# RiskIntel™ Sprinkler Systems

echelon® Insurance

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Sprinkler systems are among the most – if not the most – widely utilized and reliable sources of fire protection available.

A sprinkler system is an integrated system of underground and overhead piping connected to an automatic water supply that is designed to distribute water in sufficient quantities to control or suppress a fire in its early stages. Sprinklers were originally designed to control the spread of fire from its point of origin, allowing responding fire departments to complete the final extinguishment. However, advances in sprinkler system technology have resulted in some systems being specifically designed to suppress a fire in its entirety.

Sprinkler systems underwent significant development between 1870 and 1890, and were standardized in the first edition **of NFPA 13 – Standard for the Installation of Sprinkler Systems (NFPA 13)** in 1896. This standard outlines the minimum requirements for the design, installation, and assessment of sprinkler systems. Since its inception, this standard has evolved significantly in its scope and addresses a multitude of new technologies. It should be emphasized that the intent of **NFPA 13** is not to identify what buildings or occupancies require sprinkler protection, but rather to outline the requirements necessary to provide an acceptable level of protection where sprinkler systems are installed. The determination for when a building or occupancy requires sprinkler protection ultimately lies with national, provincial, and municipal Building and Fire Codes.

The purpose of this guide is to provide a broad overview of how sprinkler systems function and the fundamental elements associated with these systems that play a vital role in their overall performance and reliability.



# Benefits of Sprinkler Protection

## Property preservation

When a fire occurs, damage to the building and its contents can be expected to varying degrees. The primary focus of sprinkler systems in the early stages of their development was to provide property protection, which was largely driven by insurance companies. It's worth noting that one of the major economic benefits of installing a sprinkler system is that the cost of the system can be amortized over the life of the building (or operation) through potential reductions in insurance premiums (referenced in Automatic Sprinkler and Standpipe Systems and NFPA Fire Protection Handbook)[1].

This is clearly illustrated in a recently published study[2] by the National Fire Protection Association (NFPA). Between 2015 and 2019, structure fires resulted in approximately $10.6B worth of property damage per year on average. Nearly $9.4B (88%) of this was accounted for by structures not equipped with sprinkler protection, in comparison to $1.09B (10%) by structures provided with sprinkler protection. The remaining amount was accounted for by structures equipped with partial sprinkler protection.

While reductions in property loss in buildings equipped with sprinkler protection can be illustrated through tangible financial data, a less obvious benefit of sprinkler protection is a reduced business interruption exposure. By limiting damage to a building and its contents from fire, business operations are permitted to resume more quickly, which in turn has a positive impact on the short and long-term viability of the business.

## Life safety

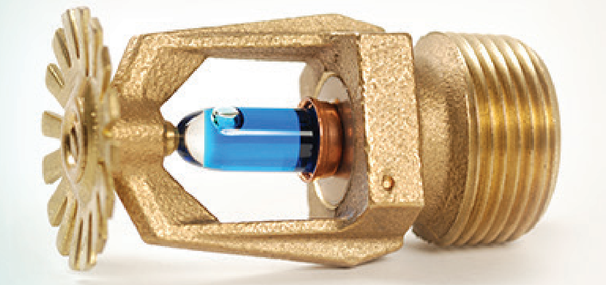
While reductions in property loss were initially apparent through the installation of sprinkler systems, it became evident that these systems also improved the overall life safety features of buildings. Not only do sprinkler systems suppress or control a fire, they also warn building occupants that a fire condition exists. In turn, this should allow occupants to exit the building more safely and quickly relative to a building not equipped with sprinkler protection.

The life safety benefits of sprinkler systems are also clearly illustrated in the previously-referenced study[2] by the NFPA. Between 2015 and 2019, structure fires resulted in approximately 12,848 civilian injuries and 2,862 civilian deaths per year on average. Of these injuries, 11,609 (90%) were accounted for in structures not equipped with sprinkler protection, in comparison to 1,130 (9%) in structures equipped with sprinkler protection. Of the deaths, 2,816 (98%) were accounted for in structures not equipped with sprinkler protection, in comparison to 37 (1%) in structures equipped with sprinkler protection.

