



Innovate, Network &
Succeed with
MANHA

June 2025
Conference

Fire Sprinkler
Presentation



Introduction

- Skip Johnson
- Sprinkler Career Since 1989
- Fire Sprinkler Service Sales Representative
- Sales Territory: Missouri
- Primary Vertical Market: Health Care (Kansas & Missouri)
- Secondary Vertical Market: Hospitality/ Hotel & Lodging (Kansas & Missouri)



Fire Sprinklers 101

Overview:

- **A Little About Sprinkler Systems (Sprinklers 101 review)**
- **Myths & Misinformation of the Fire Sprinkler**
- **Sprinkler Pipe Bursts**
- **Owner requirements for maintaining sprinkler systems**
- **Periodic Maintenance Requirements**
- **Common problems that affect sprinkler performance & NFPA 13 requirements**
- **Most common deficiencies (Grinnell inspections)**

// NFPA 13 & 25 Requirements For Testing, Inspecting & Maintenance

// A little About Fire Sprinkler Systems

// The NFPA codes we use are:

// NFPA 13 – Standard For Design & Installation Of New Sprinkler Systems and renovations

// NFPA 25 – Standard For The Inspection, Testing & Maintenance Of Water Based Fire Sprinkler Systems

// National Fire Protection Association

NFPA was founded in 1896 by a group of concerned fire officials, insurance companies, sprinkler contractors (including Grinnell) industrial leaders. It started in New England where the textile mills were the primary industry. The goal of this meeting was to create an organization that would focus on the development of standards and technology for fire protection of buildings. Today it has grown to become the world's most recognized and accepted provider of fire protection and life safety codes and standards.

