

Student Notes:

Active Fire Protection Systems

Presented by:

Michael Gilbertie

Office of Education and Data
Management



"Active Fire Protection Systems"



"Passive" Fire Protection
Systems"

What are "passive" and "active" fire protection systems?



- Passive systems do not rely on automatic or manual operation to work.
 - Examples
 - » Fire doors
 - » Fire walls
- Active systems rely on moving parts
 - Examples
 - » Fire Sprinkler Systems
 - » Fire Detection/Alarm Systems.

Student Notes:

VIDEO



SPRINKLERS NFPA 13, 2002 EDITION



Usually only 1 or 2 sprinklers are required to control the fire.

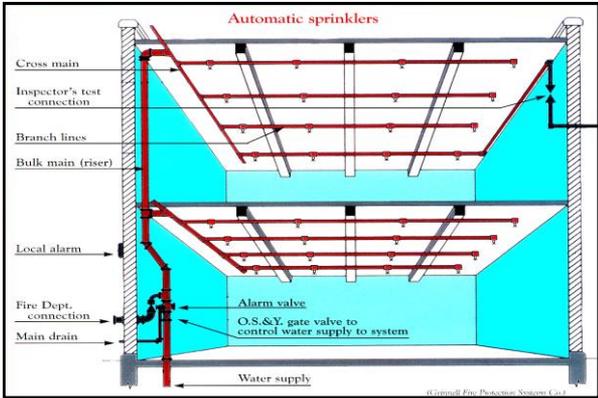
When wet pipe sprinklers operated, 88% of reported fires involved only 1 or 2 sprinklers.

For dry pipe sprinklers, 73% involved only 1 or 2 sprinklers.

System Types

1. Wet Pipe System
2. Dry Pipe System
3. Preaction System
4. Deluge System
5. Combined Dry Pipe – Preaction System
6. Anti Freeze System

Student Notes:



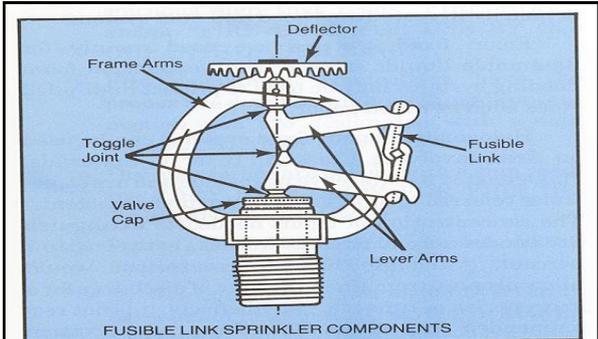
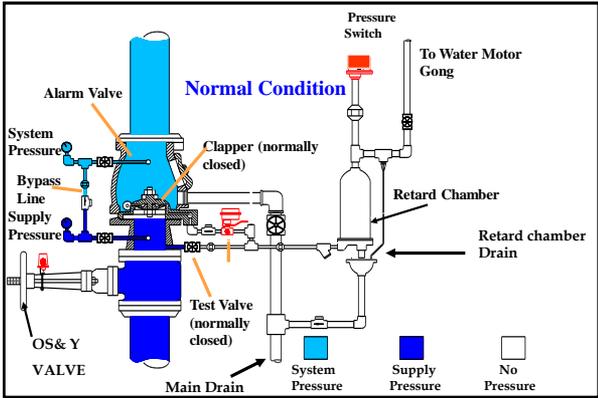
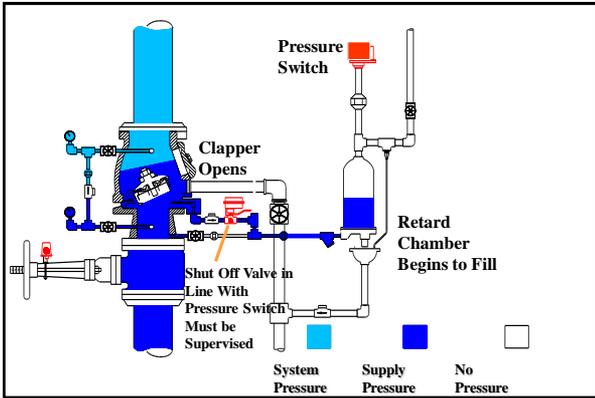


Figure 7.18 Sprinklers remain intact at normal temperatures, but fall away when the temperature exceeds the rated temperature of the sprinkler.



