NY Fire Consultants, Inc.
Fire Safety Message

www.NYFireSafe.com info@nyfiresafe.com January 2007

AUTOMATIC SPRINKLER SYSTEMS

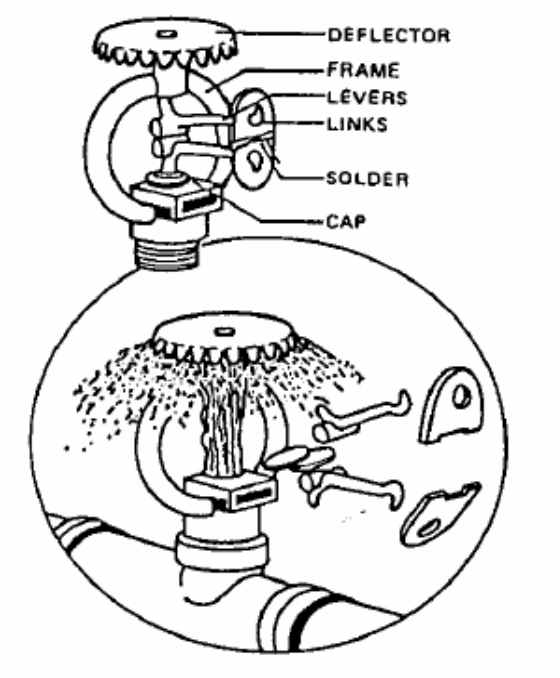
Automatic sprinkler systems are designed to automatically distribute water on a fire. The sprinkler system is designed to extinguish the fire entirely, or to prevent the spread of the fire. An automatic sprinkler system consists of a series of pipes at or near the ceiling in a building. The sprinkler system is fitted with automatic devices designed to release water on a fire. These devices are called sprinkler heads. A disk or cap normally closes the sprinkler heads. This cap is held in place by a heat-sensitive releasing element. A rise in temperature to a predetermined level causes the sprinkler head to open. Water is then discharged in the form of spray. When the sprinkler heads open they are said to have fused. The sprinkler heads are fitted at standard intervals on the piping. If more than one head opens, the area sprayed by each overlaps that of the sprinkler head next to it. Sprinkler systems are required by law in various occupancies. They also may be installed voluntarily by the owner of the building. The sprinkler systems are installed to protect the building and its occupants. The installation of sprinklers has a major effect in reducing fire losses. Statistical evidence shows that about 96% of the fires are extinguished or controlled when sprinklers are installed. The 4% failure was due to a variety of causes including burst piping, closed supply valves, frozen water lines, etc.

Automatic sprinklers are very effective for life safety. They signal the existence of a fire. At the same time they discharge water to the burning area. When sprinkler systems are installed there are rarely problems getting to the seat of the fire. They also reduce interference with visibility for fire fighting due to smoke. The downward force of the water sprayed from sprinkler heads lowers the smoke level in the room. Sprinkler systems also serve to cool the smoke. This makes it possible for persons to remain in the area much longer than they could if the room were without sprinklers. Most standard sprinkler systems have devices that automatically give an alarm when a sprinkler head discharges water. This alarm is usually an audible signal in the building. In many cases they also give an alarm at a remote location, such as the local firehouse or a central station company. The central station company monitors the entire fire protection system for water discharge and problems with the equipment. When water discharge or equipment problems are identified the local firehouse is immediately notified. This allows the Fire Department to gain control of a fire as quickly as possible. Water is rarely discharged accidentally from sprinkler heads.

SPRINKLER HEADS

Sprinkler heads are made of metal. They are screwed into the piping at standard intervals. The water is prevented from leaving the sprinkler head by an arrangement of levers and links. The levers and links are soldered together on the sprinkler head. The solder is a metal alloy with a fixed melting point. Other types of sprinkler heads use a quartz bulb which expands and breaks under heat. Still another type uses a solid chemical held in a cylinder which is broken by heat

