



Sprinklers are increasingly being used to protect fire authority buildings

Introduction

Automatic sprinkler systems are now widely accepted as providing a highly efficient and effective means for protecting life and property. Sprinklers are now installed in an increasingly wide range of properties and occupancies and their outstanding record of successful operation means that there is now a high probability that all firefighters should expect to find them at the scenes of fires. This makes it essential the basics of sprinklers are fully understood by all members of the fire and rescue services.

Part 1 of this document provides information useful for fire fighters and community fire safety personnel. Part 2 provides advice on the benefits and use of sprinklers in fire and rescue service buildings.

PART 1

Standards

There are two main standards of sprinkler systems within the United Kingdom which fire and rescue service personnel should be aware of. These are:

- A Commercial and Industrial standard (BS EN 12845: 2009).

- A domestic and residential standard (BS 9251: 2014) as applied to residential care premises, certain HMO's and domestic dwellings.
- Personnel may also encounter systems installed to other standards such as those issued by FM Global (an insurer), the US National Fire Protection Association and commercial organisations who have their own hybrid standards.

While approval of standards for individual systems is a matter for the authority having jurisdiction, most UK authorities having jurisdiction would expect to find the British standards documents in use. This does not, of course preclude the use of other international standards.

Sprinkler System Operation

Sprinkler systems offer a way of automatically introducing water quickly and directly to the seat of a fire. All parts of the protected building are covered by a grid of pipes with sprinkler heads fitted into them at regular intervals. Water is fed to the sprinkler heads from a dedicated water supply, either from a dedicated tank/s and pump/s or from the service ('towns') main. Sprinkler heads open independently when a predetermined temperature is reached and water is sprayed on to the fire. The hot gases from a fire are usually enough to make the thermal element in the head operate. Only the sprinklers in the direct vicinity of the fire open, the others remain closed. This limits fire fighting (and hence water damage) to areas where there

is a fire and reduces the amount of water used. The sprinkler heads are generally located near the ceiling and spaced so that there is always a sufficient flow of water to provide firefighting in the likely area of operation. The flow rate is carefully calculated so that there is enough to control a fire, taking into account the size and construction of the building, its use and the contents.



Main Stop Valve is controlled by lower handwheel. Note: valve is secured in open position by strap and padlock.

The supply of water to a sprinkler system is controlled by a Main Stop Valve (MSV). This can be used to shut off the system for maintenance. **For safety reasons it should always be locked open and only authorised persons should close it.** In most commercial premises, if a sprinkler opens and water flows through the valve it actuates a mechanical alarm (usually a gong) outside the building. This feature provides a local alarm without the need for electrical connections. At the same time, most modern systems, even in dwellings, are usually fitted with a flow switch which can be connected to the building's fire control panel and provide a local and remote alarm – this will provide a signal to enable a commercial alarm receiving station to summon the fire and rescue service should the sprinklers operate. (The sprinkler flow alarm signal can be 'piggy-backed' on any fire or security detection system using a redCare or similar connection).

Applications of Sprinklers Systems

There are many fire safety objectives for different buildings. The most commonly identified objectives are:

- Safety of occupants
- Prevention of fire spread (from building to building)
- Asset protection and business continuity

- Protection of the environment
- Safety of firefighters



External mechanical alarm gongs indicate that a sprinkler system is operating

Sprinkler systems are widely referenced in the guidance to the Building Regulations and Scottish Building Standards. However there are only a few circumstances where they are mandated. Many sprinkler systems are installed at the behest of the insurers either to obtain substantial discounts on premiums or to make a property more insurable. Sprinkler protection used to be specified in the now-repealed local buildings acts for tall or large buildings. (For more details see BIF 12: *Sprinklers and the Building Regulations*).