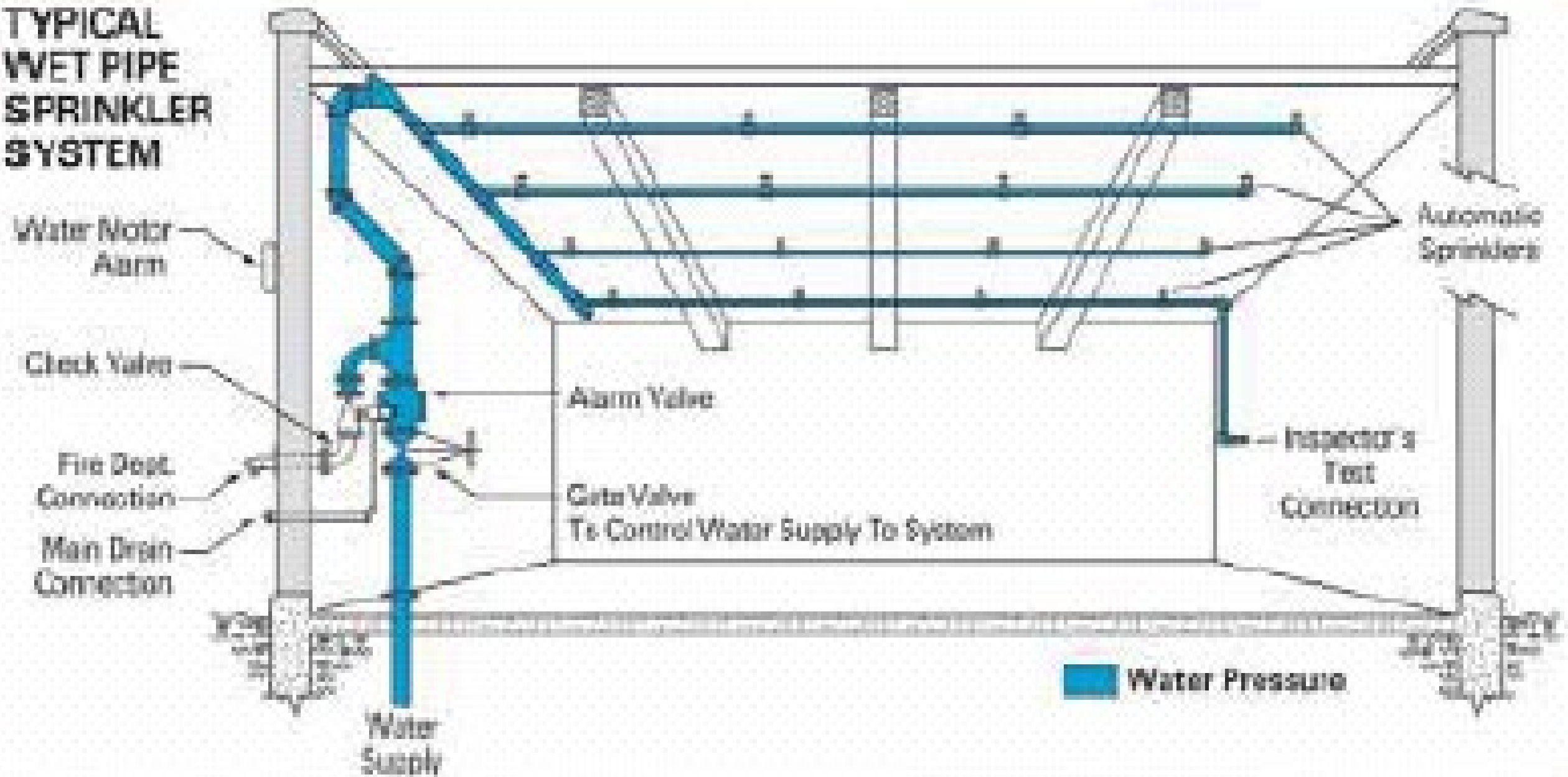


// A little about fire sprinkler systems

Fire Sprinklers 101 Review

// Fire Sprinkler System Types Wet Pipe

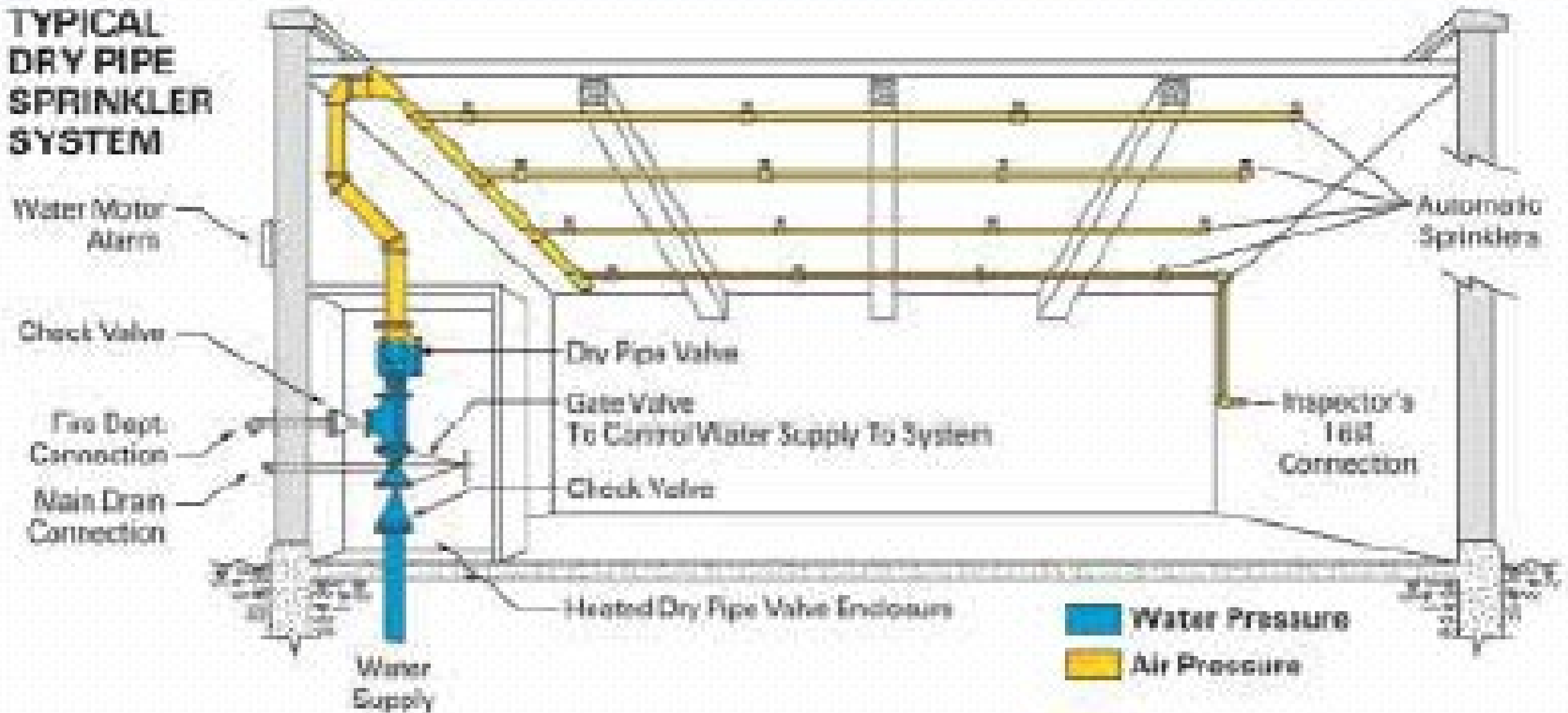
TYPICAL WET PIPE SPRINKLER SYSTEM





Fire Sprinkler System Types Dry Pipe

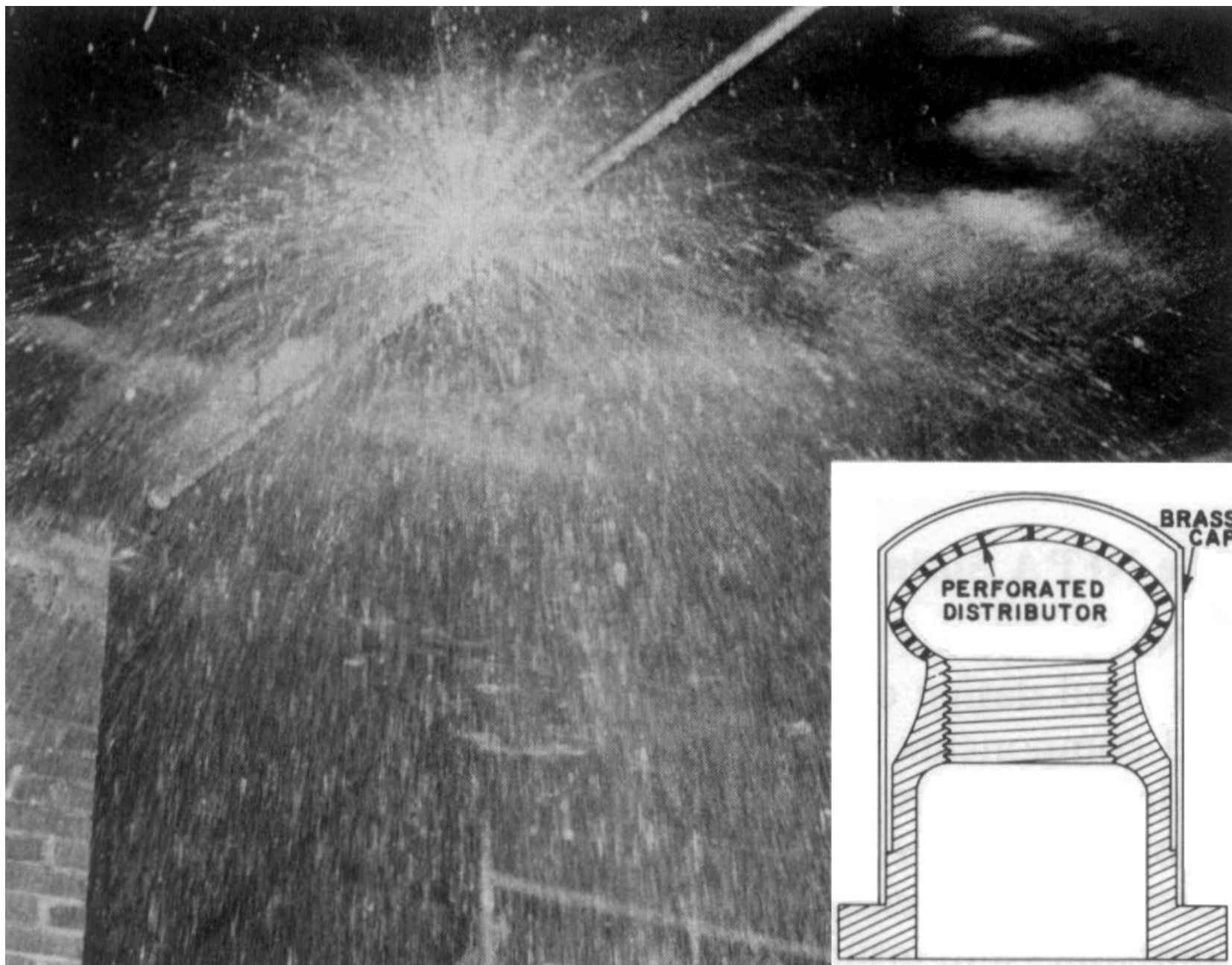
TYPICAL DRY PIPE SPRINKLER SYSTEM





Why install fire sprinklers?

