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Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard
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This draft is issued to allow comments from interested parties; all comments will be given consideration prior to publication. No acknowledgement will normally be sent. **See overleaf for information on the submission of comments.**

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Introduction
Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international and European standards, comments will be reviewed by the relevant UK national committee before submitting the consensus UK vote and comments. If the draft standard is approved, it is usual for the resulting published standard to be adopted as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote
Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments
Annotated drafts are not acceptable and will be rejected.

All comments should be submitted online at **http://standardsdevelopment.bsigroup.com**. You will need to register in order to comment.

Fire safety in the design, management and use of residential buildings – Code of practice

Contents

Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on XX Month 202X. It was prepared by Technical Committee FSH/14, *Fire precautions in buildings*. A list of organizations represented on this committee can be obtained on request to the committee manager.

Supersession

This British Standard supersedes BS 9991:2015, which is withdrawn.

Relationship with other publications

This standard complements BS 9999, which excludes individual dwelling houses, certain residential buildings and specialized housing from its scope. BS 9991 provides guidance on all of these building types.

Information about this document

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

- expansion of scope to cover residential care;
- revision of height limits for installation of sprinklers;
- removal of national classifications for combustibility;
- updating of recommendations relating to lifts, including expanded recommendations for evacuation lifts;
- updating of recommendations relating to smoke control, including changing Annex A from an informative to a normative annex;
- updating of recommendations relating to power supplies, external wall systems, kitchens, balconies, single-stair buildings and escape from basements;
- general update to take into account new and revised standards published since 2015.

Product certification. Designers and specifiers are advised to consider the desirability of using products, fittings and accessories that are supported by recognized UKAS-accredited third-party assessment.

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.

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.

Use of this document

There might be circumstances where it is necessary to use one publication to supplement another, but care needs to be taken when using a “pick-and-mix” approach, as it is essential that an integrated approach is used in any one building and that any such approach does not cause conflict with other aspects of the fire safety design.

In addition, there is an interdependency between the different aspects of BS 9991 itself. Recommendations are given for each aspect separately, though many are closely interlinked. The standard therefore needs to be considered as a whole, recognizing the relationship between different provisions. Particular attention is drawn to the potential risks in creating a situation where any part of the standard is not fully followed, as this could have a negative effect on other provisions. For example, there is a close link between the provisions

for means of escape and those for the control of fire growth, fire containment and facilities for the fire and rescue service.

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

Users may substitute any of the recommendations in this British Standard with practices of equivalent or better outcome. 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.

Presentational conventions

The provisions in 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.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. “organization” rather than “organisation”).

Contractual and legal considerations

NOTE References are made throughout this British Standard to legislation and guidance applicable in the UK. It is recognized, however, that the standard might be used outside the UK, and in such circumstances, readers of the standard need to be aware of the legislative requirements and sources of further information applicable in their own countries.

Broadly speaking, fire safety legislation in the UK sets out fire safety objectives for various types of premises and their associated activities, and specifies who is responsible for ensuring that they are met. Individual items of legislation generally refer to, and give legal force to, named sets of regulations that are more detailed than the parent legislation. They either specify how certain activities are to be performed, and duties discharged, or they state functional requirements, i.e. they describe the outcome(s) required. When functional requirements are given, the regulations usually refer to other technical guidance and/or standards, including British Standards. Reference is made throughout the text to legislative material of which users of this British Standard need to be aware.

Attention is drawn to regulatory requirements in respect of the following principal stages in the lifetime of a building:

a) planning – type, size, use, appearance, access and location of a proposed building;

b) construction – materials, methods, nature and extent of both structural and installed fire safety features, internal and external arrangements for access, and proximity to other buildings;

c) use – occupants’ activities, including storage and use of materials, provision of first aid firefighting equipment and fire safety training for occupants, and maintaining means of escape;

d) maintenance – maintenance of fire safety systems and equipment in occupied and unoccupied buildings;

e) material alterations and extensions – changes in fire risk or fire safety provisions; fire safety arrangements during construction work;

f) change of use – changes in fire risk or fire safety provisions;

g) demolition – fire safety arrangements during demolition work;

h) when empty – empty buildings are particularly vulnerable to arson.

Attention is drawn to the Building Regulations 2010 [1], the Regulatory Reform (Fire Safety) Order 2005 [2], and the equivalent regulations in Wales, Scotland and Northern Ireland ([3] to [7]). Particular attention is drawn to the legal requirement under Regulation 38 of the Building Regulations 2010 [1] for relevant fire safety information to be provided to the responsible person on completion of the building, and to the requirements of the Construction Products Regulations 2013 [8].

Section 1: General

0 Introduction

0.1 General principles

The design of buildings for fire safety relies upon an understanding of the sources of fire, materials and systems likely to be involved in fire, how people use buildings, and the likely spread of fire.

The recommendations and guidance given in this British Standard are based on the assumption that under normal circumstances (i.e. except in the case of arson) a fire is unlikely to start in two different places in a building.

All fire safety measures, procedures, etc. need to take into account the particular circumstances of the individual building or complex concerned. The same recommendations generally apply to both existing and new buildings, but existing buildings, especially historic buildings, often pose problems which are unlikely to arise in new buildings. In assessing the fire safety management needs of an existing building which is being modified, it is essential to have a full understanding of the existing structure and any fire safety provisions incorporated, and to take into account all of the following:

a) any change in use of the premises which could affect the fire risk profile (e.g. increased fire load and process risks, changes to sleeping risk, seasonal changes);

b) how the necessary fire safety levels can be practicably achieved in the existing premises and whether they are appropriate;

c) historic and environmental aspects of the premises and to what extent they need to be disturbed;

d) legislation and guidance introduced since the premises were originally constructed, or last altered, or since their fire safety was last assessed;

e) the interrelationship between life safety and measures to protect property/contents; and

f) business continuity.

Historic buildings present particular challenges, as many are listed and permitted material alterations are therefore limited without the agreement of the appropriate authorities. For such buildings, it is advisable to seek the advice of consultative bodies, such as Historic England, Historic Scotland and the Northern Ireland Environment Agency, in the early stages of design. The appropriate authorities sometimes agree to limited modifications to improve life safety where, in turn, there will be added long-term protection and preservation of the original building fabric.

NOTE Historic Scotland Guides for Practitioners 6 [9] and 7 [10] contain guidance on, respectively, conversion and fire safety management of traditional buildings.

Specific issues relating to historic buildings can be divided into four areas:

1) the preservation of the ambience and important features of the building such as timber linings to accommodation stairs and slender cast iron structure, both of which can sometimes conflict with the desired fire safety construction but can be accommodated with suitable compensating features;

2) the existing construction of the building, including hidden features such as the extent of cavities through which fire could spread and the quality of walls, partitions and floors (the fire resistance of which might be unknown or questionable). Life safety can often be addressed by the use of suitable compensating features, but these do not always cover property protection and business interests;

3) the fire performance of the building structure. Although modern construction standards seldom apply to historic buildings, action to improve the level of fire and life safety might be necessary based on change of use or due to the need to reduce the fire risk and potential for loss of the structure and/or interior in any other context; and

4) the sensitivity of historic structures and interiors (finishes and contents) to fire and smoke damage.

In both new construction and upgrading existing buildings, the various aspects of fire precautions are interrelated and weaknesses in some areas can be compensated for by strengths in others. A higher standard under one of the areas might be of benefit in respect of one or more of the other areas. BS 9991 provides a level of flexibility that allows the fire protection measures and the risks to be assessed to enable reasonable practical solutions to be designed.

Fire precautions in all premises – however old – need to be seen as a whole, a package aimed at achieving an acceptable standard of fire safety. In modifying existing structures, if the new work can be shown not to have a negative impact on the remainder, it is likely that no work will be needed on the remainder, although it might be possible to offer improvement as good practice.

The principles and recommendations in this British Standard apply straightforwardly where premises have a single main use and are contained in a single, separate building. Complications might arise, however, where a building comprises two or more different main uses. In such cases it is important to consider the effect of one risk on another. A fire in a shop or unattended office could have serious consequences on, for example, a residential use in the same building. Similarly, a high fire risk in one part of a building could seriously affect other areas in another part of that building.

Amongst the factors that need to be taken into account in establishing a minimum package of fire protection measures are:

i) the potential users of the building;

ii) the hazard posed by one occupancy to another;

iii) provision for giving warning in case of fire, including any automatic fire detection;

iv) the provision of automatic water fire suppression systems (AWFSS) and smoke control arrangements;

v) the overall management and control of the building or development, from a fire safety point of view;

vi) structural fire protection and compartmentation; and

vii) the security of and access to the building.

BS 9991 provides recommendations and guidance on the provision of measures to control or mitigate the effects of fire. The primary objective is to achieve an adequate standard of life safety in the event of fire in the building. A secondary objective is to provide a level of protection for property and businesses against the impact of fire, e.g. in close proximity to residential buildings or as part of the same building or building complex. These can also have the effect of assisting the fire and rescue service and/or of providing environmental protection. There are references throughout this British Standard to occupant safety, firefighter safety and property protection, to draw attention to the different issues these could raise. It is, however, important to be aware that provisions solely for life safety are unlikely to provide the full level of protection for buildings and property in a fully developed fire scenario.

0.2 Flats and maisonettes

0.2.1 General principles

The means of escape from a flat or a maisonette of limited height is relatively simple. With increasing height more complex provisions are needed because emergency egress through upper windows becomes increasingly hazardous.

The provisions for means of escape for flats or maisonettes are based on the assumptions that:

a) provided that the building is well managed and corridors/stairways are kept clear, fire is more likely to occur within the flat or maisonette than in the common parts (e.g. not in a stairwell);

b) there can be no reliance on external rescue (e.g. a portable ladder);

c) the flat or maisonette will have a high degree of compartmentation and therefore there will be a low probability of fire spread beyond the flat or maisonette of origin, so in most fires simultaneous evacuation of the building is unlikely to be necessary; and

d) where fires do occur in the common parts of the building, the materials and construction used in such areas will prevent the fire from spreading beyond the immediate vicinity (although in some cases communal facilities exist which require additional measures to be taken).

In purpose-built blocks of flats, special provisions are made to contain a fire within the flat of origin, with common escape routes and stairways remaining relatively free from smoke and heat in the event of a fire within a dwelling. For this reason, the general fire strategy is a stay put strategy (see **3.67** and **A.1**).

NOTE It is important that information is given to residents regarding the meaning of the stay put strategy and the arrangements for means of escape available to them if a fire affects their flat.

Whilst a simultaneous evacuation is normally unnecessary (see **A.1** regarding stay put strategy), there will be some occasions where operational conditions are such that the fire and rescue service decide to evacuate the building. In these situations, the occupants of the building will need to use the common stair, sometimes whilst firefighting is in progress. As such, the measures in this British Standard for the protection of common stairs are designed such that they remain available for use over an extended period.

0.2.2 Protection of common escape routes

When making provision for the protection of common escape routes, i.e. from the exit of an individual dwelling to the final exit, it is essential to have a full understanding of the existing structure and any fire safety provisions incorporated, and to take into account the factors listed in **0.1**a) to **0.1**f).

Recommendations for compartmentation and common escape routes are given in Clause **25** and Section **2**.

0.2.3 Smoke control in common parts

It is probable that some smoke from a fire in a flat or maisonette will enter the common parts of the building, i.e. the common corridor and/or lobby, for example as a result of occupants escaping or through the operational procedures of firefighters. It is therefore necessary to provide some means of controlling smoke in the common corridors/lobbies to provide protection to the stairways and other common areas.

Smoke can be controlled in the common areas through fitted ventilation systems which are either natural or mechanical. These ventilation systems have two main purposes: to provide protection to the stair core, and to aid firefighters when tackling a fire. Ventilation systems can also be used to compensate for extended travel distances within the common corridor

leading to the stairs and thereby help occupants to escape safely. Where smoke control is used to provide compensation for extended travel distances, it is the responsibility of the designers to demonstrate that the ventilation system can provide tenable conditions (see Annex A) for the occupants using the route with extended travel distances.

0.2.4 Protection of common stairs

Routes to common stairs need to meet the applicable travel distance recommendations and provide alternative directions of travel from any dwelling leading to common stairs, other than accepted dead ends, to enable occupants to exit the building safely. All common stairs need to have a level of fire protection involving fire-resisting construction and a smoke control system which enables them to provide occupants of the building with a safe means of escape.

The fire-resisting enclosure of a common stair is provided to prevent smoke and heat from entering the stairway, rendering it impassable for escape purposes, and to prevent fire spreading from one storey to another.

Once inside a protected stairway, a person can be considered to be in a place of relative safety from the immediate danger of flame and smoke. They can then proceed to a place of ultimate safety at their own pace. While unprotected stairways are acceptable for daily human traffic around buildings, their vulnerability to fire and smoke means that it is vital that they are not used primarily as a means of escape from fire.

Particular care needs to be taken in the design of basement stairs, as it is more probable that the stairs at this level will become filled with smoke and heat, than ground or upper storeys if a fire occurs at basement level.

0.2.5 Fire detection and fire alarm system

In most flats, the installation of smoke alarms or fire detection and fire alarm systems can significantly increase the level of safety by automatically giving an early warning of fire. Generally, a common fire alarm and/or fire detection system would not be provided for the evacuation of the occupants. This is so that during the initial stages of a fire in a flat or maisonette, only those persons in the immediate area of the fire are alerted. Recommendations for fire detection and fire alarm systems are given in Section **4**.

0.2.6 Automatic water fire suppression system (AWFSS)

The installation of an AWFSS can offer designers considerable flexibility. An AWFSS controls a fire to a small size, reducing the production of smoke and toxic gases and preventing the fire from spreading beyond the room or dwelling of origin. This means that there can be flexibility achieved in the design of the building. An AWFSS would also provide a good standard of protection for property.

NOTE Attention is drawn to legislative requirements in respect of the need for AWFSS in certain buildings.

0.3 Houses in multiple occupation (HMOs)

HMOs, because of their likely occupational uses, can vary in risk between not much more than a single family dwelling to greater than a hotel. As such, the recommendations given in this British Standard are not always entirely relevant. More detailed guidance can be found in the LACORS publication *Housing – Fire safety* [11].

Further advice and information can be obtained from the environmental health department of the local council, who administer safety and licensing, where necessary, of such premises, and might have specific requirements in their administrative area.

Guidance concerning the licensing of HMOs can be found at www.gov.uk/house-in-multiple-occupation-licence.

NOTE Attention is drawn to Sections 254 to 259 of the Housing Act 2004 [12] in respect of HMOs.

0.4 Housing typology

A broad spectrum of housing options is available which fall into three separate categories:

- mainstream housing;
- specialized housing; and
- residential care (also known as care homes).

The categories each contain a number of sub-categories as shown in Table 1. The number of sub-categories is due to developers seeking to define the intended residents' differing levels of need (due to their level of physical ability and mental cognisance) and consequently their care and support requirements. The fire safety provisions between and within each housing category will vary as a result of the anticipated residents' requirements and capabilities.

Table 1 – Housing typology

Category	Sub-categories[A)]	Descriptor
Mainstream housing		*Housing which ranges from premises with no special features to those which facilitate adaptation at design stage or post-build stage to support residents' specific requirements*
	General needs	Housing with no special features
	Lifetime homes	Housing designed to meet access and adaptability standards for everyone including older people
	Adapted homes	Housing which has been changed to meet the requirements of its residents
Specialized housing		*Housing specifically for people who require support and care services*
	Sheltered	Independent living (own front door) Can include 24 h alarm system, warden, lounge, programme of activities
	Very sheltered/assisted living	Independent living with managed on-site care and support services Features as above; can also include meals, domestic help, assisted bathing
	Extra care	Independent living with managed on-site care and support service Features as above; can also include hairdressing service, 24 h staff
	Close care housing	Independent living with on-site care and support linked to a care home
	Retirement villages	Large developments (often 100+) with a range of housing types and levels of care and support (sheltered, very sheltered/extra care, close care and nursing care) on one site
Residential care (also known as care homes)		*Residential care or care homes offer institutional accommodation (suites of bedrooms) and personal care for people who might not be able to live independently* *Some homes also offer care from qualified nurses or specialize in caring for particular groups such as younger adults with learning disabilities*
	Residential homes	Institutional accommodation (suites of bedrooms) with meals, personal care (physical and emotional) with staff on call
	Nursing homes[B)]	Institutional accommodation (suites of bedrooms) with 24 h nursing care
	Specialized care homes	Institutional accommodation for specific requirements including dementia

[A)] This list is not exhaustive. A new development will be specialized housing if it does not fall within the mainstream housing or the residential care category.

[B)] This British Standard is restricted to placements registered for the provision of care, which are provided by local authorities and independent sector providers and registered by the Care Quality Commission. Guidance on in-patient beds is given HTM 05-02 [13].

0.5 Accessible and adaptable housing

Where mainstream housing is at an early design stage, consideration needs to be given to the proposed design and internal layout to accommodate the changing requirements of occupants over time, e.g. an increase in impairments (physical or mental). This is because the installation of additional or adaptable fire safety measures is easier if features are incorporated at design stage, and can assist in future-proofing a building. For example, the provision of an AWFSS at design stage can raise the standard of fire safety in a dwelling to such an extent that future adaptation of the building might require fewer additional fire precautionary measures.

BS 9266 gives recommendations for the design of accessible and adaptable general needs housing.

0.6 Specialized housing

Specialized housing contains a diverse range of accommodation where the residents are likely to be less mobile, have other impairments or otherwise require assistance in emergency situations. This category can include housing for the elderly, children and people with a physical or mental impairment. Designers need to consider the characteristics of the residents of the building and incorporate an appropriate range of fire precautionary measures to secure a suitable level of fire safety within the building. Consideration also needs to be given to the residents' changing level of need over time in order to future-proof the building for an ageing population. This might include the provision of an AWFSS.

0.7 Tall and very tall buildings

The recommendations in this British Standard can be applied to residential buildings of any height.

Experience and research have shown that the inherent principles supporting a stay put strategy, in particular those requiring increased fire resistance as the height of a building increases, coupled with the installation of AWFSS, mean that the level of risk from fire remains equivalent across the height range of residential buildings from low rise to tall buildings.

However, the increased design demands on structural integrity, services, fire safety systems, means of firefighting and evacuation generated by buildings with a storey more than 50 m above or more than 10 m below ground level mean that specific evaluation of all fire safety provisions is needed using a qualitative design review (QDR) in accordance with BS 7974. This is to determine whether the recommendations in BS 9991 are appropriate, or whether a full fire engineered solution is required.

Enhanced measures of protection might be needed compared with single occupancy or lower risk building types. Those enhanced measures could be, for example, higher levels of fire resistance (either in terms of time or insulation) together with stronger measures in detection and alarm and a stronger emphasis on escape plans and directions to residents.

0.8 Management of fire safety

It is a fundamental assumption that features described in this British Standard will require management and maintenance throughout the life of the building. Appropriate fire safety design takes into account the way in which a building will be managed. Any reliance on an unrealistic or unsustainable management regime cannot be considered to have met the recommendations of this British Standard.

Managing fire safety is the whole process throughout the life of a building, starting with the initial design, which is intended both to minimize the incidence of fire and to ensure that, when a fire does occur, appropriate fire safety systems (including active, passive, and procedural systems) are in place and are fully functional. Fire safety procedures and maintenance schedules are developed at the design stage and included in the fire safety

manual, which is handed over to the person responsible for fire safety of the building in order to enable a suitable and sufficient fire risk assessment to be carried out. While the building is in use, the management regime needs to be maintained, and any variation in that regime needs to be accompanied by a revised or new suitable and sufficient risk assessment.

NOTE Attention is drawn to Regulation 38 of the Building Regulations 2010 [1]. Attention is also drawn to the Regulatory Reform (Fire Safety) Order 2005 [2] and to the equivalent regulations in Scotland [6] and Northern Ireland [7]. Failure to take proper management responsibility could result in the prosecution of an employer, building owner or occupier under legislation such as the Regulatory Reform (Fire Safety) Order 2005 [2].

The management of fire safety is thus an essential element in averting the loss of life in the event of a fire. Although many buildings will never have a serious life-threatening fire, it is essential for fire safety procedures to be planned for every building. There are usually numerous elements which contribute to multi-fatality fires, one being that, when fire is discovered or when the alarm is raised, the occupants of premises, be they staff or members of the public, react and respond in ways which are different from those assumed or expected by the building designer. There are a number of stages by which people react to a fire alarm. Initially they tend to seek information regarding the validity of the warning. They then gather belongings or seek associates or family. Only then do they seek to travel to a place of ultimate safety. The management of fire safety is intended to increase awareness and increase the probability of appropriate behaviour, to minimize the threat from the fire.

There have been numerous fire incidents, both large and small, where there have been lives lost or put at risk as a result of the safety systems provided being inappropriate or not being used effectively.

It is now widely acknowledged that the design and engineering put into a building for life safety can only do its job properly if it can be managed, maintained and tested over the whole life of the building, and if any staff (which will be determined by the management strategy of the building) who might be present are trained to handle incidents and operate effective and tested emergency plans.

Once the designer or engineer has handed over the building, then good management of fire safety becomes the key element to fire safety for the life of the building.

Effective management of fire safety can contribute to the protection of the building occupants in many ways:

a) by working to prevent fires occurring in the first place;

b) by carrying out effective risk assessments of fire safety precautions and built-in measures, including compartmentation and essential elements such as fire doors and fire-resistant walls and screens;

c) by monitoring the fire risks on an ongoing basis and taking appropriate action to eliminate or reduce the risk;

d) by being aware of the types of people in the building (such as disabled people, elderly people, children, pregnant women, etc.) and any special risks or requirements;

e) by maintaining all of the fire safety measures in the building in working order, and in particular keeping the means of escape available at all times; and

f) by training any staff in the appropriate action to be taken in the event of a fire.

These tasks differ in detail depending on the occupancy of the building.

1 Scope

This British Standard gives recommendations and guidance on the design, management and use of the following building types, to achieve reasonable standards of fire safety for all people in and around:

a) dwellings (single-family dwelling houses, self-contained flats or maisonettes);

b) blocks of flats;

c) residential accommodation blocks (e.g. for students or hospital staff), with individual bedrooms and the provision of kitchen/sanitary facilities constructed within a fire compartment;

d) specialized housing; and

e) residential care.

NOTE 1 Recommendations for fire safety in the design, management and use of buildings other than residential buildings are given in BS 9999.

It is not applicable to hotels, caravans/mobile homes, hospitals, places of lawful detention or hostels.

NOTE 2 Requirements for means of escape from caravans and mobile homes are given in BS 3632.

This British Standard is applicable to the design of new buildings, and to material alterations, extensions and material change of use of an existing building.

NOTE 3 Attention is drawn to the Building Regulations 2010 [1] and equivalent national variations ([3] to [5]) in respect of the definition of material alterations, extensions and material change of use.

It also provides recommendations and guidance on the ongoing management of fire safety in a building throughout the entire life cycle of the building, including measures for designers to enable the overall design of a building to assist and enhance the management of fire safety. It can be used as a tool for assessing existing buildings, although fundamental change in line with its recommendations might be limited or not practicable.

The recommendations and guidance given in this British Standard are intended to safeguard the lives of building occupants and firefighters. Whilst some of the recommendations and guidance might also assist in the achievement of other fire safety objectives – such as protection of property, the environment, communities and business/service viability – additional measures might be necessary which are outside the scope of this British Standard.

This British Standard does not cover fire safety design strategies for extreme events such as terrorist actions.

2 Normative references

Standards publications

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions of this document[1)]. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 476 (all parts), *Fire tests on building materials and structures*

BS 799-5, *Oil burning equipment – Specification for oil storage tanks*

BS 3251, *Specification – Indicator plates for fire hydrants and emergency water supplies*

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

BS 4514, *Unplasticized PVC soil and ventilating pipes of 82 – 4 mm minimum mean outside diameter, and fittings and accessories of 82 – 4 mm and of other sizes – Specification*

BS 5234 (all parts), *Partitions (including matching linings)*

BS 5266-1, *Emergency lighting – Code of practice for the emergency lighting of premises*

BS 5306-3, *Fire extinguishing installations and equipment on premises – Commissioning and maintenance of portable fire extinguishers – Code of practice*

BS 5306-8, *Fire extinguishing installations and equipment on premises – Selection and positioning of portable fire extinguishers – Code of practice*

BS 5395-1[2)], *Stairs – Code of practice for the design of stairs with straight flights and winders*

BS 5410-1, *Code of practice for liquid fuel firing – Installations for space heating and hot water supply purposes for domestic buildings*

BS 5410-2, *Code of practice for liquid fuel firing – Non-domestic installations*

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

BS 5839-6:2019+A1, *Fire detection and fire alarm systems for buildings – Code of practice for the design, installation, commissioning and maintenance of fire detection and fire alarm systems in domestic premises – Part 6: Code of practice for the design, installation, commissioning and maintenance of fire detection and fire alarm systems in domestic buildings*

BS 5839-9, *Fire detection and fire alarm systems for buildings – Code of practice for the design, installation, commissioning and maintenance of emergency voice communication systems*

BS 5852, *Methods of test for assessment of the ignitability of upholstered seating by smouldering and flaming ignition sources*

BS 5867-2:2008, *Fabrics for curtains, drapes and window blinds – Flammability requirements – Specification*

BS 5906, *Waste management in buildings – Code of practice*

BS 6180, *Barriers in and about buildings – Code of practice*

BS 6262-4, *Glazing for buildings – Code of practice for safety related to human impact*

BS 6263-2, *Care and maintenance of floor surfaces – Code of practice for resilient sheet and tile flooring*

BS 6400 (all parts), *Specification for installation, exchange, relocation, maintenance and removal of gas meters with a maximum capacity not exceeding 6 m^3/h*

BS 6644, *Specification for the installation and maintenance of gas-fired hot water boilers of rated inputs between 70 kW (net) and 1 —8 MW (net) (2nd and 3rd family gases)*

BS 6798, *Specification for selection, installation, inspection, commissioning, servicing and maintenance of gas-fired boilers of rated input not exceeding 70 kW net*

BS 7157:1989, *Method of test for ignitability of fabrics used in the construction of large tented structures*

BS 7176, *Specification for resistance to ignition of upholstered furniture for non-domestic seating by testing composites*

[2)] This standard also gives an informative reference to BS 5395-1:2010.

BS 7273-4, *Code of practice for the operation of fire protection measures – Part 4: Actuation of release mechanisms for doors*

BS 7346-7[3], *Components for smoke and heat control systems – Code of practice on functional recommendations and calculation methods for smoke and heat control systems for covered car parks*

BS 7346-8, *Components for smoke control systems – Code of practice for planning, design, installation, commissioning and maintenance*

BS 7671, *Requirements for Electrical Installations – IET Wiring Regulations*

BS 8214, *Timber-based fire door assemblies – Code of practice*

BS 8300-2[4], *Design of an accessible and inclusive built environment – Buildings – Code of practice*

BS 8313, *Code of practice for accommodation of building services in ducts*

BS 8458, *Fixed fire protection systems – Residential and domestic watermist systems – Code of practice for design and installation*

BS 8519, *Selection and installation of fire-resistant power and control cable systems for life safety, fire-fighting and other critical applications – Code of practice*

BS 8524 (both parts), *Active fire curtain barrier assemblies*

BS 8629, *Code of practice for the design, installation, commissioning and maintenance of evacuation alert systems for use by fire and rescue services in buildings containing flats*

BS 8899, *Improvement of fire-fighting and evacuation provisions in existing lifts – Code of practice*

BS 9251:2021, *Fire sprinkler systems for domestic and residential occupancies – Code of practice*

BS 9990[5], *Non automatic fire-fighting systems in buildings – Code of practice*

BS 9999, *Fire safety in the design, management and use of buildings – Code of practice*

BS EN 3 (all parts), *Portable fire extinguishers*

BS EN 54-3, *Fire detection and fire alarm systems – Fire alarm devices – Sounders*

BS EN 54-11:2001 (incorporating Amendment No. 1), *Fire detection and fire alarm systems – Manual call points*

BS EN 81 (all parts), *Safety rules for the construction and installation of lifts*

BS EN 1154, *Building hardware – Controlled door closing devices – Requirements and test methods*

BS EN 1329-1, *Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure – Unplasticized poly(vinyl chloride) (PVC-U) – Specifications for pipes, fittings and the system*

BS EN 1363 (all parts), *Fire resistance tests*

BS EN 1364 (all parts), *Fire resistance tests for non-loadbearing elements*

BS EN 1365 (all parts), *Fire resistance tests for loadbearing elements*

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[3] This standard also gives informative references to the BS 7346 series.

[4] This standard also gives informative references to BS 8300-2:2018 and to both parts of the BS 8300 series.

[5] This standard also gives an informative reference to BS 9990:2015.

BS EN 1366 (all parts), *Fire resistance tests for service installations*

BS EN 1634-1, *Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware – Fire resistance test for door and shutter assemblies and openable windows*

BS EN 1634-3:2004, *Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware – Smoke control test for door and shutter assemblies*

BS EN 12101-2, *Smoke and heat control systems – Natural smoke and heat exhaust ventilators*

BS EN 12101-3, *Smoke and heat control systems – Specification for powered smoke and heat control ventilators (Fans)*

BS EN 12101-6, *Smoke and heat control systems – Specification for pressure differential systems – Kits*

BS EN 12101-8, *Smoke and heat control systems – Smoke control dampers*

BS EN 12101-10, *Smoke and heat control systems – Power supplies*

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

BS EN 13501-1:2018, *Fire classification of construction products and building elements – Classification using data from reaction to fire tests*

BS EN 13501-2, *Fire classification of construction products and building elements – Classification using data from fire resistance tests, excluding ventilation services*

BS EN 13501-3:2005+A1, *Fire classification of construction products and building elements – Classification using data from fire resistance tests on products and elements used in building service installations: fire resisting ducts and fire dampers*

BS EN 13501-4, *Fire classification of construction products and building elements – Classification using data from fire resistance tests on components of smoke control systems*

BS EN 15650, *Ventilation for buildings – Fire dampers*

BS EN 60243 (all parts), *Electric strength of insulating materials – Test methods*

BS EN 60947 (all parts), *Low-voltage switchgear and controlgear*

BS EN ISO 7010, *Graphical symbols – Safety colours and safety signs – Registered safety signs*

BS ISO 3864-1, *Graphical symbols – Safety colours and safety signs – Design principles for safety signs and safety markings*

BS ISO 21927-9, *Smoke and heat control systems – Specification for control equipment*

Other publications

[N1] ASSOCIATION FOR SPECIALIST FIRE PROTECTION. *Fire resistance test for 'open-state' cavity barriers used in the external envelope or fabric of buildings*. TGD 19. Bordon: ASFP, 2014.

[N2] UKLPG. *Code of practice 1-2 – Bulk LPG storage at fixed installations for domestic purposes*. Incorporating amendment 2. UKLPG, 2000.

[N3] HEALTH AND SAFETY EXECUTIVE. *The keeping of LPG in cylinders and other containers*. Guidance note CS4. HSE, 1986.

3 Terms and definitions

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

3.1 access level
level used for normal access to the building that either incorporates, or leads directly to, a place of ultimate safety

3.2 access room
room that forms the only escape route from an inner room (**3.47**)

3.3 accessible and adaptable housing
housing that is sufficiently flexible and convenient to meet the existing and changing requirements of most households, and in which the interior fabric rather than the structure can be easily adapted to accommodate aids and equipment

NOTE Such households might include older people, families with children, physically disabled people or those with sensory impairments. Aids and equipment might include stairlifts, hoists and grab rails that make it easier for older people and some disabled people to stay in their home when their access needs change.

[SOURCE: BS 9266:2013, **3.1**, modified – “general needs” removed from term]

3.4 alternative escape route (from a house)
<from a house> route from any point within a room of a house that gives easy access to a second stair, a balcony or a flat roof by means of which a person can reach a place of ultimate safety

< from a flat or maisonette> one of two or more exits from within a flat or maisonette, each of which is separate from the other giving access to a route leading to a place of ultimate safety

3.5 ancillary accommodation
all parts of a building that are ancillary to the dwellings, such as rooms associated with engineering services, common amenity areas (**3.17**), refuse rooms and covered car parks

3.6 atrium (plural: atria)
space within a building, not necessarily vertically aligned, passing through one or more compartment floor(s)

NOTE Enclosed lift wells, enclosed escalator structural openings, building services ducts and stairways are not classified as atria.

3.7 automatic water fire suppression system (AWFSS)
system designed to control or extinguish fires using water without human intervention

3.8 balcony approach
design in which each dwelling is approached externally via an open common walkway, the amount of opening being uniformly distributed throughout its length between 1 100 mm and the soffit above to allow ventilation

3.9 basement
storey with a floor which at some point is more than 1.2 m below the highest level of ground adjacent to the outside walls

3.10 building management system (BMS)
system capable of making decisions based on information sent to it

3.11 classifications for combustibility
NOTE 1 National classifications for reaction to fire are given in Annex B.

NOTE 2 When a classification includes “s3, d2”, this means that there is no limit set for smoke production and/or flaming droplets/particles.

3.11.1 class A1 product or material
product or material classified as A1 in accordance with BS EN 13501-1:2018

3.11.2 class A2-s1, d0 or better product or material
product or material classified as A2-s1, d0 or better in accordance with BS EN 13501-1:2018

NOTE By definition, this includes Class A1.

3.11.3 class A2-s3, d2 or better product or material
product or material classified as A2-s3, d2 or better in accordance with BS EN 13501-1:2018

3.11.4 class B-s3, d2 or better product or material
product or material classified as B-s3, d2 or better in accordance with BS EN 13501-1:2018

3.11.5 class C-s3, d2 or better product or material
product or material classified as C-s3, d2 or better in accordance with BS EN 13501-1:2018

3.11.6 class D-s3, d2 product or material
product or material classified as D-s3, d2 in accordance with BS EN 13501-1:2018

3.11.7 class E product or material
product or material classified as E in accordance with BS EN 13501-1:2018

3.11.8 class F product or material
product or material classified as F in accordance with BS EN 13501-1:2018

3.12 common amenity area
area containing household facilities that are remote from individual dwellings

NOTE Examples of common amenity areas include kitchens, laundries, drying areas and occupiers' stores.

3.13 common corridor
protected corridor serving more than one flat or occupancy

3.14 common stair
stairway serving more than one flat or occupancy

3.15 competent person
person, suitably trained and qualified by knowledge and practical experience, and provided with the necessary instructions, to enable the required task(s) to be carried out correctly

3.16 corridor access
design in which each dwelling is approached via a common horizontal internal access or circulation space

NOTE 1 Corridor access can include a common entrance hall.

NOTE 2 Corridor access is also referred to as a corridor approach.

3.17 dead end
area from which escape is possible in one direction only

3.18 deck approach
design in which each dwelling is approached externally via a wide approach common (external) walkway that has guarding only at the edges and otherwise is completely open to the atmosphere

NOTE This is also known as deck access.

3.19 depressurization
method of smoke control in which the air pressure within the area of the fire or its adjacent areas is decreased so that it is lower than the air pressure within the protected area

3.20 dwelling
unit of residential accommodation, occupied (whether or not as a sole or main residence):

a) by a single person or by people living together as a family; or

b) by not more than six residents living together as a single household, including a household where care is provided for residents

3.21 dwelling of origin
dwelling in which the initial ignition of a fire has occurred

3.22 emergency escape lighting
lighting provided for use when the normal lighting fails, to ensure illumination of escape route(s) at all times

3.23 escape route
route forming part of the means of escape from any point in a building to a final exit

3.24 evacuation exit floor
destination floor for evacuating the building using lift(s) determined by the evacuation plan and which has a protected route to a place of ultimate safety

3.25 final exit
termination of an escape route from a building giving direct access to a street, passageway, walkway or open space, and sited to enable the rapid dispersal of persons from the vicinity of a building so that they are no longer in danger from fire, smoke and/or falling debris

3.26 fire doors

3.26.1 fire door
door assembly which, as installed in a building, is intended when closed to resist the passage of fire and is capable of meeting specified performance criteria

3.26.2 self-closing fire door
fire door fitted with a device which fully closes the door, overriding the resistance of any latch

3.27 firefighters lift switch
switch located at the fire service access level, outside the lift well, used to initiate firefighters' service

3.28 firefighting lobby
protected lobby providing access from a firefighting stair to the accommodation area and to any associated firefighters lift

3.29 firefighting shaft
protected enclosure containing a firefighting stair, firefighting lobbies, a fire main and, if provided, a firefighters lift together with any machinery space

3.30 firefighting stair
protected stairway communicating with the accommodation area only through a firefighting lobby

3.31 fire resistance
ability of an item to fulfil for a stated period of time the required fire stability and/or integrity and/or thermal insulation, and/or other expected duty specified in a standard fire resistance test

3.32 flat
separate and self-contained premises, constructed or adapted for use for residential purposes and forming part of a building from some other part of which it is divided horizontally, having all its rooms on one level or not more than half a storey height apart

3.33 free area
total unobstructed cross-sectional area of an opening, vent, etc., measured in the plane where the area is at a minimum and at right angles to the direction of air flow

NOTE The free areas of openings, vents, etc. refer to the geometric free area.

3.34 gallery
floor or balcony which does not extend across the full extent of a building's footprint and is open to the floor below

3.35 ground storey
storey, the floor of which is situated at such a level or levels that any given point on its perimeter is not more than 1.2 m below the level of the finished surface of the ground adjoining the building in the vicinity of that point

3.36 habitable room
any room in a dwelling with the exception of any kitchen, utility room, bathroom or WC

3.37 higher fire risk area
area with a fire risk higher than that of a dwelling

3.38 house
unit of residential accommodation occupied (whether or not as a sole or main residence):

a) by a single person or by people living together as a family; or

b) by not more than six residents living together as a single household, including a household where care is provided for residents

NOTE This does not include a flat or a building containing a flat.

3.39 house in multiple occupation (HMO)
building or part of a building:

a) in which more than one household shares an amenity or the building lacks an amenity; or

b) which is a converted building that does not entirely comprise self-contained flats (whether or not there is also a sharing, or lack, of amenities); or

c) which is comprised entirely of converted self-contained flats and where the standard of conversion does not meet a specified minimum, and more than one third of the flats are occupied under short tenancies

NOTE 1 Examples of amenities are bathrooms, toilets and cooking facilities.

NOTE 2 Attention is drawn to the Building Regulations 2010 [1] and equivalent national variations ([3] to [5]) in respect of the specified minimum standard of conversion.

3.40 independent alternative escape route
one of two or more escape routes from a dwelling, with its own separate exit from the dwelling and which follows a route that is separate from the other(s)

3.41 independent living
living in a manner that, through the combination of various environmental and individual factors, allows individuals to have control over their own lives

NOTE This does not relate to the individual's ability to evacuate independently, with or without assistance, but their ability to choose how they wish to live.

3.42 inner room
room from which escape is possible only by passing through another room

3.43 level of need
degree of assistance that a person might require in the event of fire, based on:

a) propensity to contribute to the starting of fire or to the development of fire;

b) capacity to respond appropriately to signs of fire or other cues; and

c) ability to escape in the event of fire

3.44 lifts

3.44.1 lift
lifting device within the scope of BS EN 81-20, with completely enclosed car and rated speed greater than 0.15 m/s, permanently serving a building and intended for the transport of persons or persons and goods

3.44.2 evacuation lift
lift used as part of the evacuation sequence for persons with disability and persons requiring assistance, which has appropriate structural, electrical and fire protection and is capable of being taken under control by a trained and authorized person

3.44.3 firefighters lift
lift with protection measures, controls and signals that enable it to be used under the direct control of the fire and rescue service in fighting a fire

3.45 maisonette
dwelling, forming part of a larger building, having rooms divided between two or more levels which are more than half a storey height apart

3.46 mainstream housing
housing which ranges from premises with no special features to those which facilitate adaptation at design stage or post-build stage to support residents' additional requirements

NOTE Further guidance on housing definitions can be found in Table 1.

3.47 means of escape
means whereby a safe route or routes in the event of fire is or are provided for persons to travel from any point in a building to a place of ultimate safety

3.48 mixed-use building
building containing dwellings together with other types of occupancy and where the dwellings are not ancillary to the other use

3.49 open-plan layout
layout with open spatial planning, where the main living space is not separated from the dwelling entrance door

NOTE 1 The main living space refers to the lounge or living rooms.

NOTE 2 Bedrooms might or might not be separated from the main living space.

3.50 place of relative safety
protected space or zone along an escape route which offers immediate access directly to an escape route and provides temporary safety from both fire and smoke

NOTE Such spaces can be used as part of an evacuation sequence to a place of ultimate safety.

3.51 place of ultimate safety
place in which there is no immediate or future danger from fire or from the effects of a fire

3.52 pressurization
method of protecting spaces against the ingress of smoke by maintaining a positive air pressure difference between the protected spaces and adjoining accommodation

3.53 progressive evacuation
managed evacuation system used in residential care facilities in which different protected areas within a building are evacuated in a controlled series of phases, with occupants moved, often horizontally, from area of fire origin to adjoining place of relative safety

3.54 protected circuit
electrical circuit protected against fire

3.55 protected corridor/lobby
circulation area consisting of a lobby or corridor enclosed with fire-resisting construction (other than any part that is any external wall of a building)

3.56 protected entrance hall/protected landing
circulation area consisting of a hall or space within the dwelling that is enclosed with fire-resisting construction

NOTE The protected entrance hall/protected landing does not include any external walls of a building.

3.57 protected stairway
stair discharging through a final exit to a place of ultimate safety (including any exit passageway between the foot of the stair and the final exit) that is adequately protected from fire elsewhere in the building by fire-resisting construction

3.58 residential care
premises that offer institutional accommodation (suites of bedrooms) and personal care for people who might not be able to live independently

NOTE 1 Residential care is also known as care homes.

NOTE 2 Further guidance on housing definitions can be found in Table 1.

3.59 separated part
<of a building> part of a building that is separated from another part of the same building by a compartment wall that runs the full height of the part and is in one vertical plane

3.60 single stair
common stair which is the only one to which dwellings in a block of flats or maisonettes have access

3.61 specialized housing
accommodation that provides independent living for occupants who are wholly or mainly limited to a specific section of population and who are likely to require additional measures to secure their safety in the event of fire, including but not limited to accommodation provided for the elderly, children and people with a physical or mental impairment

NOTE Further guidance on housing definitions can be found in Table 1.

3.62 stay put strategy
strategy normally adopted in blocks of flats and maisonettes whereby, when a fire occurs in a flat or maisonette, the occupants of that dwelling evacuate, but occupants of all other dwellings can safely remain in their dwellings unless directly affected by heat and smoke or directed to leave by the fire and rescue service

NOTE In a building with a stay put strategy, all residents are always free to leave their flats if they wish to do so (e.g. if they feel unsafe), but to do so might, under some circumstances, place them at greater risk than remaining within their flats.

3.63 storey
part of a building comprising all the rooms that are on the same level including any gallery having an area of more than half that of the space into which it projects, unless it is accessible only for maintenance or repair

3.64 sub-compartment
space created by use of fire-resisting construction to form a place of relative safety as part of a progressive evacuation strategy

3.65 storey exit
final exit, or a doorway, giving direct access to a protected stairway or external escape route

3.66 travel distance
actual distance a person needs to travel between two points within a building, having regard to the layout of walls, partitions and fittings

4 General recommendations

*COMMENTARY ON CLAUSE **4***

All fires generally start off small and can remain localized to the area around the point of ignition. Provided with sufficient fuel and ventilation, however, the potential exists for the fire to grow, and smoke and flames can spread to involve areas outside the immediate vicinity.

The recommendations and guidance given in this British Standard are based on the assumption that under normal circumstances (i.e. except in the case of arson) a fire is unlikely to start in two different places in a

*building at the same time (see **0.1**) and, in the case of flats and maisonettes, a fire is most likely to start within the living space rather than in the common access routes or stairwells (see **0.8** regarding the importance of good fire safety management).*

Further guidance on arson in dwellings is given in Annex C.

Initially the aim of these recommended fire precautions is to protect the occupants close to the origin of the fire, enabling them to reach a place of relative safety outside of the dwelling of fire origin and reducing their exposure to fire and smoke by raising the alarm and limiting travel distances. Where the fire safety measures that have been installed achieve their intended purpose, there is little risk to the other occupants of the building and simultaneous evacuation of the entire building is usually unnecessary.

If any of the following events occur then it cannot be guaranteed that the common areas used for escape will remain completely unaffected:

a) a dwelling entrance door fails to close; or

b) a fire goes unreported (e.g. in an unoccupied dwelling) and increases to the point where containment to the dwelling of origin is threatened; or

c) ignition does occur in the common parts; or

d) there is a higher risk element associated with use of the building (e.g. ancillary accommodation or mixed-use buildings).

Further fire precautions are therefore recommended to assist with escape of occupants who are not immediately at risk but who might be required to escape at a later stage of fire development.

Measures are also provided where the primary user might have additional requirements to safely evacuate a building, such as in specialized housing, and to assist persons called upon to provide search and rescue operations and/or firefighting.

4.1 Variation of recommendations

*COMMENTARY ON **4.1***

*The recommendations for means of escape in Section **2** permit variations to be made to travel distances on the basis that the level of risk can be reduced by the provision of additional fire protection measures. Such measures include the provision of:*

- *an additional level of automatic fire detection;*
- *an AWFSS (see **19.2**, Table 4);*
- *an enhanced smoke management system.*

*Equally, the recommendations for designing the building structure in Section **5** and on firefighting in Section **8** permit certain variations when such measures as an automatic water sprinkler system (see Clause **19**) are provided.*

Designers and approving authorities are thus able to allow a degree of flexibility in the provision of fire safety measures as part of the overall design package, although there are set limits on the extent of variation permitted within the scope of this British Standard.

Where variations are incorporated into any aspect of the design, the overall design should still meet all the relevant recommendations of this British Standard.

4.2 Property protection and business continuity

*COMMENTARY ON **4.2***

The recommendations and guidance in this British Standard are primarily concerned with the protection of life. The provision of fire safety systems for life safety does not necessarily give adequate protection to property (including personal possessions) or to business continuity.

Property protection and business continuity is equally important within the housing sector as in any other business activity. The effects of fire could include the potential societal loss of people's homes and the need for rehousing and care following a fire.

Businesses that provide housing should assess their business continuity arrangements and provide appropriate measures to mitigate the effects of fire on both residents and property.

The potential for property and business loss should be assessed in accordance with Annex D.

This assessment should be an integral part of the design stage of a building. It should include an assessment of the ongoing maintenance requirements of the building, as well as the fire protection needs during construction.

4.3 Environment

*COMMENTARY ON **4.3***

Many fires or emissions from combustion processes damage the environment. The contents of, and activities within, any building catching fire are likely to cause pollution to a greater extent than products used in the fabric of the building itself.

This British Standard is concerned largely with accidental fires, and the main area for consideration of the environmental impact of such fires is the loss of control of pollutants as a consequence. Fires that have been deliberately set might require additional measures to be taken which are outside the scope of this British Standard.

Appropriate steps should be taken at the design stage of any building to minimize the impact of accidental fire on the environment.

The building specification should take into account the potential environmental effects of using toxic materials, class E or class F materials and contaminated water run-off.

4.4 Mixed-use buildings incorporating non-residential use

Where a building is wholly residential and is within the scope of this British Standard then its design should be based upon this standard.

Where a building is in mixed use and is partly residential, then it should wherever practicable be designed such that from the standpoint of fire safety the residential and non-residential uses are separated and independent of each other.

NOTE If this can be achieved, BS 9991 and BS 9999 may be applied independently to the parts of the building within their respective scopes.

Where the fire safety of the non-residential parts relies upon the performance of the residential portion (or vice versa) then the most onerous recommendations of the two standards, BS 9991 and BS 9999, should be implemented.

Except as permitted by Clause **22**, the means of escape strategy for the residential parts of the premises should not be based upon them being evacuated simultaneously with the non-residential parts of the building, and the means of escape routes should be independent.

4.5 Atria

*COMMENTARY ON **4.5***

The primary objective with atria is to ensure that the incorporation of an atrium into a new or existing building does not present an increased risk to life as a result of fire and smoke spread.

This British Standard is concerned only with those additional measures that might be required to compensate for any increased risk resulting from the inclusion of an atrium within a building. It is not intended to provide a fire engineered solution for any particular design.

In atria, several storeys are contained in one volume. Atria are created by, for example:

- *split-level floors;*
- *floors arranged as a spiral throughout the height of the building;*
- *balconies or gallery floors overlooking a central well or courtyard.*

Atria can result in smoke and heat travelling readily throughout all levels of the building.

Atria should be designed in accordance with Annex E, using the occupancy category decision process given in Figure E.1 to determine whether the atrium building falls within the scope of this British Standard and, if it does, to determine a design solution.

NOTE The wide range of designs possible in atrium buildings makes it impossible for this British Standard to cover every conceivable scheme and its associated fire risk, therefore it deals only with atria up to a height

of 18 m. A fire engineered approach is needed for atria in residential buildings over 18 m in height, and such designs are therefore outside the scope of BS 9991.

4.6 Inclusive design

*COMMENTARY ON **4.6***

The available escape time is a significant factor when considering the safety of all people, and is assessed by having sufficient knowledge of both the building capability to resist the spread of fire and alert people, taking into account the diversity of requirements in an evacuation situation.

The building should be designed and built to accommodate robust emergency evacuation procedures for all building users, including people who have step-free or other specific egress requirements. All building users should be able to evacuate from a building equitably, with dignity and as independently as possible.

The need for people to require assistance from other parties to evacuate should be minimized where reasonably practicable.

NOTE 1 Emergency carry-down or carry-up mechanical devices or similar interventions that rely on people movement and handling are not generally considered appropriate, for reasons of user dignity, independence, and equitable evacuation.

*NOTE 2 Specific management procedures might be required where it is reasonable to assume that there are likely to be a higher proportion of disabled people in a building. However, management procedures are expected, as a matter of general consideration, to take into account that building occupants (including residents, visitors and staff) are highly likely to include some people with a range of impairments and any potential constraints and features of the building design, fire strategy and management, particularly in existing buildings. Recommendations for building management are given in Section **9**.*

NOTE 3 Attention is drawn to the Equality Act 2010 [14] (and, in Northern Ireland, the Disability Discrimination Act 1995 [15]) which places a duty on all employers and service providers not to discriminate against disabled people. Public bodies, which include local authorities and emergency services, are also subject to the Public Sector Equality Duty. When making plans for the fire safety and management of buildings, the requirements of disabled people have to be properly taken into account at all times.

NOTE 4 The recommendations given in this British Standard are for escape, not access. For example, certain dimensions might not provide suitable access for all people with impairments. Recommendations for access are given in BS 8300, BS 9266 and Approved Document M [16], which explain how the built environment can be designed to anticipate, and overcome, restrictions that prevent people making full use of premises and their surroundings. BS 8300 gives recommendations for the design of an accessible and inclusive built environment (this is not specific to residential buildings, but it is expected that its recommendations can be applied to common areas in the building); BS 9266 gives recommendations for the design of accessible and adaptable general needs housing.

Section 2: Designing means of escape

*COMMENTARY ON SECTION **2***

*Section **2** gives recommendations for means of escape in a range of different building types. The recommendations that are common to all building types are given first, in Clause **5**. The recommendations that follow are specific to houses (Clause **6**) flats and maisonettes (Clause **7**), and residential care (Clause **8**). This section also includes recommendations for the internal planning of flats and maisonettes, in Clause **9**.*

Means of escape for atria are covered in Annex E.

Methods of measurements such as floor heights, heights of buildings and fire and rescue service access are given in Approved Document B [17] and the equivalent documents for use in Scotland [18] and Northern Ireland [19].

Guidance on fire and safety signage is given in Approved Document B [17] and the equivalent documents for use in Scotland [18] and Northern Ireland [19].

5 General recommendations for means of escape

5.1 Escape by way of doors

5.1.1 General

Doors that are intended to be used for means of escape or rescue should meet the following recommendations.

a) Doors on escape routes (both within and from the building) should be identified and readily openable by all people.

   NOTE 1 The time taken to negotiate a closed door can be critical in escaping.

   NOTE 2 Recommendations for the visual identification of doors are given in BS 8300.

b) The door leaf of any doorway or exit should, where reasonably practicable, be hung to open in the direction of escape, and should always do so if the number of persons that might be expected to use the door at the time of a fire is more than 60.

c) All doors on escape routes should be hung to open not less than 90°, and with a swing that is clear of any change of floor level.

d) A door that opens towards a corridor or a stairway should be sufficiently recessed to prevent its swing from encroaching on the effective width of the stairway or corridor.

5.1.2 Final exits

Final exits should be dimensioned and sited to facilitate the evacuation of persons out of and away from the building.

The design of final exits should meet all of the following recommendations.

a) Final exits should be sited to facilitate rapid dispersal of persons from the vicinity of the building so that they are no longer in danger from fire and smoke. Direct access to a street, passageway, walkway or open space should be available. The route clear of the building should be well defined, and if necessary (e.g. potential traffic hazard), suitably guarded.

b) Final exits should be apparent to persons who might need to use them.

   NOTE 1 This is particularly important where the exit opens off a stair that continues down, or up, beyond the level of the final exit.

c) Final exits should be sited such that they are clear of any risk from fire or smoke in a basement (such as the outlets to basement smoke vents, or from openings to transformer chambers, refuse chambers, boiler rooms and similar risks).

d) Wherever possible, final exits should provide a level or ramped route away from the building. Where a final exit leads to steps outside the building, there should be space for

a wheelchair user to move so they do not obstruct the flow of other people leaving the building.

Where communal facilities or alternate methods of evacuation (e.g. simultaneous escape) will lead to high numbers of people using this route at the same time, the clear opening width of the final exit door(s) should:

1) be calculated based on a minimum exit width factor of 4.1 mm/person;
2) have a minimum width of 1 000 mm;
3) not be less than the width of the widest stair leading to it; and
4) account for merging flows of occupants at the convergence of a stair and any escape routes from final exit level and from routes below the final exit level by increasing the clear opening width by a factor of 4.1 mm/person for every additional person over the stair capacity.

NOTE 2 Where a stay put strategy is in place and the number of people will be the occupants of a single dwelling, then a door width suitable for general circulation and meeting inclusive design access requirements is generally adequate to accommodate escape, irrespective of the size of the stair.

NOTE 3 Sizing of the final exit based on simultaneous escape does not include circumstances where the stay put policy has been abandoned during an evacuation.

5.2 Escape by way of windows

*COMMENTARY ON **5.2***

Windows are not suitable as means of escape in residential care facilities or residential accommodation specifically constructed for older people or people with mobility impairments.

Windows that are to be used for means of escape or rescue should meet the following recommendations.

a) Escape windows should have an unobstructed openable area of not less than 0.33 m^2, with minimum dimensions of 450 mm in height and 450 mm in width.

   NOTE 1 The route through the window may be at an angle rather than on a horizontal plane.

b) The bottom of any openable area should be not more than 1 100 mm above the floor of the room in which it is situated.

   NOTE 2 Where the bottom of the openable area is less than 800 mm, it might be necessary to guard the openable area with a protective barrier in accordance with BS 6180.

c) Windows that are provided for escape or rescue purposes from a room above ground level should meet the following recommendations.

   1) If a window is a dormer window or a roof light, the distance from the eaves of the roof to the sill or vertical plane of the window or sill of the roof light should not exceed 1.5 m when measured along the roof.
   2) Any French window or patio type doors should be guarded with a protective barrier in accordance with BS 6180.
   3) The ground beneath the window or balcony should be clear of any obstructions (such as iron railings or horizontally hung windows) and should be of a size and material that is suitable and safe for supporting a ladder.
   4) Where windows are kept locked with a key (e.g. for security purposes), occupants should be advised to keep the key close to the escape window where it can be easily located.

5.3 Inner rooms

A habitable room should not be an inner room, unless it is provided as part of an open-plan design (see **5.6** and **9.5**).

Entrance halls, lobbies or corridors within dwellings should be treated as access rooms if they contain a fire risk such as appliances and mobility scooters. Entrance halls, corridors or lobbies designed with the potential to include additional fire loading should be treated as access rooms.

Where escape windows are provided in accordance with **5.2**, a room containing such windows should not be treated as an inner room.

5.4 Balconies and conservatories

All balconies should be designed in accordance with Annex F.

Enclosed private balconies and conservatories, without alternative means of escape, should be treated as inner rooms.

5.5 Alternative exits

Alternative exits from dwellings should:

a) be in accordance with the relevant recommendations of Clause **6** and Clause **7** as appropriate to the type of building;

b) be sited away from the main entrance door to the dwelling such that it can still be used as an escape route;

c) be in accordance with the approaches illustrated in **9.4.2** or **9.4.3** as appropriate; and

d) lead to a final exit or common stair that can be approached from the dwelling directly or via a protected stair, external stair, access corridor, balcony, deck or flat roof.

The internal arrangement of any dwelling having an alternative exit should be such that access is possible from all habitable rooms either to the main entrance or to the alternative exit. Fire-resisting separation should be provided to safeguard the occupants who need to use the alternative exit.

NOTE It is not normally advisable to link balconies or install doors between dwellings to provide escape via a flat roof into an adjoining building.

5.6 Open-plan kitchens

*COMMENTARY ON **5.6***

Where kitchens are not enclosed from the adjoining living area, additional consideration is needed regarding the location of cooking facilities to occupant escape routes, doors to habitable rooms and dwelling final exits. Careful location of the cooking facilities minimises the risks of occupants being trapped in the dwelling by a fast-growing fire.

The wide range of possible dwelling designs makes it impossible for this British Standard to cover every conceivable open plan kitchen layout and its associated fire risk, therefore it deals only with open plan kitchens meeting the recommendations below. A fire engineered approach is needed for open plan kitchens in other dwelling types not listed below, or where open plan kitchens do not meet these criteria.

Where habitable rooms are permitted [see **6.2**c), **6.5.1** and **9.5**] to escape though a living area containing a kitchen, which is not located within a separate enclosure, the following recommendations should be met.

a) All rooms in the dwelling, except for any exclusions as described in BS 9251:2021, should be provided with a sprinkler system conforming to BS 9251:2021.

   NOTE The use of water mist or other types of AWFSS to protect dwellings with open plan kitchens are outside the scope of this standard.

b) The dwelling should be provided with a Category LD1 fire detection and fire alarm system in accordance with BS 5839-6:2019+A1.

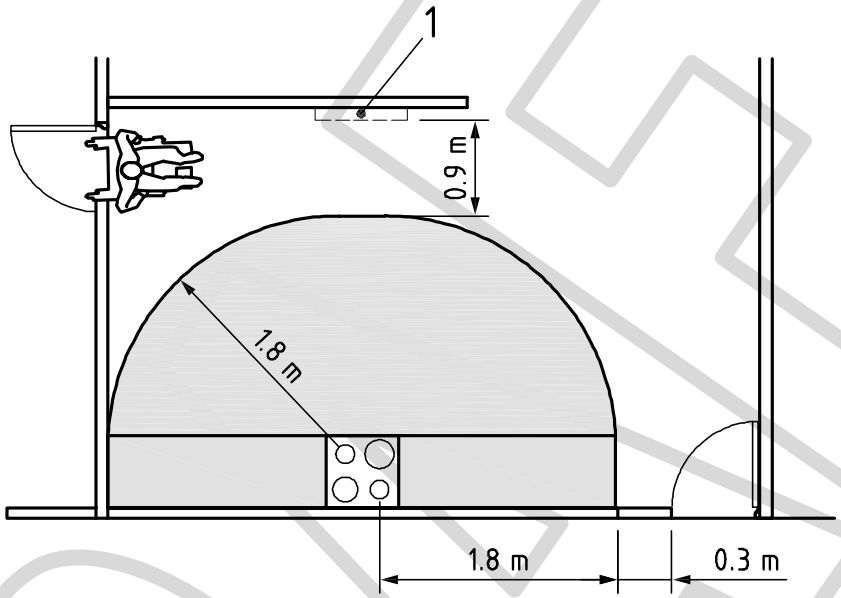
c) All cooking apparatus, with a fixed connection to the dwelling's electricity or gas supply, should be located such that the edge of the cooking apparatus is 1.8 m away from an

escape door, door to an adjoining habitable room or means of escape route to an escape door.

d) All egress routes from habitable rooms to the escape door(s) from the apartment should be not less than 0.9 m in width. No fixed obstructions (such as radiators or cupboards) should be located within the 0.9 m escape route.

e) A gap of 0.3 m should be provided between the leading edge of the door and the 1.8 m zone from the cooking apparatus, to allow people with mobility impairments to access the door hardware.

Figure 1 – Minimum separation distances of cooking facilities from escape routes in an open plan kitchen



Key

1 Obstruction along the escape route (e.g. radiator, furniture, cupboard)

6 Means of escape and provision for rescue from houses

6.1 Single and two-storey houses

NOTE A typical two-storey house would normally have a topmost storey not more than 4.5 m above ground or access level.

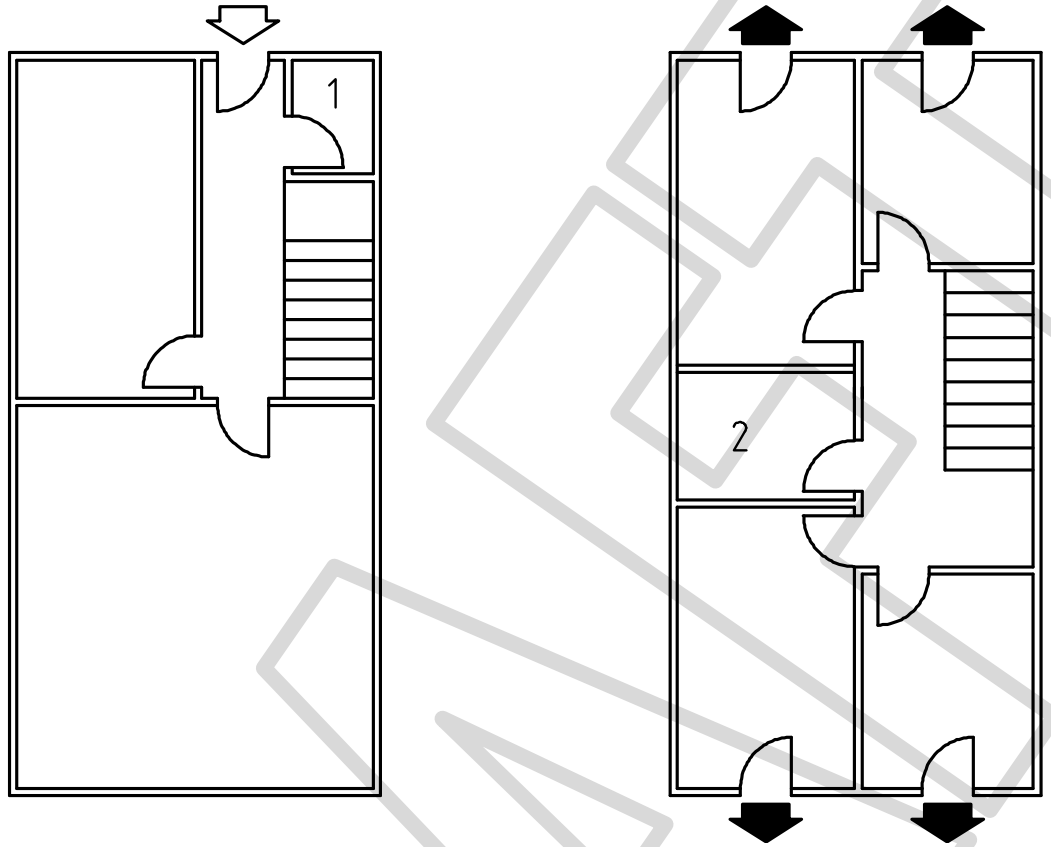
Single and two-storey housing should be provided with at least one route of escape through an exit door which leads to a place of ultimate safety outside the building.

Each escape route should be provided by one of the two following options.

a) Where practicable, a protected escape route should be provided from the habitable rooms direct to the entrance. All accommodation, with the exception of bathrooms, should be separated from the protected escape route by 30 min fire-resisting construction and accessed via FD 30 fire doors.

b) Where it is not practicable to provide a protected escape route, each bedroom should be provided with window egress (see Figure 2).

Figure 2 – Dwelling with alternative exits from each room not on the floor of entrance



Key

1 W.C.

2 Non-habitable room

Entrance to dwelling

Alternative exit from dwelling

*NOTE 1 The entrance and alternative exit doors might need to be fire doors (see **32.1**).*

*NOTE 2 Compartment walls need to be fire-resisting (see **24.2**).*

6.2 Houses with topmost storey more than 4.5 m but not more than 7.5 m

Houses with floors more than 4.5 m, but less than 7.5 m, above ground or access level should meet one of the following recommendations:

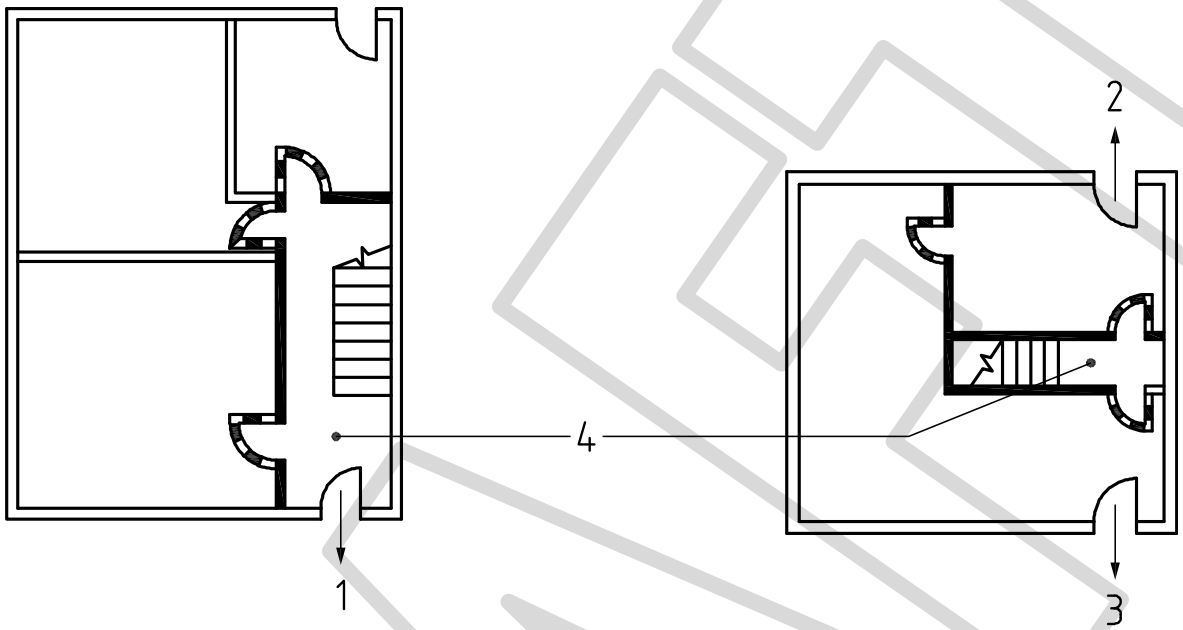
a) all floor levels above 4.5 m from finished floor level should be separated from all other storeys by a minimum of 30 min fire-resisting construction, including a fire rated floor. Each floor above 4.5 m should be provided with an alternative escape route leading to its own final exit; or

b) the internal stairway should be constructed as a protected stairway, connecting the ground and all upper storeys; and either deliver directly to a final exit [see Figure 3a)] or allow access to at least two independent escape routes leading to alternative final exits [see Figure 3b)]; or

c) the house should be fitted throughout with an AWFSS (see **19.2**, Table 4) and a Grade D, Category LD1 fire detection and fire alarm system in accordance with

BS 5839-6:2019+A1, which should be upgraded to Grade C for sheltered housing. Escape windows should be provided from all habitable rooms with floor levels below 4.5 m from ground or external deck level (see **5.2** and Figure 4).

