

Domestic and residential fire sprinklers design policy and guidance



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Content

Section	Page No.
1. Background: Fire sprinklers	3
2. Scope	3
3. Types of fire sprinklers	3
4. Types of supply	4
5. Operating pressures and flows	4
6. Design and installation of the fire sprinkler system	5
7. Design and installation of the supply to the property	5
8. Applications process	7
9. Assessment of network capability	7
10. Water use in the event of operation of a fire sprinkler	7
11. Asset records	8
Appendix A	8
Option 1 – Tank feed	8
Option 2 – Direct feed	9
Appendix B	10
For information	11
References	12

1. Background: Fire Sprinklers

Domestic properties in the United Kingdom are not required by law to have fire sprinklers but this is due to change. In 2010 the Welsh Assembly proposed that new legislation is needed to improve the fire protection in homes.

The Domestic Fire Safety (Wales) Measure 2011 received Royal Assent in April 2011. This was supported by Wales' three fire and rescue services, the Chief Fire Officers Association (UK), Fire Brigades Union and the Fire Sprinkler Network. The Measure, which precedes any regulation, does not affect England. The Hafren Dyfrdwy region however, includes Powys, Wales, and this will have an impact on work undertaken by us in installing water supply to domestic properties in this area.

2. Scope

This policy and guidance covers the installation of pipe work and fittings to supply water to the domestic properties and residential occupancies for the purpose of fire sprinklers. Residential occupancies include apartments and blocks of flats, residential homes, houses of multiple occupancy, nursing homes and other residential accommodation for care and rehabilitation.

The policy and guidance is based on the Code of Practice BS9251:2014 – Sprinkler systems for residential and domestic occupancies – code of practice. It outlines the preferred options of water supply in response to the Measure (2011) and in advance of legislation, or regulatory requirements placed on water companies.

3. Types of fire sprinklers

Fire sprinkler systems for domestic properties are designed to protect life and property. They're in addition to protection measures provided through building design which are regulated by Building Regulations. Fire sprinklers also support protection measures provided by installing smoke and fire detectors.

There are a number of different designs of fire sprinkler system. A wet pipe system is designed to be permanently charged with water whereas a subsidiary alternate system is designed to be capable of being charged with air or water. And there are a number of different types of sprinklers including:

- Fusible link - an element melts opening the sprinklers
- Glass bulb - a liquid filled glass bulb bursts opening the sprinkler
- Pendent - water discharged downwards by a nozzle
- Quick response – quick response temperature sensing element
- Recessed – heat sensing element is above lower plane of the ceiling
- Residential pattern – water discharged outward and downward
- Sidewall pattern – discharge of water outward in a paraboloid pattern
- Upright – water discharged upwards

Both the design and installation should be undertaken by a qualified designer and installer. It is advised that the designer and installer make reference to BS9251:2014 – Sprinkler systems for domestic occupancies – code of practice as the correct design needs to consider the fire and fuel loading and layout of the property. We cannot design or install fire sprinklers for you.

4. Types of supply

Sprinkler systems can be connected directly to a mains water supply or there are a number of alternative designs that may include:

- connection to a pressure tank or vessel

- automatic fire pump drawing water from a ground floor storage tank
- automatic fire pump drawing water direct from a mains water supply
- automatic fire pump drawing water from an elevated storage tank or gravity fed supply of water from an elevated storage tank

The pressure and flow can fluctuate across our water network so this must be considered when selecting a design. Our statutory requirement to provide a water service up to the property boundary should also be taken into account.

5. Operating pressures and flows

The effective operation of sprinkler systems requires the delivery of minimum pressure and flows as recommended by BS9251:2014. These recommendations state that:

- minimum operating pressure at any sprinkler should not be less than 0.5 bar
- flow rates for domestic properties, should not be less than, 60 litres/minute through any sprinkler, or 42 litres/minute through each of two sprinklers operating simultaneously in a single room

Operating pressures on the distribution network fluctuate due to the operation of pumps or pressure reducing valves and diurnal changes in demand. Supplies can be interrupted because of burst water mains, though these are located and repaired, it may result in an unplanned interruption to the water supply and hence supply to the sprinkler system. We also carry out planned maintenance on the water mains system that may result in planned interruptions to water supply.