action. The sprinkler head is designed to withstand at least 500 psi without injury or leakage. If properly installed, there is little danger of the sprinkler head breaking apart unless it is damaged. The latest type of sprinkler head is called the "cycling sprinkler". This sprinkler cycles water on and off depending on the temperature. When the disk reaches a temperature of 165°F, the valve opens, permitting water to flow. When the disk temperature cools the valve closes to shut off the water. Some sprinkler heads are designed to be used in special situations. Sprinkler heads exposed to corrosive conditions are often covered with a protective coat of wax, or lead. Corrosive vapors are likely to make automatic sprinklers inoperative or slow down the speed of operation. They can also seriously block the spray nozzles in the sprinkler heads. They can damage, weaken or destroy the delicate parts of the sprinkler heads. In most cases such corrosive action takes place over a long time. For this reason the sprinkler heads must be carefully watched for signs of corrosion. Care should be taken to make sure that the protective coating is not damaged when handling or replacing the heads. A typical fusible link type sprinkler head is shown in the picture below.



A typical sprinkler head

Spray Pattern of Sprinklers

The best way to put out a fire is to spray the water from the sprinkler head downward and horizontally. The spray pattern will also prevent the spread of the fire. The force of the water against the deflector creates a heavy spray which is directed outward and downward. The shape of the deflector determines the spray pattern of the water discharged from the sprinkler head. Usually, this is an umbrella shaped spray pattern. At a distance of 4 feet below the deflector, the spray covers a circular area having a diameter of approximately 16 feet when the sprinkler is discharging 15 gpm. The newest kinds of sprinkler heads allow the sprinklers to be placed farther apart needing lower flow rates to give coverage to an area. These new heads offer more effective fire protection and are less likely to cause water damage than the old sprinkler heads.

Systems Using Large Drop Sprinkler Heads

Large drop sprinkler heads are special sprinklers designed to discharge large drops of water from the head. These sprinkler heads are used to break through the strong updrafts of high challenge fires.

Temperature Ratings of Sprinkler Heads

Automatic sprinkler heads have various temperature ratings which state the temperatures at which they will fuse. The temperature rating of all solder type automatic sprinklers is stamped on the soldered link. For other heat sensitive units, the temperature rating is stamped on one of the releasing parts. The temperature ratings of sprinkler heads are also indicated by a color coding system.

Temperature Ratings Color Code

135°F to 170°F Uncolored
175°F to 225F° White
230°F to 300°F Blue

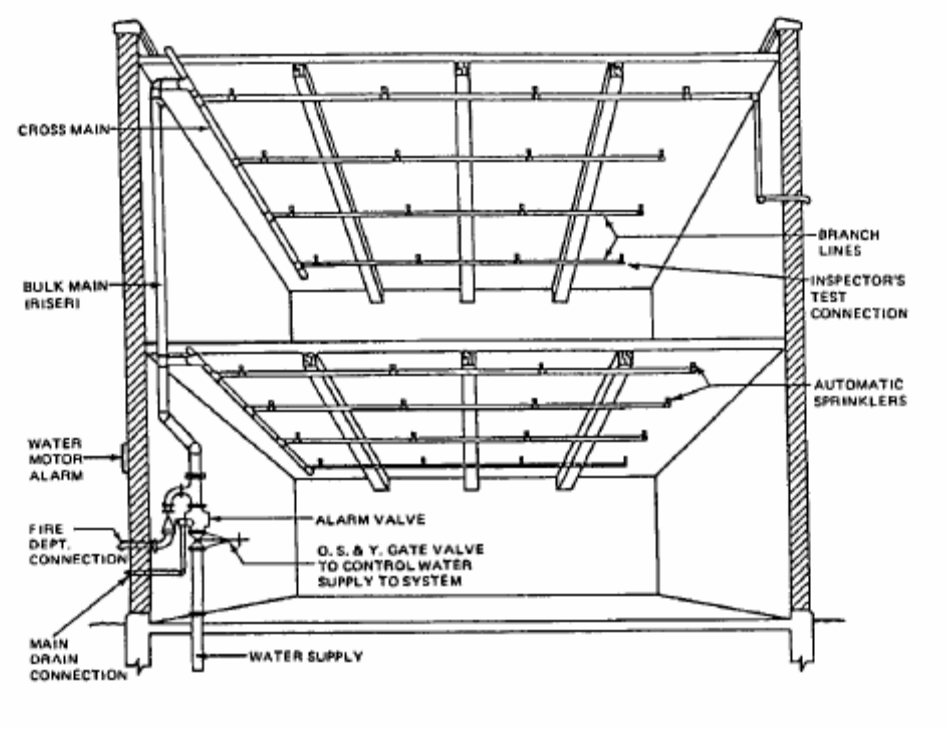
In places where the temperature is normally high (e.g. boilers, ovens and drying rooms) a sprinkler head with a higher temperature rating must be used. This is to make sure that the sprinkler head does not discharge water at the wrong time. If heads with a high temperature rating are used in ordinary room (e.g., an office, an apartment, and store) the value of the sprinkler protection is greatly reduced. This is because the temperature will have to increase much higher for the sprinkler head to open. Sprinkler systems are excellent for controlling fires. However, they can cause water damage if they are not shut down soon after the fire has been extinguished. No control valve on the system should be closed except on the order of the fire officer in charge. Sometimes the Fire Department has a difficult time finding the control valve to shut down the system. This problem can be prevented by keeping a small sketch of the sprinkler system and the position of the control valves. This sketch should always be readily available. This sketch is very helpful to the firefighters when they have to work with the sprinkler system.