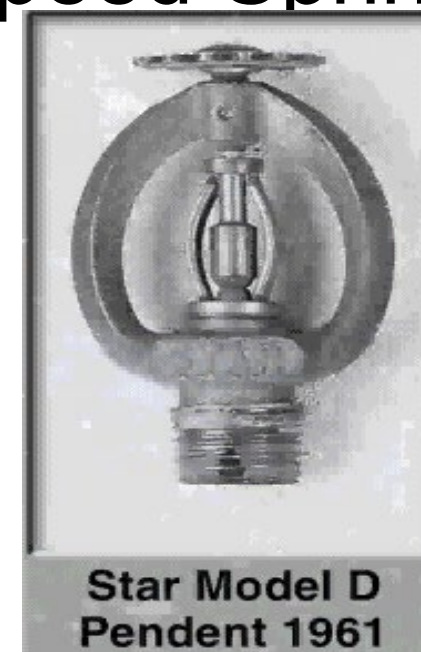
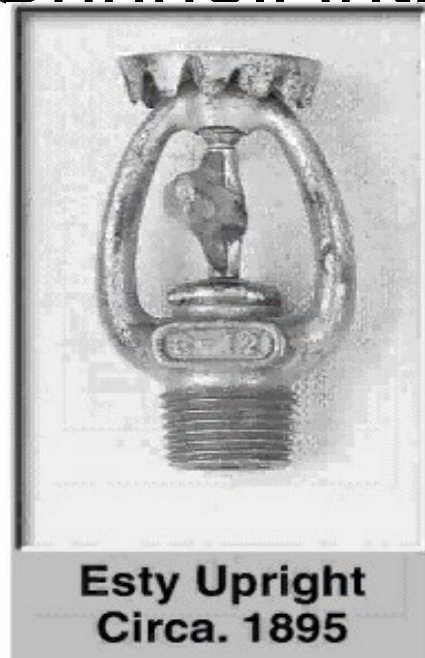
Following several fires with large losses of life
Coconut Grove Nightclub, Boston, 1942 - 492 dead,
LaSalle Hotel, Chicago, 1946 - 61 dead,
Winecoff Hotel, Atlanta, 1946 - 119 dead,
fire and building officials searched for a means to provide life
safety for building occupants. They found that factories and other
buildings equipped with automatic sprinklers have an amazingly
good life safety record compared with similar un-sprinklered
buildings...the chance of dying in a nonsprinklered building is 400
times greater than that in a sprinklered building. Sprinklers
dramatically reduce the heat and smoke from a fire, enabling the
occupants to safely escape. In fact, according to the National Fire
Protection Association (NFPA), except for explosions, flash fires,
and firefighter deaths, there has never been a documented loss of
life in a building fully protected by a properly designed and
maintained sprinklered building.



On August 11, 1874, U.S. patent No. 154,076 was obtained by Henry S. Parmelee of New Haven, Connecticut. This was a perforated head containing a valve that was held closed against water pressure by a heavy spring made of low fusing material.

Engineering Firsts for TFP Companies

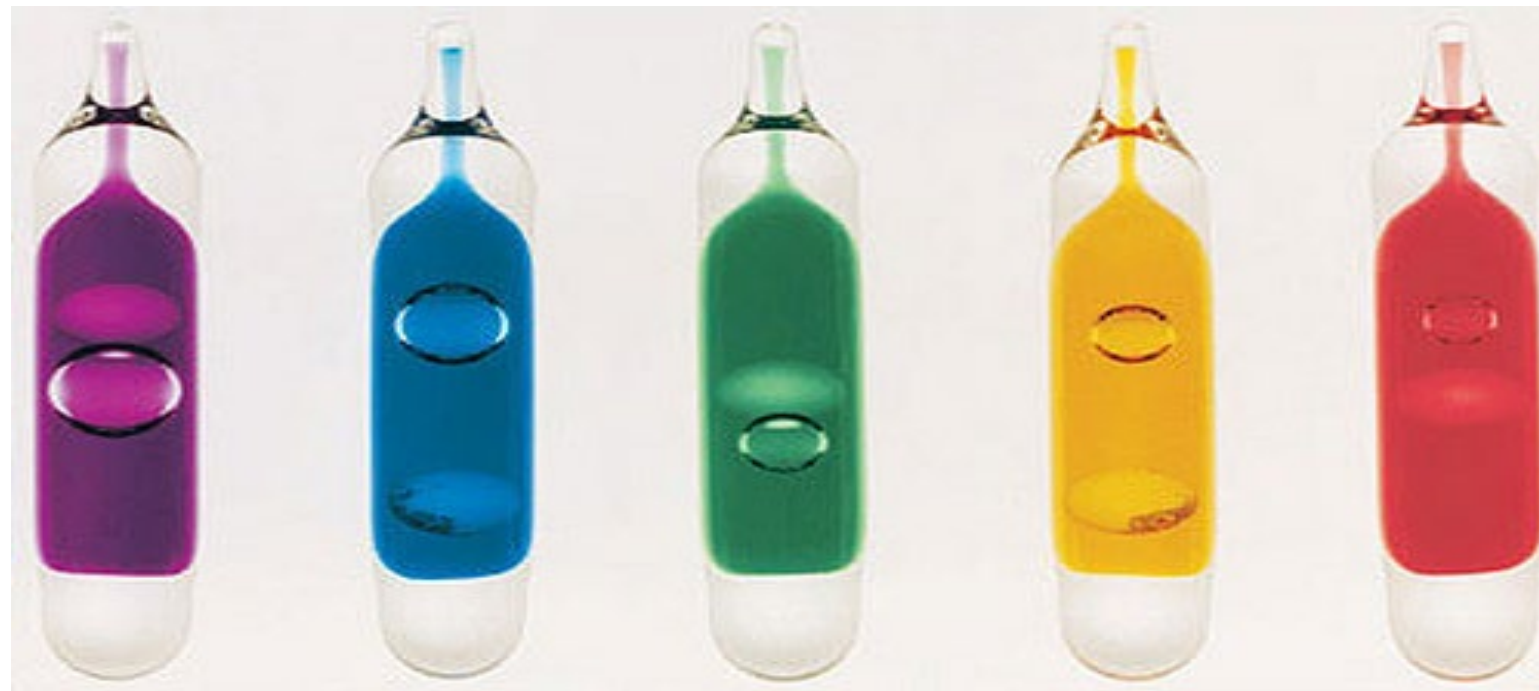
- 1879 – Grinnell patents first system valve
- 1881 – Frederick Grinnell creates first sensitive sprinkler
- 1890 – Grinnell creates first differential dry pipe valve
- 1896 – Grinnell creates first pipe schedule system (*Tree*)
- 1933 – Grinnell introduces Duraspeed Sprinkler



// Today's Modern Sprinkler Heads

The glass bulb has been filled with a special liquid that acts on the principle of thermal expansion. As temperature rises the fluid tries to rise as in a thermometer, however with limited space to rise the pressure will soon be too high and the glass bulb will burst.