Figure 3 – Alternative arrangements for escape via the access storey in dwellings with internal storeys exceeding 4.5 m in height



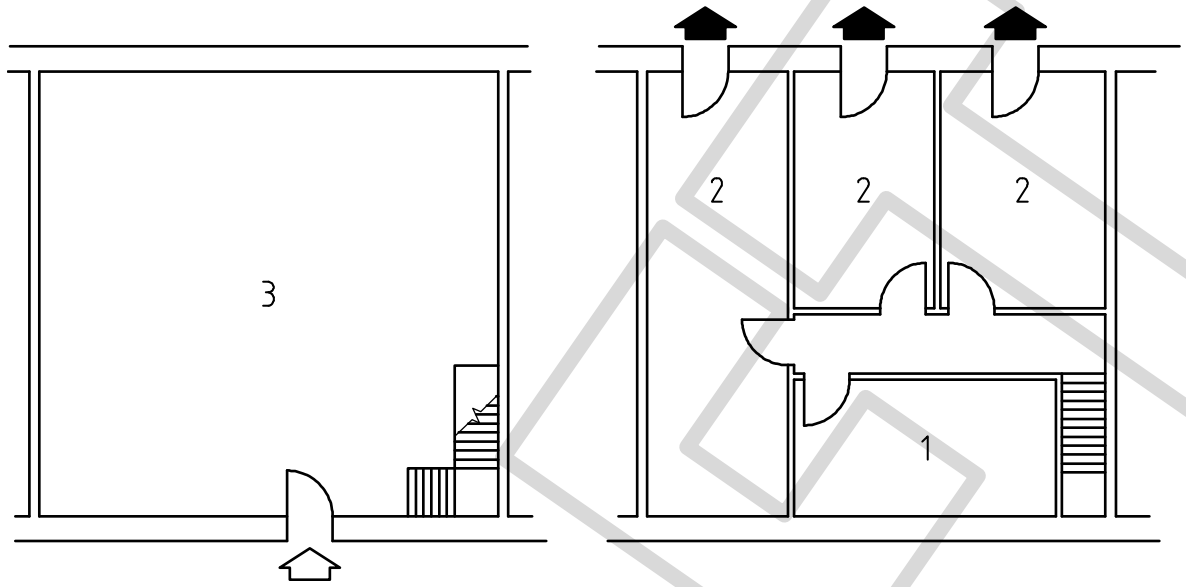
a) Protected stairway delivering directly to the final exit

b) Protected stairway allowing access to two independent escape routes

Key

1 Final exit
2 Final exit 1
3 Final exit 2
4 Protected stairway
30 min fire-resisting construction
FD 30 fire door

Figure 4 – Dwelling with open staircase at access level



Key

1 Bathroom
2 Bedroom
3 Living area

Entrance to dwelling

Alternative exit from dwelling

*NOTE 1 The entrance and alternative exit doors might need to be fire doors (see **32.1**).*

*NOTE 2 Compartment walls need to be fire-resisting (see **24.2**).*

6.3 Houses with a topmost storey higher than 7.5 m above access level

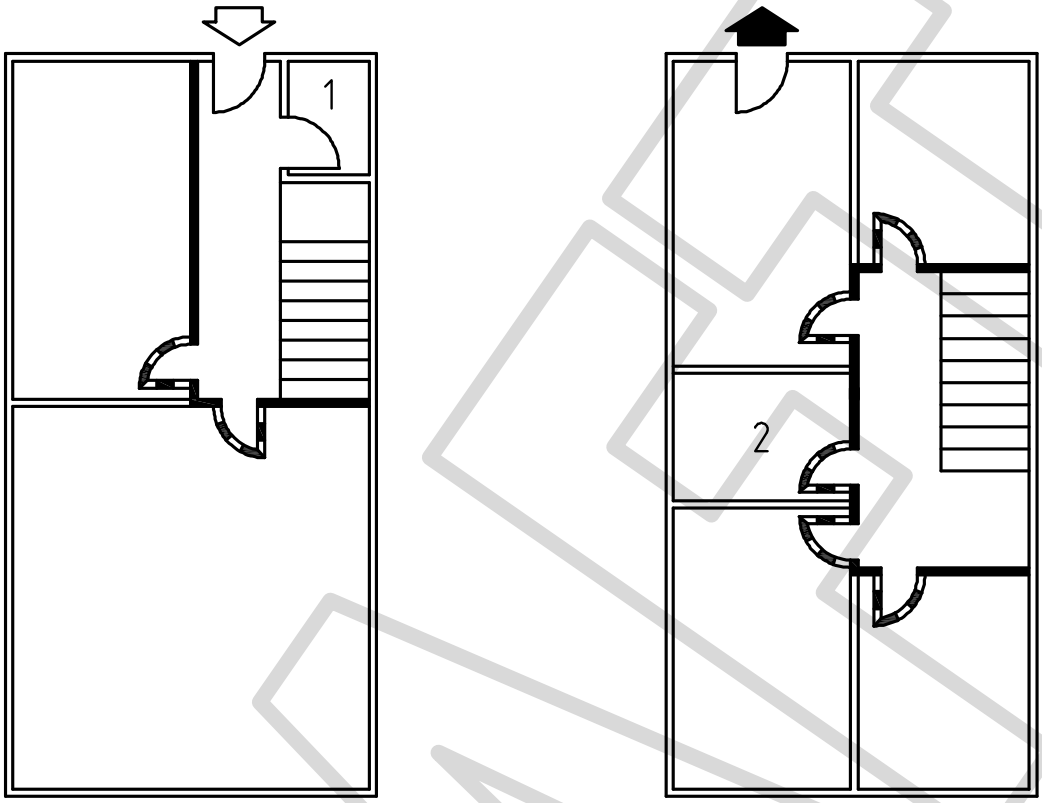
Houses with storeys over 7.5 m above ground or access level should have either:

a) a protected stairway, protected landing and an alternative escape route from each floor level (see Figure 5); or

b) a protected stairway and an AWFSS (see **19.2**, Table 4) fitted throughout the house.

The protected staircase should be constructed with 30 min fire-resisting construction and accessed by FD 30 fire doors.

Figure 5 – Dwellings with protected entrance hall and protected landing



Key

1 W.C.

2 Bathroom

30 min fire-resisting construction

Entrance to dwelling

Alternative exit from dwelling

FD 30 fire door

*NOTE 1 The entrance door might need to be a fire door (see **32.1**).*

NOTE 2 If the partitions between the bathroom and the adjacent rooms have a 30 min fire resistance then the partition between the bathroom and the hall need not be fire-resisting and the bathroom door need not be a fire door.

*NOTE 3 Compartment walls need to be fire-resisting (see **24.2**).*

6.4 Loft conversions

Where a new storey is added by converting an existing roof space, the recommendations given in **6.1** to **6.3** should be met for all floor levels including existing accommodation.

6.5 Basement storeys

*COMMENTARY ON **6.5***

In terms of means of escape, basements are similar to the upper levels of a house, where the further away they are from the entrance level, the greater the risk. Although the recommendations within this British Standard are not designed for external rescue from basements, it is recognized that buildings are safer where rescue might be possible. Basements are unlikely to have windows to facilitate rescue like the upper floors of a house. The measures applied can therefore be treated like the upper floors of a multi-storey dwelling.

*Attention is drawn to the recommendations for firefighting access (**50.1.2** and **50.1.3**) and smoke clearance (**22.4**).*

The ability to provide step-free egress for basements might not be possible. In addition, evacuation upstairs for people with mobility impairments might be much harder, and managers of social or other specialized housing are advised to take this into account as part of any personalized evacuation strategy.

6.5.1 Single basement storeys

The basement storey of a dwelling provided with a single floor level below ground floor level should be provided with either:

a) an alternative escape route; or

b) a protected stairway route via the ground floor leading to a final exit.

In either case, the layout should be in accordance with one of the following recommendations:

1) the total travel distance from any point of the basement to the foot of the stair should be limited to 9 m. Cooking facilities should be sited away from the internal escape route; or

2) a protected internal hallway from which all habitable rooms can be accessed should be provided, having a travel distance not exceeding 9 m from the foot of the protected stair to the door of any habitable room; or

3) all habitable rooms should be accessible from an internal hallway and an alternative exit should be provided from the basement; or

4) a line of fire separation, comprising 30 min fire-resisting construction, should be provided between the living and sleeping areas of the basement, and the basement should have an alternative exit from the bedroom area.

6.5.2 Multi-basement storeys

For dwellings with multiple floor levels below ground floor level, at least one of the following should be provided:

a) an alternative exit from every level below ground. A line of fire separation, comprising 30 min fire-resisting construction, should be provided between the living and sleeping areas of the basement, and the basement should have an alternative exit from the bedroom area; or

b) a protected stairway enclosure serving all habitable rooms and one alternative exit from each basement level; or

c) a protected stairway and a Category LD1 fire detection and fire alarm system in accordance with BS 5839-6:2019+A1. The maximum depth of the basement should be not more than 7.5 m below the entrance to the dwelling; or

d) a protected stairway enclosure and an AWFSS (see **19.2**, Table 4). The travel distance should not exceed 9 m from the foot of the protected stair to the door of any habitable room.

7 Means of escape from buildings containing flats and maisonettes

*COMMENTARY ON CLAUSE **7***

The aim is to ensure that a fire which starts in any one dwelling does not obstruct the escape route of the occupants of any other dwelling. The planning of this part of the escape route depends on the number of common stairs serving the storey, the arrangement of the dwellings within the building and, in particular, the normal method of approach to dwellings having a common access (i.e. by an internal corridor or lobby or an external balcony or deck).

The provisions for means of escape for flats and maisonettes are based on the assumptions that:

- *the fire is likely to occur within a flat or maisonette rather than in the common areas;*
- *there is no reliance solely on external rescue (e.g. by portable ladder);*
- *the building is provided with a high degree of compartmentation and therefore a low probability of fire spread beyond the dwelling of origin, so that simultaneous evacuation of the building is unlikely to be necessary;*
- *although fires might occur in the common parts of the building, the materials and construction in those parts will prevent the fabric from being involved beyond the immediate vicinity; and*
- *escape routes enable a person confronted by an outbreak of fire to make a safe escape without outside assistance.*

If a fire starts in the common areas (whether accidentally or deliberately set), the escape route can become impassable. In such cases occupants need to be able to remain safely inside the building until the fire has been contained or extinguished and it is safe to use the escape route.

*It is expected that designers will review, with the client, building safety manager and/or other relevant organization(s), any additional management requirements, especially with regard to occupant evacuation (see also Section **9**).*

*To facilitate escape, it might be necessary for common escape routes to be safeguarded by some form of smoke control (see Clause **22**).*

The reliance of fire safety on manipulative apparatus, e.g. lowering lines or throw-out ladders, for means of escape, or on external rescue from the lower storeys of a building by the fire and rescue service using mobile ladders, is not acceptable.

7.1 General

Flats or maisonettes that are entered directly from outside the building at ground or access level should be treated as houses, and as such should be provided with means of escape in accordance with Clause **6** rather than Clause **7**.

Means of escape from small buildings should be in accordance with **7.7**.

7.2 Refuges

Where the building is managed using progressive evacuation, the dimensions of protected stairways and corridor zones should provide sufficient refuge space for occupants to await the evacuation lift or further assistance.

NOTE 1 This may include the provision of refuges designed in accordance with BS 9999.

NOTE 2 This might have to include space for more than one wheelchair, depending on the building occupancy.

7.3 Electric wheelchairs and mobility scooters

Provision should be made for the storage and charging points associated with electric wheelchairs and scooters.

Where an area has been designated for storage of electric wheelchairs and scooters within the building, this area should be separated from the means of escape by fire-resisting construction of not less than 30 min. Electric charging points could introduce a fire risk into areas through which occupants might need to make their escape, and as such should not be located in common access corridors or protected stairways.

Where the building is provided with sprinkler protection, this should be extended to the charging areas. The sprinkler protection should be designed in accordance with BS 9251:2021 for a Category 2 system or BS EN 12845:2015+A1 for an OH1 system.

7.4 Onsite management and managed evacuation

Where occupants are not capable of independent evacuation from their flat without external assistance, the following recommendations should be met.

a) Protected stairway enclosures and protected corridor layouts, incorporating fire subdivisions as necessary, should be planned and constructed such that no person would have to travel more than 7.5 m from the flat entrance door along a corridor or lobby before reaching a fire door to either a protected stairway enclosure or another protected corridor zone.

b) Either the internal travel distances within the accommodation should be limited to 9 m, or an alternative exit should be provided that is suitable for the abilities of the occupants.

7.5 Ancillary accommodation

Means of escape from accommodation that is designed to be ancillary to the dwelling use (e.g. parking garages, gyms, lounges) should be in accordance with Section **7**.

7.6 Evacuation using lifts

NOTE BS 8899 provides guidance for the improvement and maintenance of firefighting and evacuation provision in existing lifts.

7.6.1 General

All building users should be able to evacuate from a building as independently as possible.

In all developments, where passenger lifts are installed, at least one lift should be an evacuation lift in accordance with Annex G.

Buildings in excess of 18 m in height should be provided with more than one evacuation lift.

NOTE This is so that if an evacuation lift is out of service (e.g. as a result of breakdown or maintenance), there is at least one that is still available for use.

Where more than one escape staircase serves a single storey, the number and positioning of evacuation lifts provided should be such that if a fire affects access to any one evacuation lift, alternative evacuation lifts will remain available for use.

The enclosure to the evacuation lift, or group of lifts, should be constructed as a protected shaft providing a minimum period of fire resistance not less than that recommended in **24.2.1**, Table 7 or Table 8, as appropriate.

The power supplies to the evacuation lift(s), voice communication system and lighting to both the lift car and lobby should consist of primary and secondary supplies (see Clause **15**), which may be separately provided.

Where evacuation lifts are installed, these should be clearly signed at the evacuation exit floor and information should be made available detailing the locations of the main switch, rescue controls and machinery spaces.

7.6.2 Lift design and operation

The design and operation of evacuation lifts should be in accordance with BS EN 81-20 and Annex G of the present standard.

NOTE 1 Annex G includes recommendations for "driver-assisted evacuation operation" and "automatic evacuation operation". Driver-assisted evacuation is the default method of lift operation for evacuation lifts.

Where the residential building is not provided with 24 h staffing and there might be significant delays in personnel trained to drive the evacuation lift attending site, then driver-assisted evacuation operation should be included and may be supplemented with the recommendations given in Annex G for automatic evacuation operation.

The use of automatic evacuation operation given in Annex G should be limited to sprinkler protected buildings incorporating a stay put strategy, as the population likely to be using the

lifts and the number of floors affected is likely to be low. Buildings without sprinklers and/or incorporating evacuation strategies should be restricted to driver-assisted evacuation only.

Where automatic operation is provided, the means by which the evacuation lifts enter evacuation operation mode (see Annex G) should be determined taking into account the specific configurations of all floors served by the evacuation lifts.

Automatic operation should not be used unless there is a building management system (BMS) in place to:

a) recall the lift (see **G.2.2** and **G.3.2**);

b) provide the automatic evacuation signal (see **G.2.2**); and

c) where landing calls are to be accepted only from priority floor(s) [see **G.3.3.2**b)], signal the priority floor(s) to the lift controller.

The prioritization of landing call in automatic evacuation operation and the interface between the BMS and lift controls should be discussed and agreed between the building designer and lift provider.

A fire detection and fire alarm system covering the lift spaces and lift lobbies should provide the suspend service signal (**G.2.2** and **G.4**).

NOTE 2 The recall of lifts other than firefighters lifts and evacuation lifts to an exit floor and their removal from service is described in BS EN 81-73 and BS 7273-6.

7.6.3 Evacuation lift lobbies

Access to the evacuation lift, or group of lifts, should be provided via a protected evacuation lift lobby. There should be an evacuation lift lobby in front of every lift landing door where evacuation is to take place, with minimum dimensions as shown in Figure 6 or as determined by the evacuation strategy for people with mobility impairments, whichever is larger.

There should be a fire-protected lobby in front of all other lift landing entrances. Where the evacuation lift has dual entrances, no more than one car door should open at one level.

To protect the lift spaces from potential smoke ingress, the evacuation lift lobby should not be directly accessible from any flat, maisonette, storage room or electrical equipment room.

The protected evacuation lift lobby should have direct access to an exit stair at all floor levels above or below the evacuation exit floor. At evacuation exit floor level, the evacuation lift(s) should either exit directly, or discharge via a protected lobby or corridor, to a place of ultimate safety. A lift should not directly enter a stair. If certain conditions are met, a lift may share a corridor or lobby, leading to a place of ultimate safety, which also serves a staircase: for this to be permissible, the protected corridor or lobby should be separated from the protected stair by an FD 30S fire door as a minimum.

The protected evacuation lift lobby should be provided with a period of fire resistance not less than that recommended in **24.2.1**, Table 7 or Table 8, as appropriate. The corridors or lobbies serving the flats or maisonettes should be separated from the evacuation lift lobby by an FD 30S fire door as a minimum.

Where an evacuation lift is one of a group of lifts served by a protected lobby or protected enclosure, all the lifts in the group should be designed as evacuation lifts, with the exception of lifts dedicated solely to firefighting.

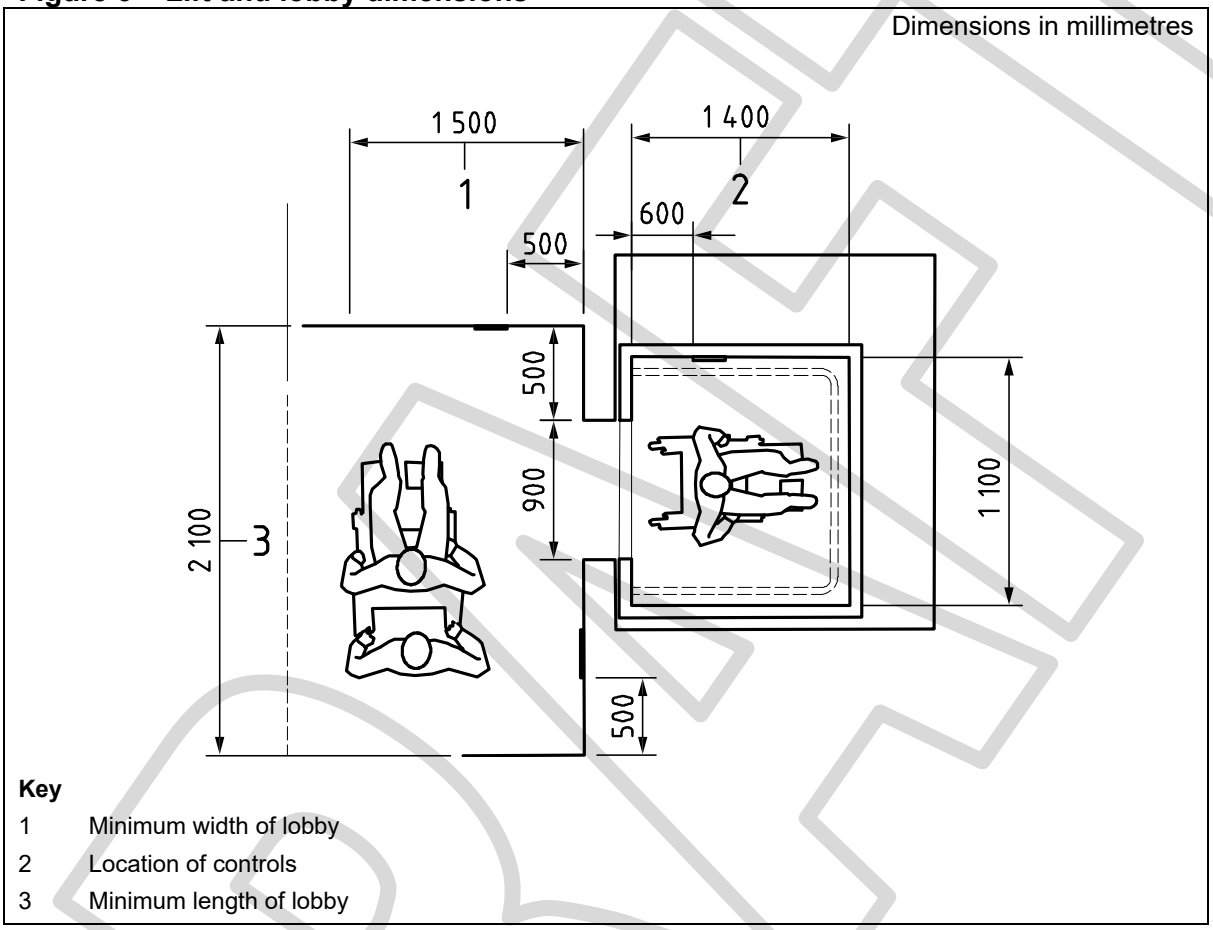
The lift lobby should be provided with an emergency voice communication system in accordance with BS 5839-9. The system should provide a fixed, secure, bidirectional voice communication system to assist people with mobility impairments, building management, firefighters and other first responders. Communication points should be at least 500 mm from any wall (see Figure 6).

*NOTE This communication system is separate from the evacuation lift communication system described in **G.6**.*

Direction to the evacuation lift should be easily identified by a suitable pictogram in accordance with BS EN ISO 7010.

The lift landing/lobby walls and lift door, and the landing floor and lift floor, should contrast visually. A visually contrasting floor surface measuring at least 1 500 mm × 1 500 mm should be provided outside the lift door area.

Figure 6 – Lift and lobby dimensions



7.6.4 Smoke ventilation of evacuation lift lobbies

The protected lobby serving the evacuation lift should be treated as part of the staircase with regard to protection from the egress of smoke. Any smoke ventilation or pressurization designed to protect the staircase should extend the same level of protection to the evacuation lift lobby.

The smoke ventilation system (see Clause **22**) to the adjoining corridors or lobbies serving the flats or maisonettes should not rely on the evacuation lift lobby doors to remain open, or partially open, as part of the system design parameters.

7.6.5 Firefighters lifts and evacuation lifts

The use of firefighters lifts as evacuation lifts should be determined according to the building's evacuation strategy, as follows.

a) For buildings designed with a stay put strategy, firefighters lifts meeting the recommendations in Annex G may be used as evacuation lifts until the lift is recalled using the firefighters lift switch (see **G.2**).

b) For buildings designed with an evacuation strategy other than stay put, firefighters lifts should not be used as evacuation lifts, as they might be in operational use by the

attending firefighters. In these circumstances, separate dedicated evacuation lifts should be provided.

Where dedicated evacuation lifts are located within lobbies containing firefighters lifts, there should be a means to minimize the effect of water penetration into the evacuation lift wells in addition to the firefighters lift wells (see **50.3.2.2**).

7.7 Escape from small buildings

Where a building does not have a storey at a height greater than 11 m, has no more than three storeys above the ground storey and has a single stair, the following recommendations should be met.

a) Escape routes should be provided with a travel distance not more than 4.5 m in accordance with Figure 7, except where the lobby is provided with an AOV with an area of at least 1.5 m^2. In the latter case, the travel distance should be not more than 7.5 m. AWFSS should not be used to increase the travel distance where no automatic ventilation is provided.

   NOTE 1 The openable vents to the stairway, as shown in Figure 7, may be replaced by a remotely openable vent over the stair.

b) If the stair connects to a covered car park at ground level or above, the car park should be separated from the stair by a protected, ventilated lobby (see **22.3.4**).

c) The stair should not serve ancillary accommodation unless the ancillary accommodation is separated from the stair by a protected lobby or corridor that is either:

   1) provided with permanent ventilation of not less than 0.4 m^2 for the control of smoke (see **22.3.4**); or

   2) protected by a mechanical smoke ventilation system.

d) Either:

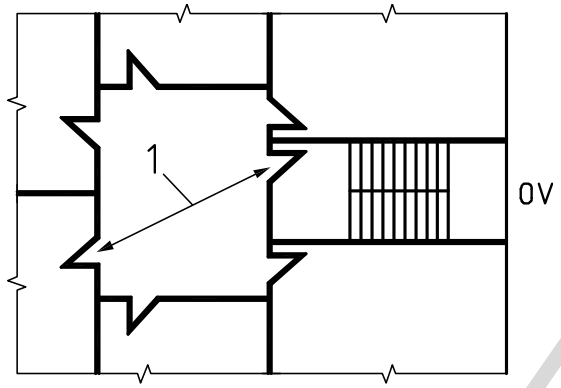
   1) a high-level openable vent should be provided at each floor level within the staircase enclosure with a minimum free area of 1 m^2; or

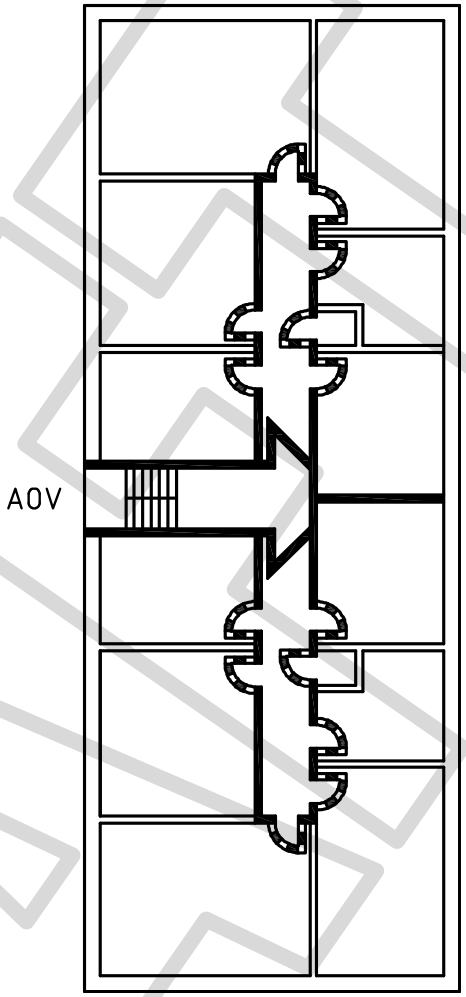
   2) a single openable vent which can be remotely operated from fire and rescue service access level should be provided at the head of the stair; or

   3) an AOV should be provided at the head of the stair.

*NOTE 2 Recommendations for connection to basement levels are given in Clause **13**.*

Figure 7 – Common escape routes in small single-stair buildings





a) Small single-stair building (see Notes)

b) Small building of not more than two dwellings per storey and protected internal entrance halls

Key

1	Maximum travel distance 4.5 m
AOV	Automatic opening vent (1.0 m^2 minimum)
OV	Openable vent for fire and rescue service use (1.0 m^2 minimum)
	FD 30 fire door
	Self-closing FD 30S fire door (double swing)
	Self-closing FD 30S fire door
	Fire-resisting construction

7.8 Escape via communal corridors or lobbies

For all buildings containing flats and maisonettes, other than small buildings as described in **7.7**, where occupants access and exit their apartment into a common corridor or lobby, the design of the corridor should prevent exposure of escaping occupants to smoke and heat in the internal corridor or lobby. This should be achieved by either:

a) limiting the travel distance between the exit doors from the dwellings and an adjoining smoke-free area, and keeping the amount of smoke and other combustion products in the internal corridor or lobby to a minimum by providing cross-corridor fire doors and either natural or a mechanical smoke ventilation system; or

*NOTE 1 Recommendations for smoke control are given in Clause **22**.*

b) providing an independent alternative escape route (see **5.6**) from each dwelling, accessed from the communal corridor or lobby. Smoke ventilation, cross-corridor doors and smoke ventilation in the corridor should still be provided (see Figure 7), but the travel distance in the corridor to the nearest escape staircase may be increased to 30 m.

*NOTE 2 The limitation on travel distance within communal corridors and lobbies is intended to reduce the time it takes occupants to escape and to reduce their potential exposure to fire and smoke. Acceptable travel distances are based on the number of staircases available to the occupants, the provision of sprinklers (see Clause **19**) and the type of smoke ventilation system provided (see Clause **22** and Annex A).*

Travel distances should be in accordance with Figure 8 where a single stair is provided and Figure 9 where escape is possible via more than one staircase.

Where travel distances are measured from the dwelling to an unventilated lobby, the lobby should not access anything other than:

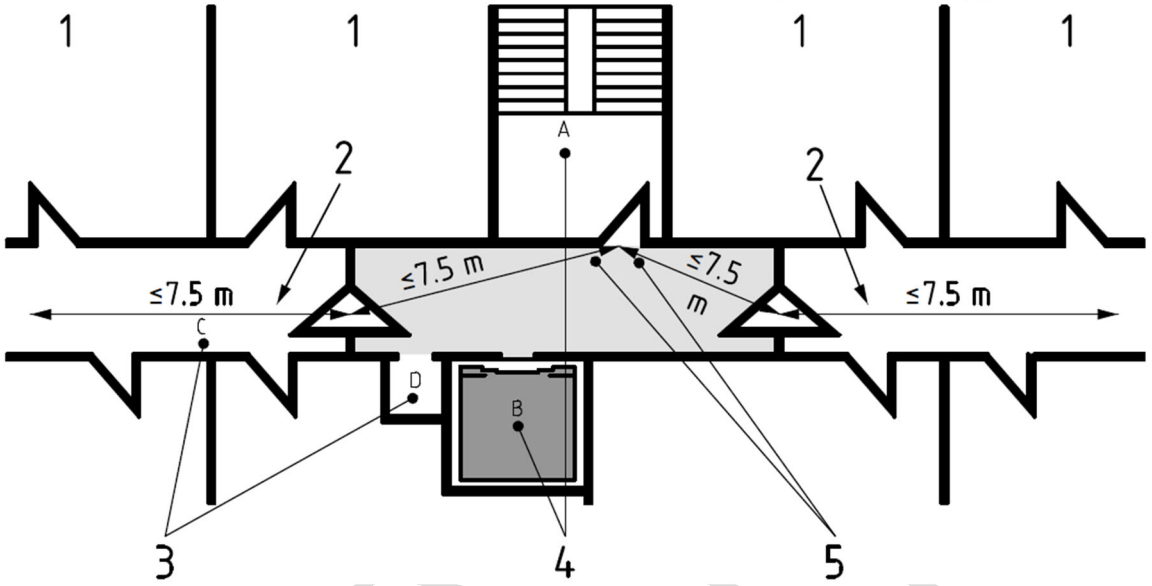
1) the staircase;
2) the lifts;
3) the adjoining ventilated corridor; and
4) service risers (unless those services risers contain motors, distribution boards, pumps or other equipment).

Where travel distance is measured to a stair lobby door, the lobby should not directly connect with any dwelling, storage space or any other space containing a potential fire hazard.

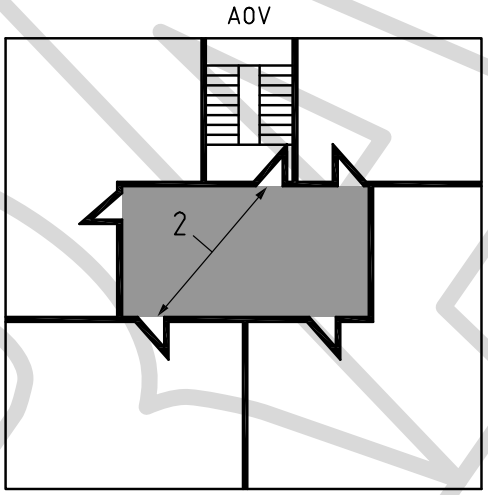
Where a firefighters lift is required, it should be sited not more than 7.5 m from the door to the stair.

Sprinkler systems used to permit extended travel distances should be in accordance with BS 9251:2021 or BS EN 12845:2015+A1 (see **19.2**, Table 4).

Figure 8 – Common escape routes in single-stair buildings with a floor level more than 11 m above ground and not more than 18 m



a) Dwellings with corridor access



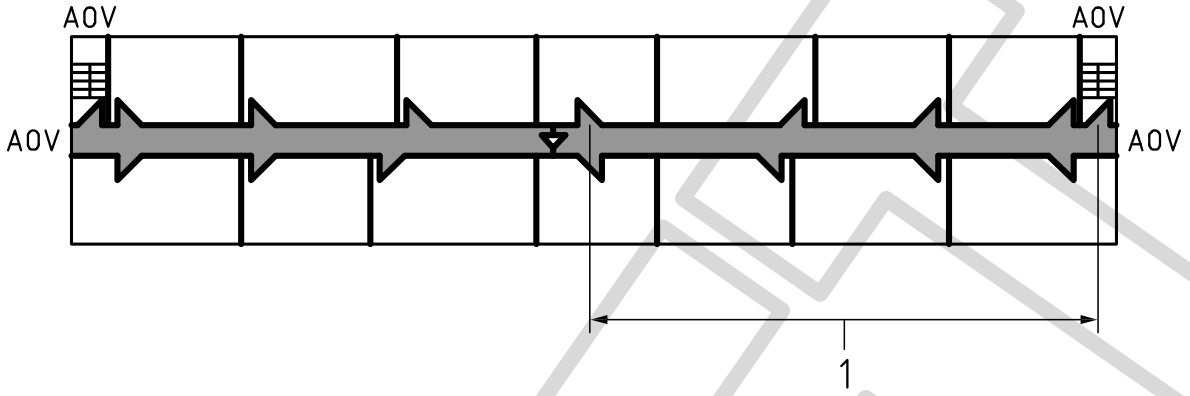
b) Dwellings with lobby access

Key

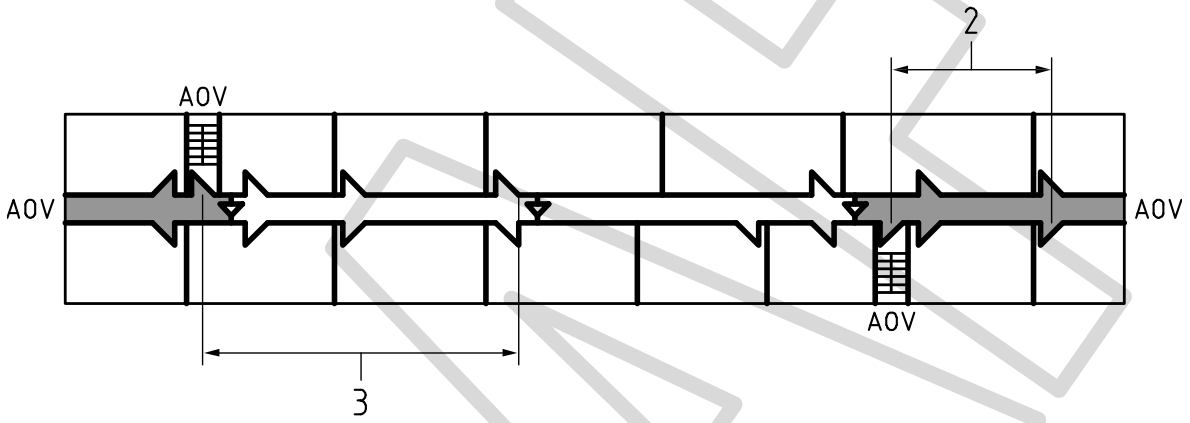
1	Dwelling		
2	Maximum travel distance 7.5 m (max. 15 m if sprinklers are fitted)		
3	Lobby access to corridors (C) and service risers (D) only		
4	Lobby serving the stairwell (A) and lifts (B) only		
5	Travel distances should be as short as possible and should not exceed 7.5 m in any situation		
AOV	Automatic opening vent (1.0 m^2 min.)		Self-closing FD 30S fire door
	Fire-resisting construction		Area requiring a smoke control system

NOTE The arrangements shown in a) and b) also apply to the top storey.

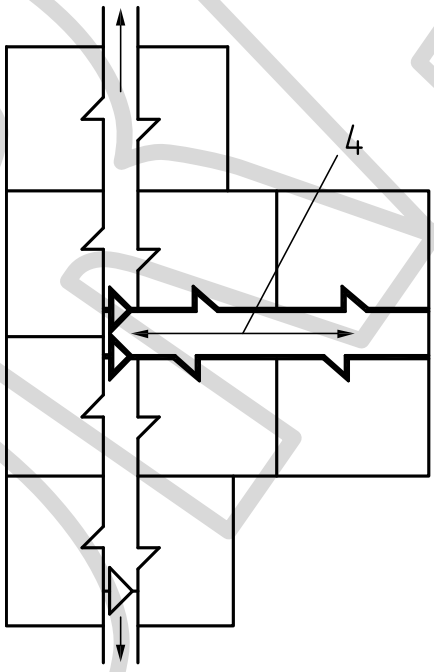
Figure 9 – Common escape routes in multi-stair buildings



a) Dwellings with corridor access and without dead ends



b) Dwellings with corridor access and with dead ends (see Note 1)



c) T junction with main corridor

Figure 9 – Common escape routes in multi-stair buildings

Key

1	Maximum travel distance 30 m (max. 60 m if sprinklers are fitted; see **19.2**)	AOV	Automatic opening vent (1.5 m^2 minimum)
2	Maximum travel distance 7.5 m (max. 15 m if sprinklers are fitted; see **19.2**)		Self-closing FD 30S fire door (can be swung in either direction)
3	Maximum travel distance 30 m		Self-closing FD 30S fire door
4	Maximum travel distance 7.5 m		Area requiring a smoke control system

NOTE 1 The central fire door may be omitted where the maximum travel distance does not exceed 15 m.

NOTE 2 The openable vents to the stairway may be replaced by an openable vent over the stair.

NOTE 3 The arrangements shown also apply to the top storey.

7.9 Escape routes from flats and maisonettes with balcony approach or deck approach

*COMMENTARY ON **7.9***

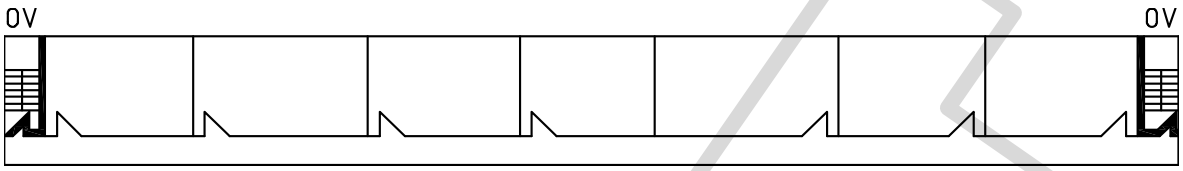
In general, there is little risk of a balcony or deck becoming smoke-logged and there is thus no need to impose a limitation on the travel distance from the dwelling entrance to the stairway. Where an approach is via a balcony or deck having a width of more than 2 m, or via a balcony that is adjoined to the building wall only where there is an entrance to a flat or maisonette, there is a risk that the balconies might become smoke-logged both laterally along the balcony and upon levels above.

The recommendations in this subclause are suitable only where the balcony is directly approached via a staircase, or a lobby serving a staircase and lifts only, with no other accommodation accessed directly off the lobby. Designs where the means of escape are provided via a ventilated or unventilated corridor, which then opens onto a balcony, are outside the scope of BS 9991 and require a fire engineering solution (e.g. using BS 7974).

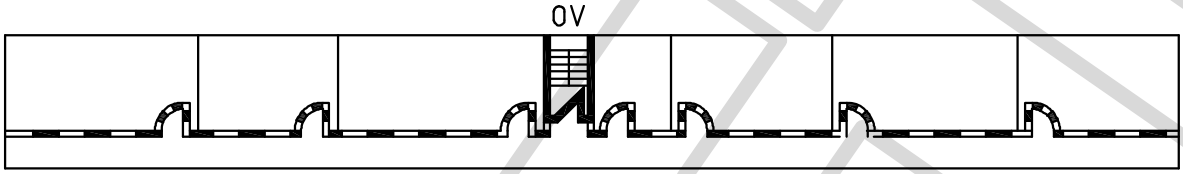
In planning balcony and deck approaches, account should be taken of the needs of the fire and rescue service, such as the distance between the nearest connection to a fire main and the flat or maisonette (see **50.1.3** and **51.1**).

In order to avoid impediment to means of escape, storage facilities should not be provided on or within the balcony or deck approach.

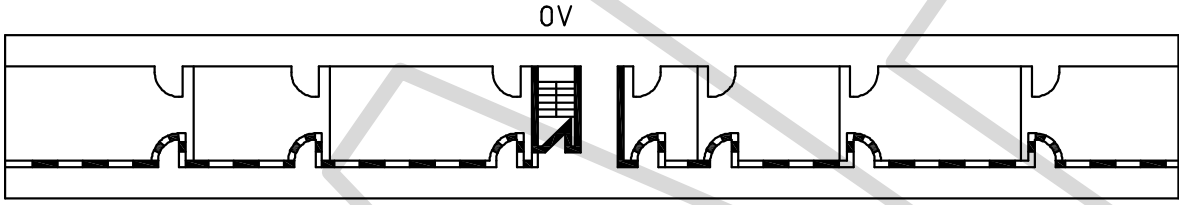
Figure 10 – Common escape routes in balcony/deck approach buildings



a) Multi-stair building



b) Single-stair building



c) Single-stair building with an alternative exit from every dwelling

Key

OV Openable vent for fire and rescue service use from the top storey (1.0 m^2 minimum)

Fire-resisting construction

Fire-resisting construction up to a height of 1.1 m above deck level

Self-closing FD 30 fire door

Self-closing FD 30S fire door

NOTE 1 Although there are no limitations on travel distance, all parts of the building need to be within 45 m of a fire main, measured along a line on which hose can be laid.

NOTE 2 The openable vents to the stairway may be replaced by an openable vent over the stair with remote operation.

Balconies and decks (see Figure 10) should meet the following recommendations.

a) The structure, including the floor, should be protected by 30 min fire-resisting construction (integrity and insulation). For buildings of any height, balconies should be constructed of class A2-s1, d0 or better materials.

b) The walking surface should be imperforate (i.e. there should be no holes or perforations in the structure so that users are protected from the effects of heat or smoke from below).

c) The sectional profile should be such that any fire plume breaking out of a flat or maisonette is directed upwards and outward, and should be arranged such that that smoke does not leak laterally along the balcony ceiling. Soffits should be flat with no edge downstand, or other feature, that would obstruct the outwards plume flow. Where the balcony has a width of more than 2 m, downstands at 90° to the face of the building should be placed on the line of separation between individual flats or maisonettes. These should project 0.3 m to 0.6 m below the soffit or any other downstand, or should be determined by calculation.

d) Balconies should be as open-fronted as possible to allow for the dispersal of smoke originating in a flat or maisonette. The opening for smoke ventilation should be vertically open between the balcony balustrade at 1.1 m and the soffit of the balcony above. Horizontally, such openings should provide more than 50% of the total balcony length and should be positioned so as to correspond with openings in the flat wall.

NOTE 1 Suitable calculations are given in the BS 7346 series and PD 7974-2.

e) Where the balcony or deck is adjoined to the building wall only at the place where there is an entrance to a flat or maisonette, unless it is a minimum of 1.8 m away from the face of the building, it should, in the case of single direction escape routes, be proven by calculation that the escape route is not subjected to hazardous exposure levels or smoke-logging.

NOTE 2 Suitable calculations are given in the BS 7346 series and BRE Report 368 [20].

f) Balconies providing a single direction of escape [see Figure 10b)] should be further safeguarded by the following provisions.

1) The face of the building (excluding window openings) should provide at least 30 min fire resistance.

2) Doors opening onto the balcony should be FD 30 self-closing doors.

3) Window openings should not extend below a height of 1.1 m above the deck level.

4) The external balustrade should be continuous without gaps between adjacent sections and between the balustrade infill and the supports, using infill materials that are imperforate.

5) Window glazing and fixed external glazing panels should not extend below a height of 1.1 m above deck level and should not include penetrations through the glass (such as extraction fans).

g) The length of balconies should be such that no point in any flat or maisonette exceeds the hose-laying distance limitation (see **50.1.2** and **50.2.2**) from a rising main landing valve or the approach position of a fire appliance, measured along the firefighting route of access.

8 Means of escape from residential care

*COMMENTARY ON CLAUSE **8***

This clause applies solely to residential care facilities registered with the Care Quality Commission (England), Care Inspectorate Wales, Care Inspectorate (Scotland) and Regulation and Quality Improvement Authority (Northern Ireland). Attention is drawn to any additional guidance and statutory requirements imposed by each registration and inspection authority.

*This clause is not intended be used for accommodation that is not required to be registered with the appropriate registration and inspection authority. For any buildings that do not fall into this category, recommendations for means of escape are given in Clause **5**, Clause **6** and Clause **7,** as appropriate to the type of building.*

For the purposes of means of escape, three categories of dependency are used. The term "dependency" relates to resident's ability to understand and physically respond to a warning of fire.

a) Low dependency describes residents who have the physical and mental capability to respond to a fire emergency and leave the premises without staff assistance.

b) Medium dependency describes residents who either:

1) require physical assistance or guidance from a staff member to respond appropriately in a fire emergency; or

2) can exit to a place of relative safety or direct to the outside unaided but take an extended time to achieve this.

c) High dependency describes residents who are totally dependent on staff and might require the assistance of two or more staff members to evacuate the compartment, sub-compartment or premises, and to manage their movements once evacuated to prevent their possible movement back into areas of risk.

Residents can have varying levels of dependency, and their mobility and responsiveness need to be taken into account. Requirements can vary over time as the mental and physical capability of residents change. Factors affecting an individual's ability to evacuate include being asleep, lucidity, familiarity with surroundings or medication. Management levels and staff availability also change throughout a 24 h period, which can also affect the evacuation strategy.

8.1 General

The personal evacuation requirements of residents of care facilities should be determined as part of the building evacuation strategy. A fire safety design review (**53.2**) should be undertaken with all relevant parties, including the residential care facility operator.

One of the following should be provided as a place of relative safety:

a) a separate sub-compartment enclosed in 30 min fire-resisting construction; or

b) a separate compartment enclosed in 60 min fire-resisting construction; or

c) a refuge in an escape stairway or lift lobby that is enclosed in 30 min fire-resisting construction.

The place of relative safety should be sufficiently large enough to accommodate the number of residents who could reasonably be expected to be in both the compartment, sub-compartment, zone or area evacuated, and the place of relative safety, if occupied. Each sub-compartment should be provided with at least two exits, each of which should be:

1) direct to the outside; or

2) into a staircase; or

3) to an adjoining but separate compartment or sub-compartment.

Fire detection and fire alarm systems should be in accordance with Clause **10**, sprinkler systems with Clause **19**, and smoke ventilation with Clause **22**.

8.2 Coordination between designers and interested parties

A fire safety design review meeting should be held to enable persons who are responsible for operating and controlling the premises, as well as other interested parties, to be involved in the design process.

NOTE Membership of the fire safety design review meeting can include:

- *architect;*
- *relevant members of the design team (e.g. services engineer, fire engineer, security consultant);*
- *operational management;*
- *relevant fire authority;*
- *approvals body (e.g. building control or approved inspector);*
- *insurers;*

- *building contractor; and*
- *any other stakeholder who might impact or be impacted by the project.*

The fire safety design review(s) should be carried out as early as possible in the design process so that any substantial findings can be incorporated into the design of the building before working drawings or construction. It should then be repeated as necessary, as the design process moves from concept to detail design.

The fire safety design review(s) should include the following factors.

a) Review of architectural design and selection of materials. This should include factors such as the number of escape routes and the proposed evacuation strategy.

b) Identification of people at risk. The designers and interested parties should review the assumptions made regarding persons who will be at risk if a fire occurs within or in the vicinity of the premises. The number, characteristics and location of occupants, residents, staff and other persons who frequent the premises should be identified. The design should include any necessary measures to facilitate the evacuation of people who require assistance, taking into account their familiarity with the premises.

c) Identification of risks related to a fire. The risk in the premises should be evaluated so that a judgement can be made on the adequacy of the proposed fire safety measures and the impact or assumptions on management. Risk should be evaluated both in regard to the likelihood that a fire might occur, and the potential for a fire to cause death, injury, or other negative consequences such as property damage.

d) Restrictions on the design. The potential limitations and impact of likely alterations (e.g. a change in the number of people present, the characteristics or dependency of the occupants or fire loading) should be taken into account.

The findings of the co-ordination review should be recorded, including any action taken or action still to be taken, and provided as part of the fire safety information provided to the building occupier.

8.3 Evacuation strategies

*COMMENTARY ON **8.3***

The two evacuation strategies provided in this standard are:

- *simultaneous evacuation: evacuation of all residents and staff to a place of safety outside of the building, immediately on activation of the evacuation signal of the fire alarm; and*
- *progressive evacuation: evacuation of residents from areas of risk to an adjoining place of relative safety, such as a sub-compartment or compartment.*

*Simultaneous evacuation strategies are generally suitable for low dependency residents. Residential and non-residential accommodation within the same building might have the same or different evacuation strategies, depending on the outcome of the fire safety design review (**8.2**).*

The evacuation strategy should be determined taking into account:

a) the dependency of the residents;

b) the level of management and staffing numbers;

c) the potential impact of adverse weather conditions if residents are evacuated outside the building; and

d) security considerations.

The location of a safe assembly point and management of residents' movements should be included as part of the fire safety design review (**8.2**).

8.4 Means of escape from non-residential accommodation

NOTE A variety of non-residential facilities can be provided in residential care premises.

For non-residential or communal facilities within residential care premises, where the occupancy of any room is designed for more than 60 persons, the means of escape should be designed in accordance with BS 9999.

Where the occupancy is designed for 60 persons or fewer, the means of escape should be designed in accordance with BS 9991.

8.5 Means of escape from residential accommodation

8.5.1 General

Irrespective of evacuation strategy, all residential care premises should have at least two independent escape routes from any floor level, to provide both means of escape and facilitate multiple access points for the fire and rescue service.

8.5.2 Progressive horizontal evacuation

Where a progressive evacuation strategy is in place, each residential compartment should be subdivided into at least two sub-compartments. Where a storey exceeds 1 500 m^2 in area, it should be subdivided into two or more compartments, each of which should not exceed 1 500 m^2 in area.

No sub-compartment should exceed 750 m^2 in area. Each sub-compartment should have at least two exits, with escape direct to the outside, or into a staircase, as well as an escape into an adjoining sub-compartment.

Means of escape should be designed such that occupants can be evacuated either outside the building, or to the corridor or designated communal room(s) in the adjoining sub-compartment or compartments. The corridor or designated communal room, as appropriate, should be sized such it is able to accommodate the maximum populations of both the sub-compartment and the largest adjoining sub-compartment, based on an occupancy density of 2 m^2 per person.

Where a storey comprises several compartments, each compartment should be able to accommodate the maximum populations of both that compartment and the largest adjoining compartment within the corridors or designated communal rooms, using an occupancy density of 2 m^2 per person.

Bedrooms should not be used as part of the holding space in the adjoining compartment or sub-compartment. In general, predominantly non-sleeping sub-compartments should not be evacuated into sleeping compartments. Where this arrangement is unavoidable, the availability of space (including furnishings) to hold residents in the adjoining corridors, and any locking arrangements, should be taken into account in the design. The evacuation of residents into non-sleeping accommodation should take into account any hazards (e.g. cooking facilities) which might be present in the sub-compartment.

8.5.3 Travel distances

Travel distances within residential compartments and sub-compartments, measured from the furthest point in the room or bedroom, should be not more than the distances given in Table 2.

Table 2 – Maximum travel distances in residential care premises

Dependency	Single direction distance (m)	Multiple direction distance (m)
High	12	25
Medium	15	32
Low	15	32

Travel distances should be measured either:

a) to a place of relative safety (direct to outside or staircase), for buildings with a simultaneous evacuation strategy; or

b) into an adjoining compartment or sub-compartment, for buildings with a progressive evacuation strategy.

8.5.4 Escape widths

All corridors used for evacuation should be not less than 1 200 mm in width.

All doors should be not less than 850 mm in width, so as to be accessible by wheelchairs. Where double doors are provided, the width of one of the doors should be not less than 850 mm.

8.5.5 Furnished areas in communal corridors

If there is no onsite management control, furnishings should not be provided in common areas.

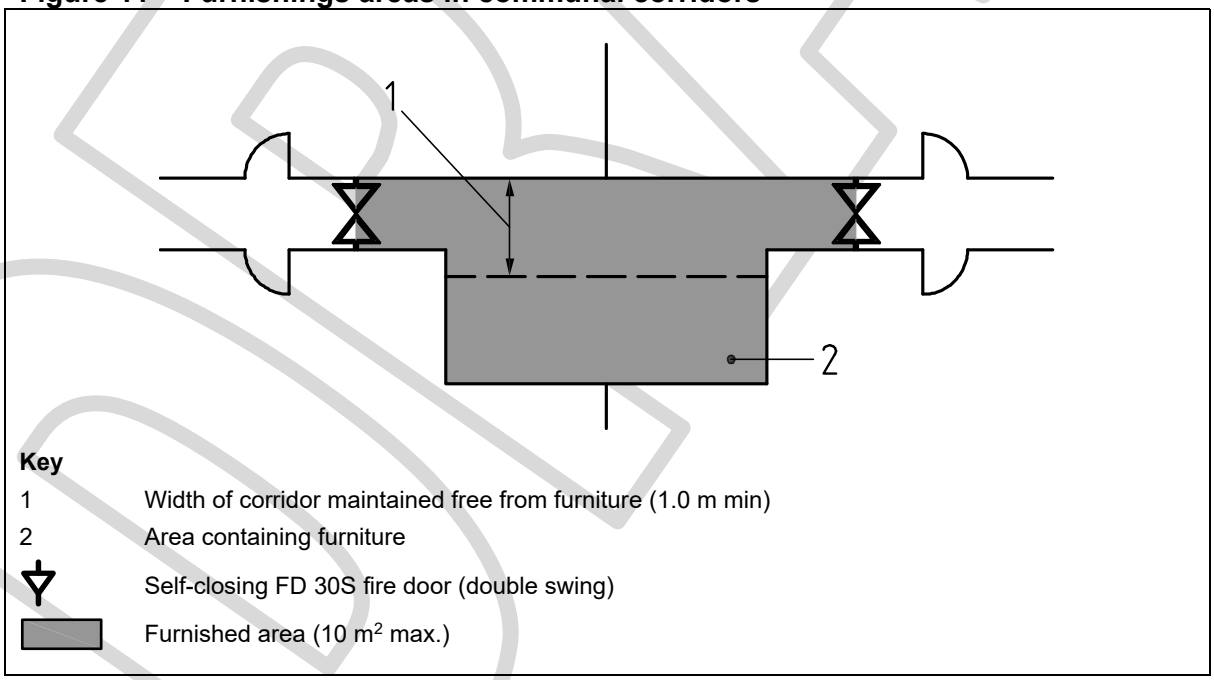
NOTE Furniture may be provided within common corridors where there is onsite management control.

Furniture should not be provided anywhere in dead-end corridors, or where escape is possible in only a single direction, due to the risks of occupants being trapped in a fire.

Furnished areas should be designed in accordance with Figure 11. The furnished areas should be provided with AWFSS protection designed in accordance with the guidance given in BS 9251:2021 for a Category 2 system or BS EN 12845:2015+A1 for an OH1 system.

Where furniture is provided in communal areas, it should conform to the medium hazard resistance to ignition classification specified in BS 7176. Curtains in communal areas should meet the performance requirements for classification as Type B or Type C when tested in accordance with BS 5867-2:2008.

Figure 11 – Furnishings areas in communal corridors



8.5.6 Vertical means of escape

All stairs used for evacuation should be not less than 1 200 mm in width.

Where the population using a staircase is in excess of 60 persons, the escape capacity should be calculated using the methodology given in BS 9999.

Where the evacuation strategy includes the use of lifts, the recommendations in **7.6** should be met.

Where the evacuation strategy for visitors or staff areas includes the provision of refuges, the refuges should be in accordance with BS 9999.

Windows should not be used as a means of providing alternative means of escape.

8.6 Basements

Basements should not be used for sleeping accommodation or residents' facilities such as common rooms, lounges, dining areas.

8.7 Additional fire separation in residential care

All corridors serving bedrooms and sleeping accommodation, including staff rest areas, should be protected corridors.

All doors and walls forming the corridor, including walls and doors to non-sleeping risk rooms, should be provided with not less than 30 min fire-resisting construction. The doors should be a minimum of FD 30S and self-closing.

All corridors greater than 12 m between exits should be subdivided by 30 min fire-resisting construction and an FD 30S self-closing fire door.

The following rooms should also be provided with 30 min fire-resisting construction and accessed by FD 30S self-closing fire doors:

a) storage rooms and cupboards;

b) smoking rooms;

c) staff changing and locker rooms;

d) kitchens and laundry rooms;

e) disposal/refuse rooms;

f) day/living rooms; and

g) bathrooms where provided with electrically powered facilities such as hoists.

Arrangements for storage or charging of electric wheelchairs and scooters within the building should be in accordance with **7.3**.

9 Internal planning of flats and maisonettes

*COMMENTARY ON CLAUSE **9***

This clause is concerned with the safety of occupants within their dwellings. The aim is to prevent a fire that starts in a dwelling from prejudicing the escape of the occupants of that dwelling. The recommendations for the internal planning of a dwelling depend on whether it is a flat or maisonette, its size, whether it is situated at or close to ground level and whether it has an independent final exit.

There are several ways of providing safe escape routes:

- *by providing an alternative exit;*
- *by designing the escape route from any habitable room to be by way of a protected entrance hall within which no likely source of fire exists, and within which the travel distance is limited; or*
- *by limiting the travel distance from any point in the flat to the flat entrance door.*

These constraints are unnecessary in the case of ground floor flats entered from outside the building and for flats situated above the ground floor provided with their own external entrance at ground level. Similar considerations apply to flats entered from a podium deck.

9.1 General

Cooking facilities in open-plan flats or maisonettes should be located in such a way that they do not prevent escape if they are involved in a fire (see **5.6**).

Flats or maisonettes having an independent external entrance at ground or access level should be treated in the same way as those having corridor or lobby access.

9.2 Basement flats

Any habitable room in a basement flat should not be an inner room, unless the room is provided with an alternative means of escape.

*NOTE Basement flats can be open-plan flats (see **9.5**).*

Basement flats with multiple floor levels should meet the recommendations in **6.5.2**.

9.3 Flats situated not more than 4.5 m above ground or access level

Flats not more than 4.5 m above ground or access level should be in accordance with:

a) subclause **6.1** for single and two-storey houses; or

b) subclause **9.4.3** or **9.4.3** for flats located more than 4.5 m above ground level; or

c) subclause **9.5** for open-plan apartments or apartments where any habitable room is an inner room.

9.4 Flats situated more than 4.5 m above ground or access level

9.4.1 General

Flats that are situated more than 4.5 m above the ground or access level should be in accordance with **9.4.2** or **9.4.3**, as applicable.

9.4.2 Flats entered on the same level as the flat

Flats having an entrance on the same level as the flat should meet one of the following recommendations:

a) the total travel distance from any point of the flat to the entrance door of the flat should be limited to 9 m [see Figure 12a and Figure 12b)]; or

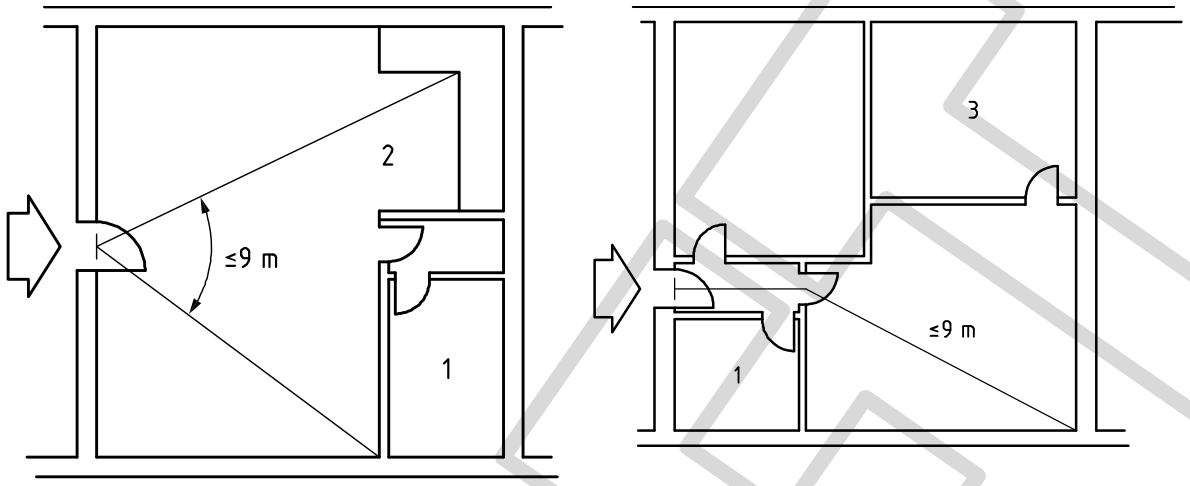
b) a protected internal hallway should be provided that leads off to all habitable rooms having a travel distance not exceeding 9 m from the flat entrance door to the door of any habitable room (see Figure 13); or

c) the flat should meet the guidance for open plan flats given in **9.5**; or

d) all habitable rooms should be accessible from an internal hallway and have an alternative exit from the flat [see Figure 14a)]; or

e) a 30 min fire-resisting construction should be provided between the living and sleeping areas of the flat, and an alternative exit from the bedroom area should also be provided [see Figure 14b)].

Figure 12 – Flat with restricted travel distance



a) Open-plan flat (studio)

b) Flat with separate habitable rooms

Key

1 Bathroom

2 Kitchen area

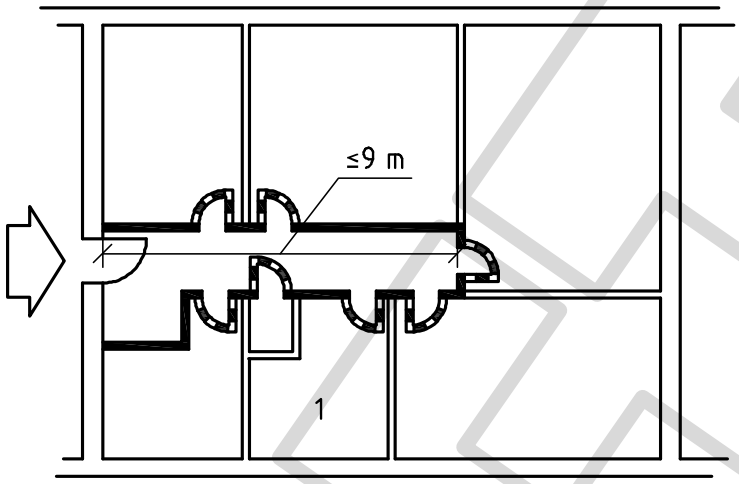
3 Kitchen

Entrance to dwelling

*NOTE 1 The entrance door might need to be a fire door (see **32.1**).*

*NOTE 2 Compartment walls need to be fire-resisting (see **24.2**).*

Figure 13 – Flat with a protected entrance hall and restricted travel distance



Key

1 Bathroom

30 min fire-resisting construction

FD 30 fire door

Entrance to dwelling

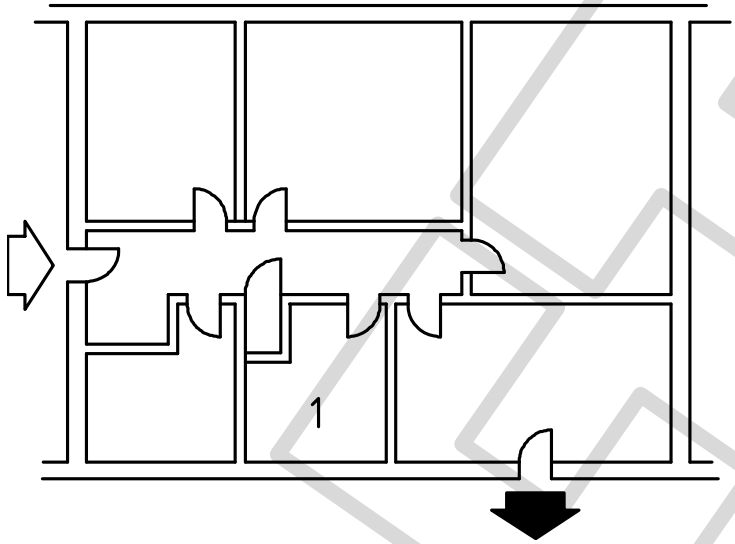
*NOTE 1 The entrance door might need to be a fire door (see **32.1**).*

NOTE 2 If the partitions between the bathroom and the adjacent rooms have a 30 min fire resistance then the partition between the bathroom and the hall need not be fire-resisting and the bathroom door need not be a fire door.

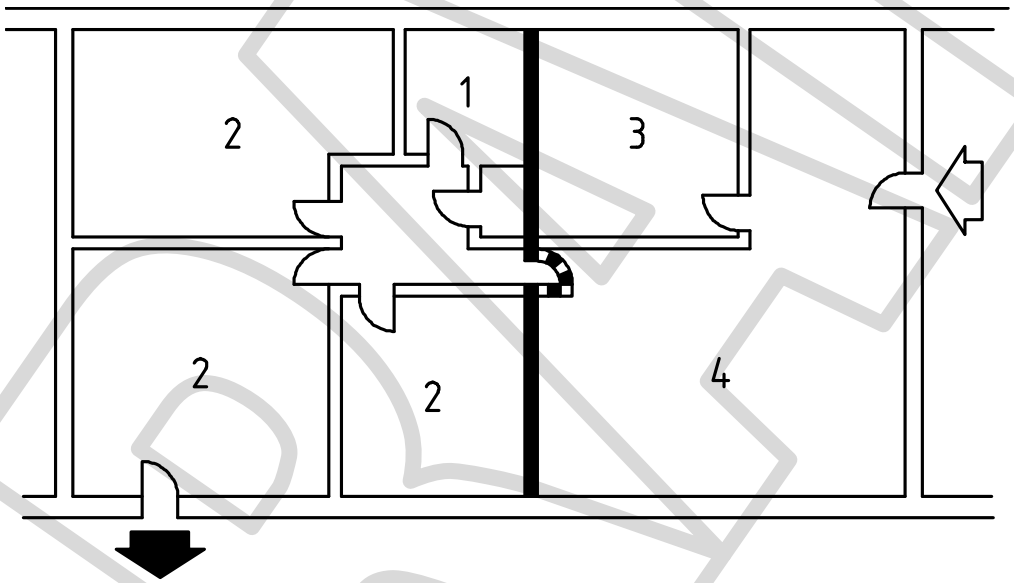
NOTE 3 The door of the cupboard (in the corner of the bathroom) need not be self-closing.

*NOTE 4 Compartment walls need to be fire-resisting (see **24.2**).*

Figure 14 – Flat with an alternative exit



a) Flat where all habitable rooms have direct access to an entrance hall



b) Flat where all habitable rooms do not have direct access to an entrance hall (see Notes 1 and 2)

Key

1	Bathroom	3	Kitchen
2	Bedroom	4	Living room
	30 min fire-resisting construction		FD 30 fire door
	Entrance to dwelling		Alternative exit from dwelling

NOTE 1 The fire-resisting partition separates living and sleeping accommodation.

NOTE 2 The bedrooms are not classed as inner rooms because escape is possible in two directions.