By improving the safety and well-being of building occupants through the installation of sprinkler systems, the potential financial loss associated with bodily injury and/or death is also reduced. Lawsuits stemming from bodily injury and/or death to occupants involved in fire can be significant from a financial standpoint, exceeding the financial loss associated with property damage in many instances. That being said, prioritizing the safety and well-being of building occupants is pivotal in maintaining the viability of the business.

[1] NFPA Fire Protection Handbook, 20th Edition, Volume II

[2] www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/Suppression/ossprinklers.pdf



# Sprinkler System Components

## Automatic sprinkler head

Sprinkler heads (formally referred to as 'sprinklers' by the NFPA) are heat sensitive devices that operate when the ambient temperature in the area of the sprinkler head reaches a pre-determined operating point. In normal conditions, water is restrained from discharging from a sprinkler head via a releasing mechanism – usually in the form of a metal fusible link or a liquid-filled glass bulb – that holds a cap in place over the sprinkler head's orifice. Once the fusible link melts or the liquid within the bulb expands to a breakage point after being exposed to heat, the cap is released off the orifice, allowing water to be released and distributed in distinct patterns and quantities over the fire.

## System piping

System piping can be sub-divided into three (3) categories:

1. System Riser – Connects the public or private water supply to the sprinkler system's cross mains.
2. Cross Mains – Supplies water to the sprinkler system's branch lines.
3. Branch Lines – Supplies water to the sprinkler heads.

## Indicating control (shut-off) valve

Indicating control valves control the flow of water from the municipal water supply to a sprinkler system and physically show if the valve is open or closed. They should always be locked in the 'Open' position, unless there is maintenance or an alteration being made to the sprinkler system. Examples of indicating control valves include:

1. Outside Stem and Yoke Valve – These valves have a stem that indicates the position of the valve and are operated by a circular handle (wheel). When the stem extends in totality from the handle, this indicates the valve is 'Open'. When the stem does not extend beyond the handle, this indicates the valve is 'Closed'.
2. Post Indicator Valve – These valves are located outside of a building and either extend from the ground or through an exterior wall of a building. In either configuration, the position of the valve can be viewed by the words 'Open' or 'Shut' which are viewable through a window mounted on the valve.
3. Butterfly Valve – These valves consist of a hand-cranked gear and an external flag that indicates the position of the valve. When the flag is parallel to the system's riser, it's in the 'Open' position. When the flag is perpendicular to the system's riser, it's in the 'Closed' position.

## Alarm check valve

All sprinkler systems are equipped with some form of an alarm check valve. The operating characteristics of these valves differ based on the type of sprinkler system installation (refer to Sprinkler System Types and Operating Characteristics); however, they share one common feature. When a sprinkler system activates, water will flow through a port connected to the alarm check valve and activate a water-driven mechanical bell or gong. In turn, this provides notification to building occupants and visitors that the sprinkler system has been activated.

## Inspector's test connection

The inspector's test connection simulates water flow from a single sprinkler head and serves several purposes, including:

1. Confirming the activation of the sprinkler system's water flow alarm
2. Testing the trip time from when a dry-pipe valve is opened to the time water arrives through the connection's orifice
3. Ensuring there is no blockage in the sprinkler piping
4. Aiding in the venting of trapped air within the sprinkler system

## Fire department connection

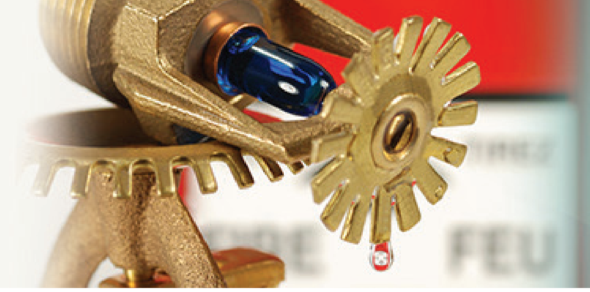
Fire departments can supplement a sprinkler system by connecting hose lines from their pumper truck to the system's fire department connection, allowing them to pump additional water into the sprinkler system. Not only does this help ensure there is adequate water volume and pressure to suppress the fire in the building, but it also acts as a backup in the instance that:

1. The domestic water supply delivers an inadequate amount of water.
2. A valve is closed between the domestic water supply and the sprinkler system, preventing water from reaching the system during a fire.
3. A change to the facility's occupancy poses a more significant fire hazard than the sprinkler system was originally designed to handle.

## Main drain

The main drain of a sprinkler system serves two purposes.