Where sprinklers are called up or their use is suggested as an option, the circumstances may be:

- To facilitate fire service operations in buildings where external rescue or fire fighting operations are difficult to achieve (e.g. tall buildings that exceed the reach of rescue equipment).
- To reduce the fire hazard in buildings where the occupancy characteristics and the risk to life from fire is considered excessive.
- As a means of alternative compliance where all or part of a fire safety objective cannot be met (e.g. where an open plan layout precludes a protected escape route).
- To allow flexibility of design of a building (e.g. where an architect wishes to provide a larger open plan area, there is substantial precedent for the convention that the presence of a sprinkler system allows compartment sizes and travel distances to double)¹.

Sprinklers have been installed in buildings for more than 150 years and were originally developed as a means of reducing fire losses to property and contents. Over recent years there has been a growing recognition of their use as a means of contributing to life safety which is recognized in current UK building standards guidance.

This recognition can be largely attributed to their good record in detecting, suppressing and containing a fire to a much smaller size than would otherwise be the case without sprinklers. This means that flashover

¹ For example, see BS 9999: 2008.

can be largely prevented and tenability improved. The advantages were first seen with an improvement in levels of life safety outside the room or compartment of fire origin. Now, with fast response sprinklers, there is evidence from real fires that even in the room or compartment of fire origin, the occupants are better protected with a sprinkler system.



Fire fighting in sprinklered commercial and industrial buildings

Sprinkler systems are fitted with a variety of controls and gauges, those of importance to firefighters are:-

- The main stop valve (MSV)
- Alarm devices

Main Stop Valve (MSV)

- Isolates the incoming water supply from the service (towns') main or sprinkler pumps/tanks
- Must be right handed thread (clockwise closing).
- Handwheel marked to indicate direction of operation
- Indication of whether valve is open or shut
- MSV must be secured open by means of a strap and lock.

Signs

- A plan showing location of MSV must be placed in the building where it can be easily seen by firefighters
- Additionally an indicator plate must be fixed to an external wall as close to the MSV as possible.

Sprinkler Alarms

- Every commercial and industrial installation must be fitted with an approved external water motor alarm
- The alarm is actuated by water flowing in the system
- Water motor (pelton wheel) actuates a hammer that strikes against a gong
- Ideally, where there is more than one gong, each will be labeled to indicate in which part of the building the sprinklers are operating (See: 'Multiple Systems' below).

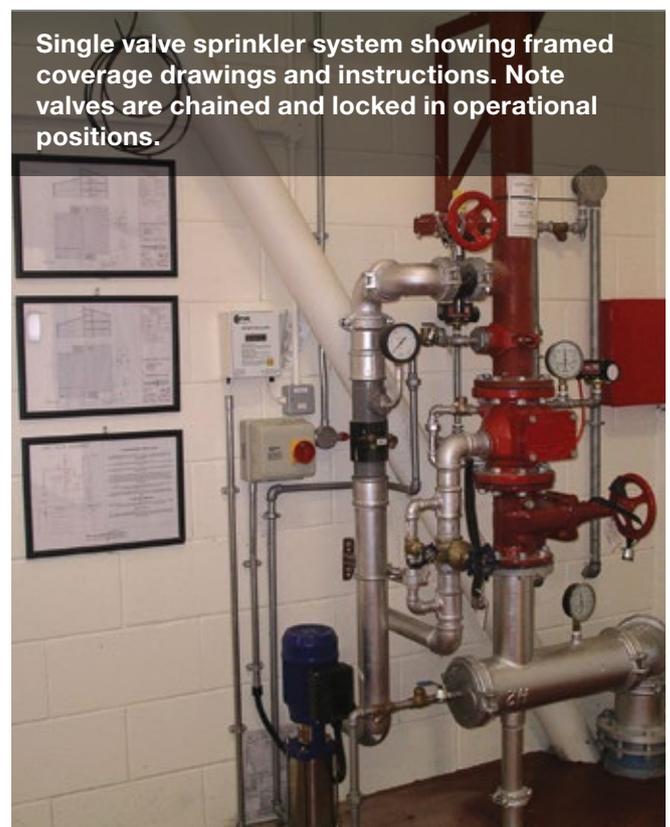
Alarm sounding

There are four main reasons why sprinkler alarm gongs operate:

- Opening of sprinkler head
- Opening of a drain or test valve
- Leakage from the system due to damage
- Fluctuations in the incoming water supply pressure.

