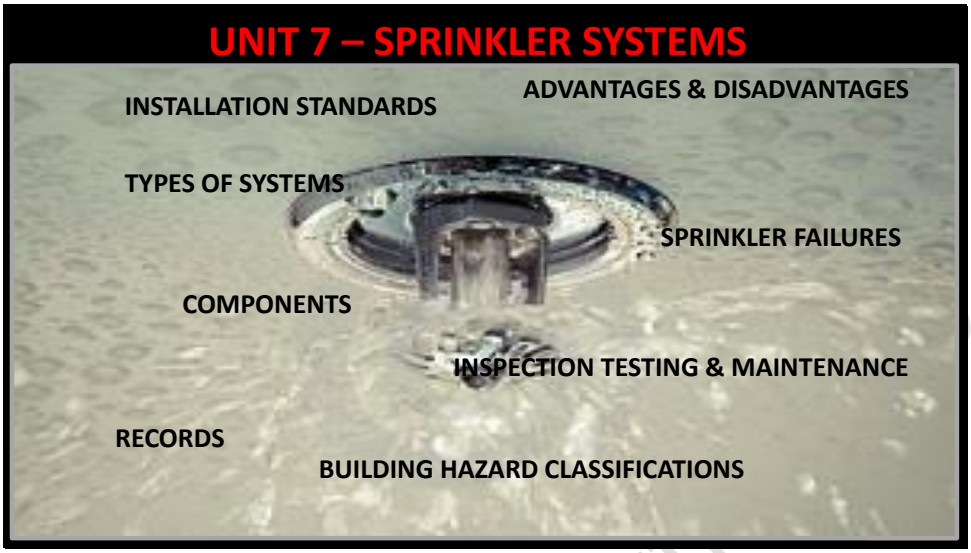


Welcome to Unit 7, Fire Sprinkler Systems

Automatic fire sprinkler systems have been in use since the eighteen hundreds. Until the 1940's, sprinklers were installed almost exclusively for the protection of commercial buildings, whose owners were generally able to recoup their expenses through savings on insurance costs. Over the years, building and fire codes have mandated the installation, testing and maintenance of automatic fire sprinkler systems in buildings based on their size and use.

In this unit we will discuss:
•Standards for the installation of sprinkler systems
•Sprinkler system designs based on hazard classification of buildings
•The types of sprinkler systems commonly installed for building and or occupant protection
•Advantages and disadvantages of the different types of systems
•Common causes of sprinkler system failure
•Sprinkler system components
•Inspection, testing and maintenance requirements for sprinkler systems
•And the importance of record keeping

Most sprinkler systems installed today are designed and installed in conformance with NFPA Standards. NFPA has 3 standards that govern the type of system that is installed. These are NFPA 13, NFPA 13R (residential) and NFPA 13D (dwelling).

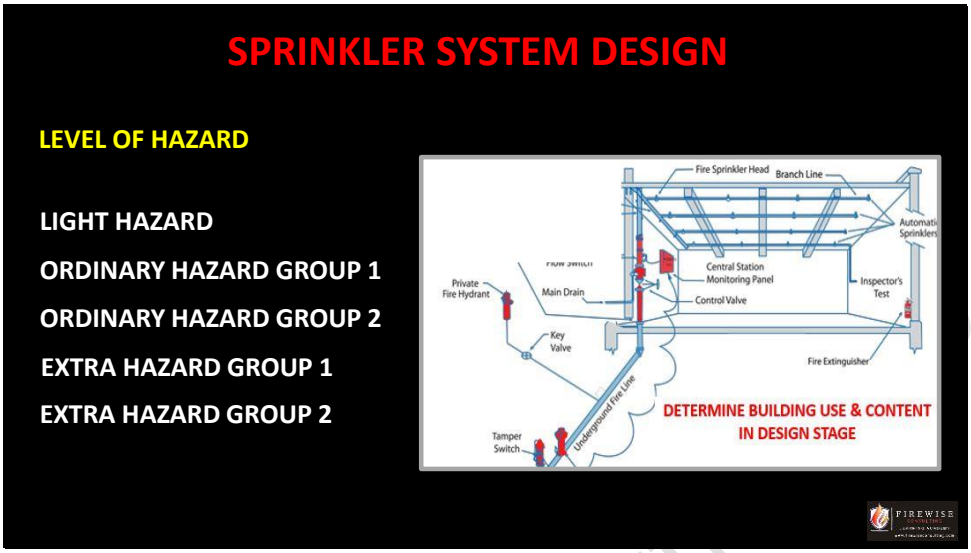
NFPA 13 is the Standard for the Installation of Sprinkler Systems. NFPA 13 protected buildings are considered 'fully sprinklered' to provide both life safety and protection for the facility. This means there's fire protection throughout the entire building, including unoccupied spaces such as attics, closets, etc.

Comparatively, NFPA 13R facilities are 'partially sprinklered' to provide life safety and a moderate level of building protection. In other words, NFPA 13R requirements provide for a level of protection that allows occupants to escape a building in the event of a fire. Conversely, NFPA 13 provides protection to not only get people out but also to control or extinguish the fire – saving the building and its contents.

