 10B/C
- Application: Class B and C fires
- Stream Reach: Up to 10 feet.
- Discharge Duration: Up to 30 seconds

Operation Procedure

- Class B fires, sweep the flames off of the burning surface.
- Class C fires, hold the discharge horn in a downward position (at an angle of about 45 degrees) toward the center of the burning area. The horn is not moved, as in the PASS method, because the discharge stream enters the fire from above and spreads out in all directions over the burning surface.
- Always attempt to de-energize Class C fires as soon as possible to eliminate the potential of reignition.

Refilling the Pressurized Water Extinguisher

Turn upside down & bleed off remaining air pressure

Unscrew threaded nozzle assembly

Remove nozzle & pick-up tube assembly

Ensure plastic anti-overfill device is free

Fill with water to bottom of anti-overfill indicator

Charge extinguisher with compressed air

Ensure the air pressure gauge is in the green

Bleed air hose & disconnect from apparatus

Maintenance

- These extinguishers do not have a pressure gauge and must be weighed to ensure it is full.
- Check cylinder for damage.
- Check hose for cracking or damage and ensure nozzle is clear.
- Ensure annual State Fire Marshal and hydrostatic testing tags are up to date.
- Return to Storeroom 42 for replacement and recharging.

Halon 1211/Halotron I

These are self-expelling extinguishers that are found on Haz-Mat 1, 2 and crash rigs.

- Size: Dependent on the agent. Check individual extinguishers.
- Application: Class A, B, and C fires.
- Stream Reach: Up to 15 feet.
- Discharge Duration: Varies depending on size of extinguisher.

Operation Procedure

- Use the PASS method.
- These extinguishers have better range than CO2 extinguishers and can be discharged in windy conditions with less disruption of the agent.
- As with other agents, avoid breathing in any agent.
- With deep-seated Class A fires, smoldering material should be broken apart to effect complete extinguishment.

Maintenance

- Check pressure gauge daily to ensure charge.
- Check cylinder for damage.
- Check hose for cracking or damage and ensure nozzle is clear.
- Ensure annual State Fire Marshal and hydrostatic testing tags are up to date.
- Return to Storeroom 42 for replacement and recharging.

Figure 10-16 Stored pressure Class D extinguisher

Stored Pressure: Met-L-X Class D

These large, yellow extinguishers are found on Haz-Mat 1, 2 and some crash rigs, Figure 10-16. Always identify the agent burning before attacking the fire.

These extinguishers should not be used on very hot burning metal fires, such as lithium.

- Size: 30 pounds, no rating for Class D agents.
- Application: Specific Class D fires.
- Stream Reach: Up to 10 feet.
- Discharge Duration: User adjustable.

Operation Procedure

These extinguishers work with a special low velocity longer reach nozzle that allows the agent to be applied to the burning material gently so as not to disrupt any crust which may have formed. Apply agent to a sufficient depth to cover the fire area adequately and provide a smothering blanket. Reapply as necessary to cover any hot spots that could develop. Leave the material undisturbed until it has cooled before attempting disposal.

Maintenance

- Check pressure gauge daily to ensure charge.
- Check cylinder for damage.
- Check hose for cracking or damage and ensure nozzle is clear.
- Ensure annual State Fire Marshal and hydrostatic testing tags are up to date.
- Return to Storeroom 42 for replacement and recharging.

Bulk Agents

Bulk agents in bins and barrels are found on chemical utility pickups. The complement of agents may change rig to rig so check to see what is available at the beginning of your shift. Met-L-X, G-1 and dry sand can be found. Always identify the metal burning and ensure that the agent is appropriate for the fire.

Apply with a scoop or a shovel to a sufficient depth to cover the fire area adequately and provide a smothering blanket, Figure 10-17. Reapply as necessary to cover any hot spots that could develop. Leave the material undisturbed until it has cooled before attempting disposal.

