



# SPRINKLER SYSTEMS

---

Leeds 10 October 2017

Duncan McIntyre – AXA Insurance



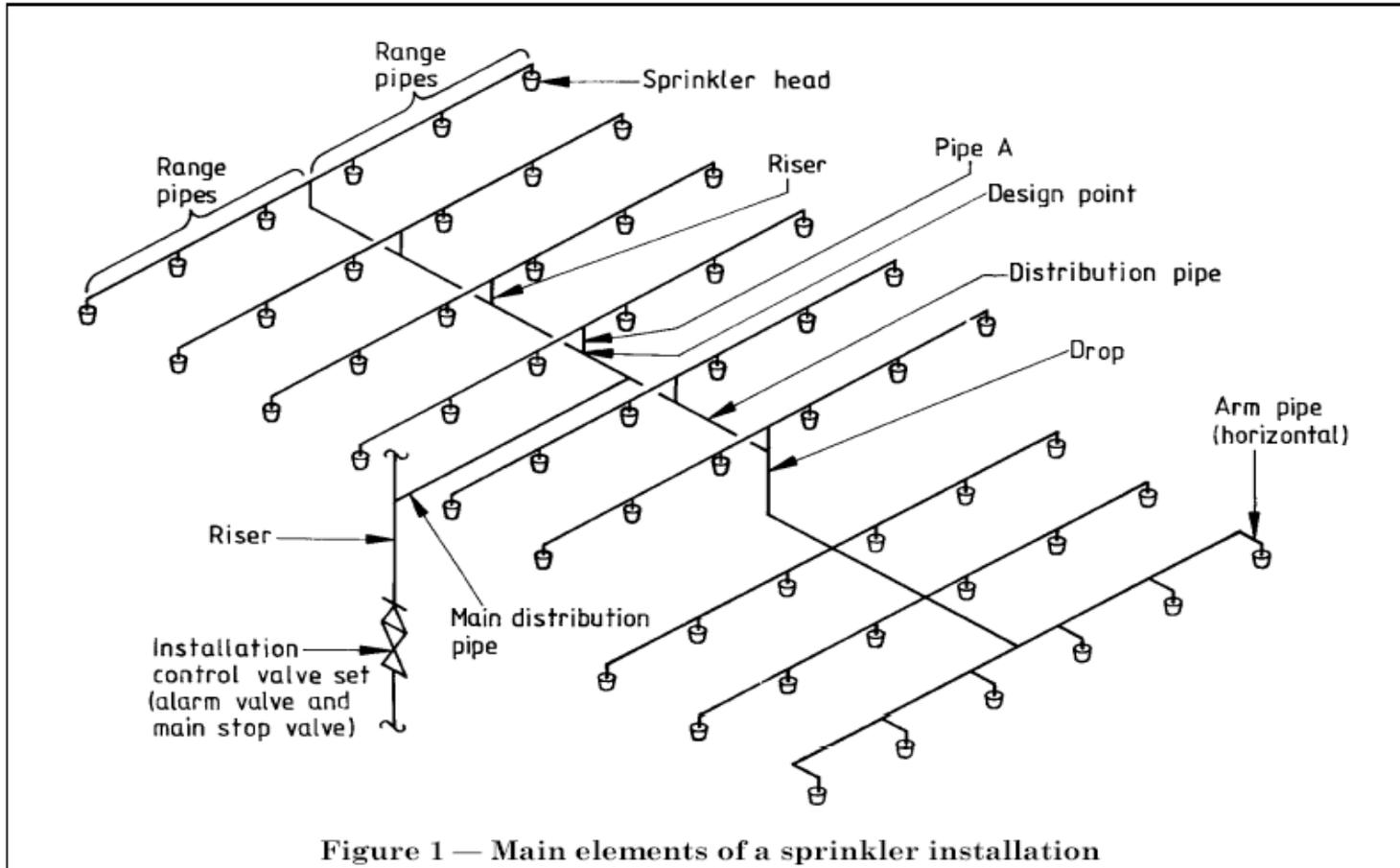
---

# Learning objectives

1. Gain an understand of how sprinkler systems work
2. What makes an effective sprinkler system
3. What type of water supply are in use
4. Non conventional sprinkler systems
5. Potential water damage
6. Why install sprinklers and what might it cost
7. An insurers view

