Fire Sprinkler Applications for Public Officials

IFIA FALL SAFETY SEMINAR

Thursday, November 15, 2012

FIRE PROTECTION PUBLICATIONS
OKLAHOMA STATE UNIVERSITY

Welcome

Tom Lia

Northern Illinois Fire Sprinkler Advisory Board

Bob Kleinheinz

National Fire Sprinkler Association

Mr David Whitfield

SPD Industries,

Fire Pump Expert !

Fire Sprinkler Applications for Public Officials

Fire Sprinkler Systems

Back to the Basics

How to understand systems when you inspect and respond on fire calls

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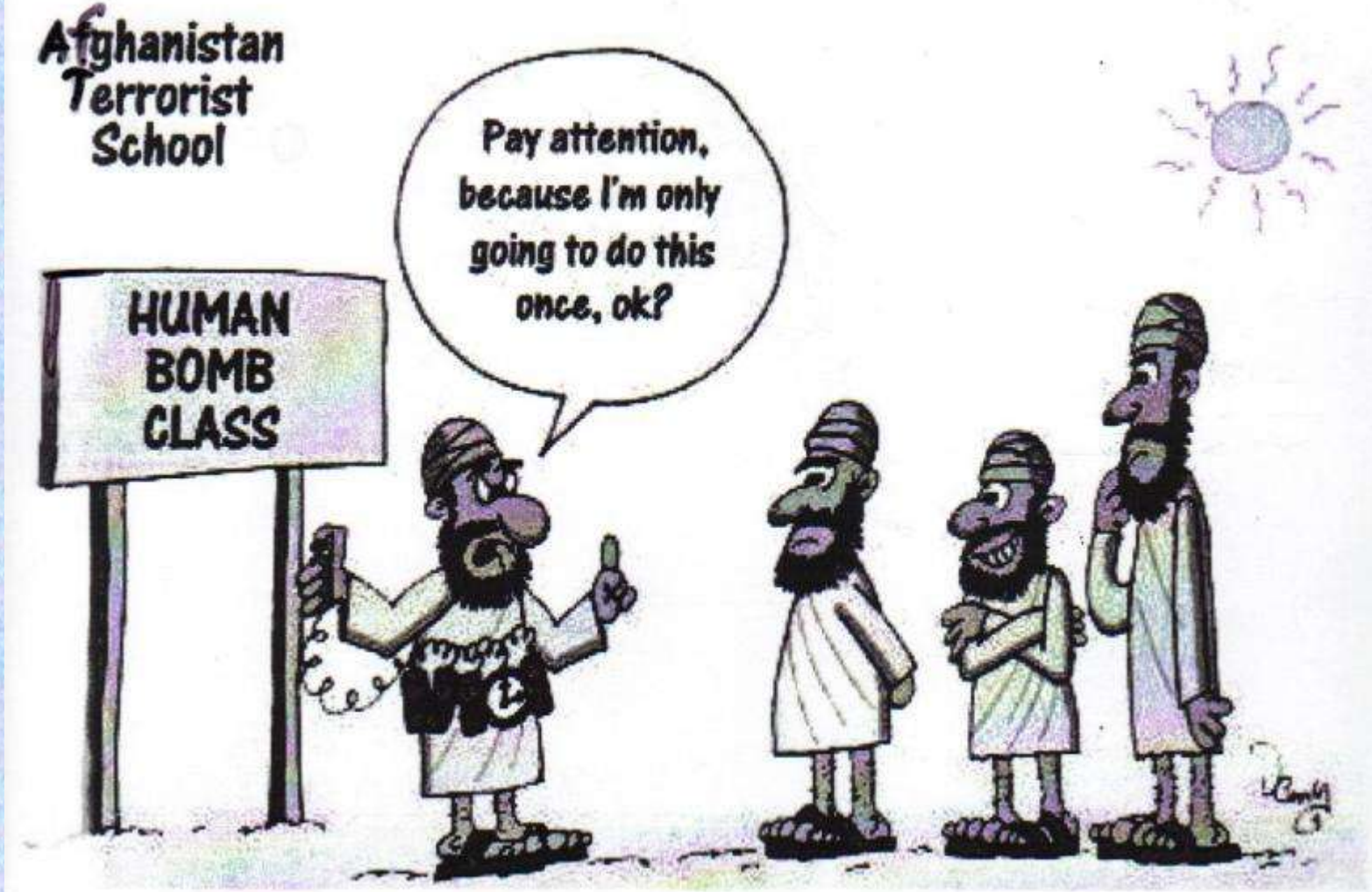
We need you to act in the role of a train the trainer who will review the information presented today and take it back to your department and find ways to implement it on all shifts and personnel.


Afghanistan Terrorist School
Pay attention, because I'm only going to do this once, ok?
HUMAN BOMB CLASS

Today's Objectives

- Identify the importance of fire sprinkler systems.
- Identify the operation principles of sprinkler systems, fire pumps and standpipes.
- Understand how to interact when in a activated flow alarm.
- Understand how the various fire sprinkler systems positively impact fire department operations.
- Determine the importance of fire sprinkler system maintenance and impairment procedures.

Why Worry About Systems?

Fire Protection Systems are a proven method to reduce fire deaths and injuries.

NFPA Report
U.S. Experience with Sprinklers
John Hall, Jr., March, 2012

Effective 96% of the time when operated

Pleasantview Fire Protection Distict

55

Successful

Activations!

AUTOMATIC SPRINKLERS

Pipe, valves and sprinklers to control or suppress a fire in its incipient stages

SPRINKLER SYSTEMS

Most widely used method of controlling fire automatically

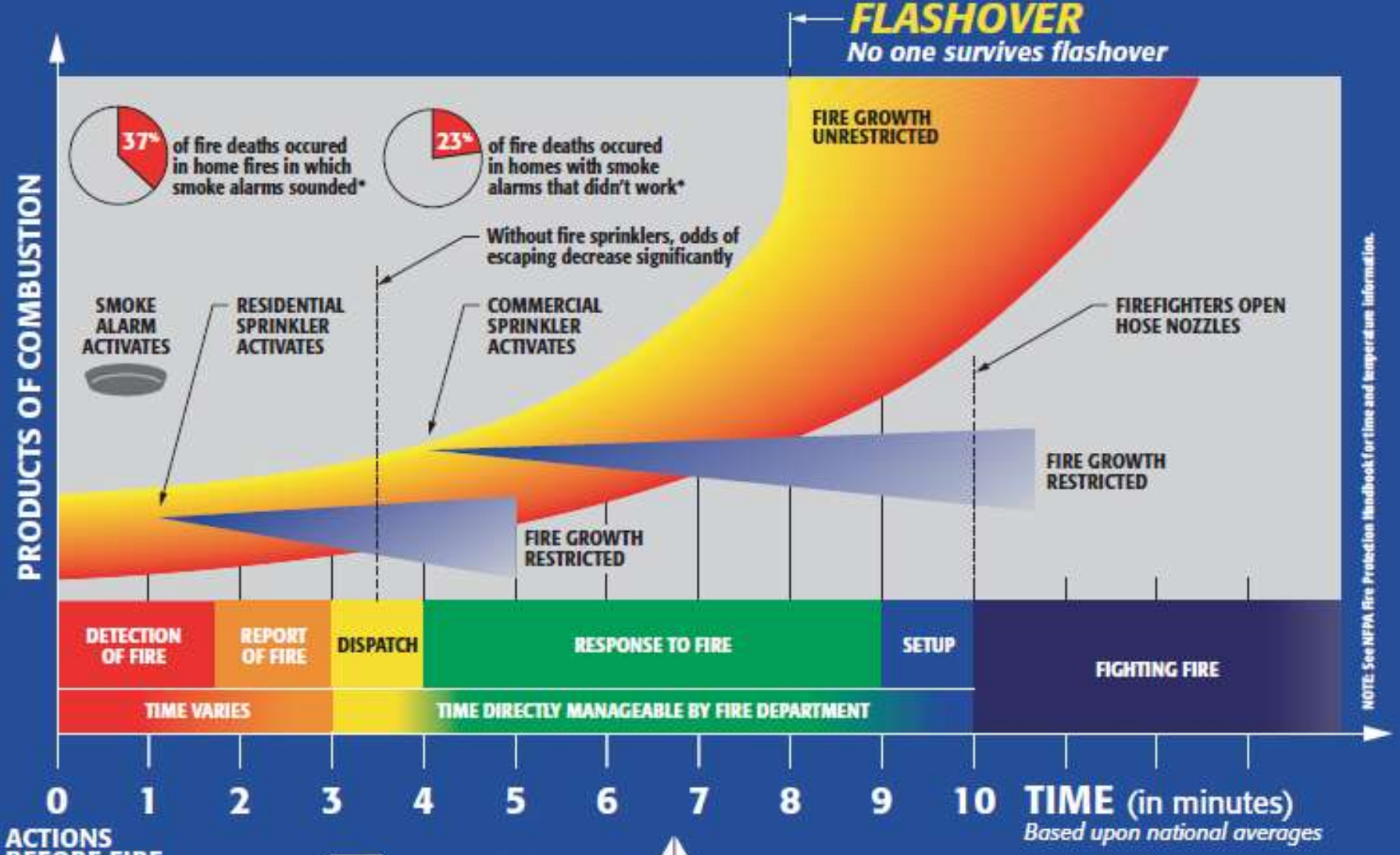
Need to be:

- **Available**
- **Reliable**
- **Appropriate design**

Fire Protection Systems Impact on Operations

- Helps identify the fire building
- Helps Identifies the location of fire
- Controls the fire
- Reduces flashover
- Suppresses the fire

TIME vs. PRODUCTS of COMBUSTION



ACTIONS BEFORE FIRE

1) TEST SMOKE ALARMS
2) CONDUCT FIRE ESCAPE DRILLS

*Smoke Alarms in U.S. Home Fires, NFPA, September 2009.

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FireSprinklerAssoc.org

ILLINOIS FIRE INSPECTORS ASSOCIATION

NORTHERN ILLINOIS FIRE INSPECTORS ASSOCIATION

Home Fire Sprinkler COALITION
Protect What You Value Most
HomeFireSprinkler.org

Other Benefits

- Risk mitigation
- Design latitude (Code Tradeoffs)
- Property conservation
- Improved firefighter efficiency
- Life safety
- Firefighter Safety

D I D Y O U K N O W ?

The National Fallen Firefighters Foundation's Firefighter Life Safety Summit developed a national program to reduce firefighter line-of-duty deaths.

The Summit developed 16 initiatives aimed at achieving a 25% reduction in firefighter fatalities over the next 5 years and a 50% reduction over the next 10 years, including:

"Strengthen advocacy for the enforcement of codes and the installation of home fire sprinklers."

To find out more about the Firefighters Life Safety Summit initiatives and other information, call NIFSAB toll-free at 866-2NIFSAB (866-264-3722) and visit **www.firesprinklerassoc.org.**

Northern Illinois Fire Sprinkler Advisory Board

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Standards

- NFPA® 13 / Fire Sprinkler Systems
- NFPA 13E / Recommended Practice for Fire Department Operations in Properties Protected by Sprinkler and Standpipe Systems

NFPA 13R
Residential Up to 4 stories

NFPA 13D
Single-Family Homes

NFPA 14
Standpipes

NFPA 20
Fire Pumps

NFPA 25
Inspection, Testing & Maintenance

NFPA 13

- Provides guidelines for most occupancies
- Assumes hose stream allowances for fire suppression
- Water supply amount and duration based on hazard (full design area)
- Assumes total coverage, with some omissions

NFPA 13

Sample omissions:

Noncombustible elevator shafts

- **No hydraulic fluid**

Electrical rooms protected by 2-hour fire-rated enclosure

- **Dry type electrical equipment only in rooms**
- **No storage in electrical room**

NFPA 13R: RESIDENTIAL--UP TO 4 STORIES

- Life safety system, intended to prevent flashover
- Only partial coverage required
- Omits
  - Bathrooms
  - Unused attics
  - Closets, balconies, and porches
- No hose stream allowances
- Duration--30 minutes (4 head design)

NFPA 13D: 1- AND 2-FAMILY AND MANUFACTURED HOMES

Anticipates only partial coverage, prevents flashover, allows escape

Omits

- Bathrooms
- Unused attics
- Closets
- Open, attached balconies and porches

No hose stream allowances

Duration--10 minutes

- 7 minutes for small one-story (2 head design)

Water Supply for Systems

- **Water Sources**
  - ✓ Reservoirs
  - ✓ Tanks
- **Moving Water**
  - ✓ Gravity Systems
  - ✓ Direct pumping
- **Combination System**

WATER SUPPLY

An adequate water supply is essential to successful fire protection system operations.

- **System demand.**
- **Hose stream allowance.**

Sprinkler Water Supply

- Determined by hazard being protected, occupancy classification, and fuel loading conditions
- Must deliver required volume of water to highest or most remote sprinkler while maintain minimum residual pressure in the system

HOSE STREAM ALLOWANCE

Water allocated for fire suppression operations

Added to water supply needed for sprinkler system

- – Light hazard: 100 gpm
- – Ordinary hazard: 250 gpm
- – Extra hazard: 500 gpm

SPRINKLER DEMAND EXAMPLE

Sprinkler system: 1,000 gallons per minute (gpm)

Hose streams: 250 gpm

Total: 1,250 gpm for 2 hours

150,000 gallons

SPRINKLER SYSTEMS

Effectiveness relies on

- Availability.
- Reliability.
- Adequate design.

Need reliable water supply identified in preincident plan.

Incident Commander (IC) should have contingency plan.