Figure 10-17 Bulk agent application method

Apparatus Extinguisher Complements

Engines

- Stored Pressure Water Extinguisher, 2A
- Stored Pressure Dry Chemical: Multi-purpose, 20A:120B/C

Trucks

- Stored Pressure Water Extinguisher, 2A
- Stored Pressure Dry Chemical: Multi-purpose, 20A:120B/C
- Carbon Dioxide, 10B/C

Brush Rigs

- Stored Pressure Water Extinguisher, 2A
- Stored Pressure Dry Chemical: Multi-purpose, 20A:120B/C

Crash Rigs and Haz-Mat

Individual apparatus have different complements of extinguishers and can be any of the following:

- Stored Pressure Dry Chemical: Multi-purpose and/or Ordinary Base
- Cartridge Operated Dry Chemical: Ordinary Base
- Carbon Dioxide
- Stored Pressure Met-L-X Class D
- Halon 1211 and/or Halotron I

Chemical Pickups

- Stored Pressure Water Extinguisher, 2A
- Stored Pressure Dry Chemical: Multi-purpose, 20A:120B/C
- Met-L-X 5 Pound Bulk

Fire Company Inspection Program

In addition to the extinguishers that firefighters check, maintain and use during the course of the workday, we also encounter them during Fire Company Inspections, or FCIP's. Our primary concern is the location and operational readiness of the fire extinguishers so they can be easily and quickly placed into service when the time comes.

Extinguisher Locations

NFPA codes have different requirements depending upon the type of occupancy and the class of fire hazard found. For the most part however, during FCIP's we are inspecting multiple residences and places of assembly where the hazard is Class A fires. In these occupancies, every point in the building should be within 75 feet of a fire extinguisher along normal paths of travel, including exits. The extinguishers shall be in conspicuous locations and readily accessible, and not obstructed from view. If they are in locked cabinets due to the possibility of vandalism, they need to have a means of emergency access, i.e. a small hammer to break glass. In addition, they need to be placed so labels, tags and operating instructions are clearly visible.

The other common portable fire extinguisher found during FCIP's will be the Class K extinguishers found in commercial kitchens. These shall be within 30 feet normal traveling distance of the cooking oil, or grease hazard. These are the only extinguishers approved for grease fires.

Extinguisher Inspections

Once it has been determined that the extinguishers are the proper type and size, and are in the right locations, check for the general condition and maintenance. The current DOT regulation is that fire extinguishers should be red, with the exception of water cans, Class D and Class K extinguishers. Also check the general appearance of the cylinder, discharge hose and nozzle.

The extinguisher should be clean, free of any corrosion and in good mechanical condition. The hose should be free of cracks with the nozzle clean and free of obstructions. Check the pressure gauge for adequate charge, intact seal, State Fire Marshal's tag and up-to-date hydrostatic test label, with the State Fire Marshal's tag and operating instructions easily visible.

Tags and Labels

In California, all extinguishers must be labeled with a service tag. The tag should contain the State Fire Marshal's certification number, name and address of the servicing firm, service performed (charged, recharged, inspected or new), and the date of servicing. The extinguishers need to be serviced annu-

Figure 10-18 Extinguisher service tag

ally, Figure 10-30. There should be a label with the date of the last hydrostatic test, which in general is every 5 years.

What to do with Deficiencies

If anything about the extinguishers is found to be deficient, the extinguishers should be removed from service by the owner and referred to a licensed servicing firm for inspection and repair. Firefighters do not perform any repairs on fire extinguishers.

Obsolete Extinguishers

Portable hand-held fire extinguishers have been around for centuries, and it is possible to come across extinguishers that are obsolete and should be removed from service and replaced. If coming across these extinguishers during FCIP's, or even in private homes, inform the owners that these should not be used as they can have failures and are potentially dangerous.

Two obsolete extinguishers to be aware of are the inverting-type soda ash and carbon tetrachloride extinguishers, often found as a glass grenade. The inverting-type cannot be turned off once turned upside down and activated, and often these older cylinders can rupture under pressure. The carbon tetrachloride extinguishers react with fires and produce highly toxic phosgene gas.