# What is a Sprinkler System?

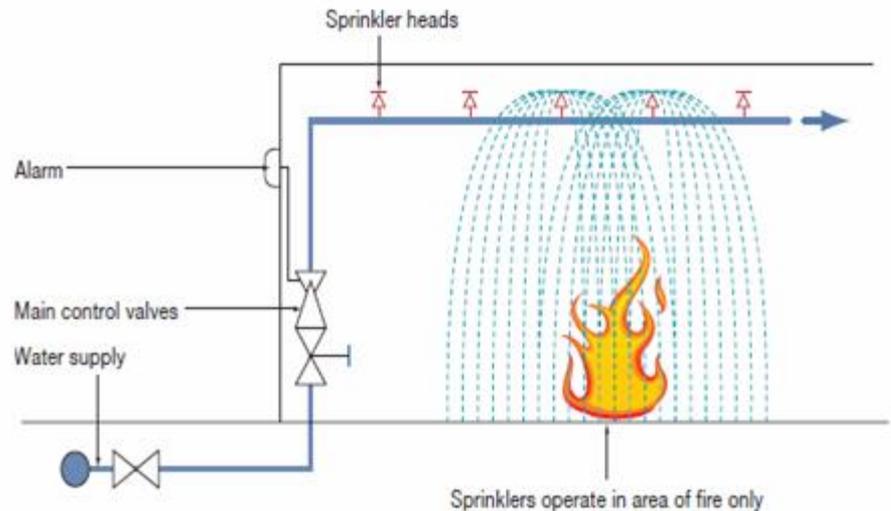
An array of pipework to distribute water to the location of a fire



# What do Sprinklers do?

**Sprinklers are the only system which will:**

- Detect a fire
- Sound an alarm
- Call the fire brigade
- Fight the fire
- Minimise the impact of the fire



# How do Sprinklers work?

- What do all these movies have in common
  - Casino Royale (2006)
  - The Incredibles (2004)
  - The SpongeBob Square Pants Movie (2004)
  - Changing Lanes (2002)
  - The Matrix (1999)
  - Lethal Weapon 4 (1998)
  - Hocus Pocus (1993)
  - Die Hard (1988)
- In each case the hero's actions resulted in ALL the sprinklers activating
- ONLY the sprinkler heads exposed to the heat of a fire will operate.

# How do Sprinklers work ?



1 - The sprinkler bulb contains a dyed liquid with a small air pocket



2- Heat expands the liquid, the air is compressed and the glass shatters



3 - Water pressure pushes the remains of the bulb away



4 - Water hits the deflector and is sprayed onto the fire



---

# A little bit of History

- 1874 – An American Henry Parmelee developed the first system to be commercially available.
- 1882 - A Parmelee system was installed at John Stones & Co, Astley Bridge, Bolton.
- 1883 – Frederick Grinnell produced an automatic system which achieved outstanding success.
- 1885 – First set of standards produced by John Wormald.
- 1888 – 1st Edition “Rules” published in London by FOC.
- 1888 – 1969 Original rules are regularly updated up to 28th Edition
- 1969 – Rules are completely re-written and issued as 29th Edition
- 1990 – 29th Edition Rules are incorporated into BS5306 part 2
- 2003 – BS5306 part 2 is superseded by EN12845



---

# Current Sprinkler Standards

- **BS EN12845**

Common European Standard

The basis for systems installed under building codes

- **LPC Rules (= BSEN12845 + TECHNICAL BULLETINS)**

Specified where property protection is required

- **American Standards**

NFPA & FM Rules



---

# What makes a good sprinkler system?

## System Design Based Upon

- Occupancy
- Fire Load

## Water Supply

- Pressure
- Flow
- Reliability

# Occupancy

Sprinkler systems are designed to a hazard class relative to the fire challenge presented by the occupancy.

