

Fire Inspector Certification Program

New Jersey Uniform Fire Code Inspector Training Program

Module 10 Fire Protection Systems



1

Welcome

Instructor introduction

- Before we get started
 - Has everyone signed in?
 - Anyone have any questions?

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Fire Protection Systems

In this module we will overview...

- Fire sprinkler systems,
- Standpipe systems,
- Water supplies and testing,
- Fire pumps,
- Fire alarm systems
- System monitoring,
- Hood protection systems,
- Smoke removal systems, and
- Fire extinguishers.

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Fire Sprinkler Systems



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Purpose of a Fire Sprinkler System

Fire Control. Limiting the size of a fire by distribution of water so as to decrease the heat release rate and pre-wet adjacent combustibles, while controlling ceiling gas temperatures to avoid structural damage.

Fire Suppression. Sharply reducing the heat release rate of a fire and preventing its growth by means of direct and sufficient application of water through the fire plume to the burning fuel surface.

NFPA 13-2013

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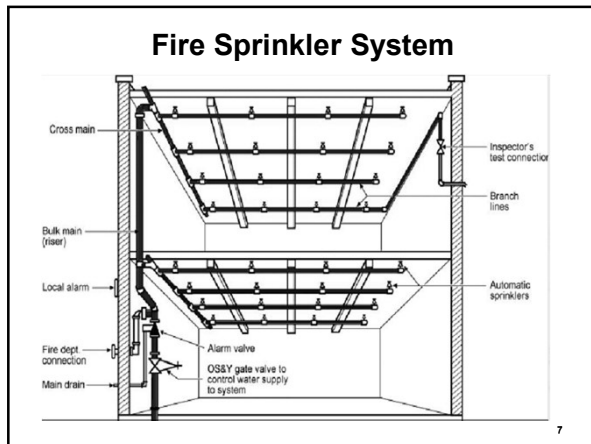
Fire Sprinkler Systems

Automatic sprinkler system:

A fire protection systems is an integrated system of underground or overhead piping designed in accordance with fire protection engineering standards. Systems include:


- A suitable water supply.
- A network of hydraulically designed piping
- Individual sprinkler heads connected in a systematic pattern.
- Designed to discharges water over the fire area.

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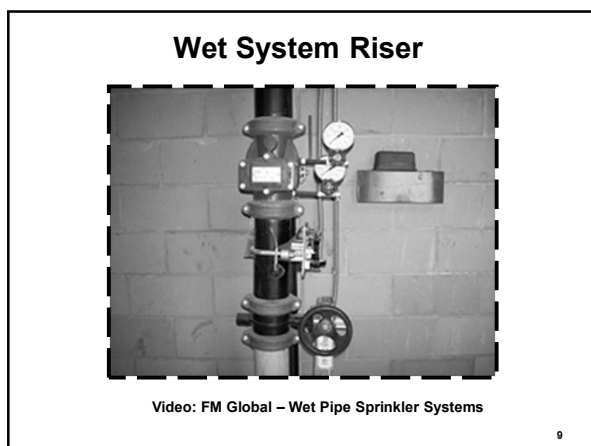


Types of Systems

- Wet Pipe system
- Dry Pipe system
- Deluge system
- Pre-action system
- Antifreeze system
- Combination Systems
- Limited Area systems

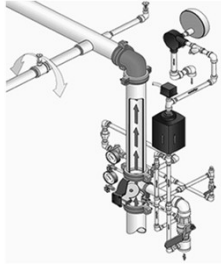


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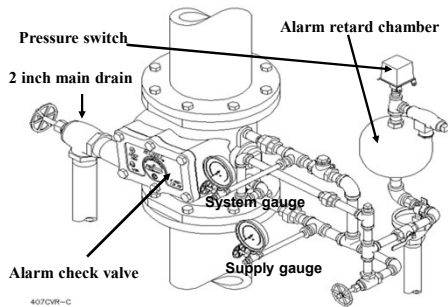
Wet Pipe Sprinkler Systems

- All pipes water filled
- Alarm Check Valve
- Fire Department connection on system side of alarm check valve if required
- Main drain above valve seat
- Retard chamber to delay water flow alarm