Student Notes:



Dry Type Sprinkler Systems

- Automatic Suppression
- Pipes pressurized with air
- Equipped with an automatic water supply
- Water is retained by a dry pipe valve
 - Air pressure holding valve closed
- Sprinkler head opens, releases air pressure causing dry pipe valve to open and water flows

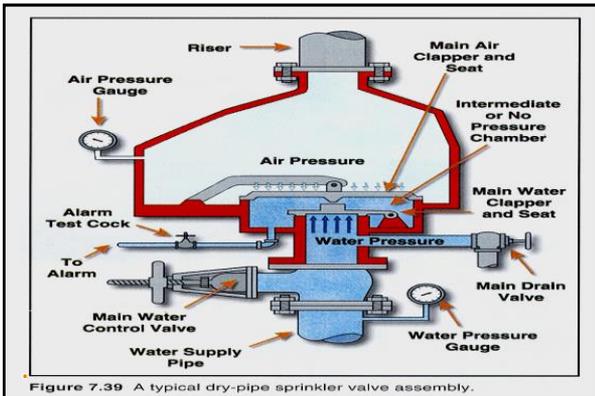


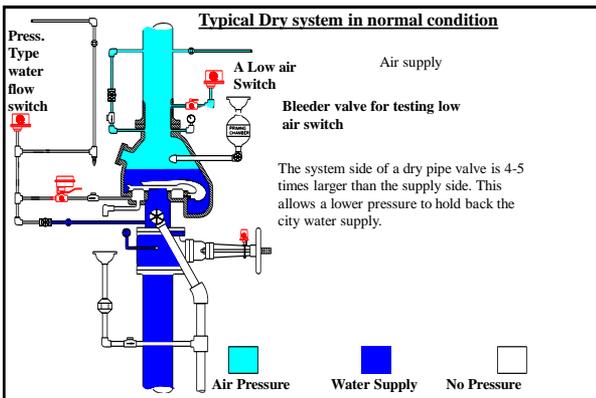
Figure 7.39 A typical dry-pipe sprinkler valve assembly.

Student Notes:

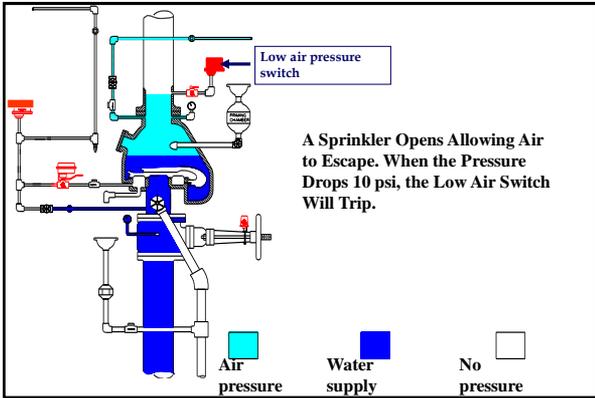
Quick Opening Devices Exhausters and Accelerators

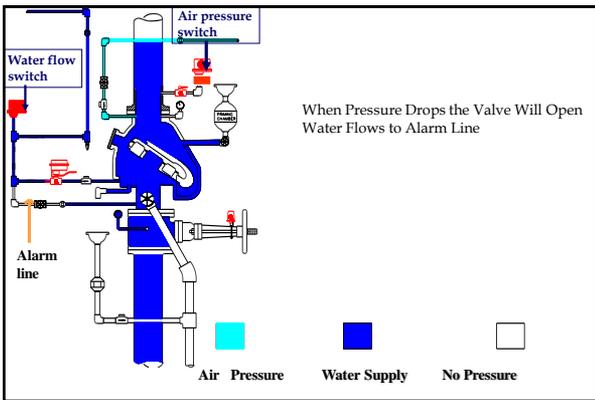
- Required for Systems Over 500 Gallon Capacity
- Unless Water Flow to the Inspector's Test Connection can be achieved Within One Minute