Water Distribution Pipes

- Underground water supply
- System risers
- Sprinkler cross mains
- Sprinkler branch lines

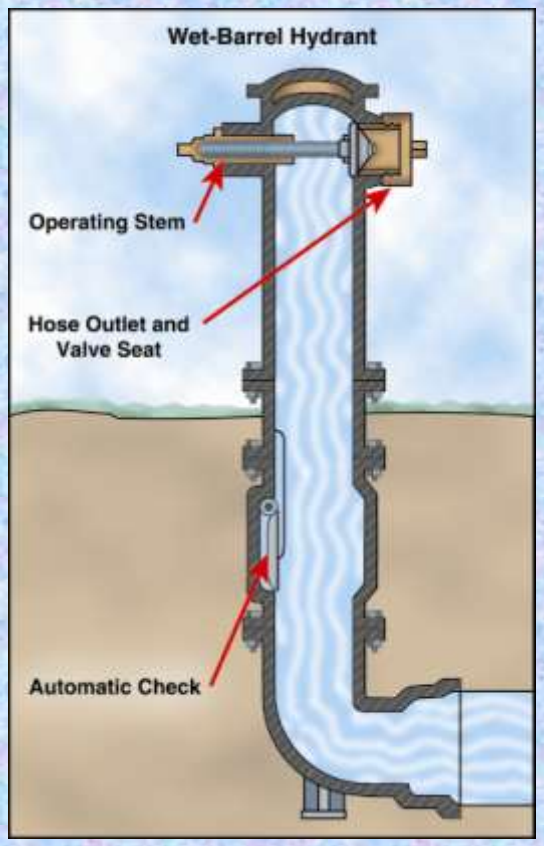
WATER SUPPLY: MUNICIPAL

System Components

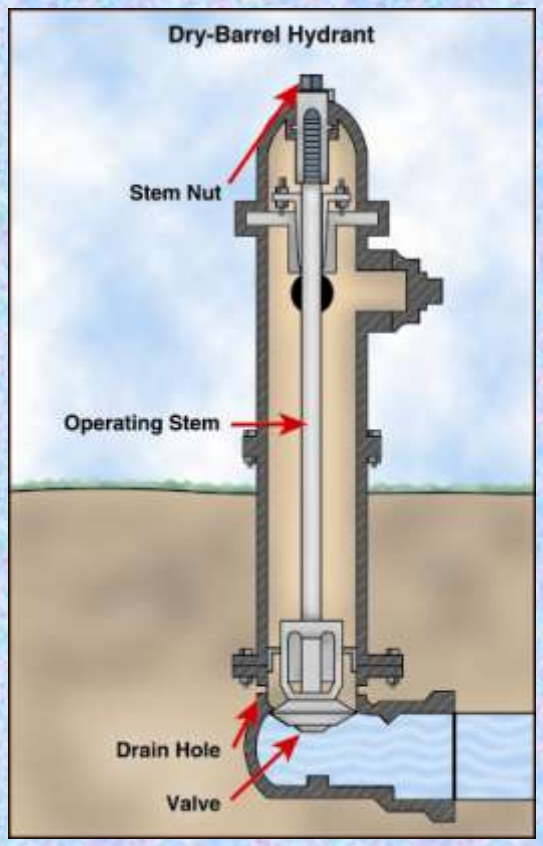
- **Storage tanks**
- **Control valves**
  - Indicating
  - Non-indicating
  - Usually exercised by municipal water dept

Fire Hydrants

Global Warming



Ice-Age



SPRINKLER SYSTEM COMPONENTS

- Pipes
- Valves
- Tamper alarms
- Flow alarms
  - Flow
  - Pressure
- Gauges
- Accelerators
- Exhausters
- Compressors

PIPE AND TUBE

Copper

CPVC

Steel
Black Iron

Water-Flow Control Valves

OS & Y

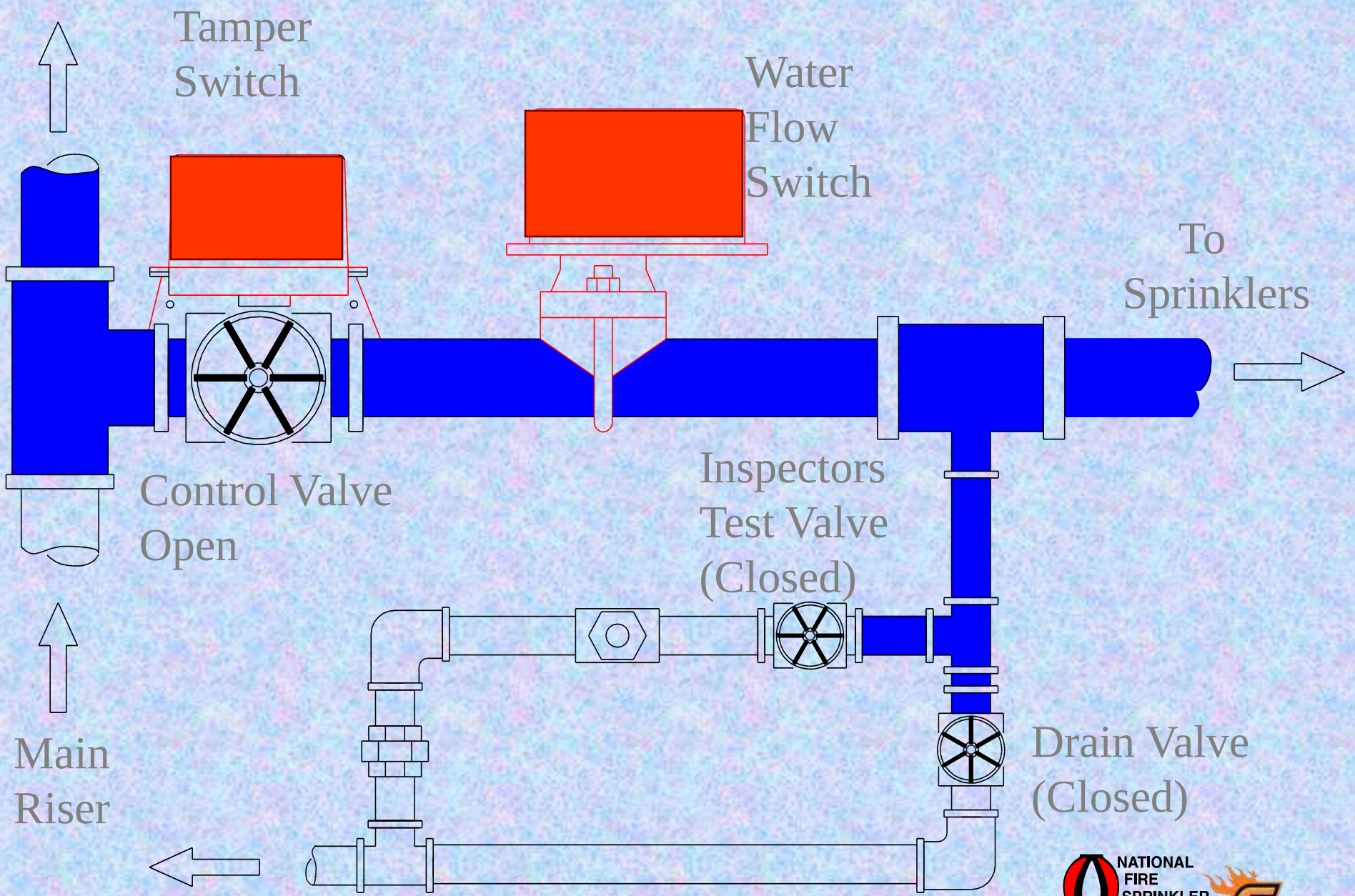
WPIV

PIV

INDICATING VALVES

NONINDICATING VALVES

SECTIONAL CONTROLS



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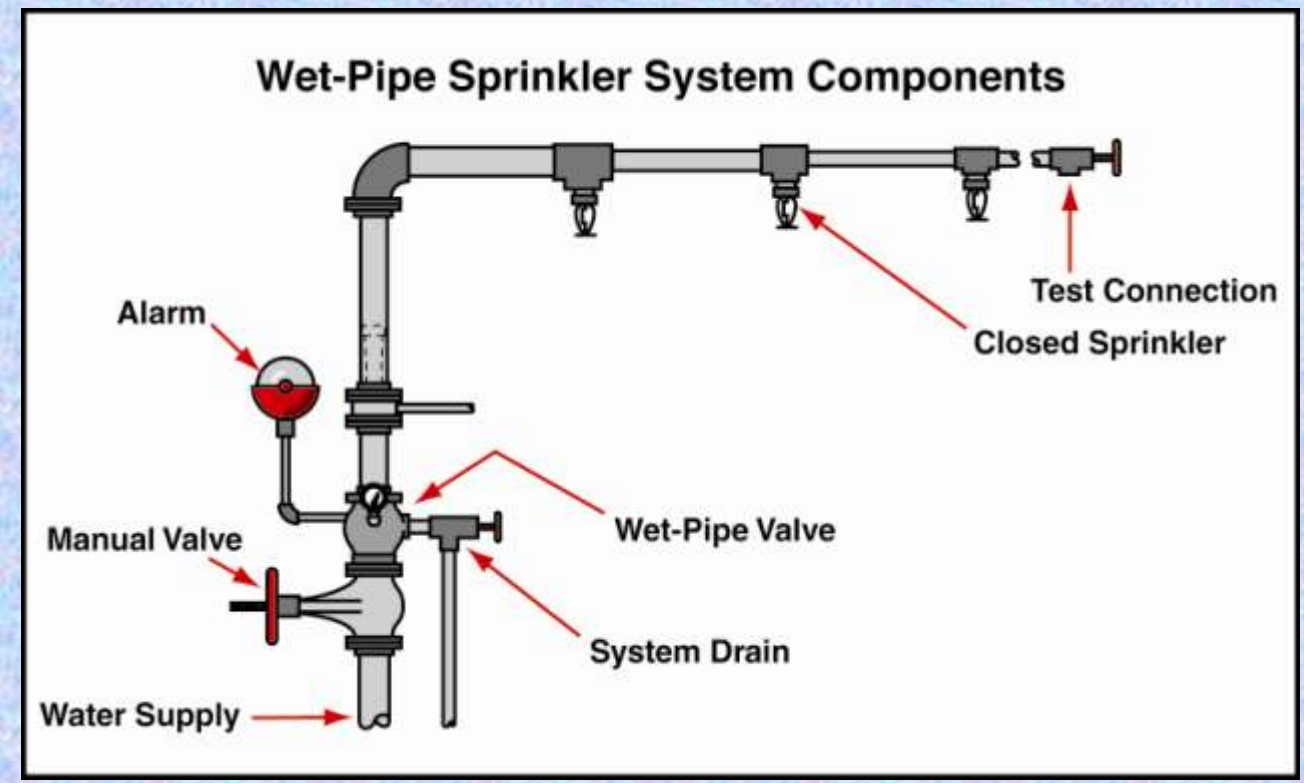
FPP
FIRE PROTECTION PUBLICATIONS
OKLAHOMA STATE UNIVERSITY

Types of Fire Sprinkler Systems

- Wet- Pipe
- Dry-Pipe
- Pre-Action Type
- Deluge Type
- Hollywood Type

Automatic Sprinkler Systems

Wet Pipe

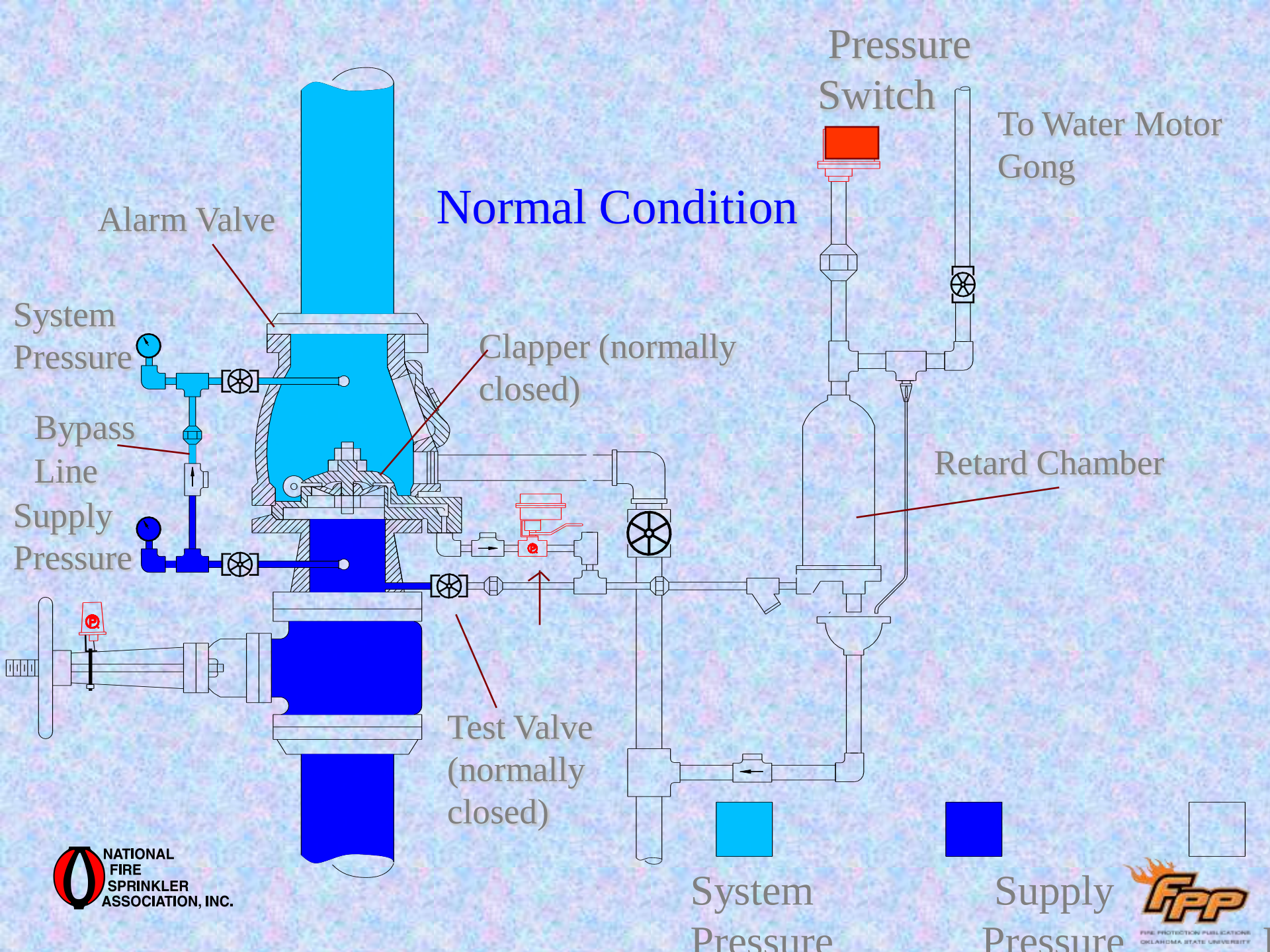


WET PIPE

Areas not subject to freezing

WHERE WET PIPE SYSTEMS ARE FOUND

- Churches/Assemblies
- Offices/Businesses
- Residences
- Storage
- Mercantile
- Industrial