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Wet Pipe Sprinkler Valve



407DVR-C

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Dry Pipe Sprinkler Systems




Video: FM Global –Dry Pipe Sprinkler Systems

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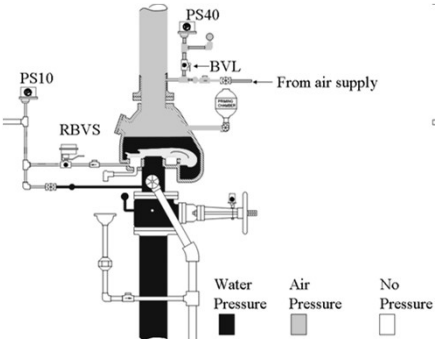
Dry Pipe Sprinkler Systems

- Pipe always dry
- 6:1 or 1:1.1 Differential
- Fire Department connection ahead of main control but below DPV
- 30% greater calculated operation area
- Not a life safety system



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Dry Pipe Sprinkler Systems

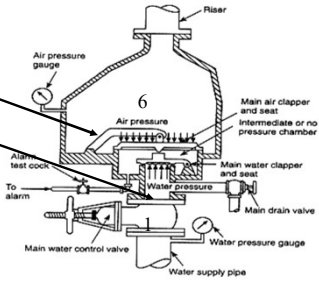


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Dry Pipe Sprinkler Systems

Bernoulli's Principle:

Pressure = Force X Area
 10psi X 60 sq. in = 600 lbs.
 Or
 60 psi X 10 sq. in = 600 lbs.



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Dry Pipe Sprinkler Systems

- Systems controlled by one dry pipe valve are limited to no more than 750 gallons per minute capacity.
- Dry pipe valves shall be provided with a listed quick-opening device where system capacity exceeds 500 gallons per minute
- The dry pipe valve and supply pipe shall be protected against freezing and mechanical injury
- Valve rooms shall be lighted and heated to 40 degrees or higher.
- The source of heat shall be of a permanently installed heating source. No heat tape.

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Dry Pipe Sprinkler Systems

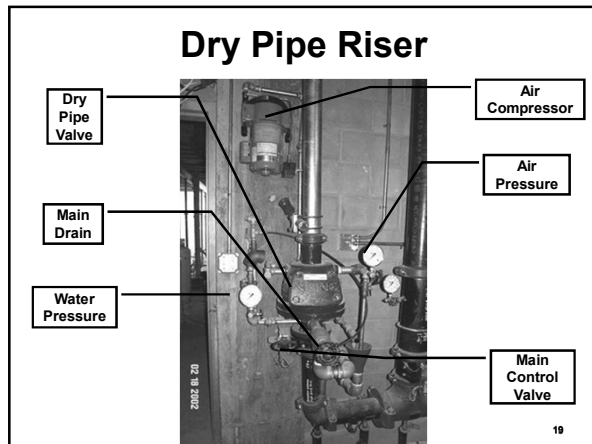
- Compressed air supply shall be available at all times and have a capacity capable of restoring the system within 30 minutes
- The system air pressure shall be maintained in accordance with the instructions furnished with the dry pipe valve, or shall be 20 psi in excess of the calculated trip pressure of the dry pipe valve,

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Dry Pipe Systems

- Check Valves
 - Where more than 275 sprinklers are required in a single fire area, the system shall be divided into sections of 275 sprinklers or less by means of check valves.
 - If the system is installed in more than one fire area or story but not more than 600 sprinklers it shall be supplied through one check valve.
 - 1¹/₄-in. (33-mm) drain on the system side of each check valve supplemented by a dry pipe system auxiliary drain