135–170 red, 175–225 yellow or green, 250–300 blue, 325–375 purple



// Other Modern Sprinkler Heads

- **Standard Exposed**

- Upright , Pendant, Sidewall

- **Ceiling Type Sprinklers**

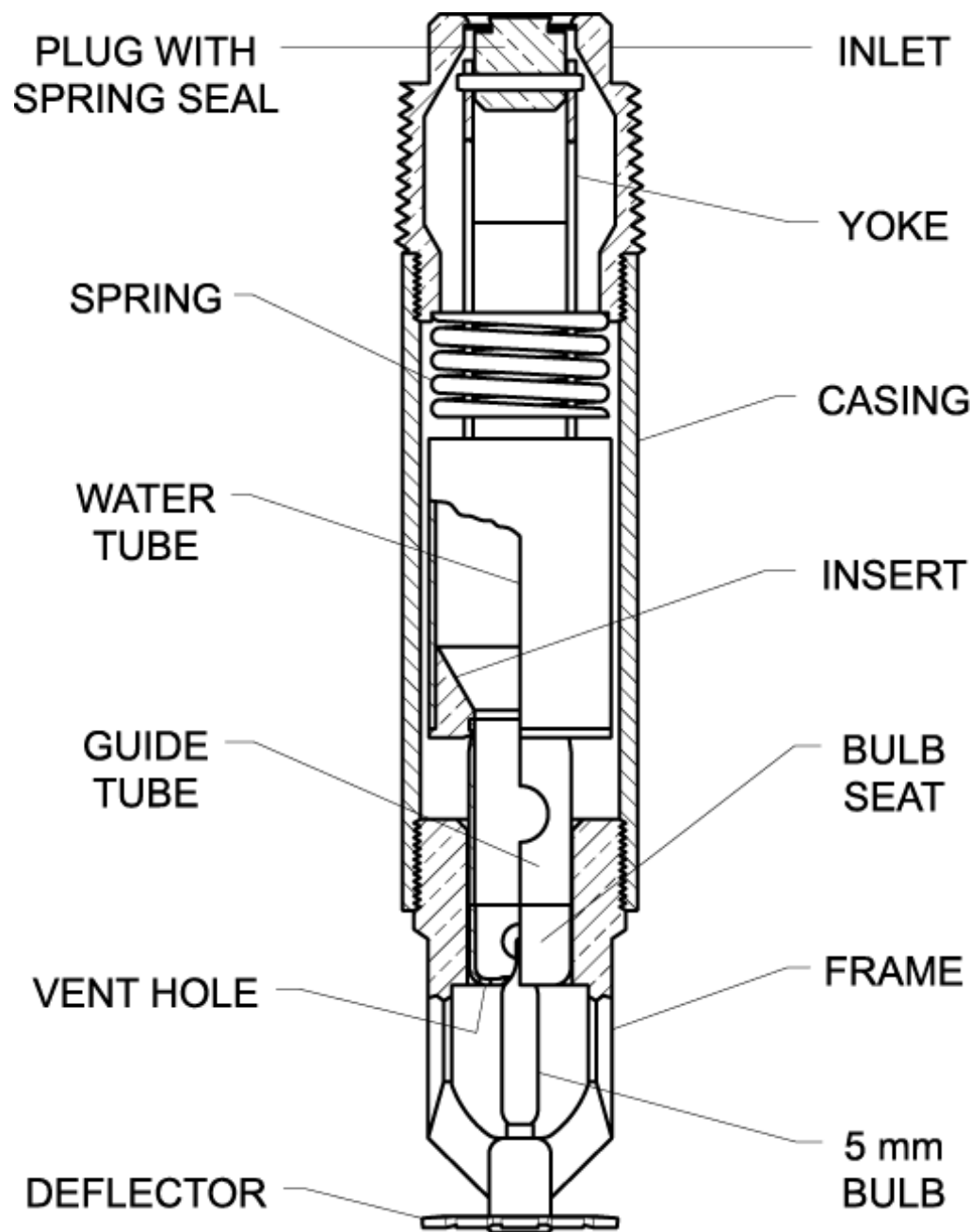
- Semi Recessed and Concealed

- **Extended Coverage**

- Can Be Exposed, Semi Recessed or Concealed
- Allows for Greater Spacing Based on Manufacturer Tests



// Dry Type Sprinkler Head



When Dry-Type Sprinklers are in service, water is prevented from entering the assembly by the Plug with Sealing Assembly in the Inlet of the Sprinkler. The glass bulb contains a fluid that expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass bulb, and the Bulb Seat is released.

The compressed Spring is then able to expand and push the Water Tube as well as the Guide Tube outward. This action simultaneously pulls inward on the Yoke, withdrawing the Plug with Sealing Assembly from the Inlet, allowing the sprinkler to activate and flow water.

// NFPA 13 Quick Response/ Standard Response

- // When Quick Response [QR] sprinklers are installed, all sprinklers within that compartment must also be QR [8.3.3.2 and 8.3.3.4 and 11.2.3.2.3.4]

The intent is to have consistent sensitivity so sprinklers can operate as intended without skipping occurring between heads. Also, a hydraulic issue could be created if the area of operation was decreased as allowed when using QR sprinklers

// Standard and Quick Response Sprinkler Heads



Standard-response 5
mm bulb



Pendent Type

Fast-response 3
mm bulb



“Myths, Misinformation, & Reality”

// Ø: Can sprinklers discharge accidentally?

- Loss records of Factory Mutual Research indicate that the probability of a standard response spray sprinkler discharging accidentally due to a manufacturing defect is only 1 in 16,000,000 sprinklers per year in service.