Pressure Switch
To Water Motor Gong
Normal Condition
Alarm Valve
System Pressure
Clapper (normally closed)
Bypass Line
Supply Pressure
Retard Chamber
Test Valve (normally closed)
System Pressure
Supply Pressure
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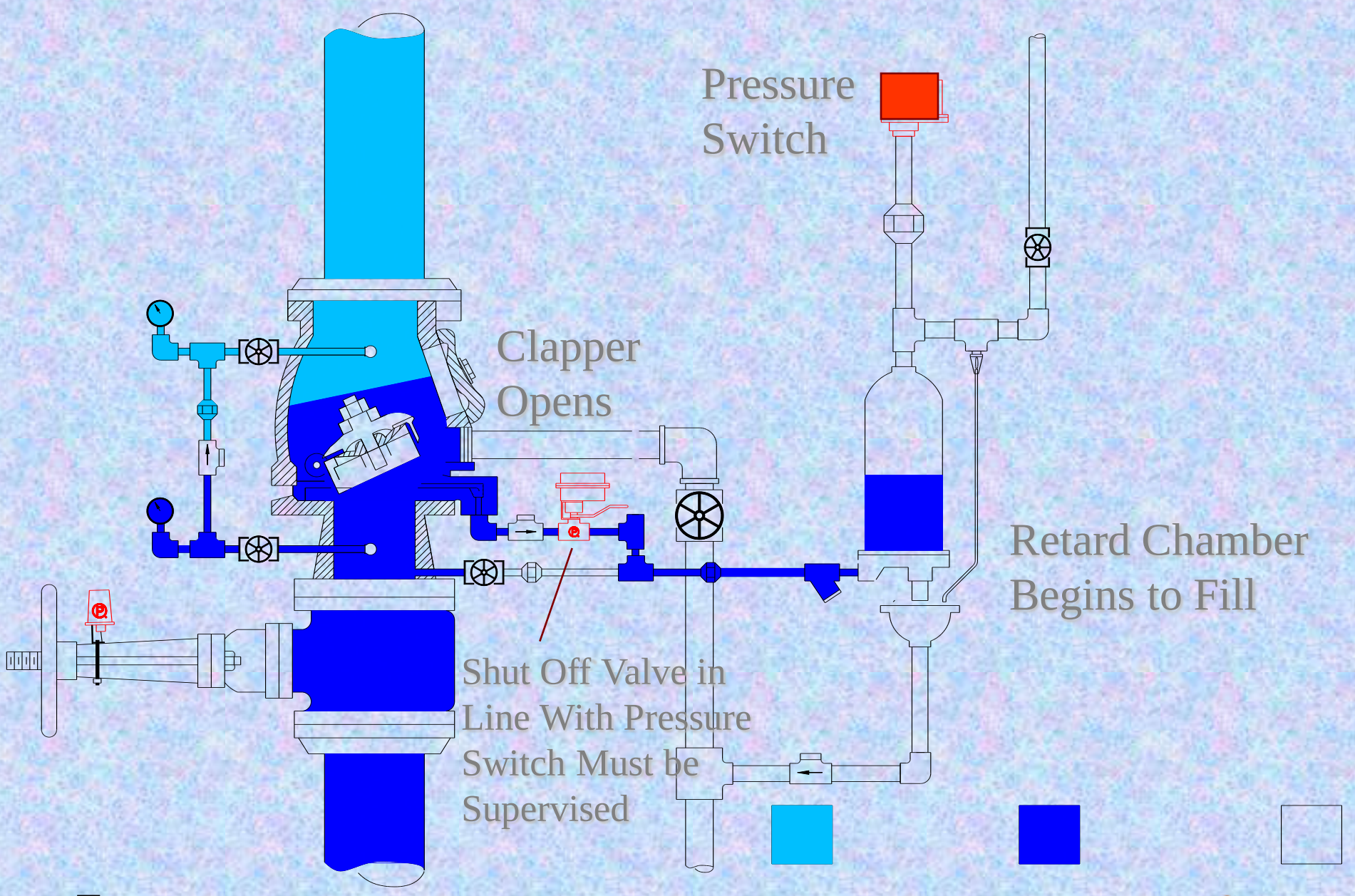
FPP



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ALARM CHECK VALVE

- Incoming water pressure lifts main clapper valve
- Two gauges
  - Upper shows system pressure
  - Lower shows incoming water pressure

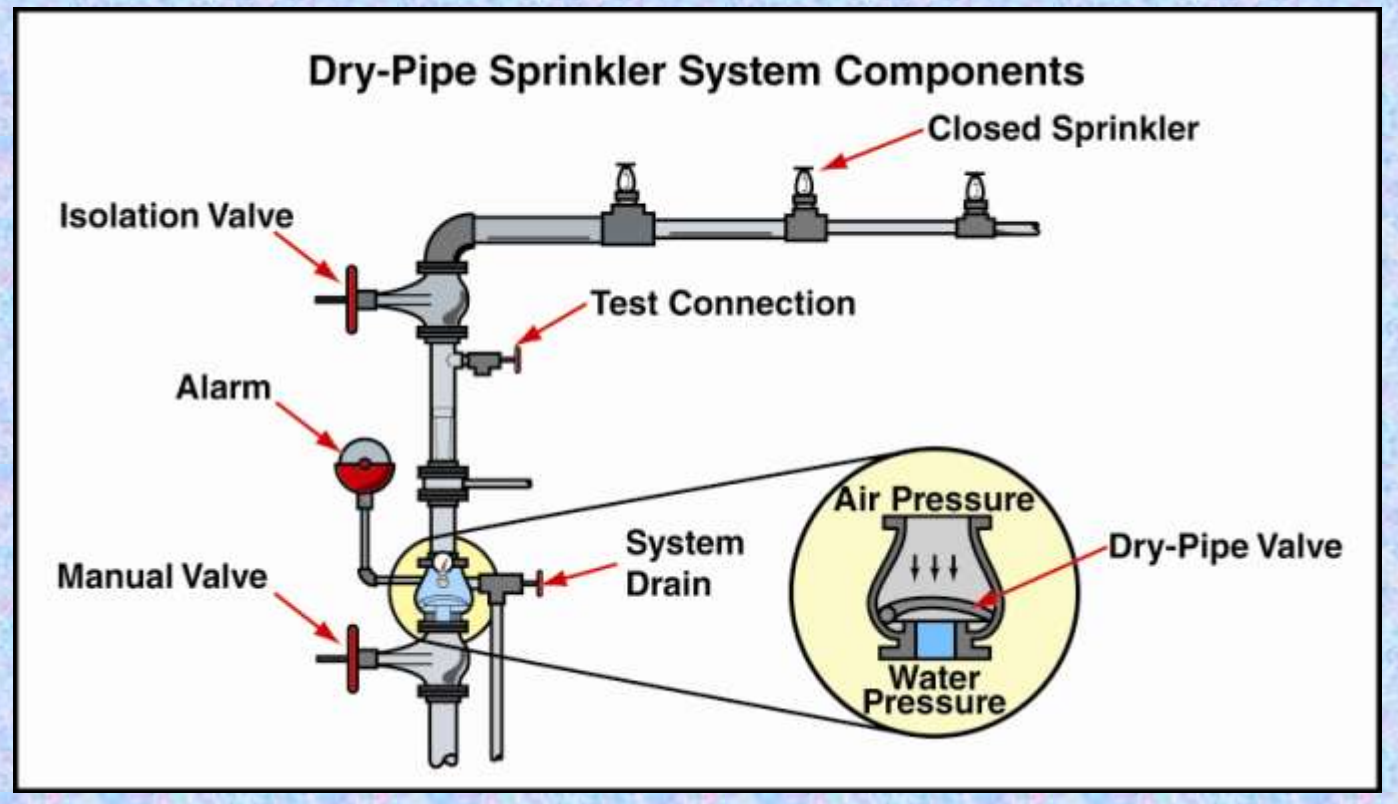
ALARM CHECK VALVE WITH RETARDING CHAMBER

Shotgun Riser

Multiple Risers

Automatic Sprinkler Systems

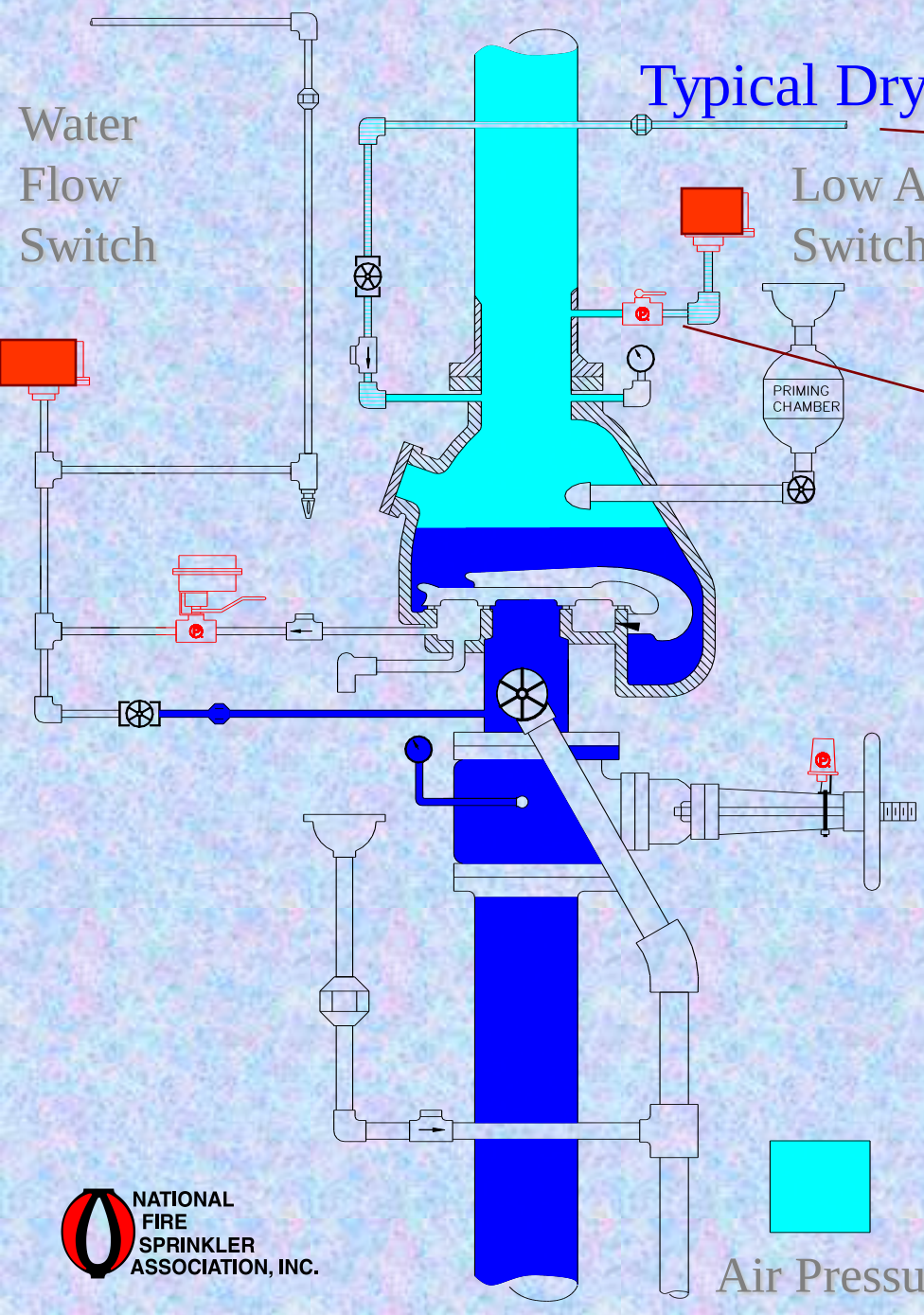
Dry-pipe



DRY PIPE

Areas subject to freezing

Typical Dry System in Normal Condition



The system side of a dry pipe valve is 4-5 times larger than the supply side. This allows a lower pressure [usually 40 psi], to hold back the city water supply. There is a small amount of priming water on top of the valve to create a better seal.

