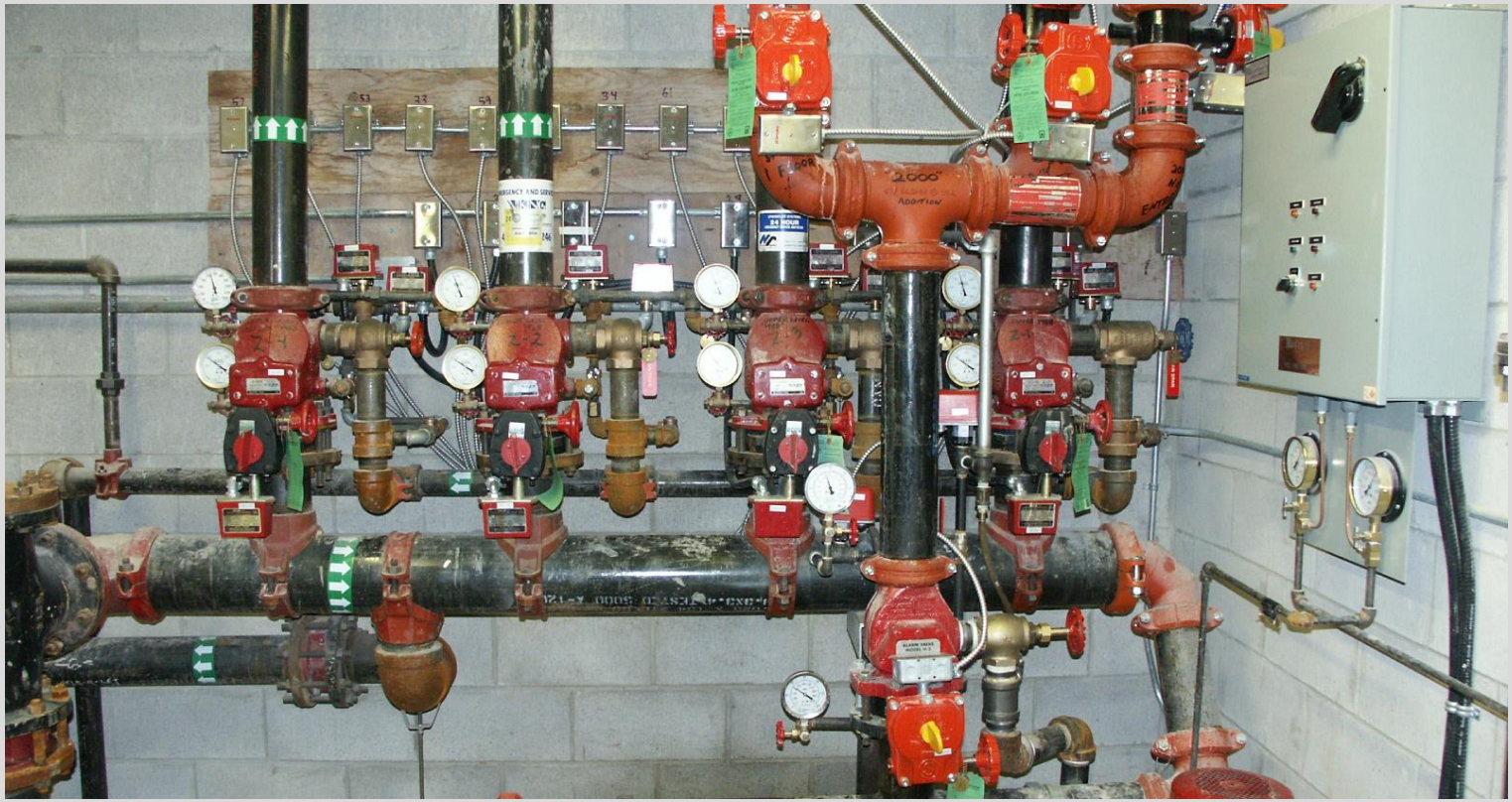
Automatic Sprinkler Systems



Dave Tiller, Ontario Fire College

Gary Laframboise, Oakville Fire Department

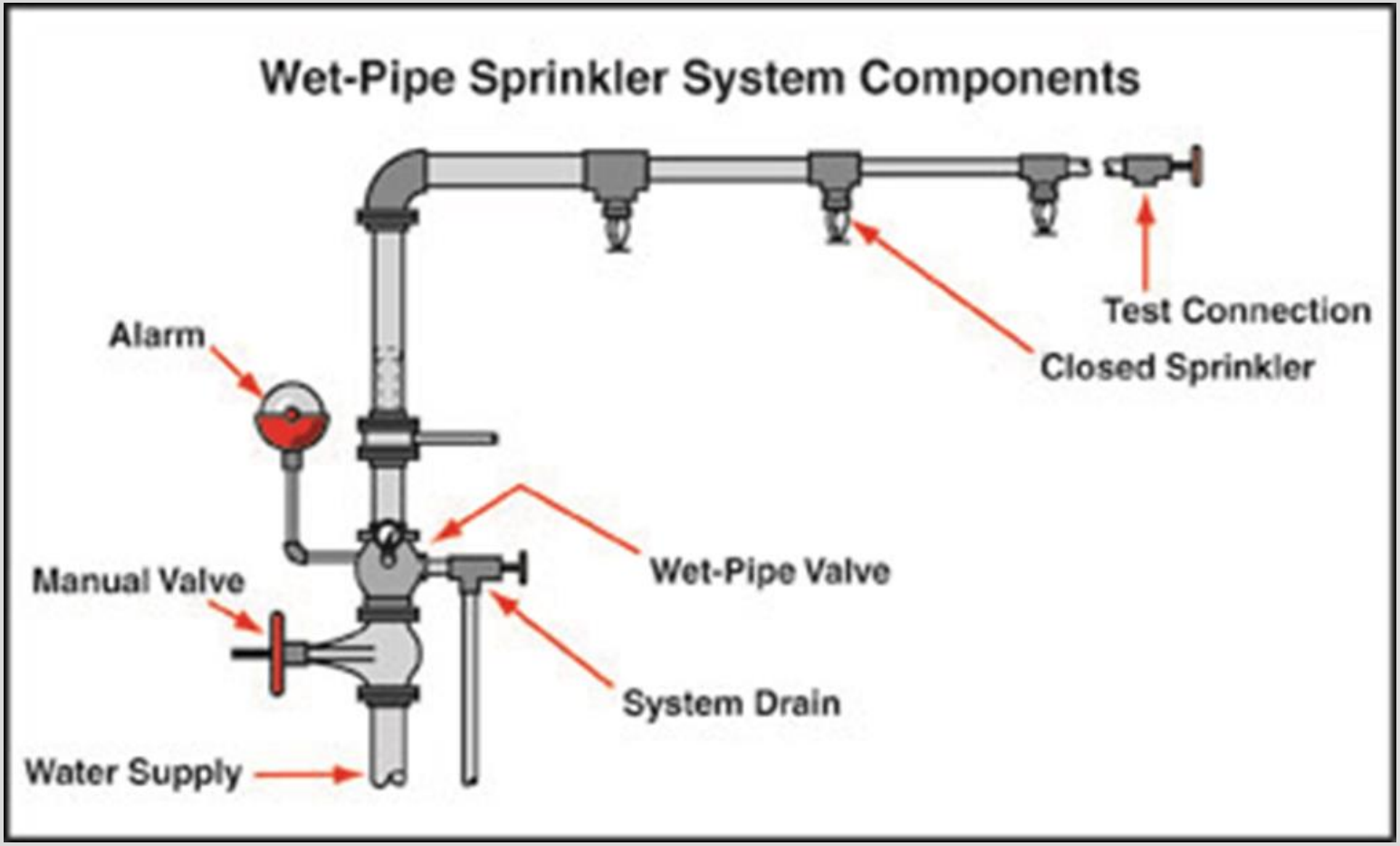
Sprinkler System Components and Design Concepts

Sprinkler System Types

Four sprinkler system types

- Wet
- Dry
- Deluge
- Pre action

Types of Automatic Sprinkler Systems



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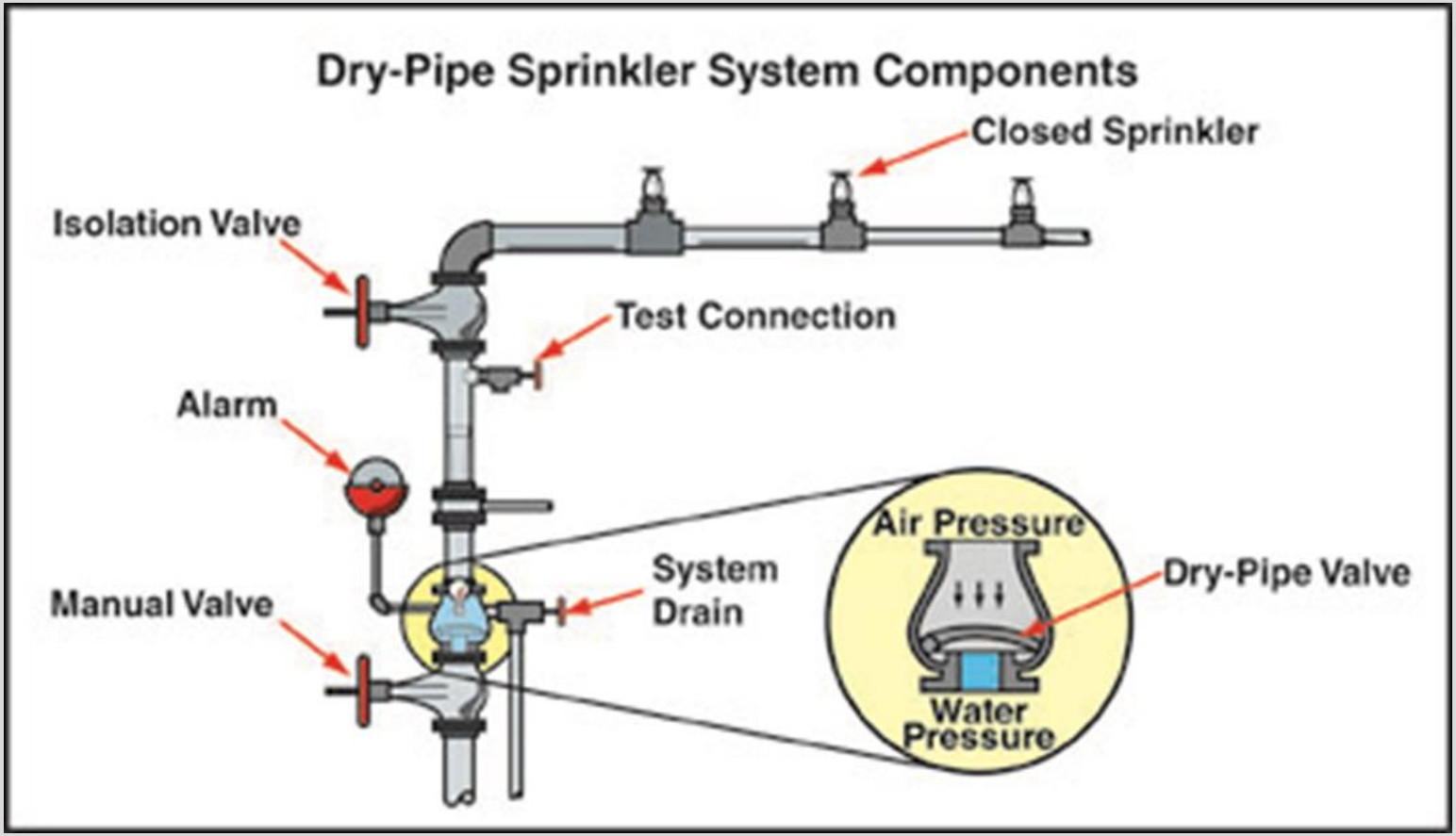

