

Sprinklers

01

Current Position

A sprinkler system is a pipework distribution system charged with water, with a network of heat-sensitive sprinkler heads supplied via a tank/reservoir or a water main. If the temperature rises above a critical point, the sprinkler head will activate and a water spray will be emitted.

Key points:

- only the sprinkler head or heads subject to the heat source will activate
- the sprinklers must be correctly rated according to the level of protection required/type of risk.

Sprinkler systems are designed to control fires at a very early stage in their development and not necessarily to halt the advance of an already established fire.

There is no general legal requirement for sprinkler systems to be installed in a place of work but there may be circumstances where sprinklers are required as detailed in the section below.

“There is no general legal requirement to install sprinklers in places of work”


Sprinklers have traditionally been installed in UK commercial buildings, particularly in warehouses with high-value stock. Residential sprinkler systems have been very unusual until recently, but are becoming more popular, particularly for developments where more vulnerable people reside or as an alternative to other requirements in order to meet the requirements of Building Regulations. The Welsh Assembly has introduced requirements for the installation of sprinklers in new and refurbished care homes, hostels and homes in multiple occupation since April 2014, and in all new dwellings since January 2016. In Scotland, since May 2005, all new care homes, sheltered housing and high-rise residential accommodation above 18 metres high have had to be fitted with sprinklers. In England, sprinklers have been required in new high rise buildings with floor levels in excess of 30 metres since 2007. Prior to the Grenfell Tower disaster, and particularly since, there have been calls for retrofitting of sprinklers in to high rise residential accommodation.

Legal Requirements

There is no general legal requirement to install sprinklers in places of work, although certain types of premises may require sprinkler systems under the requirements of the Building Regulations. However, properly maintained sprinkler systems are often required as a condition of insurance for high-risk premises.

They may also be a necessary feature, as part of a suite of fire precautions, included in a building's design, to persuade Building Control Authorities to approve a building's layout. Sprinklers are often included to offset other parameters which would otherwise be unacceptable such as large unsegregated areas, high-rise buildings or long travel distances. Specific requirements regarding sprinklers apply to high-rise buildings in central London and in Wales.

Where a fire safety risk assessment concludes that life-protection measures would not be sufficient without sprinkler provision, or the fire strategy for the building, as constructed required, sprinkler protection to offset other



features, then sprinklers and their maintenance effectively become a legal requirement under The Regulatory Reform (Fire Safety) Order 2005 and equivalent Country legislation.

Following the Lakanal House high-rise housing fire in July 2009, in which six residents died, the coroner recommended that the retrofitting of sprinklers in high-rise housing blocks be considered.

In 2011, the British Automatic Fire Sprinkler Association (BAFSA) sponsored a project in conjunction with Sheffield Council to retrofit sprinklers into an occupied 13 storey residential tower block to illustrate that this could be possible and achieved at a reasonable price. The project was achieved at a cost (2011 prices) of £1,150 per flat including the common water supplies. The annual maintenance cost for the whole block of 47 flats was estimated at £250 per year. The annualised total cost per flat of the installation and maintenance over a 30 year period, was considered to be £40 per flat. BAFSA published an update to the report following the Grenfell fire in 2017.

Although some local authorities have retrofitted sprinklers to high rise residential accommodation, generally this was rare prior to the Grenfell House fire in June 2017, when 71 residents died in a fire which spread rapidly due to a combustible external cladding. The building was not fitted with sprinklers. Since this disaster, retrofitting of sprinklers in such high rise buildings has become more common and calls for the mandatory fitting of sprinklers in high rise residential buildings have been made.

The current position is that in Scotland, since 2005, all new care homes, sheltered housing and high-rise residential accommodation above 18 metres high have had to be fitted with sprinklers. In addition, sprinklers are required in all covered shopping centres in Scotland. In Wales, since April 2014, all new and refurbished residential care homes, homes in multiple occupation and hostels (as well as certain other types of premises) must be fitted with an approved fire-suppression system. Since January 2016 all single-family dwellings in Wales, including houses and flats, must be protected with approved automatic fire-suppression systems. In England, since 2007, all newly constructed high rise buildings with floor levels in excess of 30 metres are required to be fitted with sprinklers.

