

BS 9251:2021



BSI Standards Publication

Fire sprinkler systems for domestic and residential occupancies — Code of practice

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Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 30 June 2021. It was prepared by Subcommittee FSH/18/2, *Sprinkler systems*, under the authority of Technical Committee FSH/18, *Fixed fire fighting systems*. A list of organizations represented on these committees can be obtained on request to their committee managers.

Supersession

This British Standard supersedes [BS 9251:2014](#), which is withdrawn.

Relationship with other publications

Reference is made in the publication to the advice on selection of fire protection systems set out in [BS 5306-0](#). Attention is also drawn to the requirements of [BS EN 806](#), with particular regard to backflow prevention, to BS EN 805 where appropriate, and to [BS 1710](#) for guidance on identification and marking of pipework. Where pumps are provided, attention is drawn to the electrical supply requirements of [BS 7671](#).

Sprinkler protection for industrial premises and commercial buildings other than those listed in this British Standard is specified in BS EN 12845. Where sprinklers are not installed primarily for life protection in domestic and residential occupancies, sprinkler installations conforming to BS EN 12845 might be more appropriate than those conforming to this British Standard.

Guidance on the application of sprinkler systems is given in [BS 5306-0](#), [BS 9991](#), [BS 9999](#), the Building Regulations 2010, Approved Document B for use in England [1], [2], Wales [3], [4] and its equivalents in Scotland [5], [6] and Northern Ireland [7].

BS 9251 covers fire sprinkler systems for residential and domestic premises that are more than four storeys or above 18 m in height; additionally fixed residential fire sprinkler systems in buildings for residential occupancies up to four storeys or 18 m in height, whichever are lower, are covered in [BS EN 16925](#). FSH/18/2 has detailed their concerns about [BS EN 16925](#) in the National Foreword for that publication.

Information about this document

This is a full revision of the standard, and introduces the following principal changes.

- Introduction of a fourth category of system to cater for taller residential buildings (greater than 18 m) and higher risk scenarios. The building height of over 18 m for a fourth category was chosen for the following reasons:
 - to align with Fire and Rescue Service national operational guidance, which determines capability, e.g. access and response time;
 - for consistency with [BS EN 16925](#); and
 - greater risk profile in higher rise buildings, including the need for improved resilience.
- Additional recommendations for larger capacity minimum water supplies for taller buildings and higher risk scenarios.
- Further recommendations for duplicate pumps and other reliability enhancements in certain scenarios.

- Further recommendations for non-residential occupancies in protected buildings.
- Additional measures and information for the fire service to interact with the installation.
- Clarification of alarm and fault signalling requirements.
- Clarification of roles and responsibilities.

Product certification/inspection/testing. Users of this British Standard are advised to consider the desirability of third-party certification/inspection/testing of product conformity to this British Standard. Appropriate conformity attestation arrangements are described in BS EN ISO 9001. Users seeking assistance in identifying appropriate conformity assessment bodies or schemes may ask BSI to forward their enquiries to the relevant association.

Test laboratory accreditation. Users of this British Standard are advised to consider the desirability of selecting test laboratories that are accredited to BS EN ISO/IEC 17025 by a national or international accreditation body.

This publication can be withdrawn, revised, partially superseded or superseded. Information regarding the status of this publication can be found in the Standards Catalogue on the BSI website at bsigroup.com/standards, or by contacting the Customer Services team.

Use of this document

As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Where websites and webpages have been cited, they are provided for ease of reference and are correct at the time of publication. The location of a webpage or website, or its contents, cannot be guaranteed.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is “should”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

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The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Particular attention is drawn to the Water Supply (Water Fittings) Regulations 1999 [8], the Water Supply (Water Fittings) (Scotland) Byelaws 2014 [9] and the Water Regulations (Northern Ireland) 2006 [10] in respect of requirements for any fire sprinkler system which conveys, or is likely to convey, water supplied by a water undertaker or licensed water supplier.

0 Introduction

Sprinkler systems have demonstrated their value in protecting life and property in industrial and commercial applications for many years. The advent of sprinklers that operate at an earlier stage in the development of a fire, plus the recognition that the largest numbers of deaths from fire occur in the home, have led to the introduction of sprinkler systems specifically designed for domestic and residential occupancies.

A correctly designed and installed sprinkler system can detect and control a fire at an early stage of development and activate an alarm. Operation of the sprinkler system rapidly reduces the rate of production of heat and smoke, allowing more time for the occupants to escape to safety or be rescued.

Sprinkler systems can also assist firefighters in carrying out search and rescue operations by limiting fire development, which significantly reduces the risks to firefighters.

This British Standard accordingly covers design, installation, components, water supplies, maintenance and testing of residential sprinkler systems installed for the purpose of reducing risk to life and minimizing the spread of fire.

In classifying the design of the system for any specified occupancy, care needs to be taken when considering the fire loading such that it does not exceed that which would typically be expected in that occupancy.