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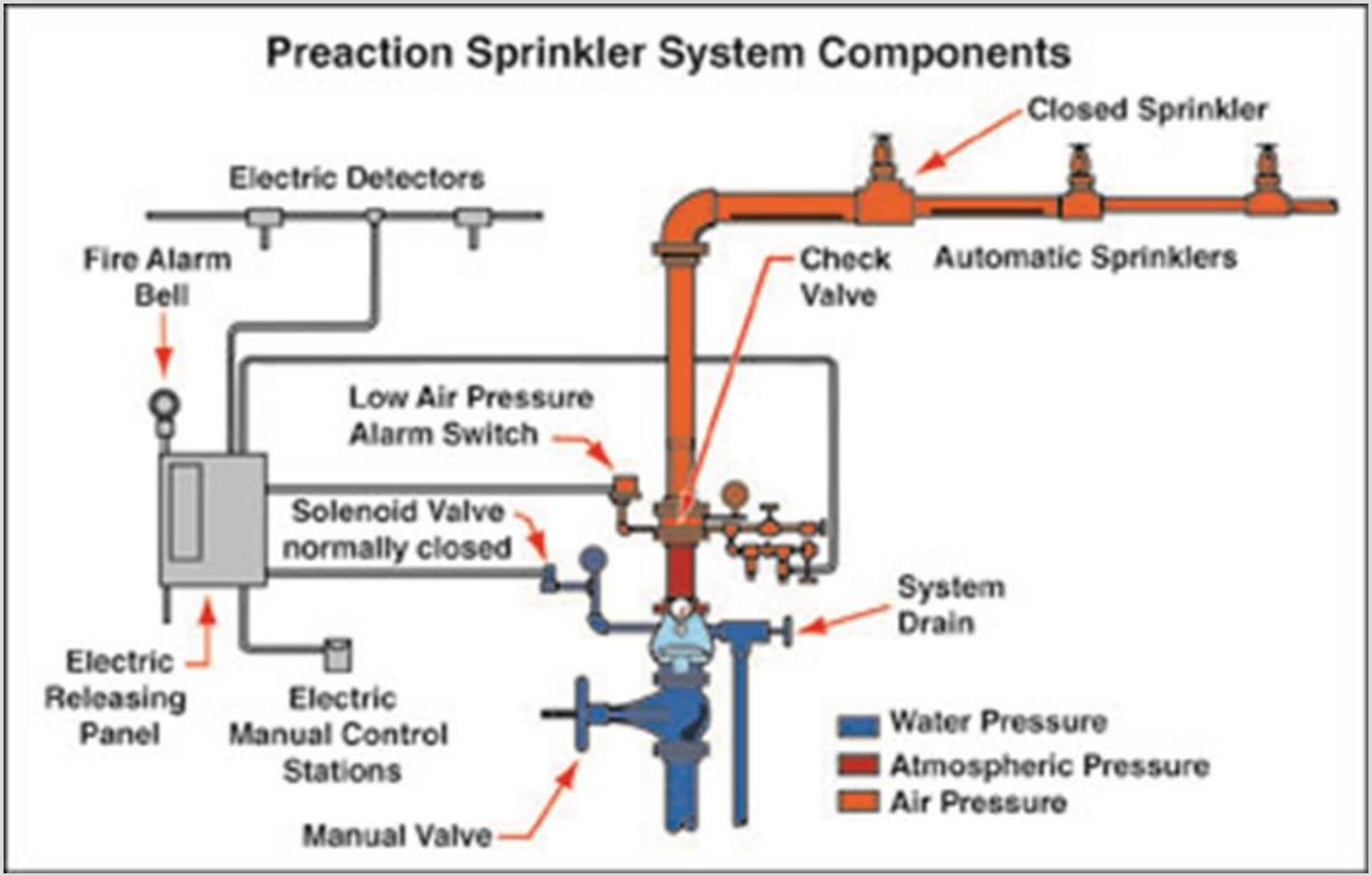

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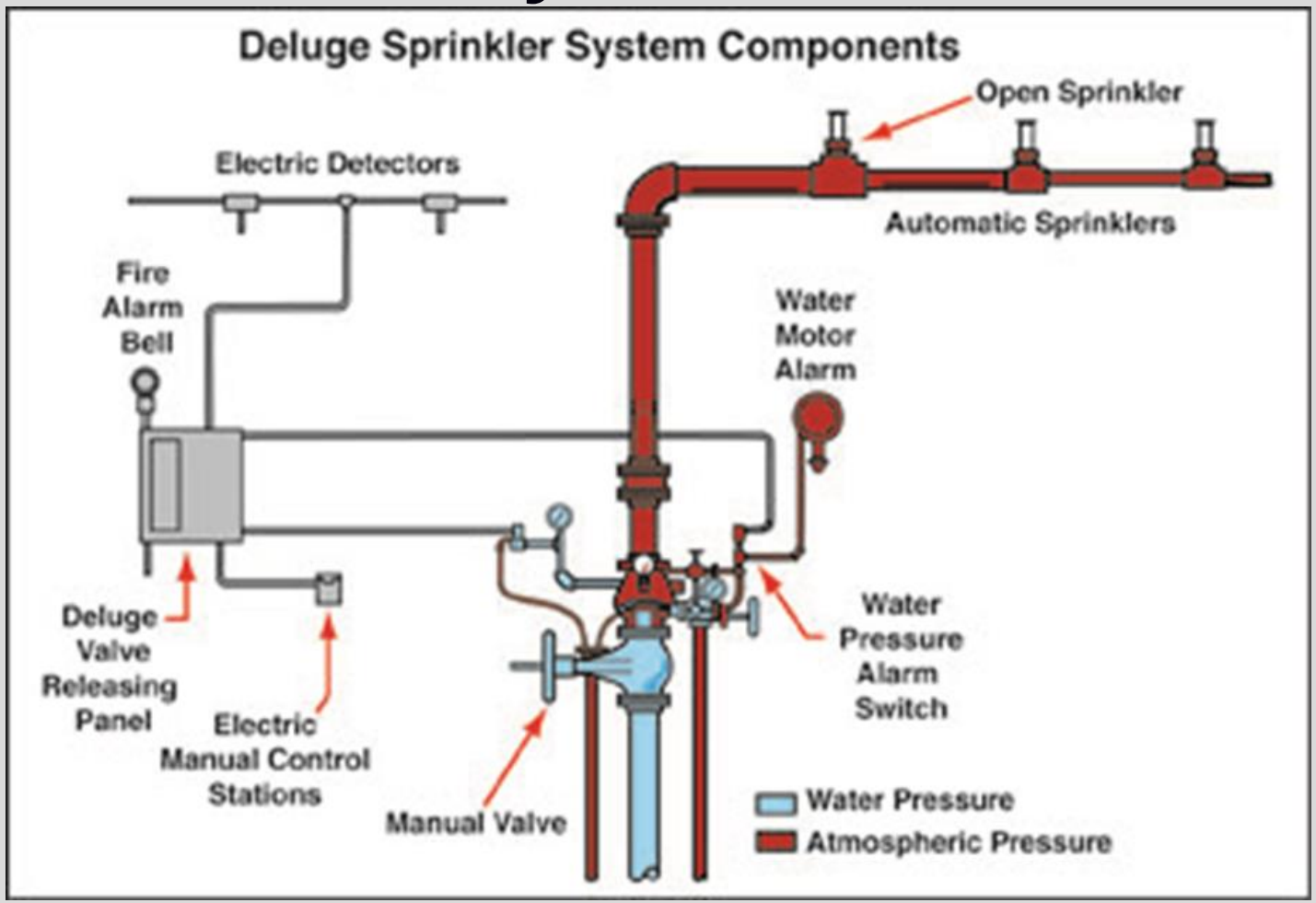
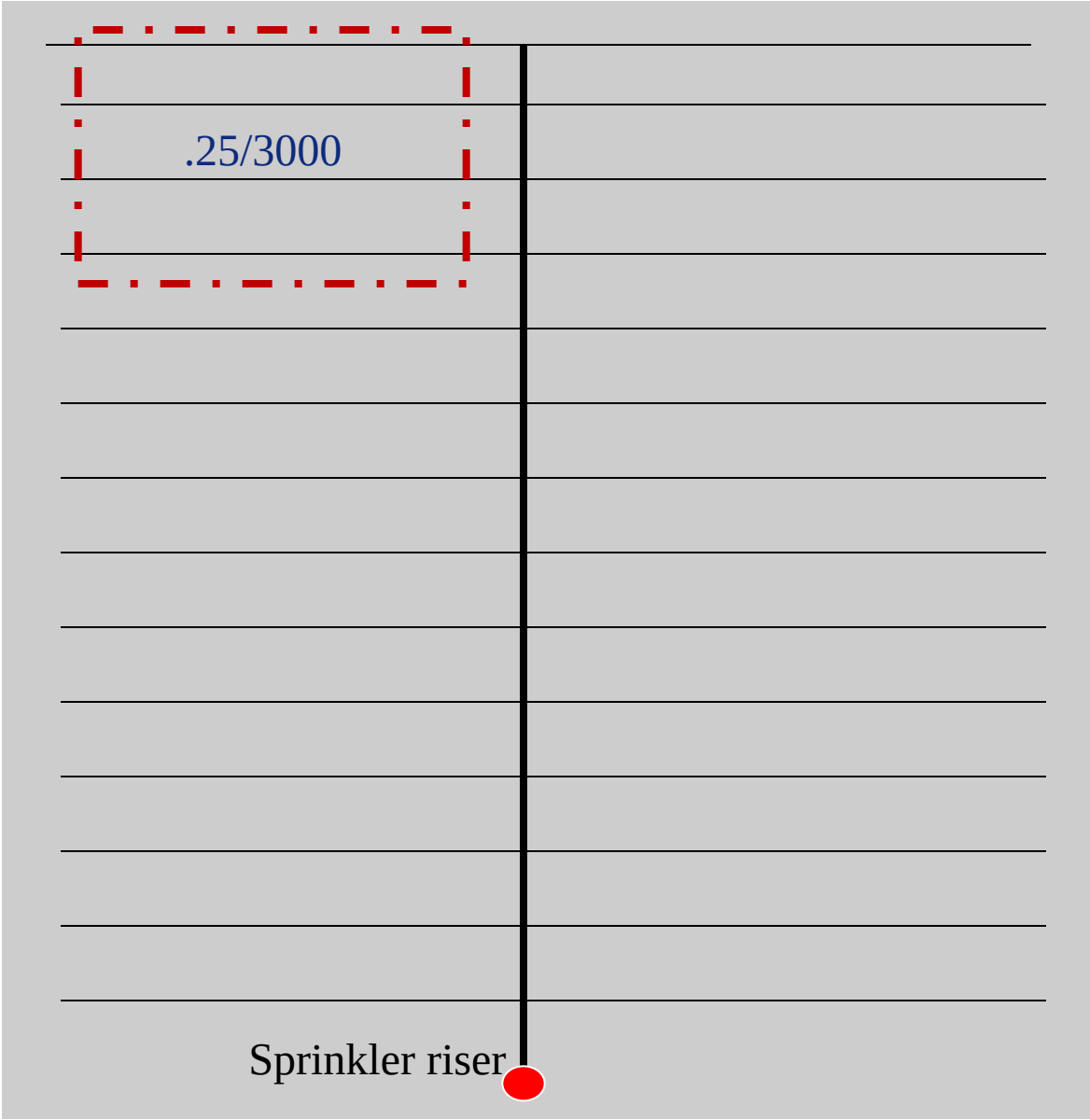


Concepts of Sprinkler Design

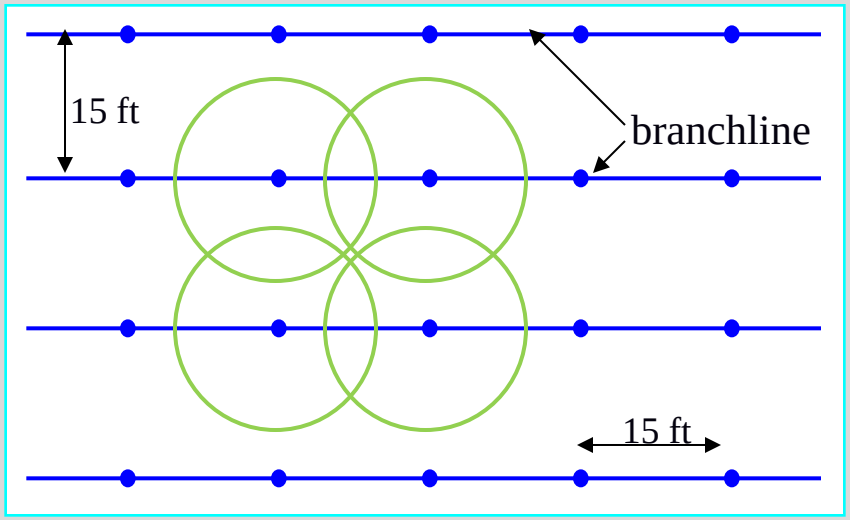
Definitions

- Sprinkler Design Density
  - Water discharged by sprinkler heads (gals), over a prescribed area (ft^2), during a specific period of time (min.)
  - Typical densities range from .10 to .60 gpm/ft^2
- Sprinkler Design Area
  - Large area over which the sprinkler design density is to be maintained
  - Examples – 1000 to 5000 sq. ft.