1. Permits water to be drained from the sprinkler system for maintenance-purposes.
2. Provides a method for testing the sprinkler system's water supply.



# Sprinkler System Types and Operating Characteristics

There are four basic types of sprinkler systems, including:

## 1 Wet pipe systems

Wet pipe systems are most common and reliable type of system available. Sprinkler heads in wet pipe systems are attached to piping that contains water under pressure at all times. When a fire occurs, individual sprinkler heads are activated (opened) by heat which allows water to discharge through those activated sprinkler heads. In addition to being the most reliable sprinkler system available, these systems are the easiest to design, install, and maintain. Considering these systems contain water at all times, they should not be installed in areas where temperatures are expected to fall below 4°C (40°F).

## 2 Dry pipe systems

Dry pipe systems should only be used in areas where temperatures are expected to fall below 4°C (40°F). Sprinkler heads in dry pipe systems are attached to piping that is charged with air or nitrogen under pressure. When a fire occurs, individual sprinkler heads are activated (opened) by heat causing the air pressure in the piping to drop in the system piping. Once the air pressure drops below a pre-determined level, a dry-pipe valve opens, which allows water to flow through the piping and discharge though the activated sprinkler heads. Dry pipe systems are more complex than wet pipe systems and are subject to design limitations considering water is inherently delayed from reaching sprinkler heads upon activation.

## 3 Pre-Action systems

Pre-action systems are typically installed in areas containing water-sensitive equipment or contents where any accidental discharge of water could cause significant damage. Sprinkler heads in pre-action systems are attached to piping that is filled with pressurized or non-pressurized air. These systems incorporate the use of a fire detection system and require a specific event (or events) to take place before water is released into sprinkler piping via a pre-action valve. There are three types of pre-action systems, all of which differ in terms of when water is released into the piping.

I. Single-Interlock System – Water is only permitted to flow into the system piping upon activation of the fire detection system. Individual sprinkler heads then must be activated (opened) following exposure to heat to allow water to discharge onto the fire.

II. Non-Interlock System – Water is permitted to flow into the system piping upon activation of the fire detection system or sprinkler heads. That being said, this system type is capable of bypassing the fire detection system in the event a sprinkler head is activated, allowing water to be discharged onto the fire more quickly.

III. Double-Interlock System – Water is only permitted to flow into the system piping upon activation of the detection system and sprinkler heads; therefore, the release of water into the piping and eventual discharge onto the fire is delayed in comparison to single-interlock and non-interlock systems.

## 4 Deluge systems

Deluge systems are typically installed in areas where large quantities of water would be needed in a short period of time to control a rapidly growing fire. These systems are similar to Pre-action Systems in that the system piping does not contain water and incorporates the use of a fire detection system in its operation. The key difference is that open sprinkler heads are connected to the sprinkler piping, rather than closed sprinkler heads. Upon activation of a fire detection system, a deluge valve opens, allowing water to be released into the system piping. Because open sprinkler heads are installed, water is immediately discharged out of all sprinkler heads in the protected area simultaneously. Deluge systems are commonly found in aircraft hangars and power plants.

# Sprinkler System Design

Sprinkler systems are designed based on the operations taking place within a facility, with a particular focus on the fire hazards associated with those operations. Design requirements are outlined in **NFPA 13** and generally consist of the following two approaches:

## Occupancy hazard approach

The Occupancy Hazard approach involves classifying occupancies based on fuel loads and potential fire severity, of which there are six categories, including:

- Light Hazard – Includes occupancies where the quantity and/or combustibility of contents is low and fires with relatively low rates of heat release are expected. Examples of Light Hazard occupancies include offices, apartment buildings, churches, hotels, and schools.
- Ordinary Hazard (Group 1) – Includes occupancies where combustibility is low, quantity of combustibles is moderate, stockpiles of combustibles do not exceed 8 Ft (2.4M), and fires with moderate rates of heat release are expected. Examples of Ordinary Hazard (Group 1) occupancies include parking garages, bakeries, beverage manufacturers, canneries, and laundries.
- Ordinary Hazard (Group 2) – Includes occupancies where the quantity and combustibility of contents are moderate to high, stockpiles do not exceed 12 Ft (3.7M), and fires with moderate to higher rates of heat are expected. Examples of Ordinary Hazard (Group 2) occupancies include machine shops, woodworkers, retail stores, dry cleaners, and textile manufacturers.
- Extra Hazard (Group 1) – Includes occupancies where the quantity and combustibility of contents are very high and dust, lint, or other materials are present, introducing the probability of rapidly developing fires with high rates of heat release, but with little or no combustible or flammable liquids. Examples of Extra Hazard (Group 1) occupancies include die-casting plants, metal extrusion plants, saw mills, and upholsteries utilizing plastic foam.
- Extra Hazard (Group 2) – Includes occupancies with moderate to substantial amounts of flammable or combustible liquids or occupancies where shielding of combustibles is extensive. Examples of Extra Hazard (Group 1) occupancies include operations that involve flammable liquid spraying, varnish/paint dipping, plastics processing, and open oil quenching.
- Special Occupancy – The majority of occupancies will fall under the previously-referenced categories; however, there are certain occupancies that require special design considerations. Examples of these occupancies include (but are not limited to) flammable and combustible liquid warehouses, aerosol product warehouses, solvent extraction plants, and aircraft hangars.

## Storage approach

The Storage Approach generally applies to warehouse facilities where large quantities of material are being stored. The primary elements that influence the fire hazard associated with warehouse facilities and the required sprinkler system design are commodity classification and storage arrangement.

Commodity Classification - Commodity classifications are determined by not only the product but also the packaging of that product, the container those products are packaged in, and the pallet type. Commodities are classified as follows:

| CLASSIFICATION | DESCRIPTION |
|---|---|
| Class I | Non-combustible products that meet one of the following criteria:<br>- Placed directly on wood pallets<br>- Placed in single-layer corrugated cartons<br>- Shrink wrapped or paper wrapped as a unit load with or without pallets<br><br>*Note: A non-combustible product is one that does not ignite, burn or contribute to the spread of a fire. Examples could include metal desks, empty glass jars and rolls of bare wire. |
| Class II | A non-combustible product in slatted wood crates, solid wood boxes, or multi-layered corrugated cartons, with or without pallets. |
| Class III | A product composed of wood, paper, and/or natural fibers, with or without cartons, boxes, or crates, and with or without pallets. Up to 5% of the commodity (by weight or volume) is permitted to consist of Group A or Group B Plastics. |
| Class IV | A product, with or without pallets, that meets one of the following criteria:<br>- Constructed partially or totally of Group B plastics<br>- Consists of free-flowing Group A plastic materials<br>- Contains within itself or its packaging an appreciable amount – 5% to 15% by weight or 5% to 25% by volume – of Group A plastics. |
| Group A Plastic | Plastic materials that have a significantly higher rate of heat release than ordinary combustible materials. Examples of these materials include polyethylene, polystyrene, and polyvinyl chloride. |
| Group B Plastic | Plastic materials that have a lower rate of heat release than Group A plastics and are treated as a Class IV commodity. Examples of these materials include silicone rubber, nylon, and cellulosic. |
| Group C Plastic | Plastic materials that have a lower rate of heat release than Group B plastics and are treated as a Class III commodity. Examples of these materials include melamine, polyvinyl chloride, and polyvinyl fluoride. |

Storage Arrangement – Common storage arrangements within warehouse environments include solid-piled storage, palletized storage, and rack storage. Under a solid-piled arrangements, factors that need to be considered (in addition to the previously-referenced commodity classifications) when determining an adequate sprinkler design consist of storage height, ceiling clearance, pile stability, and array. Rack storage arrangements present a greater challenge when it comes to controlling a fire given the greater inherent airflow in and around products in storage. With that said, numerous factors needs to be considered when determining an adequate sprinkler design for rack storage arrangements, including:

- Rack Type (Single, Double or Multiple Row)
- Storage Height
- Ceiling Height
- Aisle Widths
- Shelving Composition
- Flue Spaces
- Encapsulation (Shrink Wrap Materials)

# Sprinkler System Installation and Coverage Requirements

There are three basic principles that dictate sprinkler system installation and coverage requirements, all of which are covered in **NFPA 13**:

## 1 Importance of full premises coverage

It is important that all areas within a building be sprinkler-protected to ensure maximum reliability in the event of a fire as partial sprinkler protection is generally unreliable. If a fire starts in an unprotected area, it could spread and overwhelm the sprinkler system in the protected area. Commonly encountered situations that lead to areas not being provided with sprinkler protection include renovations and combustible concealed spaces. It should be noted that there are exceptions where certain areas of a building are not required to have sprinkler coverage, all of which are outlined in **NFPA 13** (example: small closets in a hotels and apartment buildings).