Residential sprinkler systems consist of a water supply, backflow prevention device (e.g. check valve), stop valve, priority demand valve (where required), automatic alarm system and pipework to sprinkler heads. The sprinklers are fitted at specified locations, the appropriate sprinkler type being used for each location. The main elements of a typical residential sprinkler system are shown in [Annex A](#).

Sprinklers operate at a predetermined temperature to discharge water over a known area below. The flow of water initiated causes the actuation of an alarm. Only sprinkler heads individually heated above their operating temperature by the heat from the fire operate to discharge water.

The provision of a sprinkler system does not negate the need for other fire precautions or practical measures, which can include structural fire resistance, escape routes with emergency lighting and signs, fire detectors and good fire safety management practices. Even with the installation of a sprinkler system, normal actions on the discovery of a fire need to be taken, such as immediate evacuation and the calling of the fire service. The sprinkler system is typically only to be turned off following liaison with the fire and rescue service and when it is deemed safe to do so.

Sprinkler system maintenance is not complex but is essential (see [Clause 7](#)). It is important that owners and occupiers are provided with adequate information.

1 Scope

This British Standard gives recommendations for the design, installation, components, water supplies and backflow protection, commissioning, maintenance and testing of fire sprinkler systems installed for life safety purposes in residential and domestic premises.

NOTE 1 Sprinkler systems also provide additional benefits for property protection and prevention of fire spread.

This British Standard is applicable for sprinkler protection of domestic and residential premises and contains specific recommendations for sprinkler systems in those premises of more than four storeys or above 18 m in height.

NOTE 2 Unless otherwise specified, references to residential sprinkler system in this British Standard include domestic sprinkler systems.

The recommendations of this British Standard are also applicable to any addition, extension, repair or other modification to a residential sprinkler system.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application¹⁾. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards references

[BS 5839-1:2017](#), *Fire detection and fire alarm systems for buildings – Part 1: Code of practice for design, installation, commissioning and maintenance of systems in non-domestic premises*

[BS 5839-6:2019](#), *Fire detection and fire alarm systems for buildings – Part 6: Code of practice for the design, installation, commissioning and maintenance of fire detection and fire alarm systems in domestic premises*

[BS 8558](#), *Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages – Complementary guidance to BS EN 806*

BS EN 805, *Water supply – Requirements for systems and components outside buildings*

[BS EN 806-\(all parts\)](#)²⁾, *Specifications for installations inside buildings conveying water for human consumption*

BS EN 837-1:1998, *Pressure gauges – Part 1: Bourdon tube pressure gauges – Dimensions, metrology, requirements and testing*

BS EN 1057:2006+A1:2010, *Copper and copper alloys – Seamless, round copper tubes for water and gas in sanitary and heating applications*

BS EN 10226-1, *Pipe threads where pressure tight joints are made on the threads – Part 1: Taper external threads and parallel internal threads – Dimensions, tolerances and designation*

BS EN 10226-2, *Pipe threads where pressure tight joints are made on the threads – Part 2: Taper external threads and taper internal threads – Dimensions, tolerances and designation*

BS EN 10255, *Non-alloy steel tubes suitable for welding and threading – Technical delivery conditions*

BS EN 12259-1, *Fixed firefighting systems – Components for sprinkler and water spray systems – Part 1: Sprinklers*

BS EN 12845:2015+A1:2019, *Fixed firefighting systems – Automatic sprinkler systems – Design, installation and maintenance*

BS EN ISO 9453, *Soft solder alloys – Chemical compositions and forms*

ASTM F442, *Standard specification for chlorinated poly(vinyl chloride) (CPVC) plastic pipe (SDR-PR)*

Other references

[N1] BUILDING RESEARCH ESTABLISHMENT. *Plastic pipe and fittings for use in automatic sprinkler systems*. LPS 1260. 2014. Watford, Hertfordshire.

[N2] BUILDING RESEARCH ESTABLISHMENT. *Requirements for testing flexible hoses for sprinkler systems*. LPS 1261. 2014. Watford, Hertfordshire.

¹⁾ Documents that are referred to solely in an informative manner are listed in the Bibliography.

²⁾ This British Standard also gives an informative reference to BS EN 806-2:2005.

3 Terms and definitions

For the purposes of this British Standard the following terms and definitions apply.

3.1 alarm device

device for detecting water flow in or through a sprinkler system which initiates an alarm signal

3.2 alarm receiving centre

continuously manned premises, remote from those in which a fire detection and fire alarm system is fitted, where the information concerning the state of the fire alarm system is displayed and/or recorded, allowing the fire and rescue service to be summoned

3.3 alarm test valve

valve through which water can be discharged to test the operation of an alarm device

3.4 area of operation

maximum area over which it is assumed, for design purposes, that sprinklers operate in a fire

NOTE This is sometimes referred to as the “assumed maximum area of operation”.

