F19

STUDY MATERIAL FOR THE EXAMINATION FOR CERTIFICATE OF FITNESS FOR SPRINKLER SYSTEMS WITH GRAVITY AND PRESSURE TANKS (F-19)

1/05®

This study material contains the information you will need to prepare for the examination for the Certificate of Fitness for Sprinkler Systems supplied by gravity and pressure tanks (F-19). The study material includes information taken from relevant sections of the Fire Prevention Code and the Building Code of New York. Other information describes different kinds of sprinkler systems and when they are used.

All questions on the Certificate of Fitness examination are multiple choice, with four-alternative answers to each question. Only one answer is correct for each question. If you do not answer a question or mark more than one alternative your answer will be scored as incorrect. A score of 70% correct is required on the examination in order to qualify for the Certificate of Fitness. Read each question carefully before marking your answer. There is no penalty for guessing.

Sample questions

1. The minimum water pressure at the level of the highest sprinkler head should be:

A. 15 psi.
B. 25 psi.
C. 50 psi.
D. 100 psi.

The correct answer is "**A**". You would press "A" on your touch screen monitor.

2. A supply of extra sprinkler heads:

A. is not required to be kept.
B. may be obtained from the Bureau of Fire Prevention.
C. may be obtained from the nearest Fire Company.
D. are required to be kept on the building premises.

The correct answer is "D". You would press "D" on your touch screen monitor.

PROVISIONS OF THE FIRE PREVENTION CODE OF NEW YORK

All multiple dwellings, factories, office buildings, warehouses, stores and offices, theaters and music halls, and all hospitals and asylums, and all public schools and other public buildings, churches and other places where large numbers of persons are congregated for purposes of worship, instruction or amusement, and all piers, bulkheads, wharves, pier sheds, bulkhead sheds or other waterfront structures shall provide such fire hose, fire extinguishers, buckets, axes, fire hooks, firedoors and other means of preventing and extinguishing fires as the commissioner may direct.

Sprinkler systems in garment factories and factories using flammable oil for processing.

A one source automatic wet pipe sprinkler system shall be provided in every non-fireproof building in which there is a garment factory or a factory engaged in the processing of combustible fabrics with a flammable oil, and which exceeds three stories in height, and in which more than fifty persons are employed above the street floor. A flammable oil is defined as an oil which emits a flammable vapor below one hundred twenty-five degrees Fahrenheit. An automatic dry pipe sprinkler system is acceptable in place of an automatic wet pipe sprinkler system where low temperatures or other conditions would prevent the installation of a wet pipe system. The sprinkler systems shall be provided in all parts of such buildings.

Sprinkler and/or standpipe system maintenance and inspections.

1. Automatic and non-automatic sprinkler systems shall be inspected at least once a month by a competent person holding a certificate of fitness, employed by the owner, to see that all parts of the system are in perfect working order, and that the fire department connection or connections, if any, are ready for immediate use by the fire department. A detailed record of each inspection shall be kept for examination by a representative of the fire department.

2. A supply of at least six extra sprinkler heads shall be kept available on the premises, to replace promptly any fused or damaged sprinklers. Any head which has opened or has been damaged shall be replaced immediately with a good sprinkler head. One or more employees instructed in the maintenance of sprinkler systems.

3. At least once in five years, the fire department connection or connections, if any, for a sprinkler and/or standpipe system shall be subjected to a hydrostatic pressure test and the standpipe system shall also be subjected to a flow and pressure test to demonstrate its suitability for fire department use. The test shall be conducted by the owner's representative before a representative of the fire department.

Maintenance and inspections of standpipe and sprinkler pumps and accessories.

Valves, hose, tools and other accessory fire fighting appliances shall be kept readily available and in good working order. Fire pumps shall be operated at least once in thirty days in a manner which will subject the standpipe system to a hydrostatic pressure of at least fifty pounds per square inch at the top story hose outlet. The qualified operator shall maintain a suitable record of his or her compliance with this requirement for inspection by the fire department. The installation of fire and booster pumps shall be subject to inspection and/or test in the presence of an inspector from the bureau of fire prevention.

PROVISIONS OF BUREAU OF FIRE PREVENTION FIRE DIRECTIVE 4-82

Record keeping.

The Certificate of Fitness Holder shall maintain a detailed record of all inspections. A record card with the date of each inspection, the Certificate of Fitness number, and the signature of the Certificate of Fitness holder shall be posted near the main control valve.