## 2 Protection areas and spacing Imitations

There are a number of limitations levied on the size of the area that individual sprinkler heads can protect, as well as the spacing requirements between sprinklers and sprinkler branch lines. The protection area of a sprinkler head is calculated by multiplying the distance between individual sprinkler heads on the same branch line and the distance between sprinkler branch lines themselves. A number of factors dictate what is permitted from an area and spacing standpoint, beginning with the occupancy classification (Light Hazard, Ordinary Hazard, or Extra Hazard). From there, the system type, sprinkler type, and construction variables need to be taken into consideration. A higher occupancy hazard level naturally coincides with smaller maximum protection areas and spacing requirements. If these thresholds are exceeded, it could result in the sprinkler system failing to control a fire.

## 3 Sprinkler head positioning

The position of sprinkler heads relative to architectural elements, building systems, and features can impact the overall effectiveness of a sprinkler system in two ways:

1. Heat Exposure – If a sprinkler head is positioned in such a way that it's not directly exposed to heat from a fire, its activation may be delayed. In turn, a fire could build, spread, and potentially overwhelm the sprinkler system. With that in mind, there are requirements in **NFPA 13** pertaining to the positioning of sprinkler heads in relation to the walls and ceiling of a building.
2. Obstructions – Obstructions (including HVAC equipment, lighting, storage racks, ceiling mounted decor, etc.) can negatively impact the protection capability of the sprinkler system in two ways. First, obstructions can prevent the sprinkler discharge pattern from developing as designed. Second, obstructions can prevent discharged water from actually reaching a fire. In both circumstances, a fire could build, spread, and potentially overwhelm the sprinkler system. For this reason, sufficient clearance must be maintained between sprinkler heads and nearby objects. Clearance requirements are outlined in **NFPA 13** and typically range from 18" to 36", depending on a number of factors.



# Sprinkler System Water Supplies

The performance and reliability of any sprinkler system is directly linked to its water supply. While a sprinkler system can be designed to adequately protect the operations and processes taking place within a building, it will not function properly if the water supply does not meet the system demand in terms of volume and pressure. **That being said, it should never be assumed that an adequate water supply is available.**

Every sprinkler system must have at least one automatic water supply in accordance with the current requirements of NFPA 13. An automatic water supply is defined is one that is capable of activating in the absence of human intervention in the event of a fire. While a single, primary water supply is all that is required, a secondary water supply is often recommended depending on the strength and reliability of the primary water supply, the building's occupancy, and the construction of the building, along with a variety of other notable factors.

In most cases, the water supply will be provided via a public waterworks system that feeds an underground connection into the sprinkler-protected building. Private water supplies are often provided as a secondary water supply when supply from the public waterworks system is deemed inadequate, unreliable or not present whatsoever. Examples of private water supplies include gravity tanks, pressure tanks, and reservoirs.

There are two methods for determining if a water supply is sufficient to meet the demands of a sprinkler system. The first, and most reliable, method is obtaining flow test results from fire hydrants close to the sprinkler-protected building. The second method is obtaining flow test results from the main drain component of the sprinkler system itself. If it is determined that the available water supply is not adequate for the demand of the sprinkler system, there are four options available:

1. Re-engineering the system to the available water supply
2. Integrating a fire pump to boost the water pressure
3. Petitioning the municipality to upgrade the water supply
4. Installing a secondary water supply

# Sprinkler System Inspection, Testing and Maintenance

The readiness of a sprinkler system to respond in an emergency is a direct result of inspection, testing, and maintenance (ITM) procedures. Sprinkler system ITM procedures should be performed by qualified contractors, who will certify the system and provide a list of deficiencies, where applicable. All ITM procedures should be conducted in accordance with **NFPA 25 – Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems (NFPA 25)**. An overview of these requirements can be found in the table below. Please note that this is just an overview of the requirements and not an exhaustive list. For a full list of requirements, please refer to **NFPA 25**.