Ø: If One Fire Sprinkler Goes Off,
They All Go Off!

- **WRONG... Fire Sprinklers are manufactured to react to temperatures in each room individually. Normally, only the fire sprinkler nearest the fire will activate.**
- **Data shows that in residential fire scenarios, usually a single fire sprinkler will control a developing fire.**

01



02



03

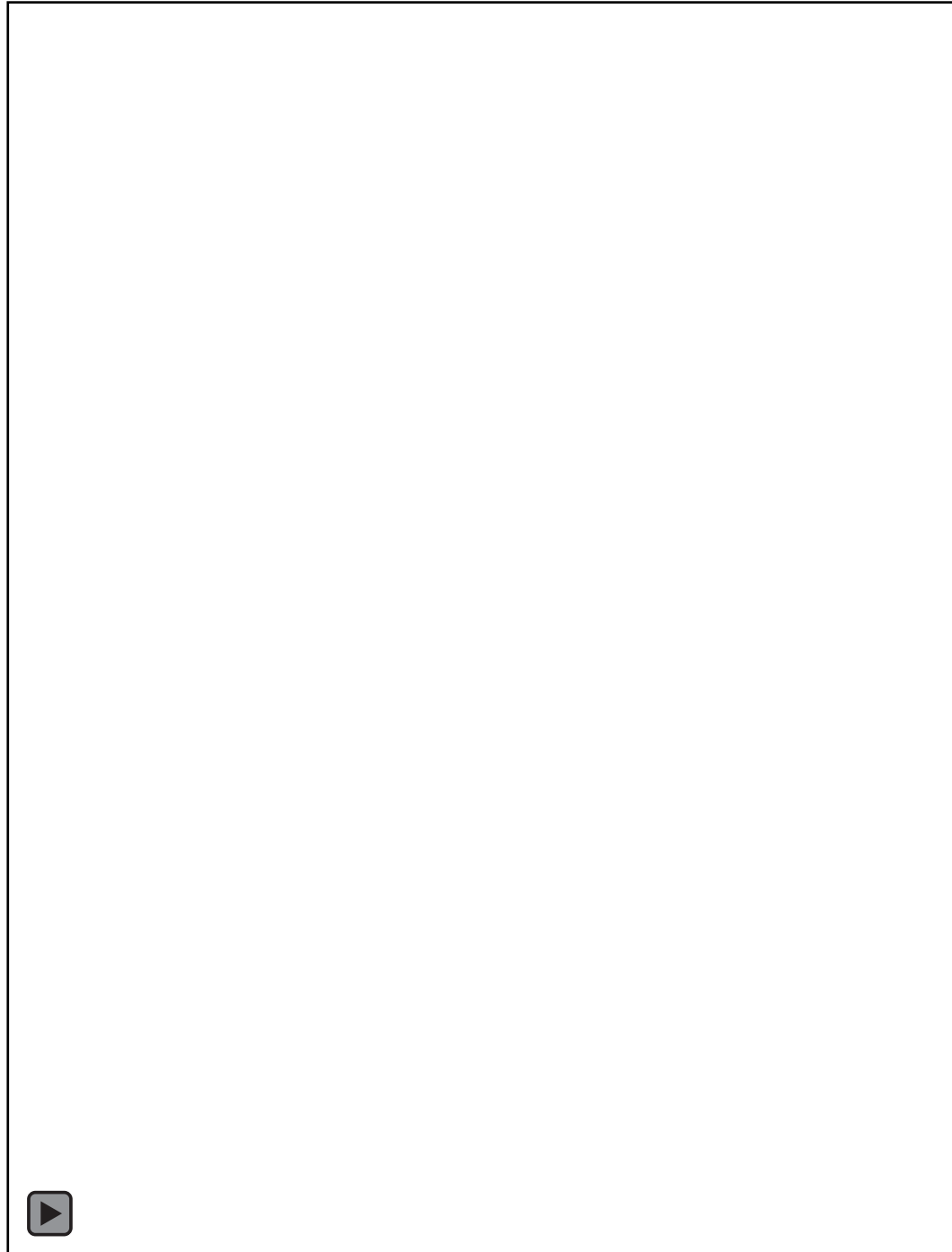


04





Sprinklers react individually to heat



// Fire Sprinklers Save Lives and Money

- For decades, automatic fire sprinklers have maintained an impressive 97+% effectiveness in controlling fires. However, each year 80% of our nation's fire deaths occur in residential settings.
- The victims are generally seniors and children.
- The truth is 2 or less fire sprinklers control over 90% of fires in residential buildings.



Sprinkler Pipe Bursts



Sprinkler Pipe Bursts

- Most likely causes
 - **Wet Systems**
 - Insufficient heat where pipe is located
 - Inadequate insulation above wet piping
 - Antifreeze solution mixture incorrect/compromised
 - **Dry Systems**
 - Accidental trip not detected
 - Low point drains not maintained
 - Improper pipe pitch and trapped water



Freeze Ups and Pipe Bursts

How winter impacts your sprinkler system:

Frozen water in your piping can cause fittings and/or sprinklers to break. As temperatures rise, frozen water melts and begins flowing through the broken sections of piping and fittings, possibly leading to water-damage problems. If air compressors are not working properly, or if the amount of priming water required for dry systems is not correct, you can experience false trips of the system. This can result in water flowing into the piping when there is no fire. If the water happens to flow into cold temperature pipes, it will quickly freeze, causing additional piping and fittings damage. Clearly, these are winter weather problems that you want to avoid.





Low-points/ Drum drip Drains

Low-points should be drained thoroughly before cold weather and after any system trip.

More frequent draining might be needed depending on condensation build up.





Causes To Shut Down The Sprinkler System

Other than fire there are three major reasons to shut down a sprinkler system. We will only be discussing the three major reason:

1. Corrosion and Pipe Leaks.
2. Freeze Ups and Pipe Bursts.
3. Testing, Maintenance, & Upgrades



Corrosion and Pipe Leaks

Any time water, oxygen and steel are combined it results in a corrosion reaction. Minimizing trapped water and excess oxygen in dry pipe systems and minimizing trapped air in wet pipe systems can extend the life of the sprinkler system. This can be done by regularly doing pitch checks on dry systems and installing air vents on wet systems.