The detailed inspection report shall include information relative to conditions of water supply, gravity and pressure tanks and levels therein, valves, risers, piping, sprinkler heads, hose valves, hoses and nozzles, siamese connections, alarms, fire pumps, obstructions, and conditions of all other system equipment and appurtenances. All defects of violations shall be noted on the report. Records should be kept for one year and be made available to any representative of the Fire Department.

Reporting of defects or violations.

The Certificate of Fitness holder should **report all major defects immediately to:**

1. the local Fire house
2. the owner or manager of the building
3. the Bureau of Fire Prevention

Major defects or violations include: empty tank, break or major leak in system water piping, inoperative or shut water supply valves; or complete or partial shut down of sprinkler and/or standpipe systems for repairs or other reason, and defective siamese connections.

Other defects or violations which are minor should be reported to the owner or manager of the building. If the defects are not corrected within 30 days, the defects should be reported in writing to the Bureau of Fire Prevention.

Failure to make inspections, maintain records, and report defects or violations may be cause for revocation of the Certificate of Fitness and court enforcement proceedings.

PROVISIONS OF BUREAU OF FIRE PREVENTION FIRE DIRECTIVE 1-68

Color code requirements for fire extinguishing systems in bulk oil storage and similar plants.

Automatic sprinkler systems (wet or dry):

1. Piping and valve bodies and handles shall be painted red with contrasting bright green bands.
2. Fire Department connections shall be painted red with green caps.

Nonautomatic sprinkler systems (including fog spray systems):

1. Piping and valve bodies and handles shall be painted red with contrasting aluminum bands.
2. Fire Department connections shall be painted aluminum.

PROVISIONS OF THE NEW YORK BUILDING CODE

Sources of water supply for sprinkler systems.

Automatic sources of water supply for sprinkler systems include a gravity tank, pressure tank, automatic fire pump, or direct connection to the public water system. Auxiliary sources of water supply for sprinkler systems include manually activated fire pumps or siamese connections. Tanks used to provide the required primary water supply to a standpipe system may also be used as a supply for a nonautomatic sprinkler system. Nonautomatic sources of supply for sprinkler systems shall include siamese connections. Where siamese connections are installed, metal signs shall be fastened to or above the siamese connection indicating the area protected. Where the building has two or more frontages, additional metal signs shall be installed indicating the location of the siamese connection. The installation and construction of siamese connections shall be the same as required for fire standpipe systems, except that the caps of each automatic sprinkler siamese connection shall be painted green. The entire siamese connection of a nonautomatic sprinkler system shall be painted aluminum. The caps of each siamese connection used for combination standpipe and sprinkler systems shall be painted yellow and signs shall be provided.

At least one automatic source of water supply shall be provided for sprinklers installed in all occupancy groups, except that:

(a) Two automatic sources of water supply shall be provided for sprinklers in:
- (1) Buildings classified in occupancy group A.
- (2) Buildings classified in occupancy group C when the area on one floor exceeds twenty thousand square feet.
- (3) Buildings classified in occupancy group F-1 when open heads are required for stages of unlimited size.

(b) The domestic water supply may be used to supply a sprinkler system when installed in buildings classified in occupancy groups E, G, H and J. The domestic water supply may be used to supply sprinklers if all of the following conditions are met:
- (1) The domestic water supply line from the tank or street has the required pressure (as described below).
- (2) An O.S. & Y. valve or an approved valve having visual indication, sealed open, is installed in the sprinkler supply branch.
- (3) The number of heads in each fire section does not exceed twenty, and no more than ten heads are supplied from any one domestic water riser.
- (4) The connection is made at the supply or riser side of any domestic branch control valves.

Direct connection of sprinklers to the public water system.

Direct connection of sprinklers to a city water main is acceptable as an automatic water supply provided the main is capable of maintaining a pressure of at least fifteen psig at the top of the highest sprinkler riser, with five hundred gpm of water flowing from a two and one-half inch hydrant outlet located at the street level within 250 feet of the building. The size of each connection shall be as large as that of the main riser and, except in sprinkler systems in multiple dwellings, shall be at least three inches and shall be controlled by an accessible shutoff valve.

Each service shall be equipped, under the sidewalk, with a control valve in a flush sidewalk box located within two feet of the front wall of the building or street line as required by the department of environmental protection. The location of the control valve shall be indicated by a sign place on the structure directly opposite the sidewalk flush box, and shall have a white background with one inch red letters reading: "Automatic Sprinkler Shutoff Valve ... Feet Opposite This Sign. Brass, bronze, or other metal signs with one inch letters, raised or counter-sunk one-eighth of an inch may also be used.

Sprinkler booster pumps.