## Inspection

| Item | Frequency |
|---|---|
| Control Valves | Weekly/Monthly[1] |
| Fire Department Connections | Quarterly |
| Gauges (Dry and Pre-Action Systems) | Weekly/Monthly[2] |
| Gauges (Wet Pipe and Deluge Systems) | Quarterly |
| Hydraulic Nameplate | Quarterly |
| Internal Inspection of Piping | Five Years |
| Pipes and Fittings | Annually |
| Spare Sprinkler Heads | Annually |
| Sprinkler Heads | Annually |
| Water flow Alarm and Supervisory Signal Devices | Quarterly |

Note 1: Monthly inspections are sufficient if control valves are locked or electronically supervised, otherwise weekly inspections are required.
Note 2: Monthly inspections are sufficient where air pressure supervision is connected to a constantly attended location, otherwise weekly inspections are required.

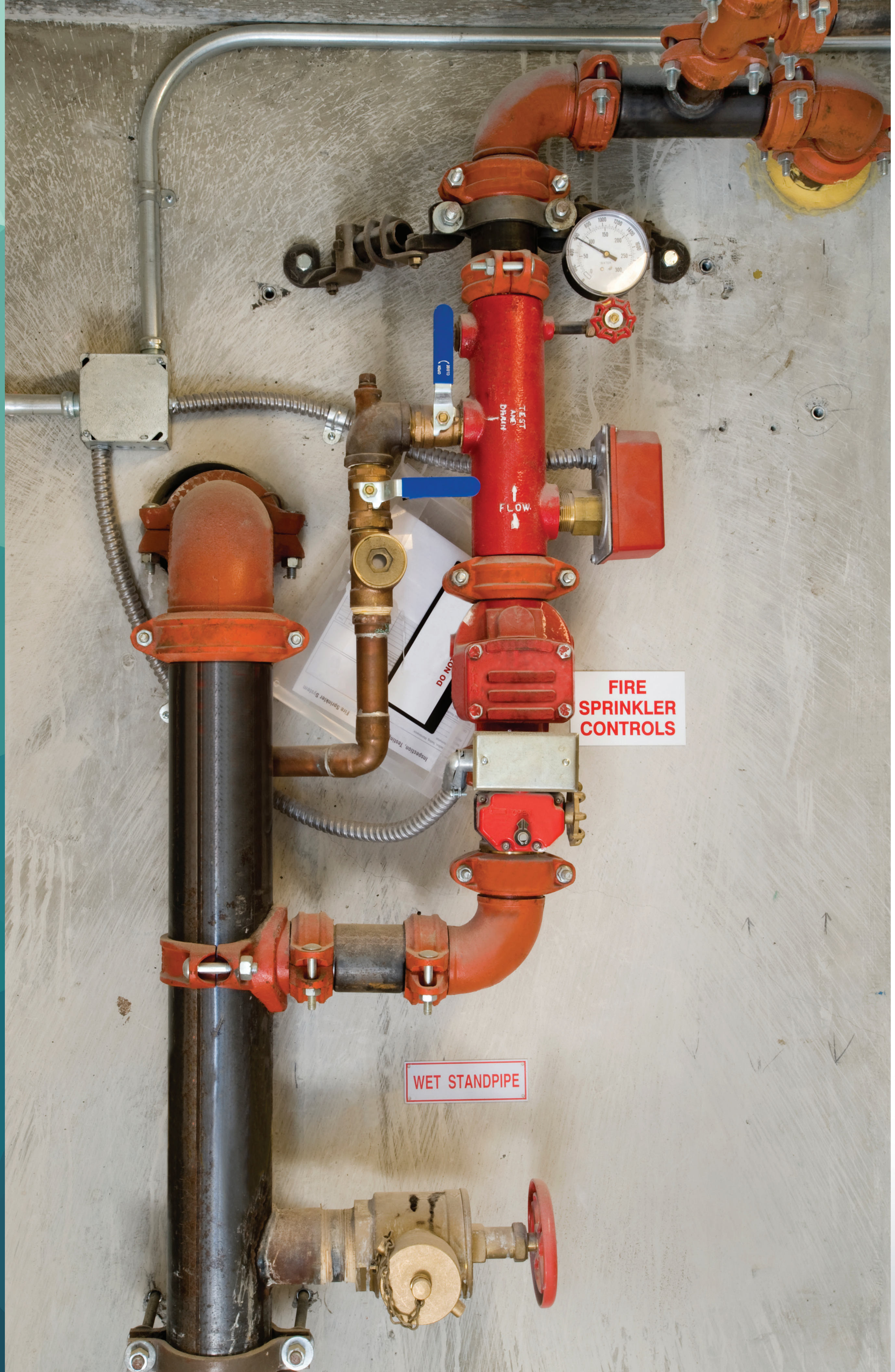
## Testing

| Item | | Frequency |
|---|---|---|
| Control Valves (Position and Operation) | | Annual |
| Gauges | | Five Years |
| Main Drain | | Annually / Quarterly[3] |
| Priming Water (Dry Pipe, Pre-action and Deluge Systems) | | Quarterly |
| Quick Opening Devices (Dry Pipe Systems) | | Quarterly |
| Sprinkler Heads | Extra High Temperature (Solder Type) | Five Years |
| | Sprinkler Heads in Harsh Environments | Five Years |
| | Fast Response | 20 Years and Every 10 Years Thereafter |
| | Dry Type | 10 Years and Every 10 Years Thereafter |
| | All Remaining Sprinkler Heads | 50 Years and Every 10 Years Thereafter<br>75 Years and Every 5 Years Thereafter |
| Trip Test | | Annual |
| Trip Test (Full Flow) | | Three Years |
| Water flow Alarm Devices | | Quarterly / Semi-Annually[4] |

Note 3: Quarterly testing is required in systems where the sole water supply is through a backflow preventer and/or pressure-reducing valves, otherwise annual testing is sufficient.
Note 4: Mechanical water flow alarm devices including, but not limited to, water motor gongs should be tested quarterly. Vane-type and pressure switch-type water flow alarm devices should be tested semi-annually.

## Maintenance

| Item | Frequency |
|---|---|
| Control Valves | Annually |
| Pre-Action and Deluge Valves | Annually |
| Dry Pipe Valves | Annually |
| Quick Opening Devices | Annually |
| Low Point Drains | After Each Operation<br>Before Freezing Weather Conditions |






## Sprinkler System Monitoring

All sprinkler systems are equipped with local alarms consisting of an outside water motor gong and an inside electric bell. These local alarms are designed to notify personnel proximate to the location that the sprinkler system is operating; however, to ensure that fire departments and property owners are immediately notified of a fire or other conditions that require prompt attention, all sprinkler systems should be monitored through an Underwriters Laboratories of Canada (ULC) listed central station.