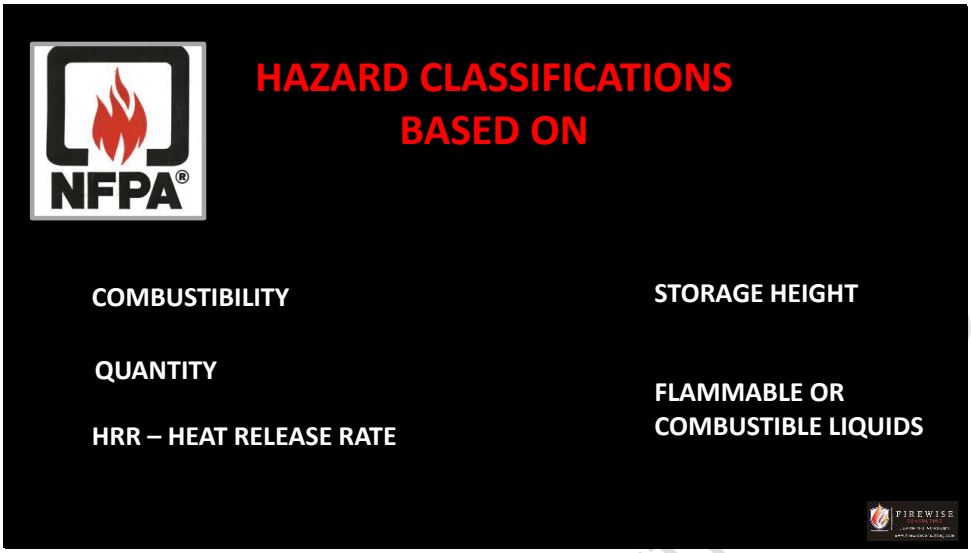
NFPA 13D is a residential sprinkler designed for one and two family dwellings and manufactured homes. The intent is to provide an affordable sprinkler system in homes while maintaining a high level of life safety. The installer of the system must provide the owner with instructions on the inspection, testing and maintenance of the system but this is usually very simple and can be completed by the home owner.

Sprinklers save lives and reduce property loss because they are available and ready for immediate operation when the need arises. They are effective in situations where high hazard operations take place, sleeping accommodation is provided, nursing homes, dormitories, and hospitals where occupants may have trouble evacuating the building.

Sprinklers do not replace firefighters they simply react quickly in the event of a fire to control the development and spread of the fire, smoke and hot gasses until firefighters arrive to complete extinguishment.

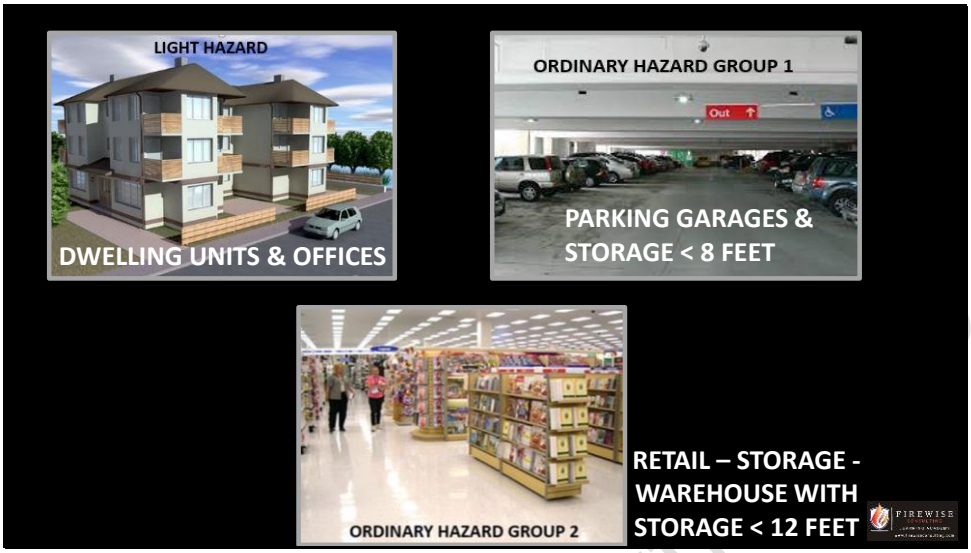


When designing a sprinkler system the building use and contents are analyzed to determine the level of fire hazard. Usually buildings are classified as Light Hazard, Ordinary Hazard Group 1, Ordinary Hazard Group 2, Extra Hazard Group 1, or Extra Hazard Group 2.



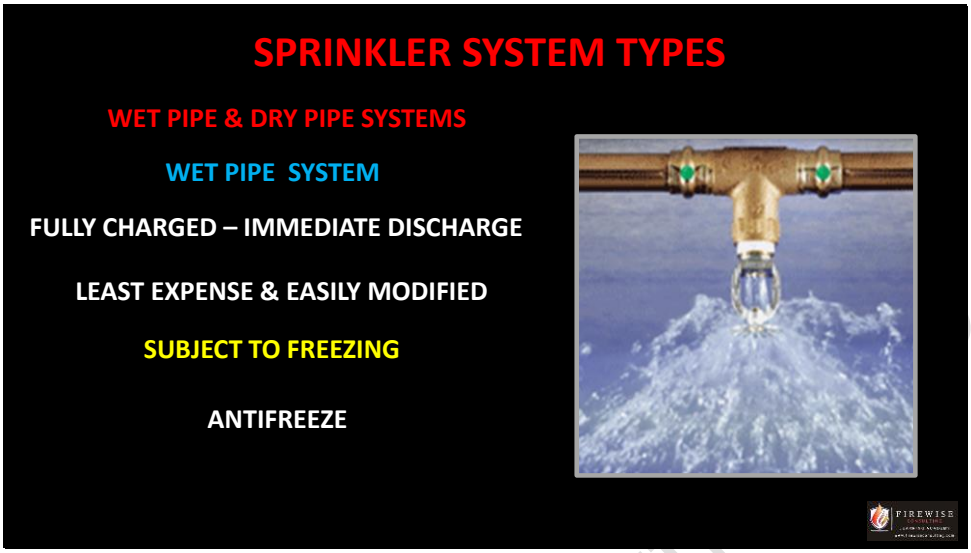
The NFPA defines each of the hazard classifications based upon a number of occupancy characteristics such as:

- The combustibility of contents.
- The quantity of combustibles.
- Rate of heat release from a potential fire
- The storage height of combustibles stored in the building
- The quantity of flammable and/or combustible liquids stored in the building



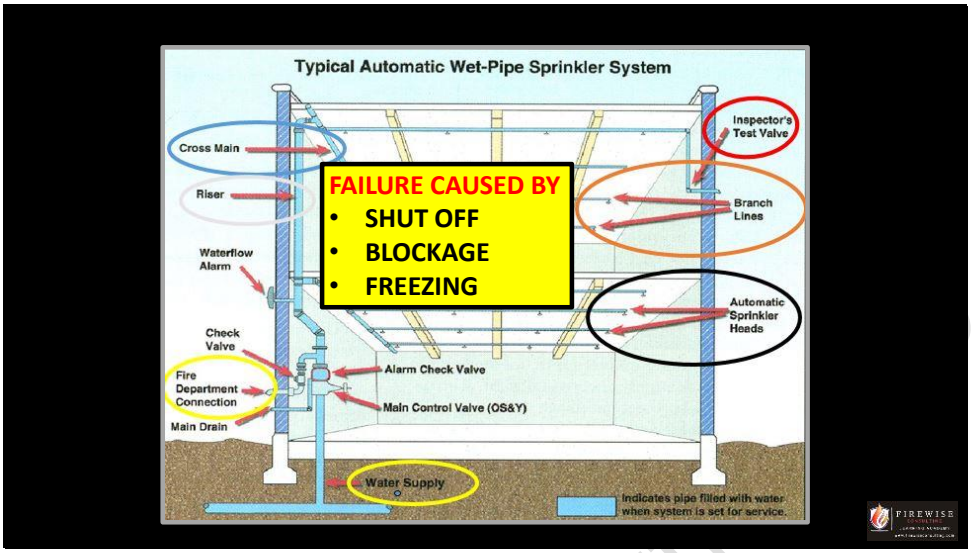
Light hazard occupancies would include things like dwelling units and offices
Ordinary hazard group one would include parking garages, mechanical rooms and storage rooms with storage height of 8 feet or less
Ordinary hazard group two includes retail stores, storage rooms and warehouses with storage heights of 12 feet or less

Extra Hazard Group one includes saw mills, plywood/particle board manufacturing and furniture upholstering using foam plastics where there are small quantities of flammable or combustible liquids.
Extra hazard Group two includes flammable liquid spraying operations and manufacturing plants where large quantities of flammable or combustible liquids are stored.

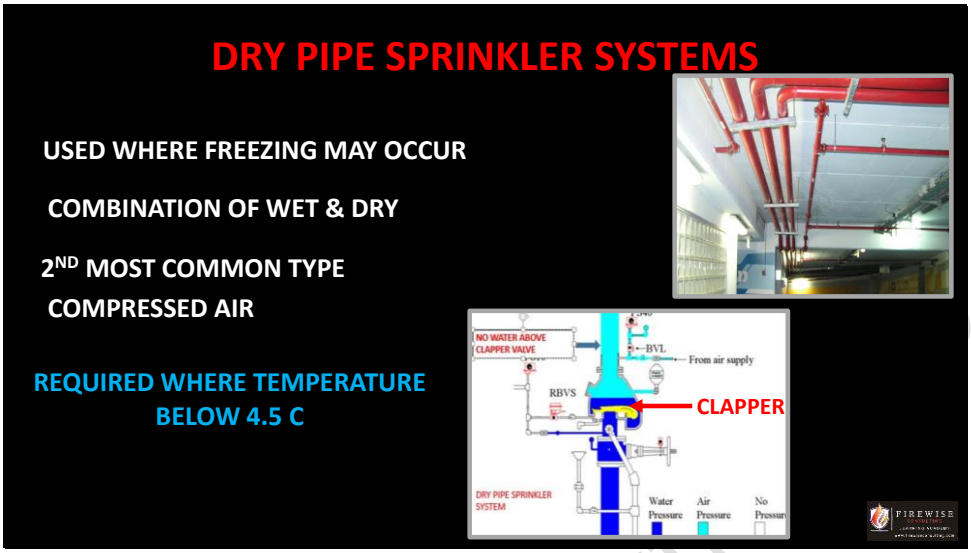


There are a few different types of sprinkler systems but the most common are the wet pipe system and the dry pipe system. Wet pipe is by far the most common and also the most reliable, because they are simple, with only a few operating components. They are fully charged with water at all times so when a sprinkler head releases water is immediately discharged. Wet pipe systems are the least expensive to install and can usually be easily modified to accommodate building alterations or renovations. The downfall is they are subject to freezing.