Where the pressure from the city water main is less than 15 psig as described above but is sufficient to give at least five psig at the highest line of sprinklers as determined by test, an automatic, electrically driven pump installed for the purpose

of boosting or increasing the city water pressure in the sprinkler system may be accepted subject to the following requirements:

(a) Pumps shall be of approved centrifugal type, capable of delivering at least two hundred gpm, and shall be capable of supplying twenty-five per cent of the heads, in the largest area supplied, at twenty gpm, at a pressure of at least twenty-five psig at the top of the highest sprinkler riser.

Pumps shall be maintained under approved automatic control with closed circuit supervisory attachment. The supervisory attachments shall be directly connected to an office where maintenance personnel are in attendance twenty-four hours a day; or, in lieu thereof, the supervisory attachment may be directly connected to the central station of an approved operating fire alarm company. The supervisory alarm services shall be arranged so as to provide positive indication at an approved central office or sprinkler alarm panel board that the pump has operated or that the source of electrical supply has failed.

When sprinkler are not directly connected to the public water system and a sprinkler booster pump is not present a pressure or gravity tank shall be used.

Protection of sprinkler system.

All parts of an automatic system exposed to freezing temperatures shall be protected from freezing or in lieu thereof, an automatic drypipe system or a system filled with a nonfreezing, noncombustible solution shall be used. When a system filled with nonfreezing solution is used and the system is connected to a potable water supply, it shall be subject to the requirements of the health department and the bureau of water supply of the department of environmental protection. Sprinkler heads subject to damage shall be protected.

Inspection and tests.

(a) **Automatic wet and dry systems.** Automatic wet and dry sprinkler systems shall be subjected to a hydrostatic pressure test for a period of one hour at a pressure of at least one hundred psig at the topmost sprinkler head and at least two hundred psig at the lowest cross connection to the siamese connections.

(b) **Automatic dry pipe systems.** In addition to the hydrostatic test the automatic dry pipe systems shall also be tested to forty psig air pressure for a twenty-four hour period with the pressure loss not to exceed one and one-half psig.

(c) **Non-automatic sprinkler systems.** Nonautomatic sprinkler systems shall be subjected to a hydrostatic pressure test of fifty psig at the topmost sprinkler head, with the test pressure maintained for a period of at least one hour.

(d) **Pressure tanks.** Pressure tanks shall be hydrostatically tested to a pressure of at least one and one-half times the working pressure for a period of one hour.

(e) **Sprinkler branches and heads supplied from domestic water.** Sprinkler branches and heads shall be tested at the pressure required by this section or at the pressure of the domestic water supply, whichever is greater.

Pumps.

In light hazard occupancies with only limited ordinary hazard areas, an automatic fire pump serving the lower 300 feet of the standpipe system may be used as the primary supply to the sprinkler system, if a secondary automatic switching power supply is available to drive the pump. In hydraulically designed sprinkler systems supplied from a gravity tank, the pressure may be increased by means of an automatic, special service fire pump. The pump shall be arranged in a bypass to permit the portion of the system so supplied to be served by the system's siamese connections. If the pump is not supplied from the street side of the building service switch, the electrical service and pump operation shall be fully supervised; provided that a secondary automatic switching power supply is available to drive the pumps.

Pressure Tanks.

A pressure tank in accordance is an acceptable water supply source. The total available quantity of water in pressure tanks need not exceed 15,000 gallons when there is a secondary source of water supply available from a gravity tank or a street connection acceptable to the Commissioner of Buildings. The maximum gross capacity of a single pressure tank shall be 9,000 gallons.

Each tank shall be kept at a maximum of 2/3 full of water and a minimum of 1/3 full of air maintained under a minimum pressure of 75 psig. The water-to-air ratio shall be so proportioned and the tank so located that a minimum pressure of 15 psig will be available on the highest line of sprinklers below the main roof when all the water is being discharged from the tank. The tanks shall be supplied with water through a fixed pipe, independent of the sprinkler piping, and at least 2 inches in size. The water supply and connection shall be capable of supplying the tank at a rate of at least 65 gpm without reducing the pressure in the tank. The tank shall have a fixed water level plate on the end of the tank opposite the gauge glass, or equivalent devices, to indicate the level of the water in the tank.

The air compressor shall be provided with automatic controls for maintaining the air pressure. The capacity of the compressor shall be sufficient to build up the tank pressure to 75 psig within 3 hours or less. Pressure tanks shall be provided with approved closed circuit high and low water and high low air alarms. Pressure tanks shall be located at or above the top level of sprinklers.

