

ACTIVE FIRE PROTECTION GUIDE

SPRINKLER SYSTEMS FOR LIFE SAFETY IN DOMESTIC AND RESIDENTIAL BUILDINGS

This document has been produced by the RISCAuthority Active Suppression & Detection working group to provide information and outline guidance on the application of fire Sprinkler Systems for Life Safety in Domestic and Residential (D&R) applications.

NOTE: Buildings and Industrial Plants Life Safety: EN 12845 (the core document used by the LPC Rules for Automatic Sprinkler Protection to which Technical Bulletins for Property Protection are attached) gives recommendations for the design, installation and maintenance of fixed firefighting systems in buildings and industrial plants for sprinkler requirements that are integral to life safety (not property protection). A description of commercial and property protection sprinkler systems is given in AFIG-13, but all references to the limitations of a life safety only objective as provided in this document are valid.

Summary

Refer to AFIG-01 Overarching Active Fire Protection Guide – All Technologies, and AFIG-13 Sprinkler Systems for Property Protection.

Sprinkler systems for life safety (LS):

- aim to assist evacuation of the building before structural collapse occurs unless specifically designed to meet other objectives
- D&R sprinkler standards are 'loose' in comparison to property protection (PP) standards (see AFIG-13) and their specification for all but 'vanilla' installations must be conducted by the fire engineer who has responsibility for the building's overall fire safety management plan
- competency in all aspects of design, installation, and maintenance is key to system performance as is product certification
- are not generally recognised by insurers as beneficial for property and business protection
- BS 9251 (Residential and Domestic Occupancies) has recently been updated to allow limited coverage of commercial and industrial areas which RISCAuthority consider are better protected with the LPC Sprinkler Rules (see TB202)
- The use of CPVC pipe, which is intolerant of contact with many materials, requires special attention if escape of water (EoW) events are to be avoided.
- The primary Standards for D&R systems (BS 9251 and BS EN 16925) are very similar aside from 9251 allowing extension to limited commercial areas and use in buildings over 18 metres in height.

*Property protection vs. life safety sprinkler systems

The performance of property and life safety sprinkler installations are very different and to avoid confusion should be thought of as entirely separate systems. Property protection systems strive for much higher levels of resilience (ability to function) through rigor in the supporting standards, design, product specification, and maintenance, that are not matched by life safety systems which generally seek to only assist occupant escape from the home or workplace.

Types of LS D&R sprinkler system

D&R sprinkler systems designed according to BS 9251 are given a category, based on the type of building and/or its occupancy, which may be enhanced to account for specific local challenges.

Category 1 systems: single family dwellings such as houses, individual flats/maisonettes and transportable homes, HMOs, B&Bs, and boarding houses.

Category 2 systems: blocks of flats, small residential care premises, and sheltered and extra care housing.

Category 3 systems: larger residential care premises, student accommodation, dormitories; and hostels.

Category 4 systems: all residential buildings 18m or higher.

Necessary enhancements are decided on the basis of (a) higher fire safety risk, (b) compensatory features, and (c) occupancy profile – vulnerable people, and these may demand increasing the category of the system, the water application design density, or the resilience of the system.

'Higher safety risk factors' include higher than normal fuel loads and hoarding, delay to Fire Services attendance, buildings with hidden voids, heritage buildings mixed building use etc.

'Compensatory features' include situations where a building is unable to follow guidance issued in support of building regulations.

'Occupancy profile' includes elements that might change the level of hazard (ignition and combustion), likelihood (arson and fire history), and risk in terms of the occupant's willingness or ability to escape.

Residential sprinkler system types include:

- mains-fed systems
- pump and tank fed systems
- multi-storey building systems where the water supply and riser is shared
- multi-storey building systems where the water supply is shared but uses a dedicated riser.

Mains-fed systems can take water from a connection made before the water meter.

Components of a fire sprinkler system

The components of a D&R fire sprinkler system vary in accordance with system type but include:

Water supply: direct from water main or stored in water tanks sized for the required duration of protection, and electric pump set capable of delivering water to sprinklers at the required flow and pressure.

Drain, flow test and alarm test valve: a pressurised mechanical non-return valve that provides alarm, prevents backflow when closed, and allows testing of the water supplies.

Electrical water flow switch: for alarm notification.

Pressure gauge: for system configuration and health monitoring.

Priority demand valve: to shut off domestic water use upon sprinkler system activation, in turn diverting all water provisions to support the fire suppression activities (as opposed to non-essential domestic use).

Pipe network: distributes water to the sprinkler heads hydraulically sized to deliver the correct quantity of water.

Sprinkler heads: of the heat sensitive glass fluid filled bulb type that might be ceiling mounted (exposure, recessed, or concealed), or wall mounted.