Some sprinkler systems add antifreeze to prevent freezing. The antifreeze agent must be tested annually and new installations can only use a product that is approved and listed for use in that sprinkler system.

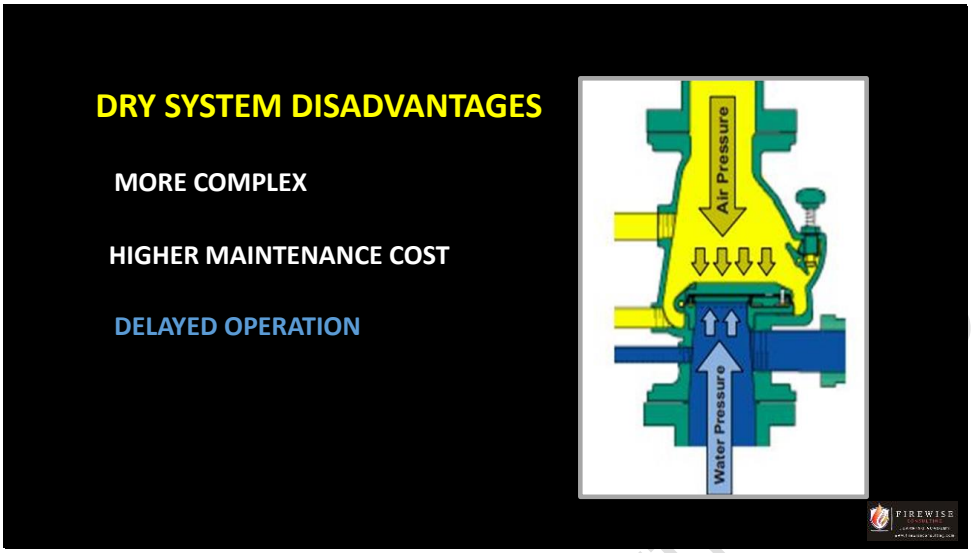


This drawing shows the components of a typical wet pipe sprinkler system. Although they seem complex they are fairly simple and very reliable. Seldom is there an accidental discharge of water and most failures occur because of valves being turned off, a blockage in the distribution lines or freezing.

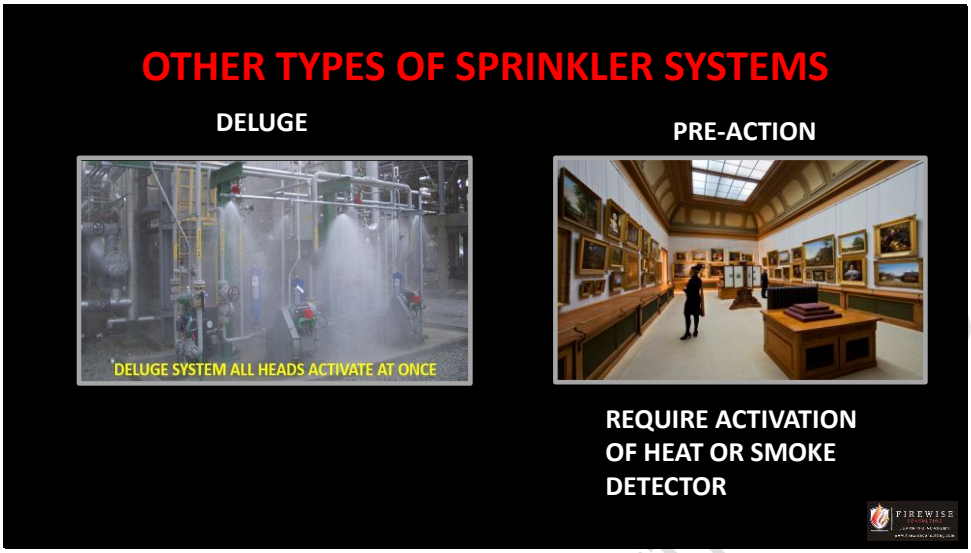


Dry pipe systems on the other hand are installed where water may freeze. Dry pipe systems are most often used in unheated areas of buildings, in parking garages and outside canopies attached to buildings. Dry pipe systems are the second most common sprinkler system type. Most codes require the installation of dry systems unless the ambient temperatures remains above 40 degrees F or 4.5 degrees C. Some installations utilize a combination of wet and dry systems.

Dry pipe systems are pressurized with compressed air at a higher pressure on one side of a check valve than the water pressure on the other side. The check valve or clapper valve prevents water from flowing past that point until the air pressure is released allowing the valve to open. Water is not present in the dry pipe portion of the system until a sprinkler head opens releasing the air pressure and allowing the water to flow.



The disadvantages of the dry systems are that they are more complex than wet systems and require more components which increases the potential for failure and the need for maintenance. The higher complexity also increases the installation and maintenance cost of the system. In addition, because the piping is empty at the time the sprinkler operates, there is a time delay of up to 60 seconds in getting the water on the fire.