AN OVERVIEW OF SPRINKLERS AND SPRINKLER SYSTEMS

AUTOMATIC SPRINKLER SYSTEMS

Automatic sprinklers 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 of each story of a building, The sprinkler system is fitted with automatic devices designed to release water on a fire. These devices are called sprinkler heads. The sprinkler heads are normally closed by a disk or cap. This cap is held in place by a heat sensitive releasing element. A rise in temperature to a predetermined heat causes the sprinkler head to open and discharge water in the form of spray. The heads are staggered on the piping. If more than one head opens, the area sprayed by each overlaps that of the sprinkler head next to it. When a sprinkler head has opened it is said to have **fused.**

Sprinkler systems are required by law in various occupancies. They also may be installed voluntarily by the owner or occupant to protect a building, its contents, its occupants, or to obtain a reduction in insurance premiums. The installation of sprinklers has a major effect in reducing fire losses. A study of recent records showed that sprinklers either extinguished or held in check 96% of the fires in which they were involved. The 4% failure was due to a variety of causes, such as burst piping, closed supply valves, frozen water lines, etc.

Automatic sprinklers are very effective for life safety because they signal of the existence of a fire and at the same time apply water to the burning area. When sprinklers are installed there are rarely problems getting to the seat of the fire. They also reduce the interference with visibility for fire fighting due to smoke. The downward force of the water sprayed from the sprinkler heads lowers the smoke level in a room where a fire is burning. The sprinklers 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 which automatically give an alarm when a sprinkler head discharges water. This alarm is usually audible signal in the building. In many cases they also give an alarm at a remote location, such as the local fire department 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 fire house is immediately notified. This allows the Fire Department to gain control of a fire as quickly as possible. Water is rarely discharged 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 breaking apart unless it is damaged.

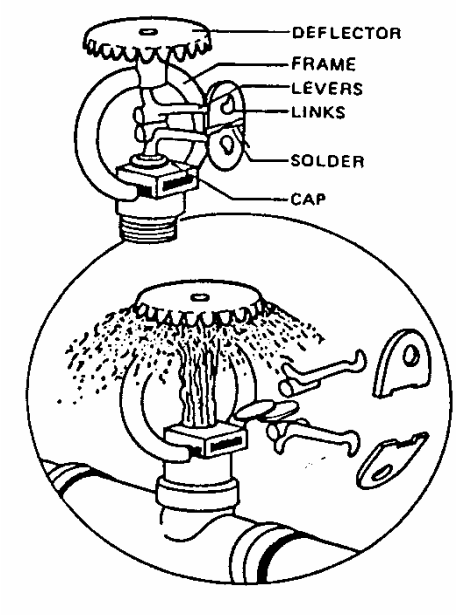
The latest type of sprinkler head is called the "cycling sprinkler". This sprinkler system cycles water on and off depending on the temperature. When the disk reaches a temperature of 165º F, the valve opens, permitting water to flow. When the disk temperature cools the valve closes to shut off the water.

Care must be taken to make certain that no part of a sprinkler head is covered with paint when the piping is being painted. Such a coating may interfere with the free movement of parts and delay its opening, or make it inoperative. During the painting of piping or nearby areas, the heads should be protected by covering them with paper bags. The bags should be removed as soon as the painting job is finished.

Some sprinkler heads are designed to be used in special situations. Sprinkler heads exposed to corrosive conditions are often coated with wax or lead. Corrosive vapors are likely to make sprinkler heads 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 below.



A typical sprinkler head

Spray Pattern of Sprinklers: The best way to put out a fire is to spray water from the sprinkler heads downward and horizontally. The spray pattern will also prevent the spread of fire. The force of the water against the deflector creates a heavy spray that 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 kind of sprinkler heads allow the sprinklers to be placed farther apart allowing for lower flow rates with the same protection as with the old type sprinklers. These new heads offer more effective fire protection and are less likely to cause water than the old sprinkler heads.

Systems Using Large Drop Sprinklers: Large drop sprinklers are special sprinklers heads designed to discharge large drops of water from the head. These sprinkler heads are used to break through the strong updrafts generated by 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 sprinklers are also indicated by a color coding system.

In places where the temperature is normally high, such as boiler rooms, kitchens, and in drying rooms, a sprinkler head with a higher temperature rating must be used. This is to make sure that the sprinkler heads do not discharge water at the wrong time. If heads with a high temperature rating are used in ordinary rooms, such as offices, apartments, or stores, the value of the sprinkler protection is greatly reduced. This is because the temperature will have to increase much higher for the sprinkler heads to open.