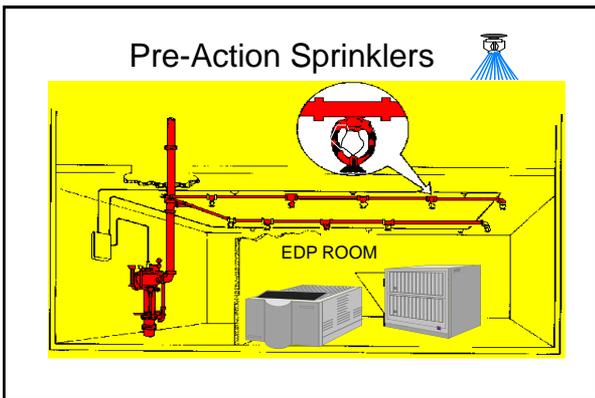




Student Notes:





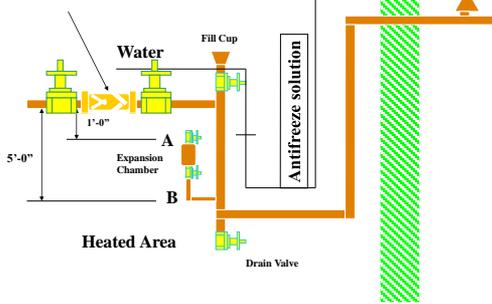


Student Notes:

Pre-action/Deluge Valves



Antifreeze Systems With Backflow Devices



Types of Valves needed for Sprinkler Systems

- Control Valves
- Directional Valves
- Check Valves
- Double Check Valve Assemblies
- Backflow Prevention Assembly

Student Notes:

Valves Controlling Connections to Water Supplies

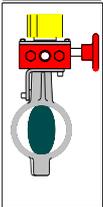
- Must be Listed Type
- Must be Indicating Type
- Shall Not Close in Less Than 5 Seconds
- Number of Valves Required
 - 1 per system
 - 1 per floor if system is attached to hose valves for FD use
- Control valves installed overhead must have indicator, visible from floor level

Sprinkler Riser Control Valves

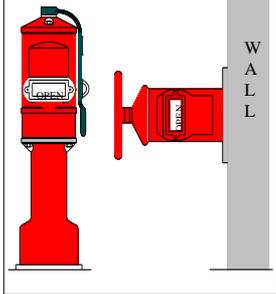
OS&Y



Butterfly



Post Indicator - Yard or Wall type



Sprinkler Riser Control Valves

OS&Y



Student Notes:

Sprinkler Riser Control Valves

continued:

Wall Mounted
Control Valve



Sprinkler Riser Control Valves

continued:

Butterfly Control
Valve

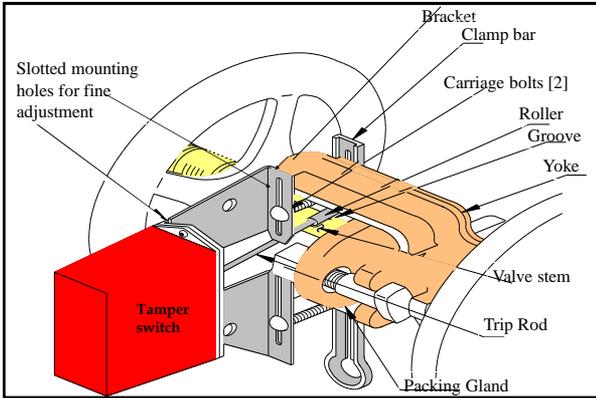


Control Valve Supervision IS VITAL

Supervision Methods:

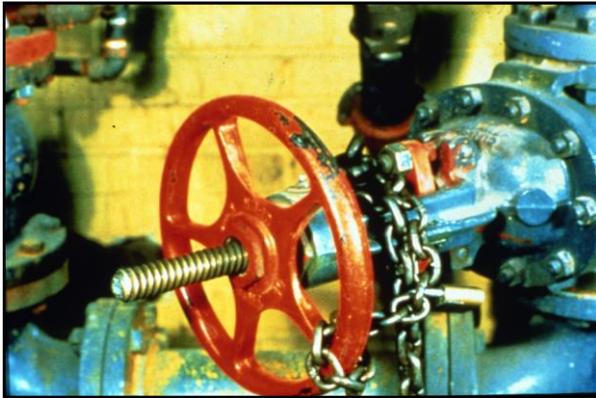
- Local Signaling Service to a constantly attended station
- Central Station, Proprietary or Remote Signaling Service
- Chain & Lock valves in Open position
- Seal valves in Open position (if fenced, under control of the owner and inspected weekly)

Student Notes:



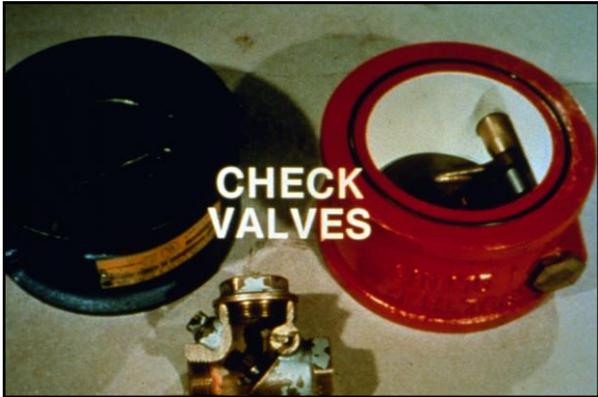
Control Valve Supervisory Switches

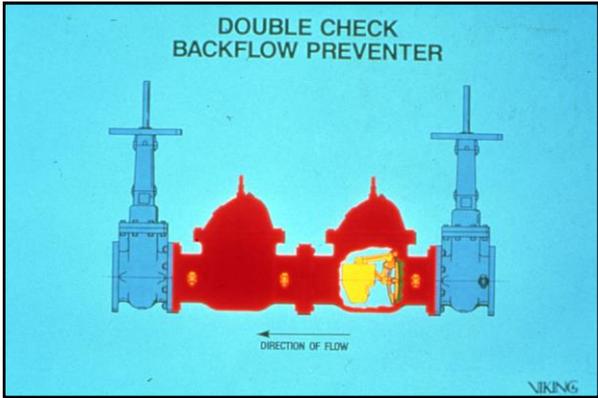




Student Notes:







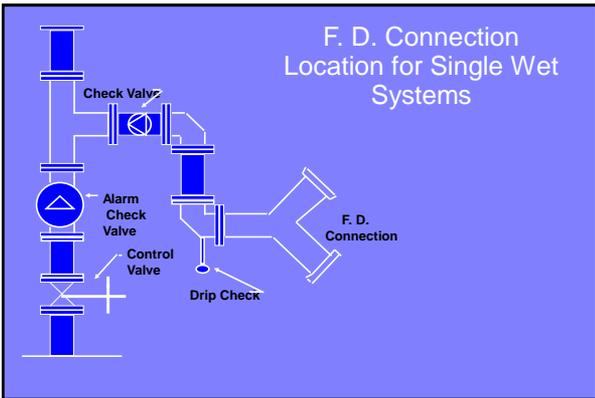
Student Notes:

Fire Department Connection Required

Fire Department Connections are required for all systems except:

1. The building is in a remote location not accessible to the fire department or;
2. The system is a large capacity deluge system designed with flows beyond the fire departments ability or;
3. The system serves a single story building not exceeding 2,000 square feet.





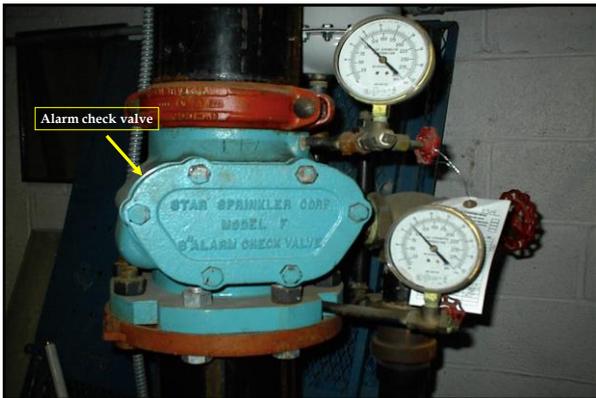
Student Notes:

Water Flow Alarms

- Device must be listed
- Alarm must sound upon water flow
- Alarm must sound within 5 minutes on the premises
- Types of alarms:
 - Alarm Check Valve*
 - Water Flow Detecting Device*
- On Preaction and Deluge Systems, alarms must be actuated independently by the detection system