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Dry Pipe - Trim

Air Exhauster – remove air from remote end of system to atmosphere or a drain

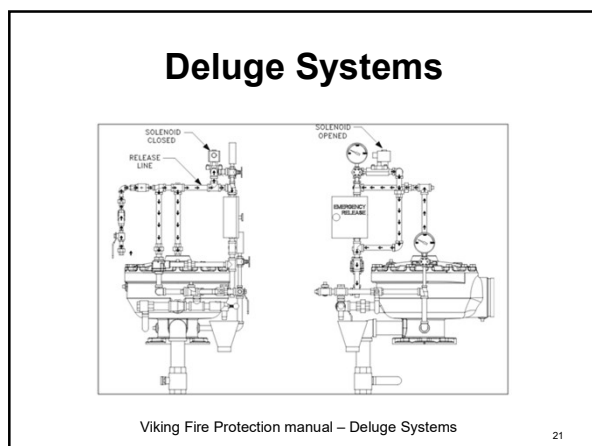
The photograph shows a vertical pipe assembly with a large, dark, circular air exhauster mounted on the side. A black arrow points from the text 'Air Exhauster' to this component.

System Size Gal. (Liters)	Quick Opening Device Required?	Required Water Delivery Time to Inspectors Test Connection
0 – 500 Gal. (0 – 1893 L)	N	None
500 – 750 Gal. (1893 – 2839 L)	Y	60 Sec
Over 750 Gal. (2839 L)	N	60 Sec

Table 2 - Summary of NFPA 13 Requirements

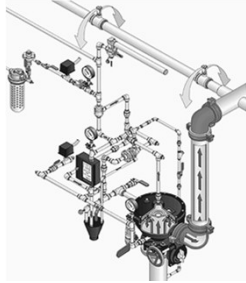
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Viking Fire Protection manual – Deluge Systems



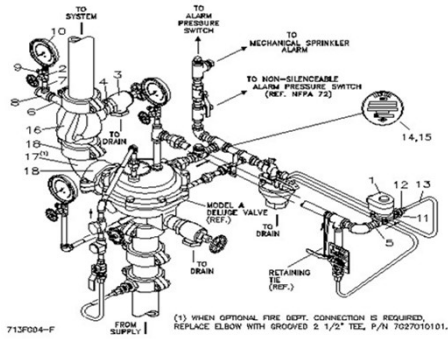
Deluge Sprinkler Systems

- All heads are open
- Large water supply required
- usually protects small spaces
- Requires detection system interface
- Used in aircraft hangers - NFPA 409



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Deluge Valve



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Deluge System in Operation



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Pre- Action Sprinkler Systems



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Pre Action Sprinkler System

- Water supply operates independent of sprinklers
- Requires fire detection interface
- Faster operation than Dry system
- Non-freezing
- May not exceed 1000 sprinkler heads



Video: Pre -Action systems

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Single Interlock System

- Water reaches sprinkler head before the head fuses
 - Computer room
 - Telecommunications center
 - Museums
 - Libraries
 - Elevators



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Double Interlock Systems

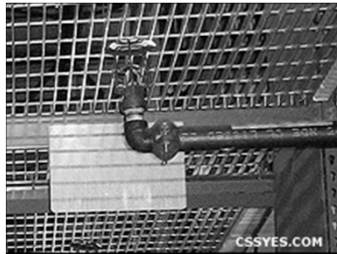
- Double interlock includes a dry pipe or check valve, both systems must operate to attain water at sprinkler head
- Used in non- heated applications such as cold storage or freezers.



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Special Application Sprinkler Systems

- Limited Area
- Foam Sprinklers
- Anti Freeze
- ESFR Systems



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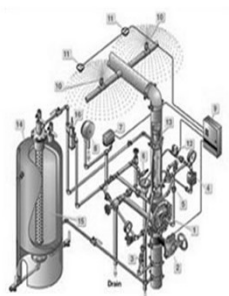

Limited Area Sprinklers

- 20 heads or less connected to domestic water
- No alarms
- No control valve unless supervised
- Must be hydraulically calculated
- No more than 6 heads in a fire area



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Foam Sprinkler Systems:





- **Protect:**
 - Class B Flammable liquids
 - Rack dispensing
 - Storage facilities
- **Agent:**
 - AFFF
 - AR-AFFF
 - FFFP

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Foam Sprinkler Systems

- May be wet, dry, deluge or pre-action
- **Requires:**
 - *Proportioner*
 - *Foam tank*
 - *Specialized sprinkler heads*