Below is a list of obsolete extinguishers that may be found still in use:

1. Soda ash
2. Chemical foam (excluding film-forming agents)
3. Vaporizing liquid (e.g. carbon tetrachloride)
4. Cartridge-operated water
5. Cartridge-operated loaded stream
6. Copper or brass shell (excluding pump tanks) joined by soft solder or rivets
7. Carbon dioxide extinguishers manufactured prior to 1971
8. Solid charge-type AFFF extinguishers (paper cartridge)
9. Pressurized water fire extinguishers manufactured prior to 1971
10. Any extinguisher that needs to be inverted to operate
11. Any stored pressure extinguisher manufacuted prior to 1955
12. Any extinguisher with 4B, 6B, 8B, 12B, and 16B fire ratings
13. Stored-pressure water extinguishers with fiberglass shells (pre-1976)

Foam Extinguishing Agents

Firefighting foam was developed in the early 20th century for combating flammable liquid fires in the oil industry. Over the years it has been refined to allow for the extinguishment of many different types of Class B fires, as well as Class A structure fires, and wildland fires. It can also be used to pre-treat vegetation and structures in the path of wildland fires. CAFS, or Compressed Air Foam Systems, are a special use Class A firefighting foam which have increased in popularity in recent years due to its highly effective characteristics in the wildland-urban interface environment, Figure 10-19.

Figure 10-19 Pre-treating a structure with foam

Firefighting foam is created by combining three basic elements in the correct proportions: water, air, and foam concentrate. When these three elements are mechanically agitated together, foam is created. This foam can then be used to suppress fires or protect structures and wildland fuels.

Firefighting foam works in one or more of four ways depending on the situation and class of fire being combated.

- **Separating** – foam can create a barrier between the fuel and the fire. With Class B fires, the foam can be pushed across the burning surface and block the fire from the fuel. With Class A fires, separating is done before the fire arrives, a layer of foam is used to coat the structure so no ignition can happen.
- **Cooling** – just like water used alone, foam can lower the surface temperature of the fuel and adjacent surfaces.
- **Smothering** – foam creates a barrier between the fuel and the air, thus keeping oxygen from the fuel and suffocating the fire.
- **Suppressing** – the barrier that foam creates over the fuel also eliminates vapor release and therefore reduces the possibility of reignition, or ignition in the case of fuel spills that have not yet caught fire.

In addition to the above qualities of foam in combating fires, Class A foam can also be used to assist water with penetrating deeper into burning bulk material.

Foam Expansion

The expansion rate is the ratio of finished foam produced from a volume of foam solution after being expanded through the foam making process. The NFPA categorizes foam concentrates into three expansion ranges.

- **Low Expansion** – Ratios up to 20:1. Designed for flammable liquid fires and for Class A fires where the cooling and penetrating effect of the foam solution is important.
- **Medium Expansion** – Ratios from 20:1 to 200:1. Medium-expansion foam is used to suppress the vaporization of hazardous chemicals. Foams with expansion between 30:1 and 55:1 have been found to produce the optimal foam blanket for vapor mitigation of highly water reactive chemicals and low boiling point organic fuels.

Figure 10-20 High Expansion Foam

- **High Expansion** – Ratios above 200:1. These foams are designed for use in Class A or B fires that are in a contained or confined space. High-expansion foam concentrate is a synthetic, detergent-type foaming agent that works by smothering and cooling the fire, Figure 10-20.

Apparatus Foam System

Foam is a mixture that requires a device to proportion, meter, or mix the foam concentrate into the water. Air must then be added to the foam solution to complete the process. For San Diego Fire-Rescue front line apparatus, foam proportioning is accomplished at the apparatus pump panel. Water and foam concentrate are held in separate tanks on the apparatus. This allows the engineer to adjust and mix the water and foam concentrate using the onboard proportioning system to achieve the desired consistency for the application. A fog nozzle set to any gpm can be used and pumped to achieve a nozzle pressure of 100 psi.

Portable Foam Eductor

Figure 10-21 Portable foam eductor

Older fire apparatus do not have pre-plumbed foam capabilities, requiring an externally attached foam eductor. San Diego uses the KLP-50, 1 ½" foam eductor, Figure 10-21. The foam eductor is attached directly to a discharge at the pump with the down tube placed into the 5 gallon bucket of foam concentrate. As water passes through the eductor, foam concentrate is drawn up the tube by the "Venturi Effect," and mixed at the set proportion.