Air Pressure

Water Supply

No Pressure

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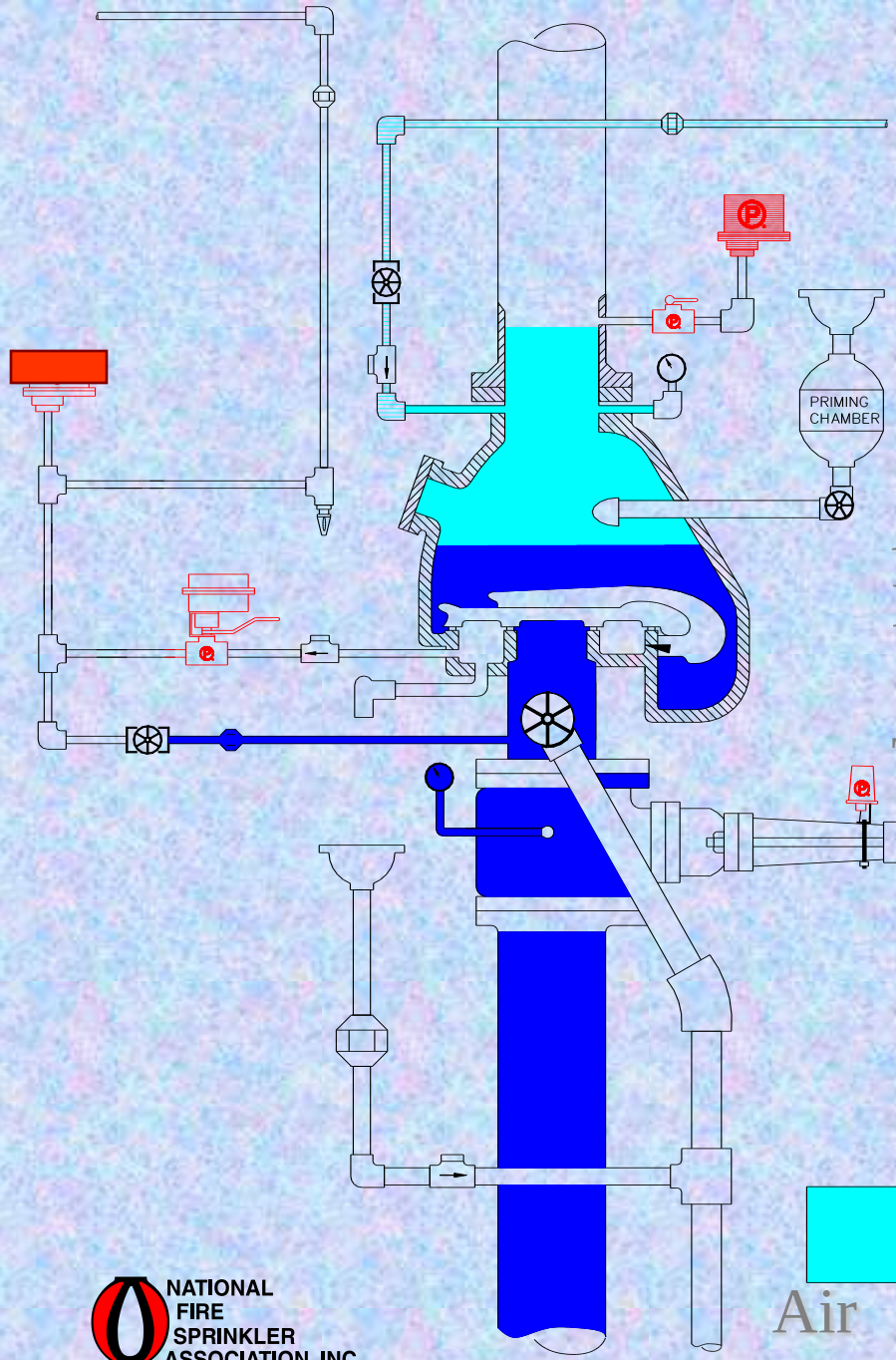

A Sprinkler Opens Allowing Air to Escape. When the Pressure Drops 10 psi, the Low Air Switch Will Trip.

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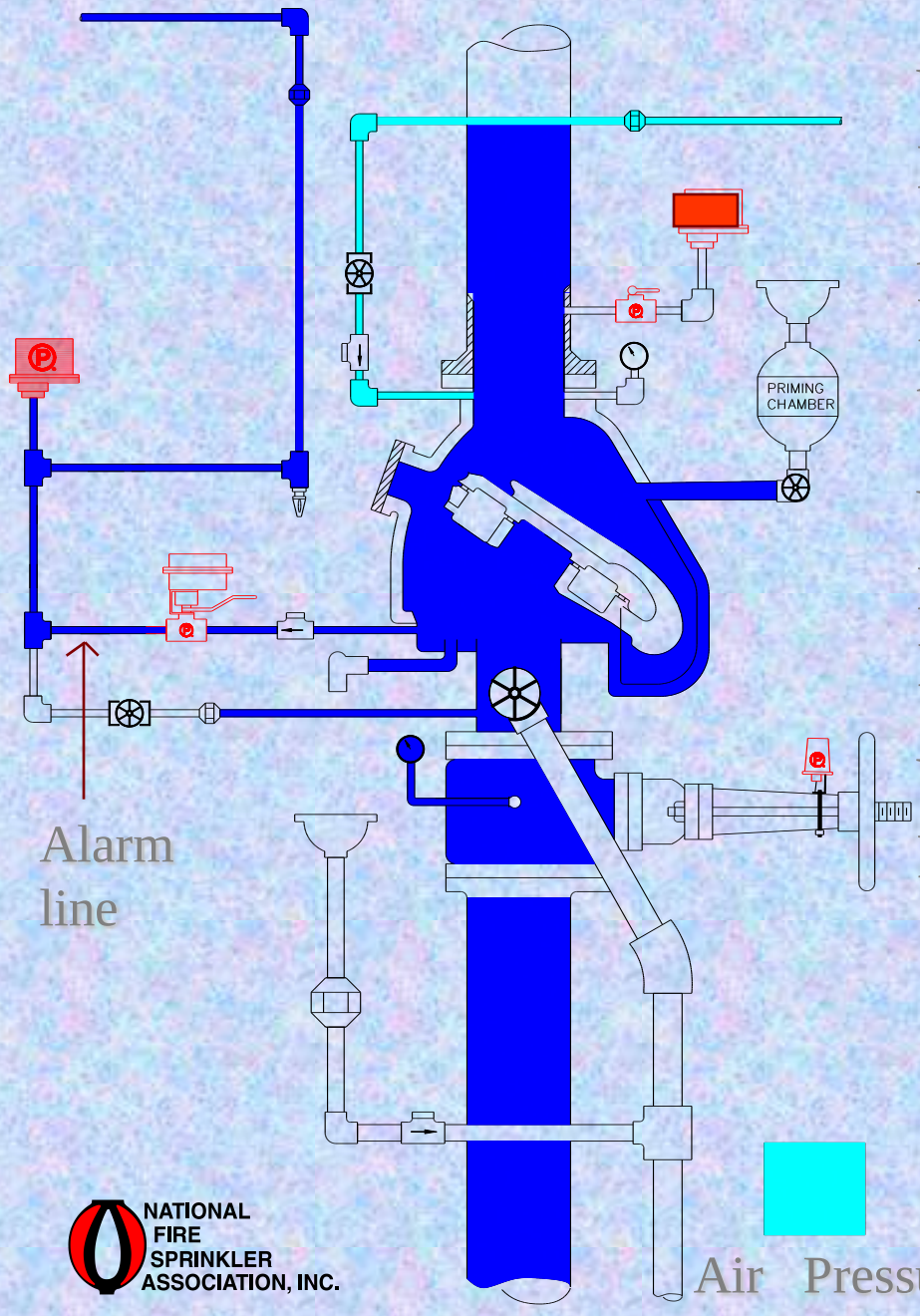
Air pressure

Water supply

No pressure



When the Pressure Drops Low Enough, the Valve Will Open. This Allows the Water Supply to Fill the Piping and be Discharged Through the Open Sprinkler.

When the Valve Opens, it Also Exposes the Alarm Line to the Incoming Water Supply.

When the Pressure in this Line Reaches 6psi, the Water Flow Switch Will Trip.

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Air Pressure

Water Supply

No Pressure

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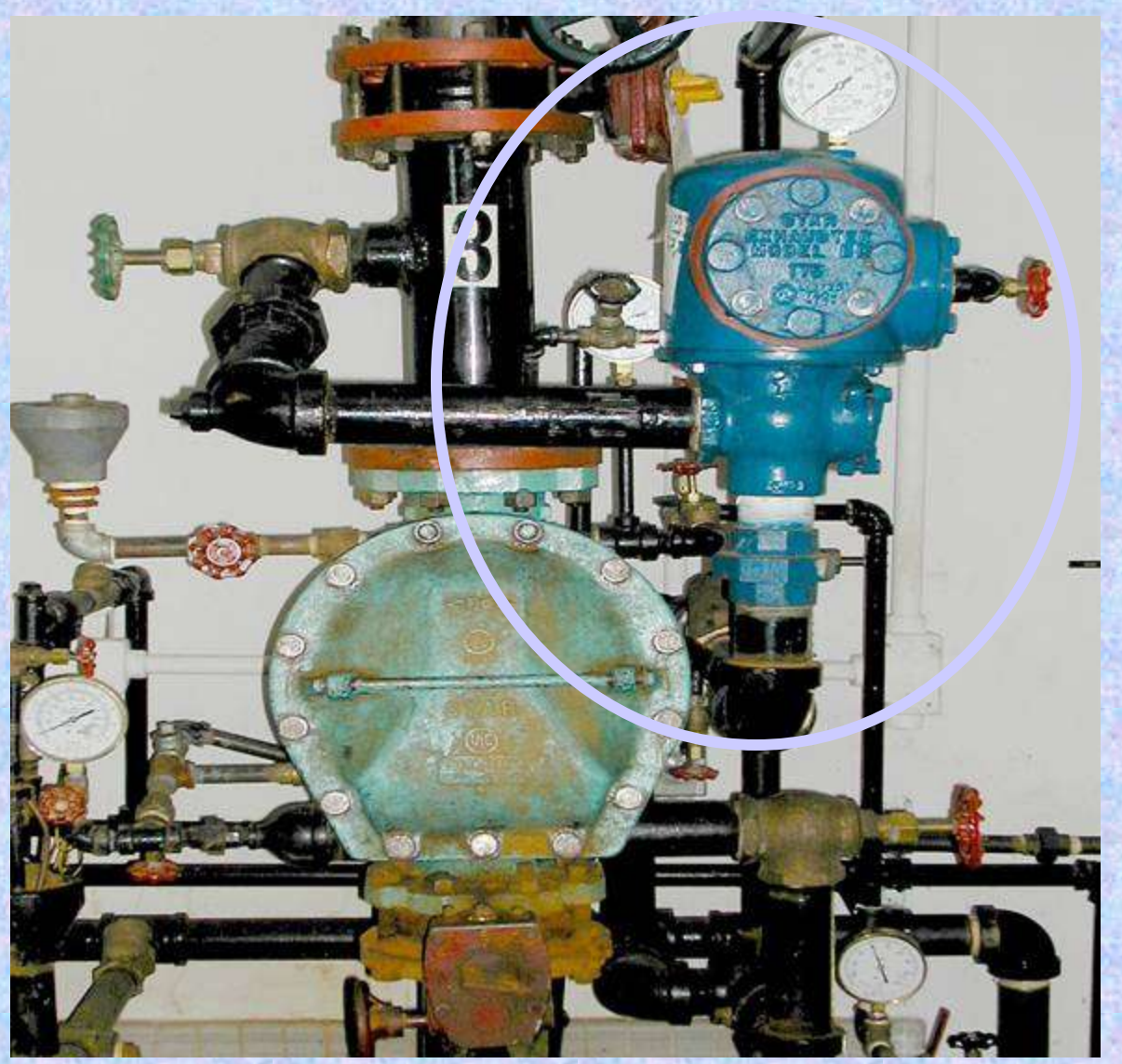
Let's Look at our Tyco Valve