Multiple Systems

Where a building has more than one installation fitted, each gong should be numbered in bold figures which correspond to the controlling valves of each installation. A description of the area protected is also desirable.



Firefighting Considerations

- On arrival, one member of the crew to be sent to the MSV
- The MSV should be opened if found closed
- The valve **must not** be closed, except on the express instructions of the Incident Commander
- If the system is fitted with a fire service inlet, the principal supply of water can be augmented. Careful consideration should apply in very large buildings or complexes which may have more than one inlet
- Additional water should not be extracted from the same service main that feeds the installation.
- Sprinklers should not normally be turned off in order to fight the fire with jets or spray branches
- Although sprinklers may appear to have extinguished the fire, careful examination of the scene is still essential to confirm that the fire is out and there is no fire spread via concealed voids

- When the Incident Commander is satisfied that the fire is extinguished the MSV may be closed
- The sprinkler pumps can then be shut down – instructions on how this can be done will be clearly stated in an instruction label on or near the pump controls
- Care should be taken if diesel driven fire pumps are running to ensure that the auto-start facility is not inhibited by manual shut down
- Mopping up operations can then begin. The building owner should then contact a competent sprinkler company and have the system reinstated with the spare sprinkler heads which should be on site. In the case of premises that have a sprinkler system installed as part of a fire engineered fire safety strategy, on no account should the premises be considered compliant until the sprinkler system is **fully operational**. If in doubt consult your duty fire safety officer
- If only one or two sprinkler heads have opened (as is likely to be the case in smaller premises) then consideration should be given to minimising the further flow of water by blocking the sprinkler head with a sprinkler stopper (if one is available) or using a wooden or rubber wedge cut to size. A pair of Mole Wrench pliers may also be used.

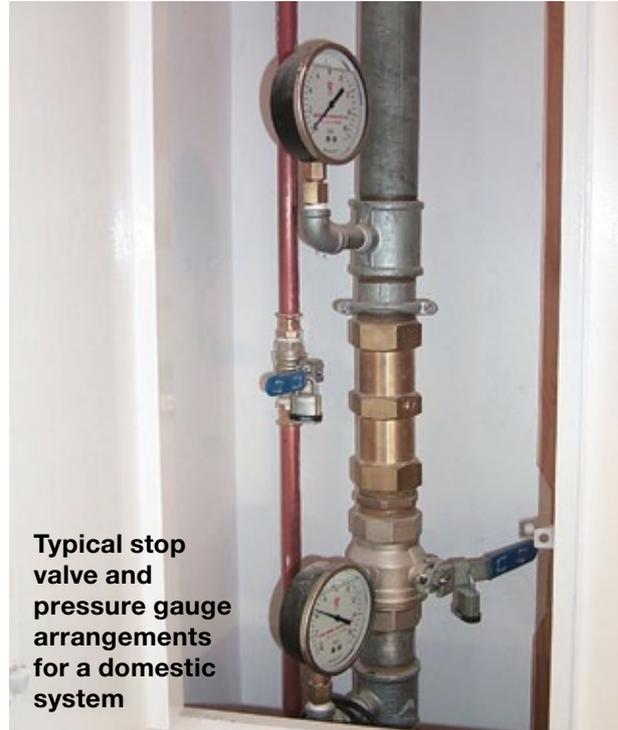


Firefighters should expect to find sprinkler systems in any and all types of dwellings

Firefighting in sprinklered residential or domestic properties

The fitting of sprinkler systems in domestic and residential properties is becoming more wide spread. It therefore likely that Fire Service personnel will come into contact with such installations more frequently. The principle components of a sprinkler system in dwellings are broadly similar to that in commercial and Industrial buildings, but smaller in scale. Where a BS 9251 system is installed, there will still be a **main stop valve** located near to the water supply inlet to the sprinkler system. It is important to recognize if the water supply is from a pump and tank, pressure vessels or directly from the service (towns') mains.