The Level of Service for drinking water supply required at the boundary to the property:

- flow rate of 9 litres per minute
- pressure of 10 metres head or 1 bar

These Levels of Service exist to protect the drinking water supply and are not applied to the supply of water for fire sprinklers.

6. Design and installation of the fire sprinkler system

Design and installation of the sprinkler system is initiated by the owner of the property or developer through an application to us for a new supply. The application must state whether you need a direct supply or a tank fed supply.

It's recommended that design and installation is carried out by a qualified designer and installer who must ensure that there's adequate pressure and flow, and volume for the installation of the fire sprinkler system in the property or properties.

All internal and external pipework and fittings must be installed by a Water Industry Approved plumber or be a member of RSA, BAFSA or an approved third party accreditation company.

Internal pipe work is owned and maintained by the owner of the property. We'll connect to the system at the boundary to the property, designated by the boundary box.

Internal pipe work for drinking water supply must remain separate from the water supplied solely for the purpose of fire sprinklers. The fire sprinkler supply must be marked with appropriate tape. We recommend these three key guidelines to all applicants.

- WRAS Water Regulations Guide
- BS6700 guidance for backflow prevention
- BS1710 guidance for identification and marking of pipe work

As part of the Water Fittings Regulations, we'll undertake inspections of sprinkler installations to enforce compliance with the regulations.

7. Design and installation of the supply to the property

There are two common options that provide a standard design for the majority of applications.

Option 1 includes a meter at the property boundary to reduce risk of illegal water use on the fire main. For option 2, as there's currently no boundary box available greater than 32mm (and fire main could be up to 50mm), the sprinkler supply will be unmetered but the domestic supply will be via a standard boundary box. To reduce risk of illegal water use this arrangement will be inspected by our new connections team before connection.

In both option 1 and 2 single check valves will be used to ensure sprinkler supply does not impact the quality of the domestic water supply

Option 1 (Drawing 1 Appendix A)

A feed to a tank supply and connected at the boundary box

A 25mm diameter feed from the water main to the stop tap and meter. A single 25mm diameter branch will be installed from the boundary box to the property to supply both the drinking water and also supply a tank for the sprinkler system. The tank must be sized by the designer and installer of the sprinkler system and be in accordance with the Water Supply (Water Fittings) Regulations 1999.

Option 2 (Drawing 2 Appendix A)

A direct feed from the water main to the sprinkler system connected at the boundary box

In summary the system comprises of a

- up to 50mm diameter direct feed from the water main
- 25mm branch from the boundary box with an integral non-return valve and water meter to supply the drinking water to the property
- up to 50mm diameter branch with an integral non-return valve, to supply the sprinkler

Any multiple dwelling residential properties (such as flats) are subject to our new connections large diameter connection process.

Further guidance on direct or indirect feed sprinkler system designs are explained in detail in the WRAS Water Regulations Guide and the Water Byelaws 2000 (Scotland) Second Edition (Recommendations R15.27).

For Option 2, the developer must be aware of headlosses through fittings that may reduce the pressure supplied along the fire main. Headloss estimates, from manufacturers' curves, are provided for ferrules, ferrule straps, stop-taps, boundary boxes and check valves. On the customer side, worst case headloss identified, through a stop-tap and check valve is estimated to be around 4m. This could vary with different suppliers' products.

8. Applications process

We should be notified of sprinkler installations in any new property, fitting to an existing property, or modification to an existing installation by making a new connections application. As part of the application process we'll advise the applicant to consult with the Fire Authority, the building control body and insurers.

9. Assessment of network capability

Before any water supply connection (under the terms of Section 47 of the Water Industry Act, 1991) is provided the network capability must be assessed.

After we receive the application we'll assess the capability of the network to provide a water supply that meets the statutory obligations. The assessment will be based on the information provided by the applicant and it's the responsibility of the applicant to ensure that this information is correct.

The assessment is required to confirm whether our statutory obligations can be met during peak demands in the water distribution network. Additional capacity of the network that may be available will not be guaranteed as operational conditions may change.

We'll advise the applicant that "a minimum 1 bar and 10m head will be maintained by us at the property boundary controlling stop tap".