Information

a. Brief System Description:

All areas of the building to be protected are covered by a grid of pipes with sprinkler heads fitted at regular intervals. Water from a tank via pumps or from town main (if it can give sufficient flow) fills the pipes.

Each sprinkler head is a heat-sensitive valve, which will open when it reaches a specific temperature and spray water onto the fire (on standard sprinkler systems, once activated, the head will remain open). The hot gases from a fire are usually enough to make it operate. The exact temperature of activation depends on the design criteria for the system, although generally the temperature set is 68°C with the exception of heads in areas exposed to high temperatures under normal conditions. Only the sprinklers over the heat source open; the others remain closed. As the water flows from the head, it strikes a deflector plate creating a water spray.

Sprinkler heads can be placed in enclosed roof spaces and into floor ducts to protect areas where a fire can start without being noticed. In a large warehouse sprinklers may be placed in the storage racks as well as the roof. It is important that storage, and other obstructions within the area, do not come within close proximity as this will affect the ability of the sprinkler to quench the fire. Each system will have its own requirements but commonly the clearance distance for ceiling-mounted heads is 0.5 metres or more.

The sprinkler heads are delicate and vulnerable to accidental damage. Managers of premises therefore need to ensure that working practices avoid accidental activation and the consequent water damage.

At the point where the water enters the sprinkler system, or section of the system, there is a valve. This can be used to shut off the system for maintenance. For safety reasons, this should be kept locked open, and only authorised persons should be able to close it. If a sprinkler opens and water flows through the valve it lets water into a secondary pipe which hydraulically activates an alarm bell. Sprinkler systems are also commonly connected to the building fire alarm system via electrically operated pressure or flow switches.

b. Types of Sprinkler System:

The most common types of sprinkler system currently in use are:

- **Wet system:** the whole system is full of water permanently to its design pressure allowing water to

“Each sprinkler head is a heat-sensitive valve”

be discharged immediately on activation of a sprinkler head. This is the most common system in use.

- **Dry system:** these systems are permanently charged with air under pressure, and the resulting pressure drop on activation of a sprinkler head activates a water control valve. This should generally only be used where a wet or alternate wet and dry system cannot be used.
- **Alternate wet and dry system:** the system is full of water during warm months and drained and charged with air under pressure in winter months where there may be a risk of freezing. When the system is charged with air it operates as described for dry systems above.
- **Pre-action system:** this system incorporates an electronic form of detection to pre-arm the system with water. The system is generally filled with air under pressure, and activation of a sensor or detector lets water into the system. Water is then released into the space on activation of the sprinkler head. These are used in applications where it is not acceptable to have the pipework full of water at all times.

c. Design and Maintenance:

The sprinkler system is designed according to the hazard it is protecting against. The classifications within BS EN 12845:2015 are:

- **Light hazard:** This category covers low-risk non-industrial applications. Typical examples are prisons, offices and schools.
- **Ordinary hazard:** This category covers commercial and industrial applications involving ordinary combustible materials and is split into four further groups:
Ordinary hazard Group 1 (includes hospitals, hotels and restaurants)
Ordinary hazard Group 2 (includes laboratories, metal working factories and museums)
Ordinary hazard Group 3 (includes most other types of factory, plant rooms, department stores, shopping centres and railway stations)
Ordinary hazard Group 4 (includes tobacco factories, waste paper processing, theatres, cinemas and exhibition halls).
- **High hazard:** This category covers commercial and industrial applications having abnormal fire hazards due to the activities taking place, the type of goods being stored etc; for example, paint factories, printing works and plastics injection-moulding factories are high hazard process 1 (HHP1). Firework factories are HHP4.

