Schnackel engineers®

Fire Protection System Basics:

A Guide for Building Owners and Architects

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Introduction

The purpose of this guide is to provide owners and architects with a summary of the basic requirements found in the *National Fire Protection Association (NFPA) Standards and the International Building Code (IBC)* that have a direct impact on space planning, architectural design, and operational requirements of their buildings.

This guide will focus on these key aspects:

- Sprinkler systems basics
- Fire pump basics
- Maintenance requirements
- Inspection requirements
- Other considerations regarding fire protection systems for your building

Codes/Standards Used Throughout Guide

The information within this guide is based on the *2022 NFPA 13, 2019 NFPA 14, 2022 NFPA 20, 2020 NFPA 25, and 2021 IBC*.

It is important to note that previous versions of the NFPA Standards and IBC codes may have different requirements. Additionally, while the codes/standards referenced in this guide are the most current, many local jurisdictions may have adopted earlier versions or local amendments that may be more stringent than the requirements outlined in this guide and the base code/standard.

CHAPTER 1

Basic Terminology and General Characteristics

Because fire protection systems can become complex, it is important to be familiar with the different components and terminology of fire protection systems in order to apply the requirements appropriately.

This first chapter is intended to familiarize the audience with the basic terminology and general characteristics of fire sprinkler service risers, fire sprinkler heads, and fire sprinkler standpipes.

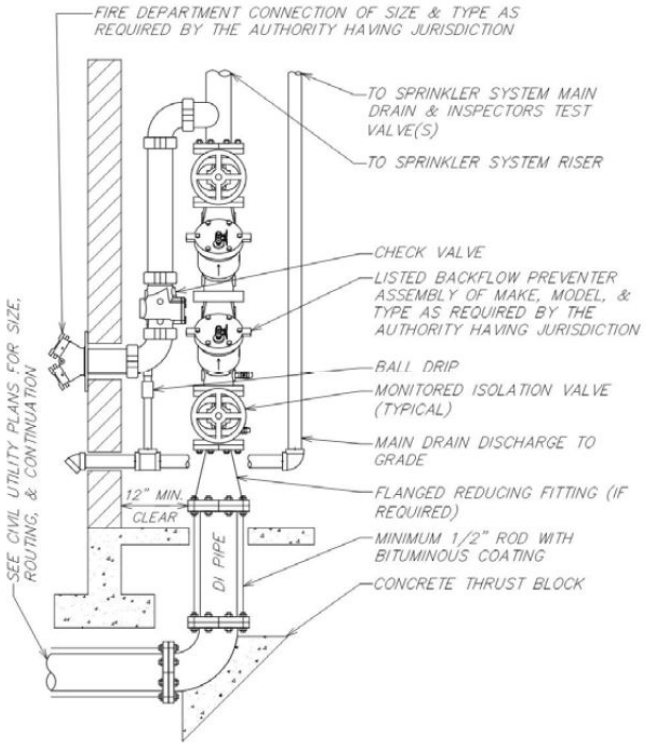
We'll close this chapter with a look at what's to come and why this guide is important to building owners and architects.

Sprinkler Services

The detail below shows a basic vertical fire sprinkler service entrance into a building.

You can see the backflow preventer, fire department connection (FDC), FDC check valve, as well as the main system drain which discharges to grade outside the building. The main service riser may utilize a vertical assembly, as shown, or a horizontal installation.

Backflow preventers may be installed inside the building or outside on site, according to local authority having jurisdiction (AHJ) requirements and environmental conditions.



Fire Department connections and indicator valves may be installed on the exterior wall or remotely on site, depending on site conditions and local AHJ requirements. The FDC and indicator valves are required to be located in a readily accessible and visible location to the fire department access of the building. The FDC is used by the fire department to connect fire hoses from a pumper truck to supplement the water supply to the fire sprinkler system in the building.

Indicator valves provide the fire department a visual indication regarding whether the main fire service valve is open or closed. The image below shows an example of a post indicator valve and a wall indicator valve. Post indicator valves are common and are required to be 40' from the building it serves, but still within the property lines. Prior approval from the local authority having jurisdiction is required to reduce the 40' requirement. Prior approval is also required for the installation of the wall indicator valve which would be installed on the exterior wall of the building it serves.

Types of Sprinkler Heads

- **Pendent** - A sprinkler designed to be installed in such a way that the water stream is directed downward against the deflector.

- **Upright** - A sprinkler designed to be installed in such a way that the water spray is directed upwards against the deflector.

- **Sidewall** - A sprinkler having special deflectors that are designed to discharge most of the water away from the nearby wall in a pattern resembling onequarter of a sphere, with a small portion of the discharge directed at the wall behind the sprinkler.

- **Dry** - A sprinkler secured in an extension nipple that has a seal at the inlet end to prevent water from entering the nipple until the sprinkler operates.

- **Concealed** - A recessed sprinkler with cover plates. When exposed to heat, the cover plate falls off, exposing the sprinkler.