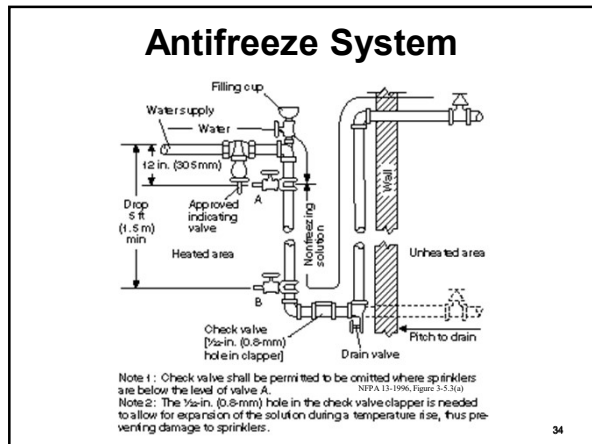


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Foam Sprinklers Operating



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Early Suppression Fast Response

- Developed in 1980
- Fast response sprinkler head
- Large flow capacity
 - 25-50gpm
 - 60-100gpm
- Ceiling ht –45 feet
- Storage ht –40 feet

Video: high piled storage test

Type of System Designs

- Pipe Schedule Systems
 - Hydraulic Designed Systems
 - Grided Systems
 - Balanced Systems
- 



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Hydraulic Nameplate



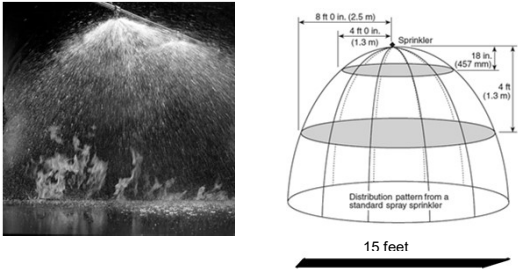
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Various System Components

- Sprinkler heads
- Branch lines
- Cross mains
- Feed mains
- Risers
- Water supply underground (*NFPA-24*)
- Fire Department connection
- Inspectors test
- Main drain



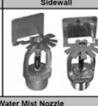
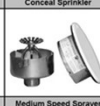






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This is the Average Sprinkler Spray pattern



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Sprinkler Heads

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Specialized Sprinkler Heads

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On-Off Sprinkler Head



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Residential QR Head



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ESFR Sprinkler



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Spare Sprinklers



NFPA 13 = minimum of 6 heads

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Sprinkler Head Activating



Video: Sprinkler Activation

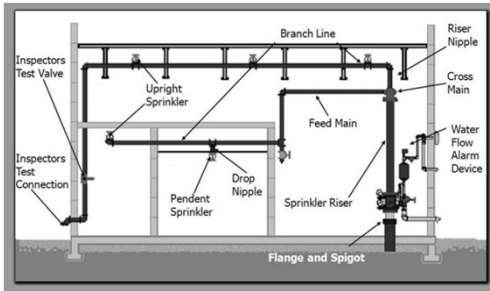
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Sprinkler Head Temperature Ratings



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Branch/Cross/Feed Mains



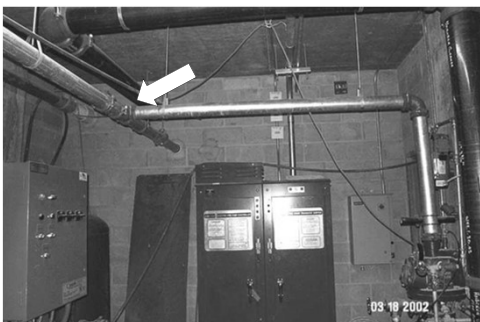
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Cross Main to Branch Line



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Feed Main to Cross Main



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Common Types of Hangers



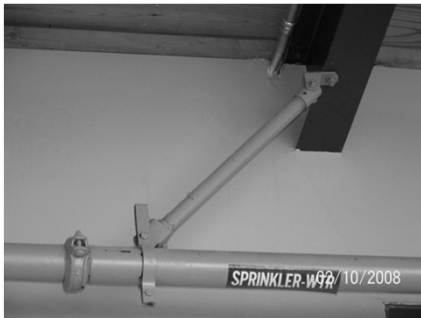
General Hanger Rules

- One hanger on each pipe section
- Hanger on Sprigs over 24 inches
- Hangers on sprigs 12 inches if over 100psi
- Lateral bracing on sprigs over 48 inches
- Flex connectors affixed to tile grid
- Limited number of bends
- Earthquake bracing based on seismic zones in building codes