Sprinkler systems are an excellent means of 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 orders of the fire officer in charge. Sometime 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 diagram of the sprinkler system, including the location of the control valves. This diagram should always be readily available. This information 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 heads from working properly. This condition is commonly called loading. Any accumulation of foreign material on sprinklers heads tends to retard their operation as a result of the insulating effect of the loading material.

If the deposit is hard, it may physically retard or prevent the sprinkler from operating. The best practice is to replace loaded sprinklers with new sprinklers rather than to attempt to clean them. Attempts at cleaning, particularly in instances where deposits are hard, are likely to damage the sprinkler, rendering it inoperative or possibly causing leakage.

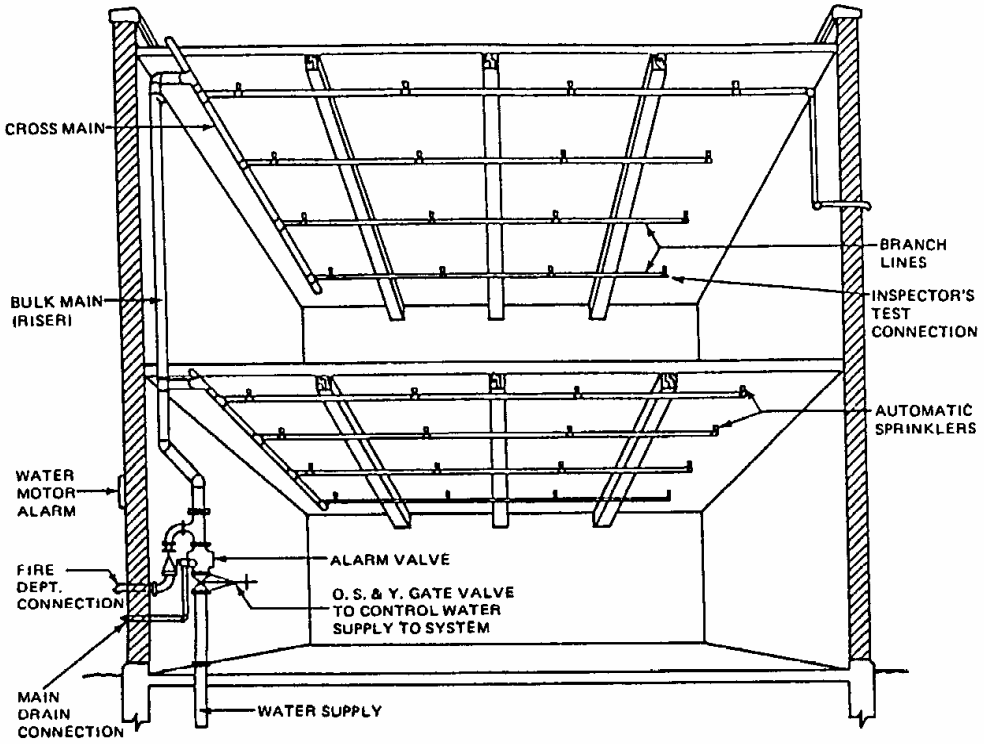
Deposits of light dust are less serious than hard deposits. Dust may delay the operation of sprinklers but ordinarily will not prevent the eventual discharge of water. Dust deposits can be blown or brushed off. If a brush is used, it should be soft to avoid possible injury to sprinkler parts. Water solution cleaning liquids of caustic or acid type are likely to be destructive to sprinklers and should not be used for cleaning. No hot solution of any kind should be used.

Sometimes sprinklers need to be protected when ceilings or sprinkler piping are being painted by temporarily placing small, lightweight paper or plastic bags over them, and securing the bags with a rubber band. Bags, however, are likely to delay the operation of the sprinklers, and should be removed immediately after the painting is completed. There is no known method whereby paint under the water cap or on the fusible link can be removed adequately. Sprinklers that have been painted other than by the manufacturer must be replaced with new units.

A supply of at least six extra sprinklers should be kept in a sprinkler cabinet so that any sprinklers that have operated or have been damaged in any way may be replaced promptly. These sprinkler heads should correspond in type and in temperature ratings as the sprinkler heads installed in the system.