10. Water use in the event of operation of a fire sprinkler

In accordance with the Water Industry Act (1991), the customer will not be charged for the use of water for the purpose of fire fighting, training and equipment testing. This does not exempt billing of water use through poor maintenance and leakage of the system.

In the event of a fire, a billing allowance will be applied to the billing period in which the fire occurred, applications for an allowance must be made within 12 months of the event. The domestic water use is calculated using average daily consumption from the same billing period:

$$\text{Water consumption (during event)} - \text{Actual domestic water usage} = \text{Allowance}$$

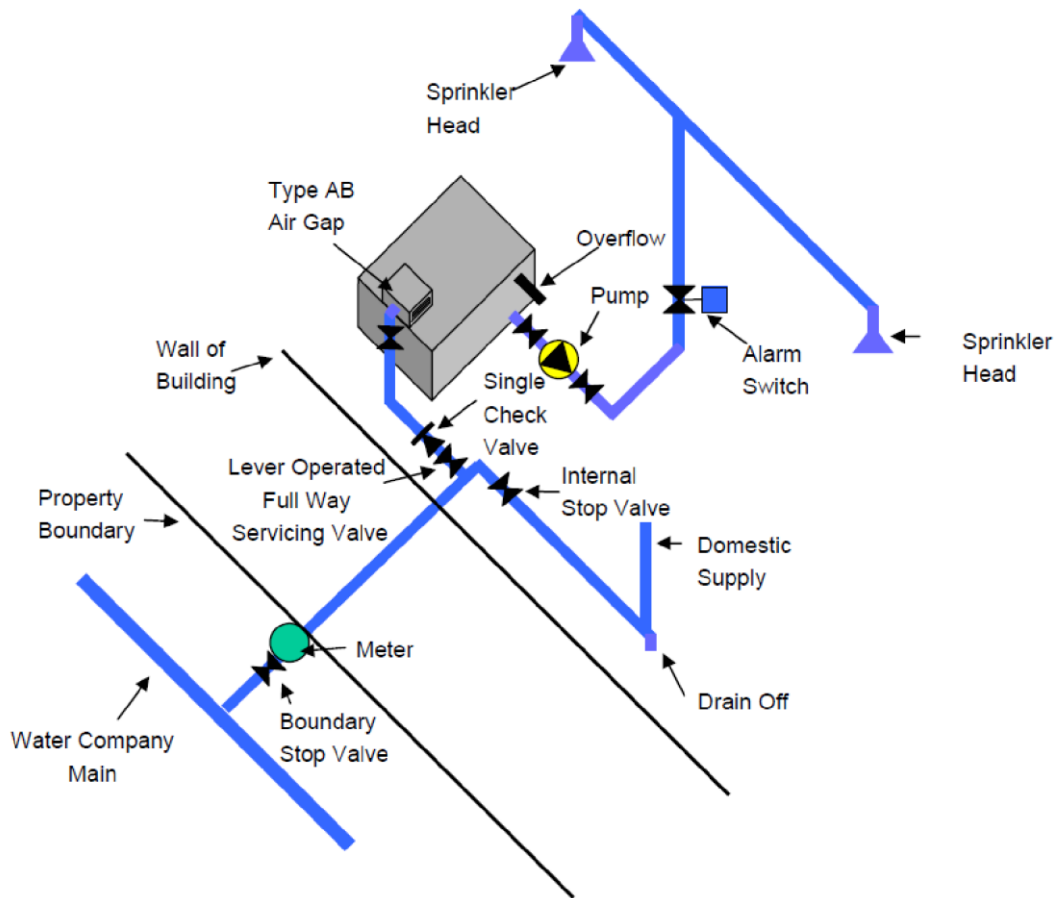
The activation of a sprinkler system, either during an event or accidental operation, can cause a sudden peak demand and a reduction in the operation of the water network. This may result in a breach of the Level of Service (Pressure). Any breach of the Level of Service (Pressure) as a result of the activation of a sprinkler system is exempt.