[SOURCE: BS EN 12845:2015+A1, 3.9, modified – Note from BS 5306-0:2011 added]

3.5 authority having jurisdiction (AHJ)

organization, office, or individual responsible for enforcing the requirements of legislation or standards, or for approving equipment, materials, an installation, or procedure

3.6 backflow

movement of the fluid from downstream to upstream within an installation

[SOURCE: BS EN 1717:2000, 3.5]

3.7 backflow prevention device

device intended to prevent contamination of wholesome water by backflow in a water supply system

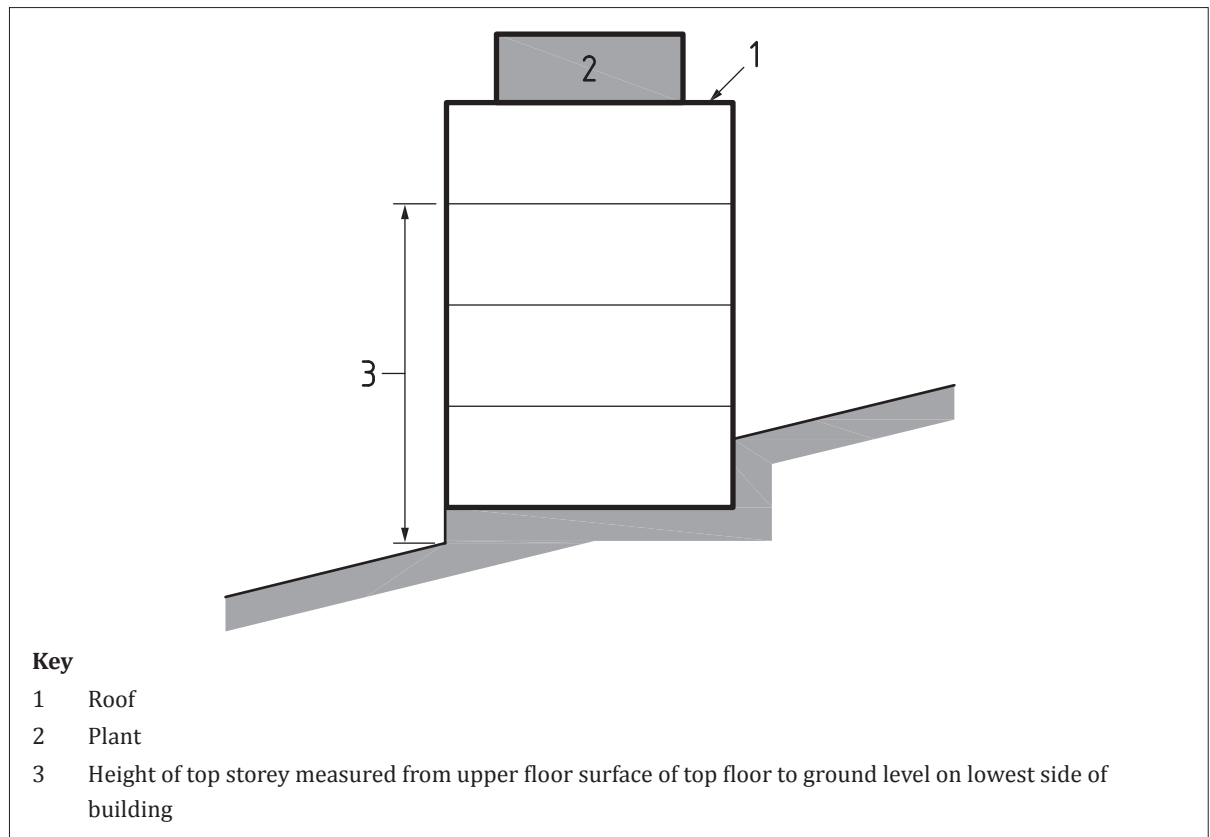
[SOURCE: BS EN 1717:2000, 3.6, modified – additional words included]

3.8 building height

height of top storey

NOTE 1 See [Figure 1](#).

NOTE 2 The number of storeys and building height is to be determined in accordance with UK building regulations guidance, as appropriate – Approved Document B (England and Wales) [1], the Building Standards Technical Handbook (Scotland) [2] and Technical Booklet E (Northern Ireland) [3].

Figure 1 — Height of top storey in building**3.9 client**

individual, group or organization that uses professional advice and/or services of other individuals, groups or organizations to procure the installation of a sprinkler system

NOTE In most circumstances this is the building owner.

3.10 compartment**3.10.1 (fire)**

building or part of a building comprising one or more rooms, spaces or storeys, constructed to prevent the spread of fire to or from another part of the same building or an adjoining building

3.10.2 (sprinkler)

area completely enclosed by walls and ceiling, where any openings in the walls and ceilings are not more than 2 500 mm in width, and have either:

- a) a lintel depth of not less than 200 mm; or
- b) a single opening of not more than 900 mm in width without a lintel, with no other openings

NOTE This is not the same as a compartment as defined by building regulations.