Alarm Check Valves

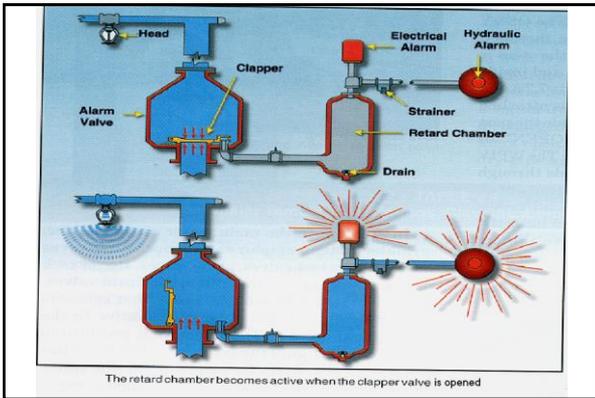
- Function as:
 - An Alarm Device*
 - A Check Valve*
- Retarding Chambers must be provided if variable water pressure conditions are encountered (Surge in pressure)



Student Notes:

Alarm Check Valve



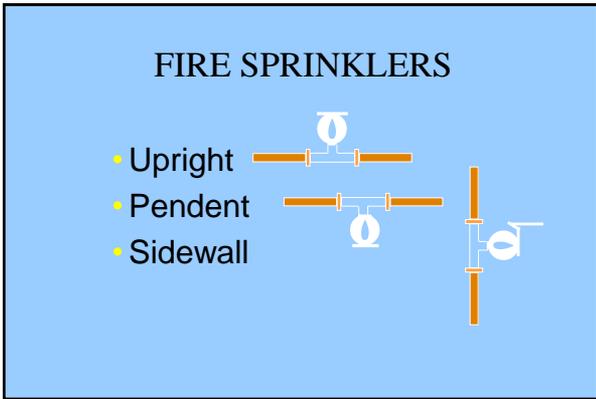


Hydraulic Design Information Sign

- Location of the design area
- Density over the design area
- Required flow and residual pressure
- Occupancy or Commodity classification, storage height and configuration
- Hose stream demand plus sprinkler demand

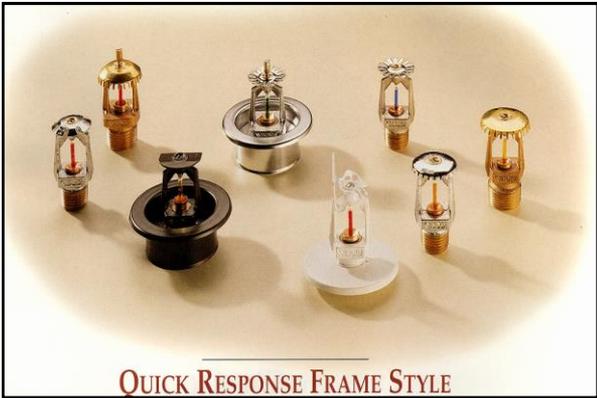
Student Notes:

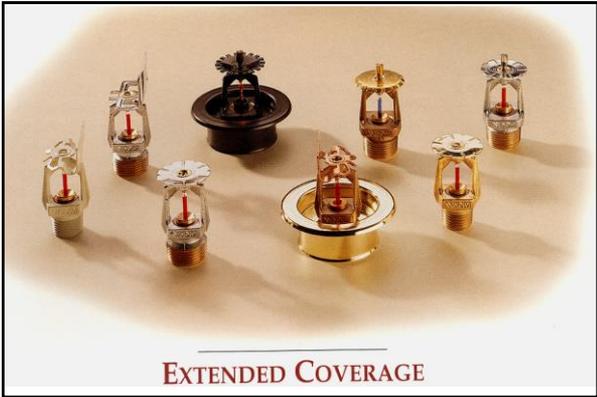


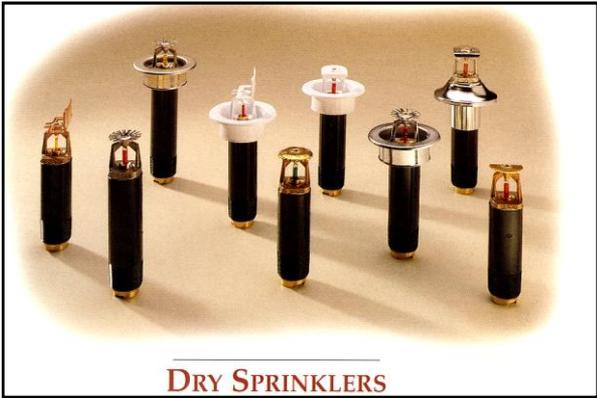




Student Notes:

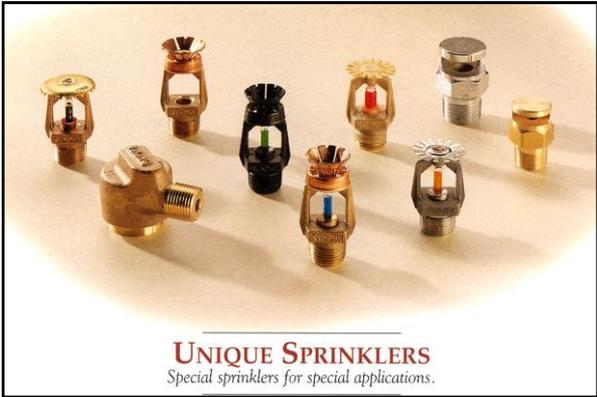






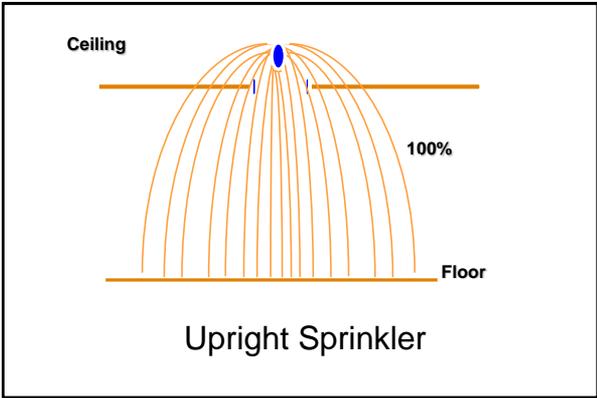
Student Notes:

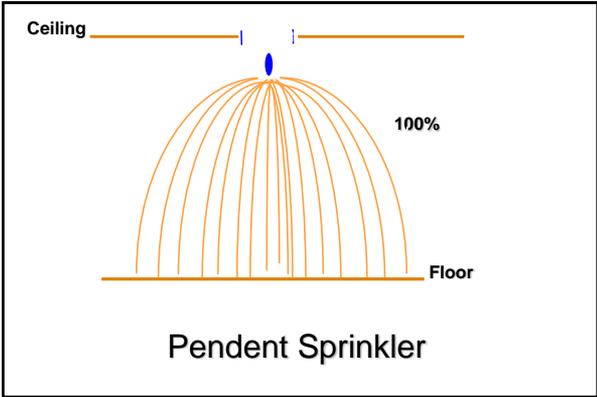


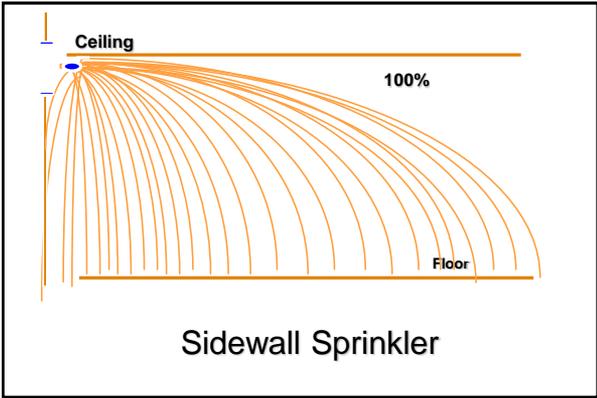




Student Notes:





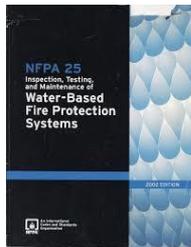


Student Notes:

Sprinkler Temperature Ratings

Maximum Ceiling Temperature		Temperature Rating		Temperature Classification	Frame Arms Color Code	Glass Bulb Colors
F	C	F	C			
100	38	135-170	57-77	Ordinary	uncolored or Black	Orange or Red
150	66	175-225	79-107	Intermediate	White	Yellow or Green
225	107	250-300	121-149	High	Blue	Blue
300	149	325-375	163-191	Extra High	Red	Purple
375	191	400-475	204-246	Very Extra High	Green	Black
475	246	500-575	260-302	Ultra High	Orange	Black
625	329	650	343	Ultra High	Orange	Black

NFPA 25 2002 EDITION



Water Based Fire Protection Systems – NFPA 25

Chapter layout:

- Chapter 1 Administration
- Chapter 2 Referenced Publications
- Chapter 3 Definitions
- Chapter 4 General Requirements
- Chapter 5 Sprinkler Systems
- Chapter 6 Standpipe and Hose Systems
- Chapter 7 Private Fire Service Mains
- Chapter 8 Fire Pumps
- Chapter 9 Water Storage Tanks