Elements that require monitoring include the following:

| Element | Purpose |
|---|---|
| **Control Valves** | A signal will be triggered in the event the water supply to the sprinkler system is shut-off or tampered with. Control valves that require supervision include the main gate valve and any divisional control valves. |
| **Water Flow** | A signal will be triggered in the event that water is flowing through the system via an activated sprinkler head or if there is a leak within the system. |
| **System Pressures** | A signal will be triggered in the event pressures within the sprinkler system are too low or too high. Low system pressures could indicate that water is flowing through an activated sprinkler head or that there is a leak within the system. High system pressures, particularly in dry pipe sprinkler systems, could delay the dry pipe valve from opening, in turn delaying the entrance of water into the system. |
| **Building Temperature** | A signal will be triggered in the event building temperatures drop below a pre-determined point. This is particularly important in buildings equipped wet pipe sprinkler systems that are located in climates subject to freezing temperatures. |

## Fire Department Response

When installed and maintained properly, sprinkler systems provide responding fire departments with significant support during firefighting operations. As previously referenced, fire departments can supplement a sprinkler system by connecting hose lines from their pumper trucks to a sprinkler system's fire department connection, allowing them to pump additional water into the system. While the primary purpose of a fire department connection is to supplement the existing water supply, there are situations where they may serve as a critical backup conduit (refer to previous section for further details).

To allow fire departments to operate quickly and efficiently upon arrival to a fire, the following practices should be implemented by the building owner and/or its occupant(s):

- Control valves to the sprinkler system should always be locked in the 'OPEN' position.
- Fire department connections should be easily located, readily accessible, and properly marked.
- Inspections should be conducted on fire department connections at quarterly intervals to ensure that threads are in good condition, there are no interior obstructions (i.e. refuse, nests, etc.), and that end caps are securely in place.
- The compatibility of fire department connection threads should be verified with the local fire department to determine if specialized adapters are required in the event of a fire emergency.