3.11 competent person

individual, suitably trained and qualified by knowledge, understanding, practical experience and qualification, who is provided with the necessary instructions to enable the required task(s) to be carried out correctly

3.12 concealed sprinkler

sprinkler with a cover plate that disengages when heat is applied

3.13 crawl space

area not used for storage, under a floor or roof, giving access to building services

3.14 design density

minimum density of discharge, in millimetres per minute of water, for which a sprinkler system is designed, determined from the discharge of a specified sprinkler or group of sprinklers, in litres per minute, divided by the area covered, in square metres

[SOURCE: BS EN 12845:2015+A1, 3.19, modified]

3.15 effective capacity

volume of stored water available to a pump, taking into account the air gap at the top and the unusable water at the base of the tank, which is affected by a vortex letting air into the pump suction

3.16 fusible link sprinkler

sprinkler which opens when an element provided for that purpose melts

[SOURCE: BS EN 12259-1:1999, 3.13]

3.17 glass bulb sprinkler

sprinkler which opens when a liquid-filled glass bulb bursts

[SOURCE: BS EN 12259-1:1999, 3.13]

3.18 hydraulically most favourable area

area of operation for which the water flow is at its maximum for a specified pressure, measured at the main stop valve or pump set

3.19 hydraulically most unfavourable area

area of operation for which the system pressure, when measured at the main stop valve or pump set, is required to be at its maximum to achieve the specified design density

3.20 mains water supply

permanent network of pipes conveying wholesome water from a public or private water supply system to a customer service connection or user draw-off point

3.21 maximum flow demand

stabilized flow rate discharged from those sprinklers located at the hydraulically most favourable area when balanced to a fire pump's flow/pressure performance curve

3.22 pendent sprinkler

sprinkler in which the nozzle directs the water downwards

[SOURCE: BS EN 12259-1:1999, 3.20]

3.23 priority demand valve

valve for isolating the supply to the domestic service in the event of sprinkler operation

3.24 pump

automatically operated device that supplies water to a sprinkler system from a water storage facility or from a mains supply when the pressure in the system drops below a pre-determined value

3.25 recessed sprinkler

sprinkler in which all or part of the thermally sensitive element is set into the ceiling or wall

[SOURCE: BS EN 12259-1:1999, 3.21, modified – location reworded]

3.26 residential pattern sprinkler

sprinkler which gives an outward and downward water discharge, designed and approved for use in domestic and residential occupancy

3.27 service pipe

pipe supplying water from a water supply to any premises subject to water pressure from that water supply

3.28 shadow area

small area not wetted by the residential sprinkler due to an obstruction such as a wall or partition

3.29 sidewall pattern sprinkler

sprinkler giving an outward half paraboloid pattern of water discharge

3.30 sprinkler system

entire means of providing sprinkler protection in the premises, typically comprising, but not limited to, sprinkler heads, pipework, alarm devices and a water supply

3.31 stop valve

manually operated valve for isolating the flow of water in the sprinkler system pipework

NOTE The stop valve is typically kept in the fully open position.

3.32 stored water supply

water, apart from mains water, available for the sprinkler system

NOTE For example, water stored in a tank/cistern or vessel.

3.33 upright sprinkler

sprinkler in which the nozzle directs the water upwards

[SOURCE: BS EN 12259-1:1999, 3.26]

3.34 vulnerable people

individuals who are at greater risk from fire due to inability to easily evacuate without assistance, or who have a higher than average likelihood of experiencing a fire, or a combination of the two

3.35 water undertaker

company licensed to provide a public water supply

3.36 wholesome water

water suitable for human consumption

NOTE Attention is drawn to the definitions given in the Water Supply (Water Fittings) Regulations 1999 [8] and equivalents in Scotland [9] and Northern Ireland [10].

4 Preliminary work and consultation

4.1 Initial considerations

Before undertaking the design of a residential sprinkler system for a specific property, the following factors, as a minimum, should be evaluated, obtaining specialist advice where necessary:

- a) the type of occupancy of the property (see [4.3](#));
- b) the water supply requirements and availability; and
- c) any additional system enhancements required (see [4.2.3](#)).

NOTE 1 See also [4.2.2](#).

NOTE 2 In some buildings or parts of buildings, a higher level of protection might be required than that provided in this British Standard (see also [4.2.3](#) and [5.5](#)).

NOTE 3 In buildings where there is a mix of residential, non-residential and commercial use (e.g. where flats are above shops, car parks, bin stores, offices and retail units), it is generally appropriate to protect the residential parts using this British Standard and the non-residential parts using BS EN 12845. See also [5.5](#) and [5.6](#).

4.2 Consultation

COMMENTARY ON 4.2

Some premises might have multiple authorities having jurisdiction who might be concerned with life safety, property protection, business continuity, heritage preservation and environmental protection. Some authorities having jurisdiction might impose additional requirements beyond those of this British Standard.

4.2.1 General

The client (and/or their representatives) should consult with all stakeholders regarding the requirements (specification) of the sprinkler system for new sprinkler systems and extensions to existing sprinkler systems. The consultation should include any relevant authority having jurisdiction (AHJs) or others who might have a direct interest in the installation, including:

- a) water undertaker or licensed water supplier;
NOTE 1 See Guidelines for the supply of water to automatic fire sprinkler systems [11].
- b) fire authority;
- c) licensing authority;
- d) building control body;
- e) conservation regulators;
- f) insurer(s) of the building and its contents;
- g) sprinkler system designer; and
- h) client, and their representatives, e.g. consultant(s), architect, fire engineer, surveyor, building owner, building management, and/or the responsible person for the building.

