

Loss Prevention Standards – Asset Classes

Sprinkler Systems – How They Operate

Version: 1.4

Date: 29th October 2024



Sprinkler Systems – How They Operate



Introduction

Sprinkler systems have been in use for well over 100 years and are a proven method of protecting property and saving lives from fire. The vast majority of sprinkler systems are very simple in design and in the way that they operate, typically comprising:

- A water supply, which can be from the town's main (subject to supply characteristics) or more reliably, from dedicated fire pumps drawing water from a storage tank or other such contained water source.
- One or more installation control valve sets, which are used to control the supply of water into the sprinkler system.
- A network of pipes, which distribute water from the supply via the installation control valves to the sprinkler heads.
- Sprinkler heads, which are strategically sited throughout the protected premises in accordance with the design codes.



Types of Installation

There are four main types of sprinkler installations:

- **Wet** – pipework is filled with water under pressure at all times.
- **Dry** – pipework above the installation control valve set is charged with compressed air at all times. Dry installations are typically used where there is a risk of frost damage, but there are limitations in their use. For example, dry systems are not considered appropriate for storage risks.
- **Alternate (Wet/Dry)** – pipework is filled with water during the summer months and with compressed air during the winter months. Alternate installations are typically used where there is a risk of frost damage. However, these installations are no longer permitted under UK sprinkler codes.
- **Pre-action** – pipework above the installation control valve set is filled with compressed air at all times. Pre-action installations operate in a similar manner to dry systems but can also be linked to automatic fire alarm systems to initiate filling of the pipework with water prior to activation of the sprinkler heads. Pre-action installations are used where there is a concern over accidental discharge of water, for example in data centres, or where there is potential for frost damage but a pre-arming of the pipework with water is considered a more robust protection option than a standard dry system.

Sprinkler Heads

Sprinkler heads are heat activated, and there are two types of heat sensitive elements:

- **Fusible Soldered Link** – soldered metal link melts at a predetermined temperature.
- **Glass Bulb** – quartzoid glass bulb is filled with a proprietary glycerol liquid and a small air bubble. The liquid expands as the temperature around the bulb increases, until the pressure in the bulb breaks the glass.

Alarms

When a sprinkler system operates, the flow of water can be used to generate an alarm. A water-driven mechanical alarm gong attached to the installation control valve set provides a localised alarm. Additionally, electrical pressure switches and/or electrical flow switches can be used to detect the presence/flow of water and provide an alarm signal site-wide via the automatic fire alarm system. They can also generate an alarm at a remote monitoring centre, thus simulating a fire alarm system.

System Design

Generally, within the UK, sprinkler systems are designed to comply with the LPC Rules for Automatic Sprinkler Installations 2015 incorporating BS EN 12845. Some systems will be designed to National Fire Protection Association (NFPA) or Factory Mutual (FM) codes. There are also various codes which are used in other countries such as CEA 4001, VdS, etc.

Sprinkler system design is tailored to suit the storage, or process hazard of the premises. The greater the fire load, the greater the amount of water that will be required to be delivered from the system. The type of goods and their packaging is assessed and categorised, along with storage heights and the method of storage, such as, freestanding, racks, shelves, etc. This information is used to evaluate the required water density and the maximum allowable storage height for a roof-only sprinkler system. Some storage configurations will require in-rack, as well as roof-level sprinklers, where storage heights exceed the maximum allowable. Your Aviva Sprinkler Risk Consultant will carry out such an assessment and provide advice on the required sprinkler design to ensure your business is adequately protected.

Whilst a sprinkler system will generally be installed throughout the premises, the water supplies will typically be sized to protect a fire area around 260m².

Sprinkler Facts

In buildings fully protected by sprinkler installations:

- 99% of fires were controlled by sprinklers alone
- 60% of fires were controlled by the spray from no more than four operational sprinkler heads

Source: European statistics over a 10-year period.

Accidental discharge of water from all causes is 1 in 500,000 (per year of service).

Source: Loss Prevention Council (LPC).

Accidental discharge of water due to manufacturing defects is 1 in 14,000,000 (per year of service).

Source: LPC (UK) and FM (USA).

Source of the above facts: [British Automatic Fire Sprinkler Association](#)

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Additional Information

Relevant Loss Prevention Standards include:

- Sprinkler Systems – Flexible Connections
- Sprinkler Systems – Review of Hazards
- Sprinkler Systems – Winter Precautions

Further risk management information can be obtained from [Aviva Risk Management Solutions](#)

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29th October 2024

Version 1.4

ARMSGI1572020

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