ACCELERATOR

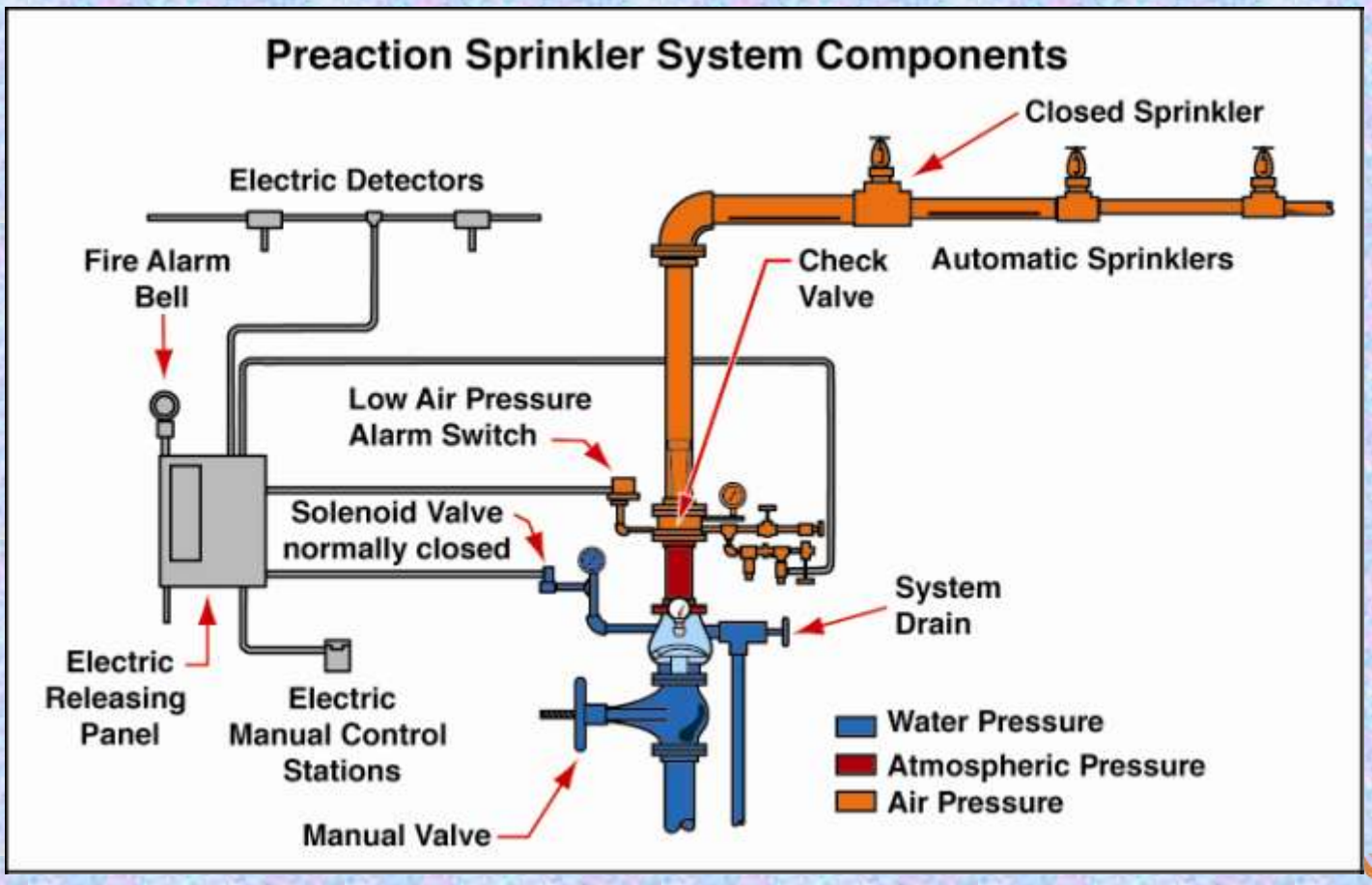
EXHAUSTER



COMPRESSORS

Automatic Sprinkler Systems

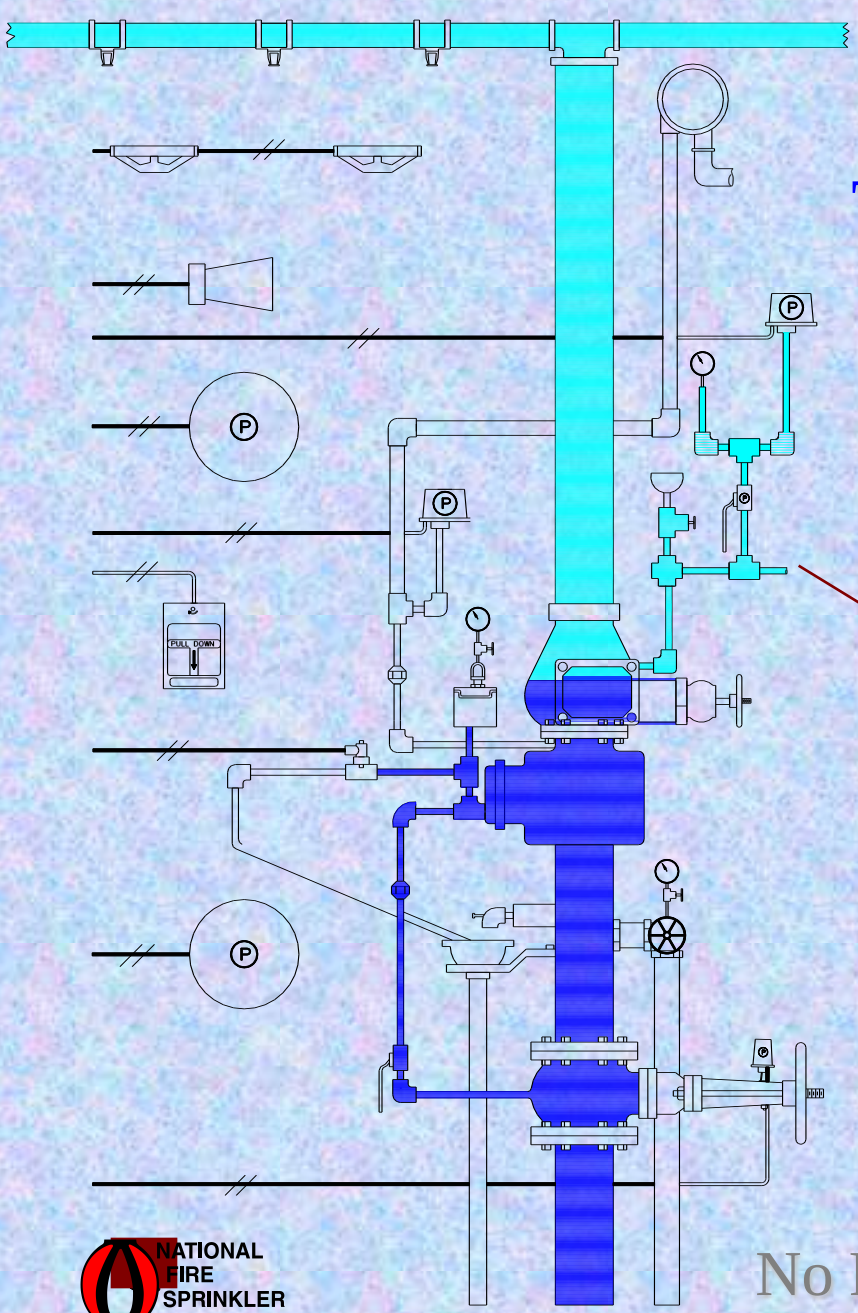
Pre-Action



PREACTION

Areas where water damage could hinder operations

Typical Preaction System



To Air Supply

No Pressure Air Pressure City Water

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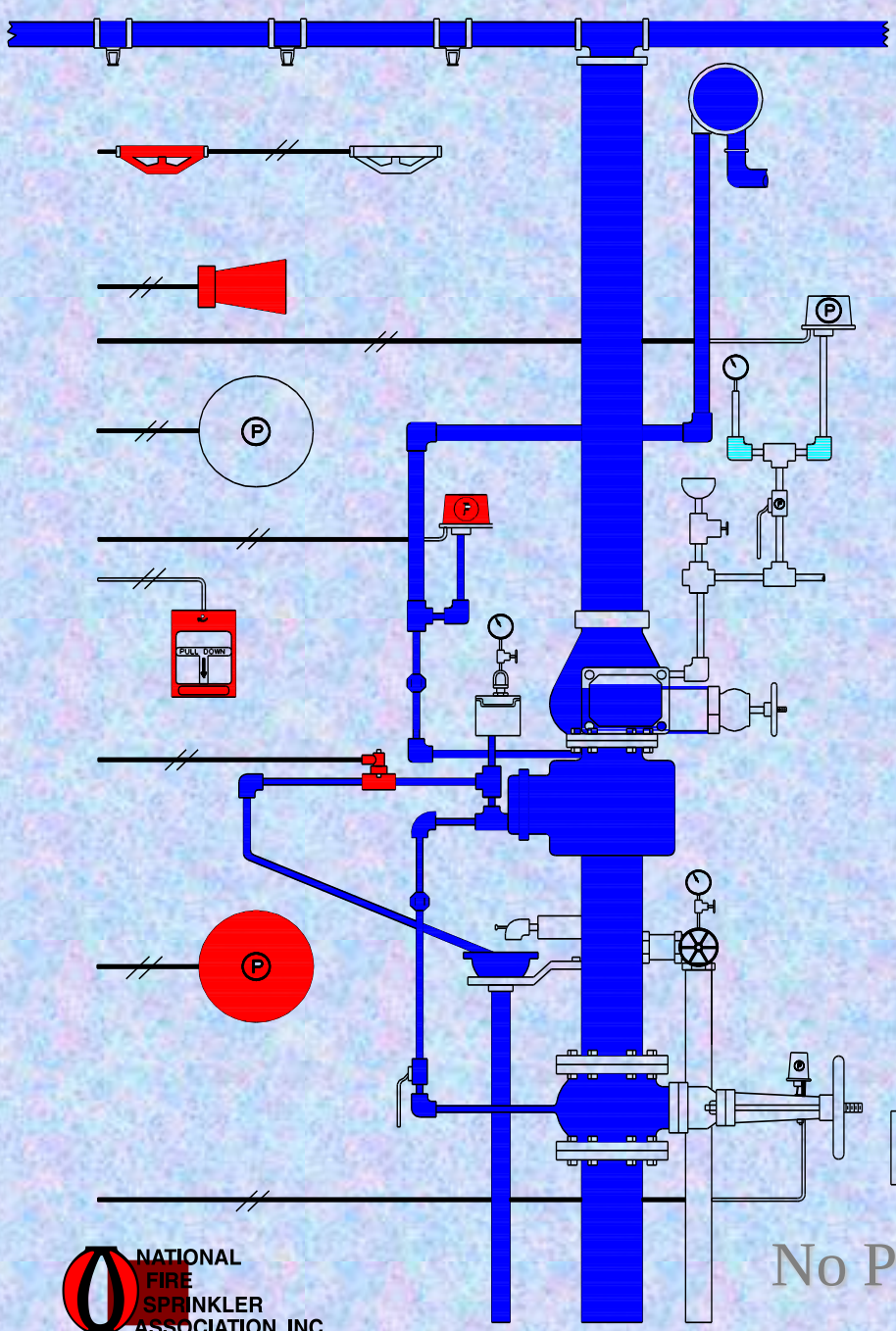

Water is Now Available to Flow out of any Sprinklers Opened Due to Fire.

No Pressure Air Pressure City Water

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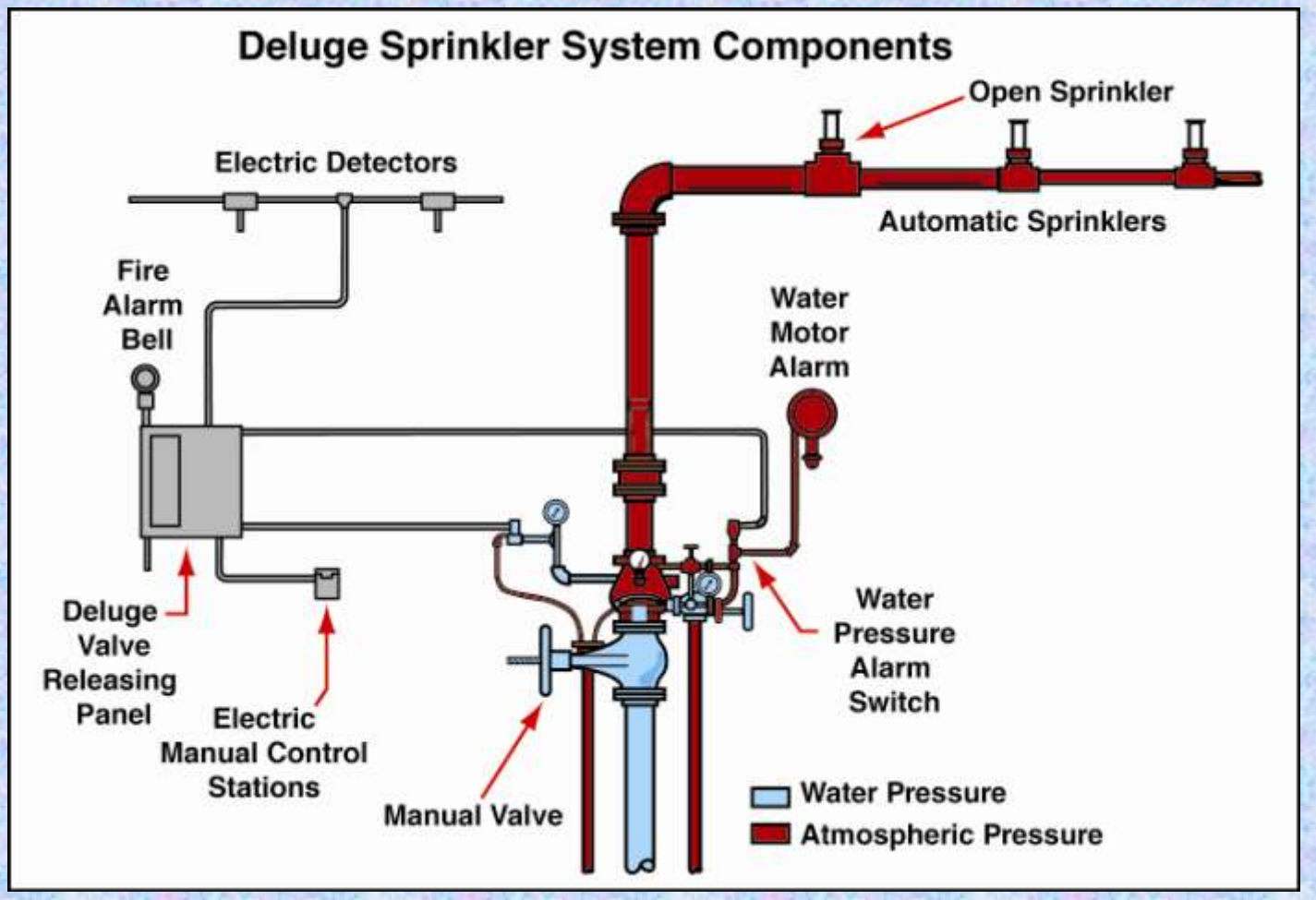
Let's Look at our Reliable Valve