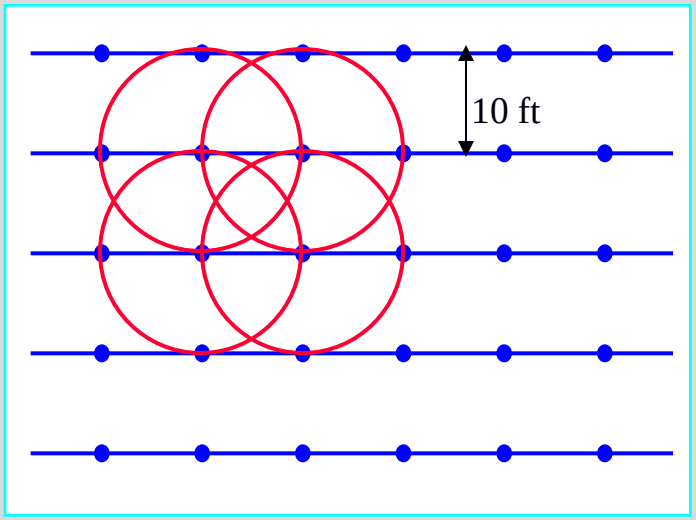
Example of sprinkler system designed to provide a .25/3000 design



Sprinkler Spacing



15 x 15 = 225 sq. ft.

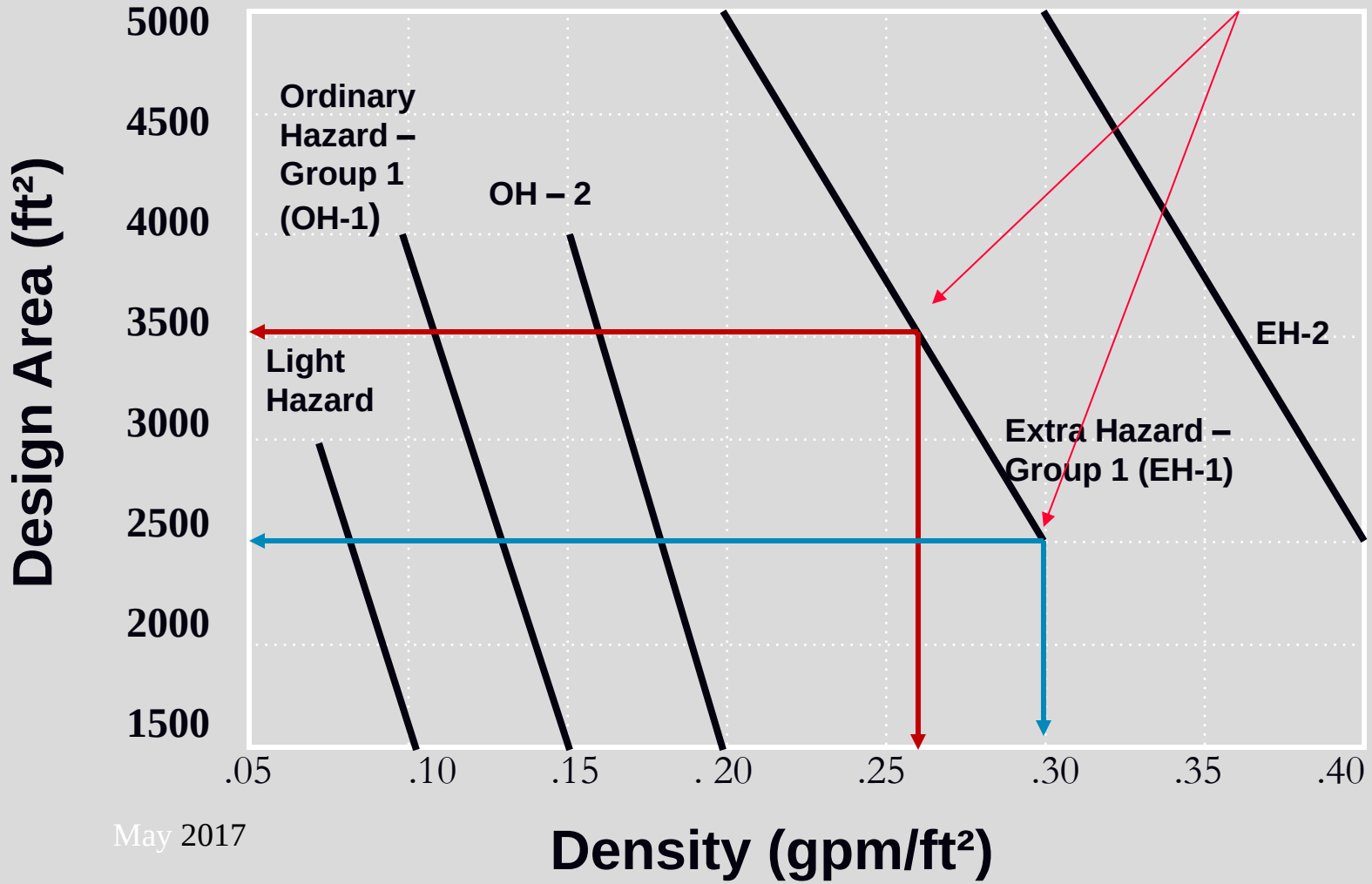


10 x 10 = 100 sq. ft.

- Closer spacing provides heavier water discharge

NFPA 13 - Figure 11.2.3.1.1.

Any point on curve provides adequate protection



Occupancy Classification

Light Hazard Occupancies

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

Offers least challenge to sprinkler systems

Ordinary Hazard (group 1)

Occupancies or portions of other occupancies where combustibility is low, quantity of combustibles is moderate, stockpiles of combustibles do not exceed 2.4m (8ft), and fires with moderate rates of heat release are expected

Ordinary Hazard (group 2)

Occupancies or portions of other occupancies where quantity and combustibility of contents is moderate, stockpiles do not exceed 3.6m (12ft), and fires with moderate rate of heat release are expected

Extra Hazard Occupancies

Quantity and combustibility of contents is very high, and flammable and combustible liquids, dust, lint, or other materials are present introducing the probability of rapidly developing fires with high rates of heat release

Extra Hazard (group 1)

Occupancies include those in which hydraulic machinery or systems with flammable or combustible hydraulic fluids under pressure are present.

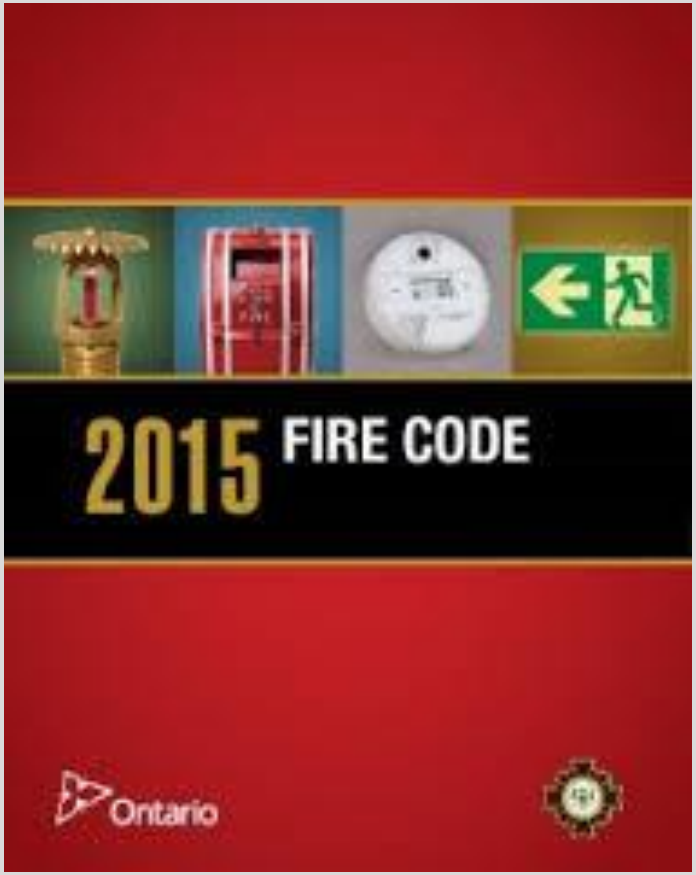
Rupture and leaks in piping or fittings have resulted in fine spray discharge of such liquids, and intense fires result

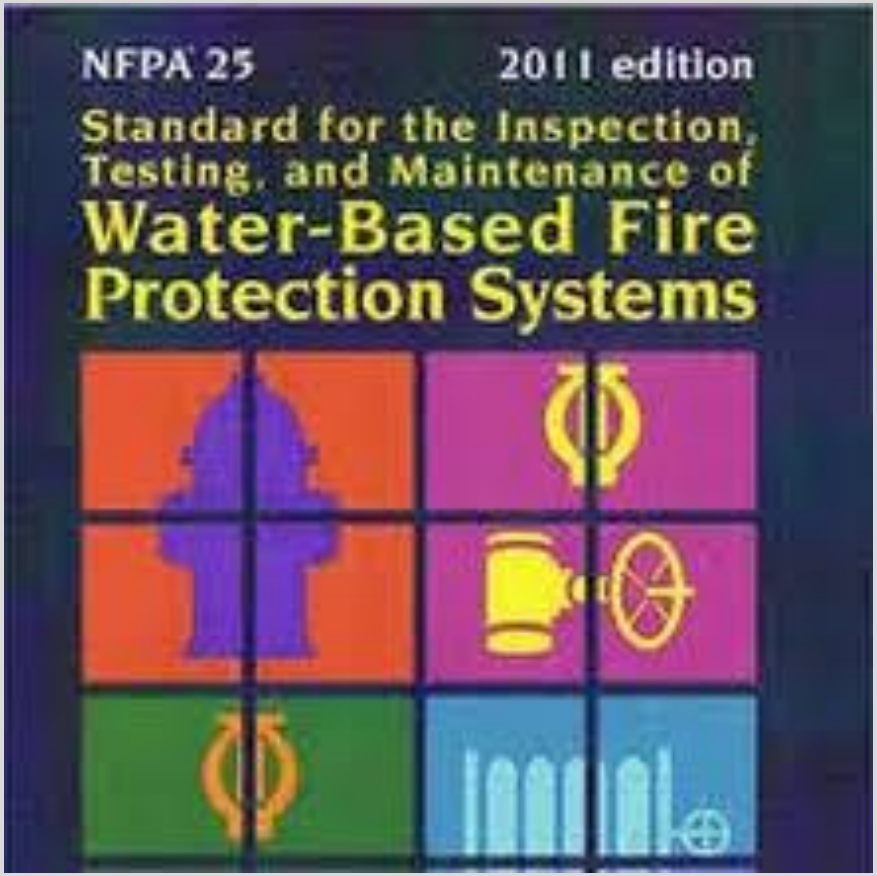
Extra Hazard (group 2)

Occupancies contain more than small amounts of flammable and combustible liquids, usually in open systems where rapid evaporation can occur when subjected to high temperatures

Also applies when ceiling sprinklers are obstructed by occupancy conditions, not structural conditions, and water discharged by sprinklers may not reach burning material

Inspection, Testing and Maintenance Requirements

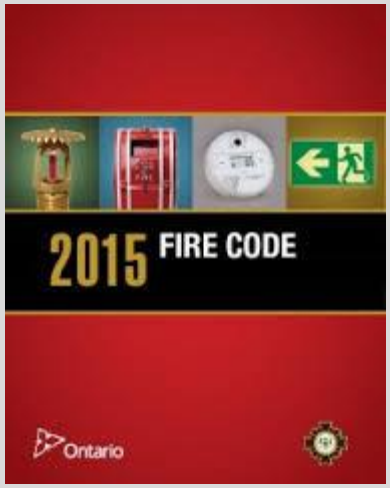




Ontario Fire Code

Division B Sentence 6.5.1.(2):

Compliance with the inspection, testing and maintenance provisions of NFPA 25, satisfies the requirements of OFC Subsections 6.5.4., to 6.5.6.