Once this has been identified, one person should be sent to the stop valve to ensure it remains open until such times as firefighting operations are completed and the fire is out. ***The temptation to shut off the sprinkler system before this must be avoided.***



Typical stop valve and pressure gauge arrangements for a domestic system

However if it is clear that the fire in the immediate vicinity of the operating heads is fully extinguished and that there has been no extension in concealed spaces, the heads may be stopped using wedges as in the advice relating to commercial systems.

Once firefighting operations have concluded and the sprinkler system is no longer required the stop valve can be closed and the system drained to facilitate replacement of the sprinkler heads which may have opened - rarely will there be more than two of these.

The system **drain valve** is usually located near to the stop valve. Operation of this will enable the sprinkler pipe-work to be drained. Where needed, a length of pipe should be connected to the drain outlet in order to feed water away from the premises.

The usual clean up operations can then be undertaken.



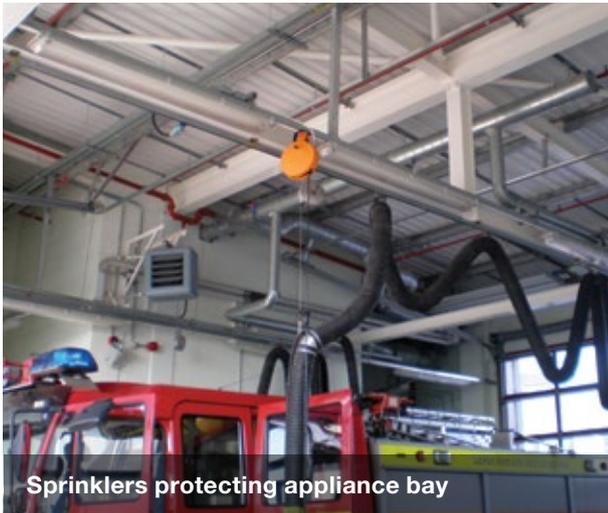
There are a number of proprietary sprinkler stoppers available

Recording of sprinkler system activations

It is vitally important to record accurate information where a sprinkler system has operated. Every effort should be made to bring sprinkler activations to the attention of the relevant person with your own Fire and Rescue Service.

To this end, any information entered into Incident Reporting System (IRS) regarding the activation of sprinkler systems should be recorded as completely as possible. If the premises are only partially protected, please ensure that the information provided reflects whether the fire was in the sprinklered part of the building or not. If a sprinkler system has failed to operate as designed it is very important to try to determine why. If it is because the main stop valve is shut off, or the pumps failed to operate, or some other obvious reason, this should be stated.

Additionally, such information can be invaluable to community fire safety and/or fire engineering personnel and fire engineering and to BAFSA and the National Fire Sprinkler Network.



Sprinklers protecting appliance bay

PART 2

The Installation of automatic fire suppression systems in fire stations

There have been a number of serious fires in fire stations which have resulted in the total destruction of fire appliances and buildings. With a fully equipped Type B water tender now costing in excess of £500,000 it should be clear that modern approaches to asset protection should be adopted for such concentrations of resources. This apart from the embarrassment factor and negative media coverage resulting from incidents in fire and rescue service-owned and -occupied premises.

An additional trigger for the provision of automatic fire suppression is the way in which modern fire stations are constructed - often under third party finance and leasing contracts where a service provider accepts responsibility for constructing and managing a resource for a specified period. Loss of a building during the term of the agreement could

result in significant problems for the provider.

It is therefore not surprising to find that several fire authorities have decided to include the provision of fire suppression in new or redeveloped fire stations.

Types of Systems

The greater majority of systems installed to date in fire stations have been wet sprinkler systems to BS EN 12845. The present hazard classification system in this standard does not specifically cover 'fire stations'. While the 'Light Hazard' (LH) classification might seem to be appropriate for smaller locations, for example, a single pump retained station, the presence of fuel, lubricating oil etc would also seem to contradict this.