The foam mix then travels through the hoseline to the nozzle. A foam nozzle, or clip-on foam attachment for a fog nozzle, should be used to achieve proper aeration of the foam, Figure 10-22. The portable foam eductor is designed to be

used at 125 gpm. A 125 gpm fog nozzle should be used in conjunction with the foam nozzle attachment and pumped at 200 psi.

Figure 10-22 Foam nozzle

Class A Foam

Class A foams were developed for forestry firefighting in the mid-1980s. However, over time, it has been found that foam can also be a valuable tool with other Class A type fuels, including structural fire fighting. Class A foam concentrates are a mixture of foaming and wetting agents in a non-flammable solvent. These products are generally non-hazardous, non-corrosive and non-flammable as well as bio-degradable. Class A foam is used at very low concentrations, in ranges from 0.1% to 1.0% depending on the application. Currently SDFD is using Phos-chek WD-881 Class A foam concentrate.

Extinguishing Properties and Uses of Class A Foam

Class A foam extinguishes fires in a variety of ways. Just like water alone, Class A foam commonly achieves extinguishment by cooling the fuel and absorbing the heat. Studies have found that Class A foam can be as much as 300% better at cooling fires than water alone. In addition, Class A foam is around 1,000 times better at penetrating fuel than water. Foam has an additional advantage over water as well. Foam can be applied as a barrier before the fire arrives , insulates the fuel from the heat and utilizes comparatively low volumes of water, thus limiting damage.

Figure 10-23 Class A foam concentrate

Class A Foam Concentrations

As stated before, Class A foam uses relatively low concentrations of foam. Proportioning percentages range from 0.1% to 1.0%. Anything over 1.0% is considered a waste of Class A foam concentrate.

"Wet Foam" - 0.1% to 0.3%

Wet foam is used for direct attack and overhaul with a concentrations of 0.1% to 0.3%. The "melted ice cream" consistency created has very good cooling effects and allows the water to penetrate the burning surface and sink into the deepest parts of the fire. This creates faster knockdown and thus less water use, which helps lessen the damage to the structure if water alone were used. An apparent disadvantage to Class A foam use is the possible effects on fire investigation and salvage operations. But considering the fact that less water needs to be used to achieve overhaul, foam has more advantages than disadvantages.

"Dry Foam" - 0.5% to 1.0%

Concentrations between 0.5% and 1.0% create a "shaving cream" type foam that is superior for exposure protection and pre-treatment of brush, Figure 10-24. When using Class A foam as a protective barrier, expansion of the solution is critical to the effectiveness of the foam. The foam's ability to "hold water" depends on the integrity of the bubbles. If the foam is not properly expanded, the water will drain quickly, providing little or no protection against the heat

Figure 10-24 "Dry Foam" application

of the fire. Properly applied dry foam should stick to structures and brush for an extended period of time to provide adequate protection.

Nozzle Aspirated Foam System - NAFS

San Diego Fire-Rescue apparatus almost exclusively use a low energy nozzle aspirated foam system, or NAFS, to discharge a foam solution This means that air is mixed to the foam/water mix upon exiting the nozzle. Because the air is not added until the end of the hose line, the hose weighs about the same as a standard water-filled hose. In addition, the fog nozzles used are low expansion nozzles so that the discharge is a wet foam that is more suited to direct attack and overhaul, but can still be used for structure protection. NAFS is considered to be five times more effective than water. Nozzle reaction and stream reach are similar to water.

Compressed Air Foam Systems - CAFS

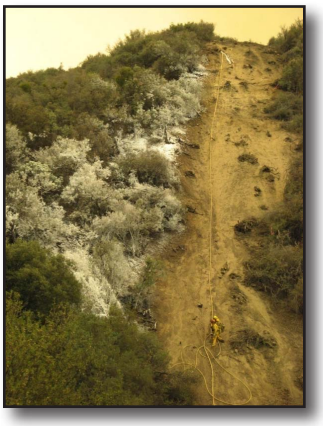


Figure 10-25 CAFS used for pretreating brush

Compressed Air Foam Systems (CAFS) are high-energy systems which combine air under pressure with the foam solution to create foam. The SDFD currently has three S&S Ultra XT Brush apparatus; Brush 14, 29 and 35, that use a Compressed Air Foam System. No other SDFD apparatus has CAFS capabilities. CAFS have many advantages over water and NAFS. In studies CAFS using Class A foam were the most effective fire fighting technique when compared to water and NAFS for time to knockdown, gallons to knockdown, total water used, and cooling effect. CAFS is considered to be ten times more effective than water.