Build up of Foreign Material on Sprinkler Heads

Sometimes conditions exist which cause a build-up of foreign material on sprinkler heads. This may prevent the sprinkler head from working properly. This build-up is commonly called loading. The build-up of foreign material insulates the sprinkler head. This insulation prevents the sprinkler head from opening at the temperature it is designed to. If the build-up is hard, it may prevent the sprinkler head from opening. The best practice is to replace loaded sprinklers with new sprinklers rather than to attempt to clean them. If the deposits are hard, attempts to clean the heads are likely to damage them. This damage may make prevent the sprinkler heads from working properly. The damage may also cause the sprinkler heads to leak. Deposits of light dust are less serious than hard deposits. Dust build up may delay the operation of sprinkler heads. However, it will not prevent the eventual discharge of water. Dust deposits can be blown or brushed off. If a brush is used, it should be soft to avoid possible injury to sprinkler parts. Scouring or acidic liquids are likely to damage the sprinkler heads and should not be used for cleaning. Hot solutions of any kind should never be used to clean the sprinkler heads. Sometimes sprinklers heads need to be protected when ceilings or piping are being painted. Usually a small lightweight paper bag or a sheet of lightweight paper is placed over the heads until the painting is completed. The bag or the sheet of paper should

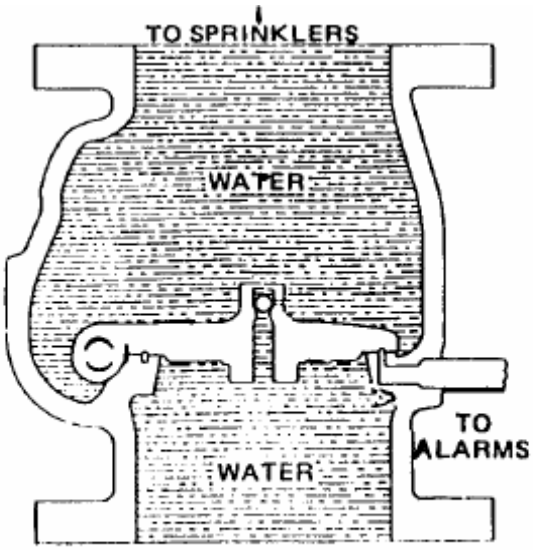
be secured with a rubber band. The bags are likely to delay the operation of the sprinkler heads and should be removed immediately after the painting is completed. There is no known method to safely remove paint from under the water cap or on the fusible link. Sprinkler heads that have been painted other than by the manufacturer must be replaced with new units. A supply of at least six extra sprinklers with the appropriate wrench should always be kept in a sprinkler cabinet. This extra supply should be used to promptly replace any sprinklers that have opened or have been damaged. The extra supply of sprinkler heads should be exactly the same as the sprinkler heads already installed in the system. It is very important that the replacement sprinkler heads have the same temperature rating as those installed in the system.