*NOTE 3 The entrance and alternative exit doors might need to be fire doors (see **32.1**).*

*NOTE 4 Compartment walls need to be fire-resisting (see **24.2**).*

9.4.3 Flats entered from a floor above or below the flat

Flats with the entrance on a floor above or below the flat should meet one of the following recommendations:

a) a protected stair and protected internal hallway from which all habitable rooms can be accessed should be provided, having a travel distance not exceeding 9 m from the top of the stair to the door of any habitable room (see Figure 15). For flats entered from the floor above, a Grade D, Category LD1 fire detection and fire alarm system in accordance with BS 5839-6:2019+A1 should also be provided; or

b) all habitable rooms should be accessible from an internal hallway and an alternative exit should be provided from the bedroom area of the habitable floor of the flat [see Figure 16a)]; or

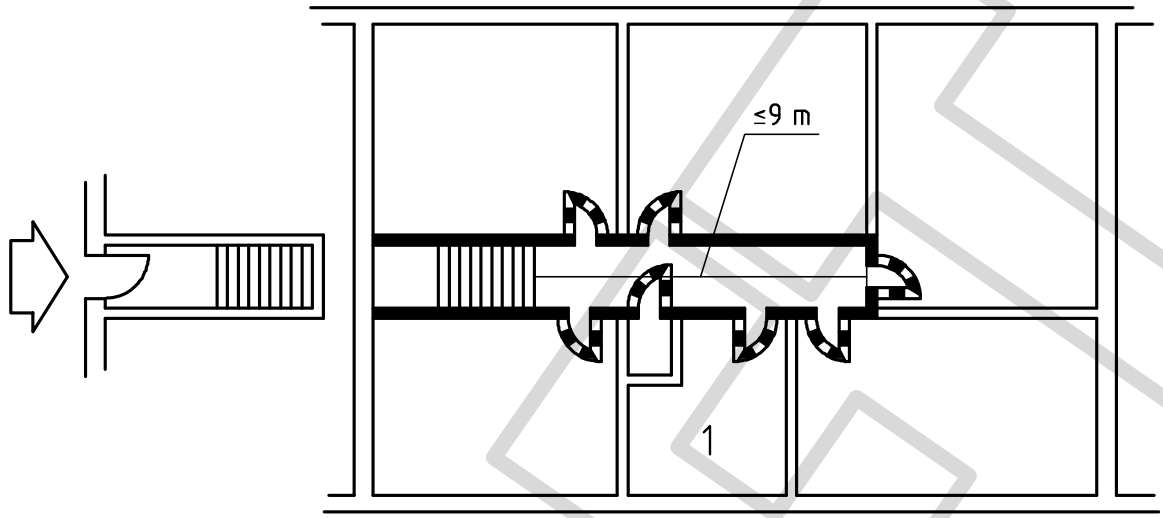
c) a line of fire separation should be provided between the living and sleeping areas of the flat and there should be an alternative exit from the bedroom area [see Figure 16b)].

Flats with the entrance on a floor below the flat should also meet one of the following recommendations:

1) the total travel distance from any point of the flat to the head of the stair should be limited to 9 m [see Figure 17a) or Figure 17b)]; or

2) the flat should meet the guidance for open plan flats given in **9.5**.

Figure 15 – Flat with a protected entrance hall and restricted travel distance



Key

1 Bathroom

Entrance to dwelling

30 min fire-resisting construction

FD 30 fire door

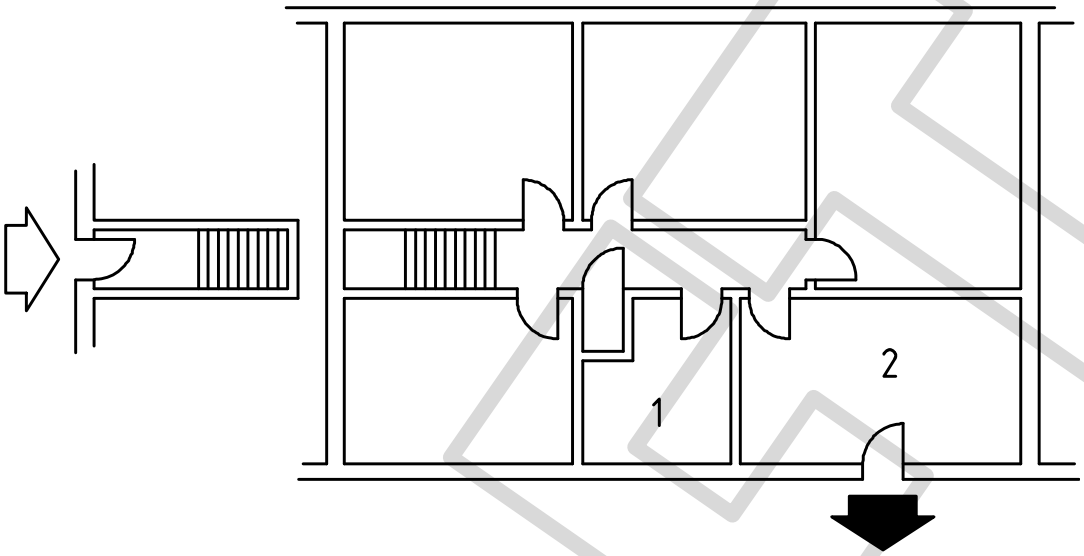
*NOTE 1 The entrance door might need to be a fire door (see **32.1**).*

NOTE 2 If the partitions between the bathroom and the adjacent rooms have a 30 min fire resistance then the partition between the bathroom and the hall need not be fire-resisting and the bathroom door need not be a fire door.

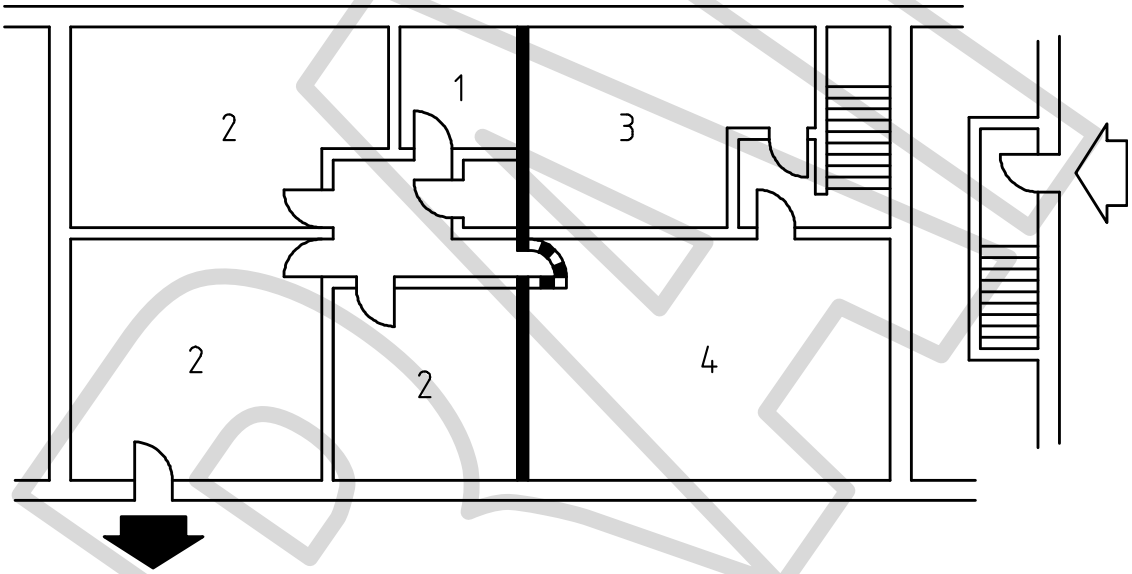
NOTE 3 The cupboard door need not be self-closing.

*NOTE 4 Compartment walls need to be fire-resisting (see **24.2**).*

Figure 16 – Flat (entered from above or below) with an alternative exit



a) Flat where all habitable rooms have direct access to an entrance hall



b) Flat where all habitable rooms do not have direct access to an entrance hall (see Notes 1 and 2)

Key

1	Bathroom	3	Kitchen
2	Bedroom	4	Living area
	30 min fire-resisting construction		FD 30 fire door
	Entrance to dwelling		Alternative exit from dwelling

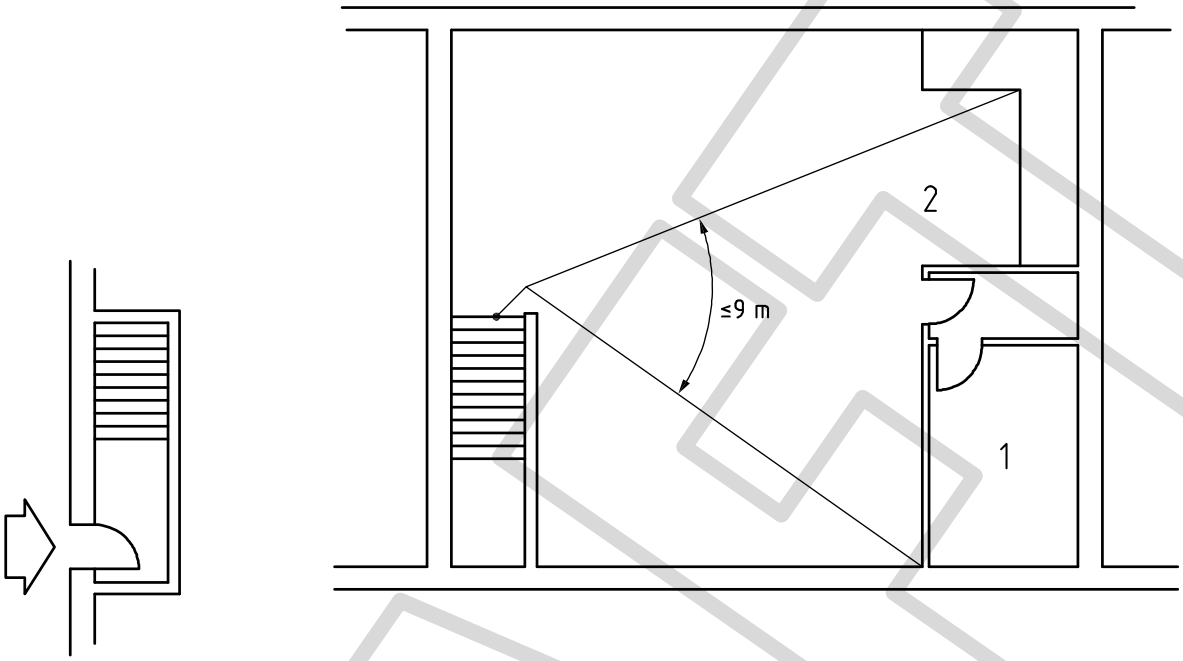
NOTE 1 The fire-resisting partition separates living and sleeping accommodation.

NOTE 2 The bedrooms are not classed as inner rooms because escape is possible in two directions.

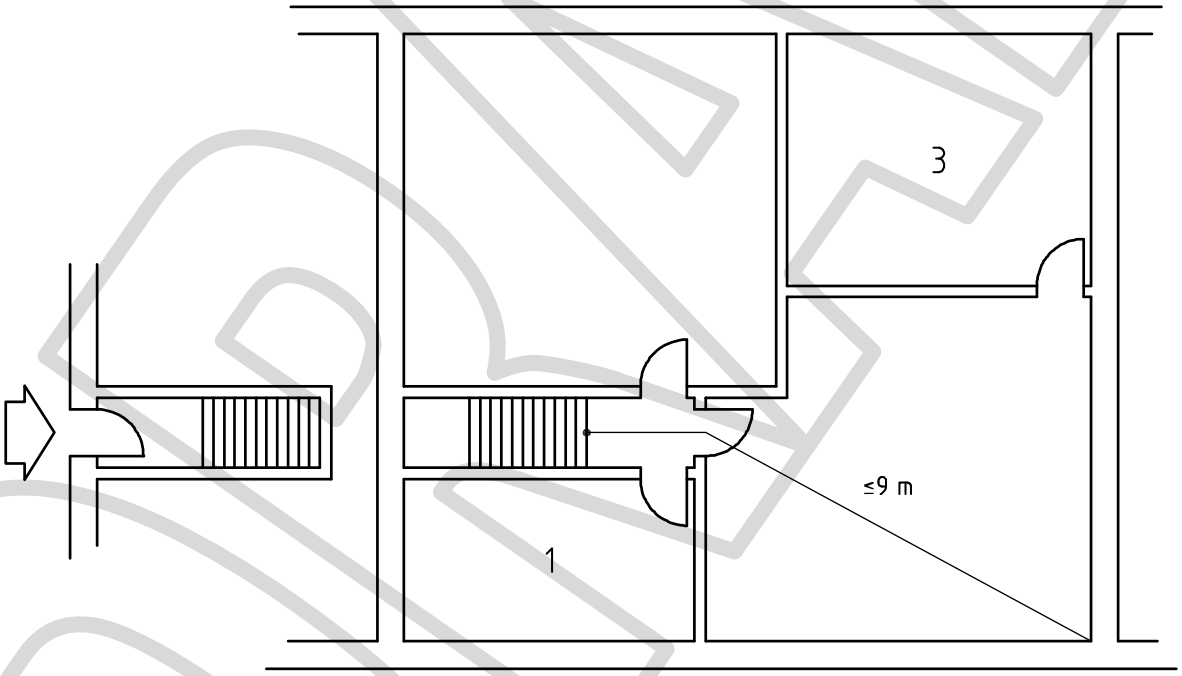
*NOTE 3 The entrance and alternative exit doors might need to be fire doors (see **32.1**).*

*NOTE 4 Compartment walls need to be fire-resisting (see **24.2**).*

Figure 17 – Flat (entered from below only) with a restricted travel distance



a) Open-plan flat (studio)



b) Flat with separate habitable rooms

Key

1	Bathroom	3	Kitchen
2	Kitchen area	⇨	Entrance to dwelling

*NOTE 1 The entrance door might need to be a fire door (see **32.1**).*

*NOTE 2 Compartment walls need to be fire-resisting (see **24.2**).*

9.5 Open-plan flat design

Open-plan flat layouts should not be provided for accommodation where the occupants are not capable of independent evacuation.

Open-plan flats that do not have protected corridors or hallways but have bedrooms that are inner rooms without having an alternative means of escape, and that are accessed directly from a lounge or similar type accommodation, should be fitted throughout with a Grade D, Category LD1 fire detection and fire alarm system in accordance with BS 5839-6:2019+A1, and an AWFSS (see **19.2**, Table 4).

Open-plan flats should meet the following specific recommendations.

a) The size of the open-plan flat should not exceed 16 m × 12 m.

b) Open-plan flats should be situated on a single level only.

NOTE 1 Single level flats exclude flats with galleries.

c) The ceilings within the open-plan flat should have a height of not less than 2.25 m.

NOTE 2 An open-plan flat design is not compatible with small single-stair buildings reliant upon internal protected entrance halls for lobby protection to the staircase enclosure.

9.6 Flats with galleries

NOTE This British Standard applies to flats with a single gallery level. Flats with galleries on multiple levels are outside of the scope of this British Standard.

Flats with galleries should meet the following recommendations.

a) To be classed as a gallery, the gallery should overlook at least 50% of the area of the room below.

b) The main level of the flat should be planned and constructed in accordance with Figure 12 or Figure 13, as applicable.

c) Any cooking facilities within a room containing a gallery should, where practicable, be enclosed with fire-resisting construction. Where cooking facilities are not enclosed with fire-resisting construction, they should be sited away from the escape route from the gallery or from the flat (see **5.6**).

d) The distance from the foot of the access stair to the gallery and the entrance door of the flat or a door leading to a protected entrance hall should not exceed 3 m.

e) Where the travel distance from the head of the access stair to the gallery to any point in the gallery exceeds 7.5 m, an alternative exit should be provided from the gallery.

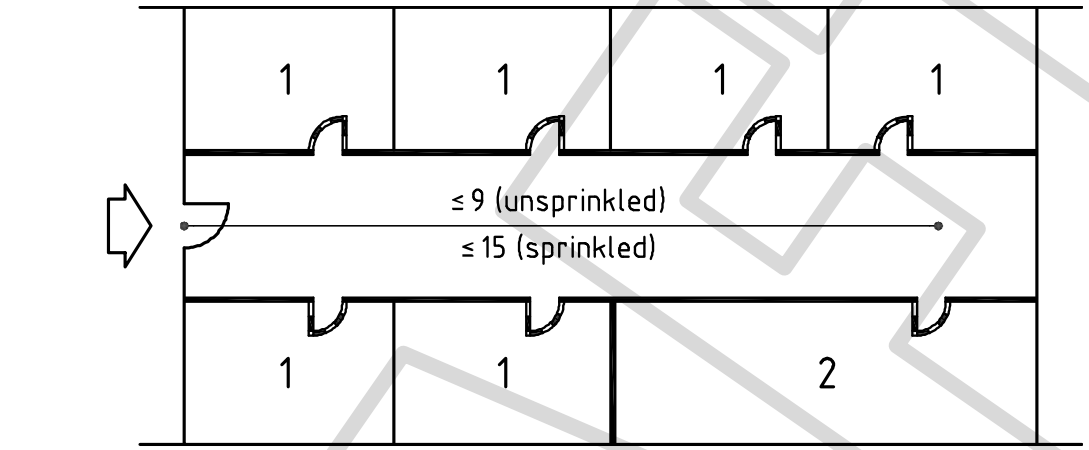
f) Where the gallery exceeds 50% of the area of the floor below, the gallery should be treated as an inner room (see **5.3**).

9.7 Cluster accommodation

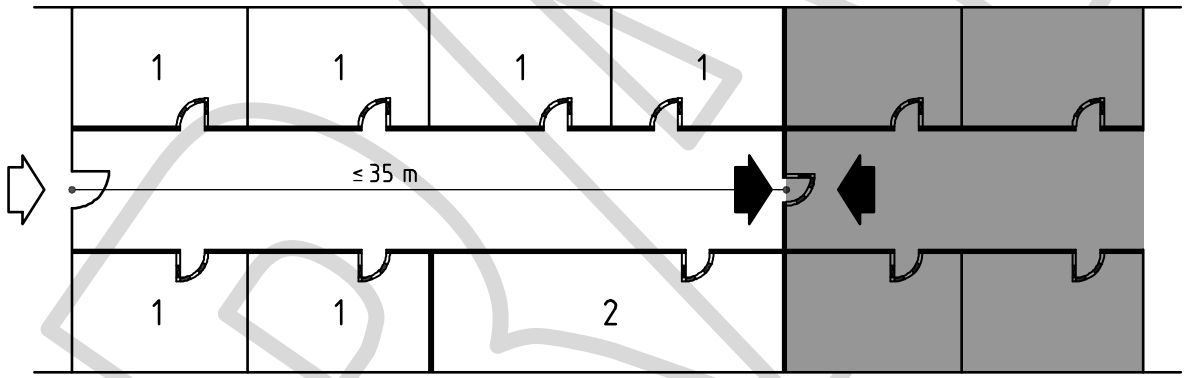
*COMMENTARY ON **9.7***

*Clusters of flats are a common arrangement found in purpose-built modern student accommodation. They are similar in layout to flats but often have more bedrooms and no living spaces apart from a shared kitchen. A typical cluster accommodation layout is shown in Figure 18. Studio flats or bedrooms with in-built cooking facilities are not considered to be suitable for cluster accommodation and are to be treated as flats. For HMOs, refer to **0.3** for guidance.*

Figure 18 – Typical cluster accommodation layout



a) Where flats have access only in a single direction



b) Where flats have access to an adjoining cluster flat

Key

1	Bedroom		30 min fire-resisting construction
2	Kitchen		Adjoining compartment
	Alternative exit from dwelling (if provided)		FD 30 fire door
	Entrance to dwelling		

*NOTE 1 The entrance and alternative exit doors might need to be fire doors (see **9.7.1** and **24.1**).*

*NOTE 2 Compartment walls need to be fire-resisting (see **9.7.1** and **24.2**).*

9.7.1 General

Escape routes from cluster accommodation should be in accordance with Clause **7**.

A cluster should be separated from the remainder of the building by construction having at least 60 min fire resistance and an FD 30S fire door. The internal corridor serving the rooms of the cluster should have at least 30 min fire resistance to each room off the corridor.

The doors to the bedrooms and living spaces accessed from the protected corridor should be FD 30S and self-closing.

*NOTE There is no limit to the number of bedrooms within a cluster, as long as the travel distances within the internal corridor of each individual cluster are no more than 9 m in a single direction and no more than 35 m where escape is possible in more than one direction. The 9 m travel distance may be increased to 15 m in a single direction where sprinklers in accordance with BS 9251:2021 or BS EN 12845:2015+A1 (see **19.2**, Table 4) are installed throughout the cluster.*

Cupboard and service duct access from the corridor should be separated by FD 30S fire doors.

Where pass doors are provided between two clusters, the travel distances along the internal corridors should not exceed 35 m from the cluster entrance door to the pass door [see Figure 10b)].

Cross-corridor doors should be provided at around the midpoint of a corridor where two escape routes are proposed and the internal corridor length exceeds 15 m.

The cluster should be lobbied from any staircases serving the building (i.e. a protected lobby should be formed between the cluster front entrance door and the stair door).

A fire detection and fire alarm system should be provided in accordance with BS 5839-6:2019+A1, Category LD1 or BS 5839-1:2017, Category L1, as applicable, for simultaneous evacuation of the cluster of fire origin.

A smoke detector should be provided in each habitable room and a heat detector should be provided in the kitchen.

A link to the fire detection and fire alarm system should be provided to the management responsible for the building if it is staffed 24 h per day, or to a remote monitoring centre.

9.7.2 Kitchens in cluster accommodation

Kitchens in clusters should be separated from any bedrooms by construction having at least 30 min fire resistance.

Kitchen doors should be provided with self-closing devices, which should be held open by an electromagnetic door holder linked to the detection system.

Kitchens should be located at the remote end of the corridor away from the final exit to the cluster.

9.8 Internal planning of maisonettes

9.8.1 Maisonettes having no floor level higher than 4.5 m above ground or access level

Maisonettes that do not have a floor level that is situated higher than 4.5 m above the ground level or the access level should either be treated as houses for internal planning purposes (see **6.1**), or designed in accordance with **9.8.2**.

9.8.2 Maisonettes having a floor level higher than 4.5 m above ground or access level

Maisonettes having a floor level higher than 4.5 m above ground or access level should have at least one of the following:

a) an alternative exit (see **5.5**) from all habitable rooms on each floor level above access level, with window evacuation in accordance with **5.2**; or

b) a protected stairway, protected landing and an alternative escape route [see **5.5**d)] from each floor level; or

c) a protected stairway enclosure and a Category LD1 fire detection and fire alarm system in accordance with BS 5839-6:2019+A1, if no floor is more than 7.5 m above or below the level of the entrance of the maisonette; or

d) a protected stairway and an AWFSS (see **19.2**, Table 4) fitted throughout the dwelling.

Where maisonettes are provided with open-plan accommodation on maisonette access level only, one of the following recommendations should be met.

1) The maisonette should be:

   i) fitted throughout with an AWFSS (see **19.2**, Table 4); and

   ii) provided with a Category LD1 fire detection and fire alarm system in accordance with BS 5839-6:2019+A1; and

   iii) provided with a protected staircase enclosure, which is enclosed at all floor levels, including access level.

   NOTE 1 This staircase is permitted to open into the open plan accommodation at access level.

2) Either:

   i) each floor level above the maisonette access level should be provided with an alternative escape route [see **5.5**d)]; or

   ii) floor levels below 4.5 m from ground or external deck level should be provided with escape windows from all habitable rooms.

NOTE 2 All other maisonettes layouts with open-plan accommodation are outside the scope of this British Standard.

Section 3: Stairs and final exits

10 Number and siting of common stairs

*COMMENTARY ON CLAUSE **10***

Because of the degree of compartmentation provided within buildings comprising flats/maisonettes and the special provisions made for controlling the spread of smoke within the communal areas and escape routes, the decision as to whether or not a single common stair is acceptable depends on a number of factors. For example:

- *the provision of AWFSS can reduce fire sizes;*
- *evacuation times can be significantly increased where occupants are required to evacuate tall buildings, owing to the decreased movement speed down staircases;*
- *tall buildings can be adversely affected by wind, which can:*
  - *impact fire growth and induce cross-flows of fire and smoke in a way that would not be experienced in a building of lower height; and*
  - *impact means of escape and fire and rescue service activities; and*
- *the height of the staircase can affect smoke buoyancy forces, causing smoke to stratify before it reaches the ventilator.*

10.1 Number of common stairs

*COMMENTARY ON **10.1***

For buildings of any height, the stair arrangements for storeys serving dwellings need to facilitate safe and resilient means of escape and firefighting capability.

Buildings less than 18 m above ground or access level may be provided with either a single common stair or multiple common staircases.

Buildings with a storey 18 m or more above ground or access level should either be provided with at least two escape stairs, or meet all of the following recommendations.

a) At least one common stair should be available from each part of a storey serving dwellings.

b) All structural elements (see **24.2.1**, Table 7) should be 90 min for buildings less than 30 m from ground or access level and 120 min for buildings greater than 30 m. Table 8 should not be used.

c) All load-bearing elements should be constructed from class A1 materials.

   NOTE This precludes the use of timber construction where only a single staircase is provided.

d) The protected stair enclosure should be entered from the adjoining protected corridors/lobbies only via a separate protected lobby. This protected lobby should not be directly accessible via adjoining dwellings or ancillary accommodation, but may be accessed directly from the building's lifts.

e) The staircase and associated lobby should be protected with a pressurization system conforming to BS EN 12101-6 for a firefighting system (see Figure 19). The air intake for the system should be drawn in at ground storey level, or at a higher level if controlled from more than one façade. Natural ventilation or mechanical ventilation of the staircase and associated protected lobby should not be provided as alternatives to a BS EN 12101-6 pressurization system.

f) Protected corridors or lobbies serving dwellings with a travel distance exceeding 15 m (measured from the further most flat entrance door to the door entering the stair lobby) should be provided with a separate smoke control system to that serving the staircase and associated lobby, in accordance with **22.3.4**.

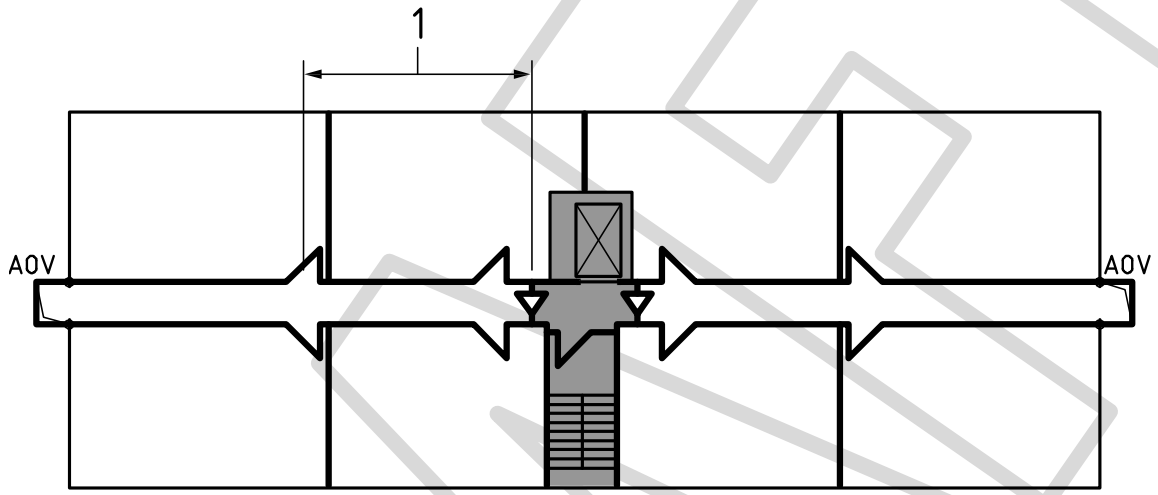
g) The stair should be not less than 1.2 m in width.

h) An evacuation alert system in accordance with BS 8629 should be provided throughout the building.

i) The building staircase should not connect to any accommodation located fully or partially below ground level (e.g. basements or sub-basements). The stair should terminate at ground or access level and should not directly access any stair which continues to serve floor levels below ground level, except where designed in accordance with Clause **13**.

NOTE 3 These recommendations do not apply to any single stair purely serving a balcony approach arrangement.

Figure 19 – Pressurization system for staircase, firefighters lift shaft and lobby with air release in the corridor



Key

1	Maximum travel distance 7.5 m
AOV	Accomodation air relief (air release path) – natural AOV to outside only if on more than one façade, otherwise natural or mechanical shaft
	Fire-resisting contruction
	Self-closing FD 30S fire door (double swing)
	Self-closing FD 30S fire door
	Areas requiring protection by pressure differential system (BS EN 12101-6)

NOTE 4 Where refurbishments are being undertaken in existing buildings with a storey 18 m or more above ground or access level, space for the provision of additional services, lobbies etc. might be limited. Designers and approving authorities are thus able to allow a degree of flexibility in the provision of fire safety measures as part of the overall design package.

10.2 Location of stairs

Common stairs should be located to enable dwellings to meet the travel distance recommendations in Clause **7**. Alternative staircases should be located such that they provide effective alternative directions of travel from any dwelling served by those stairs other than accepted dead ends [see Figure 9b)].

Where two or more common stairs are provided, they should be located such that they are situated remotely from each other. Where a common corridor connects two or more storey exits, measures should be provided to prevent both stairs from being affected by the smoke from a single fire.

NOTE Such measures may include subdivision by a self-closing fire door with, if necessary, an associated fire screen.

The door should be positioned such that smoke is not likely to affect access to more than one storey exit.

11 Width of common stairs

The unobstructed width (measured between the walls and/or balustrades) of each common stair should be not less than 750 mm.

A common stair which is a firefighting stair should have an unobstructed width (measured between the walls and/or balustrades) of 1.1 m.

The unobstructed width should be kept clear for a vertical distance of 2.0 m.

NOTE Handrails and strings that do not intrude more than 100 mm into these widths may be discounted when calculating the common stair width.

12 Enclosure of common stairs

In buildings exceeding 18 m in height, one or more common stairs should be designed as firefighting stairs (see **50.3.2**).

The following recommendations should be met for common stairs that are not firefighting stairs.

a) No storeroom should open directly into a common stair.

   *NOTE 1 Recommendations for engineering services such as gas, electricity and refuse disposal are given in Section **7**.*

b) If a common stair, or the protected route leading to the stair, projects beyond, is recessed from, or forms an internal angle of, the external enclosures to a building:

   1) the distance between any opening in the external enclosure to the building and any opening in the enclosure to the stair should be not less than 1.8 m (see Figure 20); and

   2) the enclosures within that distance [see b)1)] and up to 9 m vertically below should be of fire-resisting construction (see **24.2.1**, Table 6) that may have fixed fire-resisting glazed areas.

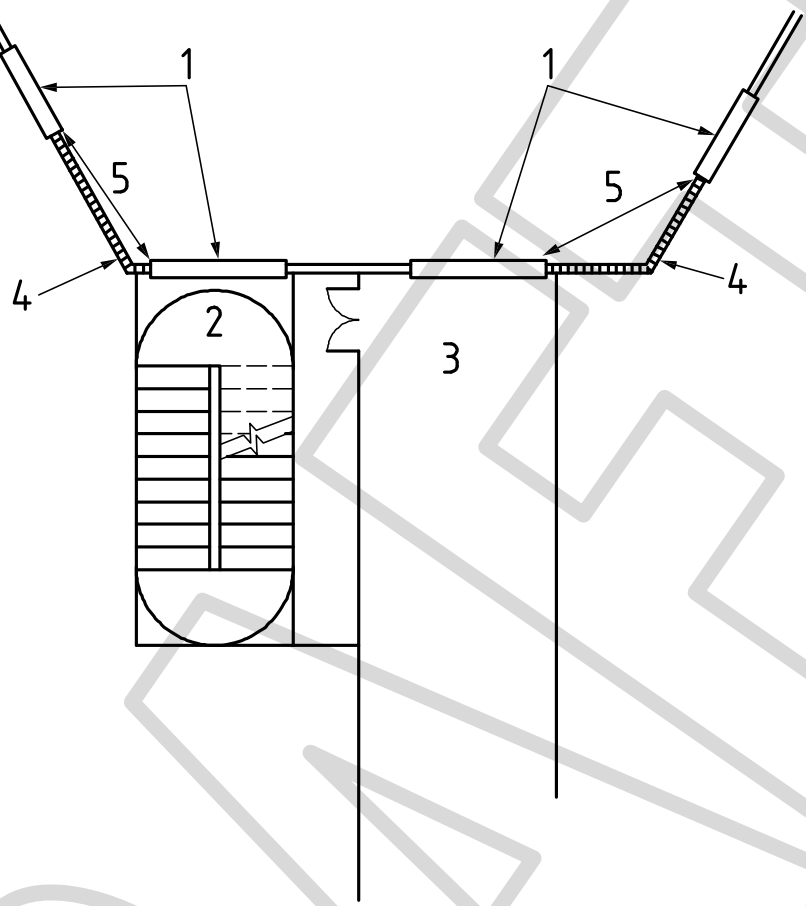
c) Where two common stairs are adjoining, they should be separated by imperforate construction.

   NOTE 2 No openings (e.g. doors) are permitted in the separating elements common to both stairway enclosures.

d) If any storey or part of a storey is required to have more than one escape route, common stairs should be sited such that access to alternative common stairs is possible from any point on that storey without passing through any other such stairway.

e) If a common stair forms part of the only escape route from a dwelling, it should not be connected to any ancillary accommodation on the same storey as that dwelling unless it meets the recommendations in **7.8** and **13.2**.

Figure 20 – Protected routes forming an internal angle



Key

1	Unprotected areas	4	External angle <135°
2	Escape stair	5	Distance no less than 1.8 m
3	Protected escape corridor		Wall with fire resistance equivalent to fire time of building

13 Basement stairs

13.1 Multiple stair buildings

Where there is more than one common stair from an upper storey or part thereof, at least one such stair serving the upper storeys (or parts thereof) should terminate at ground level.

Any other stair connecting with the basement storey(s) should be separated from each basement level by a protected lobby.

13.2 Single-stair buildings

13.2.1 General

If a stair forms part of the only escape route from an upper storey or part thereof, the stair should not continue down to the basement unless the recommendations in either **13.2.2** or **13.2.3** are met, as appropriate for the height of the building.

13.2.2 Buildings not greater than 11 m above ground

In buildings where the top floor is no more than 11 m above ground level, or where there are no more than three storeys above the ground storey, a single stair should not connect with the basement unless all of the following conditions are met:

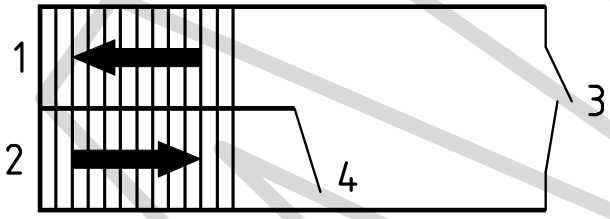
a) the basement and upper storeys are separated within the staircase at ground floor level by fire-resisting construction including an FD 30S self-closing door (see Figure 21); and

b) a fire-resisting lobby is provided at basement level between the accommodation and the staircase and any associated lift well; and

c) the lobby is provided with a vent in accordance with Table 3 (see Figure 22, Figure 23 and Figure 24); and

d) any refuse chute or refuse storeroom is not directly accessed from the lobby but is instead accessed via a separate 30 min fire rated lobby. The refuse lobby should be provided with 0.2 m^2 permanent ventilation or equivalent mechanical trickle vent in accordance with BS 5906 (see Figure 23).

Figure 21 – Staircase separating basement and upper storeys in single-stair residential buildings



Key

1 Stairs to upper floors
2 Stairs from basement
3 Entrance
4 FD 30S self-closing door

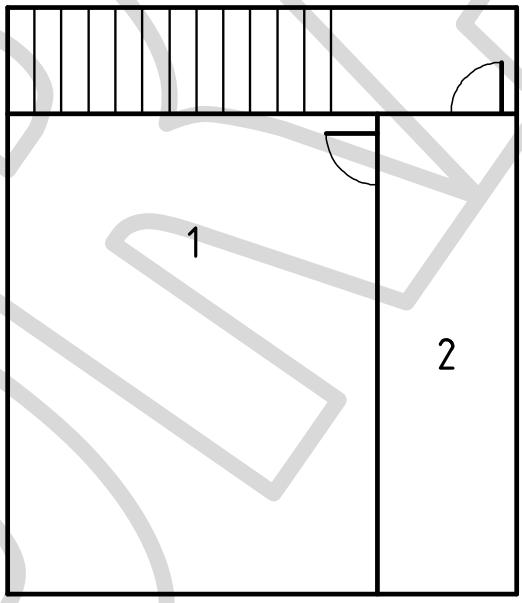
Table 3 – Lobby ventilation=

Item	Accommodation area[A) B)]	Ventilation to lobby
1	Flats	In accordance with Clause **22**
2	Communal lounges and common amenity areas	1 m^2 permanent ventilation; or 0.4 m^2 permanent ventilation with provision of automatic sprinkler protection in accordance with BS EN 12845:2015+A1 throughout the basement
3	Transformer, switchgear and battery rooms for low voltage or extra low voltage equipment	
4	Engineering service installation rooms, excluding those covered by item 2 and items 6 to 8 inclusive	
5	Refuse chutes and refuse storage areas	
6	Other storage areas	
7	Installation rooms for engineering services housing fixed internal combustion engines	1 m^2 automatic opening vent
8	Boiler rooms and fuel storage spaces	
9	Transformer and switchgear for equipment above low voltage	
10	Car park areas	

A) Places of special fire hazard should be provided with separate smoke outlets in accordance with Clause **22**.

B) Car park areas should be provided with a smoke control system in accordance with Clause **22**.

Figure 22 – Basement lobby ventilation: Clarification of recommendations for single-stair buildings – Item 1 for flats

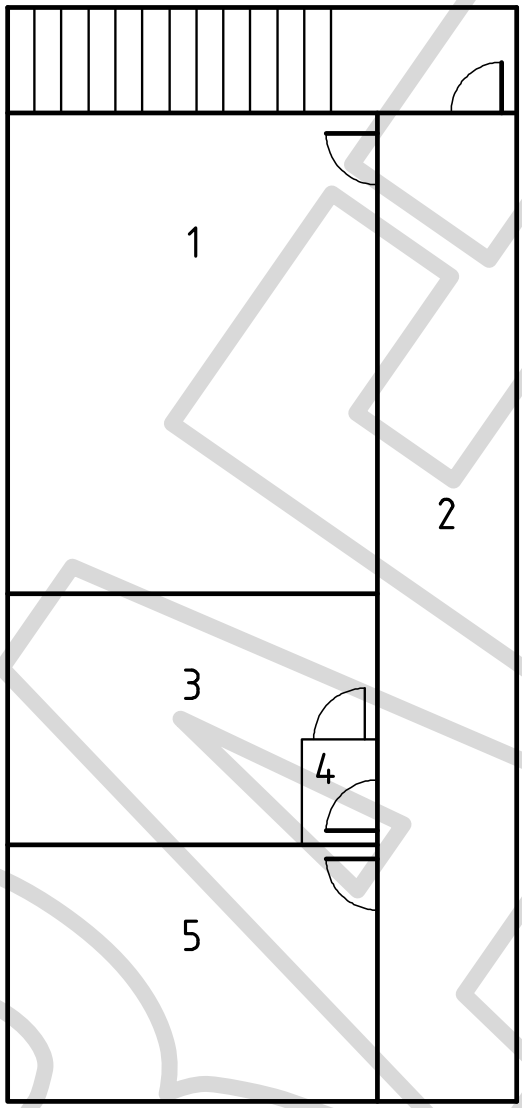


Key

1 Flat (Table 3, item 1)

2 Protected lobby with ventilation in accordance with Clause **22**

Figure 23 – Basement lobby ventilation: Clarification of recommendations for single-stair buildings – Items 2 to 6 and footnote A



Key

1 Accommodation as given in Table 3, items 2 to 4 and item 6

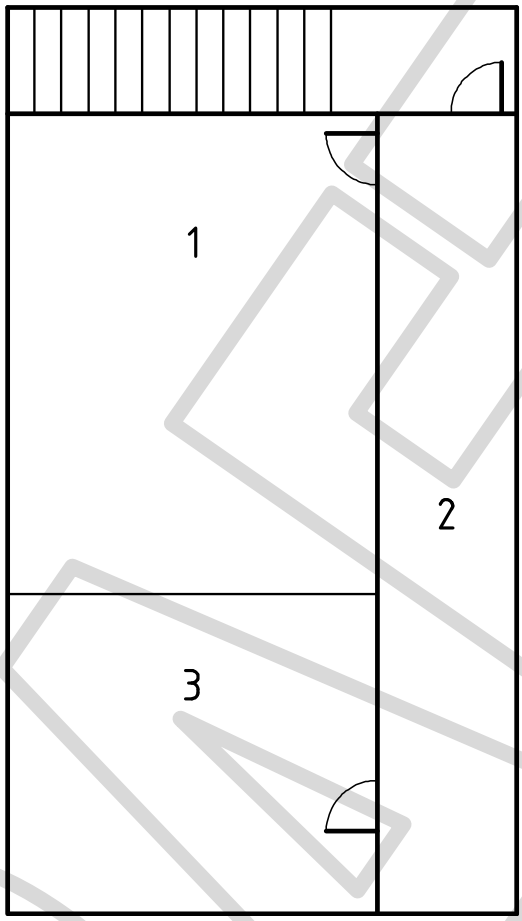
2 Protected lobby ventilated as in Table 3

3 Refuse/store/chute (Table 3, item 5)

4 Ventilated protected lobby [**13.2.2** d)[

5 Place of special hazard (Table 3, footnote A) – smoke outlet in accordance with Clause **22**

Figure 24 – Basement lobby ventilation: Clarification of recommendations for single-stair buildings – Items 7 to 9, 10, and footnote B



Key

1 Table 3, items 7 to 9

2 Protected lobby with 1 m^2 AOV

3 Car park (Table 3, item 10 and footnote B) – smoke control in accordance with Clause **22**

13.2.3 Buildings greater than 11 m above ground

In buildings where the top floor is greater than 11 m above ground level, a single stair should not connect with the basement unless all of the following conditions are met:

a) all areas of the basement are sprinkler protected in accordance with BS 9251:2021 or BS EN 12845:2015+A1; and

b) the basement stair is protected against the ingress of smoke by a lobby with either:

   1) the same venting arrangement as a single stair serving floors above the final exit level for buildings greater than 18 m high (see **10.1**); or

   2) the same venting arrangement as given in **13.2.2**c) in a building below 18 m high; and

c) the lobby or corridor at the final exit level is separated from the basement stair as well as the stair serving storeys above the final exit level (see Figure 25); and

d) the fire main outlet at fire service access level is located within the enclosure of the basement stair (see Figure 25).

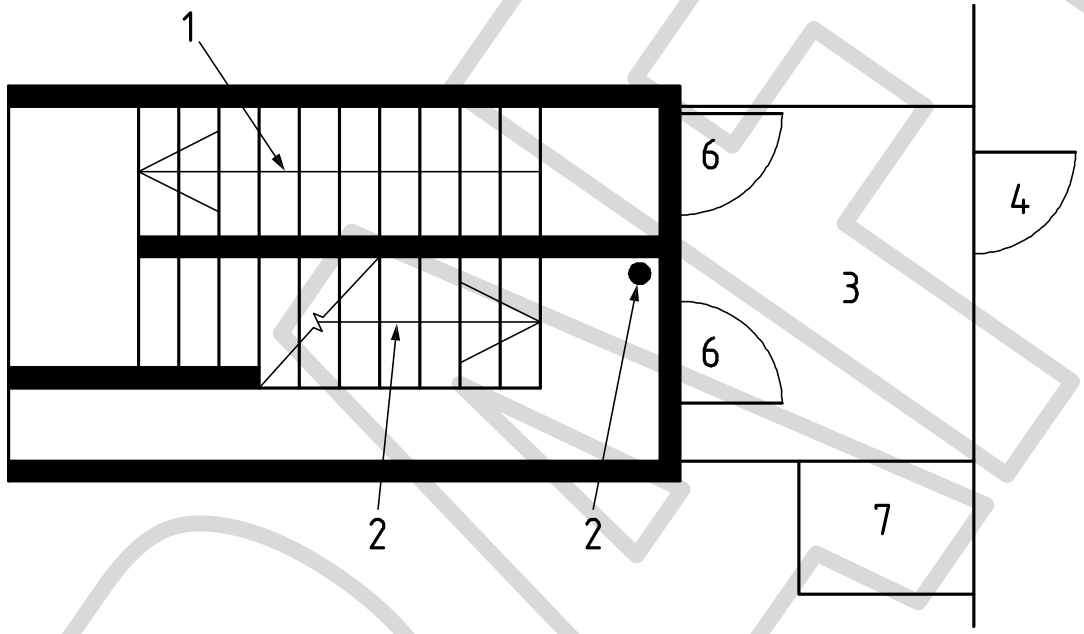
NOTE 1 This is to enable firefighting operations at basement level to be carried out without having to open the door to the stair or exit path at the final exit level.

The stair serving the storeys above the final exit level should remain clear of smoke throughout any evacuation and firefighting period. Smoke control should be provided in accordance with Clause **22** and, where deviations apply, verified through a computational fluid dynamics (CFD) analysis (see **22.2**) or mathematical calculation.

*NOTE 2 For a building with a storey over 50 m above ground level, a QDR might be required to determine whether these recommendations are suitable or whether a full fire engineered solution would be more appropriate (see **0.7**).*

The sprinkler system protecting the basement should extend to all spaces on every basement floor, except where the sprinkler design standard identifies a necessary exception.

Figure 25 – Separation of stair at final exit level for single-stair building of any height



Key

1	Stair serving floors above final exit level	5	Fire main outlet
2	Stair serving basement(s)	6	FD 30S fire doors
3	Final exit lobby/corridor	7	Lift
4	Final exit to outside	▬	Fire-resisting construction (see **24.2.1**, Table 6)

NOTE This figure illustrates the principle of what needs to be achieved, and is not the only permitted arrangement.

14 Stairs within mixed-use developments

*COMMENTARY ON CLAUSE **14***

A mixed-use development is one that contains one or more dwelling(s) and at least one non-residential occupancy.

Mixed-use developments should meet one of the following recommendations, as appropriate to the type of building.

a) In buildings having not more than three storeys above ground or access level (small buildings), common stairs that serve both dwellings and other occupancies should be separated from each occupancy by protected lobbies at all levels.

b) In buildings having more than three storeys above ground or access level:

1) all stairs serving dwellings, which are not ancillary to the main use of the building, should not communicate with any other occupancy in that building; and

2) any stair serving a dwelling, which is ancillary to the main use of the building, should not communicate with any other occupancy unless the following conditions are met:

   i) security measures do not prevent escape; and

   ii) the stair is separated from any lower storeys by protected lobbies; and

   iii) an independent alternative escape route is provided from the dwelling; and

   iv) where the main building is fitted with an automatic fire detection and fire alarm system (see Clause **18**), this system also covers the dwelling.

15 Access lobbies and corridors to protected stairways

Access lobbies and corridors to protected stairways should meet the following recommendations.

a) If a stair in a mixed-use building, having not more than three storeys above ground or access level, serves both dwellings and other non-residential occupancies, then a protected lobby should be provided between each occupancy and the stairway at all levels.

b) If a stair provides access to ancillary accommodation, there should be a ventilated protected lobby or ventilated protected corridor at that level.

c) If a stair provides access to an enclosed car park, there should be a ventilated protected lobby at every car park access level.

d) If a stair serves an area of higher fire risk, there should be a ventilated protected lobby or ventilated protected corridor at that level.

e) If a stair connects the ground or upper storeys with a basement storey(s) or serves only basement storeys, there should be a protected lobby or protected corridor at every basement level.

f) In a small single-stair building, any protected lobby or protected corridor separating ancillary accommodation from the stair should be ventilated (see Clause **22**).

NOTE For ventilated lobbies, see Table 3.

16 External stairs

*COMMENTARY ON CLAUSE **16***

*External escape stairs, whilst not desirable, may, in exceptional circumstances, be provided for small buildings (see **7.7**), or from storeys near to ground level, or from a roof or podium with its own escape route.*

Where external stairs are provided, they should meet the following recommendations.

a) External stairs should not form part of an escape route except in the case of:

   1) flats or maisonettes having an exit to a storey not more than 6 m above ground level; and

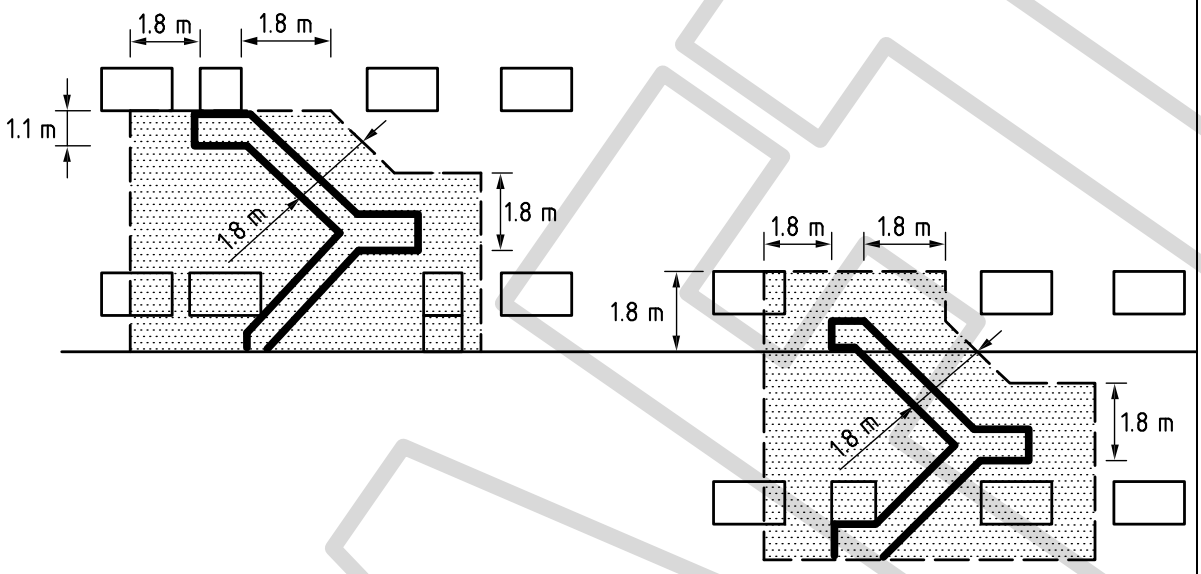
   2) flats or maisonettes having an exit to a storey not more than 6 m above a roof or podium which is itself served by an independent protected escape route.

b) Any wall or portion (unless higher than 1.1 m above the top floor level of a stair that is not a basement stair) within 1.8 m of, or within 9 m vertically below, any external escape stair should be of fire-resisting construction. The doors to the stair (other than the door at the top floor level of a stair serving storeys above ground level) should be fire-resisting and self-closing (see Figure 26).

NOTE The fire-resisting construction may have fixed fire-resisting glazed areas.

c) Where the escape route from the stair is in one direction only, any ventilation outlets or extract systems and any doors or windows that are not fire-resisting should not be sited within 3 m of the escape route.

Figure 26 – Fire resistance of areas adjacent to external stairs



a) Stair serving storeys above ground level b) Stair serving a basement

NOTE 1 Areas enclosed in dashed lines are of fire-resisting construction.

NOTE 2 The door at the top of the stair need not be fire-resisting and self-closing.

17 Discharge from common stairs and final exits

Discharge from common stairs and final exits should meet the following recommendations.

a) Protected stairways should discharge either:

1) directly to a final exit; or

2) into a protected corridor leading to a final exit which is itself lobbied from any accommodation.

NOTE 1 Figure 27 shows examples of a final exit from a stairway with lobby protection accessed from a flat with a protected entrance hall.

b) Any protected corridor leading to a final exit should have the same standard of fire-resisting enclosure and lobby protection as the stairway it serves. It should not be the common access corridor serving the dwellings at the exit level

c) An arrangement in which two stairs terminate in the same enclosure at final exit level should not be employed, because an outbreak of fire leading to penetration of the enclosure at that level would render both stairs simultaneously unusable.

d) Where the exit passageways from two common stairs adjoin, they should be separated by imperforate construction, i.e. there should be no openings (e.g. doors) in the separating element common to both passageways.

e) Any final exit should be immediately apparent to any person using a common stair that serves storeys both above and below the point of final exit.

NOTE 3 A final exit can be made immediately apparent through the use of signage.

f) Final exits should discharge directly to a street, passageway, walkway or open space that allows for the rapid dispersal of persons away from the vicinity of the building.

g) Final exits should have a level threshold and should lead to level ground where practicable. Where there is no level ground, a suitable ramp or a step should be provided. Where a step is provided there should be a suitable and apparent landing.

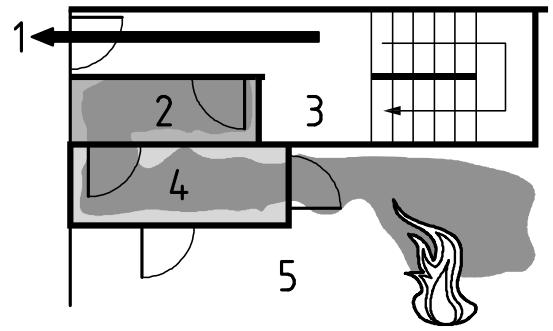
h) Final exits should be sited such that that they are clear of any risk from fire or smoke. If a protected route projects beyond, is recessed from, or forms an internal angle of, the external enclosures to a building, the distance between any opening in the external enclosure to the building and any opening in the enclosure to the stairway should be not less than 1.8 m (see Figure 20).

i) Transformer chambers, boiler rooms and refuse storage rooms and similar risk areas should not have any openings, e.g. doors that open onto escape routes, which could impede escape from residential accommodation.

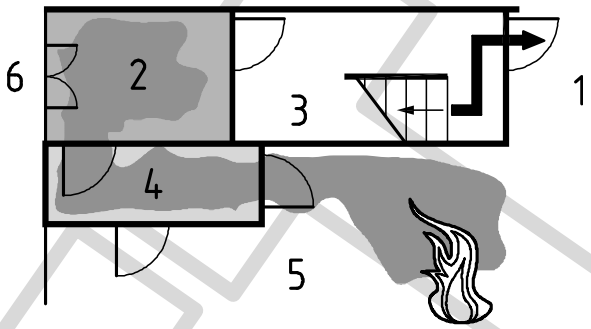
Where a tower block rises above a podium, the common stair(s) forming part of the escape route from the tower should, where practicable, descend through the podium to ground level.

Any firefighting stair should always descend through the podium to ground level. Where non-firefighting stairs cannot be so arranged and occupants are required to use the stairs of the podium, the escape route connecting the two stairs should have the same level of protection as the stairs, in order to safeguard the occupants of the building until street level is reached. Similarly, any part of the escape route that leads (for example) across a concourse, a pedestrian walkway or roof should be clearly defined and protected.

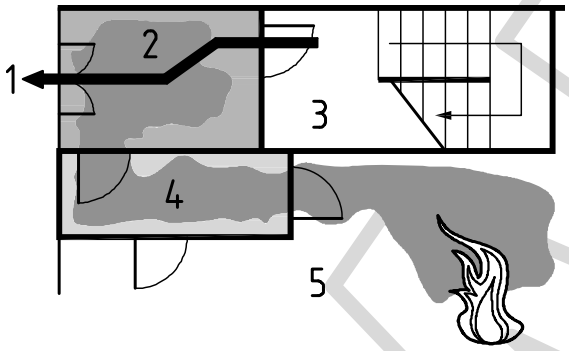
Figure 27 – Lobby protection to final exit from stairway



a) Ground/final exit level (acceptable)



b) Ground/final exit level (acceptable)



c) Ground/final exit level (not acceptable)

Key

1	Final exit (external air)	5	Residential flat
2	Ventilated common lobby	6	Entrance (external air)
3	Protected stairway	➡	Travel to final exit
4	Inner hall	→	Travel up stair

Section 4: Active fire protection

18 Fire detection and fire alarm systems

18.1 General

A fire detection and fire alarm system designed and installed in accordance with BS 5839-6:2019+A1 should be provided in all dwellings, in order to warn occupants of fire within the dwelling and to provide them with time to evacuate the premises and to call the fire and rescue service.

The need to have a fire detection and fire alarm system in common areas (e.g. lounges or communal roof gardens) should be determined according to the extent and use of these common areas, the fire risk and the management response available. Where a fire detection and/or fire alarm system is required in common areas, it should be provided in accordance with BS 5839-1:2017.

Where rapid summoning of the fire and rescue service is considered critical to the safety of occupants (e.g. on the basis of a fire risk assessment), facilities should be provided for the automatic transmission of alarm signals to an alarm receiving centre, unless there are reliable arrangements for summoning the fire and rescue service by persons in the building. Automatic transmission should also be provided if occupants are mobility impaired to a degree that would cause them to be at high risk in the event of fire, or if there is any reason to suspect that occupants would be unlikely or unable to alert the fire and rescue service.

Where fire detection and fire alarm systems are required in areas other than individual dwellings, e.g. to activate smoke control systems, a Category L5 system in accordance with BS 5839-1:2017 should be installed.

Where warning devices are installed to cater for specific sensory requirements, they should be compatible with specialist devices such as vibrating alerters, visual alarm devices, etc.

All areas comprising, or used by, residential care residents or staff should have a Category L1 fire detection and fire alarm system in accordance with BS 5839-1:2017.

18.2 Automatic fire detection and fire alarm systems for mixed-use buildings

Where any part of a mixed-use building is expected to have non-residential occupancy groups, the occupancy groups should be separated by fire-resisting construction and have independent escape routes, with the exception of certain small buildings (see Clause **14**). Each type of occupancy should be provided with the appropriate fire detection and fire alarm system in accordance with the relevant part of BS 5839.

Where flats are part of a building containing different occupancy groups, the fire detection and fire alarm system should be designed in accordance with the relevant part of BS 5839 to facilitate the evacuation and management strategy appropriate for that building. In small mixed-use buildings (see Clause **14**) which share a common escape route, the flats should have individual fire detection and fire alarm systems in accordance with BS 5839-6:2019+A1, and the other occupancy (or occupancies) should have a fire detection and fire alarm system in accordance with BS 5839-1:2017.

NOTE These alarms do not need to be interlinked.

19 Automatic water fire suppression systems

*COMMENTARY ON CLAUSE **19***

Automatic water fire suppression systems (AWFSS) are designed to detect a fire and automatically release an extinguishing agent to extinguish the fire or prevent its spread.

Water is the most common extinguishing agent, as used in sprinkler systems and water mist systems. Individual sprinkler and water mist components react to heat to release water onto the fire below.

The use of town main water supplies to sprinkler systems can be advantageous (e.g. in terms of cost and availability. Statutory minimum water supply pressures are not be confused with pressure and flow rates that are available in practice.

19.1 General

All buildings with a floor higher than 11 m above ground should be fitted with sprinklers in accordance with BS 9251:2021 or BS EN 12845:2015+A1 (see **19.2**, Table 4).

NOTE 1 In Scotland, all blocks of flats, all social housing and all multi-occupancy houses are required by legislation to be fitted with sprinkler protection. In Wales, all residential accommodation, including houses and residential care but excluding hostels, hotels, prisons and hospitals, is required to be fitted with sprinkler protection.

With certain exceptions (see Note 2 and Note 3), sprinkler protection should be provided throughout the building, including in areas are assumed to be fire sterile.

NOTE 2 Sprinklers might not be required where there is vertical separation within the same building.

NOTE 3 In buildings below 11 m in height, where sprinklers are provided as a compensatory feature to address a specific risk (e.g. extended travel distance or open-plan layout), they need not be provided throughout the rest of the building, if not required by the fire strategy.

NOTE 4 The recommendation to include sprinkler protection in common areas such as stairs, corridors or landings is intended to address the fact that fires and injuries do occur in these areas as shown by government statistics, rather than to encourage a move to these areas becoming non-fire sterile.

All residential care facilities, including associated non-residential and ancillary accommodation, should be fitted with sprinklers in accordance with BS 9251:2021 or BS EN 12845:2015+A1 (see **19.2**, Table 4).

19.2 Permitted variations

*COMMENTARY ON **19.2***

With the exception of accommodation provided for occupants who are not capable of independent evacuation from their flat, where a block of flats is fitted with a sprinkler system in accordance with BS 9251:2021 or BS EN 12845:2015+A1 (see Table 4), the maximum travel distance for escape in the ventilated section of common corridors in one direction only may be increased from 7.5 m to 15 m. This variation is only applicable where the common corridor is provided with a smoke control system ventilated as shown in Figure 8b). For escape in more than one direction the maximum travel distance may be increased from 30 m to 60 m.

The extension of travel distances is not permitted in the unventilated sections of common corridors.

*See **7.9** for applicable travel distance variations in single-stair buildings over 18 m.*

Where it is permissible within this British Standard to vary the fire safety provisions by installation of an AWFSS, the specific systems and minimum categories given in Table 4 should be used. Where the building has several requirements for the provision of AWFSS, the most onerous category or hazard classification given in Table 4 should be applied.

NOTE Table 4 also indicates whether water mist systems may be used for the permitted variation. Where water mist is proposed as a form of AWFSS, attention is drawn to the increased complexity and risks of this approach. Further guidance is given in BS 5306-0.

Table 4 – AWFSS and categories for use with permitted variations

Provision of AWFSS	Subclause in BS 9991:2021	Sprinkler system conforming to BS 9251:2021	Sprinkler system conforming to BS EN 12845: 2015+A1	Water mist system conforming to BS 8458:2015
Multi-basement buildings	**6.5.2**	Category 1 using the density in BS 9251:2021, Table 2, Footnote A), list item 1)	OH1 hazard classification or higher	Applicable
Houses with one floor more than 4.5 m and less than 7.5 m above ground floor level	**6.2**	Category 1 using the density in BS 9251:2021, Table 2, Footnote A), list item 1)	OH1 hazard classification or higher	Applicable
Houses with more than one floor above 7.5 m	**6.3**	Category 1 using the density in BS 9251:2021, Table 2, Footnote A), list item 1)	OH1 hazard classification or higher	Applicable
Loft conversions	**6.4**	Category 1 using the density in BS 9251:2021, Table 2, Footnote A), list item 1)	OH1 hazard classification or higher	Applicable
Extended travel distances in common corridors	**7.9/19.2**	Category 2 using the density in BS 9251:2021, Table 2, Footnote B)	OH1 hazard classification or higher	Not applicable
Internal planning of flats and maisonettes	**9.1**	Category 1 using the density in BS 9251:2021, Table 2, Footnote A), list item 1)	OH1 hazard classification or higher	Applicable
Provision of inner rooms in flats not more than 4.5 m in height	**9.3**	Category 1 using the density in BS 9251:2021, Table 2, Footnote A), list item 1)	OH1 hazard classification or higher	Applicable
Extended travel distances within an open-plan flat	**9.4.2**	Category 1 using the density in BS 9251:2021, Table 2, Footnote A), list item 1)	OH1 hazard classification or higher	Applicable
Extended travel distances within a flat entered from a floor below the flat	**9.4.3**	Category 1 using the density in Table 2, Footnote A)a)	OH1 hazard classification or higher	Applicable

Table 4 – AWFSS and categories for use with permitted variations

Provision of AWFSS	**Subclause in BS 9991:2021**	**Sprinkler system conforming to BS 9251:2021**	**Sprinkler system conforming to BS EN 12845: 2015+A1**	**Water mist system conforming to BS 8458:2015**
Maisonettes having a floor level higher than 4.5 m above access level	**9.5.2**	Category 1 using the density in BS 9251:2021, Table 2, Footnote A), list item 1)	OH1 hazard classification or higher	Applicable
Open-plan flats	**9.5**	Category 1 using the density in BS 9251:2021, Table 2, Footnote A), list item 1)	OH1 hazard classification or higher	Applicable
Increased travel distance within cluster flats	**9.7.1**	Category 2 using the density in BS 9251:2021, Table 2, Footnote B)	OH1 hazard classification or higher	Not applicable
Flats where occupants are not capable of independent evacuation	**19.1**	Category 1 using the density in BS 9251:2021, Table 2, Footnote A), list item 1)	OH1 hazard classification or higher	Applicable; see also **4.5**
Common areas (excluding common corridors and staircases) where occupants are not capable of independent evacuation	**19.1**	Category 2 using the density in BS 9251:2021, Table 2, Footnote B)	OH1 hazard classification or higher	Applicable
Buildings over 11 m	**19.1**/**24.2.2**	Category 2 or 3	OH1 hazard classification or higher	Not applicable
Buildings over 18 m	**19.1**/**24.2.2**	Category 4	OH1 hazard classification or higher	Not applicable
Buildings over 45 m	**19.1**/**24.2.2**	Category 4	OH3 hazard classification or higher	Not applicable
Reduction in periods of fire resistance	Table 7	Category 2 using the density in BS 9251:2021, Table 2, Footnote B) with a water duration of a minimum of 60 min	OH1 hazard classification or higher	Not applicable
External fire spread and doubling unprotected areas	**26.5**	Category 2 using the density in BS 9251:2021, Table 2, Footnote B)	OH1 hazard classification or higher	Not applicable

Table 4 – AWFSS and categories for use with permitted variations

Provision of AWFSS	Subclause in BS 9991:2021	Sprinkler system conforming to BS 9251:2021	Sprinkler system conforming to BS EN 12845: 2015+A1	Water mist system conforming to BS 8458:2015
Where buildings are not provided with fire mains	**50.1.2**	Category 2 using the density in BS 9251:2021, Table 2, Footnote B)	OH1 hazard classification or higher	Not applicable
Increased hose distances from a firefighting shaft	**50.2.2**	Category 2 using the density in BS 9251:2021, Table 2, Footnote B)	OH1 hazard classification or higher	Not applicable
Flats in atria buildings	Figure E.1	Category 2 using the density in BS 9251:2021, Table 2, Footnote B)	OH1 hazard classification or higher	Not applicable
Protecting the base of an atrium or ancillary accommodation	Figure E.1	Not applicable	OH1 hazard classification or higher	Not applicable
Balcony escape where smoke-retarding construction is provided to an atrium	**E.2.1**	Category 2 using the density in BS 9251:2021, Table 2, Footnote B)	OH1 hazard classification or higher	Not applicable
Balcony escape where no construction is provided between a balcony and an atrium	**E.2.1**	Category 2 using the density in BS 9251:2021, Table 2, Footnote B)	OH1 hazard classification or higher	Not applicable

20 Manual firefighting equipment

A fire risk assessment should be undertaken to determine the need for manual firefighting equipment in common access corridors and in other areas of the premises.

NOTE 1 In common access corridors, manual firefighting equipment is not normally required.

Where provided, portable fire extinguishers should conform to BS EN 3 (all parts) and should be selected, installed and maintained in accordance with BS 5306-3 and BS 5306-8.

As the residents of specialized housing or residential care might not be expected to use manual fire-fighting equipment, its provision should be restricted to higher fire risk areas such as communal lounges, communal kitchens, and wardens' accommodation.

NOTE 2 Where manual firefighting equipment is provided, it is important that there are persons on the premises who are familiar with the use of the equipment.

21 Special risk protection

AWFSS and equipment on premises should be selected taking into account the guidance in BS 5306-0.

NOTE 1 Special risks, such as oil storage tank chambers and oil-fired boiler rooms, might require the installation of an AWFSS associated with the risk alone.

Where a building is otherwise provided with sprinkler protection, any enclosed car park accessed from within the building should also be provided with sprinklers in accordance with BS 9251:2021 or BS EN 12845:2015+A1.

Car stackers should be protected with a sprinkler system, which should be designed such that water can reach every vehicle and that fire spread can be contained.