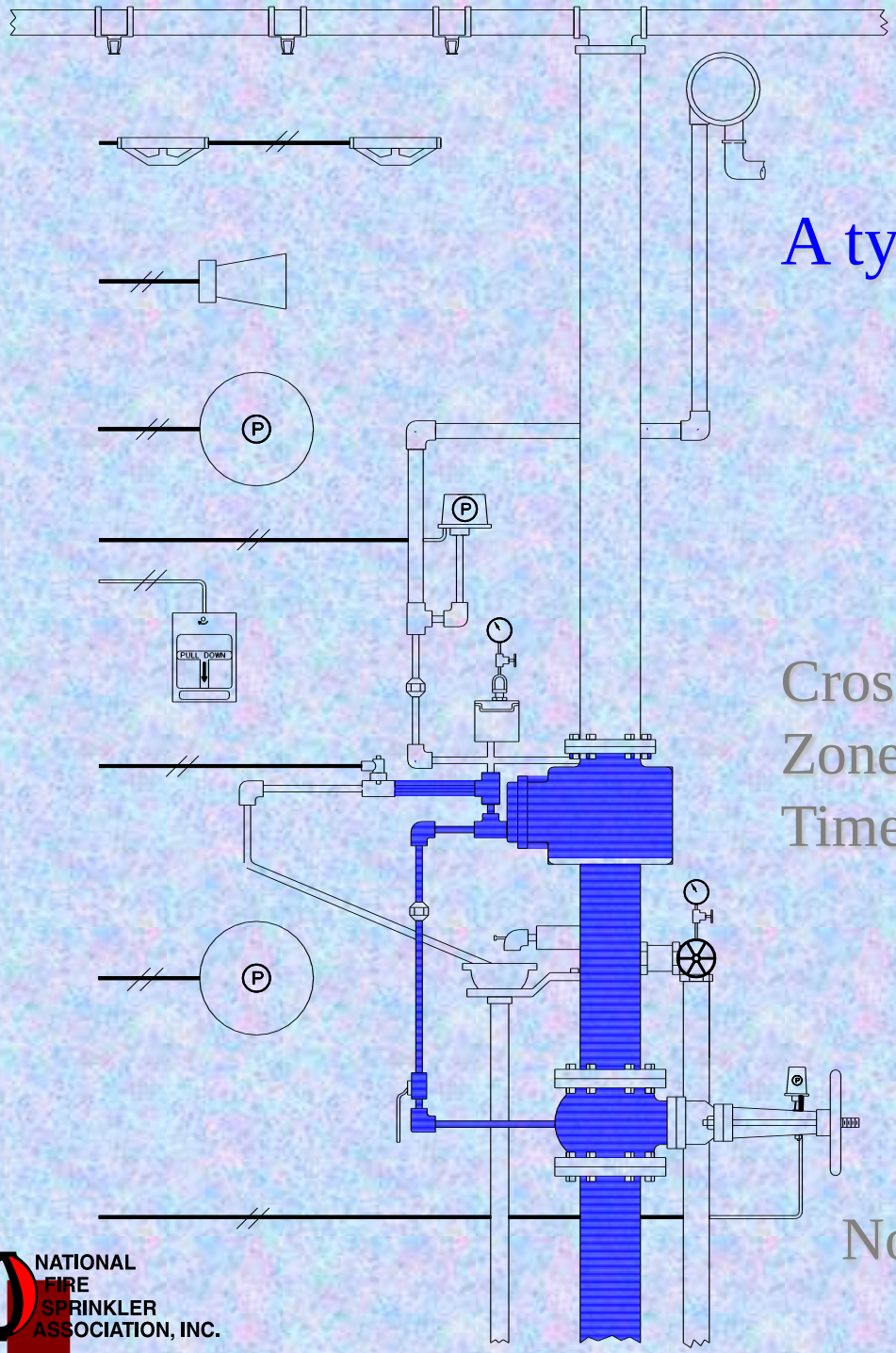
Automatic Sprinkler Systems

Deluge



DELUGE

Large volume of water needed instantaneously



A typical deluge system

Cross Zoned, Requires Two Zones to be in Alarm at the Same Time to Operate the Solenoid.

No Pressure

City Water

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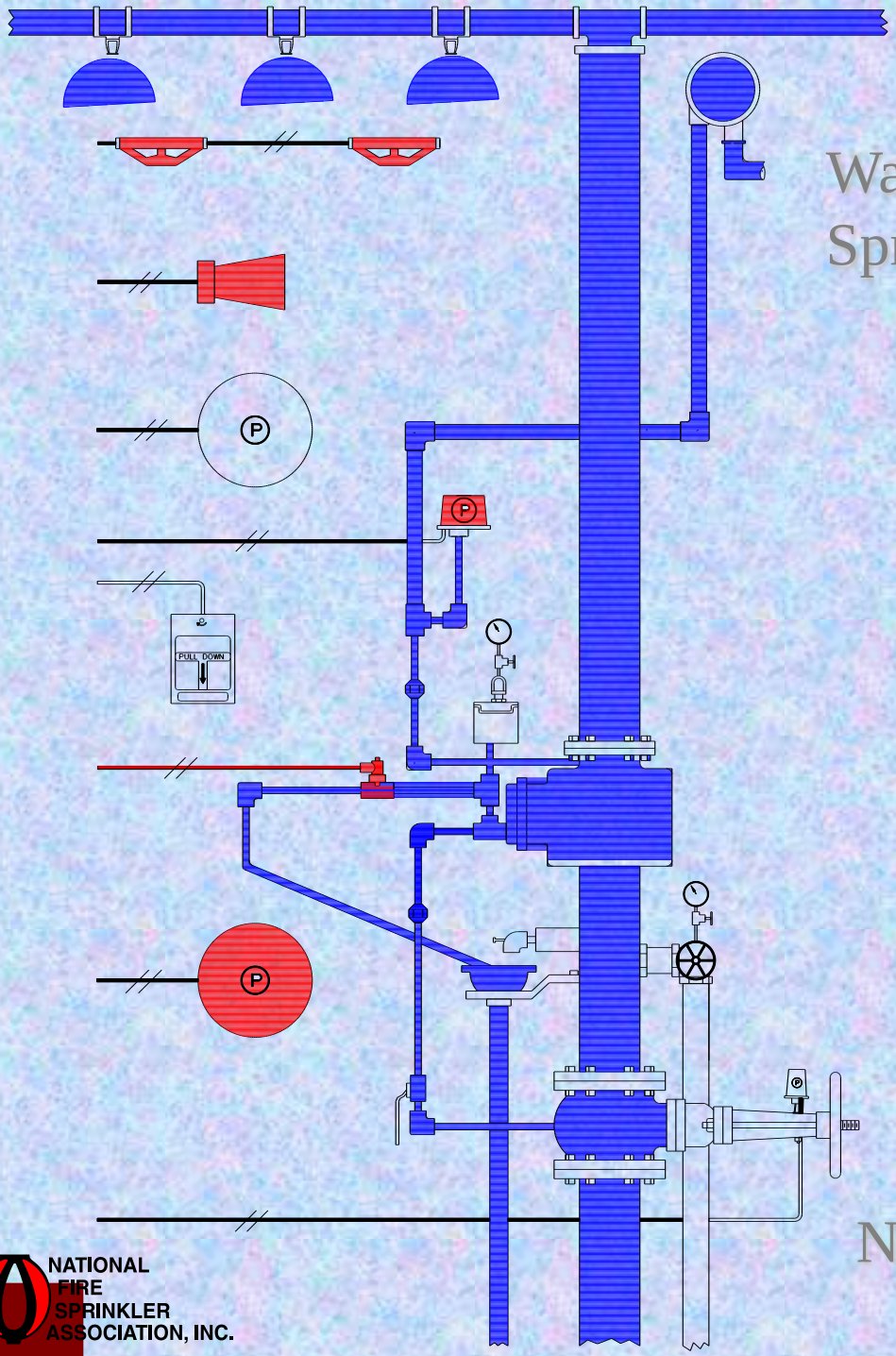

Water Now Flows Out of all Sprinklers or Nozzles

No Pressure

City Water

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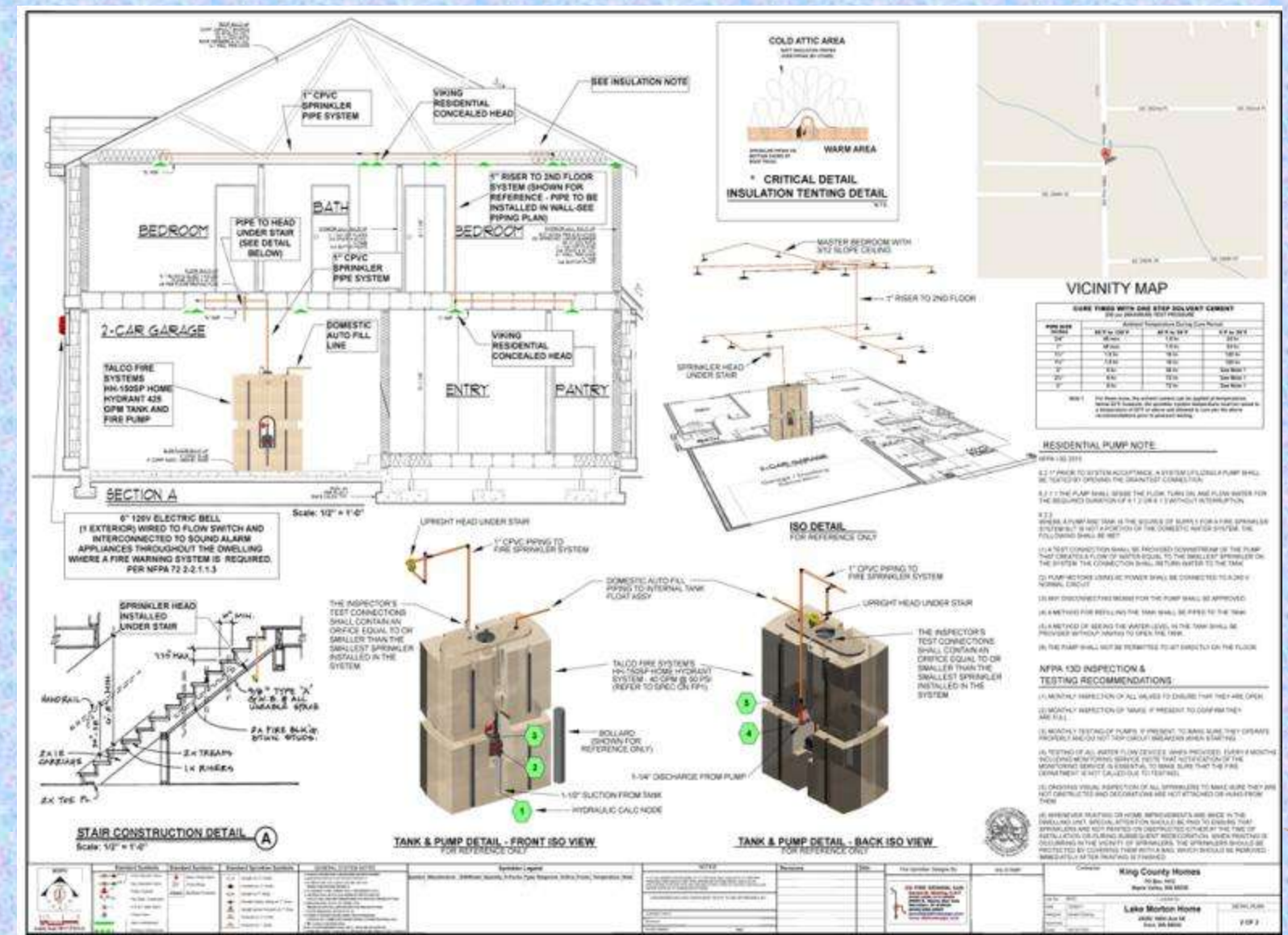
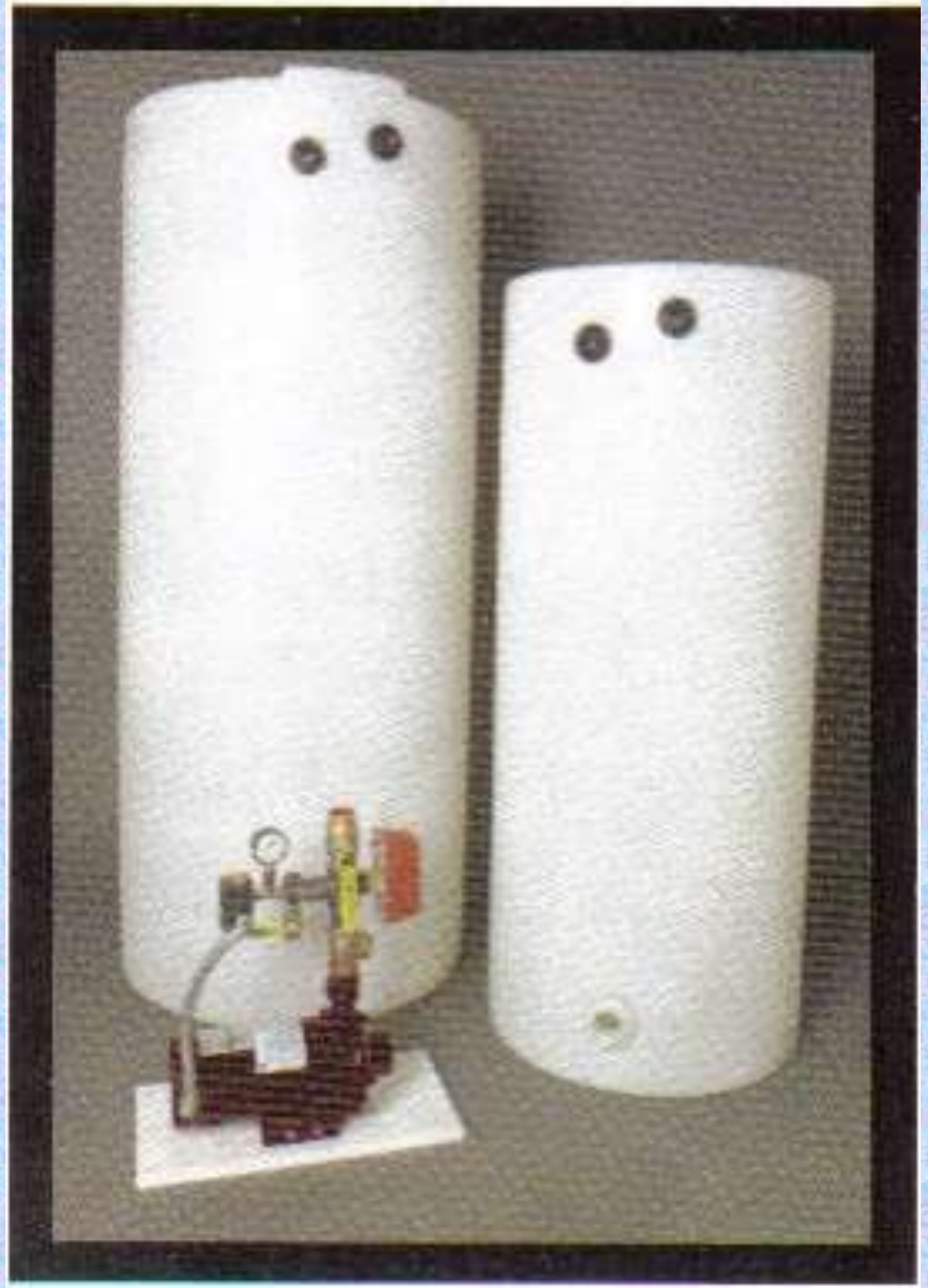
Residential Sprinklers