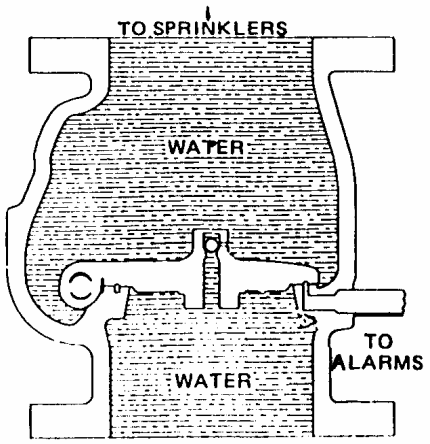
WET PIPE SPRINKLER SYSTEMS

Wet pipe systems have water in the piping at all times. This type of system is generally used wherever there is no danger of the water in the pipes freezing, and where there are no special conditions requiring a different type of system. An illustration of a typical wet pipe system is shown in the illustration below.



A Typical Wet Pipe System

A wet pipe sprinkler valve is shown in the picture below.



Typical Wet Pipe Sprinkler Valve

Where temperatures drop below freezing the ordinary wet pipe system cannot be used. There are two methods for using automatic sprinklers in places exposed to freezing temperatures. One method is the use of a system where water enters the sprinkler piping only after a control valve is opened. These are dry pipe systems, preaction systems. The other method uses an antifreeze solution in a portion of the wet pipe system.

Antifreeze Solutions: Antifreeze solution is added to the water in the piping exposed to freezing temperature. When the sprinkler heads fuse the system works in the same way as a wet pipe system. 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. Authorization must be obtained from the local fire house. 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 SUPPLIES FOR SPRINKLER SYSTEMS

The methods used to supply water to sprinkler systems are the same as those for standpipe systems. Sprinklers may be supplied from one or a combination of sources, such as public mains, gravity tanks, pressure tanks, fire pumps, reservoirs, rivers, lakes, or wells. A single water supply would appear to be all that is necessary for satisfactory sprinkler protection. This assumes that there is enough water at an acceptable pressure. However, a single supply may be temporarily out of service for maintenance or repair during a fire emergency. It may be disabled during the fire or before the fire is fully extinguished. The water supply may fall below pressure or volume during an emergency. An adequate secondary or additional water supply may therefore be advisable or necessary.

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.

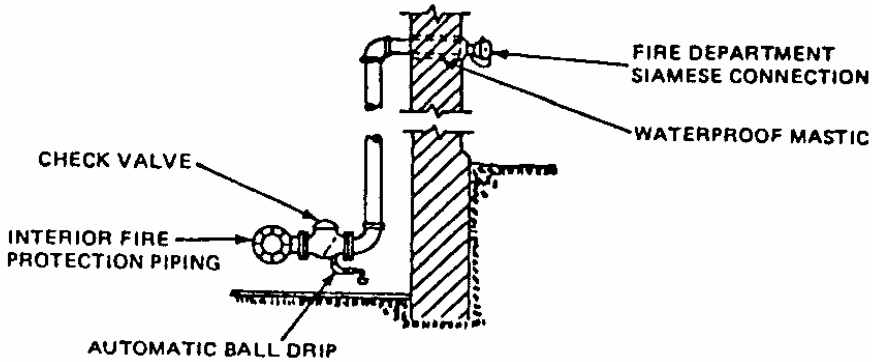
When a sprinkler system is supplied from a public water main, the entire system may be closed down by closing a control valve. This valve is located between the building and the water main in a box which is recessed in the sidewalk. The location of the box is found by reading a sign on the building or post nearby reading **"Shutoff for Sprinkler System Located 6 Feet From This Sign,"** or similar instructions. A special key may be required to operate this valve.

The control valve for the building may also be attached to an upright post, known as a post indicator valve (PIV). The building or section of the building controlled by the valve is generally indicated on the post. The position of this valve (open or closed) is shown through a telltale opening in the post. On some posts, a padlock must first be opened or forced to release the operating wrench. On others, an iron strap must first be released by cutting a riveted leather section.

The water main supply for sprinklers may also be controlled by an OS&Y valve (Outside Screw and Yoke 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. Additional valves of this type may be used to control the supply for individual floors in a building. Separate valves may be installed to shut off certain sections of a floor. Being able to shut off parts of a building allows the Fire Department to have greater control over the sprinkler system. When the fire is under control in an area, the OS&Y valve can be closed to prevent any further water damage. When maintenance or repairs must be made to the sprinkler system the OS&Y valve are used to close the water supply to only those section being repaired or maintained without having to shut the entire system down.

Siamese Connections For Fire Department Use: Normally a sprinkler system is connected to an automatic water supply source. Auxiliary sources of water are supplied through Fire Department siamese connections at the building. Siamese connections are a standard part of all sprinkler systems. When responding to an alarm the Fire Department supplies water to the standpipe system first, if one is present. 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 connections to sprinkler and standpipe systems are properly identified since these connections look the same. The exact purpose of each should be indicated nearby or on the siamese 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 system must be painted red.