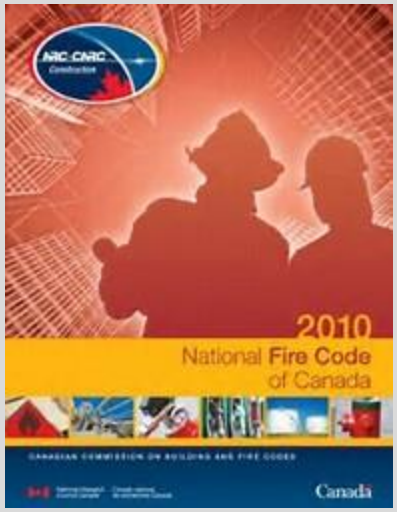


NFPA 25 – 2011 Edition

Maintenance Requirements

National Fire Code:

- Water-based fire protection systems shall be inspected, tested and maintained in conformance with NFPA 25



Maintenance Requirements

Telephone: [redacted] Fax: [redacted]

[redacted]

Telephone: [redacted] Fax: [redacted]

Fire Protection Inspection Certificate

[redacted] *Retirement Residence*
[redacted] *Oakville*

This certifies that the system(s) indicated below have been inspected and tested in accordance with the applicable code(s) indicated:

[redacted]	**FIRE ALARM SYSTEM(S):**	O.F.C. Section 6.3, U.L.C. Standard, and as per our inspection report.
[redacted]	**SPRINKLER SYSTEM(S):**	N.F.P.A. 25, O.F.C. 9.6.5 and as per our inspection report.
☐	**FIRE HYDRANT(S):**	N.F.P.A. 291 and N.F.P.A. 20 and as per our inspection report.
☐	**STANDPIPE SYSTEM(S):**	N.F.P.A. 14A and N.F.P.A. 20 and as per our inspection report.
☐	**EMERGENCY LIGHTING SYSTEM(S):**	O.B.C. 3.2.7 and O.F.C. 2.7.3. and as per inspection report.
[redacted]	**FIRE EXTINGUISHERS AND HOSES:**	N.F.P.A. 10 and O.F.C. and as per our inspection report.
☐	**OTHER SPECIAL HAZARD SYSTEMS:**	

This Inspection Was Carried Out On **November 9, 2006**

The System Should Be Re-inspected On Or Before **November 2007**

Issued: **February 20, 2007**

Inspected By [redacted]

In accordance with the conditions on the reverse

C.F.A.A. # [redacted]

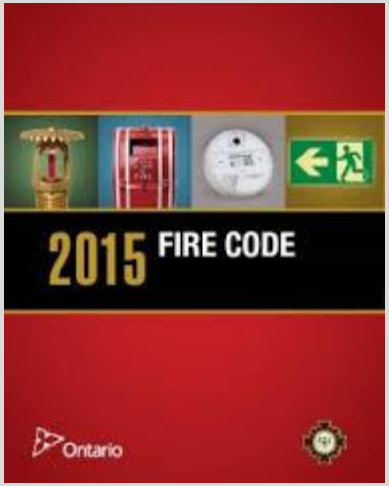
[redacted]
Authorized Signature

This certificate should be affixed adjacent to the system.

C100

Records

- 2 years after being prepared
- Most recent & immediately preceding record
- Initial test report for systems installed after November 21, 2007

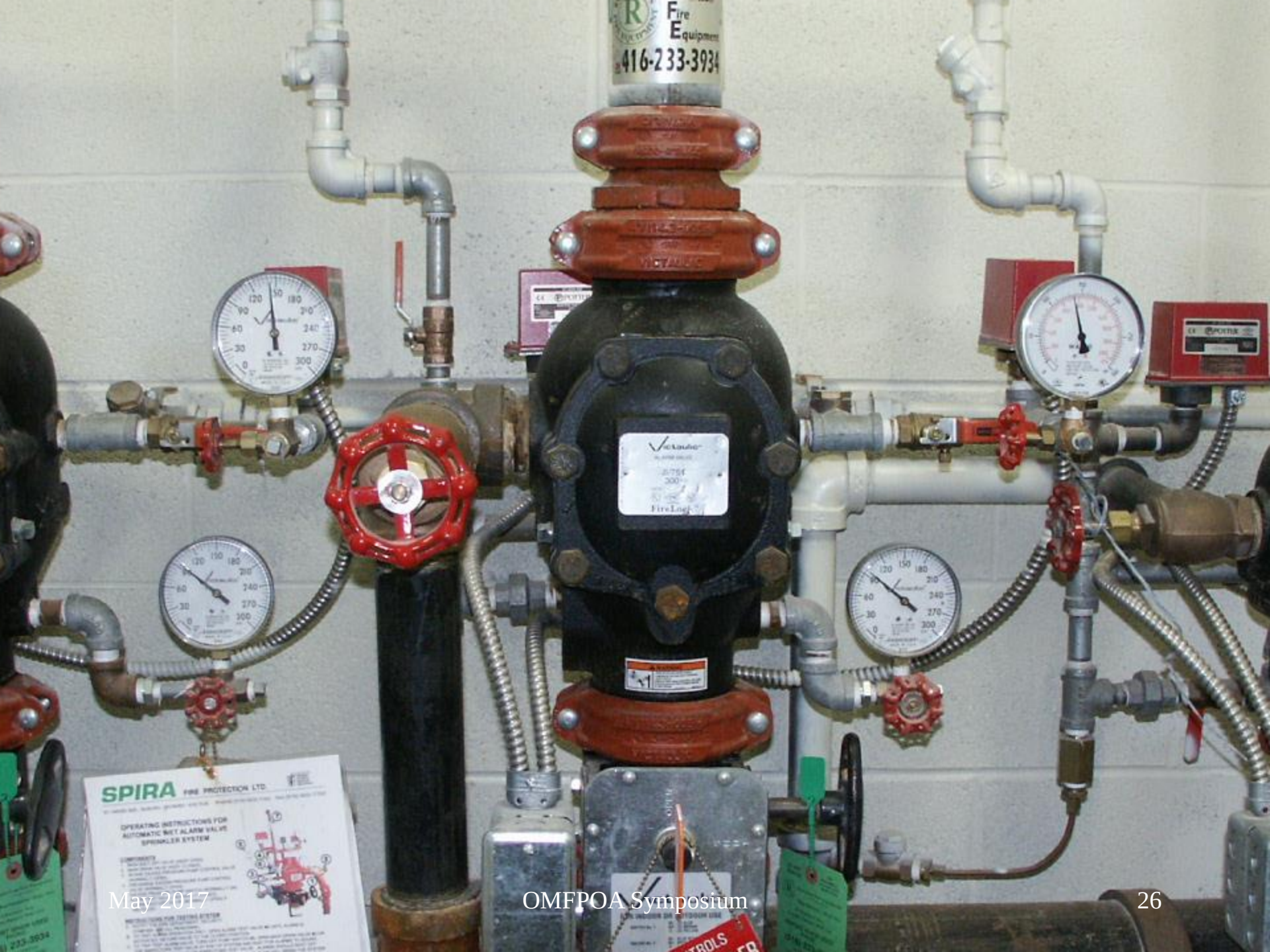


Drains

- Must be sized and installed to accept the full flow

Main Drain (2”) Flow Test

- OFC
  - Annually 6.5.5.5.
  - Any time control valve has been operated 6.5.5.6.


Fire
Equipment
416-233-3934
SPIRA FIRE PROTECTION LTD.
OPERATING INSTRUCTIONS FOR
AUTOMATIC WET ALARM VALVE
SPRINKLER SYSTEM

POTTER
120
150
180
210
240
270
300
psi
ASHCROFT
MADE IN U.S.A.

U.S.GAUGE DIAL NO. 34228
0
25
50
75
100
125
150
175
200
225
250
275
300
RAISLER CORPORATION
NEW YORK, N.Y.
WATER
LISTED
FIRE PROTECTION
75

[redacted] SPRINKLERS LTD.

CONTRACTOR'S MATERIAL & TEST CERTIFICATE FOR ABOVEGROUND PIPING

PROCEDURE

Upon completion of work, inspection and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.

A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.

PROPERTY NAME: [redacted]

DATE: July, 2003

PROPERTY ADDRESS: [redacted] Road Oakville, Ontario

PLANS

Accepted by Approving Authority(s) Names: City of Oakville Fire Dept.

Address: 125 Randal St Oakville, Ontario

Installation conforms to accepted plans: YES [X] NO [ ]

Equipment used is approved: YES [X] NO [ ]

If no, explain deviations:

INSTRUCTIONS

Has person in charge of fire equipment been instructed as to location of control valves and maintenance of this new equipment? YES [X] NO [ ]

If no, explain:

Have copies of appropriate instructions and care and maintenance charts and NFPA 13A been left on premises? YES [X] NO [ ]

If no, explain:

LOCATION OF SYSTEM

Supplies Bldgs. COMPARTMENT "B" Ground Floor

SPRINKLERS

MAKE	MODEL	YEAR OF MANUFACTURE	ORIFICE SIZE	QUANTITY	TEMPERATURE RATING
CENTRAL	Upright QR	2002	½"	57	155°F
CENTRAL	Semi-Rec QR	2002	½"	207	155°F
CENTRAL	Sidewall QR	2002	½"	1	212°F

PIPE AND FITTINGS

Pipe conforms to ASTM Standard YES [X] NO [ ]

Fittings conform to ANSI Standard YES [X] NO [ ]

If no, explain:

ALARM VALVE OR FLOW INDICATOR

ALARM DEVICE TYPE	MAKE	MODEL	MAXIMUM TIME TO OPERATE THROUGH TEST PIPE MIN.	SEC.
Flow Switch	POTTER	VSR-F		60

DRY VALVE MAKE	MODEL	SERIAL NO.	Q.O.D MAKE	MODEL	SERIAL NO.

DRY PIPE OPERATING TEST

	TIME TO TRIP THRU TEST PIPE MIN.	SEC.	WATER PRESSURE PSI	AIR PRESSURE PSI	TRIP POINT AIR PRESSURE PSI	TIME WATER REACHED TEST OUTLET MIN.	SEC.	ALARM OPERATED PROPERLY YES	NO
Without Q.O.D.									
With Q.O.D.									

If no, explain:

LCED (H.O.) 103 A - 09/84

DELUGE & PREACTION VALVES

Operation: PNEUMATIC [ ] ELECTRIC [ ] HYDRAULIC [ ]

Piping supervised: YES [ ] NO [ ]

Detecting media supervised: YES [ ] NO [ ]

Does valve operate from the manual trip and/or remote control stations? YES [ ] NO [ ]

Is there an accessible facility in each circuit for testing? YES [ ] NO [ ]

If no, explain:

MAKE	MODEL	DOES EACH CIRCUIT OPERATE SUPERVISION LOSS ALARM YES	NO	DOES EACH CIRCUIT OPERATE VALVE RELEASE YES	NO	MAXIMUM TIME TO OPERATE RELEASE MIN.	SEC.

TEST DESCRIPTION

HYDROSTATIC: Hydrostatic tests shall be made at not less than 200 psi (13.8 bars) for two hours or 50 psi (3.4 bars) above static pressure in excess of 150 psi (10.3 bars) for two hours. Differential dry-pipe valve clappers shall be left open during test to prevent damage. All aboveground piping leakage shall be stopped.