NFPA 13-1996
Figure A-2-6.1

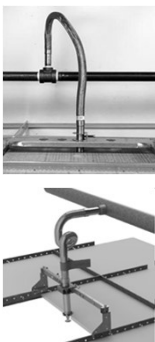
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Earthquake Bracing



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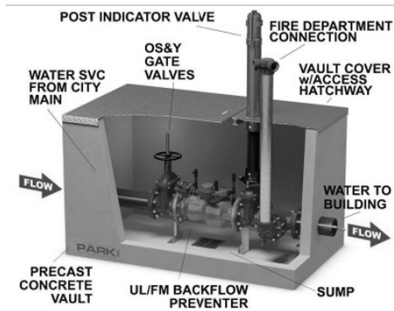
Flexible (drops) Sprigs



Generally used in 48" lengths
Each MFG. Has guidelines on
The number of bends and radius
Of bends.
These fitting also have a higher
Friction loss then schedule 40 pipe

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Supply Line & Post Indicator



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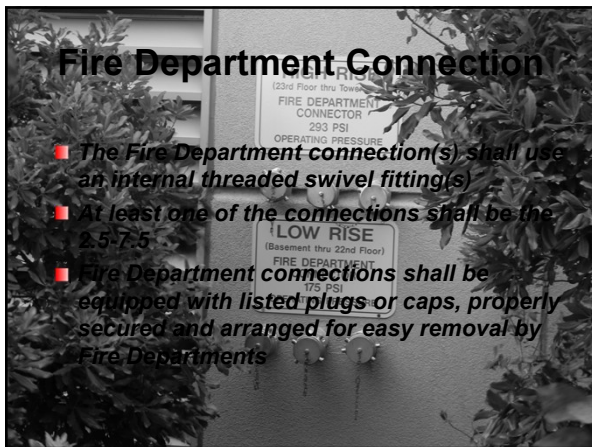
City water supply



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Fire Department Connection

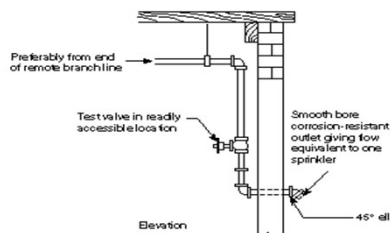
- The Fire Department connection(s) shall use an internal threaded swivel fitting(s)
- At least one of the connections shall be the 2.5-7.5
- Fire Department connections shall be equipped with listed plugs or caps, properly secured and arranged for easy removal by Fire Departments



Fire Dept Connections



Inspector's Test – Wet System

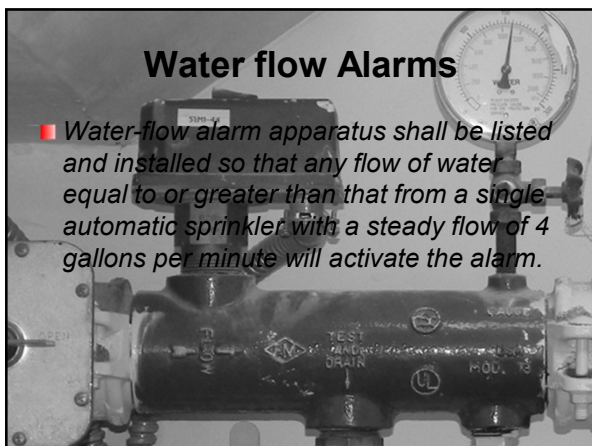


Note: Not less than 4 ft (1.2 m) of exposed test pipe in warm room beyond valve where pipe extends through wall to outside.

NFPA 13-1996, Figure A-4.15.4.2(a)

Water flow Alarms

Water-flow alarm apparatus shall be listed and installed so that any flow of water equal to or greater than that from a single automatic sprinkler with a steady flow of 4 gallons per minute will activate the alarm.