Student Notes:

Water Based Fire Protection Systems – NFPA 25

Chapter layout continued:

- Chapter 10 Water Spray Fixed Systems
- Chapter 11 Foam-Water Sprinkler Systems
- Chapter 12 Valves, Valve Components, and Trim
- Chapter 13 Obstruction Investigation
- Chapter 14 Impairments

- Annex A Explanatory Material
- Annex B Forms for Inspection, Testing, and Maintenance
- Annex C Possible Causes of Pump Troubles
- Annex D Obstruction Investigation
- Annex E Informational References

Chapter 4 General Requirements

Responsibility of the Owner or Occupant:

- Shall provide ready accessibility to components.
- Properly maintain system.
- Notify AHJ, fire department, and the alarm receiving facility before testing or shutting down a system, and when system is back in service.
- Corrections and repairs shall be performed by qualified personnel.

Inspection, Testing, Maintenance

- Components shall be inspected at intervals according to appropriate chapters.
- All components & systems shall be tested to verify they function as intended.
- Test results shall be compared with original acceptance test & most recent test results.
- When a major component or subsystem is rebuilt or replaced, it shall be tested in accordance with the original acceptance test.
- All documentation such as drawings, original acceptance test records, manufacturer's maintenance bulletins shall be retained.

Student Notes:

Chapter 5 Sprinkler Systems

5.1 General. This chapter pertains to the general requirements for inspection, testing and maintenance of sprinkler systems. Table 5.1 shall be used to determine the minimum required frequencies for inspection, testing, and maintenance.

Chapter 12 Valves, Valve Components, and Trim

12.1 General. This chapter shall provide the minimum requirements for the routine inspection, testing, and maintenance of valves, valve components, and trim. Table 12.1 shall be used to determine the minimum required frequencies for inspection, testing, and maintenance.

Why do sprinkler systems fail?

53.4% of sprinkler system failures were due to inadequate inspection, testing and maintenance of the system.

Based on numbers from NFPA studies

Student Notes:

What are some leading reasons for failure of a sprinkler system?

- 30% caused by closed valves.
- Lack of Maintenance.
- Design for the wrong hazard.
 - Change from the last inspection?
- Obstructions.
- Improper installation
 - You should have caught this at the acceptance test!!!!

Testing Section 5.3

- Sprinklers 5.3.1
- Gauges 5.3.2
- Alarm Devices 5.3.3
- Antifreeze Systems 5.3.4
- Hose Connections 5.3.5

Testing Section 5.3

- **Sprinklers** –
 - More than 50 yrs old, replace or sample areas tested every 10 years
 - Prior to 1920 shall be replaced.
 - Sprinklers more than 75 yrs., replaced or sample areas tested every 5 years
- **Gauges** - Replaced or tested every 5 years.
- **Alarm Devices** - Vain-type waterflow devices, pressure switches, and water motor gongs shall all be tested at certain intervals.
- **Antifreeze Systems** - Antifreeze tested for specific gravity and solution adjusted if needed, yearly. Antifreeze solutions are found on tables 5.3.4.1(a) & (b).
- **Hose Connections** - Tested according to chapters 6 and 12.

Student Notes:

FIRE ALARMS



NFPA 72, 2002 Edition

(National Fire Alarm Code) does not tell you where a fire system shall be installed; however, it is the how to or installation standard when a fire alarm system is required to be installed.



101

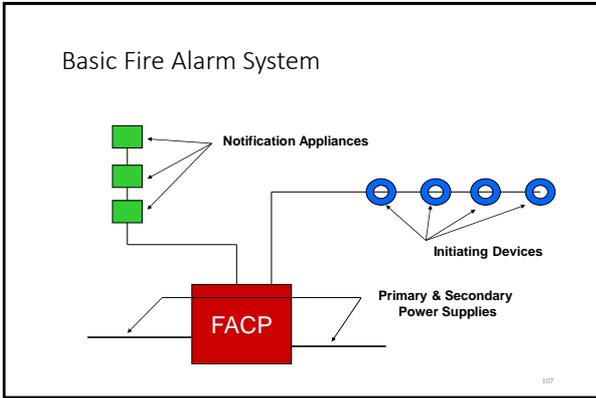
FIRE ALARM SYSTEM OPERATION

- The primary function of a fire alarm system is for the protection of life and property.
- It must perform the following functions:

- ✓ Detect.....
- ✓ Notify..
- ✓ Operate
- ✓ Notify

102

Student Notes:



- ### Initiating Devices
- Automatic fire detection devices
 - Sprinkler water flow detectors
 - Manually activated fire alarm stations
 - Supervisory signal-initiating devices
- 109

- ### Initiating Devices
- Manual Pull Stations
 - Automatic Smoke Detectors
 - Heat Detectors
 - Fixed Temperature Heat Detectors
 - Combination Detectors
 - Rate-of-Rise Compensated Fixed Temperature Detectors
 - Smoke Detectors
 - Ionization Smoke Detectors
- 
- 
- 111

Student Notes:

Initiating Devices continued...

- Photoelectric Smoke Detectors
- Photoelectric Beam Smoke Detectors
- 2-Wire Smoke Detectors
- 4-Wire Smoke Detectors
- Air-Duct Type Smoke Detectors
- Automatic Sprinkler Systems
- Waterflow Switches
- Sprinkler System Control Valves
- Supervisory Switches



112

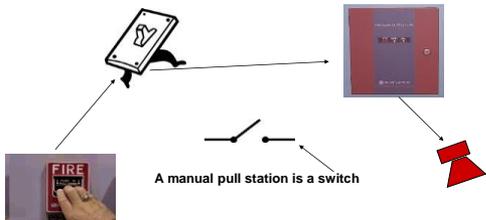
MANUAL PULL STATIONS

When a general alarm pull station is activated it will immediately sound the notification appliances throughout the building.



113

MANUAL PULL STATION



114

Student Notes:

AUTOMATIC FIRE DEVICES -

Fire produces well-defined Signatures such as thermal energy (heat), smoke, and radiant energy.



115

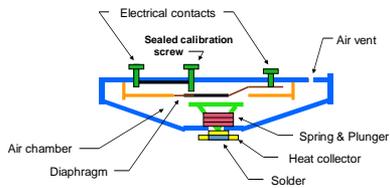
HEAT DETECTORS -

Heat detectors respond to the thermal energy (heat) signature from a fire and are generally located on or near the ceiling.



116

RATE-OF-RISE / FIXED TEMPERATURE DETECTOR



125

Student Notes:

SMOKE DETECTORS

Due to their inherent characteristics, ionization and photoelectric smoke detectors will respond differently to visible and invisible smoke particles.



127

AIR-DUCT TYPE SMOKE DETECTORS

This type of smoke detector detects smoke for the primary purpose of controlling the spread of smoke through the heating, ventilating and air conditioning system (HVAC).



129

ELEVATOR RECALL



Student Notes:

SYSTEM OPERATION

Once a fire alarm system has been activated, occupant notification is accomplished by using audible and visual notification appliances.



131

NOTIFICATION APPLIANCES

Notification Appliances Overview:

- Bells
- Horns
- Temporal Signal
- Strobes
- Synchronization
- Speakers
- Chimes
- Combination audible/visible



132

STROBES

Stroboscopic lights (commonly called "strobes") operate on the energy discharge principle to produce a high intensity flash of short duration.



136

Student Notes:

SYSTEM OPERATION

It is also essential during a fire to control other building systems, such as air conditioning, smoke doors and elevators.



137

Smoke Detector/Smoke Alarm

What is the difference?



141

Smoke Alarm

A detector comprising an assembly that incorporates a sensor, control components, and an alarm notification appliance.



142

Student Notes:

Smoke Detector

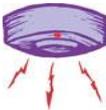
A device that detects visible or invisible particles of combustion and transmits a signal to the FACP



143

Smoke Alarms shall sound

....only within an individual dwelling unit and shall not actuate the building fire alarm system.



146

Alarm Signal

A signal indicating an emergency that requires immediate action.



148

Student Notes:

Supervisory Signal

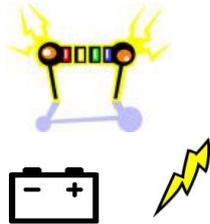
A signal indicating the need for action in connection with the supervision of fire suppression systems or equipment.



149

Trouble Signal

A signal initiated by the fire alarm system or device indicative of a fault in a monitored circuit or component i.e. a short in a wire, smoke detector removed, or a low battery.



150

VIDEO