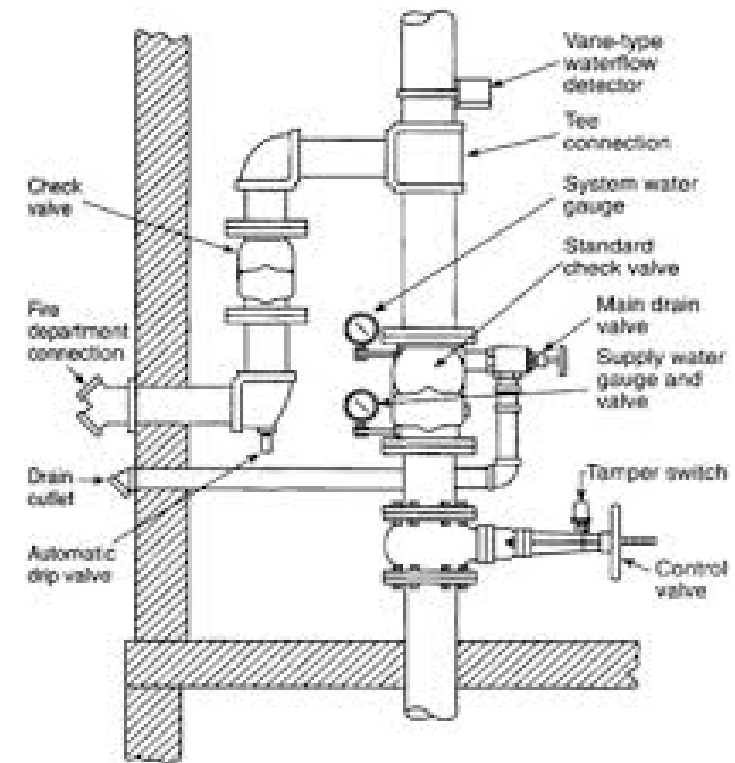


Sprinkler System Shut Down

Step one: Locate the sprinkler riser and main control valve.

Step two: Close the main control valve (all sprinkler control valves are indication open or closed).

Step three: Open the system main drain.





“Owner Requirements for Maintaining Sprinkler Systems”



NFPA 25 Sprinkler System Inspection, Testing, and Maintenance

//NFPA 25 Scope & Purpose

1.1* Scope. This document establishes the minimum requirements for the periodic inspection, testing, and maintenance of water-based fire protection systems, including land-based and marine applications.

1.1.3 This standard addresses the operating condition of fire protection systems as well as impairment handling and reporting and applies to fire protection systems that have been properly installed in accordance with generally accepted practice.

1.1.3.1* This standard does not require the inspector to verify the adequacy of the design of the system.

1.2* Purpose.

1.2.1 The purpose of this document is to provide requirements that ensure a reasonable degree of protection for life and property from fire through minimum inspection, testing, and maintenance methods for water-based fire protection systems.

// What does NFPA 25 say about maintaining Sprinkler Systems

- **4.1.2.3** Inspection tasks shall be performed by personnel who have developed competence through training and experience [Nicet Trained ?] "***National Institute for Certification in Engineering Technologies***"
- **4.1.4** The owner or occupant shall promptly correct or repair deficiencies, damaged parts, or impairments.
- **4.1.4.1** Corrections and repairs shall be performed by qualified maintenance personnel or a qualified contractor
- **4.3.1** Records of inspections, tests, and maintenance shall be made available to the AHJ upon request.

//NFPA 25 Sprinkler System Inspection, Testing, and Maintenance Requirements

- **4.1.1** The owner or occupant shall provide ready accessibility to all components
- **4.1.2** The responsibility for maintaining the system is the building owner [where the owner is not the occupant they may pass this responsibility on to the occupant by written agreement [4.1.2.4]
- **4.1.2.2** Inspection, testing, and maintenance shall be implemented in accordance with procedures meeting or **exceeding** those established in this document.



NFPA 25 Sprinklers

- **5.2.1.1* Sprinklers shall be inspected from the floor level annually.**
- **5.2.1.1.1** Sprinklers shall not show signs of leakage; shall be free of corrosion, foreign materials, paint, and physical damage; and shall be installed in the proper orientation (e.g., upright, pendent, or sidewall).
- **5.2.1.1.2 Any sprinkler shall be replaced that has signs of leakage; is painted, corroded, damaged, or loaded; or in the improper orientation.**
- **A.5.2.1.1** The conditions described in this section can have a detrimental effect on the performance of sprinklers by affecting water distribution patterns, insulating thermal elements, delaying operation, or otherwise rendering the sprinkler inoperable or ineffectual.
- **Severely loaded or corroded sprinklers should be rejected as part of the visual inspection.** Such sprinklers could be affected in their distribution or other performance characteristics not addressed by routine sample testing. **Lightly loaded or corroded sprinklers could be permitted for continued use if samples are selected for testing based on worst-case conditions and the samples successfully pass the tests.**

// NFPA 25 Sprinkler Head Inspection

5.3.1.1.1.3* Sprinklers manufactured using fast-response elements that have been in service for 20 years shall be replaced, or representative samples shall be tested and then retested at 10-year intervals.

5.3.1.1.1.6* Dry sprinklers that have been in service for 10 years shall be replaced or representative samples shall be tested and then retested at 10-year intervals.

5.3.1.1.1 Where sprinklers have been in service for 50 years, they shall be replaced or representative samples from one or more sample areas shall be tested.

// NFPA 25 Sprinkler Head Inspection

// **5.3 Testing.**

// **5.3.1* Sprinklers.**

// **5.3.1.1*** Where required by this section, sample sprinklers shall be submitted to a recognized testing laboratory acceptable to the authority having jurisdiction for field service testing.

// **5.3.1.3** Where one sprinkler within a representative sample fails to meet the test requirement, all sprinklers within the area represented by that sample shall be replaced.



NFPA 25 Loaded Sprinkler Heads

- The 2008 edition of NFPA 25 now includes:
“Sprinklers that are loaded with some type of contaminant such as dirt, dust, grease, or paint must be replaced. However, sprinklers that have a light coating of dust do not need to be replaced as long as they are cleaned by a blast of compressed air or by having a vacuum (provided that the vacuumed attachments do not touch the sprinkler, to avoid potential damage or weakening of the glass bulb or link). On the other hand sprinklers that require wiping or scrubbing or detergents or solvents to remove contaminants must be replaced.”



NFPA 25 Sprinkler Head Inspection



// NFPA 13 Spare Sprinkler Heads

6.2.9.1* A supply of at least six spare sprinklers (never fewer than six) shall be maintained on the premises so that any sprinklers that have operated or been damaged in any way can be promptly replaced.