**Light Hazard**          Non - industrial occupancies  
(room areas not more than 126m<sup>2</sup>)

**Ordinary Hazard**          Commercial / industrial occupancies

Group 1          Creameries, Offices, Cement Works

Group 2          Potteries, Engineers, Bakeries

Group 3          Paper Mills, Plastic Manufacturing, Department Stores, Textiles

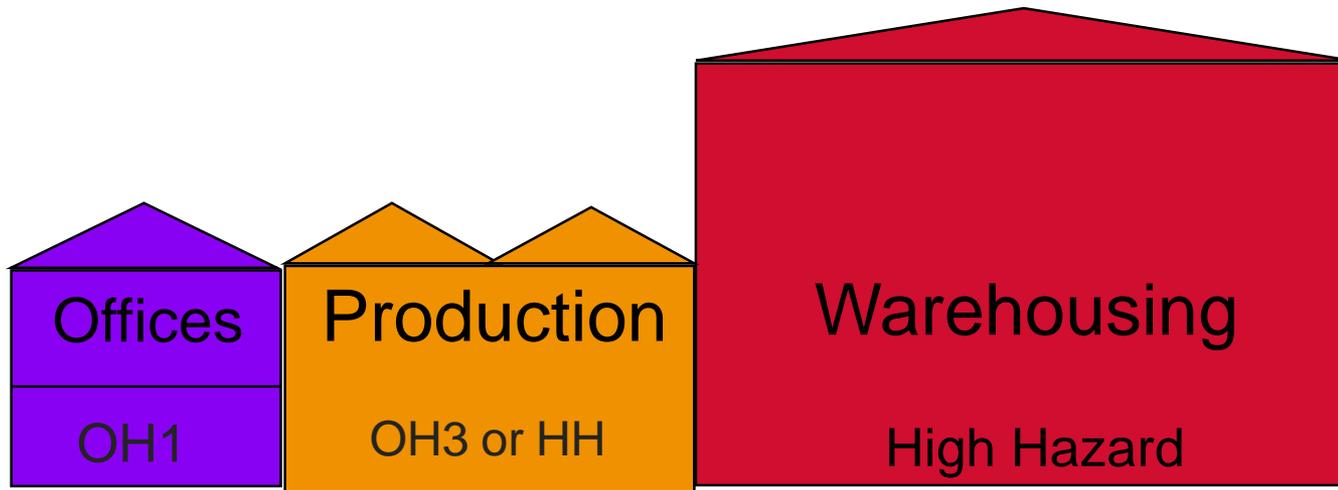
Group 4          Distilleries, Theatres, Cotton Mills

**High Hazard**          Commercial / industrial occupancies with high fire loads

Process Risks          Manufacture of paint, foam plastics, fireworks

Storage Risks          High piled storage (Warehouses)

# Occupancy



A Typical Risk –

- Offices could be Ordinary Hazard Group 1 (OH1)
- Production Area could be OH3 or High Hazard depending on Occupancy.
- Warehouse would be High Hazard with roof only or roof and in rack sprinklers



---

# Fire Load

## Fire Load Considerations

- Category of Goods - categories 1, 2, 3 & 4
- Additional “packaging” - Plastic tote boxes, shrink wrapping
- Type of Storage - Free Standing, Racks, Shelves
- Storage Height - Racked/Shelved storage over 6.0m requires in rack sprinklers or Special sprinkler systems.

# In Rack Sprinklers

- Why do insurers like them?
- Detect a fire early
- Gets water close the fire
- Allows almost limitless storage heights





---

# Water Supplies

A sprinkler system requires a water supply that is

- Adequate (meets the requirements of the design)

Pressure - to push water through the pipes

Flow - to provide the required quantity of water

- Reliable

Can the water supply be interrupted?



---

# Towns Main Water Supplies

- The most basic water supply
- Towns mains are not in the ownership of the insured and therefore there are a number of potential problems that can occur:
  - Reduction in mains pressure
  - Leaving stop valves on the main partially closed
  - Towns main improvements!

# Additional water supplies

To supplement a towns main water supply.

## Elevated Tanks

- Located on top of towers or hills
- Limited duration and low pressure as tank empties

## Air Pressure tank

- Filled with water and compressed air.
- Treated as a boiler/pressure vessel and thus subject to engineering inspections



# Pumped water supplies

Insurers prefer pumps

- Most reliable water supply
- Under the control of the insured.
- But needs regular maintenance
- And requires a stored water source.



# Water Storage

## Sprinkler Tanks

- Sized to suit the pumps and type of system
- 60 mins for Ordinary Hazard, 90 mins for High Hazard
- Usually kept topped up from towns main



## Lakes, Rivers, Reservoirs & Canals

- Found on older systems, although may be seen more often as a result of rainwater harvesting.
- Need a special “jackwell” with a foot valve.