Sprinkler Standpipes

A standpipe system is the piping which runs vertically from floor to floor delivering the water supply for hose connections, and for sprinklers on each floor in the case of a combined sprinkler/standpipe system. There are many differen types and layouts for sprinkler standpipe systems; however, they most commonly occur in the stairwells of multi-story buildings, as pictured here. These systems allow firefighters to connect hoses to the wet system and attack the fire from inside the building. If your building is four or more stories above or below grade, or the highest or lowest level is more than 30 feet away from fire department vehicle access, a standpipe system will likely be required.

Your building may require a combined system, which is a standpipe system that supplies both the normal hose connections and also supplies the automatic sprinklers on the floor/zone. The image below is a typical zone control valve used in a combined standpipe system. This control valve would serve the sprinklers in the zone.

What to Look Forward To

Fire protection systems are becoming more common and are required in most jurisdictions for all public buildings. This guide will help you become more familiar with the requirements that fire protection systems bring to your facility. Next, we will be taking a look at common fire sprinkler systems. We will then review fire pump requirements. The fourth chapter in the guide will discuss maintenance and inspection requirements. Finally, we'll wrap up the guide with a discussion regarding how to best determine the right system for your building.

CHAPTER 2

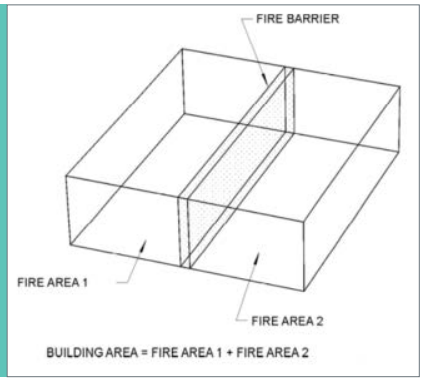
Sprinkler Systems

This second chapter seeks to outline the requirements for various types of fire protection systems your building may require:

- Wet Sprinkler Systems
- Dry Sprinkler Systems
- Pre-Action Systems
- Dry Chemical Systems
- Standpipe and Hose Systems

When are Sprinkler Systems Required

To determine whether or not your building requires a fire sprinkler system, you will first need to know the occupancy type and square footage. The building codes determine the requirements to add sprinklers to buildings. The most common building code is the International Building Code (IBC). Section 903 deals with sprinkler system requirements. As examples, we will touch on Restaurant, Office, and Mercantile occupancies.



First, a definition is in order. IBC Section 903 refers to "Fire Area" in order to determine the need for a fire sprinkler system. *"The Fire Area is defined as the aggregate floor area enclosed and bounded by fire walls, fire barriers, exterior walls or horizontal assemblies of a building. Areas of the building not provided with surrounding walls shall be included in the fire area if such areas are included within the horizontal projection of the roof or floor next above."*

For a restaurant (Occupancy Group A-2), a building is required to have a fire sprinkler system if the fire area exceeds 5,000 square feet, the occupant load exceeds 100 people, or the fire area is located on a floor other than the level of exit discharge.

For an office (Occupancy Group B), a building is not required to have a fire sprinkler system per IBC Section 903. However, if classified as a high-rise building, then a sprinkler system will be required. Also, providing a sprinkler system in the building, even if not required, may alleviate some other

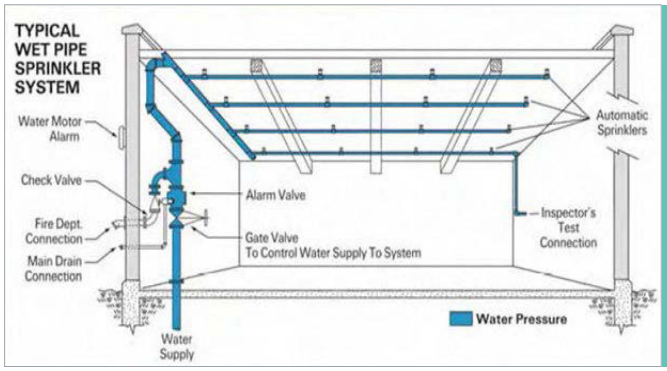
requirements such as, different degrees of rated walls in certain areas. Even if sprinklers are not required by code, providing them offers enhanced life safety, greater real estate value and a host of other benefits in terms of code compliance.

For a Mercantile occupancy (Occupancy Group M), a building is required to have a fire sprinkler system if the fire area exceeds 12,000 square feet, the fire area is located more than three stories above grade, or the combined area of all Group M occupancies on all floors exceeds 24,000 square feet.

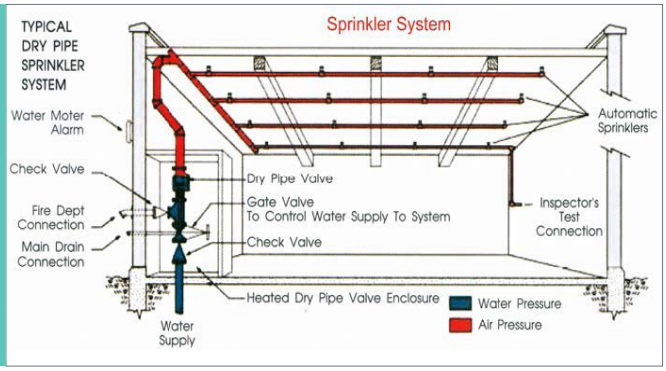
The wide range of requirements and potential benefits of a fire sprinkler system is what makes it critically important to hire a fire protection engineer who is knowledgeable about the multiple applicable codes to review your design intent and advise on the best overall solutions.