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



Fire Department Connection

The automatic ball drip device between the check valve and the outside hose coupling prevents water from building up in the piping. This drip device makes sure that Fire Department connection is not blocked by water which has frozen in the piping. If water freezes in the piping, the Fire Department will not be able to pump water into the system.

Connections to Public Water Works System: A connection from a reliable public water works system of adequate capacity and water pressure is the preferred primary supply for automatic sprinkler systems.

Fire Pumps: A fire pump having 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 body of water that the pump can draw water from. Fire pumps are commonly used because they can pump water, under pressure, into the sprinkler system over a long period of time.

Manually started pumps may be used as a secondary supply source if the primary water supply will last long enough to allow the fire pump to be started. This kind of system must give an automatic waterflow signal so the Certificate of Fitness knows when the pump must be started.

Automatic fire pumps are usually needed where a high water demand may occur immediately, as with a deluge system. The automatic fire pump is also used when someone is not present to activate the manual pump. Automatic fire pumps must have their suction under a positive head to avoid the delays of drawing water from a supply source.

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 protection. The tank is normally kept two-thirds full of water and one-third full of air. The air pressure inside the tank must be maintained above 75 psi. Air for pressure tanks is supplied by compressors. Because the water is always under pressure it can be forcefully distributed throughout the sprinkler system. An important limitation is the small volume 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. Pressure tanks are often used in situations where an adequate amount of water can be supplied by a public or private source but the water pressure is not adequate. The pressure tank gives a good starting pressure for the first sprinklers that open. The flow from the tank may be used while the automatic fire pumps begin to increase the water supply pressure. Pressure tanks are often used in tall buildings that need extra water pressure to supply the highest sprinklers until the Fire Department starts pumping water into the sprinkler system.

WATERFLOW ALARMS AND SPRINKLER SYSTEM SUPERVISON

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 waterflow is signaled by these devices.

Functions of Alarms and Supervisory Signals: A sprinkler system with a waterflow alarm serves two functions: (1) It is an effective fire extinguishing system, and (2) it is an automatic fire alarm. An alarm is sounded as soon as a sprinkler head has opened. This is important because it allows the occupants to leave the building. It also signals that the Fire Department must be summoned.

Supervisory devices are often connected to a central station company which monitors the sprinkler system for problems with equipment and when sprinkler heads are opened. In order to reduce the number of unwarranted alarms it is important that the central monitoring station is notified when any of the control valves are closed for maintenance or repair of the sprinkler system.

Waterflow alarms and fire alarms give warning of the actual occurrence of a fire or other conditions such as broken pipes. Alarms alert occupants and summon the Fire Department. Any signal, whether waterflow or supervisory, may be used to give an audible local sprinkler alarm. It may also send a signal to a central station company. The central station company will then contact the Fire Department.

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 (1) water supply control valves; (2) low water level in water supply tanks; (3) low temperature in water supply tanks or ground level reservoirs; (4) high or low water level in pressure tanks; (5) high or low air pressure in pressure tanks; (6) high or low air pressure in dry pipe sprinkler systems; (7) failure of electric power supply to fire pumps; (8) automatic operation of electric fire pumps, and (9) fire detection devices used in conjunction with deluge and/or preaction and recycling systems.

Waterflow Alarm Valves: The basic design of most waterflow alarm valves is that of a check valve which lifts from its seat when water flows into a sprinkler system. These alarm attachments are designed to initiate an alarm by a drop in water pressure in the sprinkler system. The alarm signals the occupants of the building that the sprinkler system has been activated.

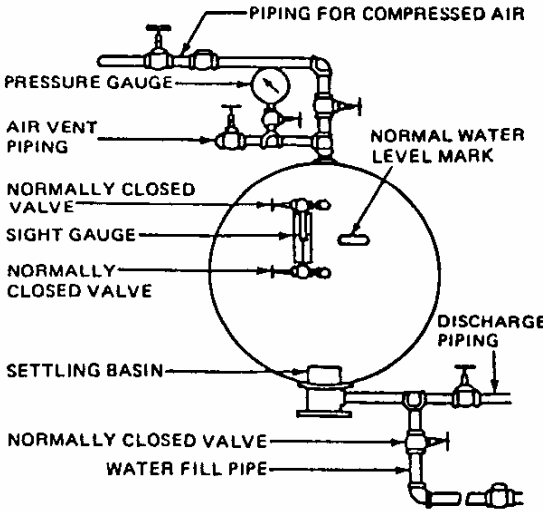
Alarm Retarding Devices: An alarm check valve that is exposed to changing water supply pressure needs an alarm-retarding device. This is required to prevent unwarranted alarms when the check valve clapper is lifted from its seat by a temporary pressure surge.