6.2.9.2 The sprinklers shall correspond to the types and temperature ratings of the sprinklers in the property.

6.2.9.4 Where dry sprinklers of different lengths are installed, spare dry sprinklers shall not be required, provided that a means of returning the system to service is furnished.

// NFPA 13 Spare Sprinkler Heads

6.2.9.5 The stock of spare sprinklers shall include all types and ratings installed and shall be as follows:

- (1) For protected facilities having under 300 sprinklers — no fewer than six sprinklers**
- (2) For protected facilities having 300 to 1000 sprinklers — no fewer than 12 sprinklers**
- (3) For protected facilities having over 1000 sprinklers — no fewer than 24 sprinklers**

6.2.9.6* One sprinkler wrench as specified by the sprinkler manufacturer shall be provided in the cabinet for each type of sprinkler installed to be used for the removal and installation of sprinklers in the system.

5.3.2* Gauges.

5.3.2.1 Gauges shall be replaced every 5 years or tested every 5 years by comparison with a calibrated gauge.

5.3.2.2 Gauges not accurate to within 3 percent of the full scale shall be recalibrated or replaced.



CODE REQUIREMENTS FOR VISUAL INSPECTIONS

MCPD-1-278134-



CODE REQUIREMENTS FOR FUNCTIONAL TESTING

A photograph of a red fire pump assembly. The pump is a large, red, cylindrical unit with various pipes and valves connected to it. A pressure gauge is visible on the left side of the pump. The assembly is mounted on a white surface.



Backflow Preventors

- Shall be tested ***annually*** at the designed flow rate of the fire protection system, including hose stream demands, if appropriate, and the friction loss across the device shall be measured
- **Per NFPA 25**
- **Certified Technician**
- **Two types are double check or reduced pressure**
- **Often equipped with a water meter**





“Periodic Maintenance Requirements”

// Obstruction Investigation and Prevention

13.2.1 An investigation of piping and branch line conditions shall be conducted every 5 years by opening a flushing connection at the end of one main and by removing a sprinkler toward the end of one branch line for the purpose of investigating for the presence of foreign organic and inorganic material.

// Obstruction Investigation and Prevention

- **13.2.3.2** Internal inspections shall be accomplished by examining the interior of the following four points:
 - (1) System valve
 - (2) Riser
 - (3) Cross main
 - (4) Branch line
- **13.2.4*** If an obstruction investigation carried out in accordance with **13.2.1** indicates the presence of sufficient material to obstruct sprinklers, a complete flushing program shall be conducted by qualified personnel.



NFPA 25 Flushing Program

Tests should include flows through 2½ in. (65 mm) fire hose directly from cross mains [see Figure D.3.2(a) and Figure D.3.2(b)] and flows through 1½ in. (40 mm) hose from representative branch lines. Two or three branch lines per system is a representative number of branch lines where investigating for scale accumulation. If significant scale is found, investigation of additional branch lines is warranted. Where investigating for foreign material (other than scale), the number of branch lines needed for representative sampling is dependent on the source and characteristic of the foreign material. If provided, fire pumps should be operated for the large line flows, since maximum flow is desirable. Burlap bags should be used to collect dislodged material as is done in the investigation of yard mains. Each flow should be continued until the water clears (i.e., a minimum of 2 to 3 minutes at full flow for sprinkler mains). This is likely to be sufficient to indicate the condition of the piping interior.



NFPA 25 Obstruction Sources

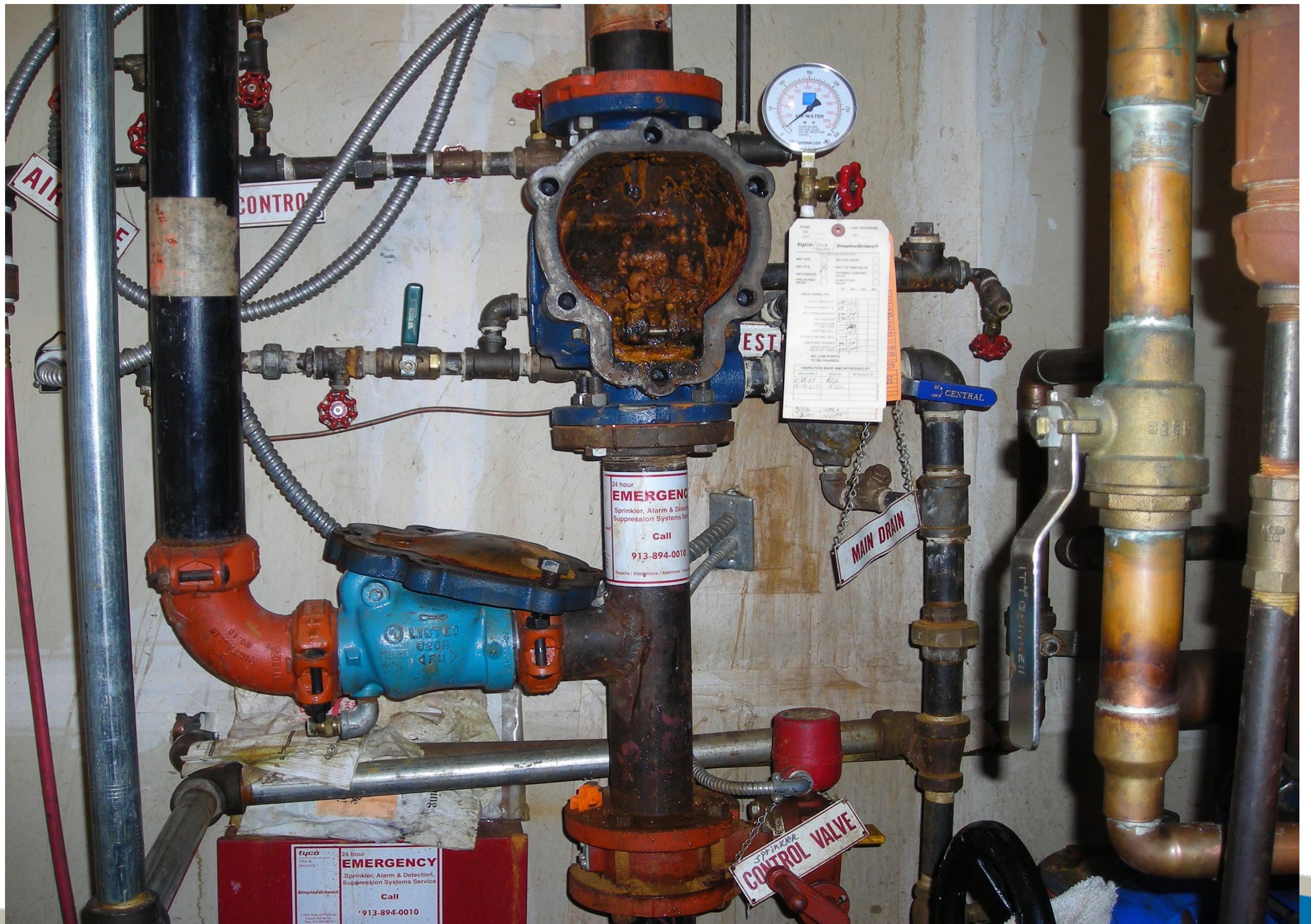
- **D.2.1 Pipe Scale**
- **D.2.2 Careless Installation or Repair.**
- **D.2.3 Raw Water Sources.**
- **D.2.4 Biological Growth.**
- **D.2.5 Sprinkler Calcium Carbonate Deposits.**