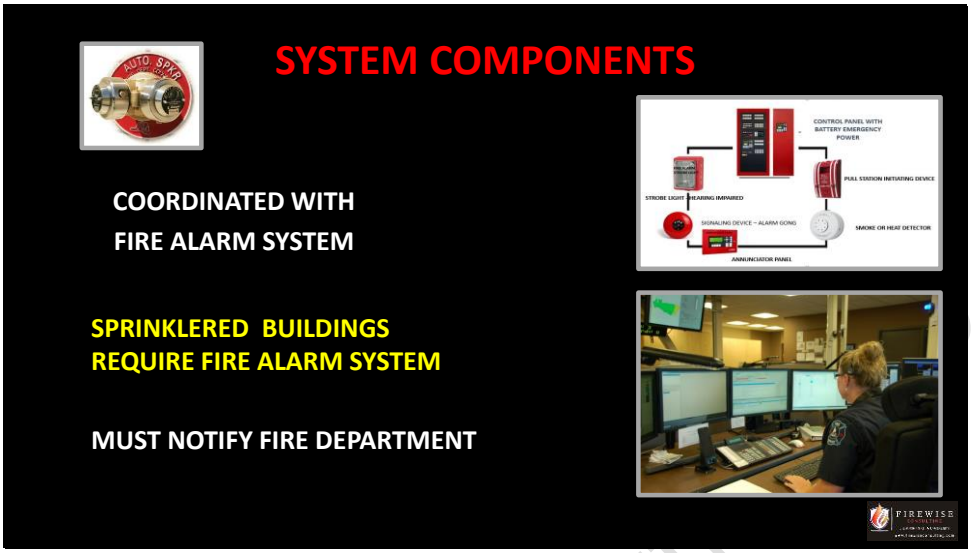
There are other types of sprinkler systems available to meet specific needs. These include Deluge, Pre-Action, Foam and water mist systems.

In Deluge systems all sprinklers connected to the water piping system are open, in that the heat sensing operating element is removed, or specifically designed as such. These systems are used where rapid fire spread is a concern. All the sprinkler heads are open so they provide a simultaneous application of water over the entire area being protected. They are installed to slow travel of fire (e.g., openings in a fire-rated wall). Water is not present in the piping until the system operates.

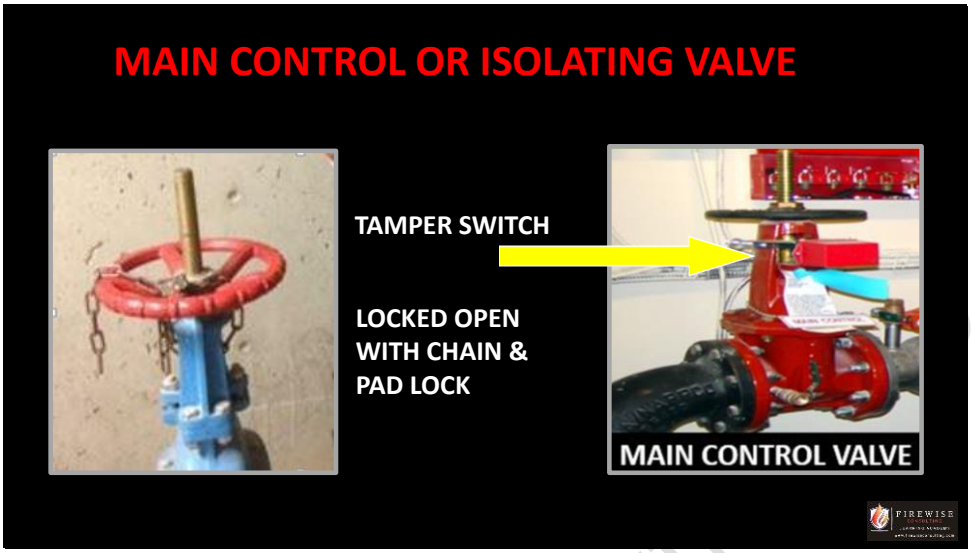
Pre-action sprinkler systems are specialized for use in locations where accidental activation is undesired, such as in art galleries, museums and data centers for protection of computer equipment from accidental water discharge. Pre-action systems are similar to dry systems except these systems require a “preceding” fire detection event, typically the activation of a heat or smoke detector prior to the release of water.

A foam water fire sprinkler system is a special application system, discharging a mixture of water and foam concentrate, resulting in a foam spray from the sprinkler. These systems are usually used with special hazards occupancies associated with high challenge fires, such as airport hangers.

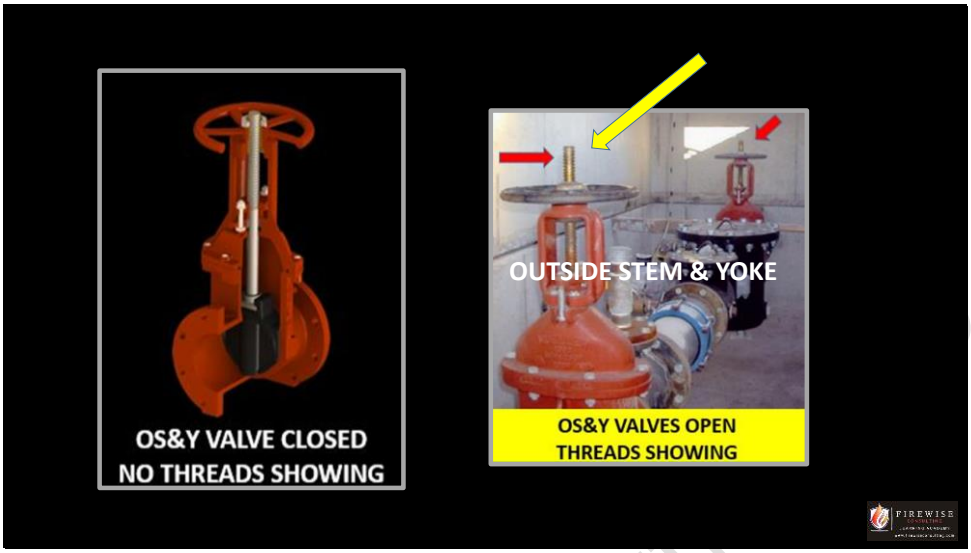
Water mist systems are used for special applications to absorb heat. This type of system is typically used where water damage may be a concern, or where water supplies are limited.