---

# Grades of Water Supplies

**The LPC Grade sprinkler Water supplies as follows:**

**Grade 1** – A “duplicate” water supply. The most common type comprising a diesel and an electric pump and a full capacity Tank. Required for all high hazard risks

**Grade 2** – A “superior” water supply. Usually two pumps but with a small tank (possibly due to lack of space). Not common.

**Grade 3** – A “single” water supply comprising a single towns main connection or single pump and tank. Common for ordinary hazard risks.

# Sprinkler System Types

## Wet System

- The pipework above the control valve is maintained full of water.
- Additional frost protection measures required in winter.



## Alternate or Dry System

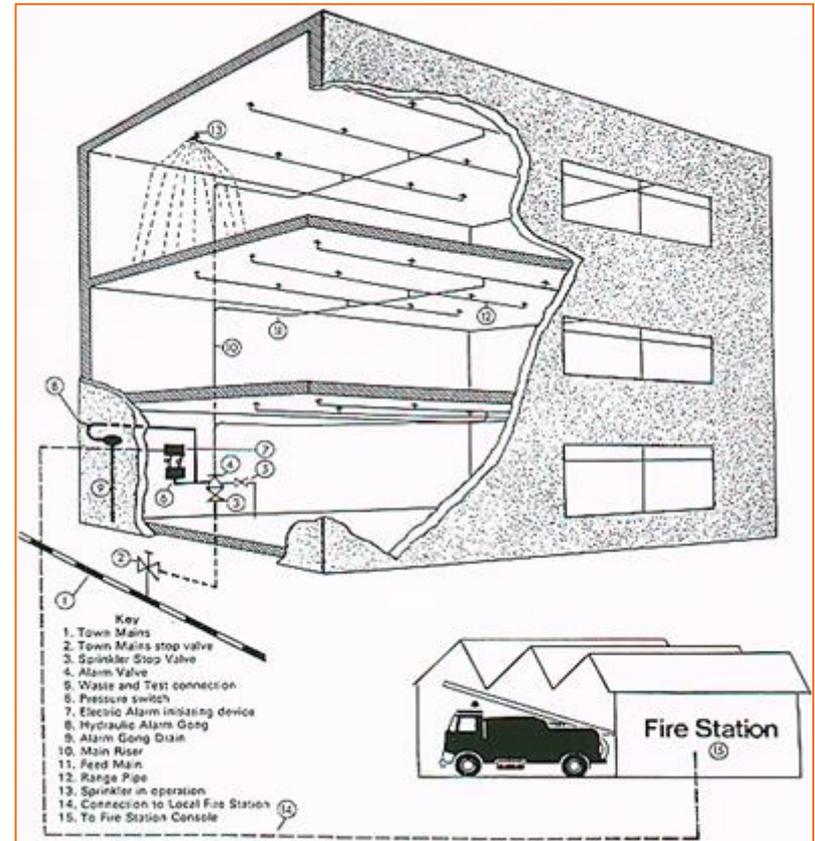
- Pipework above the control valve filled with water (summer) or air (winter).
- Slow to operate in winter as air has to dissipate before water is discharged.



# Alarm Valve Operation

All the valve types operate on the same principle :-

- Sprinkler head operates
- System pressure reduces
- Water flows from supply into the system
- Valve “clapper” lifts
- Water flows to the hydraulic alarm gong & electronic alarm pressure switch
- Signal is sent to fire brigade via monitoring centre

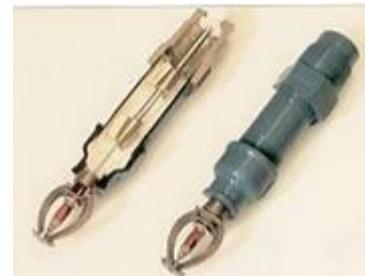


# Types of Sprinklers

Sprinkler types and uses

As well as conventional sprinklers there are:-

- Concealed Sprinklers most commonly located in decorative ceilings
- Side wall sprinklers – located along sides of rooms / corridors
- Dry Pendant Drops – Found in Cold Stores with pipework above



# Types of Sprinklers

- Sprinklers are coloured coded according to their temperature ratings

Bulb	Deg C	Fusible Link	Deg C
Orange	57	-	-
Red	68	uncoloured	68/74
Yellow	79	-	-
Green	93	white	93/100
Blue	141	blue	141
Mauve	182	yellow	182
Black	204/260	red	227

- The installed sprinkler should have a temperature rating of around 30 deg C above the maximum ambient temperature in the protected area