Sprinkler Corrosion and Microbiologically Influenced Corrosion (MIC)









“Common Problems Affecting Sprinkler Systems & NFPA 13 requirements”

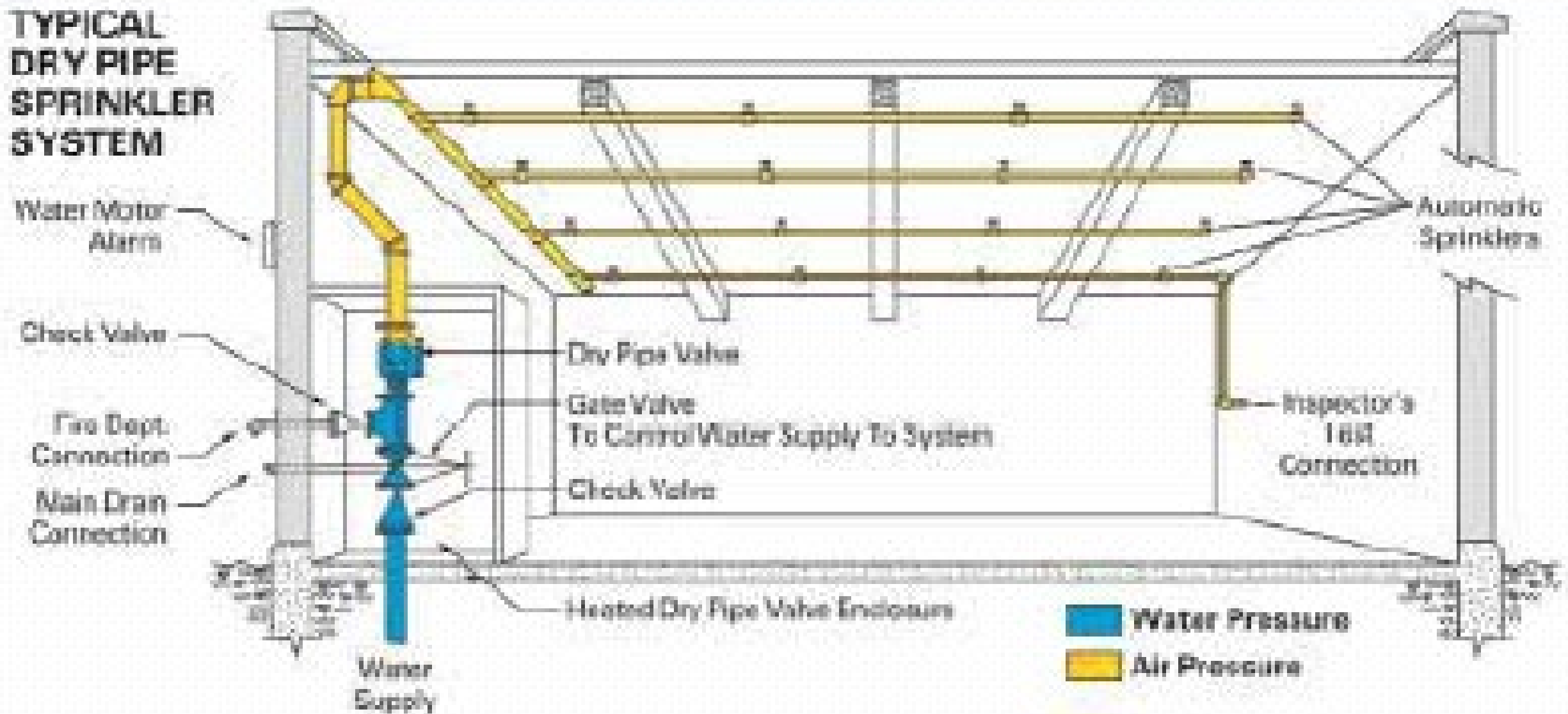


NFPA 13 Dry Systems

- // **Dry pipe systems must be pitched properly for drainage purposes. (8.15.2.3)**
- // **If piping does not slope sufficiently enough, it could accumulate water and freeze. In addition, the low points of the system must be properly maintained when portions of the system are trapped.**

Fire Sprinkler System Types

TYPICAL DRY PIPE SPRINKLER SYSTEM





Most Common Sprinkler Systems Deficiencies”

// Common Sprinkler Deficiencies

- **From SimplexGrinnell Inspection Reports**
 - Internal Obstruction Investigations
 - Systems Obstructed With Organic/ Inorganic Materials
 - Missing Fire Department Caps
 - Spare Heads/ Wrench Needed In Head Box
 - Dry pendent sprinkler heads over 10 years old
 - Backflow Preventer Failed Inspection
 - Corroded, Loaded, Painted and Damaged Sprinkler Heads
 - Escutcheon plates missing



Questions?

Thank You!

Skip Johnson / Fire Sprinkler Solutions Rep / Johnson Controls Fire Protection

Mobile: [+1 816 588 9341](tel:+18165889341) / Office [913 894 0010](tel:9138940010) Option 3
[11019 Strang Line Road](https://www.google.com/maps/place/11019+Strang+Line+Road,+Lenexa,+KS+66215/@39.014722,-94.824444,15z) / Lenexa, KS 66215 / USA

LinkedIn

www.linkedin.com/in/skipjohnsonfiresprinkler/

Skip.Johnson@jci.com / [www.johnsoncontrols](https://www.johnsoncontrols.com)