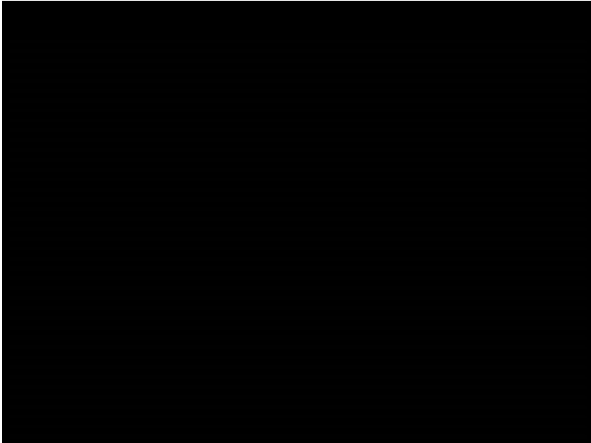


Sprinkler
and
Fire Alarm Systems
for the
Building Official

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- Topics
- Sprinkler Systems
 - Fire Alarm Systems
 - Coordinated System Testing



Sprinkler Systems

- Wet
- Dry
- Pre-action
- Deluge

Sprinkler Systems

- Wet System:
 - Pipes filled with water
 - Closed heads with fusible links
 - Discharge causes flow alarm
 - Flows until valve shut off
 - Sprinkler heads = detection

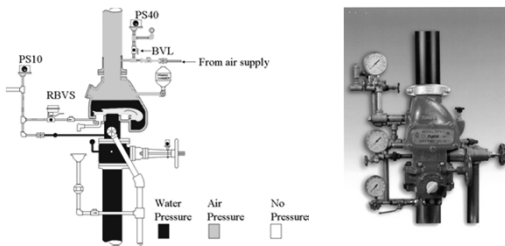
Wet System Riser and Heads



Sprinkler Systems

- Dry System:
 - Pipes filled with compressed air
 - Closed heads with fusible links
 - Water held back by clapper valve
 - Sprinkler opening releases air and this releases water
 - Flows until valve shut off

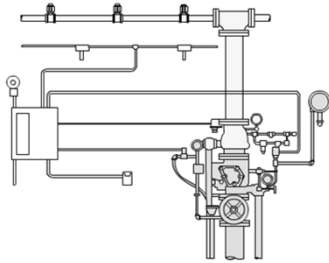
Dry Valve System



Sprinkler Systems

- Pre-action System:
 - Empty piping
 - Water held back by solenoid valve
 - Closed heads with fusible links
 - Has one or more detectors that release the solenoid valve
 - Once solenoid opened, pipe is flooded and it becomes a wet system

Pre-action Schematic



Sprinkler Systems

- Deluge System:
 - All open heads
 - Detectors open solenoid valve that releases water
 - All heads discharge water
 - Rarely used, very messy, big water demand



Sprinkler Systems

- Applications:
 - Wet: All heated (non-freeze) areas
 - Dry: Areas subject to freezing
 - Pre-action: Sensitive areas to minimize accidental discharge
 - Deluge: Exterior exposure, occasionally

Sprinkler Systems

- Sprinkler Heads:
 - Fusible link or frangible bulb
 - Heat makes link or bulb break
 - Releases plug to discharge water
 - Temperature rated, colour coded bulbs
 - Work the same as a heat detector
 - Only one at a time



Sprinkler Systems

- Supervisory Devices:
 - Activity sends signals to fire alarm
 - Flow Switch – paddle changes position, closes contact, sends alarm signal
 - Alarm Valve - same as flow switch except valve clapper acts as flow paddle



Sprinkler Systems

- Supervisory Devices
 - Tamper Switch – monitors valve handle, position change closes contact, sends supervisory (trouble) signal
 - Pressure Switch – like a gauge, drop in pressure sends supervisory signal

Sprinkler Systems

- Hydraulic Design
 - Statistics/testing based
 - Not every head included in design
 - Only the most remote area
 - Water delivery density based on hazard
 - Account for friction loss, head loss, fittings