Wet Sprinkler Systems

The vast majority of fire sprinkler systems installed in buildings are wet sprinkler systems. This means the entire system is constantly filled with water for quick discharge when necessary. In the event of a fire, heat collects around the sprinkler heads, causing the glass bulb or fusible link to break and open the sprinkler head orifice. This will allow the pressurized water in the system to discharge through only the heads where the glass bulb or fusible link broke.



A wet sprinkler system is the most reliable and cost effective type of system, which makes it the first system type to consider for your building.



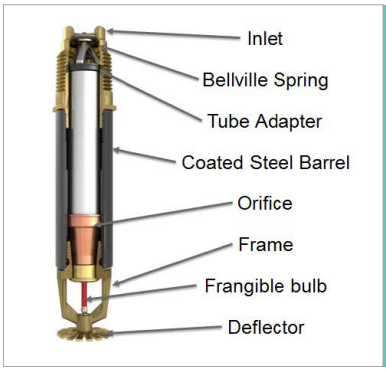
Dry Sprinkler Systems

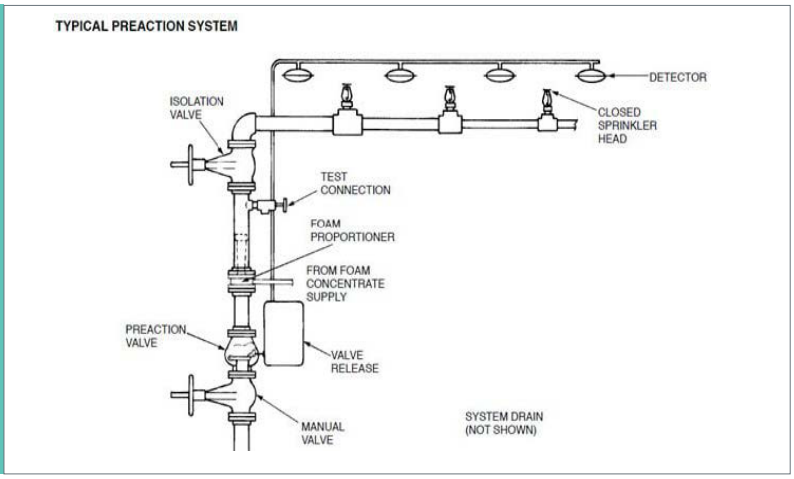
Dry pipe sprinkler systems are very similar to a wet pipe system with one very major difference. The dry pipe systems are filled with air or nitrogen rather than water. When a sprinkler head opens due to a fire, the air escapes through the sprinkler head orifice allowing water to flow from the dry pipe valve and reach the heads to discharge into the building space. Similar to the wet system, only the heads where the glass bulb or fusible link broke would allow water to flow.

Since there is no water in a dry system, except during a fire situation, they are allowed to be installed in unheated attics, overhangs, garages or warehouses as well as within freezers. This major difference also requires a dry pipe valve and an air or nitrogen supply. These additional pieces of equipment add more complexity and maintenance requirements to a dry pipe system. Some other notable disadvantages to a dry pipe system are higher costs for the additional equipment and a slightly increased sprinkler response time.

Due to these disadvantages, dry pipe systems should only be used in areas necessary due to a freezing potential.

If the potential freezing location is limited in size, a dry pendant sprinkler head can be tapped off of a wet sprinkler system to serve the limited freezing area. Dry pendant heads are sprinkler heads with a predetermined length of air filled pipe connected to them to protect the section of pipe closest to the freezing conditions. The valve at the inlet is located in a warm area, not subject to freezing conditions. These heads operate just like a dry pipe system where the air will first be released then followed by water.





Pre-Action Systems

Pre-action systems are a combination of a wet and a dry system. The pre-action systems start out as a dry system, which require a pre-action valve to be activated before water will flow into the system. The pre-action valve is connected to a detection device which can detect heat, smoke, or flames. When one of these is detected, a solenoid valve is activated to open the pre-action valve and allow water to flow into the system. At this point, the system is now a typical wet system, so when a head is activated, water will be readily available to flow through the sprinkler head.

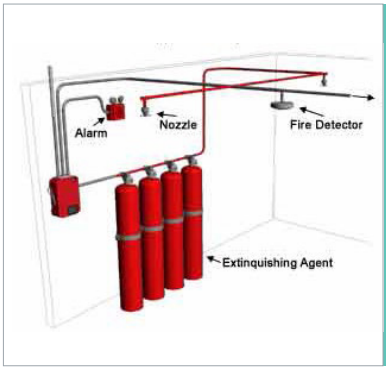
Pre-action systems are typically used in sensitive areas where an accidental discharge of water could be catastrophic to the equipment or operations in the space. This two-step activation process will help eliminate any accidental sprinkler head discharges. Some common locations are freezer warehouses, museums, libraries, and smaller computer rooms.