Gate Valves: Gate valves of the non-indicating type are provided in water distribution systems to allow for segments of the sprinkler system to be shut off for repairs or maintenance without reducing protection over a wide area. Such valves are normally a non-rising stem type, which requires a special key wrench to operate. A valve box is located over the valve to keep dirt from the valve and to provide a convenient access point for the valve wrench to the valve nut. A complete record should be made for each valve in the system, including date of installation, make, direction of opening, number of turns to open, any maintenance performed.

PRESSURE TANKS

Pressure tanks are closed water tanks of limited size. Air pressure in which the tank permits the forceful discharge of water from the tank into a sprinkler system. A pressure tank may be used as a primary or secondary water supply for a sprinkler system. A pressure tank is usually housed in an enclosed structure that is heated. The temperature is maintained at 40º Fahrenheit or above. The heated structure may be located anywhere in the building or even outside the building.

Pressure tanks are usually kept approximately two-thirds full of water and one-third full of pressurized air. The minimum acceptable air pressure inside the tank is 75 psi (pounds per square inch). The air pressure in the tank is automatically maintained by an air compressor. The maximum capacity of pressure tanks is typically 9,000 gallons. If more than 9,000 gallons of water are needed to supply the sprinkler system, several pressure tanks are used in combination to supply the system. A standard pressure tank is shown in the diagram below:



Standard Pressure Tank with Air Compressor.

Pressure Tank Alarms

All pressure tanks used to provide the required primary water supply of a sprinkler system should be equipped with a high and low air pressure, and a high and low water level electrical alarm system. This alarm system automatically controls the air-to-water ratio which should always be 1 to 2. However, when the water level or the air pressure falls below acceptable levels, an alarm signals to the Certificate of Fitness holder that there is a problem with the pressure tank. When this happens the pressure tank.

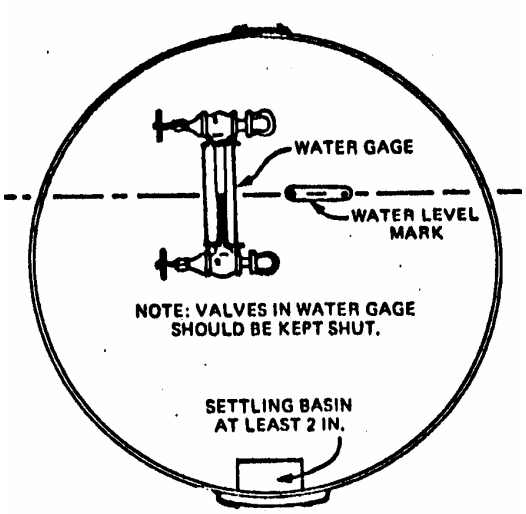
Supervision of the Pressure Tank.

The pressure tank may also be supervised by a central station company which monitors the entire sprinkler system. Supervisory devices are installed in the pressure tank, which alert the central station company when there is a problem with the tank's water level, air pressure, water temperature, or when water has been discharged from the tank. When sprinkler heads have fused and water has been discharged from the tank the local fire house is notified.

The central station company notifies the Certificate of Fitness holder when a problem is caused by equipment failure. Repairs and adjustments should be made quickly to return the pressure tank to good working order.

Inspection and Maintenance of Pressure Tanks

The water level and air pressure in pressure tanks should be inspected monthly to make sure that they offer an adequate water supply to the sprinkler system. The Certificate of Fitness holder can do this monthly inspection by visually inspecting the water gage valve. The water gage valve must be opened to examine the water level as shown in the diagram below.



When the valve is opened the water will flow into the gage allowing the Certificate of Fitness holder to compare the water level in the tank to the desired water level mark. Adjustments to the water level should be made as needed. After visually inspecting the water gage valve, the valve should be closed. By keeping these valves closed, the water and air in the tank are isolated from the sight glass. If the gage glass breaks the volume of water and the air pressure are not affected.

The inside of pressure tanks should be inspected carefully every three years to determine if there is corrosion and if repainting or repairs are needed. When necessary, the inside of the tank should be thoroughly scraped, wire brushed and repainted. As with the gravity tank, care should be taken to make sure that no foreign materials fall into the sprinkler system.

The temperature inside the structure housing the pressure tank should be checked daily during cold weather to make sure that the temperature is at least 40º Fahrenheit at all times.