CAFS is a high-energy system that combines air under pressure with the foam solution prior to the hose and nozzle. It consists of a pressurized air source, a source of foam solution (water pump and proportioner), and a means to apply the foam, either hose and nozzle or turret gun. CAFS allows the operator to control the three elements of foam production: water, foam concentrate, and air.

CAFS generated foam can be used for interior and exterior attack as well as water tower and some stand pipe operations. It is effective in direct and indirect attack, exposure protection and overhaul.

CAFS has the capability of increasing the discharge distance of low expansion foam at any given flow rate, due to the energy provided by the compressed air added to the mixture. A major advantage when working with CAFS hose lines is the less weight in the line. Because CAFS foam is created at the pump, the foam flowing through the line is much lighter than water. In addition, there is much less friction loss in the hose so hose lays up to 5,000 feet are possible, Figure 10-25. Because CAFS is a high energy system, initial nozzle reaction is greater than water or NAFS.

Class A foam concentrate is found on all Type I and Type III apparatus in the SDFD. Additional resources for Class A foam can be requested through the Logistics Division which operates a foam supply trailer. This trailer carries

Foam System Hydraulics

Apparatus Foam Eductor (Foam Pro System)

Pump for a nozzle pressure of 100 psi to a Fog nozzle set to any GPM using standard Friction Loss Rates & Gravity Loss/Gain factors

Portable Foam Eductor (KLP 50)

Pump 200 psi to the foam eductor using a 125 gpm Fog Nozzle & "clip on" Foam Nozzle up to a maximum of 600' of hose.

Compressed Air Foam Hydraulics

Use	Foam %	Nozzle	PSI
Handline (Wet Foam)	0.1 to 0.3	15/16" Smooth Bore Tip Pistol Grip Shut-Off Butt	100
Handline (Dry Foam)	0.5 to 1.0	No Nozzle Tip w/ Pistol Grip Shut-Off Butt Gated Down	100
Bumper Turret Ultra XT	0.1 to 1.0	1 1/2" x 1 3/8" x 10" Smooth Bore Tip	140
Ladder Pipe	0.1 to 1.0	1 1/2" to 2" Smooth Bore Tip Supplied by (1) 2 1/2" Hose	140
Dry Standpipe	0.1 to 1.0	Supplied by (1) 2 1/2" Hose with Shut-Off Butt	140

Compressed Air Foam Application Methods

Handline

Bumper Turret

Ladder Pipe

Dry Standpipe

Figure 10-26 Class B foam application

500 gallons of Class A foam concentrate to replenish engine companies on large scale incidents.

Class B Foam

Class B foam is used for extinguishing Class B liquid fires. Class B foam is an aggregate of gas-filled bubbles formed from aqueous solutions of specially formulated concentrated liquid foaming agents. The bubbles are filled with a gas, typically air, creating a blanket over the surface of the fuel. This blanket cools and smothers the fire while sealing in the vapors. Class B foam is only effective if it is the proper foam for the liquid burning and does not saturate with the fuel, burn off in the heat, and can maintain a solid blanket that prevents vapor escape.

Types of Class B Fuels

Unlike Class A foam, Class B foam needs to be matched with the specific fuel that is burning. Class B fuels include flammable liquids in two categories: hydrocarbons and polar solvents, Figure 10-26. It is important to remember that Class B gases are extinguished by shutting off the flow of the fuel, not by using foam on them.

Hydrocarbon Fuels

These fuels cover a wide range of substances. Common examples are heating oil, diesel fuel, gasoline and asphalt. These fuels do not mix with water and will float on top of water and continue to burn. The best method to extinguish these fires is large quantities of foam that will cool and smother the fire and provide a vapor barrier.