- Next generation of home fire protection
- Operates quicker than commercial systems

Residential sprinkler riser

Residential Floor Plan





Tank and Pump

If Water Supply Inadequate

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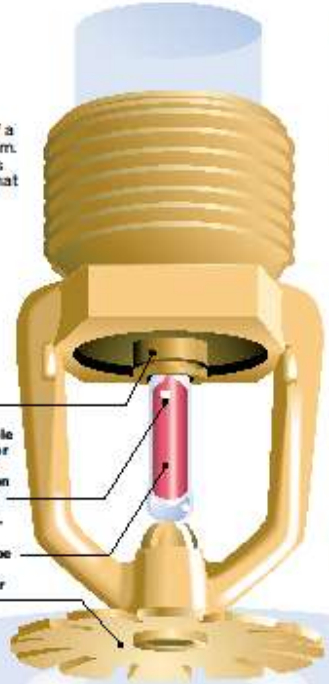
How fire sprinklers work

1 The typical sprinkler head consists of a plug held in place by a trigger mechanism. The most common type of trigger is a glass ampule filled with a glycerin-based liquid that expands when heated.

A less commonly used type of trigger consists of two metal plates held together by a solder point. When the solder melts, two spring arms pull the plates apart, releasing the plug.



2 This liquid is designed to expand and break the tube at a certain temperature. The most common are designed to break at 155 degrees. In the average sized room, a 5mm diameter ampule will usually break in about one to one and a half minutes from contact with a heat source. Ampules as thin as 1mm are manufactured for a faster response time.

3 The plug is forced out by the pressurized water behind it and deflected away by a beveled edge. The water sprays over the deflector plate which is designed to distribute it in an even pattern. Water will continue to flow until the main valve is shut off.

How an uncontrolled fire spreads

1 Smoke and toxic gases rise from the source of the fire. They spread quickly along the ceiling and heat the air in the room.

2 The current of hot air forces a curtain of deadly gases down the walls, making escape more difficult. In a few minutes the air will become so hot that the entire contents of the room will ignite spontaneously. This is known as flashover and usually occurs

How a sprinkler system puts the fire out

1 Even a small smoldering fire acts like a heat engine as it steadily increases the air temperature directly above it. The hot air fans out across the ceiling, heating up the nearest sprinkler head.

2 As soon as the trigger mechanism is heated to the required temperature, it trips and the water is released. The immediate cooling of the heat source usually prevents other sprinkler heads from activating. Often, one or two sprinkler heads are enough to

Sprinkler Types

- Early suppression fast-response (ESFR)
- Extended coverage (EC)
- Large drop
- Old style/conventional
- Open
- Quick-response early suppression (QRES)
- Quick-response extended coverage (QREC)
- Residential (RES)
- Special
- Specific application
- Standard Spray (SS)
- Nozzle

Variations of Sprinklers

- Corrosion resistant
- Dry
- Institutional
- Intermediate or Rack
- Ornamental

Orientation of Sprinklers

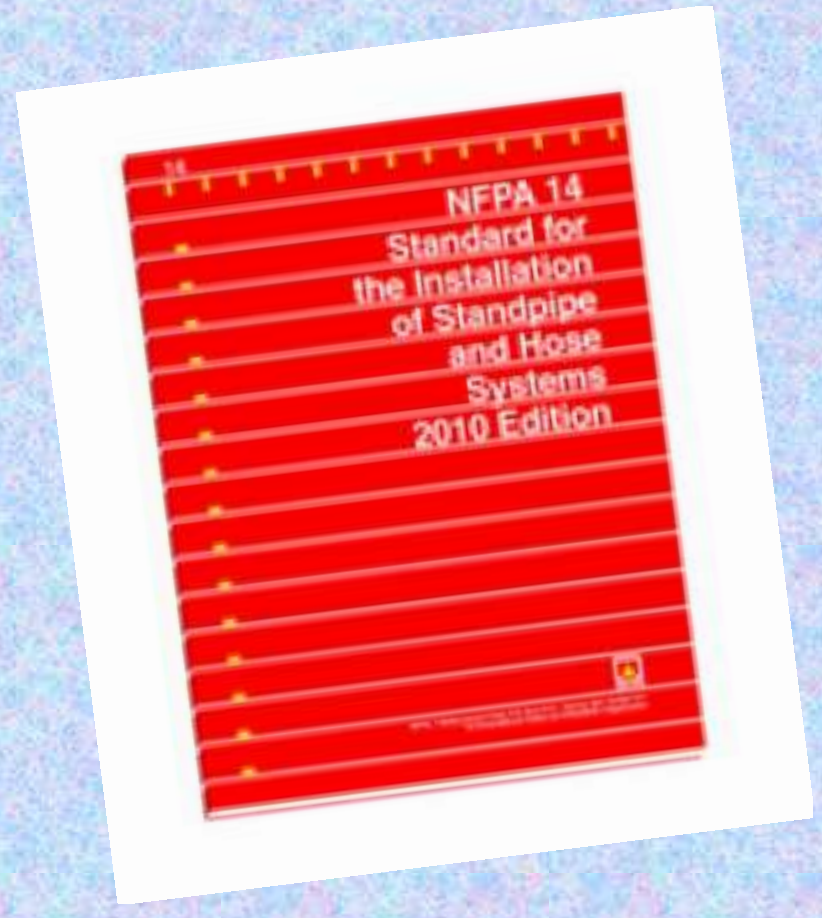
- Concealed
- Flush
- Pendant
- Recessed
- Sidewall
- Upright

Pendant

Sidewall

Upright

NFPA 14 Standpipes



STANDPIPE SYSTEMS

Pipe, valves, and hose connections installed in a building or other facility (e.g., dock, tower, highway, heliport) for use during firefighting operations.

Standpipes

Designed for manual suppression

- **Occupant use**
- **Fire Department use**
- **May be part of suppression system**

Class of Standpipes

Class I

Class of Standpipes

Class II

Class of Standpipes

Class III

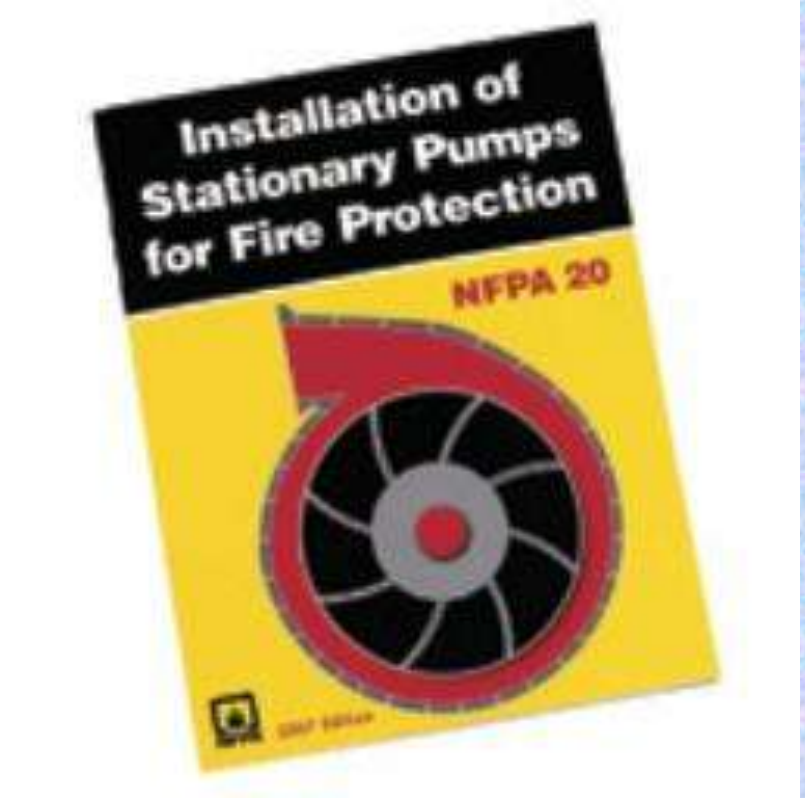
Types of Standpipes

- Automatic wet systems
- Automatic dry systems
- Semiautomatic dry systems
- Manual dry systems
- Manual wet systems

Pressure Regulating Devices

- Pressure Restricting
- Pressure Control
- Pressure Reducing

NFPA 20 Fire Pumps



Fire Pumps

Horizontal Split-Case Fire Pump

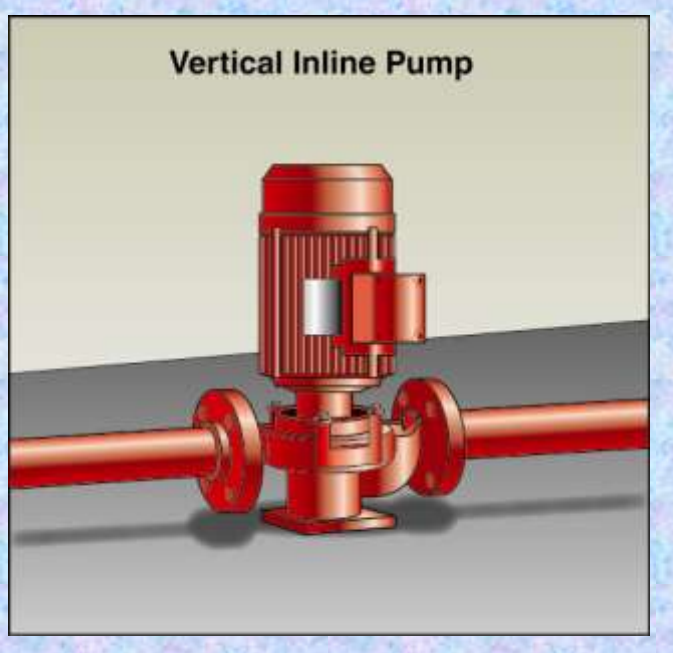
- Most common
- Boosts incoming pressure
- Shaft moves horizontally with a pump motor

Vertical Split-Case Fire Pump

- Vertical impeller shaft
- Same function as horizontal split case

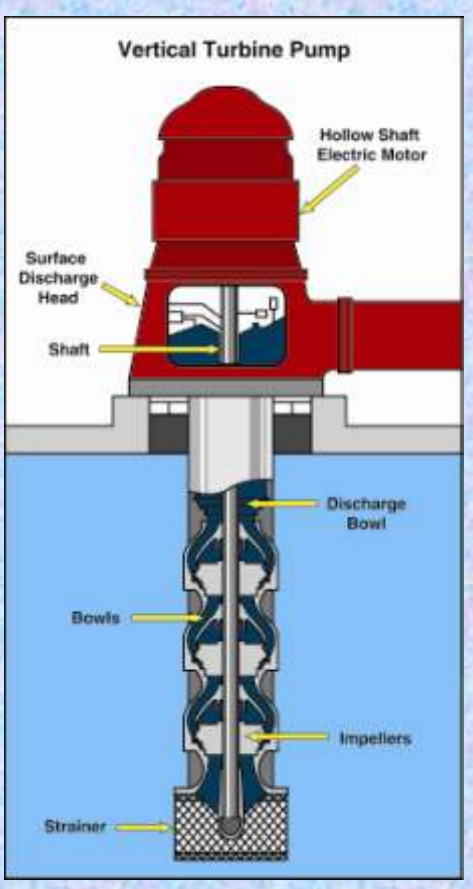
Vertical Inline Fire Pump

- **Single stage**
- **Fits into intake/discharge line**
- **Driver motor is located above inline impeller**