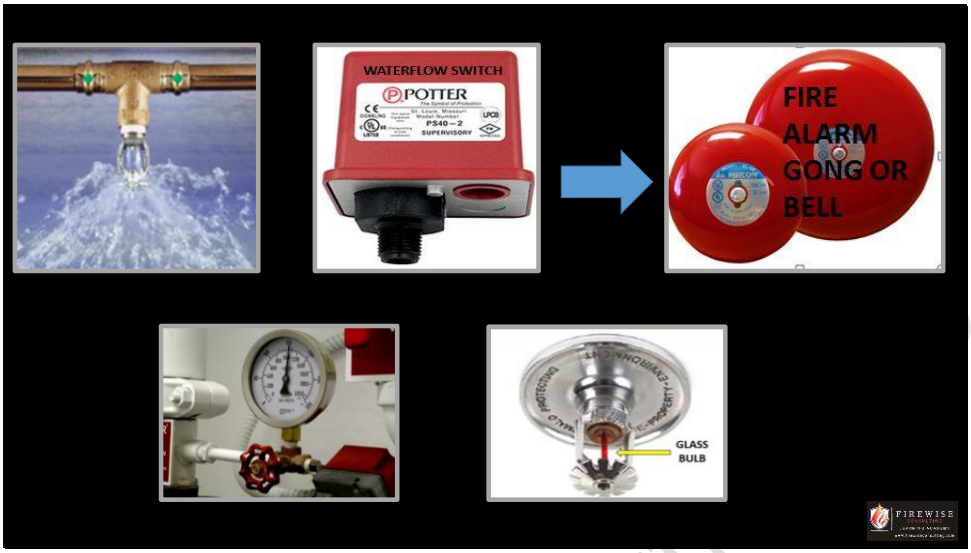
Sprinkler systems can be very simple with few control devices or very complex with many different management systems. For the purposes of this course we will only present basic information but it is important to realize that sprinkler systems are complimentary to, and coordinated with, the fire alarm system. Buildings equipped with an NFPA 13 or 13 R sprinkler system are required to have a fire alarm system. When water flows through the sprinkler system or the control valves are tampered with the fire alarm system will activate. A fire alarm system that includes water-flow indicating devices must be designed to notify the fire department that the sprinkler has been activated.



The Main Control Valve is used to isolate the water supply and is sometimes called the isolating valve. It is often painted red in color with a large circular handle which is used to stop the flow of water into the fire sprinkler system. The main control valve must be locked in the OPEN position with a pad lock and chain or be fitted with a Valve Monitor or Tamper Switch that sends a signal to the fire alarm system if the valve is moved.



There are other valves used throughout the system to control different functions. The most common type of valve is the OS&Y Valve. OS&Y stands for outside stem and yoke. It is easy to tell if these valves are in the open position as the threads on the valve will be exposed. No threads will be visible if the valve is closed.



A waterflow switch is the interface between the sprinkler system and fire alarm system. It detects water flowing in the sprinkler system and causes the fire alarm to sound the evacuation. It only detects the water flowing in the pipes. It does not turn water on or off. It sets off the alarms by activating electrical switches.

Pressure gages are also common to sprinkler systems. In dry pipe systems, pressure gauges are used to monitor water pressures in the system and in the water supply as well as the air pressure in the system. There are often multiple pressure gages in a sprinkler system.

The Sprinkler Head itself is also used to control the flow of water. It is essentially a valve that when exposed to sufficient heat the glass bulb or fusible link breaks allowing water to flow from only the affected sprinkler. The water flow will lead to a drop in pressure within the fire sprinkler system and the fire alarm will sound. The color of the liquid inside the glass bulb indicates the operating temperature of the sprinkler head.

Each sprinkler operates individually meaning that the fusible link or glass bulb in each head must release before water will flow from that head.

There are a number of different types of sprinkler heads that meet different needs.

Pendant sprinkler heads hang down from the ceiling and spray water in a circle pattern. There are also concealed pendant sprinkler heads that are recessed in the ceiling and are covered with a decorative cap. The cap is designed to fall away upon activation of the sprinkler.