Polar Solvents

Polar solvents mix with water and cause a breakdown of the foam or a mixvof flammable vapors into the bubbles of ordinary foams. Polar solvents include alcohols, both methyl and ethyl, lacquer thinners, acetone, hetones, acrylonitrile, and acetates. Many gasoline blends today have polar solvents in a solution and require alcohol-resistant foams. Normal foams will break down when used on fires involving these types of mixtures.

Figure 10-27 Class B AFFF concentrate

Synthetic Foams

Synthetic foams are based on synthetic surfactants. Synthetic foams provide better flow, faster knockdown of flames, but limited post-fire security.

Aqueous Film Forming Foam (AFFF)

AFFF is a group of Class B foams that provide the fastest possible knockdown on hydrocarbon fuels. They are made from fluorochemical surfactants and synthetic foaming agents. A disadvantage is that AFFF gives up some heat resistance, fuel tolerance, and vapor suppression compared to fluoroprotein foam. AFFF comes in 1%, 3% and 6% concentrations, Figure 10-27.

Alcohol-Resistant Foams (AR)

Contain polymers which form a protective layer between the burning surface and the foam, preventing the foam from breaking down in the presence of polar solvents. Alcohol-resistant foams will have the letters AR preceding the type of foam, such as AR-AFFF or AR-FFFP and come in 3% and 6% concentrations, Figure 10-28.

Figure 10-28 Alcohol Resistant Foam (AR-AFFF)

Protein Foams

Protein foams contain natural proteins as the foaming agents. Unlike other synthetic foams, protein foams are bio-degradable. They flow and spread slower, but provide a foam blanket that is more heat resistant and more durable.

Protein Foam (RP or Regular Protein)

Intended to be used on hydrocarbon fuels only. They are made from chemically broken down natural protein; such as animal blood, hoof and horn meal, chicken feathers, etc. Regular Protein foams have slow knockdown character-

istics, slow spread, and can be blown away by wind. However, it produces a homogenous, stable foam blanket that has excellent heat resistance and vapor suppression. It is very economical and comes in 3% and 6% concentrations, Figure 10-29.

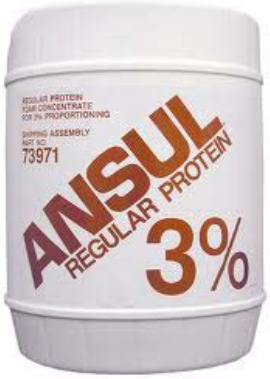


Figure 10-29 Protein based foam

Fluoroprotein Foam (FP)

Designed for use with hydrocarbon fuels and select oxygenated fuel additives, has flurochemical surfactants which enhance performance. This foam can also be injected in the bottom of a fuel tank and will float up to the surface to form a fire suppression blanket. It comes in 1%, 3% and 6% concentrations.

Film Forming Fluoroprotein Foams (FFFP)

FFFP's are a combination of fluorochemical surfactants and protein foam. They are designed to combine the fuel tolerance and burnback resistance of a fluoroprotein foam with an increased knockdown power. They release an aqueous film on the surface of the hydrocarbon fuel. They come in 3% and 6% concentrations.

Class B Foam Supplies

SDFD apparatus do not carry class B foam. There are several resources available within the department should the need arise.

- **Foam 45** - 750 gallons of 3% AFFF
- **Crash/Rescue** - Carries 130 to 420 gallons (depending on apparatus) of 3% AR-AFFF (Alcohol Resistant)
- **Logistics (FS28)**

Class A Foam on Class B Fires

Although not as effective as Class B foam, Class A foam may be utilized on a Class B fire in the absense of a Class B foam supply (SDFD Engine Companies), Figure 10-30. Its effectiveness will vary depending upon the fuel type. A foam nozzle or CAFS should be used to apply the Class A foam in a thick layer of bubbles using the "raindown" or "bounce-off" technique with a "dry foam" consistency.