A pre-action system has the same disadvantages as the dry system, as it would require extra equipment and complexity, which cost more for the initial installation as well as for long-term maintenance.

Dry Chemical Systems

Dry chemical systems are a type of fire suppression system which uses a dry chemical powder to extinguish a fire in lieu of water. Typically, these systems require a large tank or tanks filled with the chemical agent, which is then pressurized to serve the piping system. These chemicals are typically sodium bicarbonate or mono-ammonium phosphate, depending on the class of potential fire.

Chemical systems are a more specialized sprinkler system only used in limited areas. They are commonly used in industrial applications such as chemical storage areas and paint booths.



Dry chemical systems are very reliable, as they discharge a lot of chemical that quickly extinguishes any fire. The system can also be recharged after any discharge to keep the system in operation. Although the ability to recharge is an advantage, it can also be a disadvantage as your maintenance staff must remember to recharge the system. Dry chemical systems are substantially more expensive than any of the water based systems, so their application is fairly limited. Another disadvantage is that there is a lot of specialized cleanup required for the dry chemicals after a discharge occurs.

Standpipe and Hose Systems

As stated in our first chapter of this guide, a standpipe system is the piping which runs vertically from floor to floor delivering the water supply for hose connections, and for sprinklers on each floor in the case of a combined sprinkler/standpipe system. The maximum required flow rate through a standpipe system is 1,000 gpm if the building is fully sprinkled, or 1,250 gpm if the building is not sprinkled.

Per NFPA 14, which deals with standpipe systems, there are three classes of standpipe systems.

Class I systems are for use by the fire department only and are typically required in buildings that have more than three stories above or below grade. Class I systems do not provide any hose available for use in fighting fires without the presence of the fire department. Common locations for standpipe hose connections are at stairwell floor landings, the roof, and at exit passageways. Additional standpipe hose connection locations may be required if all portions of each floor are not within 200 feet of a required hose connection location. The Class I standpipe systems require a minimum of 100 psi supply pressure and a flow rate of 500 gpm through the two most remote hose connections. Additional standpipes to meet the minimum spacing requirements noted above may require an additional flow rate of 250 or 500 gpm.

Class II standpipe systems are for use by trained personnel or by the fire department. These systems consist of a cabinet with a hose for quick use to fight fires. These are typically used in large un-sprinkled buildings, large exhibit halls or stages. Class II systems must provide enough hose cabinet locations so that every portion of the floor may be reached by a 130 foot hose off of a 1 ½" standpipe connection.

These systems require a minimum pressure of 65 psi and a flow rate of at least 100 gpm for the most remote hose connection. No additional flow is required where more than one hose connection is provided. If your building is protected throughout by an approved automatic sprinkler system, you may not be required to install a Class II standpipe system, subject to the approval of the Authority Having Jurisdiction (AHJ).

Class III systems are a combination of a Class I and a Class II system as they contain both Class I and Class II hose connections. These are intended for use by fire departments and trained personnel. Class III systems must meet all of the placement, pressure, and flow rate requirements for both Class I and Class II systems.

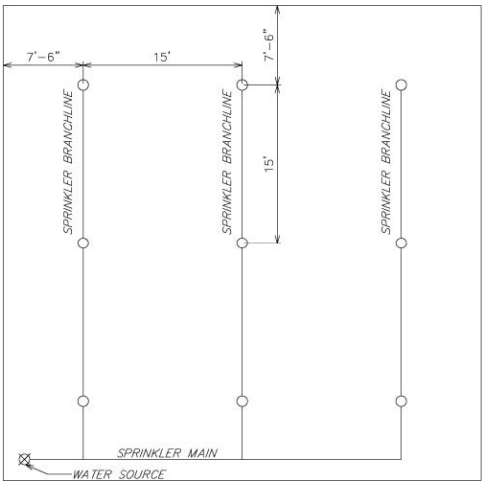
Sprinkler Head Locations & Coverage

The first step in laying out proper sprinkler head coverage is to determine the hazard classification for the occupancy type and planned storage per NFPA 13. This classification sets the maximum sprinkler coverage each head is allowed to provide. Sprinklers are required to be located a minimum of 4" from any wall and as far as half of the maximum sprinkler spacing allowed per the hazard classification type. The NFPA Standards have many other rules for spacing based on obstructions, small rooms, roof pitch, soffits, beams, elevator shafts, etc.
The numerous intricacies required to be considered when laying out sprinkler heads, are another reason why it is critically important to hire a fire sprinkler engineer to discuss the specific requirements for your project.