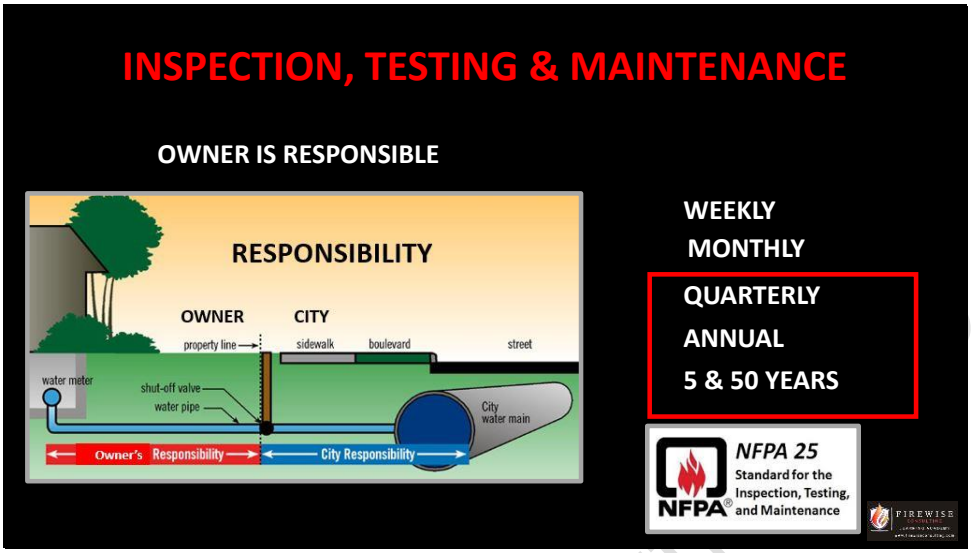
Upright sprinkler heads project up into a space. They are generally used in inaccessible areas to provide better coverage between obstructions. They also provide a circle spray pattern.

Side wall sprinkler heads stand out from a wall. They provide a half-circle spray pattern. A second deflector also sprays water back toward the wall so that the wall is protected. These are used when sprinklers cannot be located in the ceiling.

Many sprinkler heads are recessed and are concealed by a decorative cover that releases with activation of the sprinkler head. It is very important that these covers and the heads themselves are never painted over.

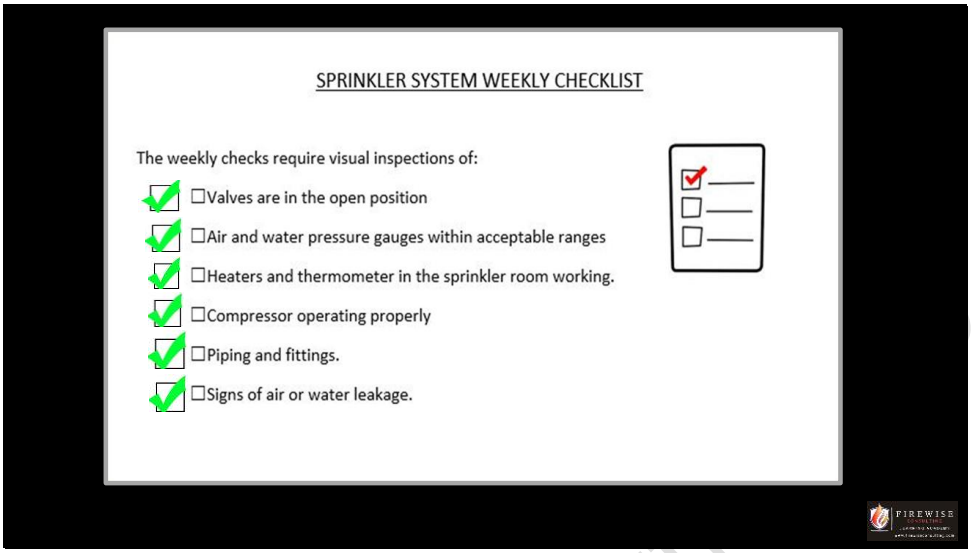
When sprinkler heads are exposed to damage they should have protection installed.

A minimum of 6 spare sprinkler heads must be available at the facility. In fact 6 spare heads should be available for each type of head used in the system. The differences in type would be the orientation of the head (pendant vs. upright vs sidewall), standard response vs. quick response, and recessed or surface mounted sprinkler heads.



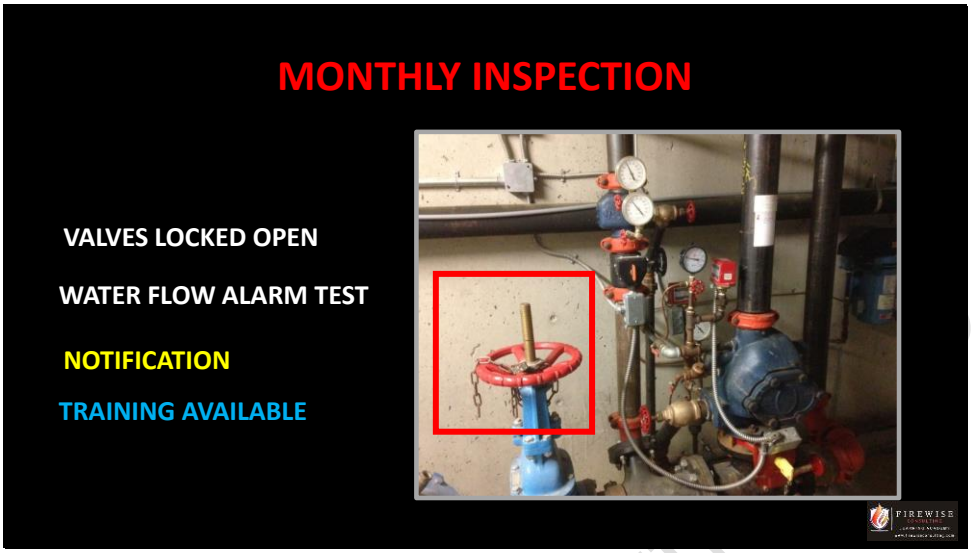
The owner is responsible for carrying out the inspection, maintenance and testing procedures of the sprinkler system. They can, through agreement, shift the responsibility to a third party such as a qualified sprinkler company to take care of their fire sprinkler inspection, testing and maintenance program.