NOTE 2 Car stackers pose an increased fire risk within car parks. This can be as a result of:

- *an increased risk of vertical fire spread up the stack and the potential for a very large fire involving numerous vehicles;*
- *rapid evolution of elevated temperatures and combustion products within the car park;*
- *potential structural damage to the fabric of the building; or*
- *potential for early structural collapse of the unprotected framework of the stacker with associated hazards for firefighters.*

22 Smoke control

*COMMENTARY ON CLAUSE **22***

The purpose of smoke control is to aid conditions around the source of the fire. Fresh cool air is provided, and some smoke and heat removed, allowing the protection of adjacent areas to the fire and helping with tenability and visibility conditions.

Smoke control systems might be required both above ground (stairwells) and below ground (basements).

a) ***Above ground****.*

Whilst the primary aim of above-ground smoke control in residential buildings is to protect the stairwell enclosure, it can also provide some protection to the adjacent protected corridor or lobby.

The fire-resisting enclosure of a common stair is provided to prevent smoke and heat from entering the stairwell, rendering it impassable for escape purposes, and to prevent fire spreading from one storey to another.

The presence of smoke in the protected stairwell proves hazardous to anyone leaving the building from any floor and also hinders firefighter access. It is also important that replacement inlet air is provided, with its location being determined in relation to the point of extract, so that the system works to effectively extract smoke from the relevant space.

In extended corridors, the primary objective of the smoke control system is to protect both the common corridor and the stairwell enclosure for means of escape.

The build-up of smoke and heat emanating from a fire can seriously inhibit the ability of the fire and rescue service to carry out rescue and firefighting operations within a building.

There are three main methods of smoke control: natural smoke ventilation, mechanical smoke ventilation and pressurization. Further information on these is given in Annex A and BS EN 12101-6.

The determination that a natural system does not work, is not a justification for providing a mechanical system that does not work and allowing the build-up of any smoke in the stairwells.

Further guidance is given in the Smoke Control Association publication Guidance on smoke control to common escape routes in apartment buildings (flats and maisonettes) *[21].*

Diagram D.5 in Approved Document B [17] illustrates the free area of smoke ventilators.

Guidance on tenability criteria for firefighters is given in PD 7974-5. In the context of BS 9991, this is not applicable to protected stairwells or extended corridors provided with smoke protection, but might be applicable in limited specific applications.

b) ***Below ground****.*

Basements also require smoke control consideration and details are given on this, Information is provided on the components to be used and the correct use of make-up air.

Covered car parks have their own specific guidance in the form of BS 7346-7. They also have day-to-day ventilation requirements, and the systems are usually integrated to fulfil a design that offers both.

22.1 General

In residential buildings designed with a stay put strategy, a smoke control system should be provided to give additional protection to the stairwell.

Once inside a protected stairwell, a person should be in a place of relative safety from the immediate danger of flame and smoke. They can then proceed to a place of ultimate safety at their own pace.

All fire-fighting shafts should be provided with a smoke ventilation system, either natural or mechanical, meeting the recommendations in **22.3**, **22.4** and Annex A.

The smoke control system within residential buildings should be located such that it is maintainable from the common parts of the building

Above-ground, basement and car park smoke control systems should all be separate in a building and be designed not to interfere with each other. All heating, ventilation and air conditioning (HVAC) systems that might be alongside a smoke control system should be shut down when the smoke control system is running. If the HVAC system is integrated with the smoke control system, the HVAC system should be designed as a smoke control system and use the associated components.

22.2 Computational fluid dynamics

COMMENTARY ON ***22.2***

When undertaking CFD analysis, and whilst the principal objective is to protect the stair from the ingress of smoke and maintain it smoke-free, it might be considered acceptable by the designer for a very small amount of smoke to be shown to enter the stair enclosure temporarily (e.g. when a door opens and closes), if it is demonstrated that the smoke is subsequently quickly removed by the smoke ventilation system.

However, this is considered to fall within the bounds of uncertainty when undertaking CFD simulation.

A computational fluid dynamics (CFD) analysis should be undertaken when there is a need to demonstrate that the proposed smoke ventilation system protects the stair enclosure from smoke ingress, both during the means of escape phase and when the stair door is held open during firefighting operations.

NOTE A CFD analysis is based upon building specific geometries and, ideally, includes a sensitivity analysis.

Tenability-based acceptance criteria to the stair enclosure in terms of visibility and toxicity should not be used in the CFD analysis.

22.3 Above-ground systems

22.3.1 Small buildings with a single stair (under 11 m)

*COMMENTARY ON **22.3.1***

For single-stair buildings under 11 m, a natural ventilation approach is followed that relies on allowing a free flow of air at the top of the stairwell or at the smoke level, and also at the lowest level via doors to outside.

22.3.1.1 General

Small buildings having a single stair in accordance with **7.7** should meet the following recommendations given in **22.3.1.2** or **22.3.1.3**, depending on whether natural or mechanical ventilation is provided.

For travel distances over 4.5 m, the recommendations for buildings over 11 m in height should be used (see **22.3.2**).

22.3.1.2 Natural ventilation

Where natural ventilation is provided, the following recommendations should be met.

a) Where there is a common lobby approach to the dwellings [see Figure 7a)], the stairwell should have either:

   1) a manually openable vent or AOV having a minimum free area of 1 m^2, inserted at the highest level practicable at each floor level within the stairwell; or

   2) a remotely operated openable vent having a minimum free area of 1 m^2 at the top of the stairwell that can be controlled at the fire and rescue service access level.

b) Where there is no common lobby [see Figure 7b)], the stairwell should have an AOV with a minimum free area of 1 m^2 at the top of the stairwell that operates on detection of smoke anywhere within the stairwell enclosure.

The smoke control strategy given in item b) should not be used with an open-plan flat layout design.

Vents, AOVs and smoke control dampers should be in accordance with **A.5**.

22.3.1.3 Mechanical ventilation

If a mechanical system is provided, then this should follow a method similar to above and provide a volume flow in the stairwell to remove any smoke that enters the stairwell using components in accordance with **A.5**.

22.3.2 Buildings with a floor level of 11 m (and not more than 18 m) above ground level and served by a single stair

22.3.2.1 General

In a building which has accommodation on two or more sides of the common stair, the various wings of the building should be isolated by fire doors in accordance with **32.1** in order to prevent corridors from becoming contaminated by smoke [see Figure 8a)].

Vents designed to open automatically from the top storey of the stairs in buildings other than small single-stair buildings should be configured to operate upon smoke detection within any of the protected corridors or protected lobbies directly adjacent to the stairwell enclosure.

Only the AOV leading from the protected corridor or protected lobby where the smoke has been detected should be configured to open. This should open either to external air or into a smoke shaft; all other protected lobby vents should be configured to remain closed. Manual override controls should not permit multiple lobby vents to be open simultaneously.

NOTE 1 This applies whether the vent opens to outside air or into a natural or mechanical shaft.

Unless a simultaneous evacuation arrangement is deemed appropriate, there should be no sounders attached to the smoke detectors within common parts.

NOTE 2 The purpose of smoke detectors is to operate the smoke control system, not to raise an alarm.

All connections between the smoke detection, vent control panels and actuator mechanisms should be within an environment that provides protection from expected fire conditions.

Where any part of the control mechanism is powered by electricity, a secondary supply should be provided.

22.3.2.2 Natural systems

Natural smoke ventilation systems should be used only in buildings up to 30 m in height, with multiple stairs and with travel distances up to those recommended in Figure 8. For buildings over 30 m, and/or where travel distances are in excess of those recommended in Figure 8, a mechanical smoke ventilation system or pressure differential system should be used

For protected corridor or protected lobby access dwellings [see Figure 8a) and Figure 8b)], the smoke control system should have one of the following:

a) AOVs to the exterior of the building with a free area of not less than 1.5 m^2, fitted in the common corridor or lobby directly adjacent to the stair at as high a level as is practicable, and an AOV that is sited at as high a level as is practicable on the top storey of the stairwell, having a free area of not less than 1 m^2; or

b) a smoke shaft in accordance with **A.5** that is fitted in the protected lobby or corridor, and an AOV that is sited at as high a level as is practicable on the top storey of the stairwell, having a free area of not less than 1 m^2.

22.3.2.3 Mechanical systems in stairwells

Mechanical systems in stairwells should be one of the following:

a) a mechanical smoke ventilation system (in accordance with **A.3.3**) that is installed in the protected lobby or protected corridor, directly adjacent to the stairwell enclosure, and an AOV that is sited at as high a level as is practicable on the top storey of the stairwell, having a free area of not less than 1 m^2; or

b) a pressure differential system in accordance with BS EN 12101-6 (see also **A.3.2**).

NOTE 1 When published, BS EN 12101-13 will take the place of the designs in the current BS EN 12101-6 and will refer to BS EN 12101-6 for kit and component requirements.

The system should respond automatically to a smoke alarm input and work automatically.

The system should have no overrides or manual inputs that change the automatic function of the system.

Should overrides be needed, the automatic system should be turned off, overriding all the alarm inputs and removing the automatic function. This is unlikely to occur until the fire incident is deemed “over” by the firefighters.

Any equipment selected to realise the smoke control design should be in accordance with **A.5**.

NOTE 2 Where fresh air supply fans are required, they do not need to have any additional elevated temperature or fire tests.

22.3.2.4 Multiple-stair buildings

All firefighting shafts should be provided with a smoke control system as described in **22.3.2**.

Smoke control systems for stairwells that are not firefighting shafts should be the same as those for single-stair buildings above 11 m (see **22.3.2**), except that any vents to the exterior of the building may also be manually operated. Where manually operated vents are used,

the smoke control system should be designed to open the vent at the head of the stair either before, or at the same time as, the vent on the fire floor.

Where the vents discharge into a smoke shaft, the vents on the fire floor, at the top of the smoke shaft and on the stairwell should all be configured to open simultaneously upon automatic activation of the system in the common corridor or lobby. The vents from the corridors or lobbies on all other storeys should be configured to remain closed.

Any components selected to realize the smoke control design should be in accordance with **A.5**.

22.3.3 Smoke control in balcony approach or deck approach buildings

Buildings with a balcony approach or a deck approach should be provided with an openable vent with a free area of 1 m^2 at the top of any enclosed stairwell, which can be remotely operated at fire and rescue service access level (see **7.10**).

Any equipment selected to realize the smoke control design should be in accordance with **A.5**.

22.3.4 Smoke control for protected lobbies and corridors

If a common stair serves an enclosed car park or an area with a higher fire risk, the lobby or corridor should be either:

a) provided with an area of permanent ventilation of not less than 0.4 m^2; or

b) protected from the ingress of smoke by a mechanical smoke ventilation system.

NOTE 1 Where every dwelling is provided with an alternative escape route to a common stair and residents do not have to use their normal means of access as their only escape route, it is only necessary for their normal access route to be provided with ventilation to clear smoke that can be operated manually by the fire and rescue service.

NOTE 2 Any common stair which does not form part of the only escape route from a flat may also serve ancillary accommodation if it is separated from the ancillary accommodation by a protected lobby or protected corridor.

Any equipment selected to realize the smoke control design should be in accordance with **A.5**.

22.4 Below-ground systems (basements)

22.4.1 General

A system of smoke and heat ventilation should be provided from every basement, except for any basement storey that has:

a) a floor area of not more than 200 m^2; or

b) a floor level not more than 3 m below the adjacent ground level.

NOTE Basement compartments having external doors or windows do not need smoke outlets, as long as the floor area recommendations are met. It is common for basements to be open to the air on one or more elevations.

Systems may be either natural, using one or more smoke outlets conforming to **22.4.2** or mechanical, conforming to **22.4.3**.

22.4.2 Natural smoke and heat ventilation

22.4.2.1 General

Natural ventilation should not be used for firefighting shafts serving basements more than 10 m below ground level. A pressure differential system in accordance with BS EN 12101-6 should be used in these situations.

Smoke outlets should be provided to allow a route for smoke to escape to the open air from the basement level(s). If a basement is compartmented, each compartment should have direct access to vents without having to open doors, for example, into another compartment.

Firefighting lobbies at basement level should be provided with either:

a) a manually openable 1 m^2 free area vent at high level, direct to open air or to a smoke shaft serving only that level (permanently open vents should not be installed); or

b) an extension of an above-ground smoke shaft serving each lobby level.

22.4.2.2 Smoke outlets

Smoke outlets should be:

a) not less than 2.5% of the floor area of each storey;

b) sited at the highest level practicable, either in the ceiling or in the wall of the space they serve;

c) evenly distributed around the perimeter of the building, to discharge into the open air outside the building; and

d) located such that they would not prevent the use of escape routes from the building.

If an outlet terminates at a point that is not readily accessible, it should be unobstructed, and should be covered only with a grille or louvre that is constructed of class A1 materials.

If an outlet terminates in a readily accessible position and is covered by a panel, stallboard or pavement light that can be broken out or opened, the position of the outlet should be suitably marked.

Where outlets are not covered and need an AOV, this should be in accordance with **A.5**.

Any other equipment selected to realize the smoke control design should be in accordance with **A.5**.

NOTE The fire and rescue service can be consulted for further information regarding suitable marking of smoke outlets.

Separate outlets should be provided from places of special fire hazard (see Clause **38**).

22.4.2.3 Basement smoke shafts

Components for smoke shafts serving basements should be in accordance with **A.5.1**.

Smoke shafts serving basements should discharge smoke directly into open air at ground level. The smoke shafts should not discharge smoke by the building exits or by fire and rescue access points.

Basement smoke shafts serving more than one floor should be provided with smoke control dampers that operate in accordance with **A.5.5**.

22.4.3 Mechanical smoke and heat ventilation

22.4.3.1 General

If a system of mechanical smoke and heat ventilation is provided within a basement as an alternative to natural venting, to remove smoke and heat from the basement, the basement storey(s) should be fitted with a sprinkler system in accordance with BS EN 12845:2015+A1.

Where a powered extract system is used, the following recommendations should be met.

a) The system should operate automatically either on activation of the sprinkler system or by a fire detection and fire alarm system in accordance with BS 5839-1:2017 at a minimum standard of L5.

b) The system should provide ten air changes per hour and provision should be made in the automatic system for (fresh) replacement air to allow this.

Any equipment selected to realize the smoke control design should be in accordance with **A.5**.

Firefighting lobbies at basement level should be provided with:

1) an AOV of 1 m^2 free area vent at high level, direct to open air or to a smoke shaft serving only that level (permanently open vents should not be installed); or

2) an extension of the mechanical system to provide ventilation.

22.4.3.2 Venting of smoke and heat from covered car parks

A smoke and heat ventilation system should be provided from every car park storey, designed in accordance with BS 7346-7 and having the objective of clearing smoke during a fire and/or after a fire has been suppressed.

Car parks also have day to day ventilation requirements and the systems are usually integrated to fulfil a design that offers both ventilation and smoke control.

All components used in the smoke control design should be in accordance with **A.5**.

23 Power supplies, cabling and installation

The power supplies, electrical wiring and control equipment should be protected against fire and water damage for a time equal to the fire resistance time for the compartmentation of the associated areas, as shown in Table 5.

Power and control cables should be designed, selected and installed in accordance with BS 8519.

All power supplies for smoke control systems should conform to BS EN 12101-10.

Table 5 – Minimum fire resistance of the building electrical switchroom enclosures

Voltage of switchroom/ transformer room	**Fire resistance of enclosure**					
	Depth below access levels of basement level			**Height of top occupied storey above access level**		
	>10 m	**≤10 m**	**≤5 m**	**>5 m ≤18 m**	**>18 m ≤30 m**	**>30 m**
LV or ELV switchroom	90 min	60 min	30 min	60 min	120 min	120 min
HV switchroom and transformer room	120 min	120 min	120 min	120 min	120 min	120 min

Where dual power supplies are recommended by the relevant British Standard for life safety and firefighting systems, the primary power source should be taken from the public electricity supply.

The secondary source should come from:

a) a life safety generator; or

b) an independent high voltage supply provided it is fed from an independent utility primary network substation to that feeding the primary supply; or

c) an uninterruptible power supply (UPS) according to the loading requirements, with the UPS and associated batteries designed, selected and installed in accordance with BS 8519.

The supply arrangement should conform to BS 7671.

NOTE 1 Typical supply configuration diagrams are shown in Figure 28.

When assessing the appropriateness of the secondary source of supply, the life safety and firefighting loads to be served by the secondary source should be identified in accordance with BS 8519.

NOTE 2 BS 8519 does not recommend dual low voltage utility supplies due to the need for the two supplies to be independent from each other.

The UPS battery equipment should be sized and selected in accordance with BS 8519. Each UPS should comprise two supply paths, i.e. rectifier/charger and static bypass, each being fed by a separate circuit protective device.

The autonomy time for each UPS system should be based on twice the intended run time of the equipment that it is to supply (sprinkler pumps, fans, etc.) (typically 2 × 30 min or 2 × 60 min). All control systems should have a backup available for 72 h after loss of the primary power source.

The UPS battery equipment should be located adjacent to the equipment that it is to support, and should be protected from the risk of fire or water damage, in accordance with BS 8519.

The UPS battery equipment serving the any equipment and controls should be appropriately sized and selected for the fan and control equipment starting characteristics.

Separate UPS secondary supplies should be provided for any other life safety and firefighting loads

NOTE 3 Wet riser pumps are generally required for residential buildings over 50 m in height. UPS battery equipment is considered unsuitable, due to the building size and motor characteristics of the additional fire pumps. For this application a life safety generator is the preferred secondary source of supply.

UPS equipment intended to supply life safety and firefighting equipment as the secondary source of supply should be designed to provide the required autonomy period from the battery installation and should conform to BS 7671. The rectifier/charger should be sized accordingly.

The battery should be recharged from being fully discharged to approximately 80% charge in 12 h and 100% charge in 24 h.

NOTE 4 During the extended battery recharge period the building remains potentially unprotected by the secondary source.

The UPS rectifier/inverter path should be rated to cater for the fault clearing requirements of the largest downstream protective device, as the static switch path cannot be relied on for fault clearance in the event of a failure of the primary mains supply.

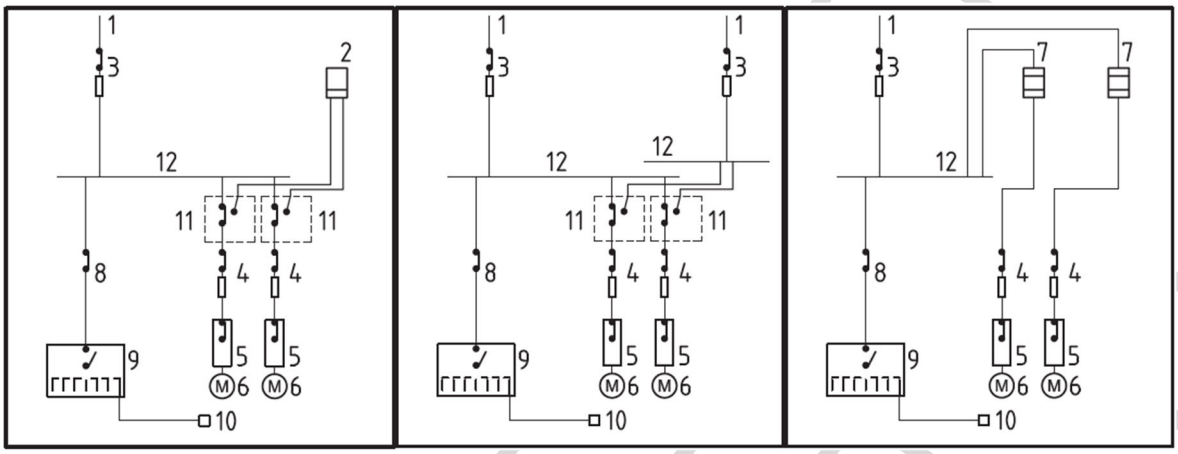
The minimum design life of UPS batteries at 20 °C should be 10 years.

The battery capacity reduces to approximately 80% at the end of life, even when maintained at its optimum ambient temperature, so the battery should be over-sized by approximately 20% in order to achieve the required autonomy time at the end of its life.

The UPS battery room should be air-conditioned by suitably resilient cooling plant, with cooling plant maintained by UPS equipment, where necessary.

If the event of the failure of the primary power source, the supply should automatically switch over to the secondary source. Failure of one source should not result in the failure of the alternative source of supply or the failure of the supply of power to the system.

Figure 28 – Typical supply configuration diagrams



Key

1	Mains supply	7	UPS, including automatic transfer switch
2	Stand-by generator	8	Main switch for building services
3	Supplier's service cut-out	9	Main distribution board for building services
4	Sprinkler pump isolating protective device	10	Sprinkler pump house ancillary equipment (e.g. lighting, fans, battery charges)
5	Sprinkler pump controller	11	Automatic transfer switch
6	Main sprinkler pump motor	12	Busbar

Section 5: Design for construction

24 Fire resistance

*COMMENTARY ON CLAUSE **24***

*For the purposes of meeting the recommendations for means of escape in case of fire, a 30 min period of fire resistance is generally considered adequate. Increased periods of fire resistance might, however, be necessary: firstly to assist in protecting individuals who remain in adjacent dwellings owing to a stay put policy (see **A.1**), and secondly to provide adequate safety for firefighting.*

*Elements of structure (columns, floors, walls, etc.) might not inherently possess sufficient fire resistance. A variety of methods of additional fire protection is available in the form of protective coverings, casings or membranes, but designers need to take into account the risk of damage. As an alternative, a sprinkler system may be fitted throughout the building to limit temperatures and protect the structure (see Clause **19**).*

*For the fire resistance of compartmentation, see Clause **25**.*

24.1 General

Fire resistance should be not less than 30 min when tested in accordance with the relevant part of BS 476 or corresponding European standard for:

a) load-bearing walls, for load-bearing capacity, integrity and insulation from either side;

b) non-load-bearing walls and partitions, for integrity and insulation from either side;

c) fire doors for integrity from either side, with the exception of doors to lift wells where performance is in respect of exposure of the landing side only and which are tested in accordance with BS EN 81-58 (see also **32.1.3**); and

d) floors, for load-bearing capacity, integrity and insulation with respect to exposure of the underside only.

24.2 Minimum levels of fire resistance for elements of structure

24.2.1 General

When tested in accordance with the relevant part of BS 476, BS EN 1363, BS EN 1364, BS EN 1365 or BS EN 1366, the elements of structure identified in Table 6 should have a fire resistance not less than the minimum values recommended in Table 7 or Table 8. To use these tables, the fire resistance (load-bearing capacity, integrity and insulation) should first be determined from Table 6; then the fire resistance periods should be determined either from Table 6 if a specific recommendation is given, or from Table 7 or Table 8, depending on whether or not ventilation conditions are to be taken into account (see Footnote A to Table 8).

NOTE Table 7 gives recommendations for fire resistance of elements of structure and other parts of a building based upon the fuel load density and assuming an unventilated fire. Table 8 gives recommendations for fire resistance of elements of structure based upon ventilation conditions.

Table 8 should be used only if the following ventilation conditions can be met:

a) minimum potential area as a percentage of the floor area: 10%; and

b) height of opening as a percentage of the compartment height (i.e. from floor to ceiling): 30% to 90%; and

c) opening height: weighted mean height (by ventilation area) of the potential openings (see Note for calculation method). If *h* is the weighted mean height of all the openings and *H* is the height of the compartment then *h/H* should be between the values given in the end column of Table 8.

NOTE If a compartment has openings each with an area of A_1, A_2, A_3,…A_n *and heights of* h_1, h_2, h_3,…h_n, *then the total area of the openings* $A = A_1 + A_2 + A_3 + \ldots A_n$, *and the weighted mean height,* h, *is given by:*

$$\bar{h} = \frac{A_1 h_1 + A_2 h_2 + A_3 h_3 + \ldots A_n h_n}{A}$$

In the calculation of the weighted mean height it is also acceptable to select only the height(s) of the openings that achieve the minimum ventilation area.

If these conditions cannot be met then Table 7 should be used.

COMMENTARY ON TABLE 7 AND TABLE 8

Fire loads are built into Table 7 and Table 8, which reflect the normal fire loadings within a residential building.

The provision of an automatic sprinkler system significantly reduces the severity of a fire. The fire resistance of compartment walls and floors can be changed if sprinklers are provided. This is reflected in Table 8.

Traditionally, standards of fire resistance have been based upon the fire load or the fuel load density. However, there are other factors which may be taken into account.

The level of heating that an element experiences is influenced primarily by the fuel load density in the compartment, the insulation properties or thermal inertia, the geometry and ventilation conditions of the fire compartment. These variables, which determine the level of heating in a real fire, can be linked to the standard fire resistance test conditions by the concept of time equivalency (t-equivalency).

The t-equivalent period of fire resistance is a means of calculating a time for which an element in a compartment subject to a real fire would undergo a heating equivalent to the same time period in a standard furnace test. This approach models the heating effects of a real fire by taking into account the actual fuel load density, the thermal inertia of the lining materials, the compartment geometry and ventilation conditions within the compartment.

In order to determine an appropriate fire resistance period for elements of structure, the t-equivalent values can be used as a basis. The values obtained in this way are then factored to take into account the three purposes of structural fire resistance, namely:

- *to minimize the risk to occupants, some of whom might have to remain in the building for some length of time due to the stay put strategy (see **A.1**);*
- *to reduce the risk to firefighters who might be engaged in search or rescue operations; and*
- *to reduce the danger to people in the vicinity of the building, who might be hurt by falling debris or as a result of the impact of the collapsing structure on other buildings.*

Background to the derivation of Table 7

Table 7 has been derived by assessing the risk assessment, fire growth rate and occupants of the building. It largely follows the guidance given in Approved Document B [17].

Background to the derivation of Table 8

Table 8 has been developed using fundamental fire safety engineering principles which use a combination of deterministic analysis combined with a risk and consequence evaluation to reflect the severity of a real fire and the threat to life safety in residential buildings.

The deterministic analysis employed a time equivalent approach based upon the validated parametric expressions given in BS EN 1991-1-2, for post-flashover fires. This considers basic factors such as the fire load density, ventilation, the thermal properties of the enclosure, compartment size and geometry. In order to cover a wide range of variables for the parametric fire, a Monte Carlo analysis was carried out involving many thousands of fires to ensure that the extreme combination of variables were captured. The analysis assumes a total burn-out of the fire.

The effectiveness of sprinklers in reducing the fire severity was considered in the form of applying a multiplication factor based upon risk, to the fire load density.

From the Monte Carlo analysis, the cumulative distributions of time equivalent were subsequently analysed based upon the fundamental premise that risk = frequency × probability × consequence of failure. The frequency was linked with the height of the building following the principles of the Building Regulations 2000 [22], and consequence of failure was linked to both the building height and risk profile of the occupancy taking account of

the familiarity and mobility of the occupants within the building and the sleeping risk. The probability of failure is directly related to the cumulative distribution curves that resulted from the Monte Carlo analysis.

NOTE 1 The fire resistance periods given in Table 7 are based on the minimum levels required for life safety given in Approved Document B [17] and are not necessarily adequate for property protection and business continuity.

NOTE 2 Table 7 gives recommendations for fire resistance of elements of structure for basement storeys. These elements are not covered in Table 8.

*NOTE 3 Minimum levels of fire resistance for fire doors are given in **32.1**.*

Table 6 – Minimum fire resistance performance

Part of building	**Minimum provisions when tested to the relevant parts of BS 476**, in minutes[A]			**Minimum provisions when tested to the relevant European standard**, in minutes[B]			**Method of exposure**
	Load-bearing capacity[C]	**Integrity**	**Insulation**	**Load-bearing capacity**[C]	**Integrity**	**Insulation**	
Structural frame, beam or column	See Table 7 or Table 8	Not applicable	Not applicable	See Table 7 or Table 8	Not applicable	Not applicable	Exposed faces
Load-bearing wall element	See Table 7 or Table 8	Not applicable	Not applicable	See Table 7 or Table 8	Not applicable	Not applicable	Each side separately
Floor[D]							
Between a shop and a flat above	60 or see Table 7 or Table 8[F]	60 or see Table 7 or Table 8[F]	60 or see Table 7 or Table 8[F]	60 or see Table 7 or Table 8[F]	60 or see Table 7 or Table 8[F]	60 or see Table 7 or Table 8[F]	From underside[E]
Any other floor, including compartment floors	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	From underside[E]
Roof							
Any part forming an escape route	30	30	30	30	30	30	
Any roof that performs the function of a floor	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	From underside[E]
External wall							
Any part less than 1 m away from any point on the relevant boundary	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	Each side separately
Any part 1 m or more from the relevant boundary[G]	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	From inside the building
Any part adjacent to an external escape route	30	30	No provision[H], [I]	30	30	No provision[H], [I]	From inside the building
Compartment wall							

Walls separating occupancies (see Clause **25**)	60 or see Table 7 or Table 8[J)]	60 or see Table 7 or Table 8[J)]	60 or see Table 7 or Table 8[J)]	60 or see Table 7 or Table 8[J)]	60 or see Table 7 or Table 8[J)]	60 or see Table 7 or Table 8[J)]	Each side separately
Any other compartment walls	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	Each side separately
Protected shaft, excluding any firefighting shafts							
Glazed screen separating protected shaft from lobby or corridor	Not applicable	30	No provision[K), L)]	Not applicable	30	No provision[K), L)]	Each side separately
Any other part between the shaft and a protected corridor/lobby	30	30	30	30	30	30	Each side separately
Any other part not described above	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	See Table 7 or Table 8	Each side separately
Firefighting shaft							
Construction separating firefighting shaft from rest of building	120	120	120	120	120	120	From side remote from shaft
	60	60	60	60	60	60	From shaft side
Construction separating firefighting stair, firefighters lift shaft and firefighting lobby	60	60	60	60	60	60	Each side separately
Enclosure							
To a protected lobby or a protected corridor (not forming part of a compartment wall or a protected shaft)	30	30	30[K)]	30	30	30[K)]	Each side separately
In a flat, to a protected entrance hall or a protected landing	30	30	30[K)]	30	30	30[K)]	Each side separately
Subdivision of a corridor	30	30	30[K)]	30	30	30[K)]	Each side separately

Fire-resisting construction							
Enclosing communal areas	30	30	30[K)]	30	30	30[K)]	Each side separately
Enclosing places of special fire hazard	30	30	30	30	30	30	Each side separately
Subcompartment walls in residential care premises	30	30	30	30	30	30	Each side separately
Cavity barrier	Not applicable	30	15	Not applicable	30	15	Each side separately
Duct[M)]	Not applicable	30	No provision	Not applicable	30	No provision	From outside
Casing around a drainage system[N)]	Not applicable	30	No provision	Not applicable	30	No provision	From outside
Flue walls[O)]	Not applicable	Half the period given in Table 7 or Table 8 for compartment wall/floor	Half the period given in Table 7 or Table 8 for compartment wall/floor	Not applicable	Half the period given in Table 7 or Table 8 for compartment wall/floor	Half the period given in Table 7 or Table 8 for compartment wall/floor	From outside
Fire door	See Table 16	See Table 16	See Table 16	See Table 16	See Table 16	See Table 16	
Construction enclosing a roadway	120	120	120	120	120	120	From the roadway side

[A)] Part 21 for load-bearing elements, Part 22 for non-load-bearing elements, Part 23 for fire-protecting suspended ceilings, and Part 24 for ventilation ducts.

[B)] The national classifications do not automatically equate with the equivalent classifications in the European column, therefore products cannot typically assume a European class unless they have been tested accordingly.

[C)] "R" rating applies to load-bearing elements only.

[D)] Guidance on increasing the fire resistance of existing timber floors is given in BRE Digest 208 [23].

[E)] If a suspended ceiling is used it should be in accordance with **24.2.5** and **28.2**.

[F)] Whichever is greater.

[G)] Clause **26** allows such walls to contain areas which need not be fire-resisting (unprotected areas).

[H)] Unless needed to meet the recommendations given in Clause **26**.

[I)] Except for any limitations on glazed elements given in Clause **30**.

J) Whichever is less.

K) See **30.1** for permitted extent of non-insulated glazed elements.

L) See **30.2**.

M) See **27.2**v).

N) See **29.4**.

O) See **29.4**, Figure 40.

Table 7 – Fire resistance periods for elements of structure (independent of ventilation conditions)

Condition	**Minimum periods of fire resistance**, in minutes						
	Depth below access level of basement level		**Height of floor of top occupied storey above access level** [A]				
	>10 m	**≤10 m**	**≤5 m**	**≤11 m**	**≤18 m**	**≤30 m**	**>30 m**
Sprinklered[B]	90	60	30	60	60	60	120
Unsprinklered	90	60	30	60	Not allowed	Not allowed	Not allowed

[A] For tall single-stair buildings, see **10.1**.

[B] Sprinkler systems should be in accordance with BS 9251:2021 or BS EN 12845:2015+A1 (see **19.2**, Table 4).

Table 8 – Fire resistance periods for elements of structure (based on ventilation conditions[A])

Condition	**Minimum periods of fire resistance**, in minutes[A]					
	Height of floor of top occupied storey above access level [B]					
	≤5 m	**≤11 m**	**≤18 m**	**≤30 m**	**≤50 m**	**>50 m**
Sprinklered[C]	45	60	75	75	90	105
Unsprinklered	60	90	Not allowed	Not allowed	Not allowed	Not allowed

[A] Where a product or system is not available to meet the minimum period of fire resistance, it is acceptable to use a product or system having the next highest available classification. The classification periods 75 and 105 do not exist in European classification system BS EN 13501-2.

[B] For tall single-stair buildings, see **10.1**.

[C] Where sprinklers are used to vary the provision of fire safety measures, only those installed in accordance with BS 9251:2021 or BS EN 12845:2015+A1 (see **19.2**, Table 4) may be used to adjust the fire resistance periods given in this table.

24.2.2 Buildings over 11 m high

Buildings having an occupied storey over 11 m above access level should be sprinkler-protected throughout in accordance with BS 9251:2021 or BS EN 12845:2015+A1 (see **19.2**, Table 4).

24.2.3 Single-storey buildings

In single-storey buildings where there are compartment walls, or where an external wall is close enough to the relevant boundary to require it, structural fire resistance should be provided.

24.2.4 Roof structure

The structure of a roof, and the structure that supports only a roof, does not generally require fire resistance unless the roof forms part of an escape route or functions as a floor, e.g. as a car park, or is part of a portal frame structure where the roof and the supporting stanchions form a single structural element.

24.2.5 Suspended ceilings

A suspended ceiling can contribute to the overall fire resistance of a floor/ceiling assembly. If a suspended ceiling is used it should be in accordance with Table 9.

Any access panels provided in fire protecting suspended ceilings of type Y or Z, as described in Table 9, should be secured in position by releasing devices or screw fixings, and they should be shown to have been tested in the ceiling assembly in which they are incorporated.

Table 9 – Provisions for fire-protecting suspended ceilings

Height of building or separated part	Type of floor	Provision for fire resistance of floor	Description of suspended ceiling [A)]
m		min	
<18	Not compartment	≤60	Type W, X, Y or Z
<18	Compartment	<60	Type W, X, Y or Z
<18	Compartment	60	Type X, Y or Z
≥18	Any	≤60	Type Y or Z
No limit	Any	>60	Type Z

NOTE 1 This British Standard uses the European classification system for reaction to fire set out in BS EN 13501-1:2018. The national classifications do not automatically equate with the corresponding European classifications, therefore products cannot typically assume a European class unless they have been tested accordingly. Further information is given in Annex B.

NOTE 2 When a classification includes "s3, d2" this means that there is no limit set for smoke production and/or flaming droplets/particles.

[A)] Ceiling type and description:

W = Surface of ceiling exposed to the cavity should be class C-s3, d2 or better.

X = Surface of ceiling exposed to the cavity should be class B-s3, d2 or better.

Y = Surface of ceiling exposed to the cavity should be class B-s3, d2 or better. Ceiling should not contain easily openable access panels.

Z = Ceiling should be class A2-s3, d2 or better and should not contain easily openable access panels. Any insulation above the ceiling should be class A2-s3, d2 or better.

25 Compartmentation

25.1 Houses, flats and maisonettes

The following elements should be constructed with a fire resistance of not less than 60 min:

a) in houses, any wall separating one dwelling from another dwelling or separating the dwelling from accommodation that does not form part of the dwelling;

b) in flats and maisonettes situated more than 5 m above ground or access level, any floor (unless it is within a maisonette), and any wall separating a flat or maisonette from another part of the building; and

c) any wall enclosing a refuse storage chamber.

A wall common to two or more buildings should be constructed as a compartment wall.

Compartment walls should be able to accommodate the predicted deflection of the floor. This should be achieved in one of the two following ways:

1) a head detail should be provided between the compartment wall and the floor, which is capable of deforming while maintaining its integrity when exposed to a fire; or

2) the design of the compartment wall should be such that it maintains its integrity by resisting the additional vertical load from the floor above when forced to sag under fire conditions.

*NOTE Further information is given in the Approved Document B [17], **8.27**, Note, and Diagram 29.*

25.2 Residential care premises

For all residential care premises, each floor should be constructed as a compartment floor.

Where a progressive evacuation strategy is in place, the following additional recommendations should be met.

a) Where a storey area exceeds 1 500 m^2, the storey should be separated into compartments, each of which should be no greater than 1 500 m^2 in area

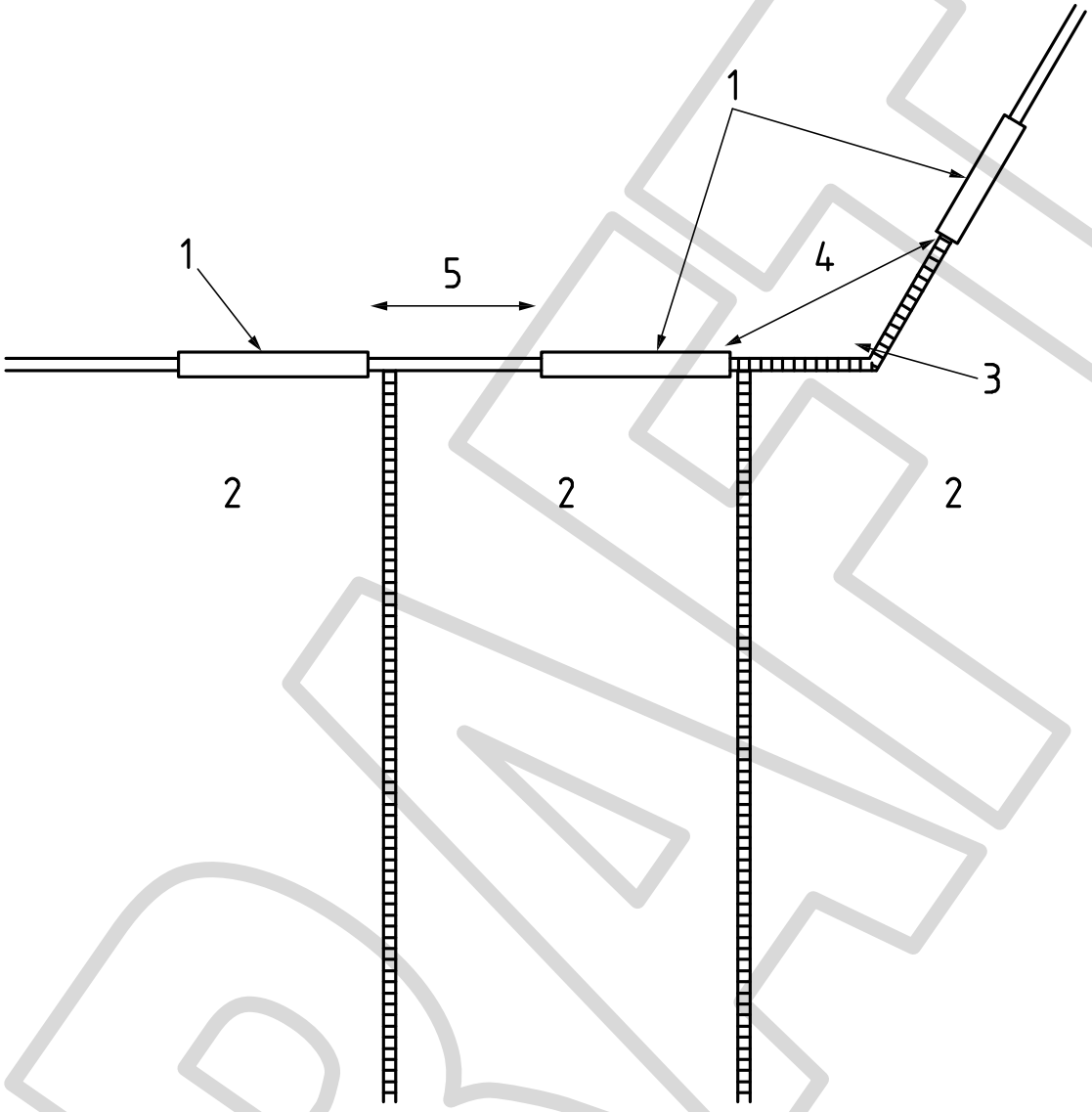
b) Each compartment, or floor plate if this is less than 1 500 m^2 in area, is divided into at least two sub-compartments by a sub-compartment wall and door(s), such that each sub-compartment is no greater than 750 m^2 in area.

25.3 Internal angle on an external wall between dwellings

In buildings of any height, the possibility of a fire spreading from one compartment to another externally across a gap created by an internal angle between the facades should be minimized.

If the external wall of a dwelling projects beyond, is recessed from, or forms an internal angle not exceeding 135° with the external wall to another dwelling, then the distance between any openings in these external walls should be not less than 1.0 m (see Figure 29).

Figure 29 – External protection between dwellings



Key

1 Unprotected areas

2 Separate dwellings

3 External angle <135°

4 Distance no less than 1.0 m

5 No minimum distance

Wall with 60 min fire resistance

26 External fire spread and building separation

*COMMENTARY ON CLAUSE **26***

The recommendations given in this clause are concerned with the measures available to restrict undue fire spread over and within external walls and to inhibit fire spread from the building of origin to a neighbouring structure.

*Recommendations are given in respect of the combustibility of materials used in the construction of external walls (see **26.2**).*

Two basic methods of fire spread between buildings are addressed:

- *direct impingement of flames from one building on another; and*
- *radiation (possibly supplemented by burning debris).*

*For buildings within 1 m of the relevant boundary (see **26.4.1**), flame spread is the main mechanism for fire spread. Beyond this distance, the mechanism for fire spread is assumed to be radiation.*

Fire spread from building to building by radiation is dependent on:

- *the distance between and orientation of the building of origin and the neighbouring structure (radiator to receiver) [this is based on the principles of configuration (or view) factor];*
- *the extent of the building surface capable of transmitting heat (external construction that has fire resistance is considered to have sufficient insulating properties, such that heat transfer can be ignored); and*
- *the intensity (emissive power) of the source radiation.*

The radiative energy emitted by the building of fire origin is dependent on the size and severity of the fire.

For the purposes of the recommendations given in this clause, it is assumed that:

- *fire does not spread beyond the compartment of origin;*
- *the compartment of origin has reached flashover;*
- *all unprotected areas of one compartment are radiating with equal intensity;*
- *radiation intensity at each unprotected area is 84 kW/ m^2;*
- *radiation is halved by the action of an automatic sprinkler system; and*
- *any glazing, and/or the supporting structure, in the façade of the building of fire origin has failed in terms of integrity, unless the glazing system is classified for fire resistance according to the relevant part of either BS 476 or BS EN 13501 to the same standard as the wall as recommended in Table 7.*

No account is taken of the attenuation of the level of radiation.

In terms of external fire spread between buildings, the acceptable risk to life is based on the relevant boundary being half the distance between buildings. Neighbouring buildings are assumed to have similar unprotected areas.

NOTE 1 A roof is not subject to the provisions in this clause unless it is pitched at an angle greater than 70° to the horizontal. Similarly, vertical parts of a pitched roof such as dormer windows (which taken in isolation may be regarded as a wall) would not need to meet these provisions unless the slope of the roof exceeds 70°. It is a matter of judgement whether a continuous run of dormer windows occupying most of a steeply pitched roof is to be treated as a wall rather than a roof.

NOTE 2 The measures recommended in this clause will not necessarily protect a building from a fire in an existing building on an adjoining site. The property loss prevention aspects of the situation need to be assessed in each case.

26.1 General

The boundary separation calculations of unprotected areas should relate to a notional boundary between the building and any other building on the site. The distance to the relevant boundary (see **26.4**) should be taken as the actual measured distance between the buildings.

26.2 Resisting fire spread over external walls

External walls should be constructed using a material that does not support fire spread and therefore endanger people in or around the building.

Flame spread over or within an external wall construction should be controlled to avoid creating a route for rapid fire spread bypassing compartment floors or walls.

*NOTE This is particularly important where a stay put strategy (see **A.1**) is in place.*

External wall surfaces near other buildings should not be readily ignitable, to avoid fire spread between buildings.

External walls should meet the following recommendations.

a) The external surfaces of walls should meet the provisions in Table 10.

b) In a building with a storey 11 m or more above ground level, the total external wall construction should be constructed of class A2-s1, d0 or better materials, with the following exceptions:

- cavity trays when used between two leaves of masonry;
- any part of a roof pitched at an angle of 70° or more if that part is connected to an external wall;
- door frames and doors;
- electrical installations;
- insulation and water proofing materials used below ground level;
- intumescent and fire stopping materials where the inclusion of the material is necessary to meet recommendations;
- membranes;
- seals, gaskets, fixings, sealants and backer rods;
- thermal break materials where the inclusion of the materials is necessary to meet regulatory requirements for thermal bridging; and
- window frames and glass.

c) Cavity barriers should be provided in accordance with Clause **27**.

Table 10 – Fire performance for external surfaces of walls

Building height	Wall materials	External surface of walls 1 m or less from relevant boundary	External surface of walls more than 1 m from relevant boundary	Fire resistance of walls 1 m or less from relevant boundary	Fire resistance of walls more than 1 m from relevant boundary
Above 11 m	Class A2-s1, d0 or better	Class A2-s1, d0 or better	Class A2-s1, d0 or better	As per Table 7 when tested from both sides	As per Table 7 when tested from both sides
11 m or below	No provisions	Class B-s3, d2 or better [A)]	No provisions	As per Table 7 when tested from both sides	As per Table 7 when tested from both sides

[A)] Profiled or flat steel sheet at least 0.5 mm thick with an organic coating of no more than 0.2 mm thickness is also acceptable.

26.3 Balconies and attachments

All balconies on a building with a storey 11 m or more above ground level should be constructed of class A2-s1, d0 or better materials.

Stacked balconies on buildings of any height should be constructed of class A2-s1, d0 materials.

The risk of fire on balconies should be assessed, all balconies should:

a) not be composed of materials or designed such that they provide a medium for undue fire spread over the external envelope of the building;

b) not propagate fire downwards, e.g. not produce falling brands or flaming molten droplets or debris capable of initiating fire below;

c) be designed to minimize the risk of becoming detached from the face of the building and present a hazard to persons below, e.g. firefighters and the public; and

d) be designed to minimize the risk of prejudicing the stability of the building when undergoing large deformations resulting from fire exposure.

Where enclosed balconies are contiguous with enclosed balconies to other flats, the fire resistance and the compartmentation between balconies should be the same as the fire resistance required for the building.

Terrace roofs should achieve B_{ROOF} (t4) classification. Any edge fascia, parapet or balustrade that forms part of an external wall to the building should accord with national standards.

NOTE General recommendations for balconies and terraces are given in BS 8579.

Other attachments to an external of a building with a storey 11 m or more above ground level should be constructed of class A2-s1, d0 or better materials.

26.4 Boundaries

26.4.1 Relevant boundary

The relevant boundary should be taken as the boundary to which separation distance is measured.

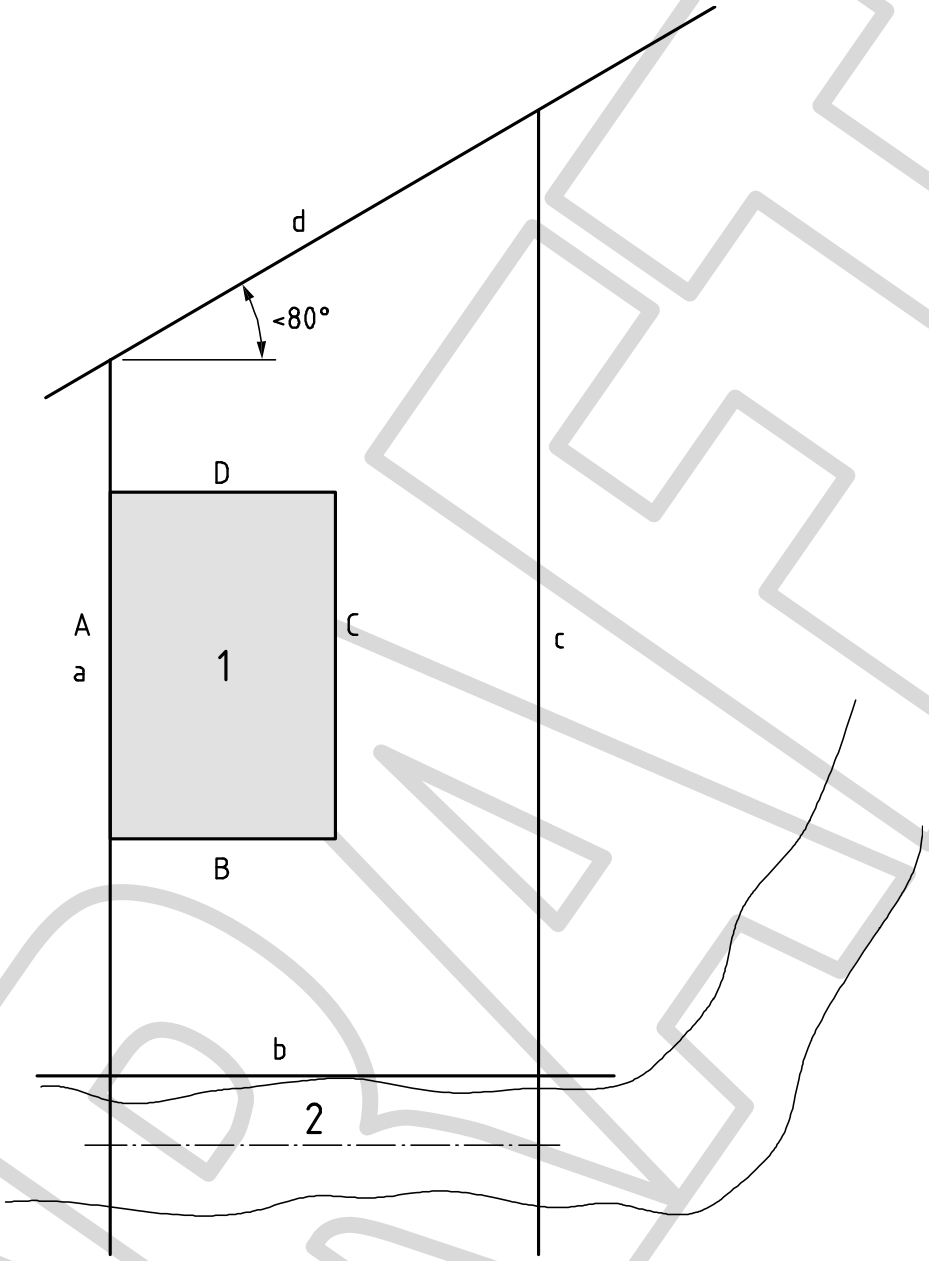
NOTE 1 A notional boundary can be a relevant boundary.

The relevant boundary should usually be taken as the site boundary.

NOTE 2 Where a wall faces onto a space that is unlikely to be developed, such as a road, canal or river, however, then the boundary may be assumed to be an imaginary line half-way across this feature.

A wall should be treated as facing a boundary if it makes an angle of 80° or less (see Figure 30).

Figure 30 – Relevant boundaries



Boundary a is coincident with and therefore relevant to side A. Boundary b is the site boundary.

As the building overlooks a river, canal, road or similar feature, boundary b is taken as relevant to side B.

Boundaries c and d are parallel with, or less than 80° to, sides C and D and are therefore relevant to them.

Key

1 Building

2 Relevant boundary may be the centre line of a road, railway, canal or river

26.4.2 Notional boundary

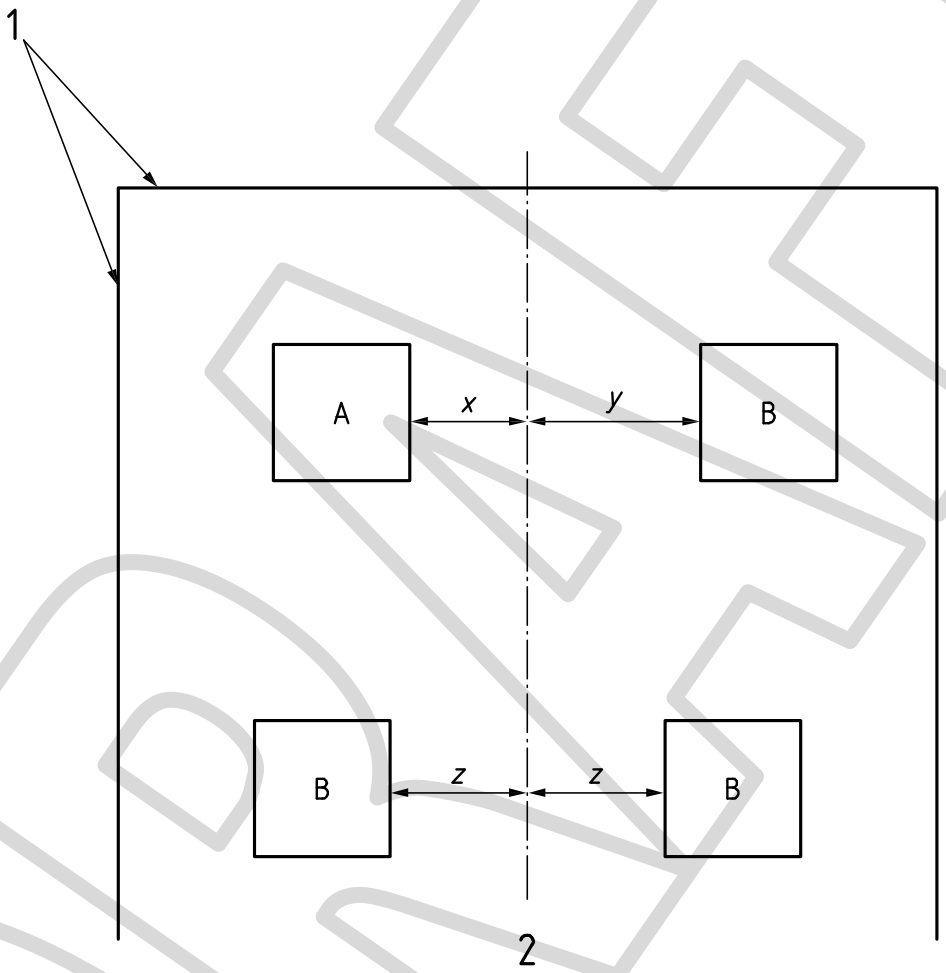
*COMMENTARY ON **26.4.2***

A notional boundary is an imaginary line assumed to exist between two buildings (see Figure 31). The principle of a notional boundary can be applied to any building for property protection purposes.

When the need for a notional boundary is determined, its location should be established according to Figure 31.

Where both buildings are new, one should be designated as existing and the recommendation for notional boundary assessed accordingly.

Figure 31 – Notional boundaries



Key

1 Site boundary
2 Notional boundary line between buildings
A Existing building
B New/proposed building
x Notional boundary set by existing building
y New building positioned according to notional boundary
z Notional boundary half-way between two new buildings

When determining the location of a new building, the position of the notional boundary should be set according to the amount of unprotected area (see **26.5**) in the façade of the existing building. A proposed new building should be subject to the restrictions on proximity and extent of unprotected area relevant to this notional boundary (see **26.6.3**).

Where both buildings are new, the notional boundary should be assumed to exist half-way between the two buildings and the location of each should be set accordingly.

26.5 Unprotected area

The following factors should be taken into account when determining the extent of the unprotected area.

a) For life safety, any part of an external façade that has a period of fire resistance less than the appropriate level recommended in Table 6 is counted as an unprotected area.

b) Included in the unprotected area calculation is any section of external wall which has the appropriate standard of fire resistance, but has a class C-s3, d2 or worse material more than 1 mm thick as its external surface. However, this section of wall is counted as having an unprotected area amounting to half the actual area of the surface (see Figure 32).

c) The amount of unprotected area in the façades of buildings needs to be restricted according to the distance between these façades and the relevant (or notional) boundaries (see **26.6**).

d) The following do not contribute to the extent of unprotected area:

   1) any part of an external wall of a stairway in a protected shaft;

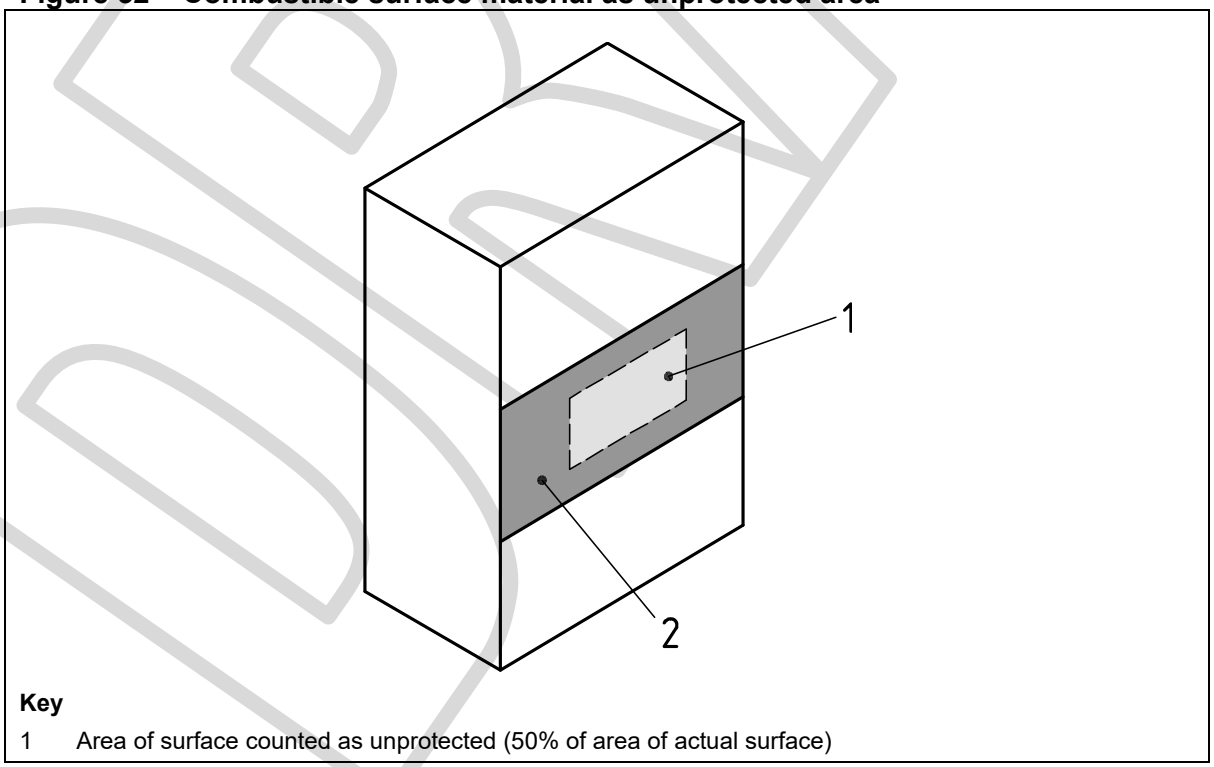
   2) parts of the external wall of an uncompartmented building that are more than 30 m above mean ground level; and

   3) small unprotected areas in an otherwise protected façade according to the constraints shown in Figure 33.

e) Where a building is provided with automatic sprinklers in accordance with BS 9251:2021 or BS EN 12845:2015+A1 (see **19.2**, Table 4), the amount of unprotected area may be doubled or the distance to the boundary for a given amount of unprotected area may be halved.

NOTE Small unprotected areas pose a negligible risk of fire spread.

Figure 32 – Combustible surface material as unprotected area



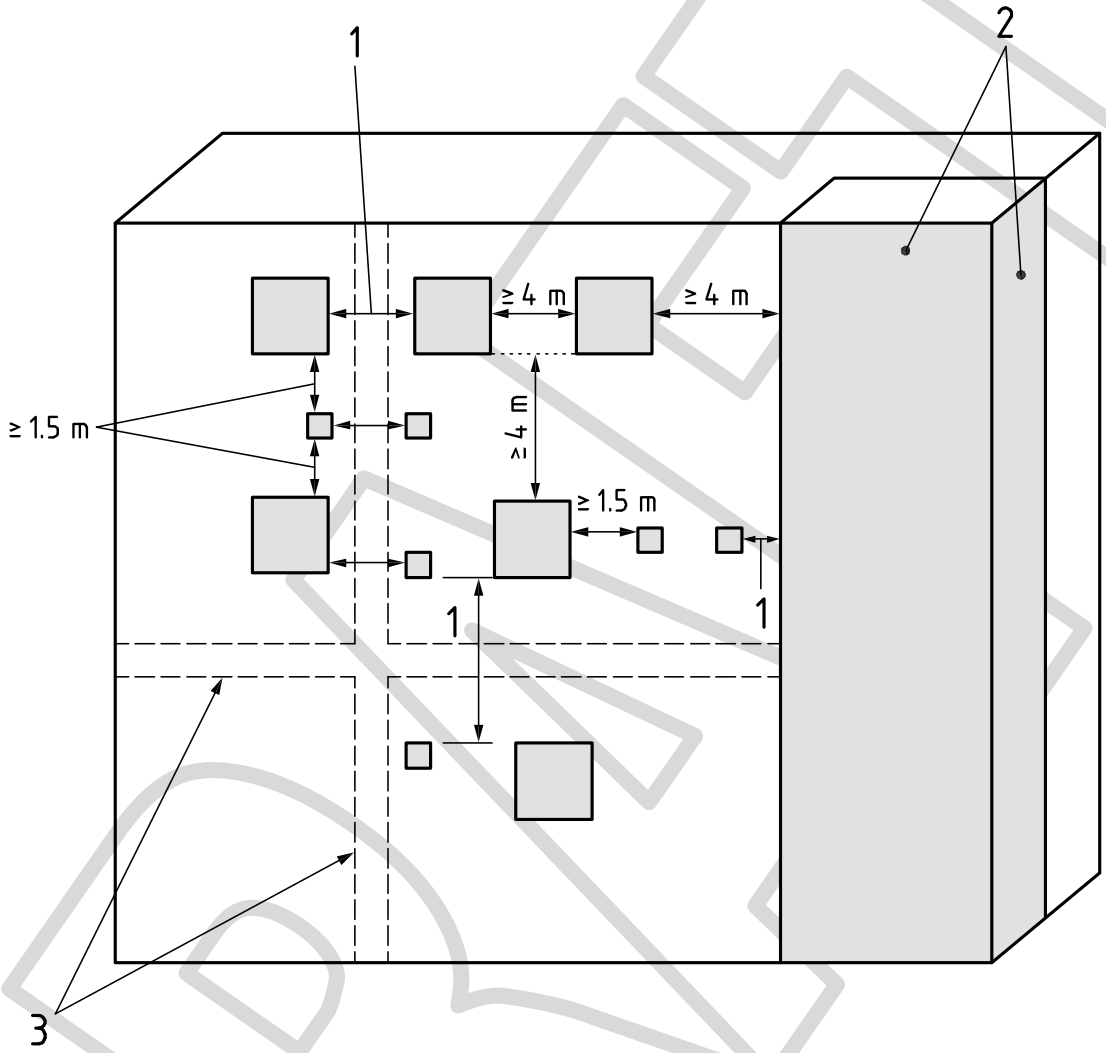
Key

1 Area of surface counted as unprotected (50% of area of actual surface)

Figure 32 – Combustible surface material as unprotected area

2	Area of class C-s3, d2 or worse surface material (>1 mm thick)

Figure 33 – Exclusions from unprotected area calculations



Key

1	Unrestricted
2	External wall of shaft that is enclosed by a minimum of 60 min fire resistance from the accommodation side
3	Compartment boundaries

26.6 Degree of separation

26.6.1 General

*NOTE 1 Separation distances between a roof and a relevant boundary are covered in **26.7**.*

A building should be separated from the relevant boundaries by at least half the distance at which the total thermal radiation intensity, received from all unprotected areas in the external façade, would be 12.6 kW/m^2.

NOTE 2 The intensity of radiation to cause ignition of wood in still air conditions is 12.6 kW/m^2. Ignition inside a receiver building is dependent on the amount of unprotected area in its façade.

NOTE 3 The use of distance to a relevant boundary, rather than to another building, allows development on the neighbouring site without prejudice.

26.6.2 External walls within 1 m of the relevant boundary

Where an external wall is coincident with or within 1 m distance of a relevant boundary, it should:

a) achieve the appropriate level of fire resistance in terms of integrity and insulation (see Table 4) from both sides when tested in accordance with BS EN 1364-1 or BS EN 1365-1;

b) have only small, unprotected areas within the limits shown in Figure 32;

c) resist direct flame impingement and high levels of radiation from the adjoining site;

d) have surfaces constructed of class A1 materials; and

e) be an effective barrier to a fire either inside or outside the building.

NOTE 1 These recommendations are aimed at protecting neighbouring buildings from direct flame impingement as well as radiation.

*NOTE 2 See **26.2** for external wall materials and construction.*

26.6.3 External walls 1 m or more from the relevant boundary

Where a wall is situated at least 1 m from all points on the relevant boundary:

a) the extent of unprotected area should not exceed that given by one of the appropriate methods in **26.6.4**; and

b) the rest of the wall (if any) should have the fire resistance stated in Table 7 or Table 8 (with 15 min in terms of insulation).

If a building is not sprinklered, or if property protection is a consideration, the proportion of external wall that is not fire-resisting should be limited according to the distance to the relevant boundary and the likely intensity of the fire.

NOTE If a building has an automatic sprinkler system, the incidence of radiation to adjoining buildings can be much reduced.

26.6.4 Calculation methods

Unless a small residential building, one of the following methods should be used to determine the maximum permissible amount of unprotected area between a building and a relevant boundary:

a) enclosing rectangles; or

b) aggregate notional area; or

NOTE 1 Details of the methods in items a) and b) are given in part 1 of BRE Report 187 [24].

c) values as shown in Table 11 (applicable to small residential buildings only; see Note 2).

NOTE 2 Where the building is intended solely for residential use, is no greater than three storeys in height and is no more than 24 m in length, it can be treated as a small residential building.

Table 11 – Small residential unprotected area limits and boundary distances

Minimum distance between façade and relevant boundary	**Maximum total unprotected area per compartment**
m	m^2
1	5.6
2	12
3	18
4	24
5	30
6	No limit

26.7 Roofs

*COMMENTARY ON **26.7***

The recommendations in this subclause are principally concerned with the performance of roofs when exposed to fire from the outside. They limit the use, near a boundary, of roof coverings that are unlikely to give adequate protection against the spread of fire over them. The term "roof covering" is used to describe a construction that might consist of one or more layers of material, but does not refer to the roof structure as a whole.

The relevant classification for the external fire performance of roof systems is BS EN 13501-5 using test 4.