FLUSHING: Flow the required rate until water is clear as indicated by no collection of foreign material in burlap bags at outlets such as hydrants and blow-offs. Flush at flows not less than 400 gpm (1514 L/min) for 4-inch pipe, 600 gpm (2271 L/min) for 5-inch pipe, 750 gpm (2839 L/min) for 6-inch pipe, 1000 gpm (3785 L/min) for 8-inch pipe, 1500 gpm (5678 L/min) for 10-inch pipe and 2000 gpm (7570 L/min) for 12-inch pipe. When supply cannot produce stipulated flow rates, obtain maximum available.

PNEUMATIC: Establish 40 psi (2.7 bars) air pressure and measure drop which shall not exceed 1½ psi (0.1 bars) in 24 hours. Test pressure tanks at normal water level and air pressure and measure air pressure drop which shall not exceed 1½ psi (0.1 bars) in 24 hours.

TESTS

All piping hydrostatically tested at 200 PSI for 2 HRS

If no, state reason

Dry piping pneumatically tested: YES [ ] NO [ ]

Equipment operates properly: YES [ ] NO [ ]

DRAIN TEST — Reading of gage located near water supply test pipe: Static Pressure _____ PSI

Residual pressure with valve in test pipe open wide _____ PSI

Underground mains and lead-in connections to system risers flushed before connection made to sprinkler piping.

Verified by copy of the "Underground" Form: YES [ ] NO [ ]

Other Explain

Flushed by installer of Underground sprinkler piping: YES [ ] NO [ ]

BLANK TESTING GASKETS

Number used | Locations | Number removed

WELDING

Welded piping: YES [✓] NO [ ]

If yes, explain:

Do you certify as the sprinkler contractor that welding procedures comply with the requirements of at least AWS D10.9, level AR-3 or equivalent Canadian Standard? YES [✓] NO [ ]

Do you certify that the welding was performed by welders qualified in compliance with the requirements of at least AWS D10.9, level AR-3 or equivalent Canadian Standard? YES [✓] NO [ ]

Do you certify that welding was carried out in compliance with a documented quality control procedure to insure that all discs are retrieved, that openings in piping are smooth, that slag and other welding residue are removed, and that the internal diameters of piping are not penetrated? YES [✓] NO [ ]

HYDRAULIC DATA NAMEPLATE

Nameplate provided: YES [✓] NO [ ]

If no, explain:

REMARKS

Date left in service with all control valves open:

SIGNATURES

NAME OF SPRINKLER CONTRACTOR: [redacted]

TESTS WITNESSED BY

FOR PROPERTY OWNER (SIGNED): [signature] TITLE: Project Engineer DATE: Aug 15/03

FOR SPRINKLER CONTRACTOR (SIGNED): [redacted] TITLE: FITTER DATE: 15/08/03

Additional explanation and notes:

TEST DESCRIPTION	**HYDROSTATIC:** Hydrostatic tests shall be made at not less than 200 psi (13.8 bars) for two hours or 50 psi (3.4 bars) above static pressure in excess of 150 psi (10.3 bars) for two hours. Differential dry-pipe valve clappers shall be left open during test to prevent damage. All aboveground piping leakage shall be stopped. **FLUSHING:** Flow the required rate until water is clear as indicated by no collection of foreign material in burlap bags at outlets such as hydrants and blow-offs. Flush at flows not less than 400 gpm (1514 L/min) for 4-inch pipe, 600 gpm (2271 L/min) for 5-inch pipe, 750 gpm (2839 L/min) for 6-inch pipe, 1000 gpm (3785 L/min) for 8-inch pipe, 1500 gpm (5678 L/min) for 10-inch pipe and 2000 gpm (7570 L/min) for 12-inch pipe. When supply cannot produce stipulated flow rates, obtain maximum available. **PNEUMATIC:** Establish 40 psi (2.7 bars) air pressure and measure drop which shall not exceed 1½ psi (0.1 bars) in 24 hours. Test pressure tanks at normal water level and air pressure and measure air pressure drop which shall not exceed 1½ psi (0.1 bars) in 24 hours.

TESTS

All piping hydrostatically tested at 200 PSI for 2 HRS		If no, state reason
Dry piping pneumatically tested	YES ☐ NO ☐	
Equipment operates properly	YES ☐ NO ☐	
DRAIN TEST	Reading of gage located near water supply test pipe: Static Pressure _____ PSI	Residual pressure with valve in test pipe open wide _____ PSI
Underground mains and lead-in connections to system risers flushed before connection made to sprinkler piping.		
Verified by copy of the "Underground" Form	YES ☐ NO ☐	Other Explain
Flushed by installer of Underground sprinkler piping	YES ☐ NO ☐	

BLANK TESTING GASKETS

Number used	Locations	Number removed

Welded piping	YES ☑ NO ☐	If yes, explain

WELDING

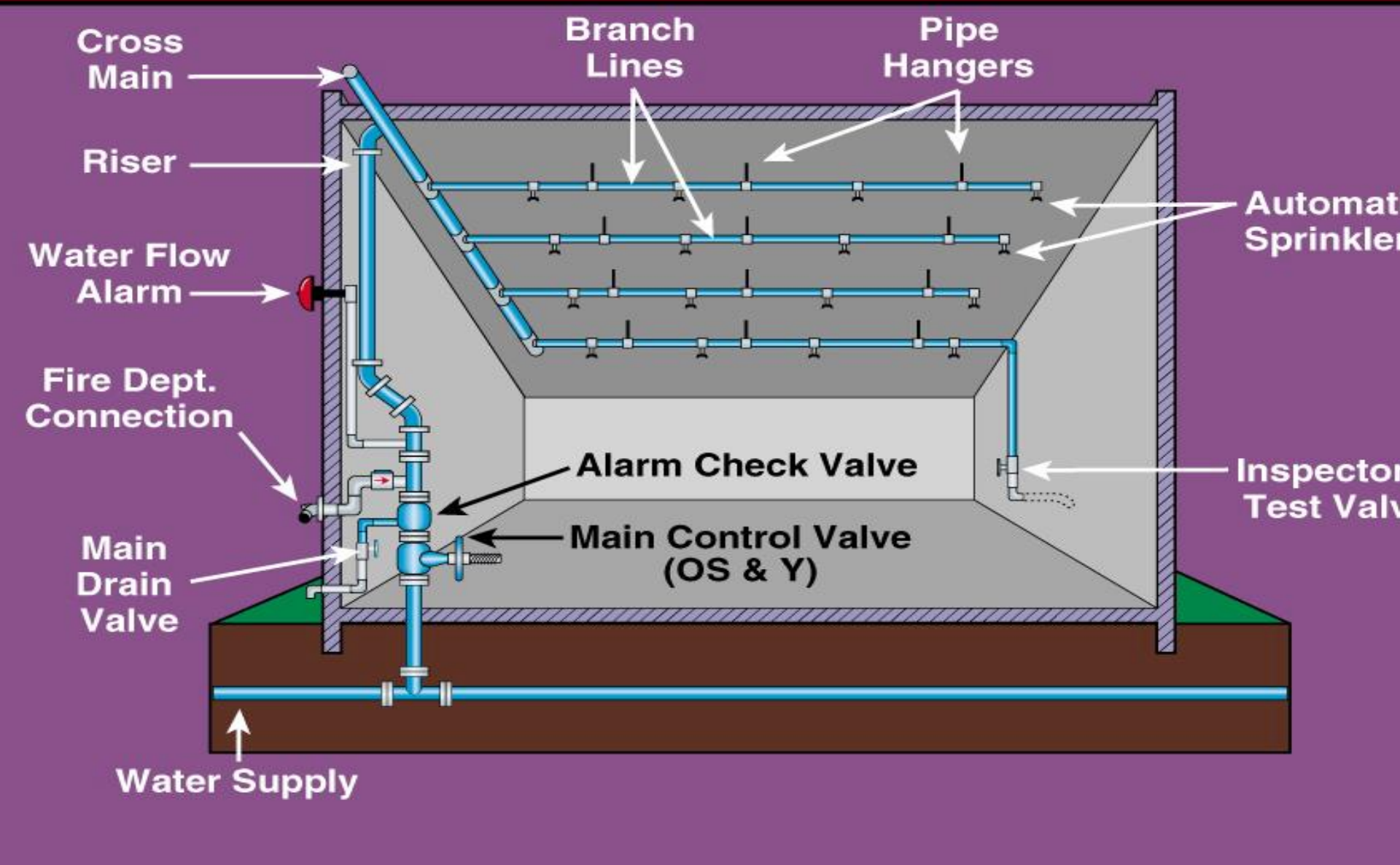
Do you certify as the sprinkler contractor that welding procedures comply with the requirements of at least AWS D10.9, level AR-3 or equivalent Canadian Standard?	YES ☑ NO ☐
Do you certify that the welding was performed by welders qualified in compliance with the requirements of at least AWS D10.9, level AR-3 or equivalent Canadian Standard?	YES ☑ NO ☐
Do you certify that welding was carried out in compliance with a documented quality control procedure to insure that all discs are retrieved, that openings in piping are smooth, that slag and other welding residue are removed, and that the internal diameters of piping are not penetrated?	YES ☑ NO ☐

Sprinkler Alarms

- OFC
  - Flow switches not monitored – monthly 6.5.5.2.(1)
  - Monitored – 2 months 6.5.5.7.(2)
  - Inspector’s test connection (wet) – annually 6.5.5.3.

Sprinkler Alarms

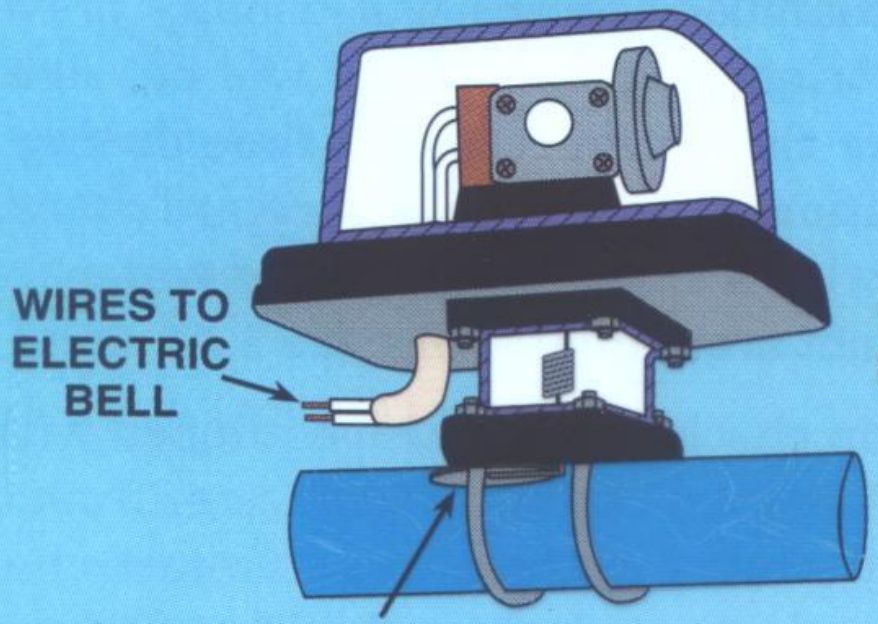
WET SYSTEM


Cross Main
Branch Lines
Pipe Hangers
Riser
Automat
Sprinkler
Water Flow Alarm
Fire Dept. Connection
Alarm Check Valve
Inspector Test Valv
Main Control Valve (OS & Y)
Main Drain Valve
Water Supply