NFPA 25, which is entitled "Inspection, Testing and Maintenance of Water-Based Fire Protection Systems" is widely recognized as the standard of care for sprinkler systems but the applicable fire code may have additional or differing requirements. These documents provide schedules for weekly, monthly, quarterly, annual, five year and 50 year inspection and maintenance requirements. The weekly and monthly test can be carried out by the owner but the quarterly, annual, 5 year and 50 year inspections must be performed by a qualified person.



Working with the sprinkler contractor the owner can establish a schedule and division of responsibilities that ensures compliance with the applicable codes and good engineering practice.

Checklists are a great way to ensure the proper inspections have been carried out.
The weekly check usually requires visual inspections of:
Valves to ensure they are in the open position
Air and water pressure gauges: Are they within acceptable ranges?
Heaters and a thermometer are located in the sprinkler room. The room must be at least 4 degrees Celsius and the heater must be operational if outside temperatures are 5 degrees Celsius or below
If there is a dry pipe system the compressor should be checked. If it stops and starts repeatedly it is considered to be running “continuously,” and the sprinkler contractor needs to assess the situation.
The piping and fittings should be checked for signs of air or water leakage.



During the monthly inspection:
All valves controlling the sprinkler system water supply that are not electronically monitored, must be inspected to ensure that they are locked in the open position. A water-flow alarm test is performed using the alarm test valve. An alarm should sound within 10 - 20 seconds of opening the valve. Prior notification of such tests must be given to all parties who could be affected by the alarm.

Many sprinkler companies provide training so the weekly and monthly inspections can be carried out by onsite personnel.

The annual inspection and testing of the sprinkler system must be conducted by qualified personnel acceptable to the authority having jurisdiction.

Sprinklers are inspected for damage, corrosion or accumulations of grease, paint, or other deposits and are replaced where such conditions would impair the operation of the sprinkler system.
At least one main drain test is conducted to ensure that the water supply available to the sprinkler system has not deteriorated.
Where an electric fire pump is installed the pump shall be tested at full rated capacity.

Every five years it is recommended that the backflow preventers be serviced by a qualified person.

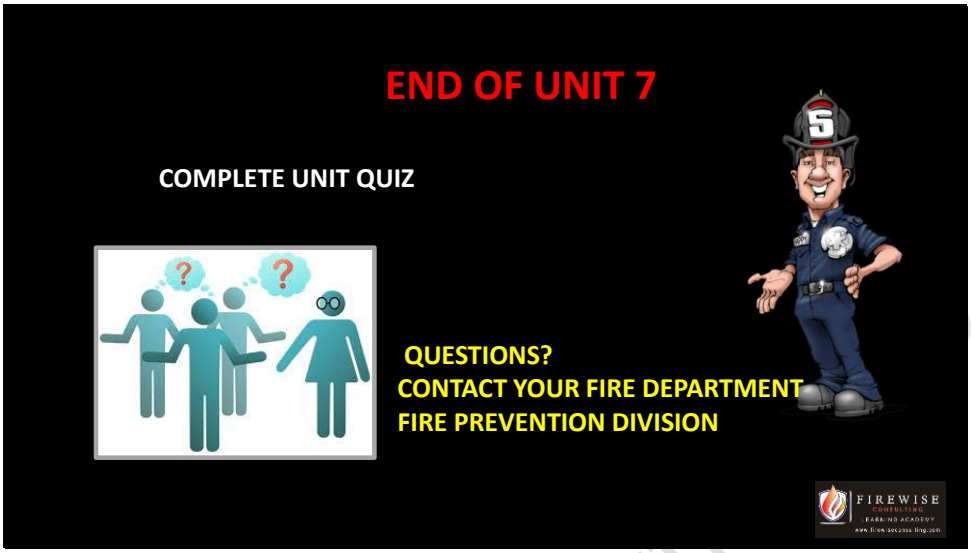
Ever fifty years sample sprinkler heads must be sent to a recognized testing laboratory for testing and this procedure must be repeated every ten years thereafter.

Records must be kept of all inspections, tests and maintenance of the sprinkler system and made available to the authority having jurisdiction upon request. The record must show what was done, who did it and what the outcome was. Records should be kept for a period of at least 2 years.

Manufacturer literature about the inspection, testing and maintenance requirements of the sprinkler system must be available and kept in the sprinkler control room or with the Fire Safety Plan.

In this unit we discussed:

- NFPA 13, NFPA 13R Residential and NFPA 13D Dwelling standards for the installation of sprinkler systems
- Sprinkler systems are designed based on light, ordinary or extra hazard classification of buildings
- Sprinklers are not designed to replace firefighters but rather to slow the spread of fire and to aid evacuation and building preservation
- That Wet and Dry sprinkler systems are the most common systems installed in buildings
- Advantages and disadvantages of wet pipe and dry pipe systems
- the most common causes of sprinkler system failure are due to freezing, blockages and valves turned off
- Sprinkler system components including OS&Y valves, tamper and water switches, pressure gauges for water and air, back flow preventers, and various types of sprinkler heads
- Inspection, testing and maintenance requirements for sprinkler systems
- And the importance of record keeping



Congratulations that is the end of Unit 7 which dealt with sprinkler systems. You are now ready to move on to Unit 8 which deals with stand pipes and hoses but first please complete the Unit Quiz. If you have any questions now is a good time to contact the local fire department fire prevention division.