WET PIPE SPRINKLER SYSTEMS



A typical wet pipe system

Wet pipe systems have water in the piping at all times. This type of system is used where there is no danger of the water supply freezing. A picture of a typical wet pipe system is shown in the picture below. A typical wet pipe sprinkler valve is shown on the following page.



A typical wet pipe sprinkler valve

Freezing Temperatures

Where temperatures drop below freezing the ordinary wet pipe system cannot be used. There are two methods for using automatic sprinkler systems in places exposed to freezing temperatures. One method is to design a system where water enters the sprinkler piping only after a control valve is opened. These are dry pipe systems, deluge systems, or pre-action systems. The other method adds an antifreeze solution to the water in the wet pipe system. The antifreeze solution is a mixture of chemicals designed to prevent the water from freezing.

Antifreeze Solutions

Antifreeze is added to the water in piping exposed to freezing temperatures. When the sprinkler heads fuse the system works in the same way as a wet pipe system does. Antifreeze solutions are costly and may be difficult to maintain. Antifreeze is usually used for small unheated areas. Antifreeze solutions may be used only in accordance with applicable local health regulations.

Cold Weather Valves

An automatic sprinkler system should not be shut off and drained to avoid freezing during cold weather. However, parts of the sprinkler system may be shut down. Permission must be obtained from the local firehouse. Permission may be given to shut off a maximum of 10 sprinklers on a wet pipe system. These shutoff valves are commonly referred to as cold weather valves.

Water Supply Sources for Residential Sprinkler Systems

Sprinklers systems may be supplied from one or a combination of sources. For example, they may be supplied by public mains, gravity tanks, pressure tanks, reservoirs, rivers, or lakes. A single water supply would appear to be all that is needed to supply a sprinkler fire protection system. This assumes that there is enough water at an acceptable pressure. However, there are a few reasons why it is good to have a second water supply source.

- The single supply source may be out of service (for maintenance or repair) during a fire emergency
- The single supply source may be disabled during fire or before the fire is fully extinguished
- The water supply source may fall below normal pressure or volume during an emergency.

In some cases it is required by law to have a second water supply source. Whether a second source is needed depends on several factors. These factors include the strength and reliability of the primary supply, the value of the property, the height, area and design of the building. When a sprinkler system is supplied from a public water main, the entire system may be closed down by closing a control valve. This valve is located between the building and the water main in a box that is recessed into the sidewalk. The location of the box is found by reading a sign on a building or post nearby. For example, the sign might read **"Shut-off for Sprinkler System Located 6 Feet From This Sign",** or it will have similar instructions. A special key may be required to operate this valve. The main water supply for sprinkler systems may also be controlled an OS&Y valve (Outside Screw and Yolk valve). The OS&Y valves are found just inside the building wall on the main riser, or outside in protected pits. It is easy to tell at a glance if the valve is open or shut. When the stem is all the way out the valve is open. When the stem is all the way in the valve is closed. Some OS&Y valves may be used to control the water supply for individual floors in a building. The OS&Y valves are also installed to shut off certain sections of an individual floor. Being able to shut off parts of a building allows the Fire Department to have greater control over the fire protection system. When a fire is under control in an area the OS&Y valve can be closed to prevent any further water damage. Sometimes repairs must be made to the sprinkler system. When this happens the OS&Y valves are used to close the water supply to only those sections being repaired. This is good because the rest of the sprinkler system does not have to be shut down. A building may have both a standpipe and a sprinkler system installed. Each system may have its own water supply source. For example, the standpipe system may be supplied by a gravity tank and the sprinkler system supplied by a pressure tank. It is quite common for the two systems to share the same water supply source. For example, both systems may use the same gravity tank as a water supply source. The gravity tank is a limited water supply. The amount of water that is allocated to each system is regulated by local building laws. Acceptable water supplies for the sprinkler system include connection to public or private water mains, connection to fire pumps, pressure tanks, and gravity tanks. These sources may be also used in combination to supply a sprinkler system. At least one of the water sources should be able to supply the sprinkler system automatically. This supply must have the needed water volume and water pressure for the entire system. The public water works system is the most commonly used water supply source. In tall buildings the connection to the public water system may not have enough water pressure to supply the upper floors. In this situation a second supply source is often required to increase the water pressure. For example, a fire pump may be installed in a building that is more than ten stories high. The higher the building the greater the water pressure needed to supply the standpipe and/or sprinkler system.