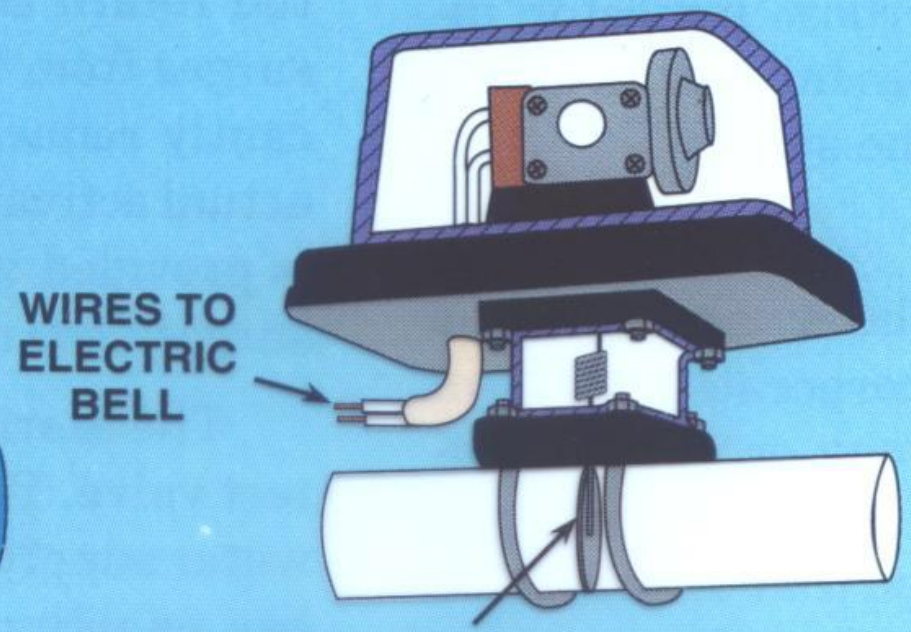
Emergency Service
CALL
564-5290
Emergency Service
CALL
564-5290

Sprinkler Alarms

WATERFLOW DETECTOR



ALARM POSITION



NORMAL POSITION

Sprinkler Heads

- OFC
  - Check heads annually

Sprinkler Heads

Sprinkler Heads

South bldg 2nd F1 P2 Sprinkler Room
South bldg atrium P3 Sprinkler Room
Supervised valve ns/P4 2nd fl at elevator
Standpipe nf1 Parks & Recreation
Standpipe nf2 Public Works Stair F
Standpipe nf3 Capital Assets Office
Standpipe nf4 Capital Assets Office
Standpipe nf5 Capital Assets Office
Standpipe nf6 First aid corridor
Standpipe nf7 Public Works
Standpipe 329 2nd F1 NW Corporate Communication
Standpipe 326 2nd F1 W Main Lobby Sprinkler Room
Standpipe 330 2nd F1 SW 1st F1 Stair H
PUMP DISCHARGE(NORMALLY CLOSED)
PUMP SUCTION(NORMALLY CLOSED)
TO SILENCE ALARM - CLOSE VALVE #3
MAINTAINING SYSTEM PRESSURE:
(416) 307-3705

Spare Sprinkler Heads

- OFC
  - 300 heads – 6 spare heads
  - 301-1000 heads – 12 spare heads
  - Over 1000 heads – 24 spare heads
  - Sprinkler head wrench or wrenches

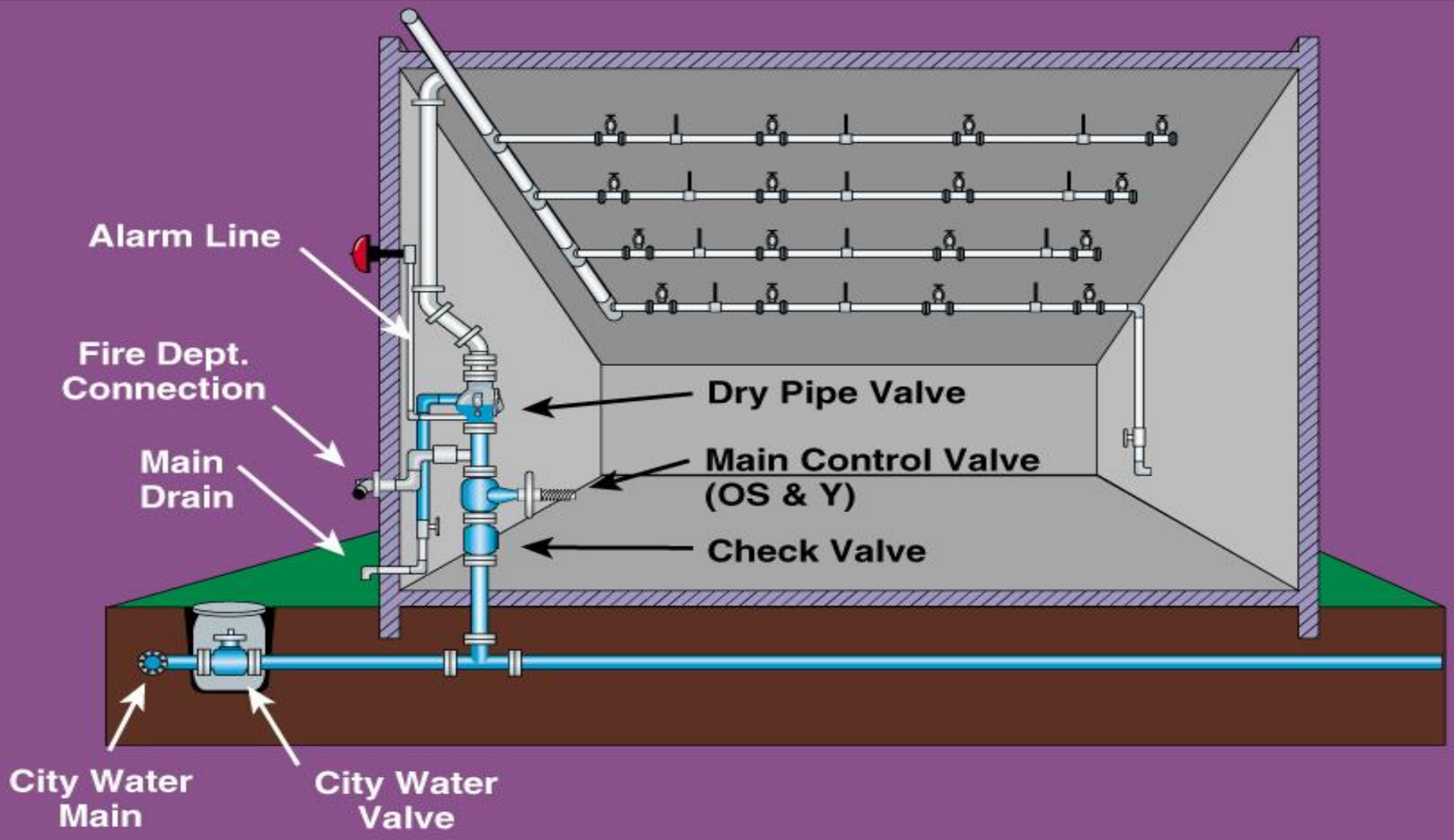
Spare Sprinkler Heads

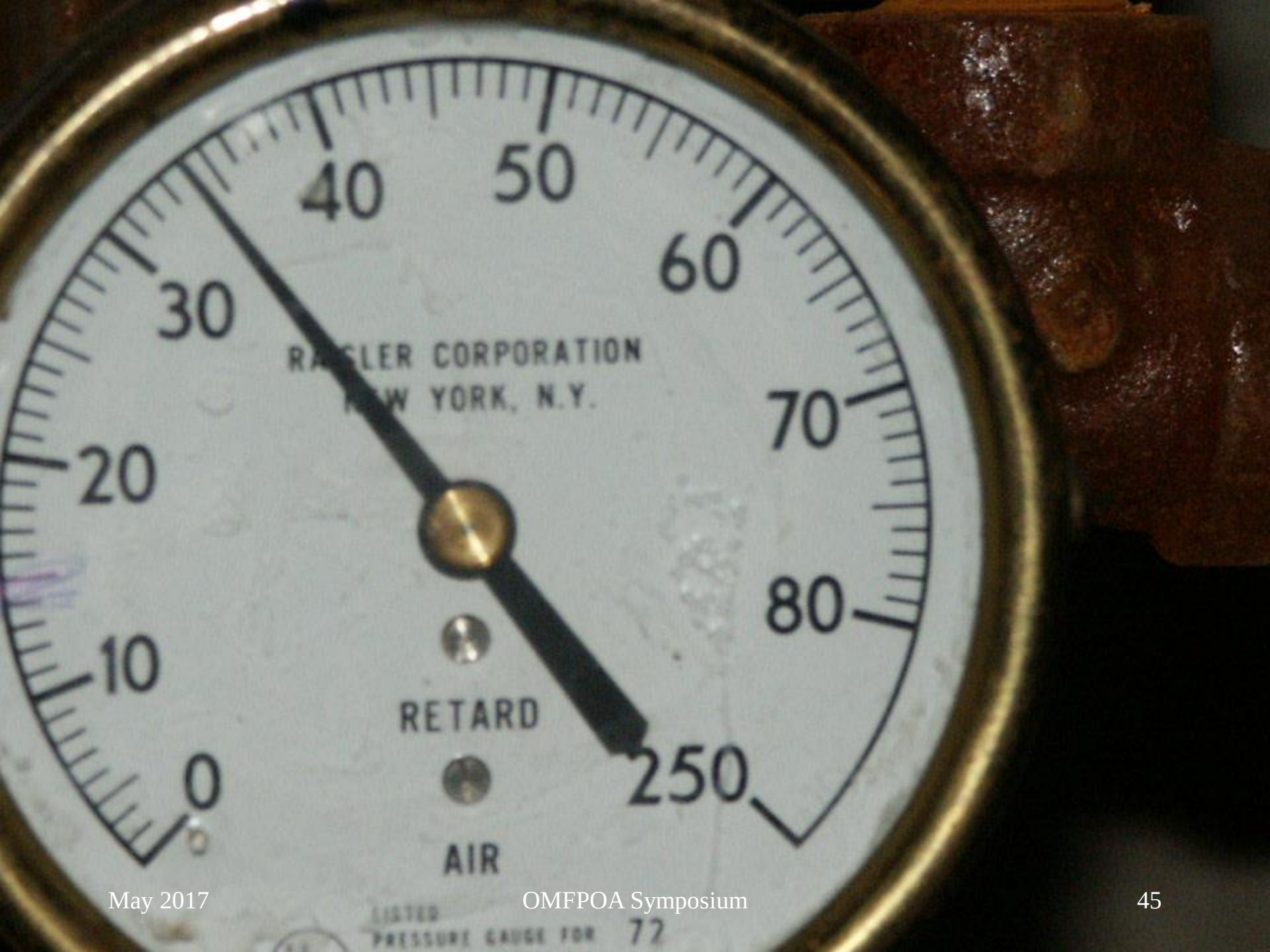
Dry pendent sprinkler head

Dry Pipe Trip Test

- OFC
  - ¾ turn trip test annually
  - Can't exceed 10% of required trip time
  - Full flow test every 3 years