## Importance of an Impairment Program

A fire protection system impairment is a condition in which a fire protection system, or part thereof is out of order, inhibiting the ability of this equipment to detect, control, and suppress a fire in the way intended. These systems play a crucial role in life safety, property preservation and business continuity. If impairments are not properly managed, the results could be disastrous.

Impairments can come in the form of emergency impairments and pre-planned impairments. An emergency impairment occurs as a result of an incident or unplanned event, such as accidental damage to a sprinkler line or an interruption to a sprinkler system's water supply. A pre-planned impairment occurs as result of scheduled activities, such as maintenance or upgrades to a sprinkler system.

While a properly designed and maintained sprinkler system is considered very reliable, an impairment could render an investment in such a system essentially meaningless. The previously-referenced study conducted by the NFPA showed that between 2015 and 2019, 57% of sprinkler system failures were the result of sprinkler system control valves being shut off. An effective fire protection equipment impairment program can prevent such oversights and help manage the impairment.

An effective fire protection equipment impairment program starts with the selection of designated personnel to manage and properly control the impairment. The personnel should have authority over all activities involved in controlling the increased exposure to fire loss created by the impairment. These activities include, but are not limited to:

1. Suspending hazardous activities (i.e. hot work, flammable liquid use, etc.)
2. Providing temporary protection (i.e. fire extinguishers, hose connections, etc.)
3. Implementing a fire watch
4. Notifying necessary parties (i.e. fire department, insurance provider, alarm-company, etc.)
5. Utilizing a permit form and tag system
6. Expediting repairs and monitoring progress
7. Confirming that repairs are complete and the system has been restored into service

| MYTH | FACT |
|---|---|
| Sprinkler systems are identical in their design. Any given sprinkler system can protect any given occupancy. | Sprinkler systems are occupancy specific. The design is based on the occupancy and its processes, as well as commodity storage arrangements. |
| My sprinkler system has never operated, therefore it does not require any testing or maintenance. | In order to remain fully operational and free of deficiencies or impairments, sprinkler systems need to be inspected, tested, and maintained at regular intervals to ensure reliability and proper working order. All inspection, testing, and maintenance procedures should be conducted by a qualified contractor in accordance with NFPA 25. |
| Sprinkler systems that are inspected, tested, and maintained by a qualified contractor provide adequate fire protection. | When a sprinkler system is inspected, tested, and maintained, the adequacy of its design is not evaluated. Design deficiencies in a sprinkler system could result in the system being overwhelmed and ineffective under fire conditions. |
| Water damage from a discharging sprinkler system will be more extensive than damage from fire. | Water damage from a sprinkler system will be significantly less destructive than water damage from firefighting hose lines and fire damage if the fire spreads throughout the building. |
| When a fire occurs, every sprinkler head goes off. | Sprinkler heads are individually activated when exposed to heat from fires. In actuality, a relatively small amount of sprinkler heads actually operate in most fires. |
| My insurance company is not able to evaluate the effectiveness of the sprinkler system protecting my building. | The Technical Risk Services team at Echelon Insurance are familiar with NFPA requirements and can evaluate the effectiveness of a building's sprinkler system to determine if your building is adequately protected. |

## Conclusion

Since their inception more than a century ago, sprinkler systems have continued to play a vital role in property preservation and life safety. With advancements in technology, sprinkler systems are available in different types and configurations allowing them to be installed in a wide variety of buildings and occupancies. It is important to note that their effectiveness and reliability is dependent on several key factors, including design, installation, water supply, testing, maintenance, and monitoring.

As referenced near the beginning of this guide, insurance companies played a major role in promoting sprinkler systems in the early stages of their development. This continues to be the case today and will undoubtedly continue into the future as sprinkler system technology evolves. By reducing property loss, improving life safety, and limiting interruptions to business operations, sprinkler systems play an integral role in the short and long term viability of businesses.

### References

NFPA Fire Protection Handbook, 20th Edition, Volume II

NFPA Fire and Life Safety Inspection Manual, 9th Edition

Automatic Sprinkler and Standpipe Systems, John L Bryan, 2nd Edition

US Experience with Sprinklers:
www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and reports/Suppression/ossprinklers.pdf

FM Global Property Loss Prevention Data Sheet 10-7 (Fire Protection Impairment Management)

American Fire Sprinkler Association (https://www.firesprinkler.org/facts-figures/)

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