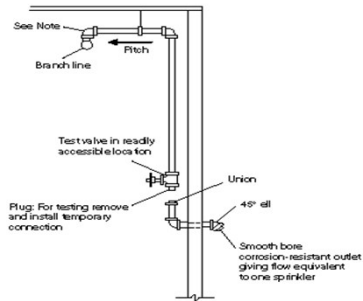
Wet System Inspectors Test

The Inspectors test connection must be located at the most remote point from the water supply and must sound the alarm within 90 seconds



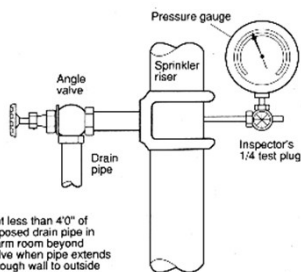
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Inspector's Test – Dry System



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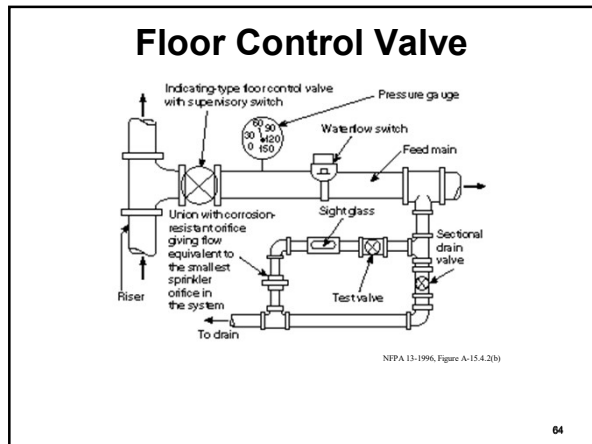
Main Drain

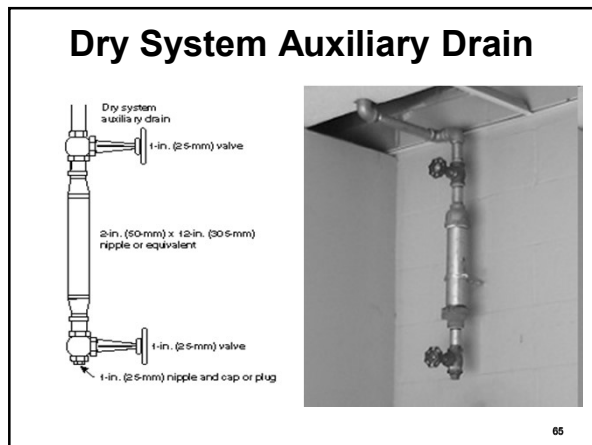


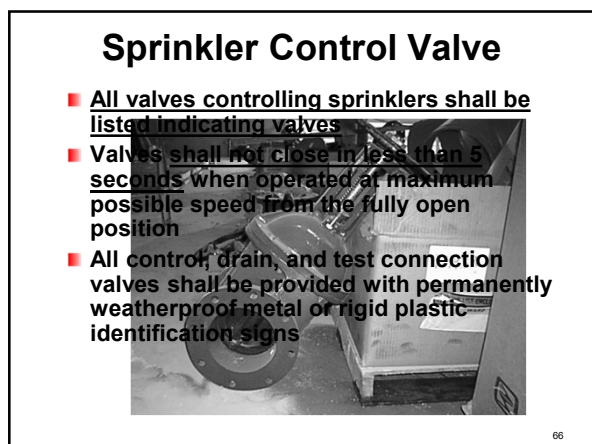
For SI Units: 1 in. = 25.4 mm; 1 ft = 0.3048 m.