While offices are normally deemed to be Ordinary Hazard 1, Ordinary Hazard 3 (OH3) is specified for a number of industrial occupancies including 'car workshops' and BAFSA believes that this is probably most appropriate for all but the very smallest fire station. Consideration could be given to specifying an OH3 systems with a reduced capacity water supply if a risk assessment indicates that this would be acceptable. In this case it would be sensible to provide a pumping in point with a breaching inlet to reinforce the supply of sprinkler water.

It is not appropriate to use BS 9251: 2014 for fire stations even where there is living accommodation. BS 9251 could be used to cover the domestic portions of a fire station only where there is at least one hour's fire resistive construction between the residential portions of the building and appliance bays/ workshops, offices and storerooms.

Note that it would **not** be good engineering practice to design a system to LH or OH1 for some parts of the system and OH3 for the remainder. Such a system would also be unlikely to be approved by an insurer. Where possible, only wet systems should be specified. If there is a risk of freezing (for example in appliance bays or roof spaces), then advice from the installer should be sought at the earliest stage.

'Life Safety Systems'

There is some confusion with regard to the designation of some sprinkler systems as being 'life safety systems'. The reality is that all sprinkler systems, when properly specified, designed, installed and maintained will protect the occupants of a building. The confusion arises from the presence of Annex F in BS EN 12845: 2009: 'Special requirements for life safety systems'. This annex is only utilised in the UK and was imported from BS 5306 Part 2. Its purpose is related to regulating the use of sprinklers in large shopping centres and similar occupancies as a means of complying with means of escape requirements in fire and building legislation. The systems so installed are not any more effective at

suppressing fires that other sprinkler systems but rather have a degree of 'enhanced reliability' - which may be necessary to ensure that the premises protected do not have to close down every time the pumps, valves or tanks are subject to routine maintenance.

As Annex F systems requires additional equipment (for example, duplicate control valves, duplicate pumps and duplicate tanks, these are likely to cost considerably more than a non-Annex F system. It is BAFSA's view that Annex F systems are unlikely to provide any additional benefit in an OH system installed in a fire station. Note that in the 2015 edition of BS EN 12845 Annex F has been re-titled 'Additional measures to improve system reliability and availability'.

LPC Rules

The LPC Rules for Automatic Sprinkler Installations are insurers' requirements issued by the FPA which set out in 30 Technical Bulletins supplementary requirements to BS EN 12845. The LPC Rules are usually specified for systems being installed at the behest of insurers. It is therefore important that the fire authority's insurers (or brokers) are consulted **before** any specification is drawn up.

Pipework

BS EN 12845 allows the use of copper and steel and 'or other material in accordance with appropriate specifications valid in the place of use of the system'. TB 227 of the LPC Rules allows the use of approved (cpvc) plastic pipe in certain circumstances - this is essentially those systems designed to LH or OH1. Cpvc should not be used in OH2 or OH3 systems.

Where cpvc pipe is used it should be only in wet systems and only where the pipework is concealed and not exposed.

Watermist Systems

There are many misleading statements circulating about watermist - for authoritative information, please refer to BAFSA Technical Guide No 3² which is also endorsed by the UK Mist WG and the Fire Industry Association. Note that this guide was prepared before the publication of the documents in the BS 8489 series as standards in their own right.

2 <http://www.bafsa.org.uk/pdfs/publications/5/00000115.pdf>



The primary difference in the specification and use of water mist rather than sprinklers is that water mist systems are essentially 'made to measure' for the premises they are intended to protect and as such, water mist should only be specified if a particular application is supported by BS 8489. Where this is not the case, then the supplying company needs to be able to prove, by fire testing, that the system will work as designed. Specific issues with mist in fire stations will tend to restrict its use in appliance bays and vehicle workshops. It is BAFSA's view that the use of mist in stores and other workshops, welfare facilities, sleeping accommodation and offices etc are covered by BS 8489 Part 7 (Low hazard occupancies). Systems offered to any other standard than BS 8489 or EN TS 14972, or where no independent standard is referenced should be subject to independent scrutiny by a professional fire engineer with relevant experience. It should also be noted that insurers should also be consulted before any decision is taken to specify or install a watermist system.

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