Sprinkler Systems

- Statistics/Testing
 - 85% of fires put out by 1 or 2 heads
 - 95% of fires put out by 4 heads
 - Design areas based on testing
 - Discharge density derived from tests/experience

Sprinkler Systems

- System Limits:
 - Wet: 52,000 ft²
 - Dry: 52,000 ft² – but limited by system capacity
 - Pre-action: 52,000 ft² – but limited by system capacity

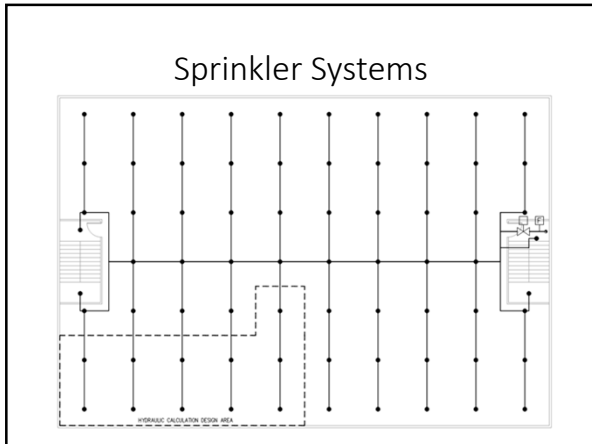
Sprinkler Systems

- Design Area/Hazards

	<u>Area (ft²)</u>	<u>Discharge Density</u> <small>(USgpm/ft²)</small>	<u>Head Spacing (ft²)</u>
Light	1500	0.1	225
Ordinary 1+2	1500	0.15-0.20	130
Extra 1+2	3000	0.4-0.6	100

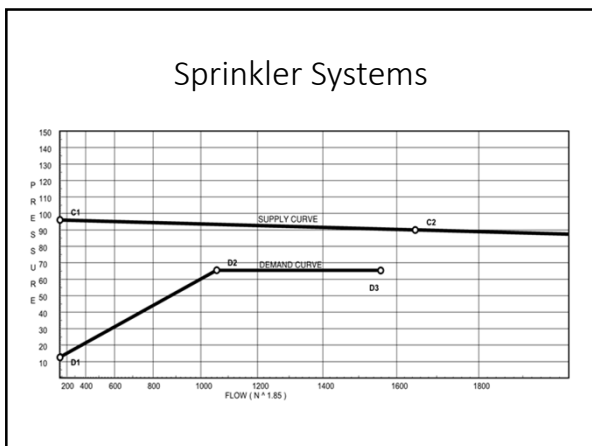
Sprinkler Systems

- Design Basis:
 - All heads in the most remote area have to deliver the minimum discharge density at minimum pressure
 - Head spacing per criteria and ULC listings




Sprinkler Systems

- Supply vs Demand:
 - Total hydraulic demand of a single system cannot exceed available water supply
 - Multiple systems in a building are not cumulative
 - Add in hose allowance (100-500 USgpm)



Fire Alarm Systems

- System of input and output devices used for detection and notification



The diagram illustrates the flow of information in a fire alarm system. On the left is a fire alarm pull station with a 'PUSH' button and a 'PULL DOWN' handle. An arrow labeled 'Inputs' points from this device to a central fire alarm control panel. From the control panel, an arrow labeled 'Outputs' points to a circular fire alarm bell.

Fire Alarm Systems

- Control Panel
 - Microprocessor based
 - Processes input signals
 - Sends corresponding output signals (bells, doors, etc.)
 - Communicates with all input devices (addressable)




Fire Alarm Systems

- Types of Systems
 - Single Stage – only one type of signal (evacuation)
 - Any device puts system into alarm




Fire Alarm Systems

- Types of Systems
 - Two Stage Alarm (intermittent) and alarm (continuous) signals
 - One device causes alert
 - Two devices or five minute time out puts system into alarm

Fire Alarm Systems


- Input devices:
 - Alarm initiating
 - Pull Stations 
 - Heat Detectors 
 - Smoke Detectors 