# ESFR

## EARLY SUPPRESSION FAST RESPONSE

- Roof Level only
- Allows Storage up to 12.2m
- Building Height up to 13.7m
- Design based on just 12 heads operating.
- Discharge density up to 75 mm/m<sup>2</sup>





---

# When can sprinklers be omitted?

Sprinklers should be Installed throughout the premises unless:

- Allowed under LPC rules
  - Fire Escape stairwell
  - Wet Process Areas
- Water may create a hazard
  - HV Switchrooms,
  - Industrial Fryers,
  - Cooking Ranges
- Fire separated areas
  - 2hr for low hazard – office, leisure, shop, residential
  - 4hr for high hazard – warehouse, industrial
- Alternative protection is installed
  - Ansul system on cooking ranges
  - Gas system in Computer Equipment Rooms

# What about water damage?

Sprinkler systems rarely cause water damage unless:

- There is a fire  
The water damage is always less than the damage that would have been caused by the fire (but it's hard to prove).
- A sprinkler head is accidentally damaged  
Sprinklers are usually out of harms way  
Guards can be fitted to vulnerable sprinklers
- There are faulty sprinklers  
Sprinklers are tested at the manufacturers  
Failure rates are 1 in 1,000,000
- There is a lack of Maintenance  
Leaking valves, pumps and pipes.
- There is Frost Damage  
The main cause of leaks



---

# Maintenance

## Weekly Testing

Can be carried out by the insured or a sprinkler contractor.  
All recorded on a weekly test card provided by the insurer

## Scheduled Maintenance

Sprinkler systems need servicing at least annually and sometimes quarterly.

Most insurers insist on LPCB approved carrying out maintenance a list of such contractors can be found at [www.redbooklive.com](http://www.redbooklive.com)

## Management

The on site management should ensure the sprinkler system is not compromised or impeded at all times.

# Frost Protection

Where wet systems are installed the ambient temperature must be maintained above 4 °C using fixed heating systems.

Where this is not possible alternatives such as trace heating and lagging are used

The trace heating comprises an element that looks like electrical cable that is wrapped around the pipe.

The lagging helps to contain the heat but must be kept dry.



# Why Install Sprinklers ?

## Building Codes

- Shopping Malls ADB / BS9999
- Retail Warehouse > 2,000m<sup>2</sup> ADB
- All uncomparted buildings > 20,000m<sup>2</sup> ADB
- Offices ADB / BS9999  
Local Building Acts
- Flats > 30m height ADB
- Legal requirements Scotland, Wales, NI

**= LIFE SAFETY**



---

# Why Install Sprinklers ?

## Insurer / Client Requirements

- High Insured Values ( £ ? )
- Large Uncompartmented Risks ( M<sup>2</sup> ? )
- High Fire Risk / Load– Process or Storage
- Business Protection

**= PROPERTY PROTECTION**



---

# What does a sprinkler system cost?

- Conventional Sprinklers - £10 / m<sup>2</sup>
- In Rack Sprinklers - £25 / m / level
- ESFR Sprinklers - £14 / m<sup>2</sup>
- Water Supply (2 pumps, 1 tank) £150k+



---

# Other types of fire suppression

- Residential and Domestic Sprinklers
- Watermist
- Deluge
- Gas Systems
- Cooking Range Systems
- Oxygen reduction



---

# The Future

- Post Grenfell
- Building regulations?
- Sprinklers v “fire protection system”
- The value v the cost.



---

# Key Information

Key information that might be to gain the best attention and avoid secondary questions from underwriters :-

- Extent of the system, what is/isn't sprinklered.
- Storage – What, How and Height, are in rack sprinklers fitted?
- Water Supply, Pumps, tank, towns main. Give details of pump and tank capacities.
- Maintenance, how often by whom, obtain a copy of the last service report.
- Frost protection measures.
- Photo's of valves, pumps, tanks, data-plates etc.

# How do Insurers rate sprinklers?

Most insurers tend to rate a sprinkler system based upon its effectiveness irrespective of water supply grade or design standard.

Rating considerations include:-

- Occupation and fire load.
- Extent and type of protection (does the protection meet expectations)
- Water supply performance (tested during survey)
- Outstanding risk improvements.
- Weekly tests and maintenance schedules.
- Remote monitoring.

Rating discounts up to 65% are possible

# The End