The main hazard classifications are listed below with a brief definition of the classification type, typical occupancies, and head coverage limits:

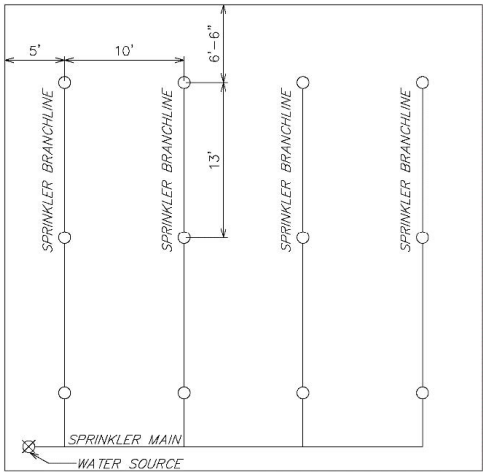
Light Hazard:

- Light hazard occupancies are defined as occupancies or portions of other occupancies where the quantity and/or combustibility of contents is low and fires with relatively low rates of heat release are expected. (Ex. Classrooms, office space, etc.
- The maximum sprinkler coverage in Light Hazard Areas is 225 square feet or 15' x 15'.



Ordinary Hazard:

- (Group 1): Ordinary hazard (Group 1) occupancies are defined as occupancies or portions of other occupancies where combustibility is low, quantity of combustibles is moderate, stockpiles of combustibles do not exceed 8 ft, and fires with moderate rates of heat release are expected. (Ex. Clothing stores, general mercantile)
- (Group 2): Ordinary hazard (Group 2) occupancies are defined as occupancies or portions of other occupancies where the quantity and combustibility of contents are moderate to high, stockpiles do not exceed 12 ft, and fires with moderate to high rates of heat release are expected. (Ex. Warehouses)
    - The maximum sprinkler coverage for Ordinary Hazard Occupancies is 130 square feet and the maximum distance between heads remains 15', however the other dimension would need to be adjusted to still limit the total coverage area to 130 square feet (8'-8" in this case).



Extra Hazard:

- (Group 1): Extra hazard (Group 1) occupancies are defined as occupancies or portions of other 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. (Ex. Wood shops)
- (Group 2): Extra hazard (Group 2) occupancies are defined as occupancies or portions of other occupancies with moderate to substantial amounts of flammable or combustible liquids or occupancies where shielding of combustibles is extensive. (Ex. Ethanol refinery)
    - The maximum sprinkler coverage for Extra Hazard Occupancies varies with the hydraulic density required for proper coverage and require special design considerations beyond the scope of this guide.

CHAPTER 3

Fire Sprinkler Pumps

This third chapter seeks to outline the requirements for fire sprinkler pumps:

- When are they required?
- Basic sizing requirements
- Types of Pumps
- Jockey Pumps
- Space planning requirements
- Ventilation requirements
- Testing Requirements

When are Fire Sprinkler Pumps Required

It is critically important to provide adequate water pressure and flow to a fire sprinkler system. NFPA 13 specifies minimum pressure and flow requirements at different sprinkler head types and different occupancy types. The first step to determine if a sprinkler booster pump is required is to request a hydrant flow test in the area of the project from the local fire department or water utility company. This flow test will help the design engineer determine if the building's fire sprinkler service has enough pressure and flow to serve the system with, or without, the need for a booster pump. There is no "rule of thumb" to determine when a pump is required and when one is not. Hydraulic calculations need to be performed by a qualified Fire Protection Engineer on every project to make this determination.

Pumps used in a fire protection system must be dedicated to and listed for fire protection service. Acceptable forms of powering a fire pump are electric motors, diesel engines, steam turbines, or a combination thereof. Electrical and diesel driven are the most common.

Regardless of how it occurs, overdesign is costly. In the case of one multi-building mixed-use project, unnecessarily expensive mechanical systems and significantly oversized pipe and wiring contributed to an unnecessary cost overrun of more than $2.5 million. With a technology-supported, value-oriented design approach, the engineering team was able to improve design accuracy and scale the system back to achieve upfront MEP cost savings, as well as significant future operational cost savings.

Basic Sizing Requirements

When a pump is determined to be required, there are many pieces of information that are required to properly select an appropriate booster pump for your specific project. Some of the information, as well as a description of that information is listed below:

- Flow test
  - The flow test must be performed within 12 months of design calculations and must be performed at fire hydrants nearest the site.

- Flow rate
  - The flow rate will vary based on the design of the building. Any flow rate requirements for automatic standpipe systems must also be included in the total require flow rate.

- Building height
  - This information is used to determine vertical pressure requirements in the system from the pump location up to the highest portion of the building that will be required to be sprinkled.

- Secondary water supply
  - Depending on the code requirements of the building type and water supply, a secondary water supply may be required.

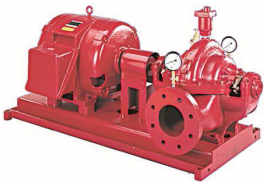
- Power availability
  - Fire booster pumps can be powered many different ways so a review of the code requirements and local power availability will be necessary to determine the best way to power the pump.

This is not an exhaustive list of information that the Fire Protection Engineer will need to properly size a booster pump. Other information that would be required includes the diameter of fire sprinkler piping, secondary pressure losses through equipment, pressure losses through horizontal piping, etc.

Types of Pumps

The most common fire pump is a centrifugal pump because they are able to support high flow rates and high pressure requirements. The pumps discussed below are capable of being used with either diesel or electric drives, unless otherwise noted below. All pumps will require vibration isolators to limit any potential for motor vibrations to disseminate through the building. There are many different sub-types of centrifugal pumps, which we will describe below.