Fire Alarm Systems

- Input devices:
 - Alarm initiating
 - Duct Smoke Detectors 
 - Kitchen Systems (ZAM) 
 - Flow Switches 

Fire Alarm Systems





- Input devices:
 - Supervisory:
 - Tamper Switches
 - Pressure Switches



Fire Alarm Systems

- Input devices:
 - Trouble
 - End of Line Resistors
 - Ground Faults
 - Electrical Supervision


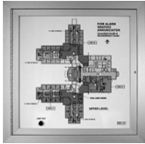
Fire Alarm Systems

- Output Devices:
 - Bells 
 - Horns 
 - Speakers 
 - Strobes 



Fire Alarm Systems

- Output Devices
 - Relays/signals to ancillary devices:
 - Elevator recall/homing
 - Fan shutdowns
 - Door releases
 - Shutter releases
 - Off-site monitoring agency

Fire Alarm Systems

- CACF (High Rise)
 - Includes:
 - Voice Communication Systems 
 - Graphic Annunciators 

Fire Alarm Systems

- CACF (High Rise)
 - Includes:
 - Door Release Switch 
 - Fan Manual Control Switches 

Fire Alarm Systems

- Standards
 - All devices ULC listed
 - CAN/ULC – 5524 – Design and Installation
 - CAN/ULC – 5537 – Verification

Fire Alarm Systems

- Verification
 - Only requires verification of output signal from fire alarm
 - Not the actual operation of the device
 - Gives rise to inconsistencies that the Schedule A and C-A are supposed to resolve

Fire Alarm Systems

- Coordinated Fire and Life Safety System Testing
 - Required since 2006
 - Schedules A and C-A
 - 3.2.4.6.(1)
 - Appendix Notes

Fire Alarm Systems

- Coordinated Fire and Life Safety System Testing
 - Last test before occupancy of a building
 - Confirm that all systems will operate in a coordinated manner to provide early warning/notification the way they are supposed to, when they have to

Fire Alarm Systems

- Coordinated Fire and Life Safety System Testing
 - Representative test only – observed by Building and Fire Officials
 - Should have been thoroughly tested by Consultants/Contractors beforehand
 - Not supposed to be a troubleshooting exercise

Fire Alarm Systems

- Coordinated Fire and Life Safety System Testing
 - Check/Test
 - Any/all input and output devices
 - Audibility
 - Sequence of Operation
 - “10% of devices” not mandated anywhere
 - Subjective/historical
 - Not really needed if the coordinated tests perform flawlessly

Fire Alarm Systems

- Coordinated Fire and Life Safety System Testing
 - Resources
 - Lots of people
 - Communication (radios)
 - Smoke, ladder?
 - Sprinkler Technician
 - Fire Alarm Technician
 - Elevator Technician

Fire Alarm Systems

- Coordinated Fire and Life Safety System Testing

Test No.	Floor/Device of Activation Description	EVAC Zone #	Observer Location	Node #	Output Device to be Observed	Expected Result	Observed Result
1	Fire Suppression System - Level 3 Manual Pull station		OPS 078 L4		Annunciator	Alert Zone 015, 107, 108, 115	
		02.3	078 L2 Corridor 03/Food Court	54	Audible appliances	Alert	
		02.2	North Baghall L2	59	Audible appliances	Silent	
		02.4	Level 2 New Per B	54	Audible appliances Elevator 278 recall Fan stop Door Maglock	Silent No change No change No change	
		03.10	A8 Level 3 Rotunda	55	Audible appliances Reset make-up air Gas appliances Electric power to appliances Elevator 173, 175, 176, 177 recall Fan Door Maglock	Alert Chir alarm Shut off gas Shut off power No change No change No change No change	

Site Issues

- Be observant about sprinkler obstructions
- Participate in coordinated testing
- Easy to check
 - Pull stations at doors
 - Sprinkler and smoke detector construction protectors not removed
 - Smoke detectors in elevator lobbies

Discussion