For restriction of fire spread over roofs the properties of a roof covering are only of relevance:

- *if the roof is close enough to a boundary to be at risk of ignition from a fire in other buildings; and*
- *in the vicinity of a compartment wall, to avoid fire spread between compartments via a roof covering (see Figure 24).*

*The circumstances when a roof is subject to the provisions for space separation are explained in Clause **26**, Note 1.*

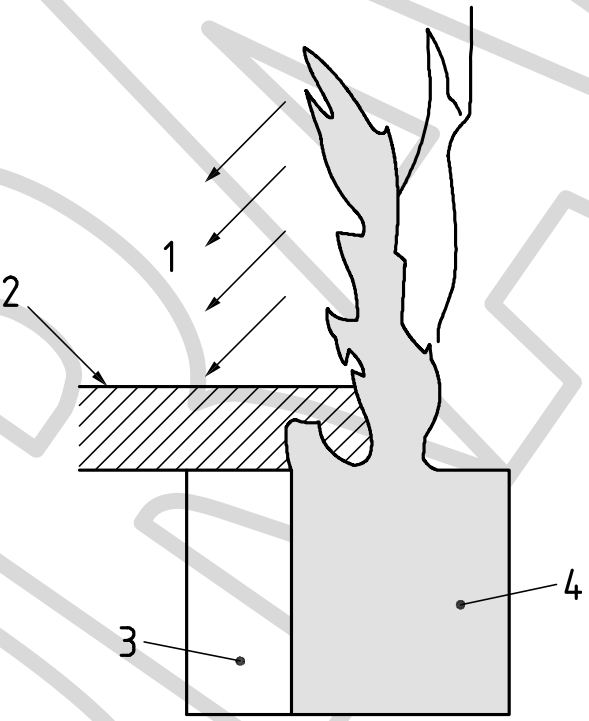
*Subclause **26.7.2** gives recommendations for the internal surfaces of roof lights as part of the internal lining of a room or circulation space.*

*Recommendations relating to roofing materials are given in **28.4**.*

Annex F provides guidance for use where roofs are used as podiums, roof gardens, etc.

Where ignition sources such as PV arrays are proposed for roofs, additional measures beyond those given in this subclause might need to be taken to prevent fire spread within the roof.

Figure 34 – Roof covering adjoining line of compartmentation



Key

1 Radiation and flame impingement
2 Roof
3 Compartment wall
4 Fire in adjoining compartment

26.7.1 Separation distances

*COMMENTARY ON **26.7.1***

The separation distance is the minimum distance from the roof (or part of the roof) to the relevant boundary, which may be a notional boundary.

Separation distances should be as recommended in Table 12 for the appropriate type of roof covering and building use.

Table 12 – Separation distances for roof coverings

Designation of covering of roof or part of roof[A)]	Distance of roof from any point on relevant boundary			
	Less than 6 m	At least 6 m	At least 12 m	At least 20 m
B_{ROOF}(t4)	Acceptable	Acceptable	Acceptable	Acceptable
C_{ROOF}(t4)	Not acceptable	Acceptable	Acceptable	Acceptable
D_{ROOF}(t4)	Not acceptable	Acceptable [B), C)]	Acceptable[B)]	Acceptable
E_{ROOF}(t4)	Not acceptable	Acceptable[C)]	Acceptable	Acceptable
F_{ROOF}(t4)	Not acceptable	Not acceptable	Not acceptable	Acceptable[C)]

NOTE 1 Unwired glass at least 4 mm in thickness has an B_{ROOF}(t4) designation.

*NOTE 2 See **26.7.2** for limitations on plastic roof lights.*

A) The performance of roof coverings is designated by reference to the classification given in BS EN 13501-5.

B) Not acceptable on buildings with a volume of more than 1 500 m^3.

C) Acceptable on buildings not listed in Footnote B, if part of the roof is no more than 3 m^2 in area and is at least 1.5 m from any similar part, with the roof between the parts covered with class A2-s3, d2 materials or better.

26.7.2 Roof lights

The separation distance for plastic roof lights should be as recommended in Table 13 for the appropriate classification (see also Figure 35). Roof lights should be at least 1.5 m from a compartment wall.

Plastic roof lights should not be used in protected stairways.

NOTE 1 When used in roof lights, a rigid thermoplastic sheet product made from polycarbonate or from unplasticized PVC, which achieves a minimum class C-s3, d2, is deemed to have an B_{ROOF}(t4) designation.

The roof covering material surrounding a plastic roof light should be formed of class A2-s3, d2 or better materials for at least 3 m distance.

NOTE 2 The designation of external roof surfaces is defined in BS EN 13501-5.

Where products have upper and lower surfaces with different properties, the more onerous distance should be assumed.

NOTE 3 Products might have upper and lower surfaces with different properties if they have double skins or are laminates of different materials.

NOTE 4 The method of classifying thermoplastic materials is given in BS 9999.

Table 13 – Separation distance for plastic roof lights

Dimensions in metres

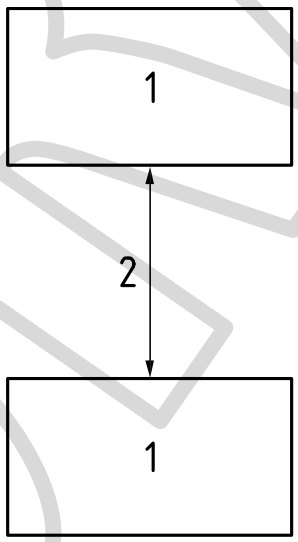
Space that roof light can serve	Min. classification on lower surface[A)]	Min. distance from any point on relevant boundary to roof light			
		Class D-s3, d2 plastic roof lights		TP(a) and TP(b) plastic roof lights	
		$E_{ROOF}(t4)$ or $D_{ROOF}(t4)$	$F_{ROOF}(t4)$	TP(a)	TP(b)
Balcony, veranda, carport, covered way or loading bay, which has at least one longer side wholly or permanently open	Class D-s3, d2	6	20	—	—
	TP(b)	—	—	N/A	6
Detached swimming pool	Class D-s3, d2	6	20	—	—
	TP(b)	—	—	N/A	6
Conservatory, domestic garage or outbuilding, wholly or permanently open with a maximum floor area of 40 m^2	Class D-s3, d2	6	20	—	—
	TP(b)	—	—	N/A	6
Circulation space[B)] (except a protected stairway)	Class D-s3, d2	6[C)]	20[C)]	—	—
	TP(b)	—	—	N/A	6[C)]
Room[B)]	Class D-s3, d2	6[C)]	20[C)]	—	—
	TP(b)	—	—	N/A	6[C)]
Any space except a protected stairway	TP(a) rigid	—	—	6	N/A

[A)] See also the limits in Table 12.

[B)] Single skin roof light only, in the case of non-thermoplastic material.

[C)] The roof light should also not exceed the limitations shown in Figure 35.

Figure 35 – Limitations on spacing and size of plastic roof lights having a Class D-s3, d2 or TP(b) lower surface



Key

1 Roof light, max. area 5 m^2, or group of roof lights amounting to no more than 5 m^2

2 Not less than 3 m between any two roof lights in any direction

27 Concealed spaces

*COMMENTARY ON CLAUSE **27***

Concealed spaces or cavities in the construction of a building provide a ready route for smoke and flame spread. This is particularly so in the case of voids in, above and below the construction of a building, e.g. walls, floors, ceilings and roof spaces. As any spread of fire or smoke is concealed, it presents a greater danger than would a more obvious weakness in the fabric of the building. Provisions can be made to restrict this by interrupting cavities which could form a pathway around a barrier to fire, subdividing extensive cavities, and closing the edges of openings.

The unseen spread of fire or smoke via voids and cavities can be a threat to occupants if it bypasses compartment boundaries or elements protecting the means of escape.

It can also be a threat to firefighters in large spaces if it leads to the obstruction of their line of retreat.

A cavity in an external wall can behave as a chimney, accelerating fire spread up a façade. This can be a threat to occupants or firefighters if the cavity is open to the exterior. Sealed cavities are generally not a problem.

*Recommendations for cavity barriers are given in this clause for specific locations. The provisions necessary to restrict the spread of smoke and flames through cavities are broadly for the purpose of subdividing cavities, which could otherwise form a pathway around a fire-separating element and closing the edges of cavities, therefore reducing the potential for unseen fire spread. (These are not to be confused with fire-stopping details; see **32.4** and Figure 36.)*

*It is also necessary to take into account the construction and fixing of cavity barriers provided for these purposes and the extent to which openings in them need to be protected (see **27.1**).*

27.1 Provision of cavity barriers

27.1.1 Junctions and compartment walls

Cavity barriers should be provided to close the edges of cavities, including around openings and other penetrations through a wall.

Cavity barriers should also be provided:

a) at the junction between an external cavity wall (except where the cavity wall is as shown in Figure 37) and every compartment floor and compartment wall; and

b) at the junction between an internal cavity wall (except where the cavity wall is as shown in Figure 37) and every compartment floor, compartment wall, or other wall or door assembly which forms a fire-resisting barrier.

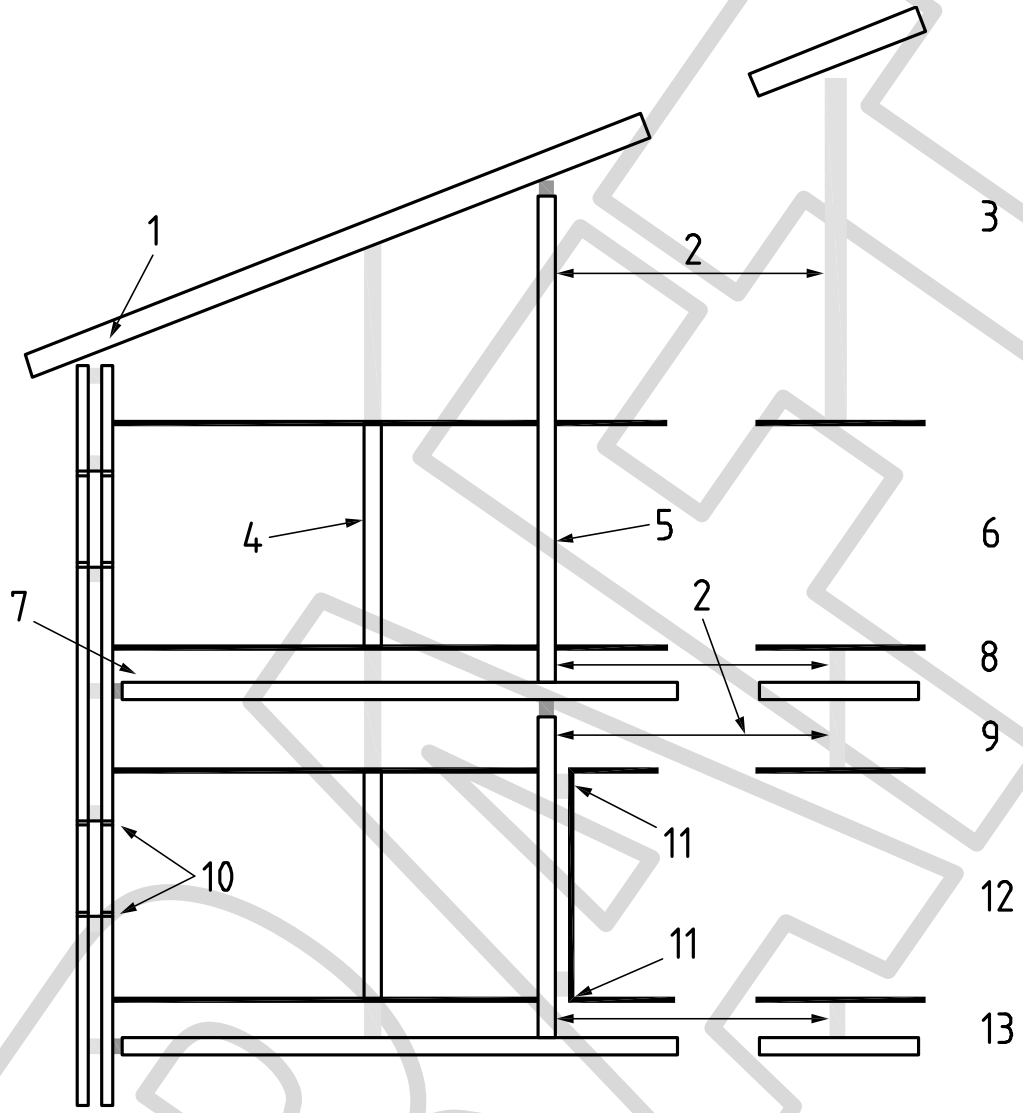
NOTE 1 In houses, cavities may be closed with a material that might not conform to the various recommendations in Table 6 for cavity barriers.

NOTE 2 Cupboards for switch boards, service boxes, service panels, etc. may be installed provided that:

- *there are no more than two cupboards per compartment;*
- *the openings in the outer wall leaf are not more than 800 mm × 500 mm for each cupboard; and*
- *the inner leaf is not penetrated except by a sleeve not more than 80 mm × 80 mm, which is fire stopped.*

Compartment walls should be carried up full storey height to a compartment floor or to the roof, as appropriate, to maintain the standard of fire resistance. A line of compartmentation should not be completed by fitting cavity barriers above the compartment wall.

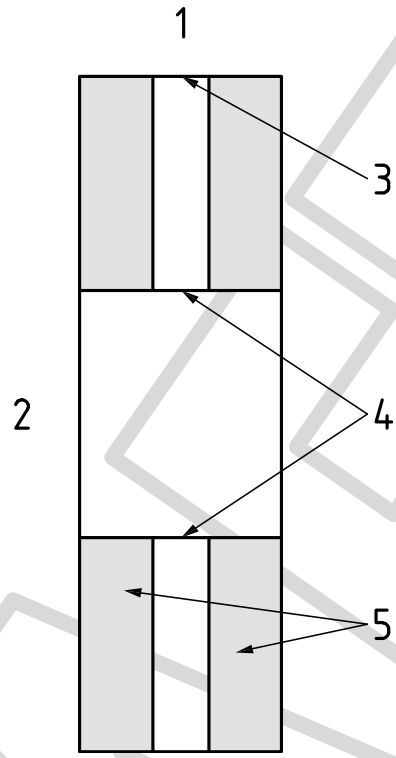
Figure 36 – Provisions for cavity barriers



Key

1	Close top of cavity	8	Floor space
2	Subdivide extensive cavities	9	Ceiling space
3	Roof space	10	Close around openings
4	Wall forming bedroom or protected escape routes	11	Close around edges
5	Compartment wall	12	Accommodation
6	Accommodation	13	Floor space
7	Compartment floor		
	Cavity barrier (30 min integrity/15 min insulation as in Table 6)		
	Fire stopping (same fire resistance as compartment – not cavity barrier)		

Figure 37 – Cavity wall excluded from provisions for cavity barriers



Key

1	Section through cavity wall
2	Opening
3	Close cavity at top of wall (unless cavity is totally filled with insulation)
4	Close cavity around opening
5	Two leaves of either concrete or masonry each at least 75 mm thick

NOTE Materials worse than Class A2-s1, d0 (e.g. Class B) may be placed within the cavity.

27.1.2 Protected escape routes

*COMMENTARY ON **27.1.2***

Within protected escape routes, cavities can result above (or below) the fire-resisting construction if the fire-resisting construction, forming the escape route, is not carried to full storey height.

In a protected escape route, a cavity that exists above or below any fire-resisting construction should be either:

a) fitted with cavity barriers on the line of the enclosure(s) to the protected escape route; or

b) for cavities above the fire-resisting construction, enclosed on the lower side by a fire-resisting ceiling as shown in Figure 38. The ceiling should:

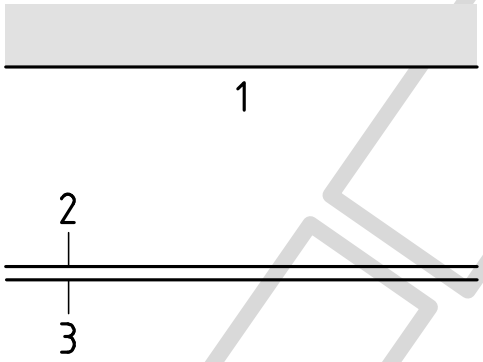
   1) have at least 30 min fire resistance both above and below the ceiling when tested in accordance with the applicable parts of BS 476;

   2) be imperforate, except for an opening described in **32.4**;

   3) extend throughout the building, compartment or separated part; and

   4) not be easily demountable.

Figure 38 – Fire-resisting ceiling below concealed space



Key

1 Cavity

2 Ceiling surface/product exposed to cavity –class C-s3, d2 or better

3 Soffit of ceiling –class B-s3, d2 or better

NOTE 1 This British Standard uses the European classification system for reaction to fire set out in BS EN 13501-1:2018. The national classifications do not automatically equate to the corresponding European classifications, therefore products cannot typically assume a European class unless they have been tested accordingly. Further information is given in Annex B.

NOTE 2 When a classification includes "s3, d2", this means that there is no limit set for smoke production and/or flaming droplets/particles.

27.1.3 Double-skinned corrugated or profiled roof sheeting

Where double-skinned corrugated or profiled insulated roof sheeting is used, cavity barriers should be provided unless:

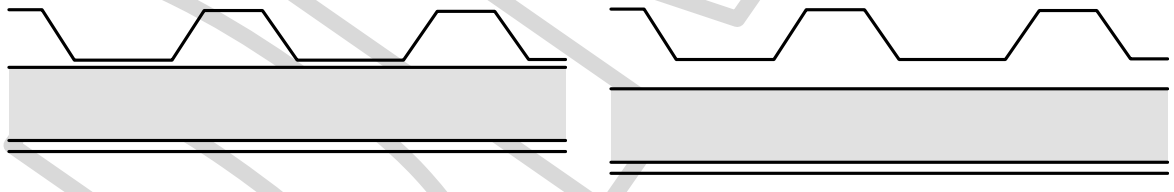
a) the sheeting is constructed of class A2-s3, d2 or better materials; and

b) both surfaces of the insulating layer have a surface spread of flame of at least class C-s3, d2 or better materials and make contact with the inner and outer skins of cladding (see Figure 39).

NOTE See also Figure 36 regarding the need for a fire break where such roofs pass over the top of a compartment wall.

A compartment wall should be taken up to meet the underside of the roof covering or deck, with fire-stopping where necessary at the wall/roof junction to maintain the continuity of fire resistance.

Figure 39 – Provisions for cavity barriers in double skinned insulated roof sheeting



a) Acceptable without cavity barriers b) Cavity barriers necessary

27.1.4 Cavities affecting alternative escape routes

Cavity barriers should be provided where corridors are to be subdivided to prevent alternative escape routes being simultaneously affected by fire and/or smoke.

27.1.5 Separation of bedrooms

*COMMENTARY ON **27.1.5***

If the enclosures are not carried to full storey height, or (in the case of the top storey) to the underside of the roof covering, this can result in a cavity above or below the partitions between bedrooms.

A cavity that exists above or below partitions between bedrooms should be either:

a) fitted with cavity barriers on the line of the partitions; or

b) for cavities above the partitions, enclosed on the lower side by a fire-resisting ceiling which extends throughout the building, compartment or separated part.

27.2 Construction and fixings for cavity barriers

Every cavity barrier should be constructed to provide at least 30 min fire resistance.

NOTE 1 A cavity barrier may be formed by any construction provided for another purpose (e.g. acoustics or security) if it meets the provisions for cavity barriers (see Table 6).

Open state cavity barriers in a horizontal position within rain screen walling should meet the effective closure criteria when tested in accordance with ASFP TGD 19 [N1].

Cavity barriers should meet one of the following recommendations.

a) In buildings other than houses, cavities surrounding window, door and other glazing panels should be stopped with appropriate materials tested as a linear gap seal, as an inherent part of the wall or partition construction, in accordance with either BS 476-20 or BS EN 1366-4.

b) In houses, cavity barriers in a stud wall or partition, or provided around openings, should be formed of:

   1) materials tested as described in item a) above; or

   2) steel at least 0.5 mm thick; or

   3) timber at least 38 mm thick with a linear gap seal in accordance with BS 476-20 or BS EN 1366-4; or

   4) polythene-sleeved mineral wool, or mineral wool slab, in either case under compression when installed in the cavity; or

   5) calcium silicate, cement-based or gypsum-based boards at least 12 mm thick.

NOTE 2 Cavity barriers provided around openings may be formed by the window or door frame if the frame is constructed of steel or timber of the minimum thickness in a) or b) above as appropriate.

A cavity barrier should, wherever possible, be tightly fitted to a rigid construction and mechanically fixed in position. Where this is not possible (e.g. in the case of a junction with slates, tiles, corrugated sheeting or similar materials) the junction should be fire-stopped in accordance with **32.4**.

Cavity barriers should also be fixed so that their performance is unlikely to be made ineffective by:

1) movement of the building due to subsidence, shrinkage or temperature change and movement of the external envelope due to wind; or

2) collapse in a fire of any services penetrating them; or

3) failure in a fire of their fixings (but see Note 2); or

   NOTE 3 Where cavity barriers are provided in roof spaces, the roof members to which they are fitted are not expected to have any fire resistance for the purpose of supporting the cavity barrier(s).

4) failure in a fire of any material or construction which they abut.

NOTE 4 For example, if a suspended ceiling is continued over the top of a fire-resisting wall or partition and direct connection is made between the ceiling and the cavity barrier above the line of the wall or partition, premature failure of the cavity barrier can occur when the ceiling collapses. However, this might not arise if the ceiling is designed to provide fire protection of 30 min or more.

Any openings in a cavity barrier within fire-resisting construction should be limited to those for:

i) doors which have at least 30 min fire resistance (see **32.1**) and are fitted in accordance with the provisions of **32.1**;

ii) the passage of pipes which meet the provisions in **32.4**;

iii) the passage of cables or conduits containing one or more cables;

iv) openings fitted with a suitable fire damper, installed in accordance with the manufacturer's instructions; and

v) ducts which (unless they are fire-resisting) are fitted with a suitable fire damper, installed in accordance with the manufacturer's instructions, where they pass through the cavity barrier.

If a cavity barrier is provided above a partition that does not need to be fire-resisting (e.g. for acoustic effect), it does not need to meet the recommendations in items i) to v) above, but any openings in the barrier should be kept to a minimum and any penetrations should be sealed to restrict the passage of smoke.

28 Materials

NOTE Materials chosen because of their ability not to support surface spread of flame (i.e. class A1 or class A2-s1, d0) are not to be taken to be fire-resistant unless the materials have been specifically classified by testing for that property.

28.1 Internal linings

*COMMENTARY ON **28.1***

Although they are unlikely to be the first materials to ignite, the materials used for wall and ceilings can significantly affect the spread of a fire and its rate of growth, and need to be selected carefully. In particular, internal linings selected for circulation spaces need to be able to delay the spread of fire, so that the occupants' means of escape is not compromised.

The internal linings within circulation spaces within dwellings should be constructed of class C-s3, d2 materials.

The internal linings within other circulation spaces, including the common areas of blocks of flats, should be constructed of class B-s3, d2 or better materials.

Small rooms of area not more than 4 m^2 should have internal linings constructed of class D-s3, d2 or better materials.

NOTE Further guidance on the classification of linings together with limitations on their use is given in BS 9999.

28.2 Suspended or stretched-skin ceilings

The ceiling of a room should be constructed as either a suspended or a stretched skin membrane from panels of a thermoplastic material of the TP(a) flexible classification, unless it is part of a fire-resisting ceiling.

Each panel should not exceed 5 m^2 in area and should be supported on all its sides.

28.3 Class A1 materials

Class A1 materials should be used in the following situations:

a) ladders forming part of an escape route in ancillary accommodation identified as higher fire risk;

b) refuse chutes;

c) suspended ceilings and their supports where the undivided cavity exceeds 40 m in extent;

d) as a sleeving where a pipe penetrates a compartment wall or floor;

e) walls of a flue that penetrates a compartment floor or wall; and

f) construction of an open-sided car park.

28.4 Special roof coverings

*COMMENTARY ON **28.4***

Special roofing types include:

- *air-supported structures;*
- *flexible membrane roofs;*
- *PTFE-coated roof membranes.*

NOTE Guidance on the use of PTFE-coated materials for tension membrane and similar roofs and structures is given in BRE Report 274 [25].

Any flexible membrane covering a structure, other than an air-supported structure, should conform to BS 7157:1989, Annex A.

29 Service ducts, pipes and shafts

29.1 Service shafts

Lift wells (other than within a protected stairway) should be enclosed throughout their height with fire-resisting construction.

Service shafts and other vertical ducts should be enclosed throughout their height with fire-resisting construction. Service ducts should be in accordance with BS 8313, and ventilation and air conditioning ductwork should be in accordance with **29.2**. Access hatches for service shafts should not be situated within a means of escape staircase unless providing smoke control or pressurization for that staircase.

NOTE The penetration of fire-resisting floors by services and vertical shafts can reduce the safety of occupants and create points of weakness in the compartmentation of the building.

Wherever practicable, services should not be run within common access corridors, including the corridor access for firefighting shafts. Where this is unavoidable, they should be run in a fire-separating construction or in a secured fire-resisting method.

The doors should be fitted with secure fastenings to discourage the use of the riser for storage (budget locks, etc.).

29.2 Installation of ductwork systems

When ductwork is installed within a building, the planning of the ductwork should be such that the ductwork does not assist in the transfer of fire and smoke through the building. Any exhaust points should be sited so as not to further jeopardize the building in the event of a fire, i.e. away from final exits, combustible building cladding or roofing materials, and openings into the building.

Ventilation ducts, and their associated plant supplying or extracting air directly to or from a protected escape route, should not also serve other areas. A separate ventilation system should be provided for each protected stairway.

Where a ductwork system serves more than one part of a compartment or fire-separated protected escape route, smoke detector operated leakage-rated ES fire dampers should be provided where ductwork enters each fire-separated or smoke-separated section of the

escape route. Leakage-rated ES fire dampers should be in accordance with BS EN 15650, tested in accordance with BS EN 1366-2 and have an ES classification in accordance with BS EN 13501-3:2005+A1 to achieve at least the same level of fire resistance as the compartment barrier in which they are fitted.

NOTE 1 Further details on the installation, fire resistance, operation and actuation of fire dampers are given in BS EN 15650.

The smoke detector operated leakage-rated ES fire dampers should be caused to close if smoke is detected. Any ductwork passing through an accommodation space should be fire-resisting, i.e. the ductwork should be protected using fire-resisting enclosures or fire-resisting ductwork.

Any ductwork passing through a protected stairway, lobby or corridor without an opening into that area should be fire-resisting, i.e. the ductwork should be protected using fire-resisting enclosures or fire-resisting ductwork.

NOTE 2 Further information on fire-resisting ductwork is given in the ASFP Blue Book [26] and the ASFP Blue Book (European version) [27].

In single-stair buildings, the ductwork enclosure should be imperforate where it passes through the stairway or any protected lobby or protected corridor.

In multi-stair buildings, ductwork access panels within protected escape routes should not reduce the fire resistance of the ductwork enclosure from the inside.

Where a service duct enclosure is provided with a level of fire resistance in accordance with BS 8313, and the service duct itself is also used for ventilation purposes, any grille or opening through the enclosure for ventilation purposes should be protected by a fire damper.

NOTE 3 See also BS 9999 for information and recommendations regarding air transfer grilles.

Service pipes containing toxic or flammable substances should not be routed in, or through, ductwork provided for ventilation purposes.

29.3 Flues

If a flue, or duct containing flues or appliance ventilation duct(s), passes through a compartment wall or compartment floor or is built into a compartment wall, each wall of the flue or duct should have a fire resistance of at least half that of the wall or floor.

29.4 Protection of pipe openings

*COMMENTARY ON **29.4***

Pipework that breaches compartment walls and compartment floors can compromise compartmentation if fire protection is not provided to the pipework. Pipes may be constructed from many different materials and all these materials behave differently in a fire situation.

Pipes that pass through a compartment wall or compartment floor (unless the pipe is in a protected shaft), or through a cavity barrier, should be either:

a) for pipes of any diameter, provided with a proprietary seal that has been shown to maintain the fire resistance of the wall, floor or cavity barrier when tested in accordance with BS EN 1366-3; or

b) for pipes with a restricted diameter, provided with fire-stopping around the pipe (see **32.4**), with an opening size that is suitable to accommodate the required fire stopping product. The nominal interior diameter of the pipe should be not more than the relevant dimensions given in Table 14.

Where more than two small (<40 mm) service penetrations occur within 40 mm of each other, either:

1) they should be treated as a single penetration and a suitable proprietary seal that has been proven by test for the application should be used to protect the combined opening area as described in item a) above; or

2) each penetration should be individually fire-stopped with a suitable proprietary seal as described in item a) above.

NOTE Further information on the types of proprietary fire-stopping products and systems that are available, information about their suitability for different applications and guidance on test methods is given in the ASFP Red Book [28].

Table 14 – Maximum nominal interior diameter of pipes passing through a compartment wall/floor

Dimensions in millimetres

Situation [A]	**Maximum nominal internal diameter**		
	a) Class A1 materials [B]	**b) Lead, aluminium, aluminium alloy, PVC**[C], **fibre-cement**	**c) Any other material**
1) Structure (but not a wall separating buildings) enclosing a protected shaft which is not a stairway or a lift well	160	110	All diameters
2) Compartment wall or compartment floor between flats	160	160 (stack pipe)[D] 110 (branch pipe)[D]	All diameters
3) Any other situation	160	40	All diameters

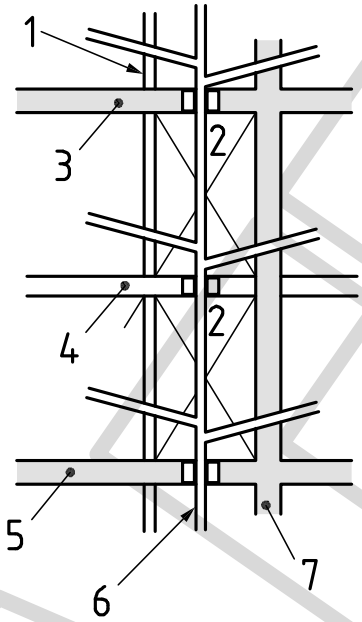
[A] The diameters given for pipes of material b) used in situation 2) assume that the pipes are part of an above-ground drainage system and are enclosed as shown in Figure 40. If they are not, the smaller diameter given in situation 3) should be used.

[B] A class A1 material (such as cast iron or steel) which, if exposed to a temperature of 800 °C, will not soften or fracture to the extent that flame or hot gas will pass through the wall of the pipe.

[C] uPVC pipes conforming to BS 4514 and uPVC pipes conforming to BS EN 1329-1. Products of any diameter that fall within the scope of BS EN 1366-3 should be fire-stopped.

[D] These diameters are only in relation to pipes forming part of an above-ground drainage system and enclosed as shown in Figure 40. In other cases, the maximum diameters against situation 3) apply.

Figure 40 – Enclosure for drainage or water supply pipes



Key

1 Casing
2 Enclosure
3 Compartment floor carried through to seal enclosure – provide fire-stopping between stack pipe and floor
4 Intermediate floor carried through to seal enclosure – provide fire-stopping between stack pipe and floor
5 Compartment floor
6 Stack pipe
7 Compartment wall

30 Glazed fire-resisting elements

*COMMENTARY ON CLAUSE **30***

The fire resistance of a fire-resisting glazed assembly is influenced by a number of factors, such as:

- *type of glass and function;*
- *pane size and shape;*
- *glazing layout and number of panes;*
- *orientation of the glazed element;*
- *framing and framing junctions;*
- *glazing seal;*
- *beads and bead fixings; and*
- *fixing of the assembly to the support structure.*

Guidance on these factors is given in the GGF publication A guide to best practice in the specification and use of fire-resistant glazed systems *[29].*

The class of fire resistance of the glazed element (i.e. either integrity or insulation, and a classification time in minutes) used in a fire-resistant construction depends on whether:

- *the glazed element is there to provide the same level of protection as the remainder of the enclosure in which it is situated to act as a barrier to fire spread (usually insulation); or*
- *it is sufficient for the glazed element to provide protection against the passage of flames and hot gases (i.e. integrity, non-insulation performance) sufficient for the purpose of protected escape.*

30.1 General

Fire-resisting glass should be used only as part of an approved glazed system of matched components based on fire resistance testing of each individual system. Unauthorized changes should not be made to the list of glazed components in each case, and the system should be installed according to the assembly and glazing arrangement as tested.

The level of fire resistance of a representative example of the glazed system should be tested in accordance with BS 476-22 or classified in accordance with BS EN 13501-2.

NOTE 1 Where the test evidence is not exactly the same as the glazed element to be installed (e.g. where the proposed glass size is greater than that tested) then a Notified Body, or an otherwise appropriately qualified body, might be able to undertake an assessment based on test evidence, or an extended application in accordance with the relevant CEN EXAP standard.

Assessments should be based only on relevant and applicable test evidence for the system under consideration. The proposed glazing design should be within the scope of the available test evidence, and the system should be specified and installed as tested and classified. There should be no changes in tested components unless authorized by the responsible glazing manufacturer.

The distance for the application of fire-resisting glazing either side of a re-entrant corner (see Note 2), or on either side of a protected stairway with an external glazed wall, should be 1 800 mm.

NOTE 2 For façade design, fire-resisting glazed elements may be used at appropriate locations to minimize the risk of fire spread in the same building from floor to floor, or on the same floor across re-entrant corners, by preventing flame break-out and break-in.

*NOTE 2 Recommendations for enclosure of common stairs are given in Clause **12**.*

NOTE 3 Specific guidance for all-glass constructions in atria is given in BS 5516-2.

Where applicable, fire-resisting glazing systems should conform to BS 6262-4 for impact safety, BS 6180 if used in a barrier, and the relevant part of BS 5234 if used in a partition.

All fire-resisting glass should be marked, as a minimum, with an identifiable name or trademark, or other mark, capable of unambiguous identification to the manufacturer or supplier (e.g. a product name, manufacturer's name or code). Installations should be in accordance with glazing guidelines provided by the manufacturer, and the glass should be installed in such a way that the identification mark is visible after installation. Appropriate documentation to confirm the system level of fire resistance should be provided on completion of the installation.

30.2 Limitations of non-insulating fire-resisting glazing

*COMMENTARY ON **30.2***

Restrictions apply to the use of non-insulating fire-resisting glazed elements because of the risks that they pose from their relative inability to provide adequate protection against transmitted heat. There are a number of hazards that could occur even if the integrity of the glazed element as a flame and smoke barrier is maintained. These include:

- *direct exposure to potentially high levels of radiant heat with the risk of burns to exposed skin;*
- *convective heating of the atmosphere in the escape way;*
- *smouldering smoke generation (before ignition) from floor coverings, fixtures and fittings in the corridor; and*
- *secondary ignition and flaming of fixtures and fittings in the escape way.*

To minimize the risk of ignition of adjacent floorings or floor coverings, non-insulating glazed areas in fire-resisting structures should be at least 100 mm above floor level.

The limiting height should, if necessary, be raised above floor level for non-insulated fire-resisting glass (e.g. from 100 mm to at least 500 mm) to minimize the risk of smoke generation in the escape route affecting safe escape or firefighter access, depending on the anticipated fire load and escape conditions.

NOTE 1 The risk of smouldering combustion before flaming occurs can be heightened on the nominally protected side of non-insulating glazing under developed fire conditions.

In buildings containing flats or maisonettes, glazed elements that are fire-resisting in terms of integrity only should not exceed the limitations given in Table 15, appropriate to their position for fire and smoke separation, on the basis that escape to a place of ultimate safety outside the building is relatively short and direct compared with other building types.

NOTE 2 In houses, glazed elements that are fire-resisting in terms of integrity only may be used in fire-resisting screens and in door panels and fanlights for fire and smoke separation, on the basis that escape to a place of ultimate safety outside the building is relatively short and direct compared with other building types.

NOTE 3 For mixed-use buildings, the limitations of non-insulating fire-resisting glazed elements are provided in BS 9999 for those areas not covered in Table 15.

In residential care facilities, any glazing provided in a compartment wall should have the same period of fire resistance (integrity and insulation) as the compartment wall. If non-insulating fire-resisting glazed elements are provided in sub-compartment walls provided, the glazing should provide a minimum period of 30 min fire resistance and is limited to a maximum of 1 m^2 in any room.

NOTE 4 Glazed elements that are fire-resisting in terms of both integrity and insulation to the required level may be used without restriction.

Table 15 – Limitations on non-insulating fire-resisting glazed elements installed in buildings containing flats, maisonettes or residential care facilities

Position of glazed element	**Maximum area of non-insulating glazing**	
	Fire-resisting walls[A)]	**Any leaf of a fire door**[B)]
Part of the enclosure of a protected entrance hall or protected landing within a flat or maisonette	In fixed fanlights only	Unlimited above 1.1 m in height
Between a flat or maisonette and a protected lobby, a common corridor or a protected stairway	Nil	Nil
Between a protected lobby or common corridor and a common stair	Unlimited above 1.1 m in height	Unlimited above 0.1 m in height
Subdividing corridors	Unlimited above 0.1 m in height	Unlimited above 0.1 m in height
Between a protected lobby, or an internal common corridor, and a communal lounge, a common amenity area or a low voltage or extra-low voltage service installation room	Unlimited above 1.1 m in height	Unlimited above 0.1 m in height
Between a protected lobby, or an internal common corridor, and any other ancillary accommodation	Nil	Unlimited above 1.1 m in height
Between a common stair and ancillary accommodation	Nil	Nil
Between an escape route and a higher fire risk area of ancillary accommodation	Nil	Nil
Between a dwelling and an open access balcony with escape in one direction only	Unlimited above 1.1 m in height	Unlimited above 1.1 m in height

NOTE For considerations of transmitted heat through glazed elements, the use of insulation glazing can significantly reduce the risk of injury to people and of secondary fire transfer.

[A)] The size of individual panes of glass making up the permitted total glazed area should be limited to sizes that have been satisfactorily demonstrated to conform to the integrity criterion for an appropriate duration under test. Similarly, any mullions or transoms, especially between adjacent glazed elements, should also be proven.

[B)] The suitability of any door with respect to incorporating fire-resisting glass should be established before glazing. Moreover, not all doors can be glazed without affecting the integrity of the door assembly.

30.3 Glazed screen separating protected shaft from lobby or corridor

If a non-insulated fire-resisting glazed screen is incorporated in the enclosure to a protected shaft between a stair and a lobby or corridor which is entered from the stair, all of the following recommendations should be met.

a) The standard of fire resistance for the stair enclosure should be not more than 60 min.

b) The glazed screen:

   1) should have at least 30 min fire resistance in terms of integrity; and

   2) should not exceed the limits on areas of non-insulated glazing given in Table 15.

c) The lobby or corridor should be enclosed to at least a 30 min standard.

30.4 Glazing and the effects of sprinklers

*COMMENTARY ON **30.4***

Sprinklers are intended to reduce the growth and the size of a fire. Where the building is protected by sprinklers it might be possible either to reduce the required fire resistance classification period of an element of glazing or to use non-insulated fire-resisting glazing, whilst retaining fire-resistant glazed elements in locations for protected escape as recommended by this standard.

Design proposals for glazing systems incorporating sprinklers should be subject to risk assessment, which should include an assessment of all the elements of the glazing system, the level of protection afforded by the sprinklers, and the criticality of the element of glazing to the fire safety of the building. This assessment should include the sensitivity of glazing to thermal shock from water impingement under fire conditions, and the vulnerability of glazing sealants and glass retention methods. Fire-resistant glazing used in the construction should be of a type that is not vulnerable to water.

Where sprinklers are provided together with a glazed assembly, intended to work together as a combined fire-resisting wall system, the following recommendations should be met.

a) The whole assembly should be designed as an integrated sprinkler-glass system, which should be installed in accordance with the manufacturer's specific data sheet that applies for such a sprinkler-glazing arrangement. The water supply and other features of the sprinkler system design not specifically addressed by the manufacturer's data sheet should be in accordance with BS EN 12845:2015+A1.

b) The sprinkler system should have a demonstrated capacity to deliver the required quantity of water throughout the full required period of fire resistance.

c) Either:

   1) the glazed system should at least be classified for non-insulated fire-resistance performance, using a fire-resisting glass type that is not sensitive to water impingement failure under fire conditions; or

   2) if not classified for non-insulated fire-resistance performance, the sprinkler array, when activated, should be able to wet the entire glazed surface of the assembly throughout the full period of any potential developed fire exposure, without the risk of dry spots caused by transoms and mullions or other obstructions during occupation of the building.

NOTE Fire resistance to be met by elements of structure, doors, and other forms of construction is determined in accordance with the relevant part of BS 476 or European equivalent.

31 Active fire curtain/barrier assemblies

*COMMENTARY ON CLAUSE **31***

Active fire curtain/barrier assemblies can be horizontal, vertical or angled. For example, in certain end-use applications, these could be used in place of fire doors, non-load-bearing walls, non-load-bearing ceilings and glazed elements.

The type of active fire curtain/barrier assembly permitted in a fire-resisting construction depends on whether the barrier needs to afford the same protection as the remainder of the enclosure in which it is situated, or whether it is only necessary for the fire barrier to afford protection against the passage of flames, hot gases and smoke at ambient temperatures.

While active fire curtain/barrier assemblies are typically opaque, vision panels can be provided within fire curtains/barriers where required. The provision or omission of vision panels does not impact the recommendations given in this clause.

Where active fire curtain/barrier assemblies are used, they should be in accordance with BS 8524 and should:

a) be deployed by an appropriate automatic fire detector;

b) be capable of multi-stage deployment to initially act as a smoke barrier relevant to the risk, where deemed necessary;

c) have emergency retract buttons relevant to the risk;

d) have built in anti-obstruction detectors, full coverage of area to prevent furniture being positioned in the barrier's path;

   NOTE 1 These need to have timers set for a maximum of 10 min.

e) have controls and associated wiring that is appropriate to the risk and type;

f) have deployment speeds in ranging between 0.06 m/s and 0.15 m/s;

g) achieve the same standard of fire resistance, integrity, insulation or radiation and smoke separation as the element of structure being replaced;

h) have automatic monthly testing and logging;

i) have monitoring of the battery condition; and

j) have display panels having visual and audible provision to:

   1) indicate any faults; and

   2) indicate if the batteries (for emergency retract) need replacing.

When fire curtain barriers are used to protect a means of escape route:

1) the escape route width should be increased by the stated deflection zone; and

2) the maximum length of an uninsulated barrier forming the protected route should not exceed 5 m.

NOTE 2 BS 8524-2 allows uninsulated barriers over 5 m with a fire safety engineering approach, which is outside the scope of BS 9991.

NOTE 3 Uninsulated barriers can be used with sprinklers to protect a means of escape route or to meet insulation requirements.

When subdividing large compartments, the fire barrier should be deployed into a 2 m clear area so that there is no fire load either side.

Where an active fire curtain/barrier assembly is used to replace a fire door, it should additionally meet the recommendations in **32.1.7**.

32 Openings

32.1 Fire doors

*COMMENTARY ON **32.1***

Doors in fire-separating elements are one of the most important features of a fire protection strategy.

Fire doors are used to:

- *protect escape routes from the effects of fire so that occupants can reach a final exit; and*
- *protect occupants, firefighters and the contents and/or structure of a building by limiting the spread of fire and smoke throughout the building.*

These functions can be achieved by means of:

- *fire resistance; and/or*
- *limitation of smoke spread.*

32.1.1 General

Fire doors should normally be self-closing, unless they give access to cupboards or service risers. In these cases, locking hardware should be installed and a “FIRE DOOR KEEP SHUT OR LOCKED” sign provided.

NOTE 1 The reliability of a fire door, especially in heavily-trafficked places, can be improved by hold-open devices that release the door automatically in response to a fire.

NOTE 2 Fire doors should do not usually need to be insulated, as there is no fire load immediately next to a door (it is normally part of a circulation route) for fire to spread by contact with the door surface.

For compartment walls greater than 5 m in length, the total width of the doors located in the wall should not exceed 25% of the total length of the wall.

NOTE 3 For compartment walls less than 5 m in length, there are no restrictions on door width.

32.1.2 Installation

*COMMENTARY ON **32.1.2***

The failure of doors under fire conditions usually occurs at one of the following places:

- *at the gap between the door and the frame;*
- *at the meeting point between two door leaves in double door assemblies;*
- *at one or more of the points where building hardware is fixed (particularly at the hinges or lock positions);*
- *in the case of glazed doors, at the line of the junction between the glazed area and the rest of the door.*

Doors installed on site should conform, in dimensions and workmanship, to the manufacturer’s specification for the appropriate fire resistance test report/assessment. Doors should be hung to give a good fit to the frame when closed, and the junction between door assembly and surrounding structure should be adequately sealed.

NOTE 1 Recommendations for the specification, installation and maintenance of timber fire door assemblies are given in BS 8214.

Security requirements should not override the provision of adequate means of escape. All security locks and/or devices fitted to a dwelling entrance or alternative exit door should be openable from the inside by a single manual operation not requiring the use of a key.

Integrated elements such as locks, letter plates and security viewers should not reduce the fire resistance of the door.

NOTE 2 Advice on the selection of appropriate door hardware can be obtained from the ASDMA Best practice guide *[30].*

Doors forming part of the means of escape from, and within, the building should:

a) be fitted only with simple fastenings that can be operated from the escape side of the door without the use of a key;

b) be hung clear of any change of floor level;

c) be hung so that they do not reduce the effective width of any escape route across a landing;

d) if opening into a corridor, be recessed to the full width of the door;

e) where hung to swing both ways (double swing), or subdividing corridors, be provided with a minimum of a vision panel; and

NOTE 3 For further information, see BS 8300.

f) open to an angle not less than 90°.

32.1.3 Fire resistance

NOTE 1 Fire authorities and insurance companies might require a higher fire performance than that recommended in this British Standard.

NOTE 2 Guidance of performance appropriate to insurance requirements is given in the LPC design guide for the fire protection of buildings [31]. This addresses the use of uninsulated doors and criteria for longevity and robustness in normal usage.

In any dwelling, the minimum fire resistance should be FD 30 for a fire door forming part of the enclosure of any of the following:

a) a protected escape route within a house; or

b) a protected entrance hall within a flat; or

c) a protected entrance hall and landing within a maisonette; or

d) a partition separating living and sleeping accommodation.

For other locations, the fire resistance of fire doors should be not less than the value given in Table 16 for the appropriate location. Unless otherwise recommended, the fire resistance should in all cases be not less than 30 min from either side, except in the case of doors to lift wells, where the fire resistance only needs to be from the landing side.

NOTE 3 In Table 16, where a fire door also needs to provide smoke control to resist leakage at ambient temperatures it has the suffix "S".

Table 16 – Provisions for fire doors

	Position of door	**Minimum fire resistance of door in terms of integrity**[A)]		
		When tested in accordance with BS 476-22	**When tested in accordance with BS EN 1634-1**	**When tested in accordance with BS EN 81-58**
1	In a compartment wall separating buildings	As for the wall in which door is fitted, but not less than 60 min	As for the wall in which the door is fitted, but not less than 60 min	—
2	In a compartment wall:			
a	if it separates a flat from a space in common use	FD 30S[B)]	E 30 S_a[B)]	—
b	enclosing a protected shaft forming a stairway situated wholly or partly above the adjoining ground	FD 30S[B)]	E 30 S_a[B)]	—
c	enclosing a protected shaft forming a stairway not described in 2b)	Half the period of fire resistance of the wall in which it is fitted but not less than 30 min and with suffix S[B)]	Half the period of fire resistance of the wall in which it is fitted but not less than 30 min	—

Table 16 – Provisions for fire doors

Position of door		Minimum fire resistance of door in terms of integrity[A)]		
		When tested in accordance with BS 476-22	**When tested in accordance with BS EN 1634-1**	**When tested in accordance with BS EN 81-58**
			minimum and with suffix S_a[B)]	
d	sub-compartment used for progressive evacuation	FD 30S[B)]	E 30 S_a[B)]	—
e	enclosing a protected shaft forming a lift well or service shaft	Half the period of fire resistance of the wall in which it is fitted but not less than 30 min	Half the period of fire resistance of the wall in which it is fitted but not less than 30 min	Half the period of fire resistance of the wall in which it is fitted but not less than 30 min
f	not described in 2a), 2b), 2c) or 2d)	As for the wall it is fitted in, but with suffix S if the door is used for progressive horizontal evacuation	As for the wall it is fitted in, but add S_a[B)] if the door is used for progressive horizontal evacuation	—
3	In a compartment floor	As for the floor in which it is fitted	As for the floor in which it is fitted	—
4	Forming part of the enclosure of:			
a	a protected stairway (except where described in item 10)	FD 30S[B)]	E 30 S_a[B)]	—
b	the separation between upward and downward flights of a basement stair	FD 30S[B)]	E 30 S_a[B)]	—
c	lift well, which does not form a protected shaft in 2b), 2c) or 2d)	—	—	E30
5	Forming part of the enclosures of:			
a	a protected lobby approach (or protected corridor) to a stairway, except for a firefighting stair	FD 30S[B)]	E 30 S_a[B)]	—
b	any other protected corridor, or	FD 20S[B)]	E 20 S_a[B)]	—
c	a protected lobby approach to a lift well	FD 30S[B)]	E 30 S_a[B)]	—
6	Forming part of the enclosures of:			
a	evacuation lifts or refuges, except for lift landing doors	FD 30S[B)]	E 30 S_a[B)]	—
b	evacuation lifts, where the door is a lift landing door	—	—	E30
7	Affording access to an external escape route	FD 30	E 30	—
8	Subdividing:			
a	corridors connecting alternative exits	FD 30S[B)]	E 30 S_a[B)]	—
b	dead-end portions of corridors from the remainder of the corridor	FD 30S[B)]	E 30 S_a[B)]	—

Table 16 – Provisions for fire doors

Position of door		Minimum fire resistance of door in terms of integrity[A)]		
		When tested in accordance with BS 476-22	**When tested in accordance with BS EN 1634-1**	**When tested in accordance with BS EN 81-58**
9	Any door:			
a	within a cavity barrier	FD 30	E 30	—
b	forming part of the enclosure to a communal area in specialized housing	FD 30S[B)]	E 30 S_a[B)]	—
10	Any door:			
a	forming part of the enclosure to a protected entrance hall or protected landing in a flat	FD 30	E 30	—
b	within any other fire-resisting construction in dwelling accommodation not described elsewhere in this table	FD 30	E 30	—

*NOTE 1 For firefighting shafts, see Clause **22**, Clause **49** and Clause **50**.*

NOTE 2 The national classifications do not automatically equate with the equivalent classifications in the European column, therefore products cannot typically assume a European class unless they have been tested accordingly.

*NOTE 3 For the separation between upward and downward flights of a basement stair (item 4 b), see Clause **13** and Clause **14**.*

[A)] Fire doors are designated by reference to their recommended performance (in minutes) for integrity only, and whether they need to retard the passage of smoke at ambient temperature. The need to include insulation as part of the specification is dependent on the function of the door. For example, reference FD 60 is to a door that should achieve not less than 60 min integrity when tested in accordance with BS 476-22 or BS EN 1634-1.

[B)] See **32.1.7**.

In a compartment wall, if two doors in series are to be provided in place of a single fire door then all of the following criteria should be met:

1) neither door has a fire resistance less than 30 min; and
2) neither door is a shutter; and
3) neither door has been identified by the manufacturer as being vulnerable to thermal shock (e.g. annealed glass).

Both doors should be self-closing if the opening is also used as a means of escape route.

32.1.4 Glazing in fire doors

Where glazed elements in fire-resisting enclosures and doors are able to meet the relevant performance only in terms of integrity (i.e. they are unable to meet the relevant performance in terms of insulation), the use of glass should be limited in accordance with Clause **30**.

Integrity-rated glass should not be installed in a door requiring insulation.

NOTE Insulation performance-rated glazing may be installed in an integrity performance fire-resistant door.

32.1.5 Lift landing doors

Where lift landing doors need to be fire doors, they should achieve the appropriate level of fire resistance in terms of integrity (see Table 6 and Table 16) when tested in accordance with BS EN 81-58.

*NOTE For lifts opening directly into flats, see **45.3.2**.*

32.1.6 Closure systems

32.1.6.1 Self-closing devices

*COMMENTARY ON **32.1.6.1***

Fire doors can only operate correctly if they are fully closed at the time of fire.

Self-closing fire doors are more likely to be propped open, and thus rendered ineffective, by the occupants of a building if the doors are regarded as an impediment to access.

Poorly specified self-closing devices can make fire doors virtually impassable to some people, e.g. wheelchair users and those with limited upper body strength.

All fire doors, except those leading to a cupboard or service duct (both of which are normally kept locked shut) and with the exception of lift landing doors, should be fitted with a self-closing device (other than rising-butt hinges) that should:

a) be of a type that cannot readily be disconnected or immobilized and does not embody a mechanical hold-open facility unless it automatically releases the door in a fire situation (see **32.1.6.2**); and

b) override any latches fitted to the door, or in the absence of a suitable latch or other positive device for holding the door shut in its frame, be of a type that when tested in accordance with BS 476-22 or BS EN 1634-1 is shown to be able to hold the door closed in the frame for a sufficient period of time for the closing role to be taken over by a thermally activated sealing device (e.g. an intumescent seal), or throughout the full period of exposure if such seals are not incorporated; and

c) for swing doors, conform to BS EN 1154.

Door closer forces should be limited to the minimum necessary to close the door reliably and effectively.

If the force needed to open a door on a circulation route exceeds 30 N, or if an automatic self-closing device would be considered a hindrance to the occupants of the building, then hold-open devices in accordance with **32.1.6.2** should be used.

Self-closing devices need not be provided on fire doors within a dwelling, flat or maisonette, except between an attached or integral dwelling and on the door between a flat and communal areas.

NOTE 1 BS 8300-2 recommends that, for most disabled people to have independent access through single or double swing doors, the opening force, when measured at the leading edge of the door, is not more than 30 N from 0° (the door in the closed position) to 30° open, and not more than 22.5 N from 30° to 60° of the opening cycle.

NOTE 2 The opening force can be checked using a plunger-type force measuring instrument. Where measurements cannot be taken at the leading edge, they may be taken at a point on the face of the door up to 60 mm from the leading edge, a position approximately in line vertically with the spindle of a lever handle or the centre line of a pull handle or push plate, in which case the opening force limits can be increased by approximately 2 N. The accuracy of force measuring instruments available on the market varies and there are inherent difficulties in measuring forces on site. It is recognized, therefore, that any measurements are subject to a degree of imprecision which could give rise to variations of between 2 N and 3 N.

32.1.6.2 Hold-open devices

*COMMENTARY ON **32.1.6.2***

Hold-open devices are used either to hold a fire door in the open position, against the action of a door closer, or to allow it to swing freely, automatically releasing the closing mechanism in a fire situation.

If a hold-open device is to be used, it should be:

a) a fusible link or heat detector (unless the door is fitted in an opening provided as a means of escape, or to protect a means of escape); or

b) an automatic release mechanism actuated by an automatic fire detection and fire alarm system; or

c) a delayed closing device with the delay adjusted not to exceed 25 s.

The automatic release mechanism should allow the door closing device to resume its self-closing function in the event of one or more of the following:

1) the detection of smoke by suitable automatic apparatus;

2) the detection of heat or smoke by any in-built sensing device;

3) failure of the power supply;

4) operation of the fire alarm system;

5) local manual operation; and

6) if the facility is provided, a manual operation at a central control point.

NOTE 1 BS EN 1155 specifies requirements for separate hold-open devices and also for hold-open mechanisms incorporated in a door closer. Devices manufactured in accordance with BS EN 1155 can hold a swing door at a fixed position or can allow the door to swing freely. BS 5839-3 specifies requirements for certain automatic release mechanisms intended to hold open (or closed) fire protection equipment, such as fire doors, fire shutters, fire dampers, etc., which are outside the scope of BS EN 1155.

NOTE 2 BS 7273-4 gives recommendations for the design, installation, commissioning and maintenance of electrical control arrangements for actuation of mechanisms that unlock, release or open doors in the event of fire.

32.1.7 Smoke sealing of fire doors

A fire door that is needed to resist the passage of smoke at ambient temperature conditions, i.e. fire doors having the suffix S (see **32.1.3** and Table 16), should either:

a) have a leakage rate not exceeding 3 $m^3/h/m$, when tested in accordance with BS 476-31.1; or

b) meet the classification requirement of S_a when tested in accordance with BS EN 1634-3:2004 using an appropriate threshold sealing system.

NOTE Smoke leakage control can be applied to non-fire-resisting doorsets.

32.1.8 Building hardware

*COMMENTARY ON **32.1.8***

Building hardware used on fire-resisting doors can significantly affect their performance in the event of a fire, and this needs to be taken into account when determining which hardware to use.

General guidance is given in BS 8214. DHF publication CP 102 [32] gives guidance on fire-resisting metal doorsets.

BS 8300-2 gives guidance on accessibility considerations for door hardware.

32.1.8.1 General

Hinges that provide the means of support at the hanging edge of a door should:

a) be shown to be satisfactory when tested in accordance with BS 476-22 or BS EN 1634-1; or

b) be made of class A1 materials.

All items of hardware for use on fire doors should be suitable for the type of door to which they are fitted. All hardware should also be protected against heat penetration with the use of seals as appropriate for the hardware, and in accordance with door test evidence.

Where hardware elements penetrate through a fire door (e.g. door letter plates), there should be sealing to limit smoke spread.

32.1.8.2 Door fastenings

In general, doors on escape routes (whether or not the doors are fire doors) should either not be fitted with lock, latch or bolt fastenings, or be fitted only with simple fastenings that can be readily operated from the side approached by people making an escape. The operation of these fastenings should be readily apparent, without the use of a key and without having to manipulate more than one mechanism.

NOTE This is not intended to prevent doors being fitted with hardware to allow them to be locked when the rooms are empty.

Where a door on an escape route has to be secured against entry when the building or part of the building is occupied, it should be fitted with a lock or fastening which is readily operated, without a key, from the side approached by people making their escape.

Where a secure door is operated by a code, combination, swipe or proximity card, biometric data or similar means, it should also be capable of being overridden from the side approached by people making their escape.

Electrically powered locks should return to the unlocked position under any of the following conditions:

a) on operation of the fire alarm (see BS 7273-4); or

b) on loss of power or system error; or

c) on activation of a manual door release unit (type A) conforming to BS EN 54-11:2001 positioned at the door on the side approached by people making their escape. Where the door provides escape in either direction a unit should be installed on both sides of the door.

32.1.9 Fire door signage

All fire doors other than lift entrance doors should be marked with the appropriate fire safety sign conforming to BS ISO 3864-1 according to whether the door is:

a) to be kept closed when not in use; or

b) to be kept locked when not in use; or

c) held open by an automatic release mechanism.

Fire doors to cupboards and to service ducts should be marked on the outside. All other fire doors should be marked on both sides.

NOTE Lift entrance doors do not need to be marked.

32.2 Shutter assemblies

Shutter assemblies across a means of escape should be released only by a heat sensor, such as a fusible link or electric heat detector, in the immediate vicinity of the door. Closure of shutters in such locations should not be initiated by smoke detectors or a fire alarm system, unless the shutter is also intended to act as a smoke curtain.

Shutter assemblies should achieve the appropriate level of fire resistance in terms of integrity (see Table 6 and Table 16) when tested in accordance with BS 476-22 or BS EN 1634-1.

32.3 Access panels

Access panels should be of a construction that has at least the same fire resistance as the element they fit into. This should be achieved by having:

a) the recommended fire resistance from both sides; or

b) an automatic heat activated sealing device, which in the event of fire will close the opening to maintain the fire resistance recommended for the compartment wall or floor.

32.4 Fire-stopping

*COMMENTARY ON **32.4***

When a building service passes through a compartment wall or floor there can be an imperfection of fit, which results in gaps in the walls between compartments. This presents a risk of allowing cold smoke and flame to breach a compartment wall via these gaps. It is therefore necessary to fill these gaps with a material that will restrict the passage of cold smoke and flame. Various materials can be used, but certain materials are more suited to certain applications.

32.4.1 Applications

Joints between elements that serve as a barrier to the passage of fire should be fire-stopped. All openings for pipes, ducts, conduits or cables to pass through any part of an element that serves as a barrier to the passage of fire should be:

a) kept as few in number as possible;

b) kept as small as practicable; and

c) fire-stopped.

32.4.2 Products and materials for fire-stopping

The selection of products and materials used for fire-stopping should take account of the size and nature of the gap and any anticipated differential movement.

Where fire-stopping and sealing systems (including those designed for service penetrations) are used, they should achieve the appropriate level of fire resistance (see Table 6) when tested in accordance with BS EN 1634-1.

NOTE 1 In the case where minimum differential movement is anticipated and where the gap does not exceed 25 mm, the following fire-stopping materials may be used without specific test evidence:

- *cement mortar;*
- *gypsum-based plaster; and*
- *cement or gypsum-based vermiculite/perlite mixes.*

To maintain the physical integrity of fire-stopping, it should be reinforced with (or supported by) class A2-s3,d2 or better materials in the following circumstances:

a) in all cases where the gap between elements that need to be fire-stopped is greater than 100 mm; and

b) in any other case where non-rigid or flexible materials are used (unless substantiated by fire test evidence); and

c) where the centres of supports for services do not exceed those tested (see Note 2).

NOTE 2 The fire performance of any installed seal can only be guaranteed if it is installed in exactly the same configuration as that in which it was tested, including the centres of supports for services. If the seal is installed with centres and tolerances outside the scope of application established in the test, there is a possibility that this will lead to localized distortion of the service, which in turn could cause displacement and thus premature failure of the seal.

33 Floors and ramps on escape routes

*COMMENTARY ON CLAUSE **33***

Surfaces of escape routes (treads, ramp surfaces and floor finishes) that might become wet as a result of firefighting operations or sprinkler activation can become hazardous.

Treads, ramp surfaces and floor finishes on escape routes should have a firm, slip-resistant surface.

*NOTE Guidance on the slip potential characteristics of treads, ramp surfaces and floor finishes is given in BS 8300-2:2018, Annex C. Detailed information on assessing slip resistance, together with a table illustrating common surface materials and their dry and wet slip resistance values (SRV), also known as pendulum test values (PTV), can be found in BS 5395-1:2010, Clause **7**. Whilst BS 5395-1 specifically relates to slip resistance*

on staircases, it is considered appropriate for use for all escape route surfaces unless otherwise agreed with the approving authorities.

Ramps should be in accordance with BS 8300-2.

34 Construction of common stairs

Common stairs should:

a) be constructed in accordance with BS 5395-1;

b) meet the recommendations for width given in Clause **11**;

c) have flights and landings constructed of class A2-s3, d2 or better materials, with the exception of:

   1) stairs in multi-stair buildings with no floor at 18 m or more above ground level; or

   2) two or three storey buildings, or parts of a building, served by a single stair; and

d) be formed of straight flights in all buildings of more than three storeys.

Ladders should not form part of a means of escape route from any dwelling.

NOTE 1 Ladders conforming to BS EN ISO 14122-4 may form part of a means of escape route from areas of a building where access is limited to occasional purposes of maintenance and repair.

NOTE 2 Guidance on the fire assessment of timber stair construction is given in CLG publication Fire performance of escape stairs: BD 2569 [33] and Building Control Alliance Guidance Note 19 [34].

Section 6: Mechanical systems for ducted heating, ventilation and air conditioning (HVAC)

35 HVAC systems within individual dwellings

Ducted HVAC systems should be arranged such that fire and smoke is not transferred from the room of fire origin in a manner that could inhibit the safe use of protected internal means of escape routes or allow the undue spread of fire.

Any house, flat, maisonette or other residential unit with a floor over 4.5 m above ground level or any basement should meet the following recommendations.

a) Transfer grilles should not be fitted in any wall, ceiling, floor or door enclosing a protected internal hallway or stair enclosure.

b) Where practicable, ducts should be routed such that they do not pass through protected internal hallways or stair enclosures.

c) Where the duct does pass through a protected internal hallway or stair enclosure, then either:

   1) where the duct penetrates the fire-resisting enclosure, it should be provided with fire dampers that are accessible for maintenance, conform to BS EN 15650, tested to BS EN 1366-2, and have an ES classification in accordance with BS EN 13501-3:2005+A1 to achieve at least the same level of fire resistance as the compartment barrier in which they are fitted; or

   2) the duct should be of fire-resisting construction and achieve at least the same level of fire resistance as the compartment barrier in which it is fitted when tested from the inside (see Section **5**); or

   3) the ceiling zone of the protected entrance hall or stair enclosure should be fire rated to the same period of fire resistance as the entrance hall or staircase enclosure when tested from the ceiling void side. The internal surfaces of the ceiling void should be constructed of class A1 materials.

d) Where an HVAC system re-circulates air and serves the protected internal hallway or stairway and other rooms, smoke detectors should be provided within the ductwork that switches the mode to shut down upon detection.

e) HVAC ducted systems that link between dwellings or serve common areas should be in accordance with Clause **36**.

36 HVAC systems serving the whole building or interconnecting dwellings and other residential units

Mechanical HVAC systems serving the whole building should be designed to prevent the spread of fire and smoke from the room of fire origin throughout the building. In particular, measures should be taken to prevent incursion of fire and combustion products into protected escape routes through air movement in the system, and to prevent fire compartmentation from being breached.

HVAC systems should be compatible with smoke control systems installed in the building (whether natural, mechanical exhaust or pressurization) when operating under fire conditions.

The following recommendations should be met to aid firefighting control.

a) Ventilation systems serving protected escape routes should not serve other areas and the normal airflow pattern should be directed away from the escape route.

b) Separate ventilations systems that do not allow for the recirculation of air within them should also be provided for:

   1) each protected stairway;

   2) plant areas;

   3) car parks;

   4) non-domestic kitchens; and

   5) residential parts of mixed-use buildings.

c) Ducts passing through the enclosure of a protected escape route should meet the relevant fire resistance recommendations.

d) Where a ductwork system serves more than one part of a compartmented or fire-separated escape route, smoke detector operated leakage rated ES fire dampers should be provided where the ductwork enters each fire-separated or smoke-separated section of the escape route.. Such dampers should be in accordance with BS EN 15650, tested to BS EN 1366-2 and have an ES classification in accordance with BS EN 13501-3:2005+A1 to achieve at least the same level of fire resistance as the compartment barrier in which they are fitted.

   *NOTE 1 See also **29.2** regarding installation of ductwork systems.*

e) Ducts passing through compartment walls and floors and other fire-separating elements should maintain the fire integrity using one of the following methods:

   1) fire dampers; or

   2) fire-resisting enclosures; or

   3) fire-resisting ductwork.

f) Where ductwork serves more than one flat or maisonette, smoke detector operated leakage rated ES fire dampers should be provided where the ductwork enters each dwelling. Such dampers should be in accordance with BS EN 15650, tested to BS EN 1366-2 and have an ES classification in accordance with BS EN 13501-3:2005+A1 to achieve at least the same level of fire resistance as the compartment barrier in which they are fitted.

g) The fire resistance of ducts and dampers should be equal to the fire resistance required for the building element being penetrated. All ducts and dampers should be fire-stopped where they penetrate compartments and fire-resisting enclosure of escape routes following the manufacturers' instructions.

h) Systems which recirculate air should be fitted with smoke detectors in the extract ductwork before the point of separation of the recirculated air and the air to be discharged and before any filters or other air cleaning equipment. Detection should cause the system to immediately shut down or switch to extract the air to an external location.

i) Fire and rescue service override controls should not permit multiple lobby vents to be open simultaneously. Override controls should be at the fire service access point or in the fire control centre if one is provided.

j) Air transfer grilles should not be positioned in enclosures to protected stairways, protected lobbies, protected corridors, firefighting stairways and lobbies, protected shafts and compartment walls or floors.

   NOTE 2 Further information on air transfer grilles is given in BS 9999.

k) Exhaust outlets should be positioned such that they:

   1) are at least 1.8 m away from and do not discharge products of combustion close to final exits or other parts of escape routes; and

   2) are at least 1.8 m away from and are not close to any combustible or otherwise vulnerable element of the building construction; and

   3) are at least 1.8 m away from and do not enable re-entry of exhaust products back in via air inlet points.

l) Service ducts should be designed and constructed in accordance with BS 8313.

m) Where pressurization or other smoke control systems are installed within a building, any ventilation and air conditioning system should be compatible with its operation under fire conditions.

n) Where plant areas are within the building, they should be treated as separate fire compartments in order to isolate any fire source.

