

Loss Prevention Standards

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.

System Maintenance

System maintenance is a requirement to ensuring the sprinkler system will operate effectively when required, and regular maintenance should be completed by a third party approved sprinkler company, such as those listed in: www.redbooklive.com.

However, less obvious is the need to continually assess any changes to the building, its occupation, storage etc., as changes can affect whether or not the system will be effective in controlling a fire. A simple alteration to the packaging, or the introduction of a new product, can alter the efficiency of the sprinkler system. Sprinkler installations have a number of moving parts, isolation valves, pumps, etc., which require regular exercising and visual checks. Pumps and alarm valves need to be inspected and tested at weekly intervals and the results recorded on an Insurance Weekly Inspection and Test Card. Contact your Aviva Account Consultant if you require such a card.

Other installation standards, such as NFPA and FM, may require different inspection, testing and maintenance regimes, but all will have the same aim; to ensure operational reliability of the system.

All of the above aspects form part of a review of your system that an Aviva Sprinkler Risk Consultant will carry out during a visit to your premises. They are also available to offer support and advice during any planned changes. Whilst sprinkler leakage can occur, in the majority of instances this is due to issues such as inadequate frost protection measures, or impact damage such as that caused by fork lift trucks. These occurrences are relatively rare and with the correct maintenance and design, the risks can be reduced.

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](http://www.britishautomaticfire.com)

Additional Information

Aviva Loss Prevention Standard: Sprinkler Systems – Flexible Connections

Aviva Loss Prevention Standard: Sprinkler Systems – Review of Hazard

Aviva Loss Prevention Standard: Sprinkler Systems – Winter Precautions



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

Please Note

This document contains general information and guidance and is not and should not be relied on as specific advice. The document may not cover every risk, exposure or hazard that may arise and Aviva recommend that you obtain specific advice relevant to the circumstances. AVIVA accepts no responsibility or liability towards any person who may rely upon this document.