- Horizontal Split Case
  - The water flow enters and exits the pump impeller from opposite sides of the pump housing. The pump is covered by a "split" casing, which can be opened for pump maintenance. The impeller is connected to the drive by a horizontal shaft. This type of pump is very reliable and available in a wide range of flow and pressure ranges. Unfortunately, this style of pump, typically, requires the largest floor space also.



- Vertical Turbine
  - Vertical turbine pumps are the only pumps allowed by NFPA 20 to start with a negative pressure on the suction side of the pump or lift water from below grade sources such as subgrade tanks. Vertical turbine pumps are also available in a wide range of capacities.

- In-Line Pump
  - These pumps are useful in small spaces, however, they have limited capacities and are harder to maintain. They are typically limited to no more than 1,500 gpm. In order to maintain them the motor must be lifted off the pump. In-line pumps tend to be less expensive and take up less floor space than other horizontal pumps. Another potential down side to this type of pump is that they can only be used with an electric motor.

- End Suction
  - Like the In-line pump, the end suction pump is limited in capacity to around 1,500 gpm. However, if the capacity works out, these pumps require less floor space than their similar horizontal split case pump and are less costly.

Jockey Pumps

Jockey Pumps are smaller pumps connected to the fire sprinkler system to maintain the system pressure when there is no call for fire sprinkler water in the building. This pump ensures that the system sees a large enough pressure drop when a sprinkler head is activated to start the main fire pump. Jockey pumps are typically sized to a flow rate less than a single sprinkler head. Since these pumps are so small they are typically a multi-stages centrifugal pump. Jockey pumps do not need to be listed for use in fire system applications. Any pump capable of producing the necessary pressure is acceptable.

Space Planning Requirements

When fire booster pumps are required, the codes have specific requirements for the room that houses the booster pump as well as access to the room. Depending on the building design, the fire pump room will need to be constructed with either 1 or 2 hour wall separation from the rest of the building. Access to this room is preferred to be from the exterior, however that is not always possible. If the room does not have direct exterior access, the corridor or stairwell leading to the room also must be constructed with 1 or 2 hour walls to match the fire pump room rating. The access to the room must be pre-planned and approved by the local fire department.

The fire pump room must be dedicated to the fire service and equipment directly associated with the booster pump. The only other devices that are allowed to be in the fire pump room are the domestic water service equipment. There is no pre-determined pump room size as all equipment and building requirements are different. The room must be sized large enough to house all of the equipment required for the fire service and booster pump, as well as any required clearances for installation and maintenance. Fire pump rooms tend to be quite large, so early coordination is critical.

A couple other things to consider for the fire pump room are lighting, floor drainage, and ventilation (which we will discuss in the next section). The room and any access corridors are required to have both normal and emergency lighting for fire department access. The rooms are also required to have adequate floor drainage to prevent any water build up in the room.

Ventilation Requirements

Ventilation is required for fire booster pump rooms per NFPA 20 and the applicable Mechanical Code requirements. For standard, electric powered pumps minimal ventilation is required per Mechanical Codes. However, if a diesel pump is provided ventilation requirements become more complex and critical. Per NFPA 20, ventilation of the pump room must be provided for the following functions:

- To control the maximum temperature 120 degrees fahrenheit at the combustion air cleaner inlet with the engine running at rated load.
- To supply air for engine combustion.
- To remove any hazardous vapors.
- To supply and exhaust air as necessary for radiator cooling of the engine when required.
- All ventilation requirements must be coordinated and designed by a Registered Mechanical Engineer.

Testing Requirements

NFPA 20 and 25 have strict testing requirements for all fire pump installations. The suction and discharge piping must be hydrostatically tested at not less than 200 psi, or 50 psi greater than the maximum pressure of the system, for a minimum of 2 hours. The pumps must be tested to show they are capable of reaching and maintaining the system design pressure and flow rate. The manufacturer, or their authorized representatives, must be present for the field acceptance testing.

Per NFPA 25 the pump performance, including flow rate, must be tested annually, at a minimum. Some components that are part of the overall fire pump system have a more frequent testing requirement, such as weekly for all fire pumps under no flow. NFPA 25 also states the requirements for inspection and maintenance of the entire fire pump system and components.

CHAPTER 4

Maintenance and Inspections

This fourth chapter seeks to outline the requirements for Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems:

- General Requirements
- Sprinkler System Requirements
- Standpipe and Hose System Requirements
- Fire Pump Requirements

General Requirements

All inspection, testing, and maintenance requirements for fire protection systems are the responsibility of the building owner, or a designated representative of the building owner. All requirements shall be performed by qualified personnel.

It is the owner's responsibility to ensure the following requirements are met for any buildings they own with fire protection systems:

- Ensure all water filled piping is maintained at a minimum temperature of 40 degrees unless an approved antifreeze solution is utilized.
- Provide ready accessibility to all components of the fire protection system.
- Notify the AHJ, Fire Department, and alarm-receiving facility before and after testing or shutting down a system or its supply, for testing purposes.
- Correct or repair any deficiencies or impairments found during inspections.
- Shall not change occupancy, use, process, or materials stored in the facility without first performing an evaluation of the existing fire protection system and any new requirements.
- Records of all inspections, tests, and overall maintenance shall be kept and made available to the AHJ.