NOTE 2 It is the responsibility of the client to provide the sprinkler system designer and installer with a specification (see [4.2.2](#)) for them to design and install, including whether any enhancements (see [4.2.3](#)) to the system are applicable.

NOTE 3 It is the responsibility of the sprinkler system designer to ensure that the specification and/or fire strategy element for the sprinkler system (see [4.2.2](#)) is appropriate for the building and its occupancy.

NOTE 4 There are occasions when a sprinkler system can be proposed as part of a fire strategy to compensate for, or overcome, circumstances where a building is unable to follow guidance issued in support of building regulations (see [4.2.3](#)).

There are also occasions when a sprinkler system can be proposed as part of a fire strategy to mitigate risks in existing buildings of the Regulatory Reform (Fire Safety) Order [[13](#)], e.g.:

- a) an older building where the existing construction cannot achieve the recommended fire resistance appropriate to the use of the premises;
- b) a building that cannot meet the recommendations for fire appliance access;
- c) loft conversions where it is either not practical or not possible to secure adequate means of escape;
- d) any building where there is doubt about adequacy of fire protection and safety provisions, or concerns over design of building in relation to fire safety, e.g. stay-put policy, single staircase, combustible materials of construction, etc.; and
- e) any circumstances in which sprinkler protection is provided as a compensatory feature for departures from other Standards or national guidance, e.g. [BS 9991](#) permits certain forms of open plan dwelling provided the dwelling is sprinkler protected.

As previously stated, it would be impractical for this British Standard to cover all circumstances. It is therefore essential that consultation take place, and where deemed appropriate to the circumstances, there might be a need to increase the category of system, the design density and/or the resilience of the system. It is not implied that in all cases there is necessarily a need to upgrade the category or increase resilience. It would be beneficial to justify any proposals by means of a fire safety strategy in such cases to support the proposals for the specific case. See also [BS 9991](#), [BS 9999](#), [BS 7974](#).

4.2.2 Sprinkler specification

The sprinkler system designer should consult with stakeholders to develop and produce the specification (see [4.2.1](#)).

The specification for the design should include the following information:

- a) occupancy types for sprinkler protected areas;
- b) available water supplies;
- c) how sprinkler system alarms interact with fire alarm system (see [5.18](#));
- d) details of any enhancements to sprinkler system (see [4.2.3](#)); and
- e) where a fire strategy relies upon the design of the sprinkler system, a version-controlled copy of that fire strategy, including sufficient detail to understand the relationships and dependencies.

NOTE Particular attention is drawn to the need for the fire engineer to consider interactions between the sprinkler system and any smoke ventilation system when they are used in combination.

There may be occasions that a specification and/or fire strategy is not provided and in these situations, the sprinkler system should be designed in accordance with this British Standard.

4.2.3 System enhancements

4.2.3.1 General

NOTE 1 The system might need to have enhanced features to address aspects of additional risk in above those identified in the design considerations in [4.3](#).

Examples of aspects of additional risk requiring enhancement of the sprinkler system could include:

- a) higher fire safety risk (see [4.2.3.2](#));
- b) compensatory features (see Note 4 to [4.2.1](#)); and
- c) occupancy profile - vulnerable people (see [4.2.3.3](#)).

Where additional risk factors have been identified, enhanced measures should be taken into account, including for example, increasing:

- 1) category of system (see [4.3](#)); and/or
- 2) design density (see [Table 2](#), Note A, Note B and Note C); and/or
- 3) resilience of system (see [4.2.4](#)).

System enhancements should be recorded on the compliance certificate (see [6.2.6](#)).

NOTE 2 This British Standard cannot always prescribe which system enhancements are to be incorporated in the design.

4.2.3.2 Higher fire safety risk

Risk of fire occurs in all buildings, however, where there are additional risks that are not the normal risk profile found in residential accommodation, these additional risks should be taken into account and a decision made if an enhancement to the sprinkler system is required to mitigate the risk.

NOTE 1 Some additional risks may be deemed acceptable if mitigated by other fire protection methods.

NOTE 2 Examples of additional risks include those with:

- a) fire loading greater than that which would typically be found in a domestic or residential living room, kitchen or bedroom, or if the fire hazard is greater than that of a conventional domestic or residential occupancy;
- b) hoarders with restrictions to means of escape and a higher fire loading;
- c) time for firefighting operations to commence which may exceed duration of water supply category of system, e.g. high rise or complex buildings;
- d) older buildings with hidden voids and/or where passive fire protection might not meet current standards;
- e) heritage residential buildings where preservation of the building needs to be considered;
- f) atria;
- g) adjacent areas not sprinkler protected;
- h) fire engineered design solutions; and
- i) mixed use buildings (see [4.1](#), Note 3).