BS EN 12845:2015 specifies requirements and gives recommendations for the design, installation and maintenance of fixed fire-sprinkler systems in buildings and

industrial plant. Annex F of the standard contains provisions for additional measures to improve system reliability and availability. These measures are relevant in systems, for example installed for 'life safety reasons'. The overall standards cover the classification of hazards, provision of water supplies, components to be used, installation and testing of the system and system maintenance.

Another useful reference is 'LPC rules for automatic sprinkler installations'. Compliance with these Rules is invariably specified if the sprinkler system is being installed as part of insurance requirements. The Rules incorporate the requirements of BS EN 12845 2015.

The sprinkler system must be maintained in accordance with these codes. The installer should provide the client with details of inspection, servicing and maintenance requirements, which should be carried out by trained persons. It is common for weekly bell and alarm connection tests and checks to be carried out by in-house maintenance staff who have received suitable training, and for such work to be supported by an external specialist maintenance contractor who undertakes the more detailed tests and inspections which are required less frequently.

A sufficient number of spare sprinkler heads should be kept available in accordance with the specification so that the system can promptly be put back into action following a fire.

Records should be kept of all servicing, testing and maintenance. It is normal practice for insurers to place a warranty on the fire insurance policy where a premium discount is given for the installation of sprinklers, requiring the sprinklers to be maintained and the insurers to be notified if the system is not in service. Failure to comply with such a warranty will invalidate the insurance cover.

Key Actions

- Identify whether a sprinkler system is needed; such systems are particularly relevant to be considered as a retrofit in sheltered housing, care homes and high-rise residential buildings
- ensure that, where a system is installed, it is inspected, serviced and maintained in accordance with the British Standard and the LPC Rules, by competent trained persons
- ensure that design drawings of the sprinkler system, and as-built drawings, are retained
- ensure that records are kept of all servicing, inspection and maintenance

- ensure that managers and staff are aware of the need to keep storage within identified boundaries so as to avoid compromising the sprinklers' effectiveness
- minimise the risk of sprinkler heads being damaged by identifying hazards and applying risk controls
- ensure that, in shared or leased buildings, responsibilities for inspection, servicing and maintenance are clearly understood and allocated
- ensure that control valve sets are kept padlocked in the open position using leather or similar straps (unless otherwise required), are protected from damage and that there is sufficient space for persons to work on them safely
- maintain a sufficient supply of spare sprinkler heads
- ensure that fire insurers are informed of any times when the sprinkler system is not operational and take what action the insurers require.

Key Terms

Sprinkler system - a pipework distribution system, usually charged with water, with a network of heat-sensitive sprinkler heads supplied via a tank/reservoir or a water main.

Sprinkler head - a heat-sensitive valve which will open when it reaches a specific temperature and spray water onto the fire.

Related Documents

Building Regulations Approved Document B 'Fire Safety' (or National Equivalent), Volume 1 and 2 2006 incorporating 2010 and 2013 amendments.

LPC Rules for Automatic Sprinkler Installations: Incorporating BSEN 12845: including current technical bulletins 2015.

Systems for Fire Protection of Commercial and Industrial Buildings BRE Digest 518 2010.

Further Information and References

<http://www.bafsa.org.uk> is the home page of the British Automatic Fire Sprinkler Association, the principal UK trade association for the fire sprinkler industry. The website contains information about sprinkler installations and a list of registered suppliers and installers.

BS 9251:2014 Fire sprinkler systems for domestic and residential occupancies - Code of practice. Components for such systems should comply with BS 9252 2011 Components for residential sprinkler systems - Specifications and Test Methods for Residential Sprinklers.

BS EN 12845:2015 Fixed firefighting systems: automatic sprinkler systems: design, installation and maintenance.

BS 9999:2017 Code of Practice for Fire Safety in Design, Management and Use of Buildings.

Safer High Rise Living- the Callow Mount Sprinkler Retrofit Project BAFSA 2012

There is also a full range of equipment British Standards for sprinkler system components.

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