Sprinkler System Requirements

Table 5.1.1.2 of NFPA 25 states the minimum required frequencies for routine inspection, testing, and maintenance of fire sprinkler systems and components.

Below is a breakdown of the main requirements that the owner needs to ensure are completed on the sprinkler system.

- Inspections:
  - Annual visual inspections of the entire sprinkler system shall be performed from floor level.
  - Sprinklers showing any of these signs shall be replaced:
    - Leakage
    - Corrosion detrimental to performance
    - Physical damage
    - Loss of fluid in the glass bulb
    - Loading detrimental to performance
    - Loading = Dirt and Debris
    - Paint other than that applied by the sprinkler manufacturer
    - Any sprinklers that are found to no longer meet NFPA 13 requirements shall be adjusted/replaced.
  - Pipe and fittings shall be free of damage, leakage,and corrosion.
  - Piping shall not be subjected to external loads by materials resting on the pipe or hung from the pipe.
  - Hangers/braces shall not be damaged, loose, or unattached. Replace or repair as necessary.
  - Water flow alarms and supervisory signal initiating devices shall be inspected quarterly to verify they are free of physical damage.
  - Hydraulic Design information signage shall be inspected annually to verify it is provided, attached securely to the riser, and is legible. Replace as necessary.

- Testing:
  - Sprinklers have different testing interval requirements depending on the type of head.
    - Standard response heads shall be replaced or sample tested after the first 50 years and then every 10 years.
    - Refer to NFPA 25 chapter 5 for more specific information.
  - Water flow alarm devices shall be tested quarterly.
  - Antifreeze systems shall be tested annually, prior to the onset of freezing weather.

- Maintenance:
  - Sprinkler heads which have been removed from a system shall not be re-installed and must be replaced.
  - A minimum of six spare sprinkler heads of each type shall be provided on the premises so that any sprinklers that have operated or been damaged in any way can be promptly replaced.
  - A wrench specific to the manufacturer of sprinkler heads shall also be provided on site
  - Table 5.5.1 of NFPA 25 indicates required actions to be performed anytime a component from a sprinkler system is adjusted, repaired, reconditioned, or replaced.

Standpipe and Hose System Requirements

Table 6.1.1.2 of NFPA 25 states the minimum required frequencies for routine inspection, testing, and maintenance of Standpipe and hose systems.

Below is a breakdown of the main requirements that the owner needs to ensure are completed on the standpipe and hose systems.

- Inspections:
  - Components of a standpipe and hose system shall be visually inspected annually at a minimum.
  - Hydraulic Design information signage shall be inspected annually to verify it is provided, attached securely to the riser, and is legible. Replace as necessary.
  - Hose connections shall be inspected annually for issues like, missing or damaged caps, general damage to hose connection, missing valve handles, leaking, etc.
  - Piping shall be inspected annually for damage.
  - Hoses shall be inspected annually for mildew, cuts, deterioration, hose thread damage, missing gaskets, etc.
  - Hose nozzles shall be inspected annually for hose nozzle missing, missing gaskets, obstructions, etc.
  - Hose storage devices shall be inspected annually for difficulty to operate, damage, obstructions, improper hose storage, etc.
  - Cabinets shall be inspected annually for corrosion, damage, door functionality, broken glass, etc.

- Testing:
  - Flow tests shall be performed every five years to verify the required flow and pressure are still available at the hydraulically most remote hose valve outlets for automatic and manual standpipe systems.
  - Common components of the system shall be inspected, tested, and maintained per chapter 13 of NFPA 25.

- Maintenance:
  - Shall be performed per chapter 13 of NFPA 25.
  - Table 6.5.1 of NFPA 25 indicates required actions to be performed anytime a component from a standpipe and hose system is adjusted, repaired, reconditioned, or replaced.

Fire Pump Requirements

Table 8.1.1.2 of NFPA 25 states the minimum required frequencies for routine inspection, testing, and maintenance of fire pumps.

- Inspections:
  - Visual inspections of the pump house conditions, pump system conditions, electrical system conditions, diesel engineer system conditions, and steam system conditions shall be performed weekly.

- Tests:
  - Diesel and electric driven fire pumps shall be tested weekly unless an approved risk analysis is performed and an alternative frequency is established.
  - Flow testing of the fire pumps shall be performed on an annual basis.

- Maintenance:
  - Preventative maintenance shall be performed for all components of the pump assembly in accordance with the manufacturer's recommendations, or an approved alternative maintenance plan.

CHAPTER 5

Choosing The Right Fire Sprinkler System For Your Building

This final chapter seeks to outline the type of fire sprinkler system you choose for your building. As discussed in previous chapters, there are several types of fire sprinkler systems to select from for the protection of your building. The International Building Code (IBC), National Fire Protection Association (NFPA) and Local building and fire codes will be a guideline to select the system required for your building. Typical considerations for you to take into account are:

- What is the occupancy of your building?
- What is the category of construction of the building?
- Is the building in an area of cold climate?
- What types of areas will need protection?
- Are there special insurance requirements?