4.2.3.3 Occupancy profile – vulnerable people risk factors

COMMENTARY ON 4.2.3.3

Vulnerability is to be taken as a combination of hazard and likelihood and, therefore, a matter of risk, where:

- a) *Hazard: Ignition source for a fire and materials to aid combustion (the fire itself);*
- b) *Likelihood: Likely occurrence of a fire starting (hazard being realized); and*
- c) *Risk: Individual being unable to escape in sufficient time to avoid injury or death from fire.*

Individuals who are vulnerable to fire are those with a higher than average likelihood of having a fire or with poor reaction or realization of the danger presented by fire, or a combination of both.

The following factors should, as a minimum, be taken as primary indicators of higher risk:

- a) higher likelihood of fire:
 - 1) high fire risk activities or habits, such as careless disposal of smoking materials or leaving cooking unattended;
 - 2) history of fire-setting behaviour;

- 3) history of previous fires or evidence of near misses, such as scorch marks on clothing or furniture; or
- 4) threats of arson;
- b) inability or willingness to escape:
 - 1) impaired mobility affecting ability to escape;
 - 2) impaired, due to cognitive ability to react to fire or warning devices;
 - 3) impaired senses affecting ability to respond to alarm;
 - 4) poor situational awareness; or
 - 5) alcohol or drugs, increasing the likelihood of a fire and lowering reaction to alarm.

NOTE Evidence for a) can be through observation. These are factors affecting the likelihood of a fire occurring. The factors in b) might require confirmation from a medical or social care agency and are linked with their ability to escape.

The most vulnerable persons are influenced by factor(s) from both groups and should therefore be considered at greater risk.

4.2.4 Resilience of system

Additional measures to improve the performance and reliability of the system to address areas of higher risk should be taken into account and include but not be limited to any of the following:

- a) increasing the duration of the water supply;
- b) improving the resilience of the water supply, including:
 - 1) provision of a back-up power supply to pump(s) (and any other emergency equipment), see [5.12.5.3](#); and
 - 2) additional pump(s);
- c) upgrading the system to a higher category (see [4.3](#)) or measures conforming to BS EN 12845;
- d) arrangements to maintain system integrity during maintenance or repair;
- e) remote monitoring of critical system components; and
- f) on dedicated pump and tank fed sprinkler installations, use of a fire and rescue service inlet to supplement the water supply. Sprinkler inlet connections should be labelled. The system maximum working pressure should also be indicated at the inlet.

NOTE Fire and rescue service inlets are typically downstream of the pump(s), after the check valve. Where this is not possible, the inlet can be used to refill dedicated sprinkler water storage tanks. Particular attention is drawn to the need to not contaminate the public water supply.

4.3 Category of system

The designer should at an early stage confirm which category of system is applicable, as this affects various design considerations.

The category of system should be determined by the type of building in accordance with [Table 1](#) and following consultation in accordance with [4.2](#).

The AHJ(s) should be consulted to agree which type of building applies, whether any enhancements to the system are applicable (see [4.2.3](#)), or whether an alternative system (e.g. BS EN 12845) is more appropriate.

Table 1 — *Category of system*

Category of system	Description of building/occupancy
1	Single family dwellings such as: • dwelling house; • individual flat^{A)}; • individual maisonette; and • transportable home Houses of multiple occupation (HMOs) ^{B)} Bed and breakfast accommodation ^{B)} Boarding houses ^{B)}
2	Blocks of flats ^{C), D)} Small residential care premises with 10 residents or fewer ^{D)} Sheltered and extra care housing ^{C), D)}
3	Residential care premises with more than 10 residents ^{D), E), F)} Student accommodation ^{E), F)} Dormitories (e.g. attached to educational establishments) ^{D), E)} Hostels ^{D), E)}
4 ^{F)}	All residential buildings 18 m or higher

^{A)} Where the majority of flats are to be sprinkler protected, the whole building is to be treated as at least category 2. Any building of a height greater than 18 m is to be treated as category 4.

^{B)} Buildings with more than two floors and five or more lettable bedrooms are to be treated as Category 2 throughout. Any building of a height greater than 18 m is to be treated as category 4.

^{C)} Any non-fire sterile communal building parts should be protected as category 3.

^{D)} Any building of a height greater than 18 m is to be treated as category 4.

^{E)} See also Approved Document B, Volume 2, para 2.46. 2019 edn. [1].

^{F)} See 5.12.5.

5 Design

5.1 General

The residential sprinkler system should be designed by a competent person in accordance with this British Standard and the component manufacturer's instructions.

Where there is a difference between this British Standard and the manufacturer's instructions, the limits of this British Standard should be applied (e.g. sprinkler head coverage areas not be exceeded) and the most onerous design or performance criteria applied (e.g. where higher density application rates are required by manufacturers).

The sprinkler system should be designed to facilitate easy maintenance. Parts requiring service or adjustment should be located in accessible locations, e.g. communal locations.

Where a sprinkler system is divided into zones, e.g. for ease of maintenance or reinstatement after a fire, each zone should:

- a) not cover more than one floor;

NOTE 1 In some situations this might not be achievable, e.g. due to duplex flats which cover more than one floor. In such cases, one or more duplex flats accessed from the same floor may be configured as one zone.

- b) have a lockable full-bore stop valve; and
- c) have a quarter turn drain valve.