Connections to Public Water Works System

While a connection to a reliable public water works system is the preferred primary water supply for automatic sprinkler systems, a check valve must be installed next to the interior connection to the sprinkler system. This valve makes sure that the system does not backflow into the public water supply.

Fire Pumps

The fire pump is designed to draw water from a supply source. The water is then pumped into the fire protection system under high pressure. A fire pump with both a reliable source of power and a reliable suction water supply is a desirable piece of equipment. A suction water supply is simply a source of water that the pump can draw water from. With a good water supply a fire pump can pump water into a sprinkler system for a long time. Sometimes more than one fire pump is installed in high-rise buildings. The extra fire pumps are needed to maintain the desired water pressure levels at the top floors of the buildings. Manually started pumps may be used as a secondary supply source if the primary water supply will last long enough to allow the pump to be started. This kind of system must give an automatic water-flow signal to the Certificate of Fitness holder when the pump must be started. Automatic fire pumps are usually installed where a high water demand may occur immediately. This demand may occur in a deluge system. An automatic fire pump is also used when someone is not always available to activate the manual pump. Automatic fire pumps must have their suction **"under a positive head"** to avoid delays in drawing water from the supply source. Under positive head means that the water supplying the pump must be fed into the fire pump under pressure. This can be achieved by connecting the fire pump to a suction tank. Water is forced into the pump by gravity. Automatic fire pumps are activated as soon as a drop of air or water pressure is noticed in the fire protection system. The drop in pressure occurs when a hose line is opened or a sprinkler head has fused.

Gravity Tanks

Gravity tanks of adequate capacity and elevation make a good primary supply and may be acceptable as a single supply. A gravity tank may be located on the top of a building or on a tall tower. The water in the tank is distributed throughout the sprinkler system because of the pull of gravity.

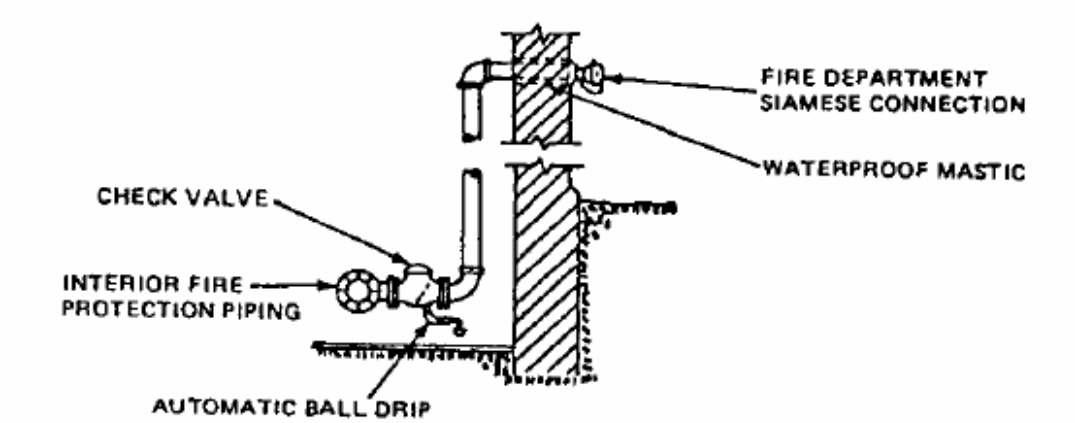
Pressure Tanks

Pressure tanks have several possible uses in automatic sprinkler systems. Pressure tanks are often used where there is enough water from a supply source but the water pressure is too low. Pressure tanks may also be used in tall buildings that need the extra water pressure to supply the highest line of sprinklers or the highest line of hoses. The tank is normally kept two-thirds full of water and one third full of air. The air pressure in the tank should be maintained above 75 psi. The air for pressure tanks is supplied by air compressors. Because the water is always under pressure it can be forcefully distributed throughout the sprinkler system. An important limitation is the small amount of water that can be stored in such tanks. Where a small pressure tank is accepted as the water supply, the system is called a Limited Supply System. The pressure tank gives a strong starting pressure for the first sprinkler heads or standpipe hoses that open. The flow from the tank may be used while the automatic fire pumps begin to increase the water supply pressure. The pressure tank supplies these sprinkler heads until the Fire Department begins pumping water into the system.