Occupancy

What is the building being used for? From an individual house to a major skyscraper, code classifies all the ways a building is occupied. IBC describes the different classifications of occupancy for your building, while NFPA 13 is the standard for which the sprinkler system shall be designed and installed. Different occupancy types may have different sprinkler system requirements.

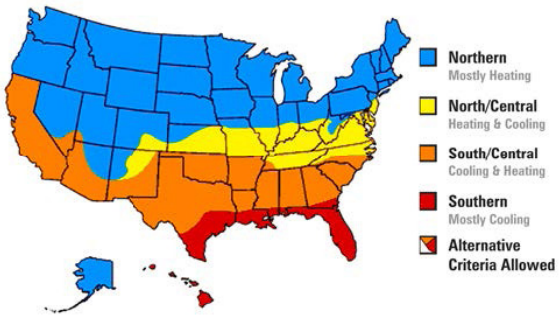
Occupancy Classification	
Description	***Group(s)***
Assembly	*A-1, A-2, A-3, A-4 and A-5*
Business	*B*
Educational	*E*
Factory and Industrial	*F-1 and F-2*
High Hazard	*H-1, H-2, H-3, H-4 and H-5*
Institutional	*I-1, I-2, I-3 and I-4*
Mercantile	*M*
Residential	*R-1, R-2, R-3, R-3.1 and R-4*
Storage	*S-1 and S-2*
Utility and Miscellaneous	*U*

The type of sprinkler system required and installed may also affect the requirements for the type of fire alarm system. If the size of your building does not require fire sprinkler protection, then a more robust fire alarm system may be required. If there is a fire sprinkler system in your building, then the fire alarm system may just be there to monitor the system and send an alarm to the monitoring company. The local jurisdiction, IBC, and NFPA 101, Life Safety Code, will determine what type of fire alarm system will be required in your building.

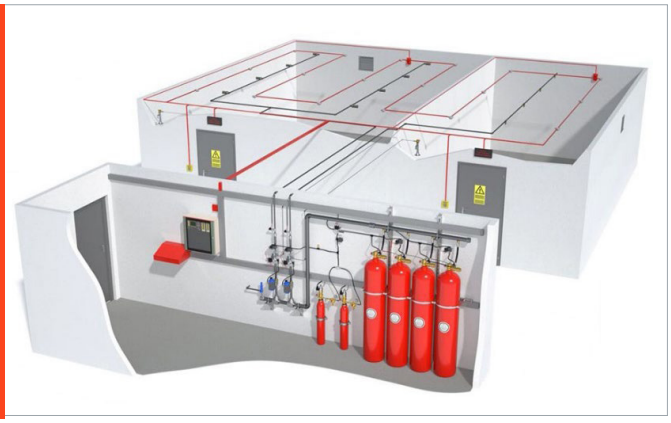
Building Construction

Is your building constructed of wood, steel, or a different material? The construction of your building can have a major impact to the requirements of the fire sprinkler system. Combustible construction, or wood construction, will require fire protection in concealed spaces. Whereas non-combustible construction, or steel construction, would not require this protection. This is just the main difference between the two types of construction materials; however, the codes go into much more detail about different requirements between the two construction material types.

Cold Climate



What part of the country is your building being constructed? This is the simplest of the decisions when it comes to requirements for your sprinkler system. If there is an area in your building that is being protected by a fire sprinkler system, the area must be maintained at or above 40 degrees. If this temperature cannot be maintained, then a dry sprinkler system would be required, which has additional equipment associated with it.



Types of Areas or Rooms

Does your building have mission critical equipment, or rooms you want to make sure are protected? One area that is commonly worried about is computer server rooms. These types of rooms house expensive equipment which would be damaged, likely beyond repair, if a standard fire sprinkler system was installed in the area and the system was triggered. There are a number of different options for systems that can be installed in these types of areas to avoid damaging the equipment in the event of a fire. This can range from multi-activation systems, up to special chemical gas systems to control a fire. These types of specialty systems have code sections dedicated to each system and require a high level of knowledge to design.

Special Insurance Requirements

Who is your insurance carrier? If you have decided to have FM Global as your insurance carrier, then a more robust system may be required. FM Global has performed their own testing of fire protection systems and come up with a more stringent set of requirements for fire sprinkler systems. This is another area which a fire sprinkler system expert, who knows FM Global's requirements, would be recommended.

Conclusion

As discussed in all of the previous chapters, fire sprinkler systems can be simple gridded systems or a very complex array of different systems combined together. There are intricate details about the construction of the building and the use of the building required for a fire protection engineer to determine the required fire sprinkler system for your building. Fire sprinkler systems are critical to the life safety of the building occupants, allowing them time to exit unharmed. They also provide substantial protection for your investment in your facilities and may lower your insurance rates. Contact Schnackel Engineers today if you have questions or need help with selecting the right fire sprinkler system for your project.