Each zone should have no more than 500 sprinklers.

NOTE 2 Small zones can be beneficial for maintenance and helping the Fire and Rescue Service locate the fire.

Zone stop valves should be installed in readily accessible positions in or near the zone they control. Each valve should be secured open and be labelled to identify the area of protection it controls. The zone stop valve should be provided with devices to monitor the status of the valve (i.e. either fully open or not fully open).

Immediately downstream of the zone stop valve a water flow alarm device, conforming to BS EN 12259-5 to detect the flow of a single sprinkler operation at the anticipated lowest flow rate, should be installed in order to forward an alarm signal. Permanent test and drain valve should be provided immediately downstream of the water flow alarm switch on each zone. The test facility should simulate operation of the sprinkler with the lowest flow rate in the zone.

5.2 System type

A residential sprinkler system should be a wet pipe system, i.e. one that is permanently charged with water.

5.3 Design density and duration of supply

5.3.1 General

The minimum design density and duration of the supply should be determined in accordance with the category of system in accordance with [Table 1](#) and the minimum design parameters for that category of system in accordance with [Table 2](#), including any enhancements agreed following the consultation process.

Table 2 — *Minimum design parameters*

Category of system (see Table 1)	Minimum design discharge density	Number of design sprinklers (see 5.3.2)	Minimum duration of supply
	mm/min		min
1	2.10 ^{A)}	1 or 2	10
2	2.80 ^{B)}	1 or 2	30
3	2.80 ^{C)}	2 to 4 ^{D)}	30
4	2.80 ^{C)}	2 to 4 ^{D)}	60 ^{E)}

^{A)} Where a higher fire safety risk applies to a sprinkler system specification (see [4.2.3.2](#)), the minimum design discharge density should be increased to either:

- 1) 2.80 mm/min for a single head operation, or 2.10 mm/min through each sprinkler operating simultaneously up to a maximum of two sprinklers in a single area of operation; or
- 2) 4 mm/min for single head operation, or 2.80 mm/min through each sprinkler operating simultaneously up to a maximum of two sprinklers in a single area of operation.

The increased level of discharge density required [1) or 2)] is to be determined during design, based on consultation (see [4.2](#)). If [4.2.3](#) gives rise to a higher density, the higher density is to be used.

^{B)} Where a higher fire safety risk applies to a sprinkler system specification, the minimum design discharge density is to be increased to 4 mm/min for single head operation, or 2.8 mm/min through each sprinkler operating simultaneously up to a maximum of two sprinklers in a single area of operation. If the recommendations in [4.2.3](#) give rise to a higher density, the higher density is to be used.

^{C)} Where a higher fire safety risk applies to a sprinkler system specification, the minimum design discharge density is to be increased to 4 mm/min for single head operation, or 2.8 mm/min through each sprinkler operating simultaneously up to a maximum of four sprinklers in a single area of operation. If the recommendations in [4.2.3](#) give rise to a higher density, the higher density is to be used.

^{D)} Where communal areas/corridors are managed areas and considered to be sterile within a fire strategy report and with agreement by the AHJ, the number of design sprinklers can be limited to two in these areas only.

Where the fire strategy report and in agreement with the AHJ that sprinkler protection is required to be installed in the communal areas/corridors, the number of design sprinklers can be limited to two in these areas only.

^{E)} This may be reduced to 30 minutes in Ordinary Hazard protected areas (as per [5.6](#)), if consistent with the fire strategy and agreed by the client and AHJs. The duration of supply is increased to 60 min for category 4 systems to allow more time for the Fire and Rescue Service to mount an effective intervention. This is considered especially relevant in the higher floors of a multistorey building. This increase in supply duration is not always expected to be necessary at the lower floors. Lower floors are typically where areas of non-residential (Ordinary Hazard) occupancy would be located. These areas tend to be hydraulically significant in the design of a sprinkler system. However, it is usually much easier for the Fire and Rescue Service to mount an effective and speedy intervention at these lower levels. This note is intended to help designers achieve efficient designs by encouraging engagement with clients and stakeholders and agreeing a reduction in water supply duration for these building parts only, where appropriate.

5.3.2 Minimum design parameters

The minimum design discharge densities, number of design sprinklers capable of operating simultaneously in a compartment (sprinkler) and duration of supply should be in accordance with [Table 2](#). For all categories, the number of design sprinklers should be determined by the maximum number of sprinklers in any compartment (sprinkler) (see [3.10](#)), up to the maximum in accordance with [Table 2](#).

The density of water delivered by each sprinkler should be calculated by the physical area of coverage, as opposed to the maximum area of the data sheet. In all cases, the manufacturer's minimum head pressure for the corresponding coverage area should be met or exceeded (see [Annex B, B.7](#)).

5.4 Extent of sprinkler protection

COMMENTARY ON 5.4

[BS 5306-0:2020](#), Clause 15 gives guidance on the use of sprinkler protection in the presence of electrical equipment and concludes it is generally safe to do so.

