

Fighting Fire in Sprinklered Buildings

Student Guide



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Purpose

Automatic sprinklers are an important line of defense when fighting a fire. Yet, even with sprinklers, fires can still burn out of control, causing excessive damage.

The purpose of the *Fighting Fire in Sprinklered Buildings* program is to provide firefighters with a greater understanding of why these losses occur and how to help prevent them. Understanding how automatic sprinklers work and how to develop a sound prefire plan will improve the effectiveness of firefighters during fires.

Instruction Guide

This guide was designed to minimize your note-taking. Follow along and concentrate on the class presentation of these lessons. Write down occasional key words that will help you remember ideas.

Additional Resources

- *Fire Protection Handbook*, National Fire Protection Association (NFPA)
- NFPA Standard 1620, *Recommended Practice for Pre-Incident Planning*
- *NFPA Inspection Manual*
- *Essentials of Fire Fighting*, International Fire Service Training Association
- FM Global Property Loss Prevention Data Sheets and publications, which can be obtained from our online Resource Catalog, www.fmglobalcatalog.com

Acknowledgment

Fighting Fire in Sprinklered Buildings was developed by FM Global, one of the world's largest insurance organizations focusing on property protection. We express our appreciation to the following organization that provided us with valuable assistance during the creation of this program:

**The Mashantucket Pequot Tribal Nation
Department of Fire & Emergency Service
Mashantucket, Conn., USA**

Objectives

This program consists of an introduction and three content units.

At the completion of each content unit, participants will be able to:

Unit Two: Automatic Sprinkler Systems

- Understand how automatic sprinkler systems work
- Understand why automatic sprinklers are used
- Recognize the components and operation of sprinkler systems
- Recognize the different types of systems
- Understand the importance of sprinkler systems when fighting fires

Unit Three: Why Sprinklered Buildings Burn

- Identify factors resulting in excessive fire damage to sprinklered buildings

Unit Four: Prefire Planning and Execution

- Evaluate the fire protection features of a facility to develop a prefire plan

Unit One: Introduction

- Introduction video
- Course objectives

Unit Two: Automatic Sprinkler Systems

How Sprinkler Systems Work

- Overview of system and sprinklers
- Video – How Sprinklers Work

Advantages of Automatic Sprinklers

- Always ready, day and night
- Prompt action, which is an important first line of defense
- Send alarm
- Operate only over the fire
- Pre-wet combustible material
- Use less water

Components and Operation

Types of Water Supplies

- Public water pumping system
- Public water storage
- Gravity tank
- Static source for fire pump
- Booster system

All must provide an adequate water supply to the sprinkler system — enough water for sprinklers plus fire hose streams.