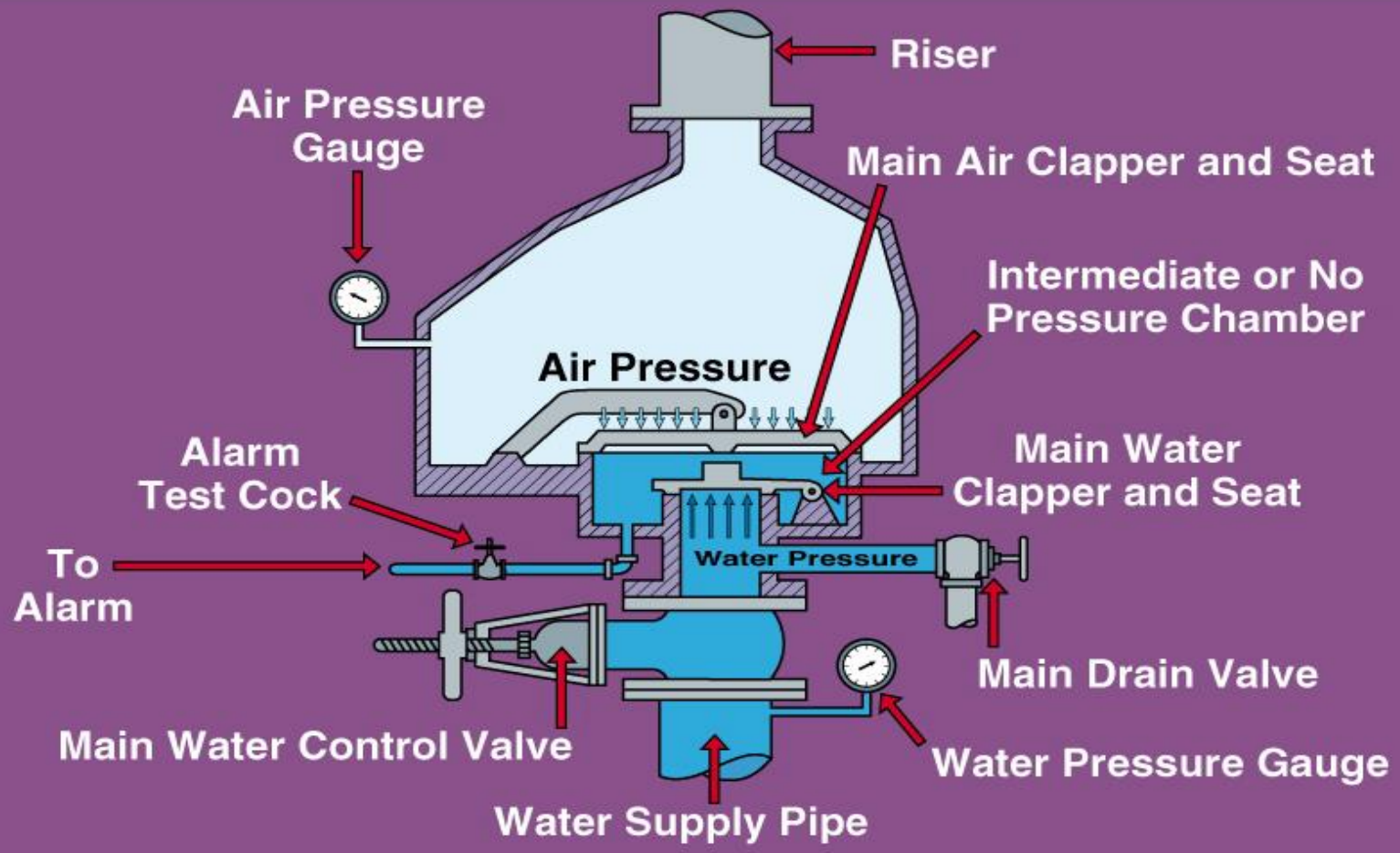
DRY-PIPE SYSTEM




0
10
20
30
40
50
60
70
80
250
RETARD
AIR
LISTED
PRESSURE GAUGE FOR 72

DRY SYSTEM VALVES & GAUGES

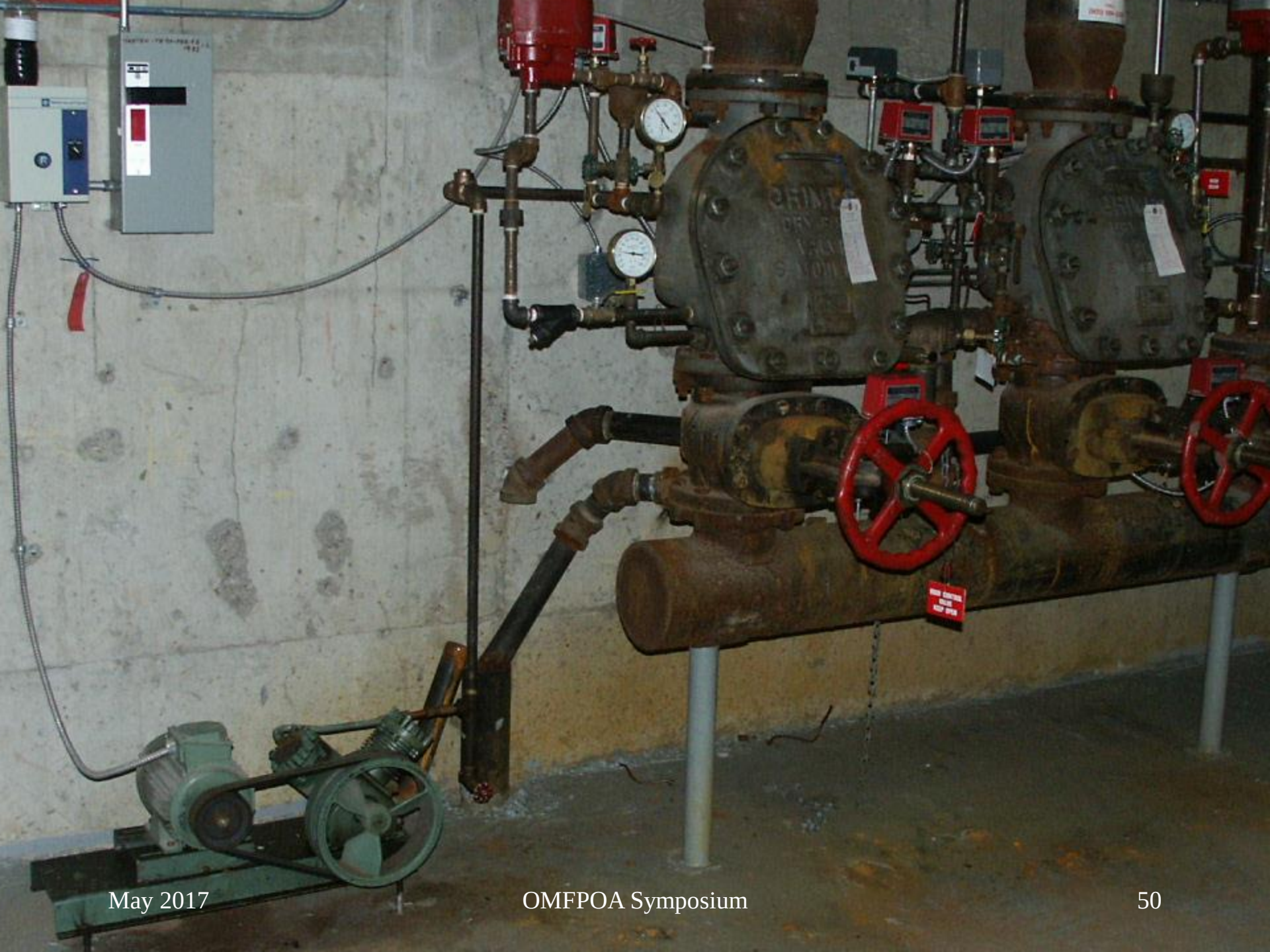
15-17



Quick Opening Devices (QOD)

- Systems not more than 500 gal
- Systems not more than 750 gal with QOD

Hazard	# Remote Sprinkler Heads	Maximum Time Water Delivery
Light	1	60
Ordinary Hazard I	2	50
Ordinary Hazard II	2	50
Extra I	4	45
Extra II	4	45
High Piled	4	40



Freezing Concerns

- Sprinkler Rooms
  - Daily during cold season
- Auxiliary Drains
  - Inspected to prevent freezing – no time frame

Freezing Concerns

GRIME
DRY
MODEL
RAISLER

Test Flushing

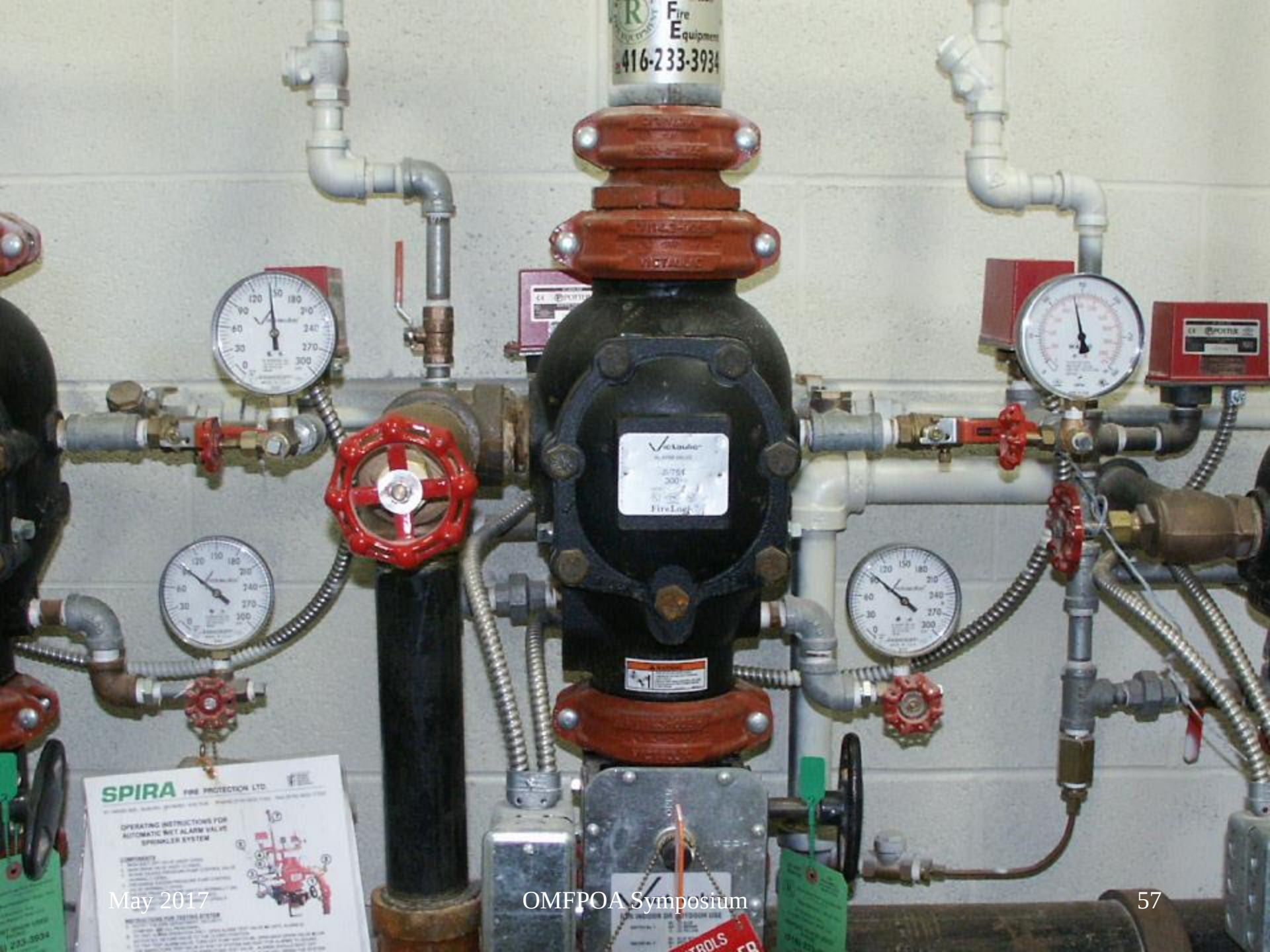
- OFC 6.5.4.2.
  - Inspected every 15 years and flush entire system if required (dry systems)

Pumper Connections

- OFC 6.5.4.4.
  - Annually
  - Flush if required

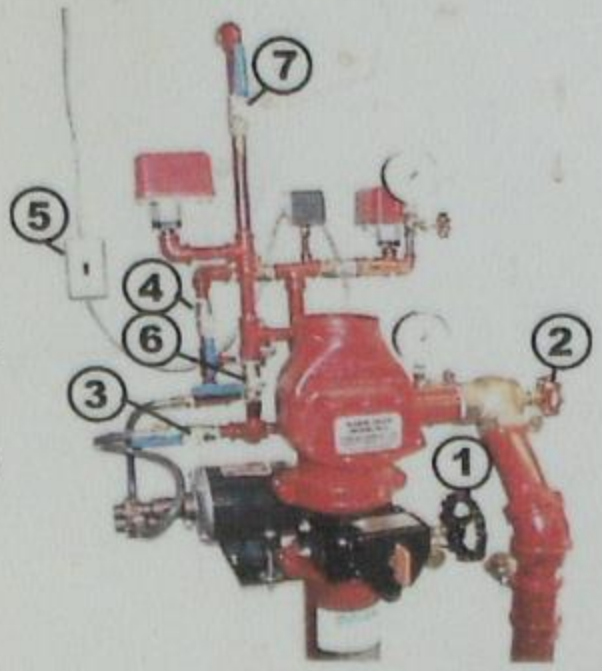
Hydraulic Nameplate

- No OFC requirements


Fire
Equipment
416-233-3934
SPIRA FIRE PROTECTION LTD.
OPERATING INSTRUCTIONS FOR
AUTOMATIC WET ALARM VALVE
SPRINKLER SYSTEM

31 HAYES AVE., GUELPH, ONTARIO N1E 5V6 PHONE (519) 823-1150 FAX (519) 822-7752

OPERATING INSTRUCTIONS FOR AUTOMATIC WET ALARM VALVE SPRINKLER SYSTEM



COMPONENTS

1. MAIN SHUT-OFF VALVE (KEEP OPEN)
2. MAIN DRAIN VALVE (KEEP CLOSED).
3. INTAKE EXCESS PRESSURE PUMP CONTROL VALVE (NORMALLY OPEN).
4. DISCHARGE EXCESS PRESSURE PUMP CONTROL VALVE (NORMALLY OPEN).
5. EXCESS PRESSURE PUMP SWITCH (NORMALLY ON)
6. ALARM TEST VALVE (NORMALLY CLOSED)
7. ALARM SHUT-OFF VALVE (NORMALLY OPEN) IF INSTALLED.