Ancillary equipment: including non-return valves, tank float valves, lockable security valves, pressure switches etc.

Multi-storey systems have a sprinkler valve on each floor and may use the building's water supply pumps or dedicated sets.

How it works

A sprinkler system provides a means for targeted application of water from the ceiling or wall. As each sprinkler head is a detection and activation device in its own right the area of water delivery increases in line with the fire until suppression or extinguishment is achieved. Sprinkler heads are placed to cover the floor and ensure walls are wetted to an appropriate height. The typical operation scenario is:

- hot gases from the fire collect at the ceiling
- the nearest sprinkler head bulb expands with heat and breaks to release the plug and discharge water at pressure
- water pressure drop is detected, which, depending upon the type of system, acts to isolate other water usage, turn on pumps, and sound local and remote alarms
- further heads operate (as required) to suppress fire
- Fire Service attends to secure fire and isolate the sprinkler system.

A key design parameter for any sprinkler system is the minimum amount of water that must be delivered according to the category of the system.

System category	Min. design discharge density (mm/min)	No. of sprinkler heads to supply	Min. supply duration (min)
1	2.1	1 or 2	10
2	2.8	1 or 2	30
3	2.8	2 or 4	30
4	2.8	2 or 4	60

These values are adjusted in accordance with enhancements pertinent to abnormal fuel loads, design compensations, and occupancy profile.

For comparison, heavy rainfall is around 0.15 mm/min.

Sprinkler systems control fire by:

- cooling the fuel involved in the fire
- removing unburned fuel by wetting (making the flammable, non-flammable).

In the domestic environment, a key facet of their function is to prevent the fire reaching flashover – keeping gas temperatures low so that universal involvement of all combustibles in the space through thermal radiation is avoided and so aids escape.

Challenges and considerations

System specification: This must be made by the engineer responsible for the building's fire safety management plan, and not by the sprinkler system designer (although this responsibility often incorrectly and ill-advisedly falls to them).

Communication and training: CPVC pipe is exceedingly sensitive to other materials it contacts which can cause it to leak or fracture causing extensive water damage and disabling the system. It is vital that those installing CPVC pipe are OEM trained, and those performing the passive make-good are similarly trained to know to use only compatible materials.

Protection of commercial and industrial areas (BS 9251) in multi-occupancy buildings: BS 9251 allows limited extension to cover small (max. 100m²) fire compartments at reduced water provision. Anything over 100m² should refer to BS EN 12845. In these situations, it is unlikely that such a system would receive any recognition from insurers and should be discussed with your insurer prior to any installation. RISCAuthority's view is that a property protection standard is the appropriate reference – see AFIG-13 and LPC Sprinkler Rules TB202.

Insurance: Life safety systems are not normally recognised for insurance purposes. Where sprinkler systems are demanded for insurance purposes of buildings using combustible materials (such as mass timber, and cross laminated timber (CLT)), the expectation is that the system will follow property protection (AFIG-13), rather than life safety standards.

Sprinklers vs. watermist in D&R applications: Whilst both technologies can support life safety objectives, a major advantage of sprinkler systems over other suppression systems is that, subject to holding the same approvals listings, components are interchangeable between suppliers and manufacturers safeguarding upkeep through life. The same does not apply to watermist which is certificated as a complete system.



Applicable standards

BS 9251 *Fire sprinkler systems for domestic and residential occupancies – Code of practice.*

BS EN 16925 *Fixed firefighting systems – Automatic residential sprinkler systems – Design, installation and maintenance.*

BS EN 12845 *Fixed firefighting systems – Automatic sprinkler systems – Design, installation and maintenance.*

LPC Rules for Automatic Sprinkler Installations 2015 Incorporating BS EN 12845.

*For insurance purposes, life safety standards BS EN 12845, BS 9251, BS EN 16925 are not recognised even though BS 9251 allows extension to cover small commercial areas.

Schemes

LPS 1301 Requirements for the approval of sprinkler installers in the UK and Ireland for residential and domestic sprinkler systems.

LPS 1048 Requirements for the approval of sprinkler system contractors in the UK and Ireland.

Warrington Certification Ltd FIRAS Residential & Domestic Sprinkler Systems.

IFC Certification SDI 22 Residential & Domestic Sprinkler Systems.

Best practice

All providers of systems should be third party certificated to approved schemes.

Fire Services should be consulted on their requirements and necessary provisions for supporting the sprinkler system.

Water authority consultation should take place to ensure WRAS conformity of installation and components.

Regulation 38 submission of the information described in BS 9251 and BS EN 16925 is essential so that the role the sprinkler systems plays in the overall fire safety management plan of the building remains front and centre.

The pipe system must be pressure tested as part of the commissioning process.