NFPA 13-1996, Figure 4-14.3.4

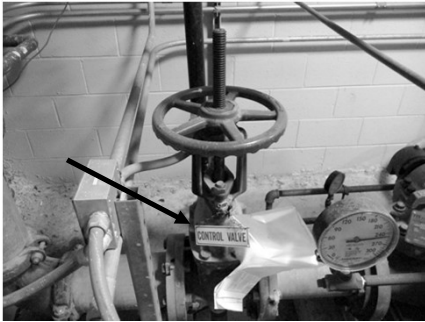
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Valve Signage



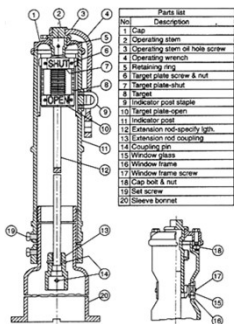
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Supply Control Valves



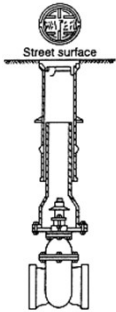
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Vertical Indicator Post Valve



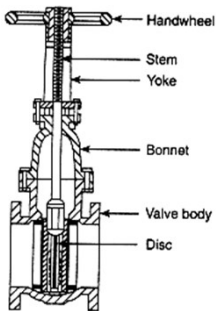
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Non-indicating type gate valve (curb box)



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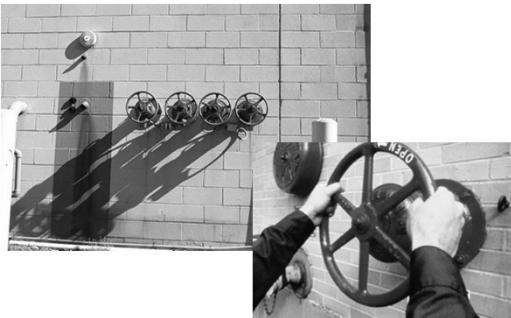
OS&Y Valve



NFPA 25-1995, Figure A-9-1(f)

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Wall Post Indicator Valves



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Water Motor Gong



NFPA 13-1996, Figure A-4-15.1.1

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Standpipe systems



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Standpipe Systems

Standpipe system:

A standpipe system is a fire protection system consisting of an arrangement of piping, valves, hose outlets and allied equipment installed in a building or structure

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Where are Standpipes Required

- NFPA-More than three stories above or one story below grade
- ICC- 30 feet above or below level of Fire Department vehicle access
- Buildings exceeding 10,000 square feet per story
- Non-sprinklered buildings exceeding 1,000 occupants of use group A
- Covered Malls, Stages, Underground buildings

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Construction & Demolition

- Standpipe required at 40 feet and shall be one level below the highest floor level containing combustibles
- Demolition The standpipe shall be maintained within one floor of the demolition



Deutsche Bank Deconstruction



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Design & Installation

- NFPA 14 "Standard for the Installation of Standpipe and Hose Systems"
 - First adopted 1915
 - Used by both NFPA 5000 and IBC
 - Complies with FM Global requirements

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Standpipes

- Three Classes of Standpipes:
 - Class I – Fire Department use only
 - Class II – Occupant hose station
 - Class III – Combination Class I & II



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Class I Standpipe Installation



Pressure Reducing Methods

Pressure reducing valve
175psi and higher

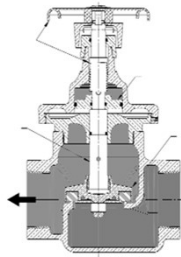


Pressure reducing device
150psi -175psi



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Non adjustable PRV



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Field Adjustable PRV

ADJUSTMENT
INSTRUCTIONS



ADJUSTMENT RODS



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Standpipe – Types



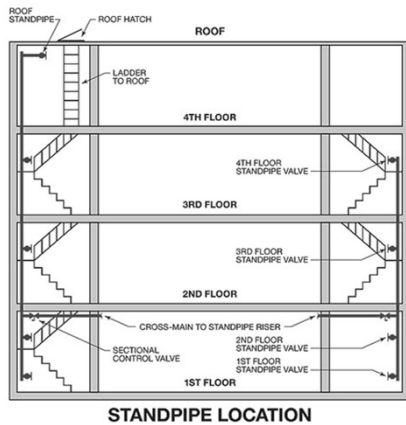
- Wet Standpipes
- Manual Standpipe
 - No water supply depends on FD pumper
- Manual Dry Standpipe
 - Water supply but lacks pressure
- Automatic Dry
 - Automatic water supply & pump
- Semi automatic Dry
 - Automatic water supply with manual control