INSTRUCTIONS FOR TESTING SYSTEM

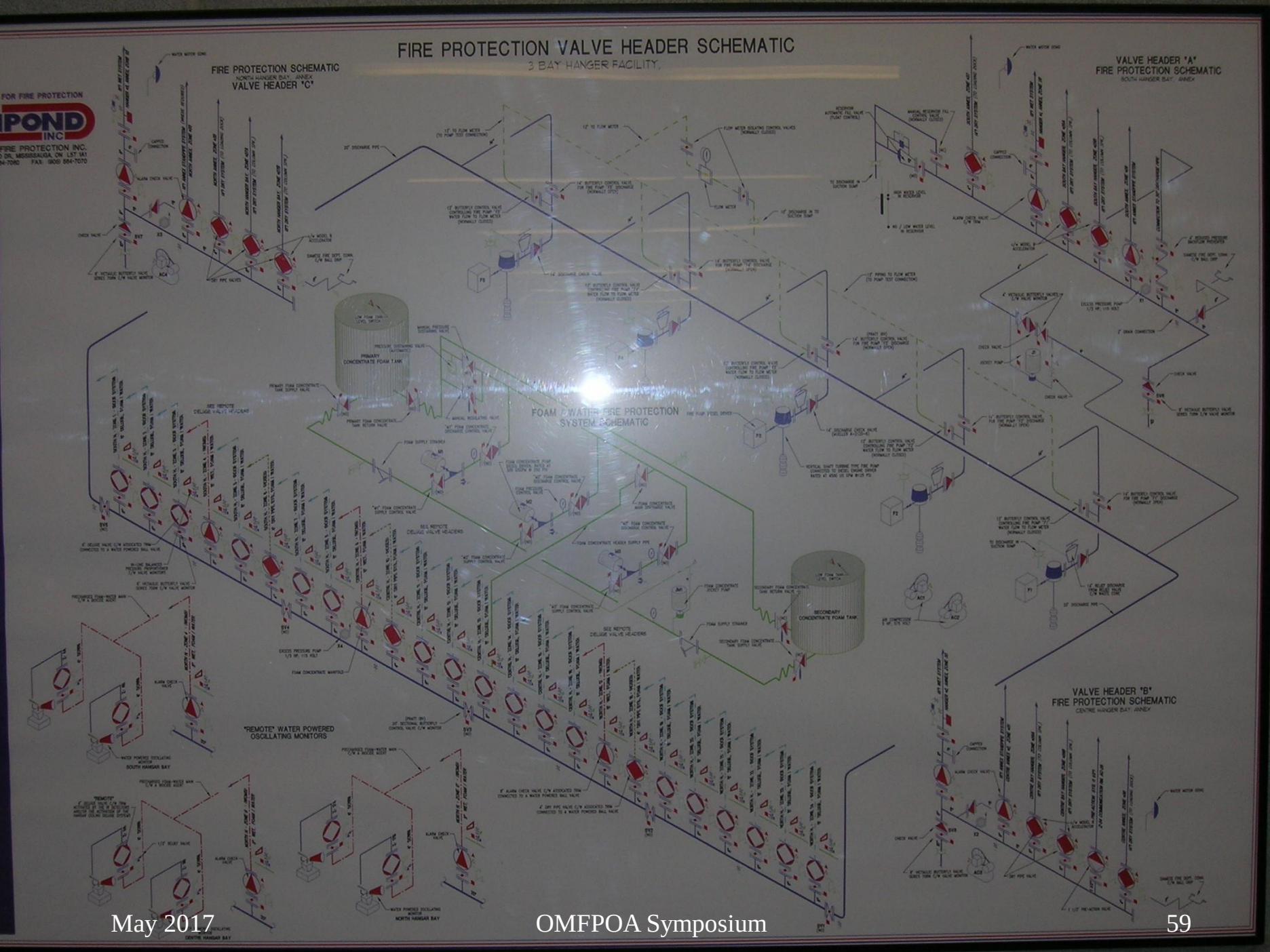
A. NOTIFY THE FIRE DEPARTMENT, SECURITY COMPANY AND ALL PERSONNEL.
B. TO TEST ALARM OPERATION ONLY, OPEN ALARM TEST VALVE #6 UNTIL ALARM IS ACTIVATED. RETURN VALVE TO THE CLOSED POSITION.
C. TO TRIP TEST ALARM VALVE, TURN OFF PUMP SWITCH #5, OPEN MAIN DRAIN VALVE #2 OR THE INSPECTORS TEST VALVE AT END OF SYSTEM AND WAIT FOR ALARMS TO SOUND. CLOSE MAIN DRAIN VALVE OR INSPECTORS TEST VALVE. ALARMS SHOULD SHUT OFF WHEN VALVE IS CLOSED. TURN ON PUMP SWITCH #5 AND PUMP WILL BRING THE SYSTEM PRESSURE UP TO NORMAL OPERATING PRESSURE AND SHUT OFF AUTOMATICALLY.

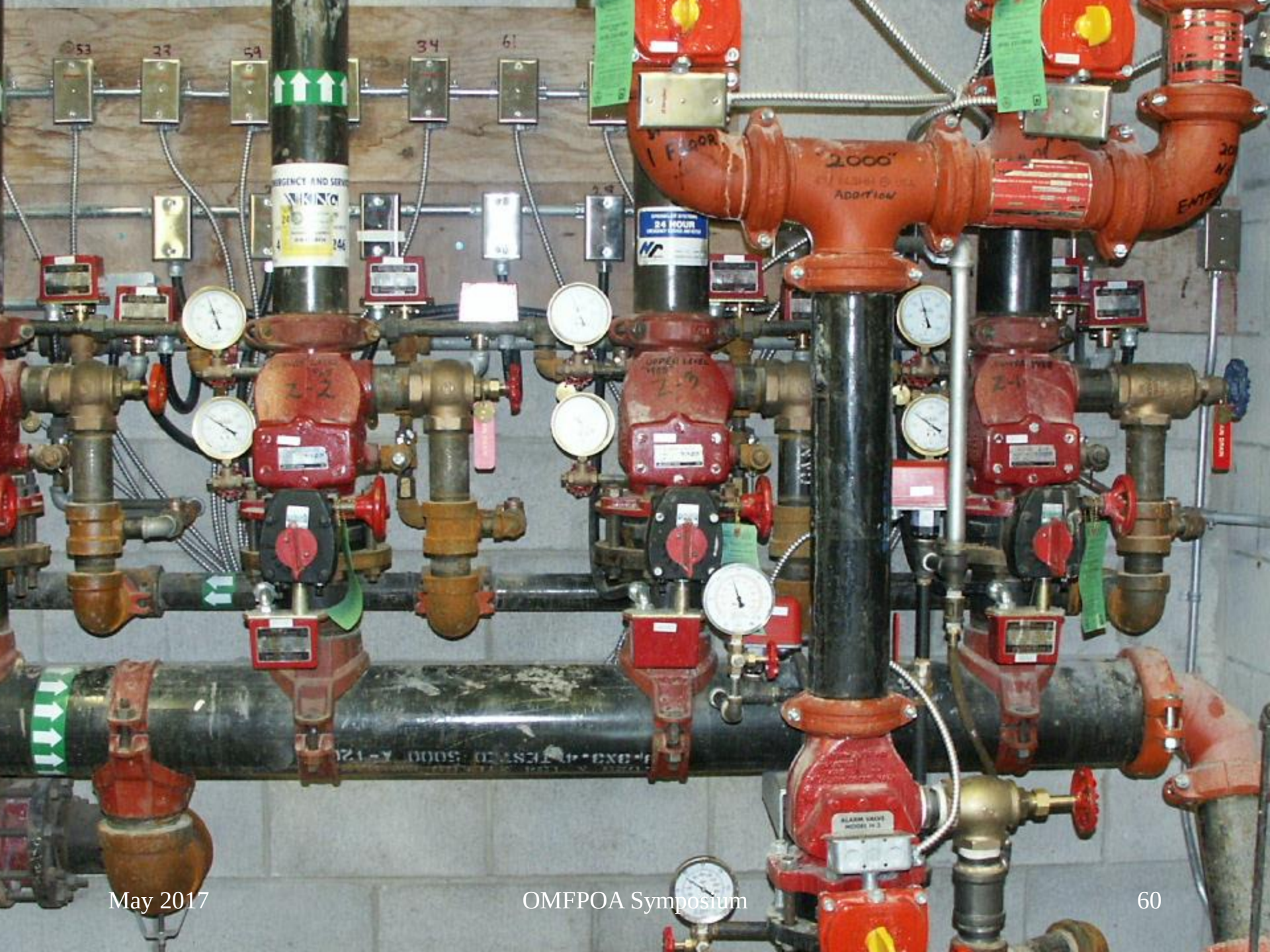
INSTRUCTIONS FOR DRAINING SYSTEM

A. NOTIFY THE FIRE DEPARTMENT, SECURITY COMPANY AND ALL PERSONNEL.
B. SHUT OFF THE PUMP SWITCH #5.
C. CLOSE THE MAIN SHUT OFF VALVE #1.
D. OPEN THE MAIN DRAIN VALVE #2.
E. OPEN THE INSPECTORS TEST VALVE AT THE END OF THE SYSTEM.

INSTRUCTIONS FOR RE-FILLING SYSTEM

A. CLOSE THE INSPECTORS TEST VALVE AT THE END OF THE SYSTEM.
B. CLOSE THE MAIN DRAIN VALVE #2.
C. OPEN MAIN SHUT OFF VALVE #1. (SLOWLY)
D. VERIFY THAT VALVES #3 & #4 ARE OPEN [illegible] PUMP SWITCH #5. ALLOW SYSTEM PRESSURE (UPPER GAUGE) TO RISE TO 125PSI. OR 50 PSI ABOVE THE LOWER PRESSURE GAUGE (PUMP SHOULD SHUT OFF AUTOMATICALLY WHEN PRESSURE IS OBTAINED)


FIRE PROTECTION VALVE HEADER SCHEMATIC
3 BAY HANGER FACILITY
FIRE PROTECTION SCHEMATIC
VALVE HEADER "C"
VALVE HEADER "A"
FIRE PROTECTION SCHEMATIC
VALVE HEADER "B"
FIRE PROTECTION SCHEMATIC
FOAM / WATER FIRE PROTECTION
SYSTEM SCHEMATIC
PRIMARY
CONCENTRATE FOAM TANK
SECONDARY
CONCENTRATE FOAM TANK
"REMOTE" WATER POWERED
OSCILLATING MONITORS
SOUTH HANGAR BAY
NORTH HANGAR BAY
FOR FIRE PROTECTION
IPOND INC
FIRE PROTECTION INC.


2000
ADDITION
24 HOUR

Any Questions