Siamese Connections for Fire Department Use

Normally a sprinkler system is connected to an automatic water supply source. Other sources of water are supplied through Fire Department siamese connections at the building. Siamese connections are a standard part of all sprinkler systems. At least one siamese connection must be installed in all sprinkler systems. When responding to an alarm most fire departments supply water to the standpipe system first. The standpipe system supplies water to the fire hoses in the building. Water is then supplied to the sprinkler system through its own siamese connection. Care should be taken that standpipe and the sprinkler connections are properly marked because the connections look the same. The exact purpose of each siamese connection should be shown nearby or on the siamese connection itself. The New York Building Code requires siamese connections to be color-coded. The siamese connection to an automatic sprinkler system should be painted green. The siamese connection to non-automatic sprinkler system should be painted aluminum. The siamese connection to a standpipe should be painted red. Two examples of typical siamese connections are:

Fire Department connections must always be accessible. Each connection should be fitted with a lower check valve. The check valve prevents the backflow of the private water supply into the public water supply. The figure below shows the main features of a Fire Department siamese connection.



Fire department connection

The automatic drip ball device between the lower check valve and the outside hose coupling prevents water from building up in the piping. This ball drip device makes sure that the Fire Department connection is not blocked by water that has frozen in the piping. If water freezes in the piping, the Fire Department will not be able to pump water into the system. Under normal conditions the automatic ball drip should be dry. A wet ball drip device indicates that the lower check valve may be defective. If the check valve is defective it should be replaced immediately. Many standpipe and sprinkler systems use the Fire Department Siamese connection as a secondary water supply source.

Water-flow Alarms in Sprinkler Systems Supervision

Sprinkler systems should have devices and equipment for signaling when water flows through risers or mains supplying the systems. The flow may be due to fire, leakage, or accidental rupture of the piping. It is important that prompt action is taken when water-flow is noticed or signaled by these devices.

Functions of Alarms and Supervisory Signals

Sprinkler systems with a water-flow alarm serve two functions:

1. It is an effective fire extinguishing system
2. It is an automatic fire alarm

An alarm is signaled as soon as a sprinkler head has fused. Water-flow alarms and fire alarms give warning of the actual occurrence of a fire. They also signal when water flows through the system due to broken pipes. Alarms alert occupants and summon the Fire Department. Any signal, whether water-flow or supervisory, may be used to give an audible alarm. It may also send a signal to an approved central station company. The central station company will then contact the local firehouse. Supervisory devices are often connected to a central station company which monitors the sprinkler systems for problems with equipment and when sprinkler heads are opened. The central station company should be notified when any control valves is closed for maintenance or repair. This reduces the number of false alarms. Automatic sprinkler systems are required to have an approved water motor gong or an electric bell, horn, or siren on the outside of the building. An electric bell or other audible signal device may also be located inside the building. Water operated devices must be located near the alarm valve, dry pipe valve, or other water control valves in order to avoid long runs of connecting pipe.

Devices and Equipment Supervised

Sprinkler system supervision is commonly provided for several purposes:

1. Low water level in water supply tanks
2. Low temperature in water supply tanks or ground level reservoirs
3. High or low water level in pressure tanks
4. High or low air pressure in pressure tanks
5. High or low air pressure in dry pipe sprinkler systems
6. Failure of electric power supply to fire pumps
7. Automatic operation of electric fire pumps

Water-flow Alarm Valves

The basic design of most water-flow alarm valves is that of a check valve which lifts from its seat when water flows into a sprinkler system. This alarm then starts an audible signal to alert the occupants in the building that the sprinkler system has been activated.

Alarm Retarding Devices

An alarm check valve that is exposed to changing water supply pressure needs an alarm retarding device. This is required to prevent false alarms when the check valve clapper is lifted from its seat by a temporary pressure surge.