Pipes and Valves

Underground Pipes

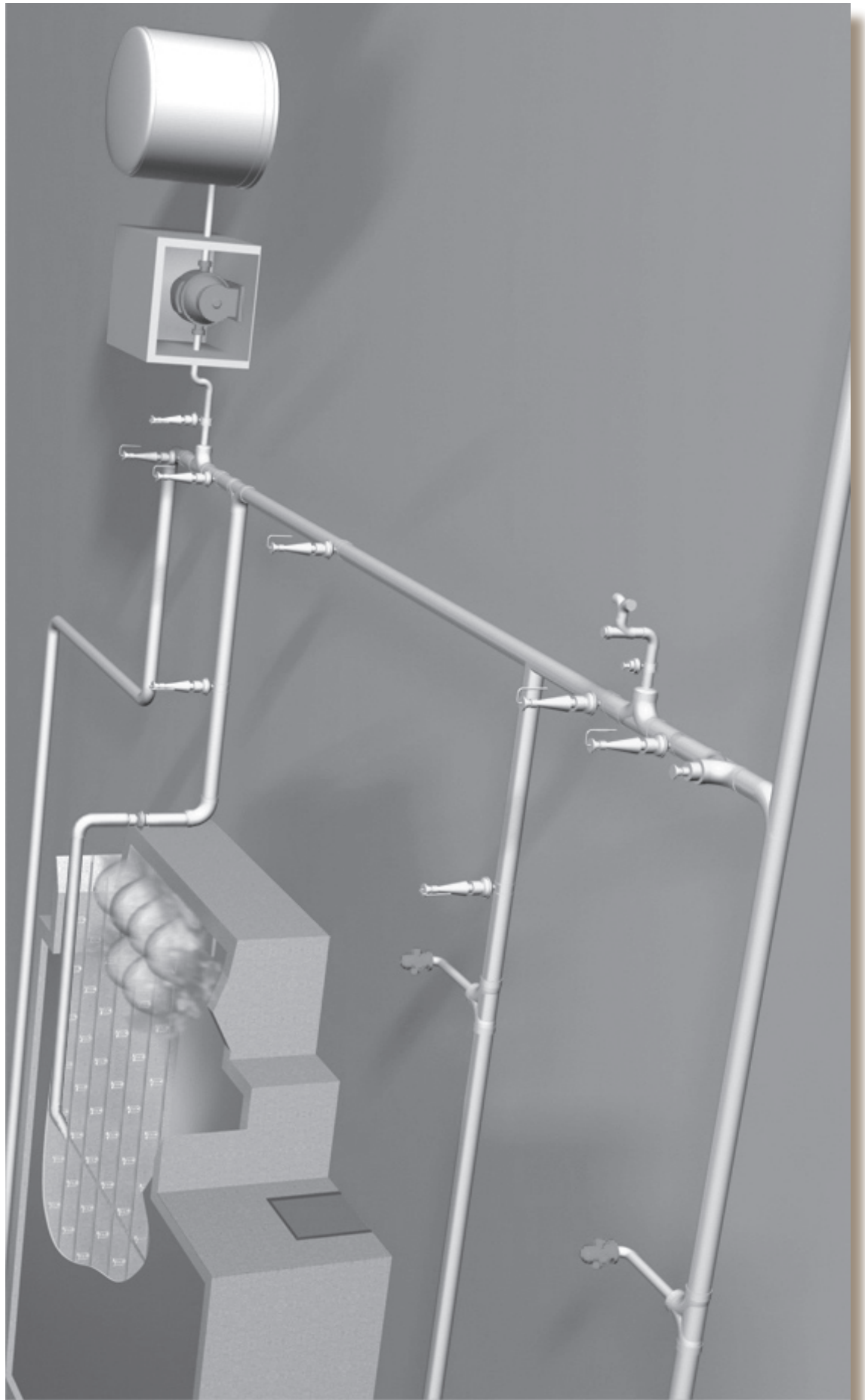
- Yard main
- Lead-in

Aboveground Pipes

- Riser
- Feed main and cross main
- Branch lines (sprinklers connect to the branch lines)

Site Plan

Top ↑



Valves isolate a section of a system, minimize areas out of service, and maintain protection in other areas. **All valves should remain open at all times!**

Supply Valve

The supply valve controls the flow of water from the public water supply or the fire pump to the yard system.

Check Valve

The check valve prevents water in the sprinkler system from flowing back into the yard or public system, out the fire service connection, or backward through the fire pump, overflowing the suction tank.

Isolation Valve

The isolation valve can turn the water on or off within a section of pipes.

Control Valve

The control valve controls the flow of water to the riser in specific areas of a sprinkler system.

Outside Screw and Yolk (OS&Y) Valve

The OS&Y valve is completely open when the stem is fully extended.

Post Indicator Valve (PIV)

PIVs must be physically tested by turning the handle to the wide-open position until you feel a spring resistance.

Sprinkler Heads

Functions

- Disperse water into evenly distributed droplets
- Cool fire area
- Pre-wet combustible material

Types of Sprinkler Heads

- **Upright** – Sits atop branch line
 - Found where sprinkler piping is exposed
 - Deflector directs water droplets down, over the fire
 - Must be used for dry sprinkler systems
- **Pendent** – Hangs below branch line
 - Found in “finished” areas where piping is hidden
 - Protrudes through ceiling
 - Deflector directs water out, over the fire

The two types cannot be interchanged.

Types of Thermo-Responsive Assemblies

- **Fusible link technology** – Uses two or three metal pieces soldered with heat-sensitive alloy

Operation

- Solder melts at sprinkler's temperature rating, links separate, lever arms release, water lifts off cap and begins to flow

- **Glass bulb technology** – Contains temperature-sensitive liquid

Operation

- Air temperature reaches sprinkler's temperature rating, expands liquid, bulb bursts, allowing water to flow

Temperature Rating

- Typically stamped on the deflector or fusible link; also identified by the color of the liquid in the glass bulb and by a color code on the sprinkler struts

Video – Types of Sprinkler Heads

Other Components

- **Fire service connection** – Allows you to increase water pressure and volume

Advantages

- Increased water pressure – Provides more water for sprinklers over the fire
- Increased water volume – Allows use of additional hose lines from yard hydrants

- **Yard hydrants** – If connection is located at the beginning of the yard system, they can safely provide water to hose streams without robbing what is needed for the sprinklers

Advantages

- Enables fighting exterior fires and protecting building structure
- Provides easy use of hose streams remote from streets

- **Sprinkler alarm** – When sprinklers activate and discharge water, an audible alarm is automatically activated

- **Inspector's test connection** – An inspector can check that water is flowing through the entire system and that the alarms are working