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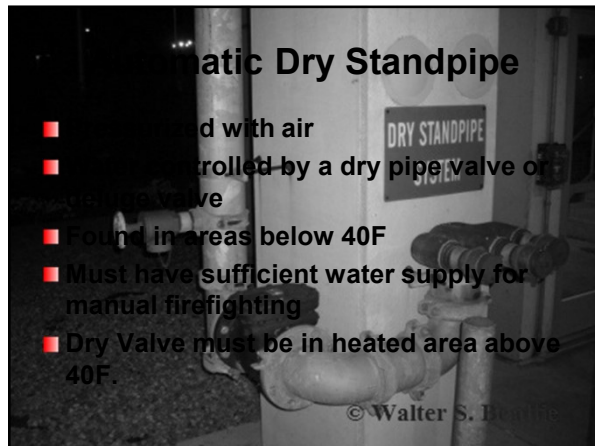
Wet Standpipe

- Automatic Dedicated Water Supply
- May have pressure maintenance pumps
- Require temperatures above 40F at all times



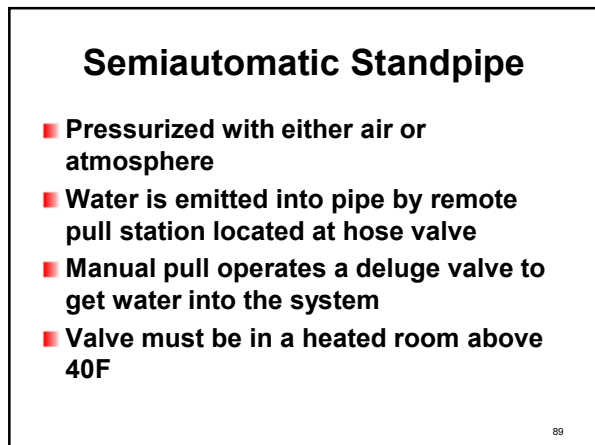


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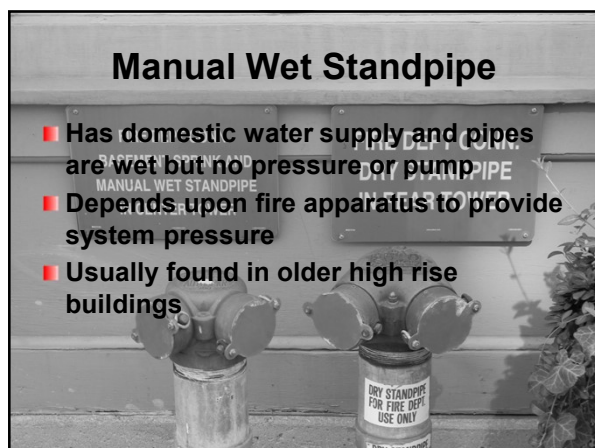
- ### Automatic Dry Standpipe
- Pressurized with air
 - Controlled by a dry pipe valve or deluge valve
 - Found in areas below 40F
 - Must have sufficient water supply for manual firefighting
 - Dry Valve must be in heated area above 40F.

© Walter S. Beattie



- ### Semiautomatic Standpipe
- Pressurized with either air or atmosphere
 - Water is emitted into pipe by remote pull station located at hose valve
 - Manual pull operates a deluge valve to get water into the system
 - Valve must be in a heated room above 40F

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- ### Manual Wet Standpipe
- Has domestic water supply and pipes are wet but no pressure or pump
 - Depends upon fire apparatus to provide system pressure
 - Usually found in older high rise buildings

Manual Dry Standpipe

- No attached water supply
- Depends upon the Fire Department to provide supply and pressure
- Usually found in parking garages
- Tampering may be a problem



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Hose Drop Close-up



- Check set test pressure
- Hose data
- Hose testing
- Tamper caps
- Nozzle
- Threads and couplings
- Access
- Station swing if designed
- Labels/signage

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Existing Structure Flow Test through Scuttle

- Sprinklered
 - 250gpm @ 65 psi
- Non sprinklered
 - 500 gpm @ 65 psi



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END PART 1

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Next Lesson

Module 10

Fire Protection Systems

Part II

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