Gate Valves

Gate valves of the non-indicating type are provided in water distribution systems. Gate valves allow parts of the sprinkler system to be shut off for repairs or maintenance. This is done without reducing protection over a wide area. Such valves are normally a non-rising stem type. They are operated using a special key wrench. A valve box is located over the valve to keep dirt from the valve. The valve box also provides a convenient access point for the valve wrench to the valve nut. A complete record should be made for each valve in the system. This record should include the exact location, the date it was installed, the make, the direction of opening, number of turns to open, and any maintenance that was performed.

GARBAGE COMPACTOR SPRINKLER SYSTEMS

Waste compactors are usually found in tall buildings and multiple dwelling occupancies such as residential buildings. They are used to reduce the trash build-up in a building. They consist of a tall chute that has an opening at each floor. Each opening is used for trash disposal. Occupants of the buildings take their trash and throw it through the opening and down the chute. The trash piles up in the chute. At the bottom of the chute there is a device that regularly crushes the trash into smaller blocks of trash. The blocks of trash are then removed and taken to a garbage dump. The compactor may be located indoors or outdoors. The build-up of trash in the compactor chute is a fire hazard. Fires have been started in several ways, for example, by a smoldering cigarette thrown into the compactor chute. Sprinkler systems must be installed to put out fires that may start in the compactor chute. Any of the standard water supply sources may be used to supply the compactor sprinkler system. For example, gravity tanks, fire pumps and pressure tanks are all used as water supply sources. Fire doors must be installed in the chute to allow firefighters access to burning trash. The Certificate of Fitness holder must know the location of all sprinkler heads, control valves, supply lines and compactor rooms. **A sketch of the entire compactor sprinkler system should be drawn by the Certificate of Fitness holder.** This sketch should be posted in the compactor room in a frame under glass. The sketch should be made available to official representatives of the Fire Department. The Certificate of Fitness holder may be questioned about this sketch by inspectors from the Fire Department during routine inspections. A sign indicating the location of all control valves should be kept in the compactor room. This sign should be displayed with the sketch in the compactor room. All control valves in the sprinkler system must be labeled. The label should show the purpose of the valve. The labels should be attached to the yoke of the valves. **All indicating valves in the compactor sprinkler system must**

be sealed open. A minimum of 6 extra sprinkler heads with the appropriate wrench must be available to replace any fused or damaged sprinkler head. Fused or damaged sprinkler heads must be replaced immediately. A garden hose connected to a water supply must be kept in the compactor room. This hose may be used to put out small fires or smoldering material in the compactor room. The Certificate of Fitness holder must conduct an inspection of the entire sprinkler system at least once a month. Special attention should be given to the condition of the sprinkler heads in the compactor chute and the compactor room. Any defects or violations must be recorded in a detailed inspection report. All inspections are recorded on a card kept near the main control valve. The Certificate of Fitness holder should sign and date the card each time an inspection is made. If any minor defects in the system are discovered they must be reported to the owner of the building. If repairs are not made within 30 days the Certificate of Fitness Holder must notify the Bureau of Fire Prevention. If any major defects are discovered they must be reported to the local fire company, the owner of the building, and the Bureau of Fire Prevention. Major defects must be repaired immediately. When a fire is discovered in the compactor room the Certificate of Fitness holder should notify the local firehouse immediately. He should not attempt to enter the compactor chute to put out the fire.

Emergency Action Plans

Deadline for all New York City Office Buildings December 31st

What is an EAP? An Emergency Action Plan outlines the procedures for a buildings response to a non-fire-related emergency involving an explosion, biological, chemical, radiological, nuclear or hazardous materials incident, natural disasters such as a hurricane or earthquake, or other emergency conditions that occur inside or in close proximity to their buildings.

EAP Quote
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Emergency Action Plans are professionally designed plans that include an official EAP document that is filed with the Fire Department and kept on site at a building. EAP training and implementation manuals must be created for the buildings staff and tenants. Emergency Action Plans take into account the building's size, its number of occupants, the number of exits/emergency stair pathways, how staff and tenants are to be notified of emergencies, the frequency of drills and who is in charge in an emergency.

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