11. Asset records

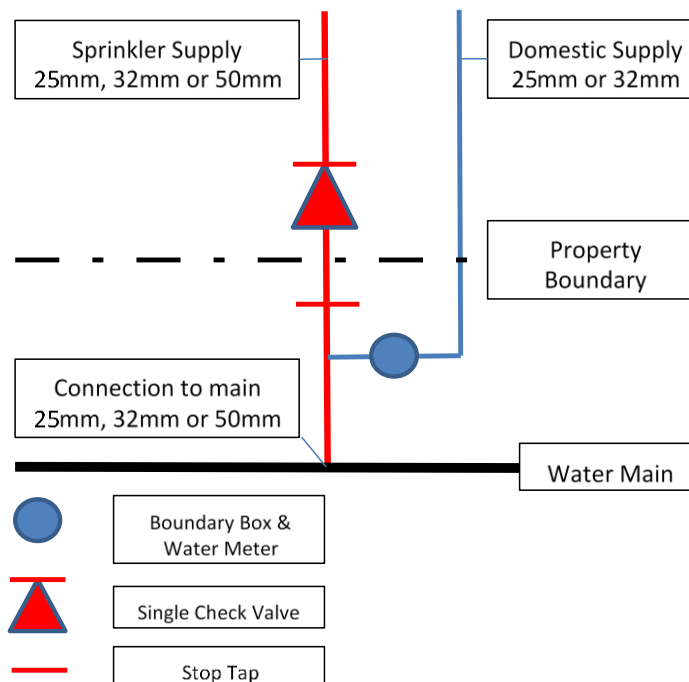
We'll record the location of the sprinkler systems on our asset records.

Appendix A

Option 1 – Tank feed



Option 2 – Direct feed Please see standard drawing in “Sprinkler System Eng Drawing v1”



Appendix B Headloss considerations for fittings

Mains designers are requested to provide a minimum of 20m head and typically 21l/min flow at the ferrule. This comfortably provides our service level requirement of 10m head and 9l/min at the external stop-tap.

Stop-Taps – WRc Headloss Tests 1990

Size	Velocity 0.5m/s	Velocity 1.25m/s
20mm	0.8m (5.8l/min flow)	1m (14.5l/m)
25mm	0.2m (10l/min)	1m (25l/min)
32mm	Not tested (16.3l/min)	Not tested (40.7l/min)

Boundary Boxes – provided by Elster (25mm)

Size	Flow-rate 9 l/min	Flow-rate 15l/min	Flow-rate 21l/min
25mm	0.4m	1.1m	10-15m*
32mm	0.4m	0.7m	1.1m

Non-Return Valves (12-18mm Philmac, 25-50mm AVK)

Size	Flow-rate 9 l/min	Flow-rate 15l/min	Flow-rate 21l/min
12mm	<0.1m	0.1m	0.2m
18mm	<0.1m	<0.1m	<0.1m
25mm/1"	3.2m	3.1m	3.0m
50mm/2"	2.5m	2.5m	2.5m

For information

Ferrule headloss data – WRc data 1990

Ferrules – ductile iron

Size	Velocity 0.5m/s	Velocity 1.25m/s
20mm	0m (5.8l/min)	0.25m (14.5l/min)
25mm	0.1m (10l/min)	1.0m (25l/min)
32mm	0m (16.3l/min)	0,24m (40.7l/min)

Ferrule straps (AC, PVC, PE)

Size	Velocity 0.5m/s	Velocity 1.25m/s
20mm	0.1m (5.81l/min)	0.4m (14.5l/min)
25mm	0.0m (10l/min)	0.3m (25l/min)
32mm	Not tested (16.3l/min)	Not tested (40.7l/min)

References

WRAS (1999): Water Supply (Water Fittings) Regulations.

British Standard Institute (2014): BS9251:2014 Sprinkler systems for residential and domestic occupancies – Code of Practice

WRAS (2000): Water Regulations Guide

Water Byelaws Scotland (2000): Second Edition (Recommendations R15.27)

British Standards Institute (2011): BS6700 Guidance for Backflow Prevention

British Standards Institute (2006): BS1710 Guidance for Identification and Marking of Pipe Work

Guidelines for the Supply of Water to Automatic Fire Sprinklers (Dec 2013) - prepared by The British Automatic Fire Sprinkler Association, The European Fire Sprinkler Network, European Fire Sprinkler Network, European Fire Sprinkler Network & EU UK