Types of Sprinkler Systems

- **Wet system** – Water fills entire system up to sprinkler head (most efficient)
 - Advantage*
 - Water always ready for discharge
 - Disadvantage*
 - Subject to freezing
 - Must be in areas heated to at least 40°F (4°C) like offices, factories, hospitals
- **Dry system** – Has water in heated part of the system, pressurized air or nitrogen in unheated area
 - Advantage*
 - Can be used in areas below 40°F (4°C) like warehouses
 - Disadvantage*
 - Longer water delivery time
 - Important Feature*
 - Air or nitrogen in piping above valve separates water supply from unheated part of the building
 - Operation*
 - Sprinkler fuses, causing pressure drop, dry-pipe valve opens, water flows
- **Deluge system** – Found in high-hazard areas like airplane hangers or oil-cooled transformers
 - Advantage*
 - Rapidly delivers large volume of water to fire
 - Features*
 - Open sprinkler heads – Allow volume of water needed to gain control of rapidly developing fire
 - Deluge valve – Holds back water until system is activated
 - Heat detectors – Located throughout the area
 - » Sense temperature rise
 - » Send signal to open deluge valve
- **Preaction system** – Used in high-valued sensitive electronic equipment, such as telephone switching equipment exchanges
 - Features*
 - Conventional sprinkler heads
 - Air-filled piping (typically not pressurized)
 - Heat detectors
 - Operation*
 - Heat detector gives early warning signal, causing preaction valve to open and water to enter system piping
 - Water is ready to be discharged when sprinkler fuses

The Importance of Sprinkler Systems

Video – Sprinklered vs. Unsprinklered: A Side-by-Side Comparison

Unit Three: Why Sprinklered Buildings Burn

Video – Why Sprinklered Buildings Burn

Design Deficiencies

- Inadequate water supplies
- Poor sprinkler system design
- Changes in occupancy

Impairments Before a Fire

- Renovation or construction – Sprinklers out of service
- Inadequate maintenance (e.g., obstructions in underground mains)
- Arson – Arsonist shuts valve and defeats protection

Impairments During a Fire

- Human element
- Protection breakdown – Valve closed thinking there was no fire
- Improper action – Valve closed prematurely so fire could “show itself” or to reduce water damage; valve not promptly re-opened when fire rekindled
- Fire cleanup – Replace fused sprinklers and restore protection quickly

Automatic sprinkler systems are useless unless supplied by water.
Always make sure the sprinkler control valve is wide open.

Unit Four: Prefire Planning and Execution

Prefire Planning

- Familiarity visit
- Occupancy
 - Non-manufacturing (office, retail, institutional)
 - Manufacturing
 - Warehousing
 - Special hazards (flammable liquid or gas, combustible dust)
- Facility protection
 - Types of sprinkler systems
 - Water supplies
 - Sprinkler control valves
 - Fire service connections

Occupancy and protection are dependent upon the other. A change in one affects the other.

Factors can change any time after your visit, without your knowledge. Developing a good rapport between the property owner or plant manager and the fire service can be very helpful.

Fire Response

- Locate the fire
- Deploy the team
- Locate the water sources
- Control the sprinklers

Workshop

- Purpose:** To apply the principles learned in this program to various fire situations.
- Objective:** Given a scenario and the material below, develop a prefire plan and apply it effectively to your fireground operations. Your effectiveness will be evaluated by the instructor.
- Material:** Building plan
Prefire plan checklist
Background scenarios
- Procedure:** This workshop is to be performed in small groups of no more than 10 people per group.
- Exercise 1:** Develop a prefire plan using the prefire checklist on page 14 as a guide. A building plan is included on page 13 for your reference. Feel free to ask questions of your instructor during this exercise.
- Exercise 2:** Use the prefire plan you developed and execute fireground operations for the given scenarios.
- Write down your group's strategies and procedures.

Complete this prefire plan checklist before developing your prefire plan.

- Building plan
- Access routes
- Building construction features
- Building occupancy and storage arrangements
- Sprinkler control valves
- Fire service connections
- Water supplies
- Fire pumps
- Alarm systems
- Fire protection impairments
- Company assignments/fire service procedures
- Subsequent visits to keep plan updated

Scenarios

Scenario #1

Upon arriving at the facility, the alarm panel shows the water flow alarm in System 7 is activated. This is the bookbinding area located on the south side of the main building. The fire involves flammable ink in a printing press.

Scenario #2

Upon arriving at the facility, you observe smoke coming from the loading dock in the northeast corner of the warehouse addition.

Scenario #3

Upon arriving at the facility, a security guard alerts you to a fire in the east flammable liquid storage room. The alarm panel shows that the water flow alarm in System 5 is activated.

Scenario #4

Upon arriving at the facility, smoke is seen coming from the east warehouse addition. A check of the alarm panel shows no zone indicated. The plant engineer notified the fire service, prior to the fire, that repairs to System 4 of the east warehouse were scheduled to be completed today.

Notes