Sprinkler protection should be provided in all parts of the premises, however, sprinkler protection may be omitted from the following areas unless it is required by a fire strategy or risk assessment:

NOTE Where a risk assessment is carried out, it needs to take into account presence of fuel load (e.g. linen), presence of potential ignition sources (e.g. immersion heater) and consequence (e.g. impact upon fire protection to the building or escape routes).

- a) bathrooms and shower rooms with a floor area less than 5 m², with linings conforming to [BS EN 13501-1:2018](#), Class A1, A2-s3, d2 and B-s3, d2, and which are not prepared for white goods, such as washing machines, dryers, electric showers or water heaters;
- b) enclosed staircases containing only materials conforming to [BS EN 13501-1:2018](#), Class B-s3 or better for construction materials and B(fl) or better for flooring, including sub categories such as d0, d1, d2 for construction materials and s1 and s2 for flooring, surface spread of flame and constructed as a fire-resistant separation;
- c) ceiling voids;
- d) enclosed vertical shafts (e.g. lifts or service shafts) containing only materials conforming to [BS EN 13501-1:2018](#), Class B-s3 or better for construction materials and B(fl) or better for flooring (including sub categories such as d0, d1, d2 for construction materials and s1 and s2 for flooring), surface spread of flame and constructed as a fire-resistant separation;
- e) cupboards and pantries with a floor area of less than 2 m² or where the least dimension does not exceed 1 m which are not prepared for consumer units or electrical equipment (excluding a single light);
- f) uninhabited loft/roof voids;
- g) water closet (WC) with a floor area less than 5 m², with linings conforming to [BS EN 13501-1:2018](#), Class A1, A2-s3, d2 and B-s3, d2, and which are not prepared for white goods, such as washing machines, dryers, electric showers or water heaters;
- h) attached buildings, such as garages and plant rooms without direct access from within the protected building;
- i) crawl spaces; and
- j) external balconies permanently open to the outside.

5.5 Classification of residential and non-residential occupancies

COMMENTARY ON 5.5

In some parts of the building, residential sprinklers might not provide adequate protection. Therefore, the nature of occupancies needs to be determined and the type of sprinkler selected accordingly. This process could determine that some areas can be adequately protected with residential sprinklers (i.e. sprinkler heads conforming to [BS EN 12259-14](#)) and others require protection by so-called "commercial and industrial" sprinkler heads (i.e. sprinkler heads conforming to [BS EN 12259-1](#)).

Where limited areas of protection conforming to BS EN 12845 design criteria (i.e. using sprinkler heads to BS EN 12259-1) are specified by this British Standard, the applicable design criteria are repeated in this British Standard for ease of reference and are to be applied. It is not necessary to apply BS EN 12845 in full unless more robust sprinkler protection in full conformity to that standard is specified.

In all cases a hazard review should be carried out to determine the correct classification of occupancy. The recommendations in this subclause should be used to assist in selecting the correct design criteria for non-residential areas of a building which might require sprinkler protection using sprinkler heads to BS EN 12259-1.

NOTE Examples of appropriate occupancies, design density and number of operation head are provided in [Table 3](#).

In no circumstances should the category of any area be less than that given in [Table 2](#).

All other non-residential areas should meet the recommendations of [5.6](#).

Table 3 — Examples of classification of areas and design criteria for areas protected with “Residential” BS EN 12259-14 sprinkler heads

Occupancy	BS 9251 category (see Table 1)	Minimum density mm/min	Minimum number of design sprinklers
One or two car garage ^{A)} , where sprinkler protected, attached to a dwelling	1	2.10 ^{B)}	In accordance with Table 2
Car parking ^{A)} within or beneath a block of flats	2, 3 and 4	See Table 4	See Table 4
Bin store within or beneath the flats	2, 3 and 4	See Table 4	See Table 4
Limited office areas (e.g. concierge or site management) ^{C)}	2, 3 and 4	2.80	As per Table 2
Residents' storage sheds/tenant stores ^{A)}	2, 3 and 4	See Table 4	See Table 4
PTSN/CCTV/Electrical rooms	2, 3 and 4	2.80	As per Table 2
Plant rooms	2, 3 and 4	See Table 4	As per Table 2
Domestic laundry/utility room	1	2.10	As per Table 2
Laundry (with storage and processing of linen, e.g. institutional, care home)	2, 3 and 4	See Table 4	See Table 4
Laundry (communal facility)	2, 3 and 4	2.80	As per Table 2
Domestic kitchens	1	2.10	As per Table 2
Hairdressing room	2, 3 and 4	2.80	As per Table 2
Retail (e.g. shop or kiosk)	2, 3 and 4	See Table 4	See Table 4
Foyer/reception	2, 3 and 4	2.80	As per Table 2
Bar/restaurant/cafe	2, 3 and 4	See Table 4	See Table 4
Kitchens in student hub accommodation (e.g. self-catering)	3 and 4	2.80	As per Table 2
Kitchens ^{D)} in residential care or similar premises, e.g. care home ≤50 m ²	2 and 3	2.80	As per Table 2
Kitchens ^{D)} in residential care or similar premises, e.g. care home >50 m ²	2 and 3	See Table 4	See Table 4