NOTE 3 Further guidance is given in BS 9999, ASFP Blue Book [26], ASFP Grey Book [27] and BS 5839-1:2017.

Section 7: Ancillary accommodation to flats and maisonettes

37 General recommendations for ancillary accommodation

*COMMENTARY ON CLAUSE **37***

Ancillary accommodation covers all those parts of buildings containing flats or maisonettes that are ancillary to the dwellings. It includes engineering services and such accommodation as common amenity areas, refuse rooms and covered car parks.

Engineering services include:

- *gas services;*
- *electrical services and wiring;*
- *lighting;*
- *lift machine rooms/machinery spaces;*
- *communal heating, ventilation and air conditioning systems;*
- *refuse storage, disposal and incineration; and*
- *car parks.*

Ancillary accommodation should meet the following recommendations.

a) Ancillary accommodation should have escape routes of such number and be situated such that the travel distance from any point does not exceed the limitations given in Table 17.

b) Ancillary accommodation should have sufficient escape capacity for the anticipated number of occupants calculated from an assessment derived from BS 9999 for the appropriate risk profile.

c) Ancillary accommodation should not connect with any part of the only escape route from one or more dwelling(s) on the same storey as the ancillary accommodation unless it meets the recommendations given in **7.7** and **13.2**.

d) In multi-stair buildings:

   1) ancillary accommodation should be separated from any stair by a protected lobby or protected corridor at the storey in which the accommodation is situated; and

   2) ancillary accommodation should be separated from any common corridors by a protected lobby where the escape route is in a single direction.

e) Ancillary accommodation should be separated from other parts of the building in accordance with Table 18 and, where necessary, have ventilated lobbies in accordance with Clause **21** and **22.1.6**.

f) Glazed areas separating escape routes from ancillary accommodation should be in accordance with Clause **30** and Clause **12**.

g) Emergency escape lighting should be provided in accordance with **44.3**.

Any ancillary accommodation that is a place of special fire hazard should meet the recommendations in Clause **38**.

Table 17 – Maximum travel distances in areas of ancillary accommodation

Ancillary accommodation	Maximum part of travel distance within the room or area		Maximum travel distance to the nearest storey exit	
	Escape in one direction only	Escape in more than one direction, in directions 45° or more apart	Escape in one direction only	Escape in more than one direction, in directions 45° or more apart
	m	m	m	m
Engineering services installation rooms	9	18	18	45[A)]
Boiler rooms	9	18	18	45[A)]
Fuel storage areas	9	18	18	45[A)]
Transformer, battery and switchgear rooms	9	18	18	45[A)]
Refuse stores	9	18	18	45[A)]
Communal lounges and common amenity areas	18	45[A)]	18	45[A)]
Covered car parks	18	45[A)]	18	45[A)]
Bicycle stores	18	45[A)]	18	45[A)]
Kitchen	9	18	18	45[A)]
Staff rooms, e.g. offices	18	45[A)]	18	45[A)]

[A)] This may include up to 18 m with escape in one direction only.

Table 18 – Fire separation for ancillary accommodation

Room type	Minimum fire separation [A)]	Additional comments
Plant room [A), B), C)]	60 min	—
Sprinkler room [D)]	60 min [E)]	—
Covered car/motorcycle park [D)]	60 min	—
Mobility scooter store	60 min	Reduce to 30 min with residential sprinkler system
Refuse store/ chute including lobby approach	60 min[F)]	With 30 min separation between store and lobby.
Kitchen – commercial type	60 min	With local suppression system within cooker hood over hob units
Kitchen – reheat only	30 min	With local suppression system within cooker hood over hob units
Laundry	30 min	—
Meter rooms	30 min	—
Hair salon/ beauty parlour	30 min	Potential risk due to high number of electrical appliances and use of chemicals which can be highly flammable
Staff rooms – offices, changing/rest rooms	30 min	—
Storeroom/ cleaners room opening onto escape routes	30 min	—

Table 18 – Fire separation for ancillary accommodation

Room type	Minimum fire separation [A]	Additional comments
IT server/ communications room	30 min	—
Library	30 min	—
Restaurant/cafe	30 min[G]	Open plan layouts are acceptable where there is a minimum of two separate escape routes to final exits
Bicycle store	30 min	Includes pedal bikes with battery charging facilities
Day rooms in managed sheltered accommodation designed for independent living with care support	30 min[G]	Open plan layouts are acceptable where there is a minimum of two separate escape routes to final exits.
Day rooms where living provides separate bedroom units with high dependency (e.g. dementia units) and building operates on simultaneous/phased evacuation	30 min	—

[A] Walls separating the ancillary accommodation with access onto the common residential corridors should have at least the minimum performance as the separation between the residential accommodation and the common corridor

[B] Refer to Clause **23** for housing power supplies.

[C] Plants rooms also include lift motor rooms, mechanical smoke ventilation system

[D] Robust masonry construction

[E] Reduced to 30 min for buildings with the upper habitable floor under 5 m.

[F] Refuse stores are by virtue of Clause **24** classed as compartments. Therefore, walls surrounding them should follow Table 6 and Table 7 or Table 8. In buildings over 18 m this can require FR of more than 60 min.

[G] Requirement relaxed with a residential system installed in communal areas.

38 Places of special fire hazard

*COMMENTARY ON CLAUSE **38***

Places of special fire hazard include oil-filled transformer and switch gear rooms, boiler rooms, storage spaces for fuel or other highly flammable substances and rooms housing a fixed internal combustion engine. Places of special fire hazard might need to have smoke or heat detectors fitted to give early warning of fire and sprinklers fitted in accordance with BS EN 12845:2015+A1 to control the fire.

Places of special fire hazard should be enclosed with fire-resisting construction in accordance with **24.2.1** (Table 6). Travel distances in places of special fire hazard should be limited to 9 m in a single direction or 18 m where escape is available in more than one direction.

NOTE Additional risk protection measures, such as increased fire resistance, might be needed to separate a flat from any storage area where fuels such as petrol and liquefied petroleum gas (LPG) are present.

Separate smoke outlets should be provided from places of special fire hazard located below ground level (see **22.4.2**).

Elements of construction enclosing places of special fire hazard should be in accordance with **22.2.1** (Table 6).

Where a common stair forms part of the only escape route from residential accommodation, unless it is designated as a small single-stair building in accordance with **7.7**, it should not also serve any covered car park, boiler room, fuel storage space or other ancillary accommodation of similar fire risk.

Refuse chutes and refuse storage areas (see Clause **47**) should be separated from other parts of the building by fire-resisting construction in accordance with **22.2.1** (Table 6). They should not be located in protected stairways or protected lobbies.

39 Installation of engineering services

*COMMENTARY ON CLAUSE **39***

Some engineering services are known potential sources of fire. The importance of correct installation in the first place is emphasized, because lighting, heating and ventilation systems are often concealed above suspended ceilings and within service ducts.

Control gear is also often located behind ceiling and wall panels. Installation faults that might lead to fire are particularly dangerous because the fire is likely to remain undiscovered for some time if it is concealed.

The equipment associated with engineering services and control gear should be installed and maintained in accordance with the relevant codes of practice.

40 Engineering service installation rooms

*COMMENTARY ON CLAUSE **40***

Engineering service installation rooms include electrical switchgear rooms, boiler rooms, fuel storage spaces, mechanical ventilation and air conditioning plant rooms, lift machine rooms, rooms housing fixed internal combustion engines and battery charging rooms.

Service installation rooms should be sited such that escape from other exits is not prejudiced by any risk that they could pose.

Service installation rooms in which flammable liquids are used or stored should have imperforate sills to doorways. Any necessary drainage should be provided with interceptors.

Service installation rooms should, where necessary for the safe operation of the equipment and to avoid undue build-up of heat, be ventilated (either directly or indirectly) to the outside air. The provision of such ventilation should not impair any fire resistance requirements for the structure.

*NOTE This ventilation may be combined with the provisions for smoke ventilation (see Clause **22**).*

Service installation rooms adjoining a building (including those on top of a flat roof) should be separated from the building in accordance with Table 16 and Table 18.

41 Gas services, installation and service pipes

All gas services and installation and service pipes should be installed such that the fire resistance of the building is unimpaired.

For small single-stair buildings, where gas service pipes run through the stair enclosure, they should be enclosed within a riser that is separated from the rest of the stair enclosure by 30 min fire-resisting construction. The service riser should not contain any equipment. Access to the service riser should be by a FD 30S fire door kept locked.

NOTE 1 Attention is drawn to the Gas Safety (Installation and Use) Regulations 1998 [35], which cover the installation of gas fittings, including installation pipework, meters and appliances.

NOTE 2 Further guidance is also given in the following publications:

- *gas services: Institution of Gas Engineers and Managers' Publication IGE/TD/4 [36]; and*
- *low pressure installation pipes: BS 6891.*

42 Electrical services

42.1 Electrical service installations

Electrical services should be installed and maintained in accordance with BS 7671.

For small single-stair buildings, where electrical services through the stair enclosure they should be enclosed within a riser that is separated from the rest of the stair enclosure by 30 min fire-resisting construction. The service riser should not contain any equipment. Access to the service riser should be by a FD 30S fire door kept locked.

42.2 Transformer, battery and switchgear rooms

A transformer, battery or switchgear room, unless situated on the roof or in a separate enclosure, should be sited adjacent to an external wall and entered only from the open air.

A transformer, battery or switchgear room should have adequate provision for ventilation.

42.3 Firefighter's emergency switches for discharge lighting installations

An exterior discharge lighting installation, or an interior discharge lighting installation, operating unattended or operating at a voltage exceeding low voltage, should be controlled by a firefighter's emergency switch.

The fire and rescue authority should be consulted for advice regarding firefighter's emergency switches.

NOTE BS 7671 specifies requirements for the installation and situation of firefighter's emergency switches.

43 Gas and electricity meters

The location of meters should be agreed with the supply authority at the planning stage.

Gas meters and associated equipment should be installed in accordance with the relevant part(s) of BS 6400. The distance between electricity meters and gas meters not placed in meter boxes should be in accordance with the BS 6400 series. Wherever practicable, gas meters should not be installed in corridors in single-stair buildings or in dead-end corridors.

NOTE 1 Attention is drawn to the requirements for installation and connection set out in the Pipelines Safety Regulations 1996 [37] and the Gas Safety (Installation and Use) Regulations 1998 [35].

NOTE 2 Guidance on suitable gas installations in blocks of flats is given in IGEM/G/5 [36].

Electricity meters and associated equipment should be installed in accordance with BS 7671.

Where meter boxes are required, gas meters and electricity meters should be housed in separate boxes. Each box should be large enough only for the meter and associated equipment.

Wherever practicable, gas and electricity meters should not be located in the entrance hall of a dwelling. If a meter has to be located in an entrance hall, it should be contained within a suitably constructed cupboard that is large enough to contain only the meter(s).

A meter should not be installed on or under a stairway, or in any other part of a building that has a maximum of one floor above the ground floor, for which the stairway, or that other part of the building, provides the only means of escape in the event of a fire, unless:

a) the meter is:

   1) of fire-resisting construction; or

   2) housed in a protected compartment; or

   NOTE 3 A protected compartment refers to an enclosure of fire-resisting construction fitted with a fire door that is kept locked shut. Further details are given in the Gas Safety (Installation and Use) Regulations 1998 [35].

b) the pipe immediately upstream of the meter, or a governor (where a governor is adjacent to the meter), incorporates a device to automatically cut off the flow of gas when the temperature of the device exceeds 95 °C.

A meter should not be installed on or under a stairway, or in any other part of a building having two or more floors above the ground floor, where the stairway, or that other part of the building, provides the only means of escape in case of fire, unless the meter replaces an existing meter and is in accordance with either item a) or item b) above.

In single-stair buildings, an electric meter should not be installed within a common escape route unless it is enclosed within a secure cupboard (allowing access only to the electricity supply company) which is separated from the common escape route by construction having a fire resistance of 30 min.

Where meters are inset into a fire-resisting wall or partition, they should be separated at the back and sides from the dwelling by construction having the same fire resistance as that recommended for the element in which they are placed.

NOTE 4 To facilitate external meter reading and attendance, the meters in flats and maisonettes may be located to be accessible or visible from a common circulation space (not a common stair) through robust doors provided with locks. Glazed viewing panels large enough to expose dials and meter numbers may be provided, where desired.

44 Lighting

44.1 General

Incandescent filament lamps and high-pressure discharge lamps should not be located close to, or fixed to, materials that are readily ignited.

Minimum separation distances should be applied in accordance with BS 7671.

Care should be taken in the selection of plastics materials or finishes and preference should be given to those with superior flame-retardant qualities.

Every luminaire should be fitted with an automatic test system for emergency lighting, in accordance with BS EN 60243.

44.2 Lighting in residential care premises

Emergency escape lighting should be provided to all areas within a residential care premises, including, but not limited to, residential, common escape routes, ancillary accommodation and non-residential accommodation.

44.3 Lighting of common escape routes in buildings containing flats or maisonettes

Provision should be made for lighting along common escape routes so that occupants and visitors to the building can see their way to safety, even in the event that the main electricity supply fails. The lighting should be such that directional or warning signs associated with common escape routes, changes in floor level, the location of fire alarm call points and firefighting equipment are also visible. Where an emergency escape lighting system is provided, it should meet the appropriate recommendations in BS 5266-1.

NOTE The essential feature of emergency escape lighting is that it is designed to illuminate when part or all of the normal lighting has failed. There are various types of emergency escape lighting, e.g. lighting that is continuously alight; lighting that is not illuminated until the mains fail, but lights automatically; single independent luminaires or central battery or generator systems.

Emergency escape lighting should also be provided within:

a) ancillary accommodation normally accessible to the occupants;

b) common stairs;

c) all common escape routes in specialized housing;

d) common escape routes across a flat roof; and

e) windowless accommodation within live-work units.

Where an emergency escape lighting system is not provided along common escape routes, the lighting should use only protected circuits (see **44.4**).

44.4 Protected circuits

A protected circuit should:

a) have the appropriate category of cable as recommended in BS 5266-1; and

b) be easily identifiable and spatially separated from non-protected circuits.

45 Protection of lift installations and machinery

45.1 Fire protection of lift installations

*COMMENTARY ON **45.1***

Generally, lifts are not included in the evacuation procedures in buildings for the following reasons:

- *it is possible for the occupants using the lift to become trapped due to loss of power;*
- *it is possible that lifts could discharge occupants onto the floor containing the fire; and*
- *people sometimes have to wait for long periods for the lift car to arrive, extending the escape time.*

Lifts that are specifically designated for the purpose can, however, be used to evacuate people safely and effectively, with priority being given to people who might have difficulty with other escape routes.

*Recommendations for the systems and procedures necessary to support the use of lifts for evacuation are given in **7.6** and Annex G.*

BS 8899 gives recommendations for the improvement and maintenance of firefighting and evacuation provision in existing lifts.

Lift wells should either be contained within the enclosures of a protected stairway or be enclosed throughout their height with fire-resisting construction. A lift well connecting different compartments should form a protected shaft.

In basements and enclosed car parks, the lift should be approached only by a protected lobby (or protected corridor) unless it is within the enclosure of a protected stairway. The same restriction should be applied in any storey that contains high fire risk areas, if the lift also delivers directly into corridors serving sleeping accommodation.

NOTE 1 Examples of fire risk areas in this context are kitchens, lounges and stores.

A lift should not be continued down to serve any basement storey if it is in a building (or part of a building) served by only one escape stair, or if it is within the enclosures to an escape stair that is terminated at ground level.

Lift machinery spaces should be sited over the lift well or within the top of the well whenever possible. If the lift well is within a protected stairway which is the only stairway serving the building (or part of the building), then if the machinery spaces cannot be sited above or within the top of the lift well, they should be located outside, or should be separated from, the stairway (to avoid smoke spread into the stairway from a fire in a machinery space). Any machine, pulley or other associated equipment located outside of the lift well should be within the same fire compartment as the well.

NOTE 2 A corridor can be protected from a lift well by means of additional automatic fire/smoke doors or fire/smoke barriers, thus eliminating the need for a lobby.

In buildings designed for phased or progressive horizontal evacuation, where the lift well is not contained within the enclosures of a protected stairway, the lift entrance should be separated from the floor area on every storey by a protected lobby.

Lifts other than firefighters lifts and evacuation lifts should be recalled to an exit floor and then taken out of service in accordance with BS EN 81-73. Where there is no suitable fire alarm system, the lift should be recalled from a manual recall device in accordance with BS EN 81-73.

45.2 Lift machine rooms and machinery spaces

Where a lift well is located within a common escape route, any lift machine room should be either above or outside of the common escape route. Lift machinery spaces should be enclosed in fire-resisting construction (see Table 6).

Lift machine rooms or machinery spaces should conform to the appropriate part of BS EN 81. Access routes to lift machine rooms and machinery spaces should conform to BS EN 81-20 and should lead to a protected escape route, or place of ultimate safety, to allow safe egress.

Hydraulic lifts designed without a machine room and which incorporate all of the plant and hydraulic oil reservoir within the lift well should not be used in blocks of flats having a single stair.

45.3 Access to lifts

45.3.1 Lifts serving more than one flat or maisonette

Lifts serving more than one flat or maisonette should not open directly into flats or maisonettes due to the risks of smoke spread into dwellings from an otherwise remote fire.

Lift access should be via ventilated communal corridors or lobbies (see Annex A).Corridors and lobbies serving the lift should not form part of any dwelling. The lift, including any lift door, should not form part of the compartment construction bounding a dwelling or act as the direct entrance into a dwelling.

45.3.2 Lifts serving only a single flat or maisonette

45.3.2.1 Lifts providing internal access within a flat or maisonette

Lifts should not directly connect sleeping accommodation to any other habitable room.

Where flats or maisonettes are provided with floor levels in excess of 4.5 m from ground or access level, internal lifts should meet the following recommendations.

a) Unless located within the protected stair enclosure on all floor levels, the lift shaft should be provided as a protected enclosure constructed of 30 min fire-resisting construction. Lift doors should be 30 min fire rated but do not need to be smoke-sealed.

b) The lift may open directly into habitable rooms, entrance halls or landings, but should not directly access kitchens or places of special fire risk, including private parking garages.

NOTE Where internal lifts are provided in flats or maisonettes with floor levels less than 4.5 m from ground or access level, the lift is not required to be in a protected enclosure.

45.3.2.2 Lifts providing private access into a flat or maisonette

A private lift serving only a single flat or maisonette from the access floor level should meet the following recommendations.

a) Where a lift serves multiple floor levels within a maisonette, a protected lobby, comprising 30 min fire resisting construction and FD 30 doors, should be provided between the lift and the residential accommodation within the maisonette on all floor levels, with the exception of the maisonette access floor. Any other floor levels served should be provided with a protected landing or entrance hall constructed of 30 min fire resistance. All accommodation accessing the protected landing should be provided with FD 30 fire doors.

b) The lift should not directly access sleeping accommodation.

c) Lifts that serve a single floor level of a ventilated car park (**22.4.2.5**) should be approached via a protected lobby and provided with a smoke ventilation system in accordance with Annex A. The protected lobby should serve only a single private lift and should not be shared with other private lifts or communal lifts. The lobby should be provided with smoke detection and alarm linked to the fire alarm system serving the flat or maisonette.

d) The lift should discharge directly, or via a protected corridor which does not serve any accommodation or place of special fire risk, to a place of ultimate safety. Such a corridor or lobby should not also serve as a final exit for a communal staircase.

NOTE The corridor or lobby may serve as a route to a place of ultimate safety for other communal, or private, lifts provided it contains no fire loading (including receptions or postal collection) and serves no other accommodation, including car parking.

e) The lift should not be a firefighters lift, should not share a common lift well with a firefighters lift or evacuation lift. It should not discharge into a firefighting or evacuation lobby, even at emergency evacuation floor level.

46 Communal heating, ventilation and air conditioning systems

*COMMENTARY ON CLAUSE **46***

The principal risks associated with communal heating, ventilation and air conditioning systems are concerned with the plant, equipment and distribution systems involved, particularly boiler rooms, heat exchange equipment, fuel storage, and distribution ducting.

Communal heating, ventilation and air conditioning systems should meet the following recommendations.

a) Oil-fired boilers should be installed and maintained in accordance with BS 5410-1 and BS 5410-2.

b) Gas-fired boilers should be installed and maintained in accordance with BS 6798 or BS 6644.

c) Boiler rooms, other than those installed in accordance with BS 5410-2, should have adequate provision for the venting of smoke.

d) Oil fuels should be stored in accordance with BS 5410-1, BS 5410-2 and BS 799-5.

e) Solid fuel should be stored in bunkers protected by walls constructed of class A1 materials, of sufficient thickness to prevent heating of the fuel by nearby boilers or steam pipes.

f) Bulk storage of liquefied petroleum gas should be in accordance with the UKLPG guidance [N2] and HSE guidance note CS4 [N3].

g) Ducts for engineering and building services should be in accordance with BS 8313; ducts and ductwork for ventilation and air conditioning should be in accordance with Clause **29**, Clause **35** and Clause **36**.

NOTE With emerging technology in heating design, it might be advisable to consider in the design of a boiler room and ancillary spaces the possibility of a future change to other fuels.

47 Refuse storage, disposal and incineration

Provision should be made for the safe storage and disposal of refuse from dwellings.

Refuse storage, disposal and incineration should meet the following recommendations.

a) Refuse storage chambers, refuse chutes and refuse hoppers should be sited and constructed in accordance with BS 5906.

b) Refuse storage chambers should be approached solely from the outer air and should be separated from other parts of the building in accordance with Table 18. Access to refuse storage chambers should not be sited adjacent to escape routes or final exits or near to windows of dwellings.

c) Refuse chutes and rooms provided for the storage of refuse should be separated from other parts of the building in accordance with Clause **21**. They should not be located within or accessed directly from common stairs. Rooms containing refuse chutes or provided for the storage of refuse should be approached only by way of a protected lobby having not less than 0.2 m^2 of permanent ventilation or suitable mechanical alternative.

d) In low-rise, multi-stair blocks, where rooms are provided for the storage of refuse (in lieu of a refuse chute system), any access lobby to such a room should be of the smallest size possible in order to prevent its use for the storage of refuse. Access to such rooms should not be by way of a dead-end corridor.

NOTE BS 5906 recommends that a refuse chute system is provided in blocks of more than four storeys: refuse hoppers are provided on each storey served by the refuse chute, with the refuse falling through the chute into a refuse storage chamber located at a level accessible directly by refuse disposal vehicles.

e) Refuse incinerators should be located in a separate building.

48 Car parks and domestic garages

*COMMENTARY ON CLAUSE **48***

Car parks and domestic garages within or adjoining a building pose additional fire risks to a building.

A covered car park in a single-stair building served by the stair or lift needs to be provided with permanent cross-ventilation.

NOTE 1 Attention is drawn to the Petroleum (Consolidation) Regulations 2014 [39], which might require licensing for car parks and domestic garages together with any storage of petrol in cans, drums or other receptacles. This might be enforced through the Petroleum Licensing Authority for the area.

NOTE 2 Attention is drawn to the Dangerous Substances and Explosive Atmospheres Regulations 2002 [40], which might be applicable during the design of the car park in order to limit any fire risk assessed under these regulations.

48.1 Car parks within or adjoining buildings

Any car park within or adjoining the building (whether required to be licensed or not) should:

a) have any external openings situated so as not to endanger any escape route or final exit from the residential accommodation;

b) have adequate provision in accordance with Clause **22** for venting smoke;

c) be provided with suitable access for firefighting (see Section **8**); and

d) be provided with fire resistance as shown in Table 19.

*NOTE See **7.7** for small buildings and connections to car parks.*

Table 19 – Fire resistance periods for car parks

Building height m	**Car park location/design**	**Minimum fire resistance** min
Any	Basement depth ≤10 m	60
Any	Basement depth >10 m	90
Any	Open-sided	60
≤18	Enclosed	60
>18, ≤30	Enclosed	90
>30	Enclosed	90 (elements not forming part of structural frame)
>30	Enclosed	120 (elements forming part of structural frame)

48.2 Domestic garages adjoining buildings

Where a door is provided between a domestic garage and a house, either:

a) the floor of the domestic garage should be laid to allow fuel spills to flow away from the door to the outside; or

b) the door opening should be placed at least 100 mm above the domestic garage floor level.

The wall and any floor should have 30 min fire resistance with a self-closing fire door.

NOTE 1 A covered car park in a single-stair building served by the stair or lift needs to be provided with permanent cross-ventilation.

NOTE 2 These recommendations do not cover car lifts or car stacking systems.

Section 8: Access and facilities for firefighting

49 General recommendations for firefighting facilities

*COMMENTARY ON CLAUSE **49***

Firefighters need to be able to reach a fire quickly with their equipment. Physical safety and lives, both those of the firefighters and those of the occupants of the building, and the preservation of the building and its contents, can be jeopardized by delays in reaching the area of the fire.

Early consultation with the appropriate approving authorities (including the fire and rescue service and building control bodies) is advised when deciding which facilities are to be provided.

The exact choice of facilities depends on the use, size or layout of the building, the nature of its contents, and the site upon which it is situated.

When designing new buildings and provisions for occupant evacuation, account should be taken of the requirements for fire and rescue service access into and around buildings for firefighting purposes.

Firefighting facilities should be selected and designed to assist the fire and rescue service in protecting life, protecting firefighters, reducing building losses, salvaging property and goods and minimizing environmental damage.

Firefighting facilities should include, where appropriate:

a) the provision of vehicular access for fire appliances to the perimeter of the building or site;

b) provision of easy and speedy entry to the site and/or the interior of the building for firefighters and their equipment;

c) provision of and access to sufficient supplies of a firefighting medium, as determined by a risk assessment;

   NOTE The usual firefighting medium is water, but other media might be required.

d) means of enabling firefighters, once they have entered a building, to reach any point within that building in the shortest time possible, including the provision of firefighters lifts, where appropriate;

e) means of enabling firefighters to remain in relative safety whilst they carry out their firefighting operations at any given location within a building;

f) provision for fire and rescue service communications;

g) provision of facilities to release, or extract, smoke and heat from the building or site; and

h) provision for removing spent firefighting extinguishing medium (e.g. drainage).

50 Firefighting access

50.1 Access for fire appliances

50.1.1 General

Every building should be provided with suitable access for firefighting purposes. Roadways should be constructed to allow access for fire appliances, and entry points to buildings should be readily identifiable to the fire and rescue service.

The provisions made for vehicular access should be determined according to whether or not a fire main is provided (see **50.1.2**, **50.1.3** and **51.1**).

Fire appliance access to buildings should be discussed with the fire and rescue service at the concept stage.

NOTE The location of residential buildings can create issues for fire and rescue service access due to the increased demand for the development of areas with restricted access.

50.1.2 Buildings not fitted with fire mains

Houses that are not fitted with fire mains should allow access for a fire appliance to within 45 m of all points within the house, measured on a route suitable for laying hose.

Blocks of flats that are not fitted with fire mains should have vehicle access for a fire appliance not more than 45 m from all points within each dwelling, measured on a route suitable for laying hose.

NOTE If the internal layout of partitions, fittings, etc. is not known when plans are deposited, direct distances may be used for assessment. The direct distance is taken as two thirds of the travel hose laying distance.

Where sprinklers in accordance with BS 9251:2021 or BS EN 12845:2015+A1 (see **19.2**, Table 4) are fitted throughout a house or block of flats:

a) the distance between the fire appliance and any point within the house (in houses having no floor more than 4.5 m above ground level) should not exceed 90 m;

b) the distance between the fire and rescue service pumping appliance and any point within the house or flat should not exceed 75 m (in houses or flats having one floor more than 4.5 m above ground level).

50.1.3 Buildings fitted with fire mains

In buildings fitted with fire mains, pumping appliances should have access to the perimeter at points near the mains, so that firefighters can enter the building to make a hose connection from the fire appliance to pump water into the main. Fire mains should be provided in accordance with **51.1**.

Buildings fitted with dry fire mains should have access for a fire appliance to within 18 m of each fire main inlet connection point.

NOTE This is typically on the face of the building close to the entrance point leading to the firefighting shaft, with the inlet visible from the fire appliance.

Multi-storey buildings fitted with wet fire mains should have fire appliance access:

a) within 18 m of, and within sight of, a suitable entrance giving access to the wet fire main; and

b) within sight of the inlet for the emergency replenishment of the suction tank for the wet fire main.

50.2 Access for firefighters

50.2.1 General

Buildings with a floor higher than 18 m above fire and rescue service access level, or with a basement more than 10 m below fire and rescue service access level, should be provided with firefighting shaft(s) containing firefighters lifts.

A sufficient number of firefighting shafts should be provided to meet the maximum hose distance set out in **50.2.2**. At least two firefighting shafts should be provided in buildings with a storey of 900 m^2 or more in area.

To avoid potential conflicts between access and the security arrangements for the building, the local fire and rescue service should be consulted at an early stage in the design of the building.

The designated route to the firefighting shaft should be clearly indicated by appropriate signage or other recognizable means where the entrance is not directly accessed from the outside, and in a location visible from a fire appliance.

50.2.2 Siting of firefighting shafts

Firefighting shafts should serve every storey through which they pass.

Access should be provided to enable firefighters to create a bridgehead from where they can operate at a level immediately above or below the fire floor. The local fire and rescue service should be consulted regarding access to firefighting shafts.

Wherever practicable, firefighting shafts should be sited against an exterior wall. Where this is not practicable:

a) the route from the fire and rescue service entrance to the firefighting shaft should be as short as possible; and

b) the firefighting shaft should be protected by fire-resisting construction to prevent fire from affecting the route or cutting off the means of escape for either the fire and rescue service or other persons within the building.

Where firefighting shafts are required, they should be located such that the following recommendations are met.

1) If the building is fitted throughout with a sprinkler system in accordance with BS 9251:2021 or BS EN 12845:2015+A1 (see **19.2**, Table 4), then sufficient firefighting shafts should be provided that every part of every storey is no more than 60 m from a fire main outlet in a firefighting shaft, as measured on a route suitable for laying hose.

2) If the building is not fitted with sprinklers, then every part of every storey should be no more than 45 m from a fire main outlet contained in a protected stairway and 60 m from a fire main in a firefighting shaft, as measured on a route suitable for laying hose.

NOTE 1 In order to meet the 45 m hose criterion in b), it might be necessary to provide additional fire mains in escape stairs. This does not imply that these stairs need to be designed as firefighting shafts.

NOTE 2 If the internal layout of partitions, fittings, etc. is not known when plans are deposited, direct distances may be used for assessment. The direct distance is taken as two thirds of the travel hose laying distance.

NOTE 3 In blocks of flats the protected corridor or protected lobby provided for means of escape purposes is assumed to be the firefighting lobby, and it is not necessary to provide an additional firefighting lobby between the protected corridor or protected lobby and the firefighting stair.

50.3 Construction of firefighting shafts

50.3.1 General

Firefighting shafts should be constructed in accordance with the recommendations given in BS 9999 for the fire resistance, resistance to damage of enclosing and separating partitions, and floor coverings of firefighting shafts.

Any glazing incorporated into the firefighting shaft should be in accordance with Clause **30**.

Only services associated with the firefighting shaft, such as ventilation systems and lighting for the shaft, should pass through or be contained within the firefighting stair.

50.3.2 Firefighting stairs and firefighters lifts

50.3.2.1 Firefighting stairs

Firefighting stairs should be sufficiently wide to be easily used by firefighting personnel carrying firefighting equipment. Firefighting stair enclosures should be provided with facilities for smoke control (see Clause **22**) so that they remain relatively smoke-free.

A firefighting stair should not contain any cupboards or provide access to service shafts serving the remainder of the building.

Where the building has more than one staircase, a firefighting shaft should serve all floors from the lowest to the highest, including basement and above ground. In order to prevent smoke from basement storeys penetrating the stair enclosure above ground level, firefighting

stairs serving floors both above and below ground level should be separated at ground floor level by a fire door. For buildings with a single stair, the recommendations in **13.2.3** should be met.

Firefighting stairs should be designed in accordance with BS 5395-1, with a width between the walls or balustrades of not less than 1.1 m. This width should be kept clear for a vertical distance of 2.0 m, as measured from the pitch line or landing floor level, with the following exceptions:

a) stringers, each intruding into the stair by not more than 30 mm; and

b) handrails, each intruding into the stair by not more than 100 mm.

Scissor stairs should not be used to form a firefighting staircase, as their design includes features that are not compatible with the recommendations for a firefighting stair.

Helical stairs/winders should not be used for firefighting stairs.

Emergency escape lighting in firefighting stair enclosures should be provided in accordance with BS 5266-1.

The firefighting stair should serve every storey that is served by the firefighters lift.

NOTE Both the firefighters lift and firefighting stair are used together during firefighting operations. The firefighting stair is the line of retreat if the firefighters lift fails.

Signage numerically indicating the floor level should be provided within the firefighting stair.

50.3.2.2 Firefighters lifts

*COMMENTARY ON **50.3.2.2***

A firefighters lift installation includes the lift car itself, the lift well and the lift machinery space, together with the lift control system and the fire and rescue service communications system.

The firefighters lift landing doors are fire doors.

If a firefighters lift does not serve the topmost storey of a building, the firefighting lobby on the topmost storey serves the firefighting stair only. If the topmost storey consists only of the firefighters lift machinery space, no lobby is necessary.

A firefighters lift, unlike a normal passenger lift, is designed to operate so long as is practicable when there is a fire in parts of the building beyond the confines of the firefighting shaft, as it is used to transport firefighters and their equipment to a floor of their choice. The floors to be served by the firefighters lift are assumed to be determined as part of the design of the building for fire. Firefighting lifts might not need to serve a storey on which there is no entrance to any accommodation or the top storey of the building if it consists exclusively of plant rooms.

It is essential that firefighters lifts remain operational at all times. A firefighters lift can be used in normal times as a passenger lift by the occupants of the building but, in order to prevent the risk of the entrance being obstructed when the lift is required to go into the firefighting mode, it is essential that it is not used for moving refuse, nor for moving goods. In buildings provided with a single lift, its use for the transport of goods needs to be avoided unless essential, lift lobbies need to be kept clear, and when the lift is used for moving goods it is essential that the doors are not propped open.

Firefighters lift installations should conform to BS EN 81-20 and BS EN 81-72.

The firefighters lift may open directly into the protected corridor or protected lobby, but the firefighters lift landing doors should not be placed more than 7.5 m from the firefighting stair and should not be located within the stair enclosure, even if the building is being refurbished.

Dual-entry firefighters lifts should meet the requirements for such lifts in BS EN 81-72.

NOTE 1 The use of a dual-entry firefighters lift serving more than one landing at any storey is not recommended in residential buildings. Dual-entry firefighters lifts may be used where there is only one lift landing entrance at each storey and where the lift is accessed from one side at the fire service access level and from the other side from all other storeys.

The power supply of the lift and lighting should consist of primary and secondary (emergency, stand-by or alternative) supplies. There should also be means to minimize the effect of water penetration into the firefighters lift well.

NOTE 2 Suitable methods include:

- *providing drainage channels and drainpipes; and*
- *laying the lift landing floor to a fall so that any water entering the lobby will not enter the lift well but will drain away down the stairs and/or into a smoke shaft and/or to gargoyles or scuppers on the outside of the building.*

NOTE 3 The minimum flow rate from a wet fire main recommended in BS 9990:2015 is 1 500 l/min, and this is considered to be representative of the maximum possible flow rates into the lift well in the worst-case conditions. The flow from a dry main is dependent on a number of factors including the pumping pressure and height of the building. The actual flow of water into the lift well is also dependent on the location of the outlet. These factors can be taken into account when assessing potential water ingress into the lift well.

Access points into the firefighters lift well should be provided in accordance with BS EN 81-72.

Where a firefighters lift is intended to run blind through a number of floors, it should be determined that there is adequate access for firefighting personnel to set up a bridgehead on any required floor. Where lifts are proposed to run blind there should be early consultation with the local fire and rescue service.

NOTE 4 BS EN 81-72:2020 requires that when the distance between consecutive landing doorsills exceeds 7 m, intermediate emergency doors be provided, such that the distance between sills is not more than 7 m.

In buildings provided with more than one lift, firefighters lift cars should be clearly and conspicuously marked with a notice conforming to BS ISO 3864-1 stating “Firefighters lift: Do not use for goods or refuse”.

In firefighting shafts with a pressure differential system (see Annex A), the lift doors should be capable of opening/closing against the maximum pressure difference attained when the system is fully operational.

Firefighters lifts, associated systems such as secondary power supplies, and any drainage and ventilation provided during firefighting operations, should have a regime of checks, maintenance and thorough examination as recommended in BS 8899.

51 Water supplies for fire and rescue service firefighting use

51.1 Fire mains

Fire mains should be designed and installed in accordance with BS 9990.

Fire mains should be provided as follows:

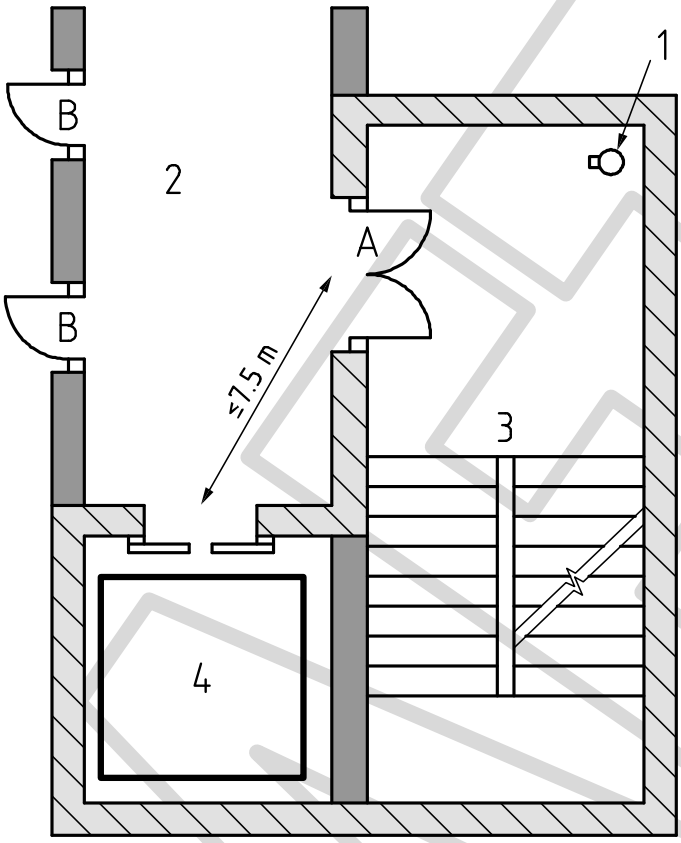
a) in buildings where any floor is higher than 18 m above ground level:
   1) no floor higher than 50 m above ground level: wet or dry fire mains;
   2) one or more floors higher than 50 m above firefighting access level: wet fire mains; and

      NOTE This is because of the pressures required to provide adequate water supplies at the landing valves at upper floors, and also so that water can be immediately available at all floor levels.

b) in any building provided with a firefighting shaft.

Fire mains should be located within the stair enclosure (see Figure 41).

Figure 41 – Components of a residential firefighting shaft



Key

1	Fire main outlet	A	FD 60S fire door
2	Common corridor	B	FD 30S fire door
3	Firefighting stairs		120 min fire-resisting construction
4	Firefighters lift in lift well		60 min fire-resisting construction

51.2 Location and access to external water supply

All premises should be provided with a supply of water for firefighting. Firefighters have to lay out hose between the water supply and the fire appliance, so these distances should be kept to a minimum.

Hydrants should be located in positions that are near to building entry points (including entry points to firefighting shafts containing fire mains) and fire appliance parking positions, as follows.

a) For buildings provided with dry fire mains, hydrants should be provided within 90 m of dry fire main inlets.

b) For buildings not provided with fire mains (or where the building is fitted with a wet fire main), hydrants should be provided within 90 m of an entry point to the building and not more than 90 m apart.

Water mains and hydrants should be capable of delivering a sufficient flow of water to enable effective firefighting to be undertaken.

Prior to the construction of the building, consultation should be undertaken with the water authority, fire and rescue service and building control body on the nature of the water supply and the quantities or capacity to be provided.

The water supply should comprise one or a combination of the following:

1) hydrants provided by the water undertaker on the service main;
2) private hydrants designed and installed in accordance with BS 9990, ideally forming part of a ring main system; and
3) any other water supply that the local fire and rescue service considers to be appropriate.

All hydrants should have signage in accordance with BS 3251.

52 Information for fire and rescue service use

52.1 General

*COMMENTARY ON **52.1***

It is of considerable advantage to the fire and rescue service if appropriate information about the building is made available to them for use during an incident. A premises information box provides a secure means to store such information.

Depending on the structural complexity of the building, it might also be appropriate to make schematic fire system plans available. An isometric or cut-away view might be appropriate as the best means of illustrating the building.

Residential buildings with a top storey more than 11 m above ground level should be provided with a premises information box.

NOTE 1 A premises information box might also be beneficial in other residential buildings, particularly those with large, complex, or uncommon layouts or those having extensive accommodation below ground level.

Where appropriate, a premises information box should include:

a) simple floor plan layouts, indicating any relevant fire resistance provisions, internal access provisions, firefighting facilities, building services and any specific hazards;
b) relevant information (including operating instructions) relating to equipment/fixed installations/active systems (e.g. smoke control systems) provided for means of escape or firefighting;
c) information regarding the implications of any fire engineering strategy on the performance of the building during a fire, e.g. reduced fire resistance of elements of structure or areas of the building with additional fire protection measures;
d) information relevant to preventing environmental damage;
e) relevant information (including operating instructions) relating to lifts provided for means of escape or firefighting. Where evacuation lifts or firefighters lifts are installed, these should be clearly signed at the fire service access level, and relevant information should be available detailing the locations of the main switch, rescue controls and machinery spaces; and
f) information regarding any evacuation alert system (EAS) for use by the fire and rescue service (see **52.3**).

Where schematic fire system plans are provided, fire protection facilities shown on any of these plans should be labelled, and where plan symbols are used, a key to the symbols should be provided.

NOTE 2 Further guidance is given in the FIA publication Code of practice for the provision of premises information boxes in high-rise residential buildings *[41].*

52.2 Wayfinding signage for the fire and rescue service

52.2.1 Provision of floor identification signs and flat indicator signs

To assist the fire and rescue service to identify each floor in a block of flats with a top storey more than 11 m above ground level, floor identification signs and flat indicator signs should be provided.

The floor identification signs should meet all of the following recommendations.

a) The signs should be located on every landing of a protected stairway and every protected corridor/lobby (or open access balcony) into which a firefighting lift opens.

b) The text should be in a sans-serif typeface with a letter height of at least 50 mm. The height of the numeral that designates the floor number should be at least 75 mm.

c) The signs should be visible from the top step of a firefighting stair and, where possible, from inside a firefighting lift when the lift car doors open.

d) The signs should be mounted between 1.7 m and 2 m above floor level and, as far as practicable, all the signs should be mounted at the same height.

e) The text should be on a contrasting background, easily legible and readable in low level lighting conditions or when illuminated with a torch.

52.2.2 Wording of floor identification signs

The wording used on each floor identification sign should take the form “Floor X”, with “X” designating the number of the storey, as intended for reference by residents. The floor number designations should meet all of the following recommendations.

a) The floor closest to the mean ground level should be designated as either “Floor 0” or “Ground Floor”.

b) Each floor above the ground floor should be numbered sequentially beginning with “Floor 1”.

c) A lower ground floor should be designated as either “Floor -1” or “Lower Ground Floor”.

d) Each floor below the ground floor should be numbered sequentially beginning with “Floor -1” or “Basement 1”.

52.2.3 Wording and location of flat indicator signs

All floor identification signs should be supplemented by flat indicator signs, which provide information relating to the flats accessed on each storey. The flat indicator signs should meet all of the following recommendations.

a) The signs should be sited immediately below the floor identification signs, such that the top edge of the sign is no more than 50 mm below the bottom edge of the floor identification sign.

b) The wording should take the form “Flats X–Y”, with the lowest flat number first.

c) The text should be in a sans-serif typeface with a letter height of at least half that of the floor indicator sign.

d) The wording should be supplemented by arrows when flats are in more than one direction.

e) The text and arrows should be on a contrasting background, easily legible and readable in low level lighting conditions or when illuminated with a torch.

In the case of multi-storey flats with two or more entrances, the flat number should only be indicated on the normal access storey.

52.3 Evacuation alert system for use by the fire and rescue service

In residential buildings with stay put strategy and a storey more than 18 m above ground level, an evacuation alert system (EAS) should be provided to enable the fire and rescue service to initiate operation of evacuation alert sounders within each dwelling on any single floor, multiple floors and the entire building, according to circumstances.

An EAS should not be used as mitigation for any defects in construction or as a compensatory measure for reduction in any other measures identified in this British Standard, and it should not be regarded as a component of a fire engineering solution

NOTE 1 This would imply that fire and rescue service attendance was part of mitigation, or compensatory measures, or a component of a design solution, all of which would be unacceptable.

An evacuation alert system is not, and should not be confused with, a fire detection and fire alarm system. The EAS should not be integrated with a fire detection and fire alarm system (or any other system), and no devices (such as fire detectors), other than evacuation alert devices, should be connected to the EAS.

The EAS should be designed, installed and commissioned in accordance with BS 8629.

Evacuation alert and control indicating equipment (EACIE) for the EAS should be sited in accordance with BS 8629. The EACIE should be located such as not to impinge on the effective width of escape routes.

Within each flat, at least one evacuation alert sounder, conforming to BS EN 54-3, should be provided. The sound pressure level of the alarm signal at each open bedroom doorway should be at least 85 dB(A). Sound pressure level within other habitable rooms should be at least 60 dB(A) when all doors in the dwelling are closed. Facilities should be incorporated in accordance with BS 8629 to enable additional devices to be added to alert people who are Deaf or hard of hearing.

All wiring, other than the wiring of power supplies, should comprise cables of enhanced fire resistance, as recommended in BS 8629.

NOTE 2 Power supply cables may be of standard or enhanced fire resistance.

If a networked system is used, the following recommendations should be met.

a) The wiring of the data network should comprise cables of enhanced fire resistance.

b) The data network should be fault tolerant, such that, in the event of a single open or short circuit fault on the network cable, the system should continue to operate fully in accordance with BS 8629, while giving an audible and visual fault indication at central EAS control equipment.

c) Where practicable, wiring of the data network should be diverse routed, such that the “return” leg of a loop circuit follows a different path from the “outward” leg. If this is not practicable (e.g. because it is necessary for the data loop to be contained within a single service riser), the sub-panels and the entire data network should be located in areas of low fire risk (i.e. areas that are unlikely to be affected by a fire(s) in any flat, and the out and return legs should be separated by at least 300 mm.

NOTE 3 BS 8629 does not provide recommendations for networked systems, in which evacuation alert sounders are connected to a number of local control panels (sub-panels), all connected on a data network. This arrangement might be necessary in a tall or very large block of flats. Such an arrangement is acceptable subject to maintaining the high integrity required of an evacuation alert system, following the principles in BS 8629.

Section 9: Management

*COMMENTARY ON SECTION **9***

*Section **9** gives recommendations for actions to be taken by owners and occupiers of flats and maisonettes. It also provides recommendations for the owners and managers of buildings containing flats or maisonettes to help them to make the best use of the design features of the building.*

Attention is drawn to Regulation 38 of the Building Regulations 2010 [1], and BS 9999 regarding guidance for designers on information to pass on to their clients concerning fire precautions designed into a building.

Guidance on the management considerations for people requiring support or assistance to evacuate is given in Annex H. Guidance is also given in the NFCC publication Fire safety in specialized housing *[42], including guidance on personal emergency evacuation plans (PEEPs) and person-centred risk assessments.*

Advice to occupiers of domestic residential buildings on precautions that they can take against fire is given in Annex I.

53 Management of specialized housing and residential care

The fire strategy for all types of specialized housing and residential care should be based upon a realistic in-use management regime. The design process should facilitate compatibility between the fire protection provisions and management, in particular the staffing levels needed to support the evacuation strategy.

A fire risk assessment should be conducted, and appropriate evacuation and management measures should be adopted based on the results.

NOTE Recommendations for carrying out fire risk assessments in residential buildings are given in PAS 79-2. The fire risk assessor is expected collaborate closely with the responsible person and managers of the facility, taking account of the design and protection arrangements that are in place, with a view to ensuring that the emergency plan, staffing levels and evacuation arrangements are robust.

54 Evacuation of disabled occupants or occupants who require assistance to escape

54.1 General

The provision of an accessible means of escape should be an integral part of fire safety management in all residential buildings. Fire safety management should take into account the diversity of people who might occupy, use or visit the premises, including people with a range of permanent, intermittent or temporary impairments or conditions. The evacuation plan should include the methodology for all people to move away from danger and exit the building to a place of ultimate safety.

NOTE 1 It is the responsibility of the premises management to assess the requirements of all people to make a safe evacuation when formulating evacuation plans. Further guidance is given in Annex H.

An evacuation plan should not rely on the assistance of the fire and rescue service.

It should not be assumed that facilities provided in a building to make it accessible will be usable in a fire evacuation (for example, lifts that are not appropriately designed for emergency evacuation might not be usable for evacuation).

*NOTE 2 Recommendations for evacuation lifts are given in **7.6**.*

In specialized housing, a log should be kept of any residents who are likely to require assistance in the event of a fire in order to evacuate their dwelling and/or the building. The fire and rescue service should be made aware of the log and its location.

NOTE 3 The log may form part of the fire safety manual for the premises.

54.2 Emergency evacuation plans

*COMMENTARY ON **54.2***

A personal emergency evacuation plan (PEEP) might be required where a resident, carer or other responsible person has identified that an individual might not be able to self-evacuate in the event of a fire within the building.

Where transience of residents, staff or visitors is expected, a generic emergency evacuation plan (GEEP) can be provided by the responsible person as an alternative.

In buildings containing student residential accommodation, residential care buildings (see Clause **8**), and residential buildings provided as specialized housing that has been purposefully adapted to a resident's specific requirements, the responsible person should verify that a PEEP is in place for any residents, staff or frequent visitors who have been identified as requiring one.

NOTE 1 The responsible person in this instance could be the owner, occupier or management of the building.

NOTE 2 Guidance on the production of PEEPs can be found in the publication Practical fire safety guidance: the evacuation of disabled persons from buildings *[43].*

55 Residents

The responsible person should advise residents formally of the fire safety arrangements for the building, what to do to prevent fires occurring, and what to do in the event of a fire. This information should be contained within a handbook, which should also address the potential for particular problems arising where residents employ sub-contractors (e.g. for fit-out work).

NOTE 1 The responsible person in this instance could be the owner, occupier or management of the building.

NOTE 2 Annex I contains information that can be given to owners and occupiers of dwellings in residential buildings (including flats) along with examples of fire instruction notices for residential buildings.

56 Caretakers

Where a caretaker or other person is employed to maintain common areas within a building, the responsible person should advise such persons formally of the fire safety arrangements for the building.

NOTE The responsible person in this instance could be the owner, occupier or management of the building.

57 Maintenance of fire protection measures and other equipment

The fire protection measures should be inspected on a regular schedule to verify that they are available and functional at all times.

At least the following recommendations should be met, and any other inspections carried out as necessary.

a) Door locks, panic bars and automatic door release mechanisms should be maintained so that they are easily openable in an emergency.

b) Where services breach compartment walls or floors, the integrity of fire separation should be maintained through the use of appropriate fire-resisting materials at the breach points.

c) Fire safety equipment such as fire extinguishing and fire main inlet and outlet valves should not be obstructed by stored goods, machinery or parked vehicles.

d) All fire safety equipment, e.g. fire alarms, emergency escape lighting, AWFSS, smoke control systems and fire extinguishers, should be maintained and tested in accordance with Annex J.

NOTE 1 It is desirable to incorporate automatic self-test facilities in control panels.

e) Fire doors should be maintained in accordance with **32.1**.

NOTE 2 When a fire occurs in the premises, the safety of occupants and their means of escape rely heavily on the flat front doors retaining their self-closing devices and their fire resistance.

f) Evacuation lifts should be maintained and undergo periodic tests to verify that they will operate correctly in the event of a building evacuation.

NOTE 3 Attention is drawn to the Regulatory Reform (Fire Safety) Order 2005 [2] and its equivalents in Scotland [6] and Northern Ireland [7] in respect of the requirement for maintenance of fire safety equipment.

NOTE 4 Fire can start in machinery and equipment which is not adequately maintained or cleaned. Attention is drawn to the Gas Safety (Installation and Use) Regulations [35] and to BS 7671. These regulations require electrical and gas installations to be regularly examined by a competent person who, if not qualified, has to have authority to engage a qualified person to carry out any investigations and/or repairs deemed necessary for safety reasons.

Where it is probable that significant quantities of combustible material (such as junk mail and pushchairs) will be present in the common areas, means should be taken to prevent the development and spread of any fire that might develop there.

58 Response of systems in the event of an emergency

*COMMENTARY ON CLAUSE **58***

It is essential that in the event of a fire, all fire safety provisions function as intended and all fire emergency procedures are implemented in order to facilitate appropriate action. As it can never be foreseen when a fire might occur, it is part of the role of the responsible person to verify that all of the built-in passive and active safety systems operate (or are effective) on demand.

The responsible person in this instance could be the owner, occupier or management of the building.

58.1 Escape routes

The following recommendations should be met in order to keep escape routes available for use at all times when the building is occupied.

a) All escape routes should be kept free from obstruction.

b) Goods, materials, unwanted furniture, etc. should not be stored within escape routes. Any obstruction should be removed immediately.

c) All escape routes should be inspected frequently. A log detailing the frequency and results of inspection should be included in the fire safety manual and corrective measures should be taken where necessary.

d) Fire doors that are intended to be kept closed should remain closed and unobstructed.

e) Fire doors on hold-open devices should be operable and should be unobstructed.

f) The exterior of the building should be inspected to verify that final exits and routes to assembly points are not blocked.

g) Entrance halls, lobbies or corridors should not contain furniture or fittings that would reduce, at any point, the required exit width.

h) In a building or part of a building served by a single stair, and firefighting stairs, furniture should not be placed within the stair enclosures and exits therefrom.

i) Fire safety signs and notices, fire extinguishers, emergency escape lighting, fire doors and shutters should not be obscured.

j) Seating areas should not be provided within escape corridors.

k) Maintenance and redecoration of surface finishes and floor coverings should not use materials that might propagate surface spread of flame and/or fire, or adversely affect the means of preventing such propagation.

l) The floor surfaces (including stairs, stair nosings and ramps) within escape routes should be maintainable, even and non-slip. Resilient floor surfaces should be maintained in

accordance with BS 6263-2. Only emulsion polish (not wax polish) should be used on such floor surfaces.

58.2 Maintenance of fire safety equipment and provisions

Planned inspection, maintenance and testing procedures should be established and used to verify that all fire protection systems can operate effectively when required. Arrangements should be made for all fire safety equipment, installations and systems to be inspected and tested on a regular basis by a competent person (see Annex J).Material alterations, additions, repairs or modifications to services and equipment should be carried out only by competent persons.

Routine maintenance, inspection and testing should be carried out in accordance with:

a) BS 5839-1:2017 and BS 5839-6:2019+A1 for fire detection and fire alarm systems;

b) BS 5266-1 for emergency escape lighting systems;

c) BS 9251:2021 or BS EN 12845:2015+A1 for automatic sprinkler systems in residential and domestic buildings;

d) BS 8458 for water mist systems;

e) BS 8214 for fire doors;

f) BS 7273-4 for fire door automatic release mechanisms;

g) the relevant part of BS EN 12101 for smoke control systems;

NOTE Further information regarding testing, inspection and maintenance of mechanical smoke ventilation systems is given in the Smoke Control Association publication Guidance on smoke control to common escape routes in apartment buildings (flats and maisonettes) *[21].*

h) BS 5306-3 for portable fire extinguishers;

i) BS 9990 for fire hydrants and fire mains; and

j) BS 8524 for active fire curtain/barrier assemblies.

58.3 Firefighting access and equipment

58.3.1 Firefighters lifts

*COMMENTARY ON **58.3.1***

One or more of the passenger lifts in the building may be made available for the exclusive use of firefighters in an emergency, when a switch at fire and rescue service access level (usually the entrance level) marked "Firefighters lift" is operated.

Any lift that is designated as a firefighters lift should be repaired as quickly as possible when it breaks down.

Regular inspections of the firefighters lift switch should be made to check for any unauthorized use.

Operational tests, routine inspections and maintenance of firefighters lifts should be carried out in accordance with BS EN 81-72 and the lift owner's manual.

58.3.2 Fire mains

Wet or dry rising fire mains and the accompanying inlet and/or outlet boxes, together with any foam inlets to oil-fired boilers, should be regularly inspected for damage and repaired where necessary.

Where outlet straps are provided, they should be checked to verify that they are in place and secure.

58.3.3 Access roads

*COMMENTARY ON **58.3.3***

Fire and rescue service access roads and gates leading to the building can become seriously obstructed by the indiscriminate parking of cars and other vehicles using the site.

Control and enforcement of parking restrictions can prove difficult, but the provision and maintenance of notices giving clear instructions regarding parking arrangements can go some way to alleviating this problem.

Management procedures should be implemented to exercise control over the parking of vehicles on private access roadways also used for fire and rescue service access, so that fire appliances are not obstructed in an emergency and are able to proceed to within the required distance of fire main, foam or other inlets.

In the interests of security, unauthorized entry along such roadways should be restricted, in agreement with the fire and rescue service, if deemed necessary.

58.4 Resilience of fire safety design and contingency planning

*COMMENTARY ON **58.4***

In all buildings, the safety of occupants can be compromised if fire safety design or systems are compromised. Fire risk assessments and fire strategy documents are expected to detail the fire safety design and systems used in a building.

The building fire safety design (as documented in the fire risk assessment) should take into account any reasonably foreseeable scenarios of fire safety design or system impairment, e.g. system outage due to failure, maintenance or repair.

For all buildings, where a fire safety design or system impairment is encountered or anticipated, a risk assessment should be undertaken to determine the need for mitigation of any such impairments, and appropriate measures should be put in place.

NOTE In some circumstances, contingency arrangements are needed so that the building can continue to be used in a safe way in the event of safety systems being unavailable. Examples of such contingency arrangements might include:

- *built-in redundancy;*
- *a suitable alternative (temporary or permanent) water supply to a fixed firefighting system, while the main supply is impaired or unavailable;*
- *the measures outlined in BS EN 12845:2015+A1, Annex J (which include minimizing outage, supervisory staff, wardens, security, controls on hot works and provision of additional fire extinguishers);*
- *emergency maintenance contracts for risk-critical active fire protection measures (e.g. lifts, smoke control systems and sprinkler systems); and*
- *notification of fire and rescue service and insurers.*

Section 10: Building works: Material alterations, extensions, refurbishment, change of use, disuse, decommissioning and demolition

59 Design of works

Alterations to a building should retain at least the level of fire safety protection that was in place before the alterations were carried out.

NOTE 1 It can be beneficial to improve fire safety through building works, wherever practicable.

A fire risk assessment should be carried out regarding the impact of any proposed alterations to verify that:

a) no unacceptable existing fire risks are continued;

b) existing fire safety measures are not compromised; and

c) no new fire risks are created.

This should include checking for changes and breaches in compartmentation and the effectiveness/design of smoke control systems.

NOTE 2 Attention is also drawn to buildings that are covered by the Regulatory Reform (Fire Safety) Order [2] and its equivalents in Scotland [6] and Northern Ireland [7], which are required to undergo a fire risk assessment for their post-altered state.

60 Change of use

In the event of a change of use, a new fire risk assessment should be conducted to cover the changed circumstances.

NOTE Attention is drawn to the Building Regulations 2010 [1] and equivalent national variations ([3] to [5]). Changing the use of a building might alter the regulations which are applicable to the building.

61 Refurbishments

When undertaking a refurbishment, whether or not directly it is related to fire safety, a condition survey should be carried out in accordance with Clause **59** to determine whether fire safety improvements are needed.

Compartmentation and fire separation should not be compromised during refurbishment or remodelling.

NOTE Even relatively minor modifications could compromise fire-resisting elements of compartmentation and separation. Management control, approval and inspection of the original design and construction, and of any subsequent modifications, are therefore all very important if fire safety is to be maintained to at least the minimum levels defined in this British Standard.

62 Dwellings in disuse and areas decommissioned

*COMMENTARY ON CLAUSE **62***

Despite the supportive value of automatic detection and fire extinguishing systems, surveillance by human presence and immediate action taken in the very first stages of fire represent the most effective way of limiting its effects. When the human element is not present, as in the case of an unoccupied dwelling or a decommissioned part of a building, the occupants of the remainder of a building or complex are deprived of a first line of defence against fire.

Even if a temporarily discontinued occupancy results in a reduction of the fire load normally expected to be present in a dwelling, the importance of automatic fire protection within that dwelling or area is increased rather than diminished, particularly if work such as shop fitting is in progress.

Where a building is in disuse, surveillance by staff should be intensified to discourage any form of careless practice and to verify that protective systems remain fully operative.

Any decommissioned area, unoccupied dwelling, or dwelling that is in the process of being fitted out should be either:

a) physically separated from the rest of the building by construction having not less than 60 min fire resistance; or

b) protected by other fire protection measures as agreed by the relevant enforcing authorities.

In either case, the unused part of the building should be subject to routine inspection, as determined by a fire risk assessment.

63 Managing building work and material alterations

Building work and material alterations should be managed and monitored to minimize the likelihood of fires occurring.

NOTE Experience demonstrates that fires are more likely to occur when buildings are undergoing works of maintenance and alteration.

Designers and contractors should be made aware of the existing fire safety features of the building.

A fire risk assessment should be conducted that identifies and deals with all risks across the duration of the building project.

Building works should be continuously monitored to prevent the creation of unplanned extra and undue risks.

NOTE 1 Attention is drawn to the Construction (Design and Management) Regulations 2015 [44] and the Construction (Design and Management) Regulations (Northern Ireland) 2007 [45].

NOTE 2 Further guidance is given in HSE publication HSG 168 [46] and the Construction Confederation and Fire Protection Association publication Fire prevention on construction sites – The joint code of practice on the protection from fire of construction sites and buildings undergoing renovation *[47].*

64 Building works to occupied or partly occupied buildings

*COMMENTARY ON CLAUSE **64***

Where works are to be conducted to an existing occupied building or where a new building might be partly occupied before full completion, increased vigilance against fire risk is necessary.

A fire risk assessment should be evolved between the responsible person for the building and the contractor.

The fire risk assessment should be continually reviewed during the period of occupation, and alternative approaches implemented where the risk assessment indicates this to be necessary.

NOTE Alternative approaches might include the provision of extra fire precautionary measures or the prohibition of contemporaneous occupation.

Annex A (normative)
Methods of smoke ventilation

COMMENTARY ON ANNEX A

In residential buildings designed with a stay put strategy, only the occupants from the dwelling of origin evacuate and all other occupants remain in place, unless either they are directly affected by heat or smoke, or the fire and rescue service deem it necessary to evacuate other residents at a later stage. As a result of this strategy, special provisions are necessary to enable the stairwell(s) to remain free from smoke and heat in the event of a fire within a dwelling. This is of particular importance where only one stairwell serves the building.

The implementation of a smoke control system can be used as one such provision. The primary objective of smoke control in residential buildings is to protect the stairwell enclosure; however, the adjacent protected corridor or lobby might also gain some protection.

For extended corridor scenarios, the primary objective of the smoke control system is to protect both the common corridor and the stairwell enclosure for means of escape.

Further information regarding smoke control is given in the Smoke Control Association publication Guidance on smoke control to common escape routes in apartment buildings (flats and maisonettes) *[21].*

A.1 General

Smoke control systems should be designed, installed, commissioned and maintained in accordance with BS 7346-8.

Any equipment selected to realize the smoke control design should be in accordance with **A.4**.

A.2 Firefighting facilities of smoke control systems

A.2.1 Controls

*COMMENTARY ON **A.2.1***

Fire and rescue services have experience of controls which have been unclearly labelled, which has meant they are unable to be used by attending fire crews.

On simple systems, controls or overrides can be useful for firefighters to turn particular aspects of a system off or on if conditions change during firefighting.

On complex systems, firefighters are likely to be reluctant to interact with systems where the outcome of the interaction is unclear. This would particularly be the case if that interaction had the potential to worsen conditions rather than improve them.

The option on such systems to be able to override the alarm input and allow access to a more complicated control panel may be selected, to allow access to the panel in a manual override scenario to allow a qualified person to individually address specific fans, dampers, vents, etc. under the guidance of the firefighters, who would not be expected to know all the locations and flow routes. This could be used for post-event smoke clearance. It is expected that smoke clearance would only be used after the firefighters have confirmed that the source of the smoke has been extinguished.

Owing to smoke control systems responding to a first single alarm input, fans are often sized to extract from specific areas and that opening other dampers might split this extraction volume between zones and put the integrity and design parameters in the first area at risk.

Resetting to "AUTO" would reset the alarm inputs then take the first alarm input and this might be in an area different to that first indicated.

It can be beneficial to have override functionality replicated within control and indication equipment/a smoke control panel. In sophisticated systems, this would always be the case.

Systems (with the exception of openable vents) should be fully automatic in their operation and should not rely upon the interaction of firefighters to achieve their performance objectives during either the means of escape or firefighting phases.

Smoke control systems should start in firefighting mode at the outset if this is the requirement. Alternatively, variable speed mechanical systems should be controlled using pressure sensors or other means and should not require firefighters to operate controls in order to initiate a high-speed mode (sometimes referred to as a "boost" or "firefighting" mode.

Control panels should be simple and logical to operate in fire conditions without reliance upon operational manuals.

A.2.2 Identification and signage

All elements of a smoke ventilation system with which firefighters might be expected to interact should be clearly identified, whether the purpose is to provide firefighters with information about the status of the system or to enable them to alter its operation.

To discourage use by unauthorized persons and to clearly identify controls as being for fire and rescue service use only, all override controls should be labelled “for firefighter use only”.

Manual control points and control and indicating equipment (e.g. system control panels) should be clearly identified as to their use and function. Labels/signage should indicate the area served by the system and each position/function of the control should clearly indicate its function, e.g. “SMOKE VENT: STAIR” with “AUTO”, “OPEN” and “CLOSE” switch positions.

Natural smoke and heat exhaust ventilators should conform to BS ISO 21927-9.

NOTE 1 These requirements cover the dimensions of control enclosures and lettering as well as the following requirements for the colour of manual override controls:

The following colours should be used:

a) visual operation board: clean white in accordance with RAL 9010;

b) lettering: deep black in accordance with RAL 9005; and

c) housing: deep orange in accordance with RAL 2011.

The housing and visual operation board of any manual control points which are intended for maintenance and not for firefighter use should be coloured white.

Smoke control system control and indicating equipment should be clearly distinguished from fire alarm panels (where provided).

NOTE 2 Central control and indicating equipment may also be provided in a fire control room, where applicable.

A.3 Above-ground natural and mechanical smoke ventilation

*COMMENTARY ON **A.3***

There are two main methods of smoke ventilation, as follows.