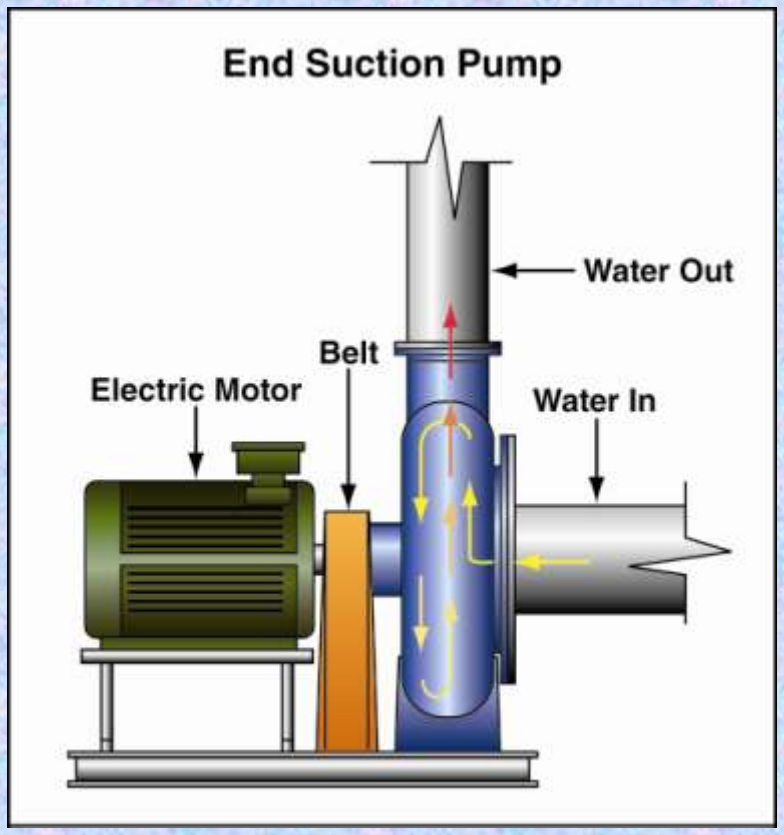
Vertical Turbine Fire Pump

- Impellers in water source
- Lifts water from source below pump
- Used as well pumps in non-fire application



End Suction Fire Pump

- **Single-stage**
- **Center line suction**



Jockey Fire Pump

- Found on automatic sprinkler systems
- Maintains pressure
- Design may be same as any of previous types

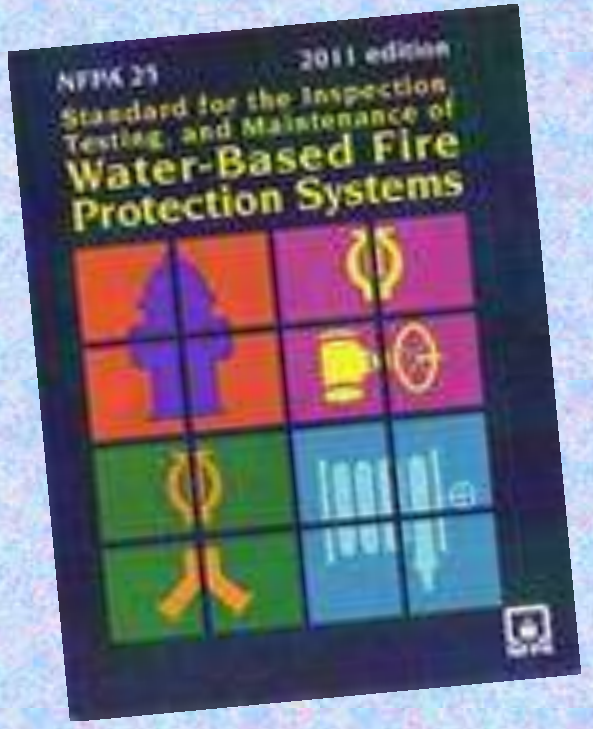
Pump Drivers

- Electric – most common
- Diesel – more expensive; more maintenance
- Steam – less common

Pump Controllers

- **Electric**
  - Opens and closes circuits for motors
- **Diesel**
  - Closes circuit for starting motor
- **Start and stop pump automatically**

NFPA 25
Inspection, Testing & Maintenance



System Maintenance

- Fire protection system failures can be attributed to poor maintenance and systems being shut off
- Only trained personnel should perform maintenance and repair
- *In Illinois, licensed NICET II trained or journeyman fitter
- Owner/occupant responsible for ensuring completion

All National Model Codes Require Annual Testing and Maintenance

DID YOU KNOW?

ANNUAL FIRE SPRINKLER TESTING IS REQUIRED BY THE STATE.

The Illinois Office of the State Fire Marshal adopted the NFPA Life Safety Code 101 2000 Edition, effective January, 2002. The Standard covers the entire state, including Chicago as verified by the James Lee Witt Report on the 69 W. Washington Street high-rise fire.

Section 9.75 mandates all automatic sprinkler and standpipe systems required by NFPA Life Safety Code 101 "shall be inspected, tested, and maintained in accordance with NFPA 25 (1998 Edition), *Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems*". This includes fire pumps.

For sample NFPA 25 and 2" main drain and inspector test forms; contact NIFSAB at **FireSprinklerAssoc.org** or phone **1-866-264-3722**.

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NFPA MEMBER

NATIONAL FIRE SPRINKLER ASSOCIATION, INC.

D I D Y O U K N O W ?

Annual Fire Sprinkler Testing is Required by the International Fire Code.

Chapter 9, Fire Protection Systems of the 2006 International Fire Code requires water based fire protection systems to be inspected, tested and maintained in accordance with NFPA 25 Standard for the Inspection, testing and maintenance of water based fire protection systems.

For a sample of NFPA 25, 2" main drain and inspection test forms, and letters contact NIFSAB at **nifsab@nifsab.org** or phone **1-866-264-3722**.

*The Illinois Office of the State Fire Marshal adopted the NFPA Life Safety Code 101 2000 Edition, effective January 2002. This code also requires annual testing.

Lieutenant Joris Lillge, Grayslake Fire Protection District

Northern Illinois Fire Sprinkler Advisory Board
www.firesprinklerinfo.org

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62 Orland Square Drive
Suite 201
Orland Park, IL 60462
NIFSAB@NIFSAB.org

In the Field Fire Department Operations NFPA 13E


If Bell Rings
Call 911

You Are Sent to the Sprinkler Room . . .

Size Up Location and Extent of Fire

Where is the fire?

Check Sprinkler Control Valves to See if They Are Open

- Radio communication
- Stay until ordered to leave
- Pump operating?
- Fire ground commander

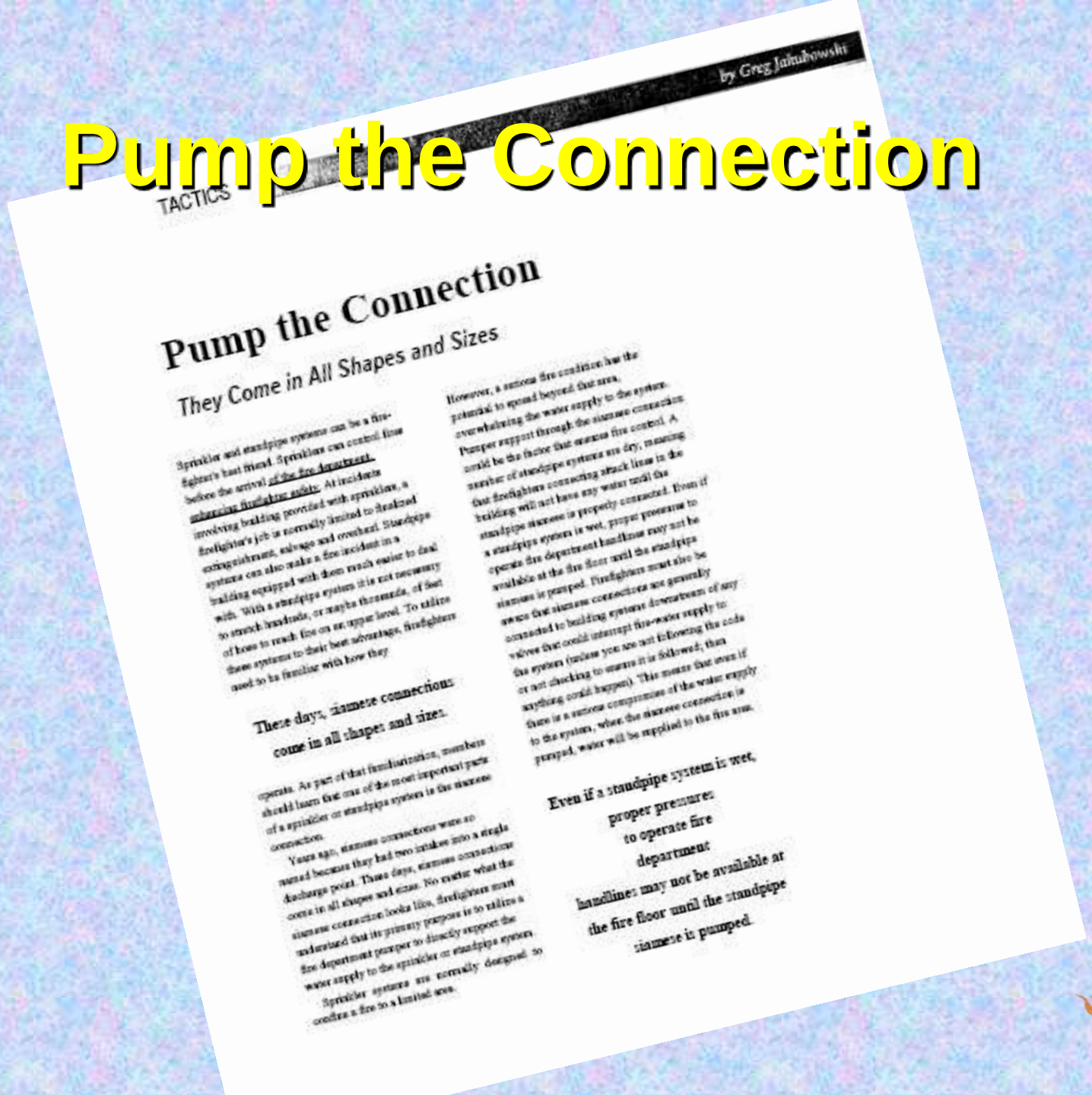
STANDPIPE FIRE DEPARTMENT CONNECTION

Reinforce the Water Supply to the Sprinkler System

A minimum of one supply line

150 psi supply pressure

Pump the Connection



TACTICS

by Greg Jakubowski

Pump the Connection

They Come in All Shapes and Sizes

Sprinkler and standpipe systems can be a fire-fighter's best friend. Sprinklers can control fires before the arrival of the fire department, enhancing firefighter safety. At incidents involving building provided with sprinklers, a firefighter's job is normally limited to finishing extinguishment, salvage and overhaul. Standpipe systems can also make a fire incident in a building equipped with them much easier to deal with. With a standpipe system it is not necessary to stretch hundreds, or maybe thousands, of feet of hose to reach fire on an upper level. To utilize these systems to their best advantage, firefighters need to be familiar with how they

These days, siamese connections come in all shapes and sizes.

operate. As part of that familiarization, members should learn that one of the most important parts of a sprinkler or standpipe system is the siamese connection.

Years ago, siamese connections were so named because they had two intakes into a single discharge point. These days, siamese connections come in all shapes and sizes. No matter what the siamese connection looks like, firefighters must understand that its primary purpose is to utilize a fire department pumper to directly support the water supply to the sprinkler or standpipe system.

Sprinkler systems are normally designed to confine a fire to a limited area.

However, a serious fire can drive the potential to spread beyond that area, overwhelming the water supply to the system. Pumper support through the siamese connection could be the factor that siamese fire control. A number of standpipe systems are dry, meaning that firefighters connecting attack lines to the building will not have any water until the standpipe siamese is properly connected. Even if a standpipe system is wet, proper pressure to operate fire department handlines may not be available at the fire floor until the standpipe siamese is pumped. Firefighters must also be aware that siamese connections are generally connected to building systems downstream of any valves that could interrupt fire-water supply to the system (unless you are not following the code or not checking to ensure it is followed; then anything could happen). This means that even if there is a serious compromise of the water supply to the system, when the siamese connection is pumped, water will be supplied to the fire area.

Even if a standpipe system is wet, proper pressure to operate fire department handlines may not be available at the fire floor until the standpipe siamese is pumped.

FPP
FIRE PROTECTION PUBLICATIONS
OKLAHOMA STATE UNIVERSITY

Lay Handlines

When?

AFTER!

the fire sprinkler system is supported.

Take Water from Sources That Will Not Rob the Sprinklers of Water

- Large street mains
- Water mains other than those supplying the fire sprinklers

Salvage

- Use tarps to cover stock
- Use tarps to funnel and stear water

Fighting Fires in Sprinklered Buildings

This whole section can be summed up with this:

It's there,

It's in the code,

Let it work.

What If?


DRY STANDPIPE

Clogged FDC

Recommendations:

- Highlight pre-plans or pre-incident plans.
- Work with Training Department or Suppression Department.
- Know and inspect every fire sprinkler protected building.

SUMMARY:

SPRINKLERS AND FIREFIGHTERS ARE PARTNERS

SEPARATE BUT COMPLIMENTARY

Thank You To:

FM Chris Johnson, Deerfield FD

Paul Valentine, Nexus Engineering

FM Global

NFSA