Figure 10-30 Class A foam on a Class B fire

It is important to note that Class A foams do not meet national standards for use with hydrocarbon fuels, which require foam to contain hydrocarbon vapors for at least 15 minutes. The Class A foam may extinguish the fire, however, it will not suppress the vapors for an extended period of time. The danger is that if a heat source is present, the vapors could re-ignite. Class A foam should only be considered as a temporary solution until a Class B foam operation is set up. When available, the Class B foam can be applied directly over the Class A foam.

Foam Application Techniques

Foam is not the same as water. Although this seems intuitive, in the stress and pressure of firefighting operations, it is easy to forget and simply aim the nozzle directly at the fire. When applying foam, use the technique that works best for the conditions and fuel burning.

Direct Attack

If using low concentrations of Class A foam as a wetting agent, it is alright to use standard nozzle techniques. Penciling the ceiling to take heat out above you and prevent rollover and attacking the seat of the fire with a straight stream works well. Once knockdown is achieved, alternate between fog patterns to get foam over a wider area and a straight stream to apply more foam and water to specific hot spots to accomplish complete overhaul.

Bounce Off Technique

Spraying the foam stream at a wall or other obstruction when available and allowing the foam blanket to cover the burning fuel is a good technique when a gentle application is needed to not disrupt the blanket and keep vapor release down. Foam can also be applied onto the fuel surface by hitting the ground in front of the spill, allowing the foam to "pile up" and roll onto and over the fuel. This technique is useful if there is no wall to use the bounce off technique.

Raindown Technique

The foam stream can be directed up into the air above the fire to its maximum height and allowed to break into small droplets. The foam will then fall down on the fire and form a blanket that will cover the fuel. The operator must adjust the altitude of the nozzle so the fallout pattern matches that of the spill area. This technique can provide very fast and effective knockdown. However, if there are high winds, or the fire has been burning for an extended time and a significant thermal column has developed, this method may not be practical or effective.

Never plunge the stream directly into a Class B fire. This can splash the fuel, causing fire spread. In addition, this can interrupt the blanket of foam and allow vapors to release and possible cause reignition.

Summary

Portable Fire Extinguishers are found everywhere in the fire service. In addition to the common extinguishers found on our front line apparatus, there are extinguishers found on auxilliary equipment and specialty apparatus. It is very important for all firefighters to be familiar with the uses and operation of these extinguishers.

The advantage handheld extinguishers have is the ability to deploy quickly and into hard to access areas that have incipient fires. Using these tools properly and in a timely manner can stop small fires from growing larger, negating the necessity to deploy hose lines and additional personnel and reducing the public hazard and property damage.

During FCIP's, knowledge of fire extinguishers and the codes that govern them can ensure that they are properly located and in good working order when the public needs them.

Firefighting foam has become an important element in modern day firefighting. It is important for firefighters to understand the characteristics and usages for Class A foam, including CAFS, and Class B foam.

In conclusion, fire extinguishers and firefighting foam are very effective tools for the fire service and for the public when used in the proper situation.

Media & Link Index

- CAFS Presentation Part 1 - Introduction to Compressed Air Foam Systems
- CAFS Presentation Part 2 - CAFS Task Force & Introduction to Ultra XT Brush Apparatus
- CAFS Presentation Part 3 - Ultra XT Driver/Operator Training

- CAF Task Force Guidlines
- Wildland Firefighting Tactics for CAFS
- Ultra XT Brush Apparatus Manuals

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3. NFPA 12 – Standard on Carbon Dioxide Extinguishing Systems
4. NFPA 12A – Standard on Halon 1301 Fire Extinguishing Systems
5. NFPA 17 – Standard for Dry Chemical Extinguishing Systems
6. NFPA 17A – Standard for Wet Chemical Extinguishing Systems
7. NFPA 408 – Standard for Aircraft Hand Portable Fire Extinguishers
8. NFPA 2001 – Standard on Clean Agent Fire Extinguishing Systems
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15. http://www.fireengineering.com/index/articles (Class A foam on Class B fires)

NOTE: If you have any additional information or content that you feel would be appropriate to contribute to this Chapter or would like to report any errors or misrepresentations, please contact the SDFD Training Division or email the Drill Manual Revision Staff at

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Date	*Revision/Update Description*