*a) Natural systems (see **22.3**). The general principle is that a vent is provided to the lobby or corridor adjoining the stair to facilitate the removal of smoke through the vent prior to it entering the stairwell enclosure. The vents can be located either on an external wall or in a vertical shaft. A vent is also provided from the top storey of the stairwell to outside air, to act as an outlet if smoke enters the stairwell or as an inlet to make the system more efficient prior to the arrival of the fire and rescue service.*

*b) Mechanical systems. This can take the form of either a pressure differential system (see **A.3.1**) or a mechanical smoke ventilation system (see **A.3.2**).*

A.3.1 Pressure differential systems

*COMMENTARY ON **A.3.1***

A pressurization system can be provided within the stairwell or firefighting shaft enclosure. The general principle is that it injects air into these spaces to create a higher pressure than in the adjoining spaces. This prevents any combustion products from entering the stairwell or firefighting shaft. For these systems it is necessary to determine not only where the fresh air supply for pressurization is to be introduced into the building, but also where that air and smoke will leave the building and the paths it will follow in the process.

Pressurization systems should be designed and installed in accordance with BS EN 12101-6.

Any equipment selected to realize the smoke control design should be in accordance with **A.5**.

A.3.2 Mechanical smoke ventilation systems (MSVS)

*COMMENTARY ON **A.3.2***

The general principle is that a vent is provided to the lobby or corridor adjoining the stair to facilitate the removal of smoke through the vent prior to it entering the stairwell enclosure. An MSVS uses fans to provide ventilation, rather than relying on buoyancy and wind forces as natural ventilation does. Most systems use a vertical shaft.

Adverse wind or building stack pressures are less likely to affect a pressure differential system or an MSVS than a natural smoke control system.

A.3.2.1 General

An MSVS design should demonstrate the correct conditions in the lobby or corridor and stairs. Therefore, each of the following scenarios should be allowed for in the design of the MSVS:

a) stairwell door closed;

b) stairwell door open; and

c) stairwell door open, apartment door open, broken window.

Under each of the scenarios above, the MSVS should demonstrate the conditions in each of the following areas:

1) in the lobby;

2) in the corridor; and

3) in the stairwell.

NOTE 1 Accepted parameters are a velocity through the open stairwell door away from the stair and pressure differential across the closed stairwell door in each scenario.

The design of the MSVS should limit pressure differentials so that door opening forces do not exceed 100 N at the door handle at any stage.

The fire-resisting enclosure of a common stair should be confirmed as a place of relative safety as defined in **22.1**.

A secondary power supply should be provided to the fans and all actuators and controls.

Fan sets should be provided as duty and standby fans, such that that the standby fan operates automatically upon failure of the duty fan.

For an MSVS to operate effectively, account should be taken of the route of the exhaust air, the inlet replacement air supply and the air flow within the space being ventilated. The MSVS ventilation rate and provision for replacement air should be such as to enable air to be extracted from the protected lobby or protected corridor without allowing smoke from the flat of fire origin to be drawn in.

NOTE 2 The presence of smoke in the protected lobby or protected corridor can prove hazardous to occupants trying to escape.

The ventilation rate of an MSVS should be determined through an assessment of any specific risks within the building, and verified using either a computational fluid dynamics (CFD) analysis in accordance with **22.2** or a mathematical calculation.

The following factors should be taken into account with regard to their effect on the ability of the MSVS to meet its performance criteria:

i) different fire locations (both close to and far from the point of extract);

ii) pressure differences across a flat front door with a variety of extraction rates;

iii) a negative wind coefficient at the stair head vent;

iv) fire pressure and increasing fire growth;

v) a variety of door opening sizes for the stair or corridor door (when closed, partially open and fully open);

vi) increased ventilation to a fire due to a broken window; and

vii) low-level ventilation to the stair.

If an MSVS is to provide protection during the firefighting phase, then it should be designed to work at this level from the start.

NOTE 3 It has become increasingly less likely that firefighters will interrupt or try to change an automatic system in case something goes wrong. They prefer it to work completely autonomously and allow it to protect them in what they do.

Any equipment selected to realize the smoke control design should be in accordance with **A.5**.

A.3.2.2 Extended corridors

*COMMENTARY ON **A.3.2.2***

Where the design of a block is such that travel distances exceed those shown in Figure 7 and Figure 8, a fire engineered MSVS may be provided to compensate for the extended travel distance.

The primary objective for this type of system is to return the extended corridor and the associated stairwell enclosure to tenable conditions for means of escape and rescue purposes. Information regarding tenability criteria (such as temperature and visibility) for assessing the performance of the MSVS is given in PD 7974-6.

Dual systems with powered supply and powered extract might be required to maintain tenable conditions in the corridors and the protected stairwell.

NOTE Guidance on tenability criteria for firefighters in corridors is given in PD 7974-5 and the Smoke Control Association publication Guidance on smoke control to common escape routes in apartment buildings (flats and maisonettes) *[21].*

The inlet air in relation to the point of extract should be located such that it does not create dead spots in the protected zone.

A.4 Basement (below ground) natural and mechanical smoke ventilation

*COMMENTARY ON **A.4***

There are two main methods of smoke ventilation, as follows.

*a) Natural systems (see **22.4**). The general principle is that outlets are provided as high as possible in the spaces to be ventilated and connect directly to outside.*

*b) Mechanical systems. This can take the form of either a pressure differential system (see **A.4.1**) or an MSVS (see **A.4.2**).*

A.4.1 Pressure differential systems

*COMMENTARY ON **A.4.1***

A pressurization system can be provided for ventilation for the basement. The general principle is that it injects air into spaces (e.g. stairwells, firefighting shafts, corridors) to create a higher pressure than in the adjoining spaces. This prevents any combustion products from entering these spaces. For these systems it is necessary to determine not only where the fresh air supply for pressurization is to be introduced into the building, but also where that air and smoke will leave the building and the paths it will follow in the process.

Pressurization systems should be designed and installed in accordance with BS EN 12101-6.

A ground level supply stairwell pressurization system conforming to BS EN 12101-6 should be provided in firefighting stairs serving basements more than 10 m below ground floor level.

Any equipment selected to realize the smoke control design should be in accordance with **A.5**.

A.4.2 Mechanical smoke ventilation systems (MSVS)

*COMMENTARY ON **A.4.2***

The general principle is that ventilation is provided is provided to the spaces in the basement to facilitate the removal of smoke. An MSVS uses fans to provide ventilation, rather than relying on buoyancy and wind forces as natural ventilation does. Most systems use a series of ducts and shafts.

A.4.2.1 General

An MSVS design should demonstrate the correct conditions in the spaces in the basement and the protection of escape routes and firefighter access.

For complicated makeup air paths via ductwork, fan powered systems supply systems should be used to ensure that fresh air comes from outside rather than through leakage into the protected spaces.

The MSVS design and realization should demonstrate the conditions in all areas.

Spaces from which smoke is to be extracted, e.g. basement storage areas or enclosed or basement car parks, should have 10 air changes per hour (ach^{-1}) for smoke clearance purposes.

The design of the MSVS should limit pressure differentials such that door opening forces do not exceed 100 N at the door handle at any stage.

NOTE 1 The fire-resisting enclosure of firefighting stairs is provided to prevent smoke and heat from entering the stairwell, rendering it impassable for escape purposes, and to prevent fire spreading from one storey to another.

Once inside a protected stairwell, a person should be in a place of relative safety from the immediate danger of flame and smoke. They can then proceed to a place of ultimate safety at their own pace.

When undertaking CFD analysis, in addition to providing the necessary air changes, the stairwells should be maintained smoke-free.

NOTE 1 The presence of smoke in the protected stairwell proves hazardous to anyone leaving the building from any floor and also hinders firefighter access. It might be considered acceptable by the designer for a very small amount of smoke to be shown to enter the stair enclosure temporarily (e.g. when a door opens and closes), if it is demonstrated that the smoke is subsequently quickly removed by the smoke ventilation system.

Replacement inlet air should be provided, with its location being determined in relation to the point of extract such that the system works to effectively extract smoke from the relevant space.

A secondary power supply should be provided to the fans and all actuators and controls.

Fan sets should be provided as duty and standby fans, such that that the standby fan operates automatically upon failure of the duty fan.

For an MSVS to operate effectively, account should be taken of the route of the exhaust air, the inlet replacement air supply and the air flow within the space being ventilated. The MSVS ventilation rate and provision for replacement air should be such as to enable air to be extracted from the smoke source and other areas to be protected.

NOTE 2 The presence of smoke in other spaces can prove hazardous to occupants trying to escape or the firefighters trying to gain access.

The following factors should be taken into account with regard to their effect on the ability of the MSVS to meet its performance criteria:

a) different fire locations;

b) pressure differences across doors;

c) fire pressure and increasing fire growth;

d) a variety of door opening sizes; and

e) supply air makeup routes.

If an MSVS is to provide protection during the firefighting phase, then it should be designed to work at this level from the start.

NOTE 3 It has become increasingly less likely that firefighters will interrupt or try to change an automatic system in case something goes wrong. They prefer it to work completely autonomously and allow it to protect them in what they do.

Any equipment selected to realize the smoke control design should be in accordance with **A.5**.

A.4.2.2 Use of smoke control ducts, fire-resisting ducts and smoke control dampers

*COMMENTARY ON **A.4.2.2***

The application of a smoke control system still requires compartmentation to be maintained. However, smoke control allows the apparent breach of compartmentation, but essentially it "extends" the compartment into the shaft or duct that is either extracting the heat, air and smoke or supplying the makeup air. The principle of smoke control ducts and dampers has been developed to address this situation of extending the compartment.

For the extract of smoke and heat, and for the supply of makeup air, smoke control ducts should be used.

NOTE 1 For the supply air, the requirement to maintain cross-section might be seen as less important and the duct is unlikely to collapse as it is supplying cool fresh air from outside.

There should be no fire dampers in either of these ducting systems because the failure of power or a fusible link will cause any fire dampers to close and block the free flow and negate any smoke ventilation. Smoke control dampers should be used throughout.

NOTE 2 Figure A.1 to Figure A.5 show a series of examples, as follows.

- *Figure A.1 shows the principle of multi-compartment smoke control ducts and dampers used throughout. The compartmentation at the walls is maintained by the duct installation and the inlets/outlets by smoke control dampers. Where one damper opens, the compartment is maintained by the ducts at the walls and the dampers at the branches. Smoke control dampers are not needed at the compartment boundaries.*
- *Figure A.2 shows a single compartment at the end of a multi-compartment duct. The single compartment ducts (and dampers) need to be isolated with a multi-compartment smoke control damper at the junction of the multi-compartment duct, otherwise the fire could defeat the single compartment duct and dampers, which are only classified for 600 °C. The method shown uses the fire resistance of the smoke control duct at the compartment to avoid fitting the smoke control dampers in the wall.*
- *Figure A.3 shows a single compartment at the end of a multi-compartment duct. The single compartment ducts (and dampers) need to be isolated with a multi-compartment smoke control damper at the junction of the multi-compartment duct, otherwise the fire could defeat the single compartment duct and dampers, which are only classified for 600 °C. This shows the multi-compartment smoke control damper mounted in the wall to provide the compartmentation instead of the smoke control duct.*
- *Figure A.4 shows a single compartment connected to multi-compartment ductwork leading directly to outside, without penetration or damper. This allows the single compartment duct and dampers, which are only classified for 600 °C. It differs from Figure A.3 in that no dampers can be opened in the multi-compartment space, so there is need to protect the single compartment dampers with a multi compartment one.*
- *Figure A.5 shows a single compartment connected directly to outside allowing the single compartment duct and dampers, which are only classified for 600 °C. No compartment boundaries are penetrated and therefore multi-compartment boundaries are required.*

The principles shown in Figure A.1 to Figure A.5 can be used in any application where any combination of smoke control dampers and smoke control duct/fire-resisting duct is used.

Figure A.1 – Multi-compartment smoke control duct and multi-compartment smoke control dampers

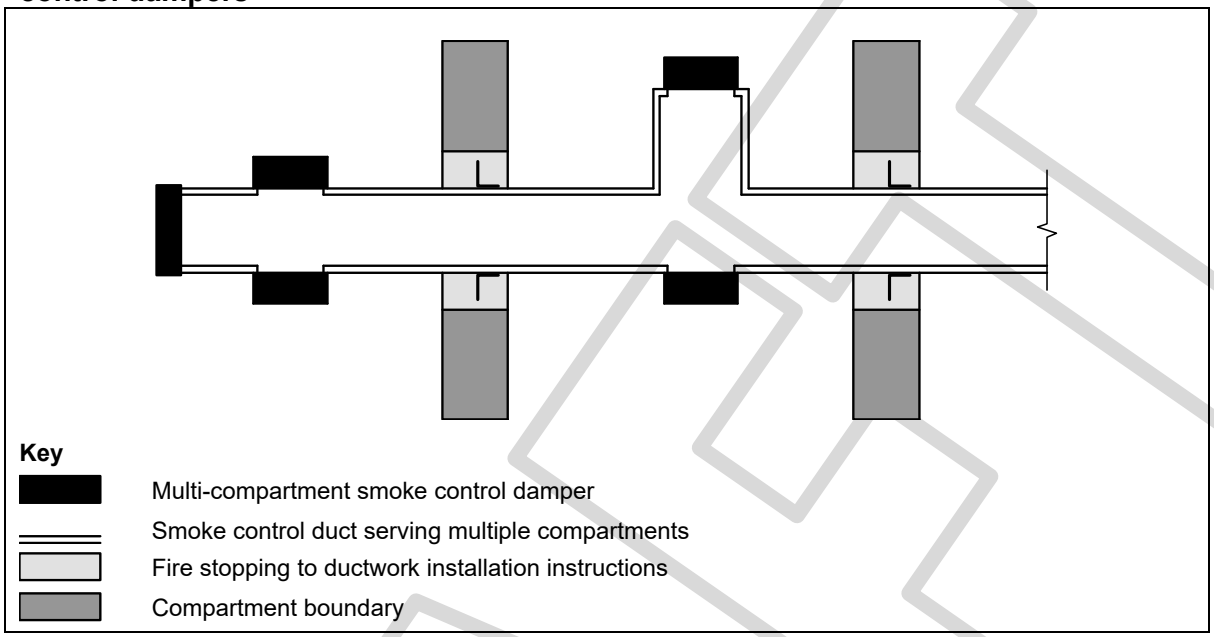


Figure A.2 – Multi-compartment smoke control duct and multi-compartment smoke control dampers with a single compartment adjacent – avoiding smoke control dampers in walls

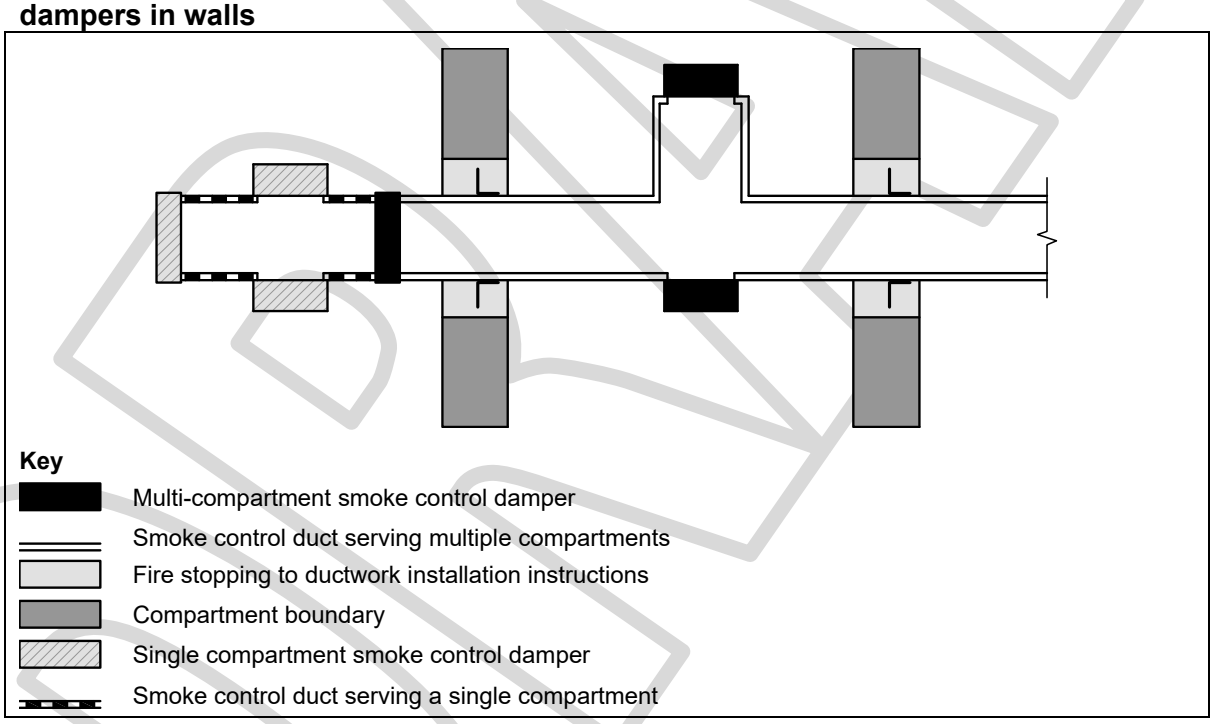


Figure A.3 – Multi-compartment smoke control duct and multi-compartment smoke control dampers with a single compartment adjacent

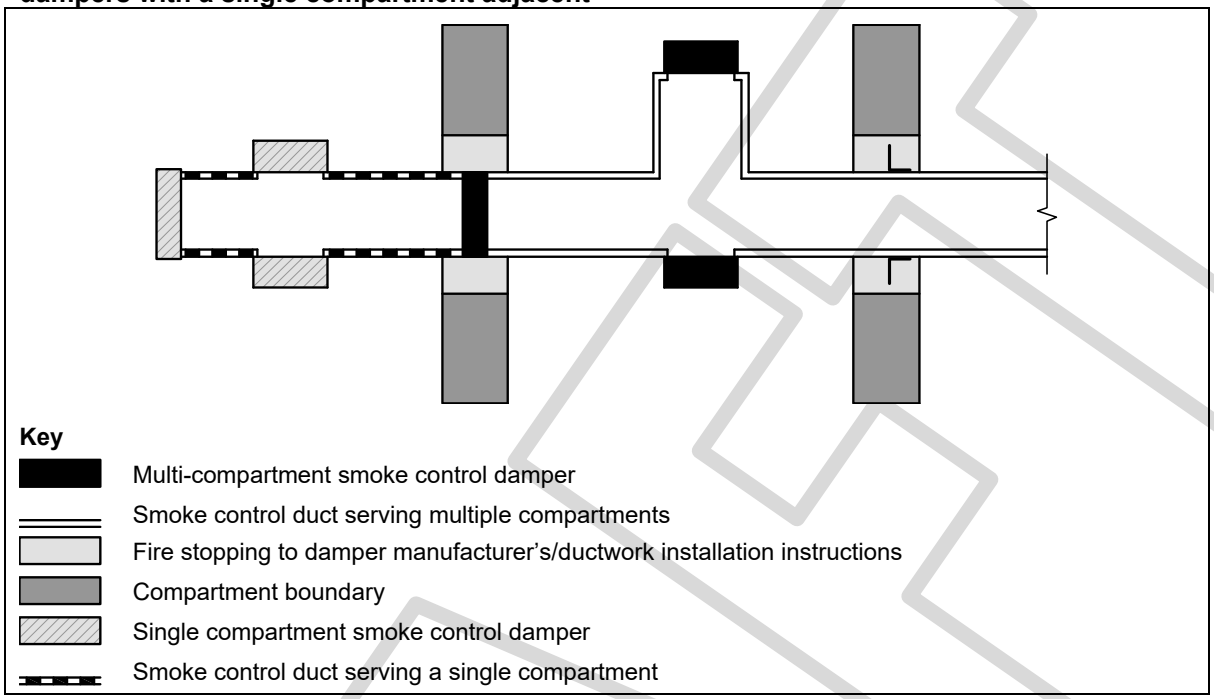


Figure A.4 – Single compartment smoke control duct and single compartment smoke control dampers via a multi-compartment duct direct to an external wall/floor

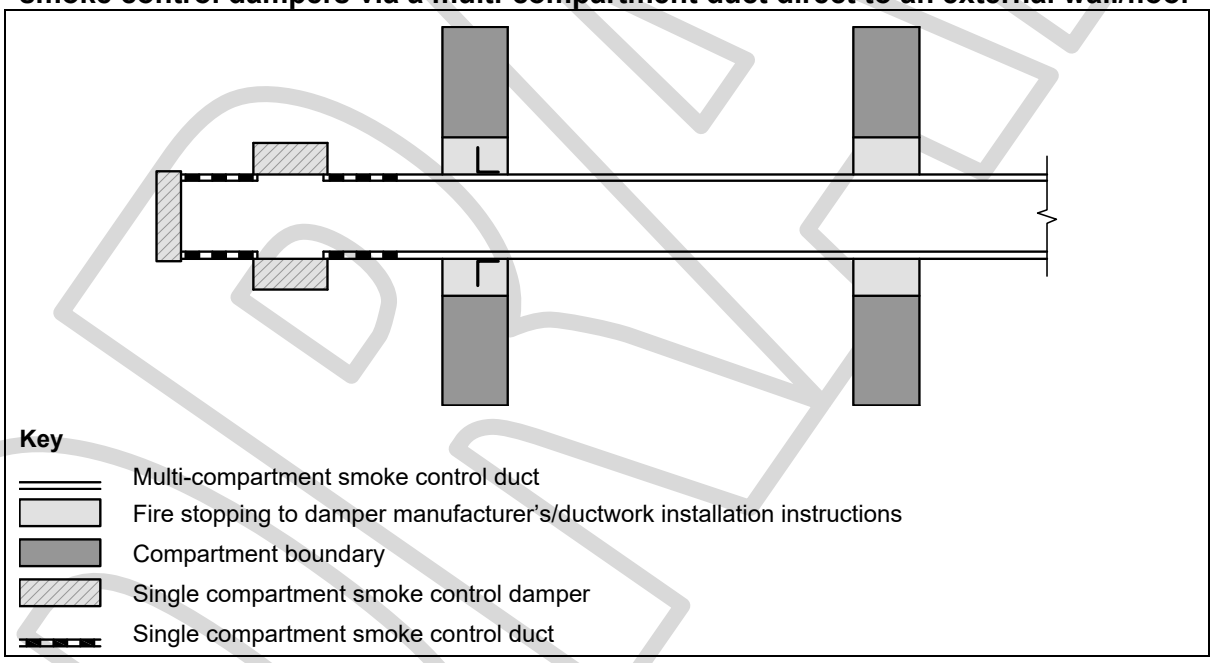
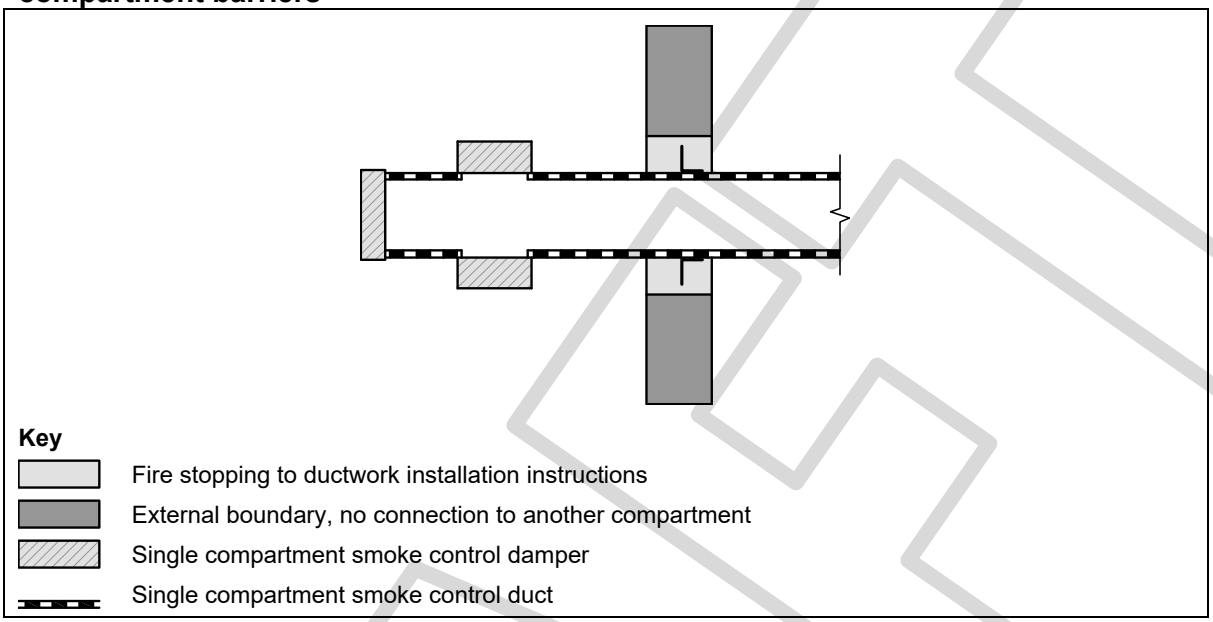


Figure A.5 – Single compartment smoke control duct and single compartment smoke control dampers direct to an external wall/floor – no penetration of compartment barriers



A.5 Smoke control systems components

A.5.1 Smoke shafts

A.5.1.1 General

Any smoke shaft that penetrates a fire compartment should, as a minimum, maintain the same level of fire compartmentation as that which has been breached.

A.5.1.2 Construction

Smoke control shafts should be one of the following:

a) concrete shafts;

b) brick or blockwork shafts ;

c) dry wall shafts in which the construction and all joints have the same fire resistance as the walls/floors in which they are installed.

NOTE It can be desirable to fully render brick or blockwork shafts, or to line brick, blockwork or dry wall shafts with a DW144 steel duct.

All shafts/ducts should leak not more than 3.8 $m^3/h/m^2$ of the surface area of the shaft/duct at 50 Pa negative pressure, and should be smooth and flush internally.

If smoke control ducting is used as an alternative to a smoke control shaft, it should conform to BS EN 1366-8.

A.5.1.3 Smoke shafts for natural systems situated above ground level

Smoke shafts for natural systems serving storeys above ground level should meet the following recommendations.

a) Smoke shafts should be constructed in accordance with **A.5.1.2**.

b) The smoke shaft should be fully open to the external air at the top and closed at the base.

c) The opening at the top of the smoke shaft should be located at least 0.5 m above any surrounding structures that fall within a 2 m radius on a horizontal plane so that it is not

subject to adverse wind effects (i.e. it should always have negative wind pressure coefficients).

d) The shaft should extend a minimum length of 2.5 m above the ceiling of the highest storey which is served by the shaft.

e) The cross-sectional area (free area) of the smoke shaft should be at least 1.5 m^2, with a minimum dimension of 0.85 m in any direction.

f) The lobby or corridor vent, the opening at the head of the shaft and all internal locations (such as safety grilles) within the shaft should have a free area of at least 1.0 m^2.

g) The top of the lobby or corridor vent should be located as close to the ceiling of the lobby or corridor as is practicable, and should be at least as high as the top of the door connecting the lobby or corridor to the stairwell.

h) Vents or AOVs opening to outside should be natural smoke ventilators (see **A.5.2**).

i) AOVs opening into shafts or ducts should be smoke control dampers (see **A.5.2.3.2**).

j) No services should be contained within the smoke shaft (including control devices for the smoke shaft).

k) The smoke shaft should be located at the remote end of the corridor away from the stairwell.

A.5.1.4 Smoke shafts for mechanical smoke ventilation systems (above-ground and basement)

Smoke shafts for MSVS, both above ground level and in basements, should meet the following recommendations.

a) Smoke shafts should be in accordance with **A.5.1**.

b) The smoke shaft should be fully open to the external air at the top and closed at the base.

c) The cross-sectional area (free area) of the smoke shaft should be sized according to the requirements of the MSVS, with a minimum dimension of 0.85 m in any direction.

NOTE The cross-sectional area can vary between 0.6 m^2 and 1.0 m^2, depending on the height of the shaft and the potential for resistance to flow.

d) The top of the lobby or corridor vent should be located as close to the ceiling of the lobby or corridor as is practicable, and should be at least as high as the top of the door connecting the lobby or corridor to the stairwell.

e) Vents or AOVs opening to outside should be natural smoke ventilators (see **A.5.2**).

f) AOVs opening into shafts or ducts should be smoke control dampers (see **A.5.2.3.2**).

g) No services should be contained within the smoke shaft (including control devices for the smoke shaft).

h) The smoke shaft should be located at the remote end of the corridor away from the stairwell.

A.5.2 Smoke control vents and AOVs

A.5.2.1 Manually openable vents

All manually openable vents provided for smoke control, whether in the stairs, in a protected lobby or in a protected corridor should:

a) be in accordance with BS EN 12101-2;

b) achieve the relevant free area;

c) be outward opening;

d) not be top-hung;

e) open to a minimum of 30°;

f) be clearly identifiable and accessible; and

g) be fitted with:

   1) simple lever handles; or

   2) rotary drives to simple rack or gear operated devices; or

   3) locks that can be readily and easily operated by the fire and rescue service.

NOTE It might be advisable to seek advice from the fire and rescue service.

Openings should be guarded to a height of not less than 1.1 m from floor level.

A.5.2.2 Remotely openable vents

Remotely openable vents should be in accordance with **A.5.2.1** and the following additional recommendations.

a) Openable vents situated above a stair should be provided with a remote control located adjacent to the fire and rescue service access doorway. The function and means of operation of the remote control should be clearly marked. The remote control should be capable of opening and closing the vent.

b) All connections between the remote control and actuator mechanism should be within an environment that provides protection from expected fire conditions. Where any part of the remote control mechanism is powered by electricity, a secondary supply should be provided.

A.5.2.3 Automatic opening vents (AOVs)

A.5.2.3.1 AOVs opening to outside air

AOVs opening to outside air (e.g. windows, panels, roof vents) should be natural smoke ventilators in accordance with BS EN 12101-2 and having the correct free area.

A.5.2.3.2 AOVs opening into shafts or ducts

AOVs opening into shafts or ducts should be smoke control dampers (see **A.5.5**). Where they enter vertical shafts, they should be multi-compartment and should achieve at least the same level of fire resistance as the compartment barrier in which they are fitted.

NOTE 1 Products tested as “smoke rated fire doors” are not acceptable replacements for smoke control dampers (e.g. BS EN 12101-2 products with additional tests).

NOTE 2 The fitting of actuators to other components to “make” natural smoke vents or smoke control dampers is not acceptable, as no performance has been tested.

A.5.3 Smoke control fans (extract)

Fans should be in accordance with BS EN 2101-3 and should be capable of handling gas temperatures of 300 °C for a continuous period of not less than 60 min.

All wiring associated with the fans should be in accordance with BS 8519.

NOTE Fans supplying fresh air as make up do not need to have elevated temperature characteristics

A.5.4 Smoke control ducts

Smoke control ducts should be tested in accordance with BS EN 1366-8 or BS EN 1366-9 and classified in accordance with BS EN 13501-4 to achieve the same level of fire resistance as the compartment barriers through which they pass.

NOTE Smoke control ducts require testing from inside and outside and do not require a reduced leakage characteristic, as the E characteristic is much lower than that for smoke control dampers.

Where fire-resisting duct is used for the supply of make-up air from outside as an alternative to smoke control duct, it should be fitted with smoke control dampers to prevent any unregulated closures.

A.5.5 Smoke control dampers

Smoke control dampers should conform to BS EN 12101-8. They should be tested in accordance with BS EN 1366-10 from both sides in the application proposed, and classified in accordance with BS EN 13501-4 to achieve the same level of fire resistance as the compartment barriers and associated smoke control ducts. In addition, they should be classified for reduced leakage S.

Smoke control dampers should be either AA or MA depending on the override functionality of the control panel. If override of the dampers is allowed during a smoke incident, then the smoke control dampers should be MA.

NOTE 1 As firefighters are unlikely to want to interfere with an automatic system, then AA smoke control dampers are acceptable as long as any manual testing override functionality of the panel is immobilized during a smoke incident. When alarms are cleared, or overridden, functionality will be returned for "smoke clearance" depending on new alarms or alarm isolation.

Smoke control dampers should have a minimum operations classification of $C_{10\,000}$. They are under the control of a system and should be tested/operated weekly.

NOTE 2 A classification of C_{300} therefore only covers 6 years which is not adequate for smoke control systems

All duct-mounted smoke control dampers should be provided with an access door both sides unless readily accessible form the end of a duct. All access doors should be suitable for the duct to which they are to be fitted.

A.5.6 Power supplies, cabling and installation

Power supplies, cabling and installation should be in accordance with Clause **23** and the following additional recommendations.

The output of each power supply should be sufficient to satisfy the maximum demands of the system.

The life safety system should be connected to an independent distribution board used exclusively for that system.

The life safety distribution board should be clearly marked at the point of isolation with a warning explaining that isolation would switch off the life safety system.

The life safety distribution board should be located in a separate fire-resisting enclosure (with a minimum of 60 min fire-resisting construction) to the primary main electrical distribution board and should not be accessible directly from the communal areas of the building or from a part of the building where dual supply is required (such as a shaft serving an evacuation lift).

The enclosure surrounding the primary main electrical distribution board should be provided with a minimum of 60 min fire-resisting construction.

The substation or transformer room should be either located outside the building or separated by 120 min fire-resisting construction and directly accessible from the outside.

The diverse (primary and secondary) power cables should only come together in the fire compartment housing the control panel by means of an automatic change-over switch, unless the cable route is via a fire compartment which does not open onto areas requiring protection via the relevant life safety system.

The electrical distribution system should conform to BS 7671, the relevant parts of BS EN 60947, and BS 7346-8.

Annex B (informative)
Transposition from European classification

B.1 National classifications for reaction to fire

Reaction to fire relates to the degree to which a product contributes, by its own decomposition, to a fire under specified conditions. Products, other than floorings, are classified as A1, A2, B, C, D, E or F (with class A1 being the highest performance and class F being the lowest) in accordance with BS EN 13501-1:2018. Class F is assigned when a product fails to attain class E.

This British Standard uses the European classification system for reaction to fire set out in BS EN 13501-1:2018; however, there might be some products lawfully on the market using the classification system set out in other statutory guidance. Where this is the case, Table B.1 can be used for the purposes of this document only.

Table B.1 – Reaction to fire transposition to national class

BS EN 13501-1:2018 classification	**Transposition**
A1	Material that, when tested to BS 476-11, does not either: a) flame; or b) cause a rise in temperature on either the thermocouple at the centre of the specimen or in the furnaces
A2-s1, d0	None
	Material that meets either of the following: a) Any material of density 300 kg/m^3 or more, which, when tested to BS 476-11, complies with both of the following: 1) does not flame; and 2) causes a rise in temperature on the furnace thermocouple not exceeding 20 °C b) Any material of density less than 300 kg/m^3, which, when tested to BS 476-11, complies with both of the following: 1) does not flame for more than 10 s; and 2) causes a rise in temperature on the thermocouple at the centre of the specimen or in the furnace that is a maximum of 35 °C and on the furnace thermocouple that is a maximum of 25 °C
B-s3, d2	Any material that meets both of the following criteria: a) Class 1 in accordance with BS 476-7; and b) has a fire propagation index (I) of a maximum of 12 and sub-index (i1) of a maximum of 6, determined by using the method given in BS 476-6. Index of performance (I) relates to the overall test performance, whereas sub-index (i1) is derived from the first 3 min of the test
C-s3, d2	Class 1 in accordance with BS 476-7
D-s3, d2	Class 3 in accordance with BS 476-7

NOTE The national classifications do not automatically equate with the alternative classifications in the European column, therefore products cannot typically assume a European class unless they have been tested accordingly. This table is only to be used for the purpose of this standard and cannot be used for any other purposes.

B.2 National classifications for roofs

Performance of the resistance of roofs to external fire exposure is measured in terms of penetration through the roof construction and the spread of flame over its surface.

Roof constructions are classified within the European system as B_{ROOF}(t4), C_{ROOF}(t4), D_{ROOF}(t4), E_{ROOF}(t4) or F_{ROOF}(t4) in accordance with BS EN 13501-5. B_{ROOF}(t4) indicates the highest performance and F_{ROOF}(t4) the lowest.

BS EN 13501-5 refers to four separate roof tests. The suffix (t4) used in paragraph B16 indicates that Test 4.

This document uses the European classification system for roof covering set out in BS EN 13501-5; however, there may be some products lawfully on the market using the classification system set out in previous editions. Where this is the case, Table B.2 can be used for the purposes of this document.

Table B.2 – Roof covering classifications: transposition to national class

BS EN 13501-5 classification	Transposition to BS 476-3 classification
B_{ROOF} (t4)	AA, AB or AC
C_{ROOF}(t4)	BA, BB or BC
D_{ROOF}(t4)	CA, CB or CC
E_{ROOF}(t4)	AD, BD or CD
F_{ROOF}(t4)	DA, DB, DC or DD

NOTE The national classifications do not automatically equate with the transposed classifications in the European column, therefore products cannot typically assume a European class unless they have been tested accordingly.

Annex C (informative)
Arson in dwellings

COMMENTARY ON ANNEX C

The recommendations given in this British Standard are primarily concerned with accidental fires. Deliberately set fires have always been a considerable concern to society. Arson fires, often referred to as incendiary fires, from whatever motive can result in multiple fatalities and even when damage is restricted to a single dwelling unit, such fires can do considerable damage and disrupt the lives of occupants and the wider community.

Motives for arson in dwellings are often not clear and can result from one or more of a number of triggers including:

- *revenge or jealously;*
- *concealment of another crime;*
- *race, religious or ethnic hatred;*
- *family discord;*
- *economic reasons such as insurance fraud, removing tenants from a property or obtaining re-housing;*
- *attacks on drug dealing or other criminal activity;*
- *as part of social disorder or riotous behaviour; and*
- *pathological fire setting behaviour.*

The insurance industry has produced various guides which are directed at property protection, arson and vandalism (see Commentary on Annex D).

C.1 Relationship between arson and security

Preventative measures for many arson fires closely interrelates to security and management control measures provided within the building. Building management/operational proposals, in addition to any security designs, need to take into account the risk of arson, and preventative measures need to be included as part of the development of these strategies.

AWFSS such as sprinklers can provide an invaluable adjunct in countering arson fires, even where multiple seats of fire might be present. If a risk assessment or employers requirement identifies that deliberate fires might occur, despite additional security provisions, then this information needs to be provided to the design team and responsible person at the earliest stages.

Where a risk assessment suggests that a property might be at risk from arsonists, specific measures to improve security can be undertaken as described in BS 8220.

In the UK, the official police security initiative, Secured by Design, also publishes helpful guidance[6)].

C.2 Fire risk assessment

By carrying out an arson risk assessment as part of the security review, the consequences of arson can be highlighted to the owner, occupier, operator, tenant, designers and insurers.

As an alternative, where a security review has not been deemed necessary by the responsible person or design team, the inclusion of the risk and impact of arson fires could be included as an extension to other risk assessments carried out for life safety as required under various legislation.

The primary method for examining the potential for arson is a fire risk assessment. This accounts for the fire safety provisions in the building and the level of fire prevention management.

[6] https://www.securedbydesign.com/guidance/design-guides

Fire risk assessments for all residential accommodation are expected to take account of the risks of and from deliberately set fires. They can include the impact and risk of arson in relation to property protection and business continuity, as well as life safety.

Fire risk assessments are also expected take into account the existing or proposed fire safety and security systems and equipment, as well as the level of fire and security prevention management intended for the building. The outcome of this risk assessment can be used to determine what overall fire safety and security systems and equipment are required, what function they have in relation to reducing the risks of arson and what management responsibilities are required to maintain and operate these systems.

C.3 Arson and building management

Fires are often started in common areas of buildings, which are supposed to be sterile or free of combustible materials, but often are not, especially where discarded furniture and rubbish may have been dumped.

Building management plans need to take into account the risks of accumulating or dumping of rubbish and to have a clear reporting and removal system in place.

Annex D (normative)
Additional recommendations for property protection and business continuity

COMMENTARY ON ANNEX D

The recommendations given in this British Standard are primarily concerned with the protection of life. The provision of fire safety systems for life safety do not necessarily give adequate protection to property or the business carried out in the building. Therefore, the aim of this annex is to enable the potential for property and business loss to be assessed so that risks can be understood and acceptable. It is also important to understand that fire presents a significant challenge to any business. In communal dwellings a fire which is contained to the dwelling of origin can very easily cause damage which will affect the habitability of other dwellings, e.g. through the damage of shared services.

The insurance industry has produced various guides which are directed at property protection, arson and vandalism (including the Fire Protection Association publication Design guide for the fire protection of buildings: Essential principles *[48], the CLG publication* Arson control forum annual report *[49], and the Arson Prevention Bureau publication* How building design can reduce the threat from arson *[50]).*

Many insurers use the LPC design guide for the fire protection of buildings *[31] as a basis for providing guidance to the building designer on what they require.*

D.1 General

Continuing operations in the event of a fire is essential for any organization, and businesses should therefore have appropriate business continuity plans in place.

NOTE Further advice is given in BS 25999, which provides a basis for understanding, developing and implementing business continuity within an organization.

D.2 Property protection and business continuity risk assessment

*COMMENTARY ON **D.2***

By carrying out a property protection and business continuity risk assessment, the consequences of fire on property and business loss can be highlighted to the owner, occupier, operator, tenant, designers and insurers. One aim of a property protection and business continuity risk assessment is to provide a link between the provisions for life safety and those for property protection and business continuity.

The risk assessment for property protection and business continuity could be an extension to other risk assessments carried out for life safety as required under various legislation.

Recommendations for carrying out fire risk assessments in residential buildings are given in PAS 79-2.

The property protection and business continuity risk assessment should, as far as is reasonably practicable, determine whether the fire precautions and fire prevention management in the building provide adequate protection against:

a) property protection:
   - loss of contents;
   - damage to fabric and building services;

b) business continuity:
   - loss of dwellings and the social cost to the community;
   - need to provide rehousing;
   - loss of personal effects of the tenants;
   - loss of operational continuity for the business providing the housing.

NOTE Further advice and guidance can be obtained from the Fire Protection Association publication Design guide for the fire protection of building: Essential principles [48].

In addition, the property protection and business continuity risk assessment should be used to determine what overall fire safety systems and equipment are required, what function they have in relation to property protection and what management responsibilities are required to maintain and operate these systems.

D.3 Responsibilities

*COMMENTARY ON **D.3***

The responsibility for agreeing the level of fire precautions, and fire prevention management in relation to insurance, lies solely with the insurers or their agents and their client. The result of these discussions might result in a change of brief or increased fire precautions in the building.

There is frequently a life safety benefit as a result of a property protection measure. It might be possible to remove or simplify some life safety measures, in negotiation with the relevant authorities, when more stringent property protection measures are adopted.

Discussions with the insurers should occur at an appropriate phase in the design and should allow for any contingency planning.

As part of the development of the brief, the responsibility for carrying out a property protection and business continuity risk assessment (see **D.2**) should be taken by one of the following:

a) owner, occupier, operator, tenant or concessionaire, for self-assessment;

b) suitably competent member of the design team;

c) insurer's fire surveyor;

d) risk manager/engineer; or

e) fire safety engineer.

The level of detail required should also be decided upon when allocating responsibility.

Any changes in the design should be discussed with the relevant authorities to verify that there is no adverse impact on life safety.

D.4 Acceptable level of risk

The acceptable level of risk to property or business should be established at an appropriate stage in the design. This acceptable level of risk to property or business should be compared with the design criteria necessary for life safety. Any increases in performance standards required for property protection or business continuity should then be identified and incorporated in the design.

D.5 Qualitative risk assessment

D.5.1 General

*COMMENTARY ON **D.5.1***

For many buildings, some form of qualitative risk assessment is appropriate.

The technique(s) to be used for qualitative risk assessment should be agreed at an appropriate stage of the design.

When the aims or objectives for property protection and business continuity have been agreed, then a strategy for achieving those aims should be developed from the risk assessment, taking into account various methods to prevent fire occurring and developing.

NOTE 1 These methods are referred to here as controls on fire development and they take into account both fire prevention management and the design of fire precautions.

Controls on fire development should be assessed against the way the fire is likely to start and then grow.

NOTE 2 The growth of the fire and the actions of various controls on fire development can be assessed in a sequential order known as a timeline. The following controls on fire development approximate to a timeline for many fires:

- *fire prevention management: control of ignition sources and fire loads, training of staff and work procedures, maintenance and upkeep of fire safety systems;*
- *fire detection, fire alarm and first aid firefighting;*

- *smoke management;*
- *AWFSS;*
- *compartmentation and structural fire protection;*
- *firefighting facilities (external and internal); and*
- *external fire spread and building separation.*

The success or failure of each control mechanism should be taken into account in the risk assessment of potential damage to the property and business. Any improvements in the management system should also be identified, together with contingency plans, as necessary.

D.5.2 Fire prevention management

*COMMENTARY ON **D.5.2***

The first barrier to property and business loss is the level of fire prevention management in the building. This is to enable ignition hazards to be controlled or eliminated, operations in the building to be carried out appropriately, and fire loads are to be subject to control and good housekeeping. It is also important to recognize that in domestic dwellings, the owner or occupier of that dwelling might have little expertise or understanding of the fire protection and prevention measures in their home.

Any anticipated lack of knowledge on the part of the owner or occupier of a dwelling regarding fire protection and prevention measures should be recognized and taken into account in determining the level of additional protection provided. This should be both in terms of fire safety feature of the built environment and in advice given to occupants for managing the risk from fire in their dwellings.

D.5.3 Fire detection, fire alarm and first aid firefighting

*COMMENTARY ON **D.5.3***

If a fire occurs and grows then the first barrier to its development is by first aid firefighting. The usual advice to homeowners is to refrain from first aid firefighting, leave the dwelling and call the fire and rescue service. In situations where staff are available, first aid firefighting might be appropriate.

Any enhanced provision for fire detection, fire alarm or first aid firefighting should be incorporated into the risk assessment.

D.5.4 Automatic fire suppression and smoke control

*COMMENTARY ON **D.5.4***

If first aid firefighting is unsuccessful and the fire continues to grow then the next barrier to fire development is likely to come from any automatic or control suppression systems in the building. Such systems can be in the form of AWFSS, fixed dry powder systems or gaseous fire suppression systems.

Smoke control systems can also contribute to property protection and business continuity. They can either be active or passive. Active smoke management systems can be turned on automatically via the fire detection and fire alarm system and take one or more of the following forms:

- *mechanical and natural smoke extract with appropriate means to allow makeup air. These are designed to either limit the extent of smoke spread and/or to reduce the build-up of heat in the compartment;*
- *pressurization systems to prevent the flow of smoke from one area to another by raising the pressure in the protected space;*
- *depressurization systems to prevent the flow of smoke from one area to another by lowering the pressure in the fire-affected space; and*
- *directional fans designed to force smoke in one direction.*

With AWFSS, the fire can be assumed to be controlled or extinguished. Either way, a degree of smoke damage can be anticipated within the compartment or smoke reservoir depending on whether or not it is an active or passive smoke management system.

When assessing the adequacy of an AWFSS or smoke control system, the design objectives of the system should be taken into account to verify that it is sufficient for the aims of property protection and business continuity.

The potential for smoke damage should be assessed qualitatively for its impact on property and/or business. Any single points of failure that are likely to affect business operations should be identified.

D.5.5 Compartmentation and structural fire resistance

*COMMENTARY ON **D.5.5***

If there is no AWFSS, or if for the purposes of an extreme event analysis it is decided to assume that the fire is not controlled by active means, then the next level of control on fire development is fire compartments and fire resistance to the structure. Compartmentation is often an important feature of residential building design.

Compartmentation is the provision of fixed horizontal and vertical barriers with designated fire resistance, including adequate fire-stopping; cavity barriers; dampers or seals; doors or shutters, all of which are commensurate with the barrier in which they are housed.

If a building is compartmented, smoke and heat damage can be assumed to occur throughout the compartment. There is also a risk that the compartmentation could be breached as a result of inadequate fire-stopping between floor slabs and the external façade, or by external fire spread via the façade.

When assessing the adequacy of the compartment and structural fire resistance, the design objectives should be taken into account to verify that the fire resistance is sufficient for the aims of property protection or business continuity and day-to-day operation.

The potential for smoke and heat damage, and for breach of compartmentation, should be assessed. Any single points of failure that are likely to affect business operations should be identified.

D.5.6 Firefighting facilities

*COMMENTARY ON **D.5.6***

Although firefighting facilities are included here as the fifth control to fire development, they could be equally applicable from any moment that a fire is detected.

The speed of response to the fire and availability of firefighting provisions play an important role in limiting the potential damage to property.

The principal aim of these activities is life safety. For most buildings it is expected that these provisions will also be adequate for property protection.

The following factors should be taken into account when assessing firefighting operational requirements to reduce property losses:

a) provision for external firefighting; and

b) provision for internal firefighting.

Annex E (normative)
Designing atria

COMMENTARY ON ANNEX E

This annex contains different design options for the inclusion of atria in residential buildings. The exemplars given cover buildings up to 18 m in height, incorporating both enclosed and unenclosed balconies.

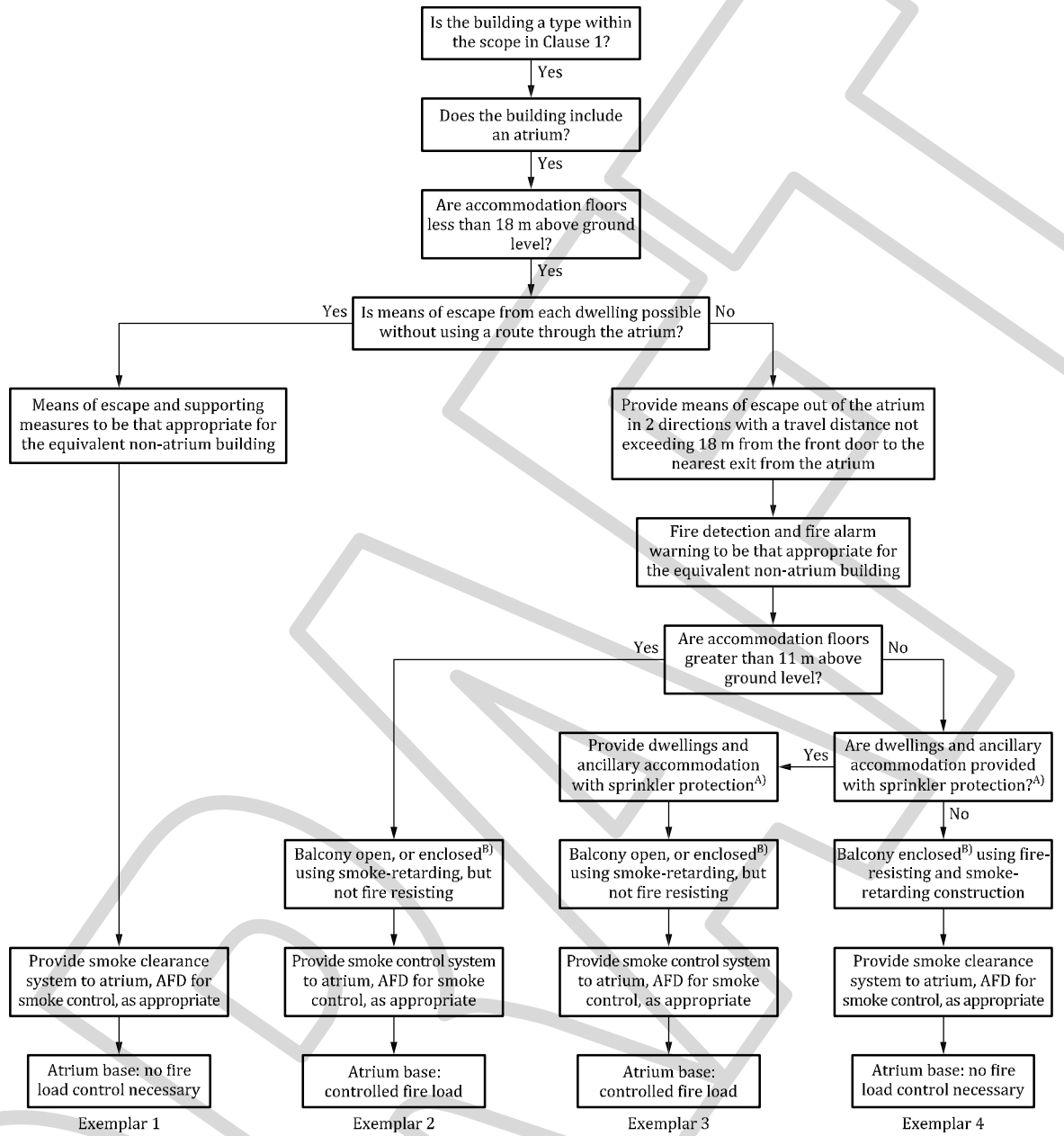
E.1 General

The flowchart in Figure E.1 should be used to determine whether an atrium building falls within the scope of BS 9991 and this annex, and, if it does, to determine a design solution.

Where specific reference is not made to a particular element of design and/or construction, such elements should be designed in accordance with the recommendations given elsewhere in this standard for the equivalent non-atrium building.

NOTE The enclosure of an atrium by imperforate construction (such as a glazed screen) can significantly reduce the probability of smoke damage to storeys removed from the fire. If the fire grows large, however, the temperature build-up within the atrium is likely to lead to failure of non-fire-resisting glazed elements, and smoke and flames can spread between storeys. If a fire continues to develop unchecked, the build-up of heat is likely to lead eventually to the failure of non-fire-resisting glazing systems used for the atrium enclosure. Therefore, to achieve an additional level of protection, the provision of a fire-resisting enclosure to the atrium can be beneficial.

Figure E.1 – Design feature decision process for atria



[A)] Where sprinklers are required within dwellings, they should be installed in accordance with BS 9251:2021 or BS EN 12845:2015+A1 (see **19.2**, Table 4). Where sprinklers are required in ancillary accommodation and/or to cover the atrium base, they should be installed in accordance with BS EN 12845:2015+A1.

[B)] Where balconies are enclosed, ventilation should be provided in accordance with Clause **22**.

NOTE For exemplars 1 to 4, see Figure E.2 to Figure E.5.

E.2 Means of escape

E.2.1 General

Means of escape from a dwelling and ancillary accommodation in a building incorporating an atrium should place the occupants at no greater risk from fire and smoke than that of an equivalent non-atrium building.

In circumstances where escape is only possible by passing through an atrium, either the route should be separated from the atrium or measures should be taken that take into

account the effect heat and smoke might have on people using the escape route, especially on the higher storeys.

NOTE This might involve the use of smoke control methods and/or automatic suppression.

E.2.2 Escape using atrium balconies

Where escape from dwellings or ancillary accommodation is possible without entering the atrium, the following recommendations should be met.

a) All dwellings and ancillary accommodation should be separated from the atrium or balcony by 60 min fire-resisting (integrity and insulation) and smoke-retarding construction.

b) There should be two directions of escape from every location on a common balcony.

c) It should be possible to reach an exit from the atrium within 18 m from any point on a common balcony.

d) A smoke clearance system should be installed in the atrium (see Exemplar 1).

Where escape is only possible by passing along a balcony within the atrium, the following recommendations should be met.

1) All dwellings and ancillary accommodation should be separated from the atrium or balcony by 60 min fire-resisting (integrity and insulation) and smoke-retarding construction.

2) There should be two directions of escape from every location on the balcony.

3) It should be possible to reach an exit from the atrium within 18 m from the front door of every dwelling or entrance to ancillary rooms.

4) Where the top accommodation floor is greater than 11 m above ground level:

   i) sprinkler protection should be provided in accordance with Clause **19**; and

   ii) a smoke control system should be provided in the atrium in accordance with **E.6**; and

   iii) the atrium base should either contain a controlled fire load in accordance with **E.6.10** or be protected using sprinklers in accordance with **E.6.11** (see Exemplar 2).

   NOTE The balcony can be open, or enclosed using smoke retarding construction, but need not be fire-resisting).

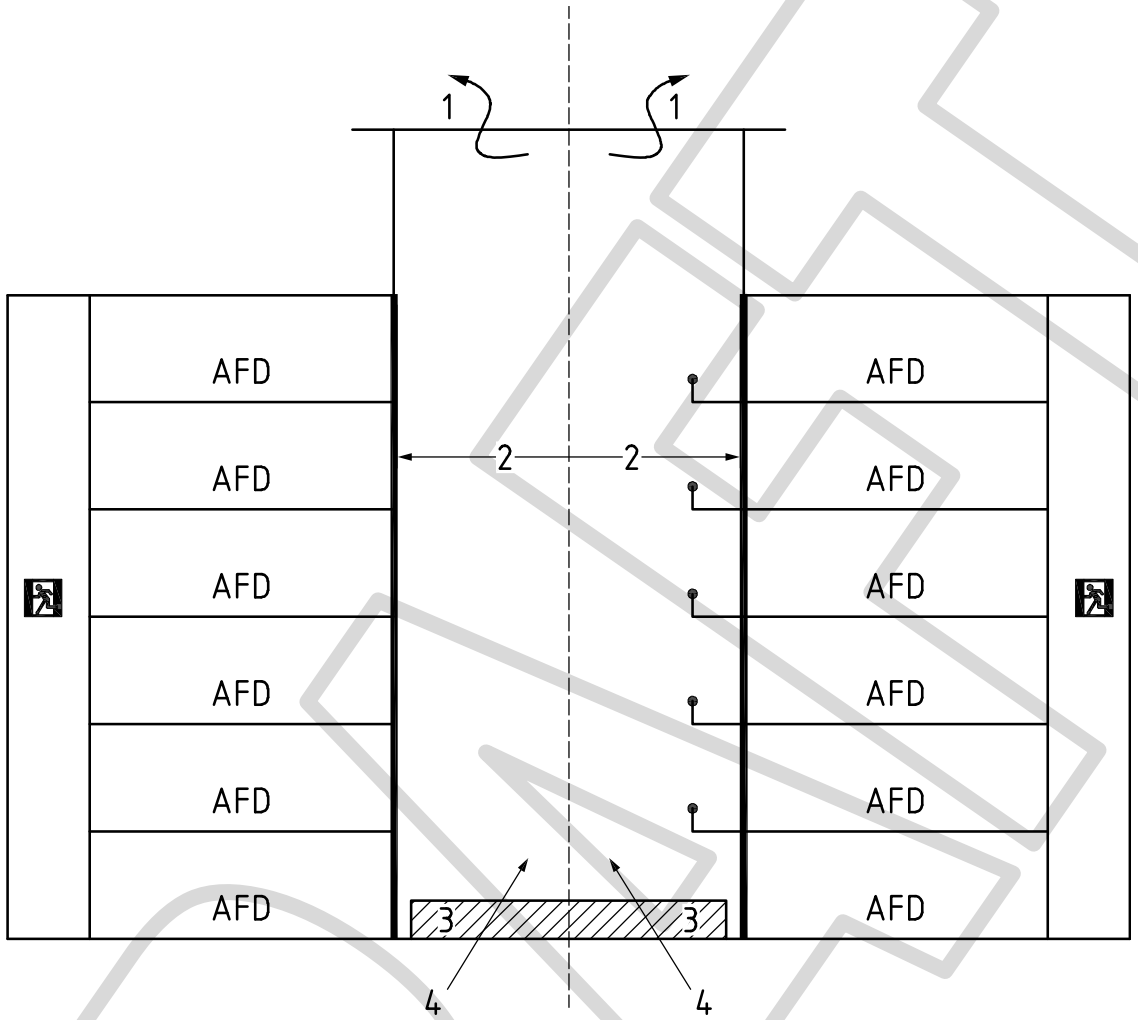
5) Where the top accommodation floor is not greater than 11 m above ground level:

   i) if sprinkler protection is provided in accordance with Clause **19**, the measures in **E.2.1** should be applied (see Exemplar 3) or

   ii) if sprinkler protection is not provided then;

   - the balcony should be separated from the atrium by fire-resisting and smoke-retarding construction in accordance with **E.3.1** and **E.3.2** respectively; and
   - a smoke clearance system should be installed in the atrium; and
   - the atrium base should either contain a controlled fire load in accordance with **E.6.10** or be protected using sprinklers in accordance with **E.6.11**) (see Exemplar 4).

Figure E.2 – Exemplar 1: Escape not through the atrium

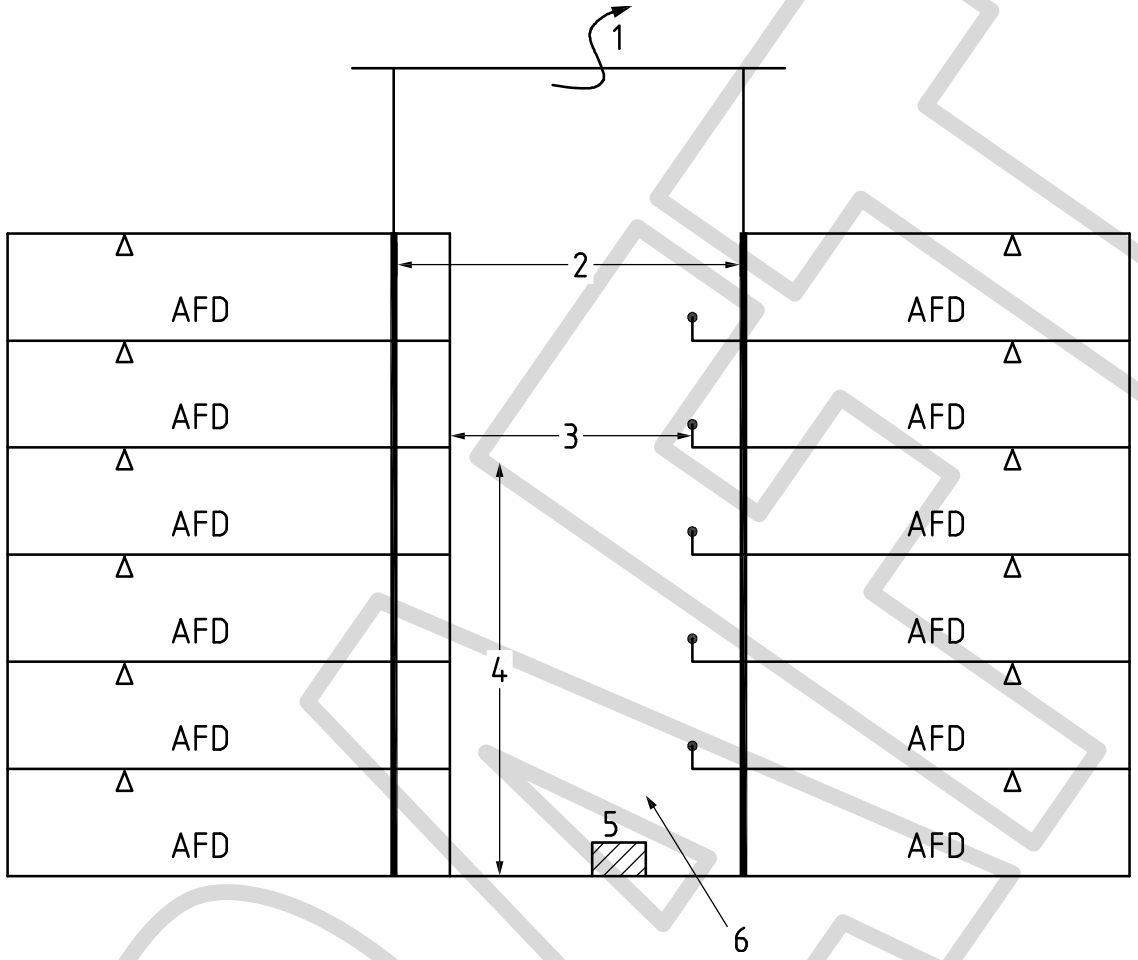


Key

AFD	BS 5839-6:2019+A1 fire detection and fire alarm system appropriate to that of equivalent non-atrium building	2	Atrium separated from dwellings by 60 min fire-resisting and smoke-retarding construction
	Escape possible without going through atrium	3	Fire load within atrium need not be controlled
1	Smoke clearance system from atrium	4	Clearance system replacement air

NOTE If the building is over 11 m then a sprinkler system conforming to BS 9251:2021 should be installed throughout.

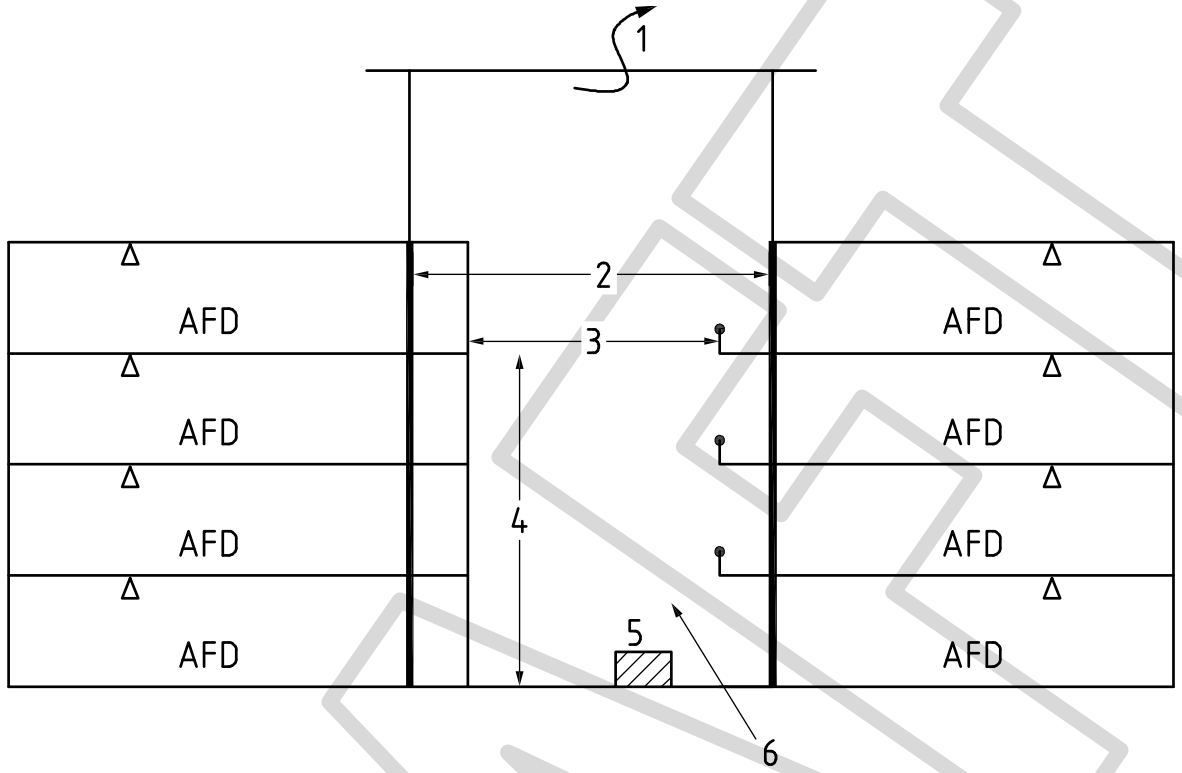
Figure E.3 – Exemplar 2: Top floor greater than 11 m



Key

1	Smoke control system from atrium
2	Atrium separated from dwellings by 60 min resisting and smoke-retarding construction
3	Atrium balcony open, or enclosed with smoke-retarding construction
4	Top floor greater than 11 m above ground level
5	Controlled fire load in atrium base
6	Smoke control system replacement air
AFD	BS 5839-6:2019+A1 fire detection and fire alarm system appropriate to that of equivalent non-atrium building
△	Sprinkler protection installed in dwellings and ancillary accommodation

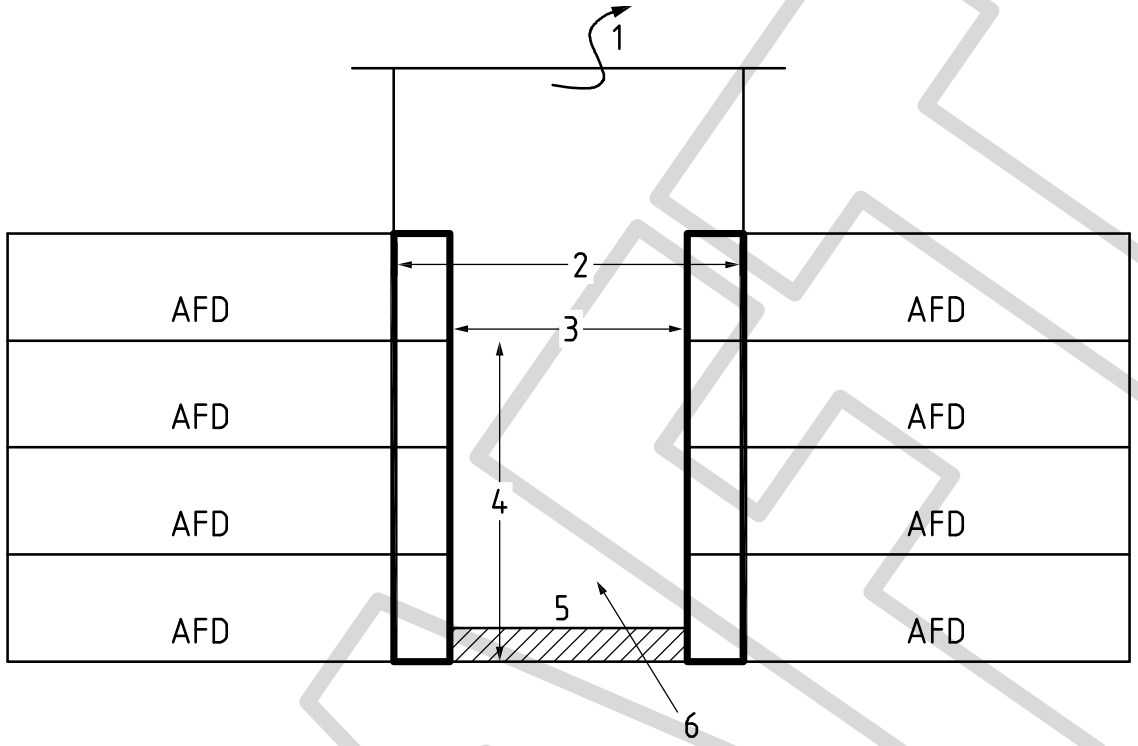
Figure E.4 – Exemplar 3: Top floor less than 11 m with sprinkler protection



Key

1	Smoke control system from atrium
2	Atrium separated from dwellings by 60 min fire-resisting and smoke-retarding construction
3	Atrium balcony open, or enclosed with smoke-retarding construction
4	Top floor less than 11 m above ground level
5	Controlled fire load in atrium base
6	Smoke control system replacement air
AFD	BS 5839-6:2019+A1 fire detection and fire alarm system appropriate to that of equivalent non-atrium building
△	Sprinkler protection installed in dwellings and ancillary accommodation

Figure E.5 – Exemplar 4: Top floor less than 11 m without sprinkler protection



Key

1	Smoke control system from atrium
2	Atrium separated from dwellings by 60 min fire-resisting and smoke-retarding construction
3	Atrium balcony enclosed with fire-resisting and smoke-retarding construction
4	Top floor less than 11 m above ground level
5	Fire load within atrium need not be controlled
6	Smoke control system replacement air
AFD	BS 5839-6:2019+A1 fire detection and fire alarm system appropriate to that of equivalent non-atrium building

E.2.3 Fire detection and fire alarm system

Fire detection and fire alarm systems should meet the recommendations given in Section **3**, as appropriate for the equivalent non-atrium building.

E.3 Prevention of fire and smoke spread in atria

*COMMENTARY ON **E.3***

Recommendations and guidance are provided in this annex on various methods to prevent the flow of hot gases and flames from a fire in an associated dwelling into the atrium and subsequently having a possible effect on other dwellings.

Various strategies might be acceptable to achieve this, including:

- *fire-resisting and smoke-retarding construction between the atrium and the associated dwelling in conjunction with a smoke clearance system from the atrium;*
- *fire-resisting construction between the atrium and the associated dwelling in conjunction with a smoke control system in the atrium;*
- *fire-resisting construction between the atrium and the associated dwelling in conjunction with sprinkler protection to the dwelling and a smoke clearance system from the atrium.*

E.3.1 Fire-resisting construction

Where the accommodation needs to be separated from the atrium by a fire-resisting construction, then both sides of the construction should meet the appropriate fire resistance periods in Table 7 or Table 8.

E.3.2 Smoke-retarding construction

*COMMENTARY ON **E.3.2***

It is not always necessary to enclose the atrium with fire-resisting construction. A smoke-retarding enclosure might, however, be needed to prevent the early ingress of smoke to those levels that are not directly affected by fire. Some forms of construction which are fire-resisting (e.g. traditional roller shutters) would not be sufficiently impervious to smoke to be considered as smoke-retarding.

Where smoke curtains are used, they should be in accordance with BS EN 12101-1.

Smoke-retarding construction should not contain unsealed joints and permanently open, or openable, areas. Joints between such construction and any abutting element should be tight and sealed with a filler conforming to BS EN 1366-3 or BS EN 1366-4 (e.g. plaster), a mastic, or a flexible strip (e.g. neoprene), as appropriate.

Any doors in an atrium, when tested in accordance with BS 476-31.1 with the threshold taped, and subjected to a pressure of 25 Pa, should have a leakage rate not exceeding 3 $m^3/h/m$.

E.3.3 Connection of an atrium to below-ground storeys

*COMMENTARY ON **E.3.3***

There is essentially little difference in the potential for fire and smoke spread between an atrium penetrating below ground level and an atrium that is wholly above ground, and it is not necessary to separate the below-ground sections of an atrium and its associated floor areas from the upper storeys by means of fire-resisting construction. No specific recommendations are made for atria connecting with below-ground storeys.

Protected escape routes and firefighting provisions in atria should be in accordance with the recommendations for the equivalent non-atrium building.

E.4 Glazing

E.4.1 General recommendations for overhead glazing

Overhead glazing should be designed to minimize the risk of injury due to falling glass.

NOTE 1 This generally requires the use of polyvinylbutyral (pvb) laminated safety glass on the inner pane facing into the atrium space. Relevant guidance on the limitations of other glass types is given in BS 5516-2.

Up to a height of 5 m above floor level:

a) single glazing should consist of toughened glass, Georgian wired glass, pvb laminated safety glass or heat-soaked toughened glass; and

   NOTE 2 Georgian wire glass contains a wire mesh within the body of the glass.

b) for insulating glazed units, the lower pane should be one of the glass types described in item a) above. Where the lower pane is either toughened or heat-soaked toughened glass, the upper pane of the unit should also be one of the glass types described in item a).

At a height of between 5 m and 13 m above floor level:

1) single glazing should consist of Georgian wired glass, a glazing including pvb laminated safety glass as the outer layer, or heat-soaked toughened glass with a thickness not more than 6 mm and a pane size not more than 3 m^2; and

2) for insulating glazed units, the lower pane should be one of the glass types described in item 1) above. Where the lower pane is toughened glass, the upper pane should also be one of the glass types described in item 1).

At a height of more than 13 m above floor level:

i) single glazing should consist of Georgian wired glass or a glazing including pvb laminated safety glass; and

ii) for insulating glazed units, the lower pane should be Georgian wired glass or a glazing including pvb laminated safety glass as the outer layer.

E.4.2 Fire protection of glazed walls and the atrium roof

Glazed atrium walls and the atrium roof should meet the following recommendations.

a) If one or more of the sides of the atrium form a vertical escape and access stair then the vertical glazing either side of the corner, for a distance of at least 3 m on both sides, should be a minimum of 30 min insulation and integrity for the full height of the atrium.

b) The roof glazing should be part of a classified minimum 30 min integrity fire-resisting glazed system combined with a smoke-retarding construction.

c) Any façade glazing outside and above the atrium should be part of a fire-resisting glazed system for a distance of at least two floors above the atrium roof, and having a minimum of 30 min insulation with integrity.

E.5 Load-bearing elements

Load-bearing elements of structure that are fire-resisting should be of an equal level of fire resistance as those appropriate for the equivalent non-atrium building.

NOTE The anticipated fire load (per m^2 of floor area) in a building incorporating an atrium would normally be no greater than in the equivalent non-atrium building.

E.6 Smoke control and controlling the fire load on the atrium base

*COMMENTARY ON **E.6***

Smoke control systems are designed to move or control the smoke and fire effluent in a predetermined manner in order to minimize the threat to life. Smoke control can be achieved in a number of different ways, such as through a smoke clearance system which assists firefighters in removing smoke from the building in the aftermath of a fire.

For general guidance on smoke control systems, see Annex A.

E.6.1 General

Smoke control systems should:

a) maintain a clear layer of not less than 3 m above the top open-occupied storey, or 2.5 m above the floor of fire origin; and

b) prevent the smoke layer temperature from exceeding 200 °C.

Where the design of the smoke control system allows the layer of smoke to descend below closed storeys, smoke should be prevented from leaking into these floors or, where applicable, the smoke control system design should provide by dilution conditions such that the optical density per metre does not exceed 0.1 at all points on the top storey open to the atrium.

NOTE This measure is intended to ensure that the visibility on the open storeys does not become lower than the accepted 8 m to 10 m range which is deemed adequate for safe use of the escape routes.

E.6.2 Makeup air

Any smoky gases exhausted from the atrium should be replaced by clean, fresh air. This replacement air should enter below any buoyant smoke layer to avoid immediate mixing with smoke, and to allow the best conditions for the use of escape routes and for firefighting.

E.6.3 Calculation procedures

The calculation procedures used should be relevant to the circumstances in which they are intended to be used. The procedures and calculations should be fully documented.

NOTE Guidance on calculation procedures for the design of smoke and heat control systems is given in a number of documents, e.g. BS 7346-4 and BS 7346-5, BRE Report 368 [20] and CIBSE Guide E [51].

E.6.4 Interaction between HVAC and other systems

*COMMENTARY ON **E.6.4***

HVAC ductwork used in conjunction with a smoke control system presents a risk as inlet air and exhaust air can spread smoke and fire within the atrium building.

The risk posed by HVAC ductwork should be taken into account when determining fire protection measures, integrity of construction, ventilation controls, and routing of ductwork used for smoke and heat control systems.

E.6.5 Post-fire suppression ventilation

*COMMENTARY ON **E.6.5***

Smoke and heat from a building might need to be released after the fire has been suppressed by the fire and rescue service. Ventilation for this purpose is usually obtained by opening windows to provide cross-ventilation and smoke clearance. In a building with an atrium, the spread of smoke to a number of storeys can make it more difficult to open windows on every storey affected by smoke.

In atrium buildings, a mechanical or natural ventilating system should be provided that is capable of clearing the smoke from the atrium and the affected floor area.

Where a smoke control system is not provided, smoke clearance facilities should be provided for operation by the fire and rescue service.

NOTE Where a smoke control system is provided for means of escape purposes, it is not generally necessary to provide additional facilities specifically for the fire and rescue service.

Stand-alone manual override facilities should be provided that allow the fire and rescue service to have direct control of the smoke control and normal ventilation systems within the building.

E.6.6 Natural smoke control for atria

A smoke control system operating on natural ventilation principles should be designed to remove residual smoke, taking due account of mixing effects, when relying solely on the thermal stack effect created by the buoyancy of the smoke and on the areas of openings provided.

NOTE A separate low-level inlet is not always required. Inlet air can be provided by firefighters opening windows and doors.

Natural smoke clearance for atria should meet the following recommendations.

a) Natural exhaust vents should be provided in the atrium roof. The total area of vents should be not less than 10% of the maximum plan area of the atrium.

b) Vents should be located in such a way that ensures adequate coverage and cross-ventilation of the total atrium.

c) Vents and associated controls should conform to BS EN 12101-2.

E.6.7 Mechanical smoke ventilation for atria

An MSVS should be provided having a low-level inlet within the atrium to provide replacement air changes every hour based upon the total volume of the atrium including the largest floor open to it. The MSVS should provide:

a) four air changes per hour in sprinklered buildings where the atrium base has a controlled fire load;

b) six air changes per hour in unsprinklered buildings.

E.6.8 Automatic control

Smoke control systems should be actuated by means of smoke detection in the common access space to residential accommodation.

E.6.9 Ventilation and smoke controls for the fire and rescue service

*COMMENTARY ON **E.6.9***

In order to assist the fire and rescue service in rescue, firefighting and clearance of smoke after the fire has been extinguished, it has become normal practice to provide switches at suitable locations by which fire and rescue service or other authorized personnel can override the operation of smoke exhaust fans and ventilators and alter the configuration of the normal air handling system.

An assessment should be made as to whether override switches are required for smoke exhaust fans and ventilators, and, if so, where they should be located.

NOTE It might be advisable to seek the advice of the fire and rescue service regarding designing ventilation and smoke controls.

E.6.10 Controlling fire load on the atrium base

Where it is necessary to control the fire load within the atrium, the following recommendations should be met.

a) If the total weight of the fire load on the atrium base exceeds 160 kg, the materials should be confined to isolated islands, each island containing a maximum of 160 kg fire load, covering a maximum floor area of 10 m², and being separated from other fire loads by a distance of at least 4 m (except where those areas are protected by a sprinkler system; see **E.6.11**).

b) All wall and ceiling linings should be constructed of class B-s3, d2 or better materials.

c) When tested in accordance with BS 5852, all upholstered furniture should resist ignition from the smouldering source and the flaming source.

   NOTE Attention is drawn to the provisions of the Furniture and Furnishings (Fire) (Safety) Regulations 2010 [52] in respect of filling materials.

d) All textiles (drapes and curtains) should conform to BS 5867-2:2008.

e) Where an AWFSS is provided, the fire load should be assumed to be controlled.

E.6.11 Sprinkler protection to the atrium base

The design and installation of sprinklers should take the following factors into account, to enable the sprinklers to control a fire in an atrium.

a) Where sprinkler protection is provided to the atrium base, the objective is to limit the heat output of the fire to 2.5 MW convective heat flux.

b) In atria, the effectiveness of sprinklers diminishes with an increase in height above the atrium base.

Sprinkler systems should be installed in accordance with BS EN 12845:2015+A1.

Annex F (normative)
Private balconies (open or enclosed) and communal roof gardens

F.1 General

At least 50% of the vertical section of a balcony should be open and the area of opening should be uniformly spread around the surface.

NOTE 1 An open balcony is one that could reasonably be assumed not to become smoke-logged in a flat fire situation.

NOTE 2 General recommendations for balconies and terraces are given in BS 8579.

F.2 Construction of private balconies and terraces (open and enclosed)

All balconies on a building with a storey 11 m or more above ground level should be constructed of class A2-s1, d0 or better materials.

Stacked balconies on buildings of any height should be constructed of class A2-s1, d0 or better materials.

All balconies should:

a) not be composed of materials or designed such that they provide a medium for undue fire spread over the external envelope of the building;

b) not propagate fire downwards, e.g. not produce falling brands or flaming molten droplets or debris capable of initiating fire below;

c) be designed to minimize the risk of becoming detached from the face of the building and present a hazard to persons below, e.g. fire fighters and the public; and

d) be designed to minimize the risk of prejudicing the stability of the building when undergoing large deformations resulting from fire exposure.

Where enclosed balconies are contiguous with enclosed balconies to other flats, the fire resistance and the compartmentation between balconies should be the same as the fire resistance required for the building. Party walls and floors and any penetrations through them should follow the recommendations in Clause **25** and **32.4**.

Terrace roofs should achieve B_{ROOF} (t4) classification. Any edge fascia, parapet or balustrade that forms part of an external wall to the building should accord with national standards.

F.3 Means of escape from private balconies and terraces below 4.5 m above ground level

The ground beneath the balcony or terrace should be clear of any obstructions (such as iron railings or horizontally hung windows) and should be of a size and materials that is suitable and safe for supporting ladders.

NOTE It is important to ensure that there is sufficient space to bring in and safely erect a suitable ladder.

If an enclosed balcony contains an escape window, the window should be in accordance with **5.2**.

F.4 Means of escape from private balconies and terraces more than 4.5 m above ground level

Balconies and terraces more than 4.5 m above the ground level should meet the following recommendations.

a) The escape route from the balcony or terrace (open or enclosed) should not pass through more than one access room.

b) The interior of the access room should be clearly visible from all parts of the balcony unless warning is provided by a fire detection and fire alarm system in accordance with BS 5839-6:2019+A1.

c) Any cooking risk in the access room should be enclosed with fire-resisting construction unless:

   1) the open cooking risk is remote from the balcony and positioned in such a way that it does not prejudice the escape route through the access room; and

   2) a fire detection and fire alarm system in accordance with BS 5839-6:2019+A1 is provided to the access room with an alarm system on the balcony.

d) Where the travel distance from the balcony access door to the furthest point on the balcony exceeds 7.5 m, either it should be provided with an alternative escape route without going via the same access room, or the access room should be provided with automatic smoke detection.

F.5 Construction of communal terraces and roof gardens

The construction of the roof should be of fire-resisting construction (REI when tested from below) to the standard required for a floor in the building, and the upper surface should achieve B_{ROOF} (t4). Areas such as green roofs, planters, and soft surfaces to playgrounds that might not achieve that classification should be isolated 3 m away from any vertical building façade above the terrace surface and by 0.5 m from other perimeters of the terrace and from roof lights, ventilation openings or other penetrations of the roof.

Any fire risk or roofed structure erected on the terrace, such as BBQ stations and enclosed buildings, should be erected on a slab of class A1 material that also extends at least 1.2 m from the edges of such feature.

Planting structures should be constructed of class A1 materials.

Perimeter construction that forms part of an external wall, such as parapets, balustrading, etc. of buildings with a storey 11 m or more above ground level, should be constructed of class A2 s-1, d0 or better materials.

F.6 Means of escape from communal terraces and roof gardens

Roof spaces, terraces, or balconies (used as a common amenity) having a travel distance exceeding 18 m should have an alternative escape route.

Where alternative escape is provided the travel distance should be not more than 45 m.

Single direction escape routes from a terrace to a protected stair should not be via a common corridor serving flats.

The staircase, and corridors, leading to or from the roof garden, terrace or balcony should be protected from all floors (excluding an open roof area) in accordance with **24.2.3** for small buildings, or with **24.2.2** for buildings exceeding 11 m in height.

Where a roof garden is fully or partially enclosed, it should be treated as a floor for means of escape and the same protection should be provided to the staircase.

Provisions for the evacuation of disabled occupants, or occupants requiring assistance to escape, should be made in accordance with Clause **54**.

Alarms, both audio and visual, should be provided to the area activated by automatic fire detection and fire alarm systems sited in the protected corridors and stairs serving the terrace or roof garden.

F.7 Communal terraces and roof gardens in specialised housing

The size and design of all balconies and roof terraces used in specialized housing should take into account the need for access and egress, whether assisted or unassisted.

Annex G (normative)
Design and operation of evacuation lifts in residential buildings

COMMENTARY ON ANNEX G

This annex supplements BS EN 81-20 and BS EN 81-70, and provides additional recommendations for the safe evacuation of persons in residential buildings.

The use of remote assistance lifts is outside of the scope of this British Standard.

G.1 Fundamental recommendations

Evacuation lifts should be designed in accordance with BS EN 81-20:2020 and with the following additional recommendations.

a) The minimum lift car size should be type 2 in accordance with BS EN 81-70:2021, Table 3. Where the evacuation lift is part of a lift group, the car size should be at least the same size as the lift cars in the same group.

b) Any ambient temperature sensor should not stop, or prevent the start of, the evacuation operation.

c) An evacuation lift should be provided with a means to suspend evacuation operation.

NOTE The suspend service signal allows a BMS to suspend evacuation operation e.g. if smoke or fire is detected in the lift spaces, lobbies etc.

d) No electrical fault on any other lift located in the same group as the evacuation lift should affect the operation of the evacuation lift.

e) When on evacuation operation, the evacuation lift door should open only where there is a protected lobby in front of the landing door.

f) In the case of lifts with more than one car door, no more than one car should open at a time during evacuation operation.

g) The landing and car doors should be automatic power operated horizontally sliding doors.

G.2 Lift control system

G.2.1 General

Evacuation operations should not override any of the following:

- any electric safety devices;
- the suspend service signal;
- the inspection operation (see BS EN 81-20:2020);
- the emergency electrical operation (see BS EN 81-20:2020);
- any firefighters lift switch (see BS EN 81-72:2020), if applicable;
- the remote alarm system (BS EN 81-28:2018+AC:2019); and
- any maintenance control.

G.2.2 Evacuation control signals, functions and signal priorities

Evacuation control signals, functions and priorities of signals should be provided in accordance with Table G.1.

Table G.1 – Summary of evacuation controls, functions and priorities

Control name	Function name	Signal priority	Subclause	Source
Suspend service signal	Suspend service	1 (Highest)	**G.4**	—
Driver assisted evacuation signal	Driver assisted evacuation operation	2	**G.3.4**	From evacuation lift switch
Automatic evacuation signal	Automatic evacuation operation	3	**G.3.3.2**	From BMS
Evacuation recall signal	Evacuation recall	4 (Lowest)	**G.3.2**	From evacuation lift switch and BMS

*NOTE Where the evacuation lift is also a firefighters' lift to BS EN 81-72, operation of the firefighters lift switch overrides these signals (see **G.2.1**).*

Interruption of a connection to the lift control system should be treated in accordance with Table G.2.

Table G.2 – Signal connection interruption reaction

Interrupted signal	Treatment by lift control system
Suspend service	Active
Driver assisted evacuation (evacuation lift switch)	Active
Automatic evacuation	Inactive
Evacuation recall	Active

G.3 Evacuation operation

G.3.1 General

An evacuation recall signal should be provided by an evacuation lift switch and may also be provided automatically, e.g. by BMS.

The evacuation recall signal should remain active during evacuation operation to prevent a return to normal operation by the lift in case of any evacuation operation signal malfunction.

G.3.2 Evacuation recall (Phase 1)

NOTE 1 Terminology and operations are as given in BS EN 81-20:2020 unless otherwise stated.

On activation of the evacuation recall signal or on deactivation of any evacuation operation (Phase 2), the lift should behave as follows.

a) All registered car and landing calls should be cancelled and no new calls should be registered.

b) Visual indication, e.g. "Evacuation", should be given in the car.

c) Door re-open button, door close button (where provided), door protective device, door reopening device and remote alarm system should remain operative.

d) A car parked at a landing should close the doors and travel non-stop to the evacuation exit floor. When the door is not closed after 20 s, the protective device should be made inactive and the doors should attempt to close. An audible signal should sound in the car until the doors are closed.

e) A car travelling away from the evacuation exit floor should make a normal stop latest at the nearest possible landing without opening the doors, make an audible speech message such as “evacuation” and reverse its direction and return to the evacuation exit floor.

f) A car travelling towards the evacuation exit floor should continue its travel non-stop to the evacuation exit floor.

NOTE 2 If the lift has already started stopping at a level, it is acceptable to make a normal stop and without opening doors, make an audible speech message such as “evacuation”, and to continue to the evacuation exit floor.

g) On arriving at the evacuation exit floor, the car should open its door and should make an audible (e.g. speech message) and a visual indication (e.g. text message “Evacuation – exit now”) to exit should be given in the car. The audible signal should be in accordance with BS EN 81-70.

h) When the door is not closed at the evacuation exit floor after 20 s, the protective device should be made inactive, the doors should attempt to close and an audible signal should sound in the car until the doors are closed.

i) To enable the fire and rescue service to check whether the car is present and persons are not trapped at the evacuation exit floor, any landing call at the evacuation exit floor should initiate opening of the doors.

j) When any evacuation operation is not active, after deactivation of the evacuation recall signal and when the lift is at the evacuation exit floor, the car should return to normal operation and visual indication should be deactivated.

G.3.3 Evacuation operation (Phase 2)

G.3.3.1 General

After evacuation recall is completed and any evacuation operation is activated, the lift should operate as follows.

a) Registration of landing calls should be reactivated on those landings intended to be served according to the evacuation strategy.

b) When evacuation operation is activated and the lift is capable of serving landing calls, information (e.g. potential-free contact) about this service capability and the active evacuation exit floor location of the lift should be available e.g. for BMS.

NOTE This information can be used e.g. for controlling evacuation route indicators.

c) At a given landing, activation of any landing call or any accessibility button should register a call to travel to the evacuation exit floor.

d) At a given landing, the call registration feedback should be according to BS EN 81-70:2021, Table 4, item g).

e) If evacuation operation is not available, e.g. due interrupted connection or lift malfunction, all existing landing calls should be cancelled and call registration feedback should not be given.

Evacuation operation capability and the active evacuation exit floor location should be visually indicated at all evacuation exit floors.

G.3.3.2 Automatic evacuation operation

After the procedure described in **G.3.3.1** and when the automatic evacuation signal is active and when no higher priority signal is active, the lift should operate as follows.

a) In automatic evacuation operation, the lift should serve registered landing calls.

b) The priority of the landing calls should be based on the evacuation strategy, e.g. evacuate the fire floor first, then the distance from the fire floor with the closest landing call getting highest priority.

NOTE 1 The lift control system needs appropriate information for evacuation priorities before automatic evacuation operation.

c) If the lift has started deceleration to answer a landing call, any new landing call should be served after answering the landing call.

d) On arrival at a landing other than the evacuation exit floor, the car should open the doors and give a voice announcement to inform persons to enter the car (e.g. message such as “Evacuation. Enter the car”).

e) Once passengers have entered the car, the doors should be closed and the car should proceed towards the evacuation exit floor.

f) At the latest when the actual door dwell time exceeds 20 s, all door protective devices should be made inactive and the doors should attempt to close.

NOTE 2 If the car is empty, it may answer the next landing call without visiting the evacuation exit floor.

g) If the car makes stops on the way to the evacuation exit floor, the following should be provided:

1) an audible and visual indication to inform persons not to leave the car (e.g. message such as “No exit”). The audible signal should be in accordance with BS EN 81-70;

2) means (e.g. load and/or space sensors) to prevent stops without sufficient (e.g. one wheelchair) capacity of the lift.

NOTE 3 The car may serve other landing calls on the way to the evacuation exit floor if agreed as part of the evacuation strategy.

h) Actuation of the landing call device should not prevent a loaded car from closing its doors and leaving the floor.

i) On arriving at the evacuation exit floor, the evacuation lift car should open its door and should make an audible and visual indication such as “Exit now”. The audible signal should be in accordance with BS EN 81-70.

G.3.3.3 Deactivation of automatic evacuation operation

Automatic evacuation operation should cease when:

a) the automatic evacuation signal is deactivated; or

b) the driver-assisted evacuation signal is activated.

In these cases, the car should return to the evacuation exit floor.

G.3.4 Driver-assisted evacuation

G.3.4.1 General

Driver-assisted evacuation signal should override the automatic evacuation signal.

NOTE Driver-assisted evacuation is evacuation under the control of an “evacuation assistant” authorized by building management, who controls the lift from the car operating panel.

G.3.4.2 Driver-assisted evacuation operation

After the procedure described in **G.3.3.1** and when the driver-assisted evacuation signal is active, the lift should operate as follows.

a) Registered landing calls should be indicated in the car by a blinking car call acceptance light for the given landings or by a blinking floor identification on a display.

b) Where multiple lifts in a group are in evacuation operation, all registered landing calls should be indicated in each car in the driver assisted evacuation operation. If one of the cars serves the landing call, the landing call should be cancelled from the other car.

c) The evacuation exit floor location should be indicated in the car.

d) All heat and smoke-sensitive door protection devices should be made inactive.

e) Constant pressure on any active car call button or on the door close button should cause the car door to close. Closing should start only after 1 s to 2 s delay. If the button is released before the car door is fully closed, the car doors should automatically reopen. When the car door is fully closed, the car call can be registered and the car should start to travel to the destination landing.

f) If car doors are closed by the door close button and car call is not registered within 15 s, the car should travel to the evacuation exit floor and open its doors.

g) At any time, it should be possible to register a new call from within the car. The previous car call should be cancelled. The car should travel in the shortest time to the newly-registered landing.

h) On arrival at any destination, the car should automatically open its selected door and remain at the landing until the car door is closed and a new car call is registered as described in e), or until timeout expires as described in f).

G.3.4.3 Deactivation of driver-assisted evacuation operation

Driver-assisted evacuation operation should cease when the driver-assisted evacuation signal is no longer active. The car should return to the evacuation exit floor.

G.4 Suspension of evacuation operation

When any lobby, lift well or machinery space of an evacuation lift becomes unsafe, e.g. due to smoke or fire, the evacuation operation should be suspended.

NOTE 1 This can be achieved by the BMS or fire detection system giving the suspend service signal.

Upon receiving the suspend service signal, the lift should operate as defined in BS EN 81-73 where the designated landing is to be understood as the evacuation exit floor.

NOTE 2 The suspend service signal can also be used when the evacuation operation is complete.

G.5 Car and landing control equipment

G.5.1 Car controls for driver-assisted evacuation operation

Whilst on driver-assisted evacuation operation, control of the evacuation lift should be by means of buttons or similar devices in the car.

NOTE These may be buttons for the normal use of the lift. In the case of destination controls, the car controls and car signals for the evacuation operation may be arranged behind a cover which is locked and only accessible to the driver

G.5.2 Landing controls

Landing controls should conform to BS EN 81-70.

G.5.3 Landing signals at the evacuation exit floor

The evacuation exit floor should have a car position indicator and a visual indication of the active evacuation operation and active communication system.

G.5.4 Landing signals at the landings intended to be served

Indication of available evacuation service should be given by the landing call registration feedback according to BS EN 81-70. No feedback should be given if the evacuation service is not available.

The illuminated signals specified in BS EN 81-20:2020 should be arrows and should be placed above or adjacent to the landing doors. On arrival the lift should give an audible signal according to BS EN 81-70.

G.5.5 Evacuation lift switch for driver-assisted evacuation operation

An evacuation lift switch should be provided for driver-assisted evacuation operation.

Evacuation lift switches should be located in the lobbies at the evacuation exit floor within 2 m horizontally from the evacuation lift, at a height between 1.4 m and 2.0 m above floor level. The switches should be marked with a safety sign in accordance with BS EN ISO 7010, and it should be clearly indicated to which lift each switch is associated, in accordance with BS EN 81-70. The size of the safety sign should be at least 100 mm × 100 mm.

Operation of the evacuation lift switch should be by means of a key. Where no other key has been agreed, the key should be the unlocking triangle as defined in BS EN 81-20. The key should be available on the site of the lift installation and accessible only to authorized persons.

The switch should have at least two positions clearly marked “0” and “1”. There should be a clear visual indication of the switch position.

NOTE In position “1”, driver-assisted evacuation operation is initiated. Other positions are permitted and can be used for other evacuation operations, e.g. recall “R” and/or automatic operation “A”.

G.6 Evacuation operation communication system

An evacuation lift should have a communication system or similar device for interactive two-way speech communication between the evacuation lift car and:

a) the evacuation exit floor. The communication between the car and the evacuation exit floor should be permanently active during evacuation operation (from the beginning of driver-assisted evacuation) without pressing a control button;

b) the evacuation lift machine room or for lifts without a machine room at the emergency and test panel(s). The microphone should only be made active by pressing a control button on the intercom unit; and

c) optionally, other locations for communication, e.g. central command point. Microphones for other locations should only be made active by pressing a control button on the intercom unit.

The communication equipment within the lift car and at the evacuation exit floor should be a built-in microphone and speaker, and not a telephone handset.

NOTE 1 The communication system may be the same as the communication system required in BS EN 81-72.

NOTE 2 The wiring for any evacuation operation communication system may be installed within the lift well and/or machine room if provided.

G.7 Vandal prone areas

The requirements of BS EN 81-71 should be met when evacuation recall is activated.

Annex H (informative)
Evacuation management planning for people who require support or assistance

H.1 General

Owners and managers of buildings containing flats or maisonettes need to make every effort to ensure that all residents and regular users are aware of the fire safety arrangements for the building and that they understand the actions they are to take in a fire emergency. Easy-read notices with appropriate symbols or pictures can help to communicate the key points to the majority, but in some cases providing information in alternative formats or through an interpreter or translator might be beneficial.

It is expected that information for disabled people will be noted in fire action notices and in the evacuation plan (see Clause **54**). Assumptions cannot be made about the likelihood of individuals to remain in their flats even where a stay put strategy exists. It is also possible that some residents will not be inside their own dwelling at the time a fire occurs; they might, for example, be in the process of using lifts or stairs to reach their home, visiting a neighbour or in a common area such as a terrace or communal garden, in which case returning to their flat might not be appropriate or possible.

A duty of care is also owed to non-residents who might enter a building using a lift and then find themselves having to use the stairs to evacuate if the alarm sounds. Whilst in a building with a stay put strategy many residents and their guests are likely to stay in the relative safety of their own flat, account also needs to be taken of other people who might be on the premises but not be visiting any particular resident. This could, for example, apply to any supplier working in the common areas, or postal workers delivering goods to residents, such as home shopping, parcels, etc. People might have temporary or hidden impairments or health conditions, such as heart or respiratory conditions, which would make independent ambulant escape physically difficult or impossible, and some people might be unable to hear, understand or interpret the need for evacuation.

The UK has an ageing society, and age brings an increasing likelihood of impairment and associated assistance requirements. Many older people live in general housing accommodation rather than supported or care settings; a requirement for assisted evacuation therefore needs to be anticipated in most buildings as part of an inclusive, equitable approach.

Subclauses **H.2** to **H.7** do not give an exhaustive list but are indicative of the range of considerations that can be anticipated.

Subclauses **H.8** to **H.10** summarize some management and building interventions which can be provided.

H.2 Mobility

Assumptions cannot be made about a person’s ability to mobilize, including people who use walking equipment or wheelchair users. If direct and accessible escape to a place of ultimate safety is not possible, the potential for horizontal movement across a building to another fire compartment can be explored.

People who identify as having a mobility impairment and who do not identify as being a wheelchair user, have historically been identified as being “ambulant disabled”. Levels of mobility vary according to the individual, and can potentially vary at different times, so assumptions cannot be made. The range of difficulties can be very broad and can include limited standing tolerance, balance/vestibular difficulties, and conditions affecting stamina such as heart and respiratory conditions. Therefore, whilst some people might be able to use stairs independently, they might not necessarily be able to reach a place of ultimate safety.

H.3 Cognitive

People can have a range of cognitive, learning or neurological conditions that can affect working or long-term memory and recall, concentration, and/or the ability to interpret and retain information (often including orientation and negotiation), as well as different perceptions of safety and risk. In a fire evacuation situation, some people can become anxious and confused and be either unable or reluctant to evacuate.

Loud noises, including fire alarm sounders and flashing lights, can create sensory overload, causing some individuals to become overwhelmed, confused and disorientated. Voice addressable systems can provide reassurance. Providing advance information (such as a fly-through video), and opportunities to experience an evacuation in safe circumstances, such as a fire drill or accompanied run through, can be beneficial.

H.4 Mental health

People who experience poor mental health can experience challenges in an evacuation situation. Some mental health conditions, or medication for those conditions, can affect memory and concentration or sometimes result in the inability to actively react or speed and appropriateness of reaction. Phobias, such as fear of confined spaces or crowds are typical examples which can initially prevent someone from entering a busy stairway.

H.5 Hearing

Some people with severe to profound hearing loss might not be able to hear fire alarm systems in order to react to the alert, or to understand verbal communications during the process of evacuation (especially under emergency lighting conditions where lip-reading is not possible). Some Deaf people communicate by BSL and might not be able to read written instructions. Many people with hearing impairments also experience vestibular difficulties affecting balance.

There might be potential for some hearing-impaired residents to link in their personal warning devices to the fire safety alerting system.

H.6 Vision

The level and type of vision impairment can vary significantly, from a small percentage with complete loss of sight, to blurry, patchy vision or the loss of peripheral or central field vision. Lighting is particularly important in enabling maximum independent for someone with a visual impairment, so emergency lighting conditions present a significant challenge. During an evacuation, a person with a vision impairment escape might be able to follow or be led by others or move independently with voice instructions from someone nearby or an evacuation voice communication (EVC). The confidence in negotiating the way out is also greater if the route is already familiar.

H.7 Other considerations

Many people experience multiple disabilities or conditions. It is therefore important, wherever practicable, to engage with occupants.

The following non-exhaustive list gives examples of people or circumstances where additional considerations, not specifically related to a disability, might require consideration:

- children who are very young;
- people who are very elderly;
- women who are pregnant;
- people who are severely obese or bariatric;
- people under the influence of medication, alcohol or drugs;
- people recovering from surgery or injury;

- people with temporary impairments such as a broken leg; and
- people who do not understand English or who cannot read.

H.8 Communicating the fire safety message

Fire instructions for residents need to be accessible and easily understood. They need to be available in alternative formats such as large print, Easy-read, Braille, and audio. Any video instructions need to offer subtitles and British Sign Language interpretation.

For many people with additional evacuation requirements or who are likely to experience anxiety, the opportunity to experience the process for evacuation in a non-emergency situation is helpful, allowing both management and occupants to assess how this might work in practice and provide additional information or support where appropriate.

All fire notices displayed in the building need to be easy for everyone to understand the contents without ambiguity.

Appropriate fire notices would:

- be written in Plain or preferably Easy-Read English;
- be concise, preferably using bullet points;
- be in large print, 16pt or above;
- use mixed case text (not block capitals)
- be in sans serif font type;
- have good contrast of text against the background of the notice;
- stand out clearly from the wall surfaces where they are located;
- be displayed with a centreline of 1 500 mm above finished floor level; and
- be supplemented with clear symbols and/or include appropriate pictorial signage.

H.9 Features that assist safe evacuation

Escape routes that are designed and managed to meet good accessibility standards, such as signage, handrails, adequate lighting, and visual contrast between adjacent surfaces (including contrasted step edge markings), are helpful to all building users in facilitating safer and easier egress. Further details are provided in BS 8300-2.

The presence of audio and tactile information is beneficial to people with sight or hearing impairments.

An illuminated route out, with low level LED lights or fluorescent markers, can be very reassuring for anyone experiencing difficulty with navigation and orientation.

A voice evacuation communication (EVC) system is helpful in providing instructions and reassurance, particularly to people who may be overwhelmed by the situation; it provides the benefit of repeat information to enhance appropriate interpretation and action.

Evacuation lifts are helpful to all building occupants. Recommendations for evacuation lifts are given in **7.6**.

H.10 Assistance dogs

There are many types of assistance dogs. Some people rely on the assistance of a guide or hearing dog, or a dog that provides physical assistance such as fetching items or gives a warning of epileptic seizure. Assistance dogs are expected to remain with their owners wherever possible, but account needs to be taken of the possibility of a person being separated from their assistance dog and how that would change their ability to evacuate. It also needs to be determined how the dog would be evacuated, as it is unrealistic to expect an owner to leave their assistance dog behind when evacuating in a fire situation.

Annex I (informative)
Advice to occupiers of dwellings in residential buildings

I.1 General

This annex contains information regarding fire safety advice that can be given to occupiers of flats and other dwellings in residential buildings which are not single private dwellings. In general, the same information applies to both occupiers of flats and occupiers of other domestic residential buildings. Where the information differs, the difference is highlighted in the text. The fire and rescue service can generally provide additional advice on fire safety if it is felt to be necessary. Examples of suitable fire instruction notices (see Clause **55**) are given in **I.10**.

I.2 Smoke alarms

The longer a fire burns before it is discovered, the more likely it is to cause death or injury. A fire that starts smouldering at night is therefore very dangerous.

People are not always awoken by the smell of smoke. A fire involving certain furnishings can produce poisonous gases that prevent people from recovering consciousness. Even when people do wake up, their means of exit can be blocked by thick smoke.

Installing smoke alarms in a dwelling does not stop fires starting and does not put a fire out, but if properly installed and looked after they can give an early warning of fire and increase the chances of escape.

Guidance on the selection and installation of smoke alarms can be obtained from local fire and rescue services.

I.3 Ways in which fires can start

Fires in domestic buildings can start in many ways, including:

- careless use of matches, candles, cigarettes and pipes;
- careless use of cookers, especially leaving chip pans without watching them;
- drying and airing of clothes and other items that could burn near heaters (such as gas fires and electric radiant, storage and convector heaters);
- no fire guards to prevent objects from falling into an open fire;
- children playing with matches and cigarette lighters;
- old or faulty domestic appliances, including electric blankets;
- putting portable heaters close to furniture and curtains;
- not taking out the plugs from electrical appliances at night or when away from home, unless they are designed for continuous operation, e.g. refrigerators, video recorders, clocks;
- use of paraffin heaters;
- covering of storage and convector heaters thus preventing air from getting to them; and
- irregular or poor servicing of heating appliances.

I.4 General fire safety advice

Figure I.1 shows an example of a general fire safety advice that can be given to occupiers of dwellings in residential buildings.

Figure I.1 – General fire safety advice for occupiers of dwellings in residential buildings

Small fires are common, causing serious injuries and extensive damage to property and possessions. By following a few simple steps and maintaining a basic level of awareness you can considerably reduce the chances of fire in your home. The easiest and most effective way of protecting your home is by fitting at least one smoke alarm, and regularly making sure it works.

The following 13 tips will help keep your family and home safe:

Fit smoke alarms on each level in your home. Keep them free from dust and test them once a week. Consider buying a 10-year alarm; otherwise change the batteries in your alarm every year.

Make a fire action plan so that everyone in your home knows how to escape if there is a fire.

Keep the exits from your home clear so that people can escape if there is a fire.

Make sure that everyone in your home can easily find the keys for doors and windows.

Take extra care in the kitchen – accidents while cooking account for over half of fires in homes. Never leave young children alone in the kitchen.

Take extra care when cooking with hot oil. Consider buying a deep-fat fryer which is controlled by a thermostat (if you don't already have one).

Never leave lit candles in rooms that nobody is in or in rooms where children are on their own. Make sure candles are in secure holders on a surface that doesn't burn and are away from any materials that could burn.

Make sure cigarettes are stubbed out properly and are disposed of carefully, and never smoke in bed.

Get into the habit of closing doors at night. If you want to keep a child's bedroom door open, close the doors to the lounge and kitchen; it might help to save their life if there is a fire.

Don't overload electrical sockets. Remember, one plug for one socket.

Keep matches and lighters where children can't see or reach them.

Take special care when you're tired or when you've been drinking.

Don't leave the TV or other electrical appliances on standby as this could cause a fire. Always switch it off and unplug it when it is not in use.

If you or a member of your household has any difficulty seeing, hearing or moving about the home, you will need to take extra care to deal with the risk of a fire. Your local fire and rescue service will be able to assess how safe your home is and help to fit fire safety equipment such as smoke alarms.

High-rise flats are built to be fire-resisting, and most fires won't spread further than one or two rooms. Walls, ceilings and doors will hold back flames and smoke, so if there's a fire somewhere else in the building, you're usually safest staying in your flat unless you're affected by heat or smoke. You should plan how to escape if there is a fire in your home. It is likely that the flat will share common areas with other flats. The owner or occupiers of the flats will have the responsibility of making sure that the necessary fire precaution measures needed in these areas are installed. For example, there may be a fire alarm and the doors and fire-resisting features of the common areas will need to be maintained.

It is important that occupiers understand the fire precaution measures built into the common areas and that they ask the landlord to explain the safety plans for the premises and make sure that they are familiar with what they should do when a fire happens. If you cannot escape you will need to find a room where you can wait for assistance. This is particularly important if you have difficulty moving around or using stairs. It is advisable for your safe room to have a window that opens, and a phone.

I.5 Heating

Most dwellings, including flats, are provided with a fixed heating system. The risk of a fire occurring can be reduced if the fixed heating system is used rather than heaters, as all types of portable heaters can start a fire if they are not properly sited, used correctly and maintained in good working order.

The entrance lobby and corridor of a flat is the normal escape route in the event of a fire, so it is essential that portable radiant heaters are not used in these areas. It is not advisable to

use paraffin heaters. Special care needs to be taken with portable bottle gas heaters, particularly when changing cylinders. The manufacturer's instructions for all portable heaters include guidance on where they are to be placed, how they are to be used and how they can be kept in safe working order.

I.6 Doors

Self-closing doors are provided in flats and other dwellings in residential buildings, to stop the spread of fire and smoke. It is most important that they are not wedged open and that the self-closing mechanism works correctly.

If self-closing doors do not close themselves, it is the responsibility of the occupants to ensure that the defect is reported to the porter, caretaker or landlord, or to the local housing authority.

It can help to prevent the spread of fire if occupants tightly close as many doors as possible before going to bed or when leaving the premises empty.

I.7 Abuse of firefighting equipment

Firefighting equipment (in the form of fire extinguishers, fire mains and outlets) and fire safety signs might be installed in flats and other residential buildings. Where such equipment is installed, it is the responsibility of all occupants to ensure that it is not interfered with, and that, if any item of equipment is found damaged, to report it immediately.

I.8 Access roads

It is important that fire and rescue service access roads to blocks of flats and other residential buildings are kept clear and unobstructed, to allow access by the fire and rescue service and other emergency vehicles at all times. It is the responsibility of all occupants to ensure that they do not park their cars in these roads or allow their visitors to do so, and if they see any vehicles parked there, to report them.

I.9 Automatic water fire suppression systems (AWFSS)

These systems are activated by heat from the fire, and release water onto it. They are designed to prevent the fire growing, so that much less smoke and heat are produced and people have more time to escape. In many cases an AWFSS will put the fire out. Where an AWFSS is installed it is important that the sprinklers or water mist nozzles are not painted over, since this can slow their response to a fire. Concealed sprinklers hide the sprinkler using a cover plate, which falls away when the solder holding it in place melts. It is particularly important that this cover plate is not painted over.

I.10 Examples of fire instruction notices

The fire instruction notice provides instructions on fire precautions and actions to take in the event of a fire. This annex gives examples of fire instruction notices for a range of situations.

An example of a suitable fire instruction notice for flats is shown in Figure I.2.

An example of a suitable fire instruction notice for other residential buildings is shown in Figure I.3.

Figure I.2 – Example of a fire instruction notice for use in flats

This building has been built in such a way as to protect the people in it if a fire breaks out.
The important thing to remember is that if the fire starts in your home, it is up to you to make sure that you can get out of it.

AT ALL TIMES

Make sure that the smoke alarms in your home are working.

Do not store anything in your hall or corridor, especially anything that will burn easily.

Use the fixed heating system fitted in your home. If this is not possible, only use a convector heater in your hall or corridor. Do not use any form of radiant heater there, especially one with either a flame (gas or paraffin) or a radiant element (electric bar fire).

Do not store things in the cupboard(s) where your gas and electricity meters are fitted.

Do not block access roads to the building.

IF A FIRE BREAKS OUT IN YOUR HOME

If you are in the room where the fire is, leave straight away, together with anybody else, then close the door.

Do not stay behind to try to put the fire out.

Tell everybody else in your home about the fire and get everybody to leave. Close the front door and leave the building.

Do not use the lift (unless it is a designated evacuation lift).

Do not use a balcony unless it is part of the escape route from the building.

CALL THE FIRE AND RESCUE SERVICE.

IF YOU SEE OR HEAR OF A FIRE IN ANOTHER PART OF THE BUILDING

It will usually be safe for you to stay in your own home.

You must leave your home if smoke or heat affects it. Close all doors and windows.

CALLING THE FIRE AND RESCUE SERVICE

The fire and rescue service should always be called to a fire, even if it only seems a small fire. This should be done straight away.

The way to call the fire and rescue service is by telephone as follows.

Dial 999.

When the operator answers, give the telephone number you are ringing from and ask for FIRE.

When the fire and rescue service reply, tell them clearly the address where the fire is.

Do not end the call until the fire and rescue service have repeated the address to you and you are sure they have got it right. The fire and rescue service cannot help if they do not have the full address.

Figure I.3 – Example of a fire instruction notice for use in other residential buildings

If a fire starts in your home, it is up to you to make sure that you can get out of it. Do not wait until a fire happens. Read these instructions and find out the best way for you and your family to get out of your home and also out of the building if a fire started somewhere else. There may be more than one way out. If you and all the other people in the building follow these rules you will all be much safer and less likely to start a fire or be injured in one.

AT ALL TIMES

Make sure that the smoke alarms in your home are working.

Do not store anything in your hall or corridor, especially anything that will burn easily.

Use the fixed heating system fitted in your home. If this is not possible, only use a convector heater in your hall or corridor. Do not use any form of radiant heater there, especially one with either a flame (gas or paraffin) or a radiant element (electric bar fire).

Do not store things in the cupboard(s) where your gas and electricity meters are fitted.

Do not block access roads to the building.

IF A FIRE BREAKS OUT IN YOUR HOME

If you are in the room where the fire is, leave straight away, together with anybody else, then close the door.

Do not stay behind to try to put the fire out.

Tell everybody else in your home about the fire and get everybody to leave. Close the front door and leave the building.

Do not use the lift (unless it is a designated evacuation lift).

Do not use a balcony unless it is part of the escape route from the building.

CALL THE FIRE AND RESCUE SERVICE.

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The fire and rescue service should always be called to a fire, even if it only seems a small fire. This should be done straight away.

The way to call the fire and rescue service is by telephone as follows.

Dial 999.

When the operator answers give the telephone number you are ringing from and ask for FIRE.

When the fire and rescue service reply tell them clearly the address where the fire is.

Do not end the call until the fire and rescue service have repeated the address to you and you are sure they have got it right. The fire and rescue service cannot help if they do not have the full address.

Annex J (normative)
Routine inspection and maintenance of fire safety installations

COMMENTARY ON ANNEX J

It is essential for the safety of the occupants of a building that fire safety equipment (including both active and passive fire protection provisions) is inspected frequently.

Unless temporary alternative fire safety systems can be put in place, it might be appropriate for certain of the inspections carried out at three-monthly or longer intervals to be done outside normal working hours.

Where an automatic self-test facility is included, this may be used to assist with some of the checks described in this annex. However, manual testing is still required, e.g. for sprinkler systems.

J.1 General

Although much of the inspection can be undertaken by suitably trained personnel, a formal agreement should be made with the installer or the installer's representative or equally competent external provider to provide the regular inspection and testing described in the relevant British Standards for individual fire safety installations.

J.2 Daily inspections

J.2.1 General

The checks described in **J.2.2** to **J.2.6** should be undertaken daily. For premises with defined opening times such as shops, theatres and cinemas, these checks should be undertaken prior to members of the public entering the building.

J.2.2 Fire detection and fire alarm systems

All fire detection and fire alarm systems should be inspected daily. In particular, it should be verified that:

a) the control and indication panel indicates normal operation or, if any fault is indicated, that it has been logged and the appropriate action(s) taken; and

b) any fault recorded the previous day has received attention.

J.2.3 Smoke control systems and fire damper control panels

All smoke control systems and fire damper control panels (e.g. stairwell, MSVS, basement, car park, other ventilation) should be inspected daily. In particular, it should be verified that:

a) the control and indication panel indicates normal operation or, if any fault is indicated, that it has been logged and the appropriate action(s) taken; and

b) any fault recorded the previous day has received attention.

J.2.4 Emergency and escape lighting systems

All emergency and escape lighting systems should be inspected daily. In particular, it should be verified that:

a) every lamp is lit if the system is maintained;

b) the control panel for any central battery system or generator indicates normal operation; and

c) any fault found is logged and the appropriate action(s) taken.

J.2.5 Sprinkler systems

All sprinkler systems should be inspected daily. In particular, it should be verified that:

a) unless the connection to the fire and rescue service is automatically monitored continuously, there is continuity of the connections between the alarm switch and the control unit and between the control unit and the fire and rescue service (usually via a remote manned centre);

b) unless automatically controlled, the water level and air pressure are correct in any pressure tank that provides a duplicate supply; and

c) any necessary corrective action(s) are taken.

J.2.6 Fire door automatic release mechanisms

All doors that are held open by automatic release mechanisms should be released daily.

J.2.7 Portable fire extinguishers and hose reels

All points should be inspected daily at which portable fire extinguishers or hose reels are usually located. Missing fire extinguishers or hose reels should be replaced immediately. Any extinguisher used in a fire or for training, or otherwise discharged, should be recharged immediately. Damaged extinguishers or hose reels should be repaired or replaced.

J.3 Weekly

J.3.1 General

In addition to the checks recommended in **J.2**, the checks described in **J.3.2** to **J.3.7** should be undertaken once a week.

J.3.2 Fire detection and fire alarm systems

All fire detection and fire alarm systems should be inspected weekly. In particular, it should be verified that:

a) the control equipment is able to receive a fire signal and to initiate the evacuation procedure, recording which trigger device has been used, in accordance with BS 5839-1:2017; and

b) any standby batteries are in good condition and the fuel, oil and coolant levels of any standby generators are correct, topping up as necessary.

J.3.3 Sprinkler systems

All sprinkler systems should be inspected weekly. In particular, it should be verified that:

a) water and air pressure gauge readings on installations, trunk mains and pressure tanks, and water levels in elevated private reservoirs, rivers, canals, lakes, water storage tanks, etc., meet the design criteria and all gauge readings and levels are recorded;

b) each alarm valve has been tested and the water motor alarm has been sounded for at least 30 s;

c) automatic pumps start when the water pressure is reduced to the specified level;

d) for automatic pumps powered by a diesel engine:

   1) the fuel and oil levels of the engine meet the design and/or manufacturer's specification;

   2) the oil pressure, the flow of cooling water through open-circuit cooling systems and/or the water level in the primary circuit of closed-circuit cooling systems, as appropriate, meet the design and/or manufacturer's specification;

   3) the engine restarts using the manual start test button;

e) the electrolyte level and density of all lead acid Plante cells meet the design and/or manufacturer's specification. If the density is low the battery charger should be checked for efficient operation and, if the charger is working correctly, the affected cells should be replaced;

f) the mode monitoring system for stop valves in life safety installations is operating correctly;

g) there is continuity of connection between the alarm switch and the control unit and between the control unit and the fire and rescue service (usually via a remote manned centre) for automatically monitored connections; and

h) trace heating systems provided to prevent freezing in the sprinkler system are functioning correctly.

J.3.4 Gaseous, foam and powder extinguishing systems

All gaseous, foam and powder extinguishing systems should be inspected weekly. In particular, it should be verified that:

a) any pressure gauges are functioning correctly;

b) all operating controls are both properly set and accessible;

c) all indicators are functioning correctly;

d) the equipment, particularly pipework and nozzles, is free from dust and dirt, is not physically damaged nor leaking, and remains in its designed position;

e) the fire risk and its enclosure have not changed; and

f) the quantity of extinguishing medium is correct and, for foam systems, the water supply is available and at the correct pressure.

J.3.5 Smoke control systems and fire damper control panels

Actuation of the system should be simulated once a week. It should be verified that any fans and powered exhaust ventilators operate correctly, smoke dampers close (or open in some systems), fire dampers close, natural exhaust ventilators open, any associated doors operate correctly, automatic smoke curtains move into position, etc.

NOTE On large multi-zone installations it might be acceptable, with agreement from the relevant authorities, to rotate the equipment tested so that a system is tested every week and individual items are operated at intervals of no more than 3 months.

J.3.6 Evacuation lifts and firefighters lift installations

The operation of the evacuation and firefighters lift switches should be tested once a week and should be repaired or replaced if found to be faulty.

J.3.7 Fire hydrants

All fire hydrants should be inspected once a week. In particular, it should be verified that there are no obstructions impeding access, that the indicator plates are in position, and that the isolating valves are locked open.

J.4 Monthly

J.4.1 General

In addition to the checks recommended in **J.2** and **J.3**, the checks described in **J.4.2** to **J.4.9** should be undertaken once a month.

J.4.2 Fire detection and fire alarm systems

Any standby generator should be started up once a month by simulating failure of the normal power supply, and allowed to energize the system for at least 1 h, while the system is monitored for any malfunctioning caused by the use of the generator. After restoring the normal supply, the charging arrangements for the generator starting battery should be tested, and the appropriate action should be taken if they are found not to be functioning correctly. In addition, the oil and coolant levels should be topped up and the fuel tanks filled.

J.4.3 Emergency and escape lighting systems

A failure of the supply to the normal lighting should be simulated once a month, during which all luminaires and exit signs should be inspected to determine whether they are functioning correctly. If the standby supply is from a generator with back-up batteries, a test should be carried out to determine whether all luminaires and exit signs function correctly even if the generator is prevented from starting. Any luminaires or exit signs that do not function correctly should be repaired or replaced.

After restoring the supply to the normal lighting, it should be verified that:

a) indicator lamps or devices to self-contained luminaires or internally illuminated exit signs show that the normal supply has been restored;

b) indicator lamps or devices to central battery systems show that the normal supply has been restored, and that the charging arrangements are functioning correctly;

c) the charging arrangements for any battery for starting a generator are functioning correctly; and

d) the oil and coolant levels are topped up and the fuel tanks filled.

J.4.4 Gaseous, foam and powder extinguishing systems

Gaseous, foam and powder extinguishing systems should be checked once a month.

J.4.5 Evacuation lifts and firefighters lift installations

A failure of the primary power supply should be simulated once a month. If a generator provides the standby power supply, it should energize the lift(s) for at least 1 h.

J.4.6 Hose reels

Hose reels should be visually inspected once a month. In particular, it should be verified that there are no leaks and that drum assemblies are free to rotate on their spindles.

J.4.7 Automatic opening doors

The operation of fail-safe mechanisms should be tested once a month, either by “breaking out” the doorset or by simulating failure of the mains power supply, as appropriate. The results of the test should be recorded. Any doors that are found to be faulty should be repaired or replaced.

J.4.8 Doors on hold-open devices

The operation of hold-open devices should be tested once a month by simulating failure of the mains power supply or operation of the fire detection and fire alarm system. The results of the test should be recorded. Any doors that are found to be faulty should be repaired or replaced.

J.4.9 Emergency and panic escape doors

The operation of all emergency and panic escape devices, especially on external doors not used for other purposes, should be checked once a month for ease of operation and opening of the door.

NOTE Weather conditions can affect the door and frame relationship, and therefore the ease of operation of escape devices.

J.5 Three-monthly

In addition to the checks recommended in **J.2**, **J.3** and **J.4**, the actuation of all smoke control systems should be simulated once every three months. All zones should be separately tested and it should be verified that any fans and powered exhaust ventilators operate correctly, smoke dampers close (or open in some systems), etc.

All fire damper control panels should also be tested as above.

J.6 Six-monthly

J.6.1 General

In addition to the checks recommended in **J.2**, **J.3**, **J.4** and **J.5**, the checks described in **J.6.2** and **J.6.3** should be undertaken once every six months.

Arrangements should be made for six-monthly inspections and tests to be carried out by competent persons on the fire detection and fire alarm systems, the sprinkler systems, any extinguishing systems, the emergency and escape lighting systems and the firefighters lift, for any defects found to be logged and the necessary action taken, and for certificates of testing to be obtained.

J.6.2 Fire doors

All fire doors should be inspected every six months. In particular, it should be verified that:

a) heat-activated seals and smoke seals are undamaged;

b) door leaves are not structurally damaged or excessively bowed or deformed;

c) gaps between the door leaf and the frame are not so small as to be likely to bind, or so large as to prevent effective fire and smoke-sealing; and

d) hanging devices, securing devices, self-closing devices and automatic release mechanisms are operating correctly.

J.6.3 Fire mains

All fire mains should be inspected every six months. In particular, it should be verified that:

a) inlets, landing valves, drain valves, door hinges and locking arrangements for inlet and landing valve boxes are ready for immediate use, and spindles, glands and washers are in a satisfactory condition;

b) for wet mains:

   1) booster pumps and their associated mechanical and electrical apparatus are functioning correctly; and

   2) storage tanks are full of clean water.

J.7 Yearly

In addition to the checks recommended in **J.2**, **J.3**, **J.4**, **J.5** and **J.6**, arrangements should be made for annual inspections and performance tests of the following to be carried out by competent persons, for any defects to be logged and the necessary action taken, and for certificates of testing to be obtained:

a) fire detection and fire alarm systems;

b) self-contained luminaires with sealed batteries, if more than 3 years old;

c) sprinkler, drencher and water mist systems;

d) smoke control systems and associated components (e.g. fans, AOVs, smoke control dampers);

e) fire dampers and any associated control systems;

f) fire doors and associated equipment (e.g. control systems, closers/openers, hinges, door furniture);

g) auxiliary power supplies (e.g. generators, UPS equipment);

h) evacuation lifts;

i) firefighters lift installations;

j) fire hydrants;

k) fire mains;

l) portable fire extinguishers; and

m) hose reels.

Stocks of foam concentrate or solution should be checked annually and replenished as necessary.

NOTE Attention is drawn to the testing and inspection requirements of BS 7671.

All ducting and shafts should be cleaned at least annually following the correct standards. This includes standard ventilation duct, fire-resisting duct and smoke control duct, as well as ventilation shafts and smoke control shafts. Certificates of cleaning should be obtained

J.8 Records

Records should be kept for each system and component of active and passive fire protection.

Positive evidence of recording of inspections, even where there are no faults should be generated, as this gives confidence that the inspections are being regularly undertaken.

Records should show faults where found, the corrective action, the time taken to complete any corrective action and any actions taken to prevent recurrence.

J.9 Faults

*COMMENTARY ON **J.9***

Faults are not simply a maintenance issue to be dealt with later. Faults in active and passive fire protective measures are a life safety issue.

If faults are found, a written risk assessment should be made with regard to what measures might need to be put in place, and residents should be advised accordingly.

Bibliography

Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 3632, *Residential park homes – Specification*

BS 5516-2, *Patent glazing and sloping glazing for buildings – Code of practice for sloping glazing*

BS 5839-3, *Fire detection and alarm systems for buildings – Specification for automatic release mechanisms for certain fire protection equipment*

BS 6891, *Specification for the installation and maintenance of low pressure gas installation pipework of up to 35 mm (R114) on premises*

BS 7273-6, *Code of practice for the operation of fire protection measures – Fire detection and fire alarm systems – Interface with ancillary systems and equipment*

BS 7346 (all parts), *Components for smoke and heat control systems*

BS 7974, *Application of fire safety engineering principles to the design of buildings – Code of practice*

BS 8220 (all parts), *Guide for security of buildings against crime*

BS 8300 (both parts), *Design of an accessible and inclusive built environment*

BS 8579, *Guide to the design of balconies and terraces*

BS 9266:2013, *Design of accessible and adaptable general needs housing – Code of practice*

BS 25999, *Business continuity management – Specification*

BS EN 81-73, *Safety rules for the construction and installation of lifts – Particular applications for passenger and goods passenger lifts – Behaviour of lifts in the event of fire*

BS EN 1155, *Building hardware – Electrically powered hold-open devices for swing doors – Requirements and test methods*

BS EN 1991-1-2, *Eurocode 1 – Actions on structures – Traffic loads on bridges*

BS EN 12101-13 (in preparation), *Smoke and heat control systems – Part 13 – Pressure differential systems (PDS) – Design and calculation methods, installation, acceptance testing, routine testing and maintenance*

BS EN 13501-5, *Fire classification of construction products and building elements – Classification using data from external fire exposure to roofs tests*

BS EN ISO 14122-4, *Safety of machinery – Permanent means of access to machinery – Fixed ladders*

PAS 79-2, *Fire risk assessment – Housing – Code of practice*

PD 7974-2, *Application of fire safety engineering principles to the design of buildings – Spread of smoke and toxic gases within and beyond the enclosure of origin (Sub-system 2)*

PD 7974-5, *Application of fire safety engineering principles to the design of buildings – Fire and rescue service intervention (Sub system 5)*

PD 7974-6, *Application of fire safety engineering principles to the design of buildings – Human factors – Life safety strategies – Occupant evacuation, behaviour and condition (Sub-system 6)*

Other publications

[1] GREAT BRITAIN. Building Regulations 2010 and subsequent amendments. London: The Stationery Office.

[2] GREAT BRITAIN. Regulatory Reform (Fire Safety) Order 2005. London: The Stationery Office.

[3] GREAT BRITAIN. Building (Amendment) (Wales) Regulations 2014. London: The Stationery Office.

[4] SCOTLAND. Building (Scotland) Regulations 2004 and subsequent amendments. Edinburgh: The Stationery Office.

[5] GREAT BRITAIN. Building Regulations (Northern Ireland) 2012 and subsequent amendments. Belfast: The Stationery Office.

[6] SCOTLAND. Fire Safety (Scotland) Regulations 2006. Edinburgh: The Stationery Office.

[7] NORTHERN IRELAND. Fire Safety Regulations (Northern Ireland) 2010. Belfast: The Stationery Office.

[8] GREAT BRITAIN. Construction Products Regulations 2013. London: The Stationery Office.

[9] HISTORIC SCOTLAND. *Conversion of traditional buildings*. Guide for Practitioners 6. Edinburgh: Historic Scotland, 2007.

[10] HISTORIC SCOTLAND. *Fire safety management in traditional buildings*. Guide for Practitioners 7. Edinburgh: Historic Scotland, 2010.

[11] LACORS. *Housing – Fire safety*. London: LACORS, 2008. ISBN 978 1 84049 638 3.

[12] GREAT BRITAIN. Housing Act 2004. London: The Stationery Office.

[13] DEPARTMENT OF HEALTH. *Guidance in support of functional provisions (Fire safety in the design of healthcare premises)*. Health Technical Memorandum 05-02: Firecode. London: The Stationery Office, 2015.

[14] GREAT BRITAIN. Equality Act 2010. London: The Stationery Office.

[15] GREAT BRITAIN. Disability Discrimination Act 1995. London: The Stationery Office.

[16] DEPARTMENT FOR COMMUNITIES AND LOCAL GOVERNMENT. *The Building Regulations 2010 – Approved Document M: Access to and use of buildings – Volume 1: Dwellings*. 2015 ed. London: The National Building Specification (NBS), 2015.

[17] MINISTRY OF HOUSING, COMMUNITIES AND LOCAL GOVERNMENT. *The Building Regulations 2010 – Approved Document B: Fire safety*. (Volumes 1 and 2.) 2019 edition incorporating 2020 amendments for use in England. Crown Copyright, 2020.

[18] SCOTTISH BUILDING STANDARDS AGENCY. *The Scottish Building Standards Technical Handbook – Domestic – Section 2: Fire*. Edinburgh: Scottish Government, 2013.

[19] NORTHERN IRELAND DEPARTMENT OF FINANCE AND PERSONNEL. *The Building Regulations (NI) 2000 Technical Booklet E – Fire safety*. Belfast: The Stationery Office, 2005.

[20] BUILDING RESEARCH ESTABLISHMENT. *Design methodologies for smoke and heat exhaust ventilation*. BR 368. Watford: BRE, 1999.

[21] SMOKE CONTROL ASSOCIATION. *Guidance on smoke control to common escape routes in apartment buildings (flats and maisonettes).* Reading: FETA, 2015.

[22] GREAT BRITAIN. Building Regulations 2000. London: The Stationery Office.

[23] BUILDING RESEARCH ESTABLISHMENT. *Increasing the fire resistance of existing timber floors*. DG 208. Watford: BRE, 1988.

[24] BUILDING RESEARCH ESTABLISHMENT. *External fire spread: building separation and boundary distances*. BR 187. Watford: BRE, 1991.

[25] BUILDING RESEARCH ESTABLISHMENT. *Fire safety of PTFE-based materials used in building*. BR 274. Watford: BRE, 1994.

[26] ASSOCIATION FOR SPECIALIST FIRE PROTECTION. *Fire resisting ductwork tested to BS 476 Part 24 (Blue Book)*. Second edition. Bordon: ASFP, 2007.

[27] ASSOCIATION FOR SPECIALIST FIRE PROTECTION. *Volume 1: Fire dampers (European standards) – E (integrity) and ES (integrity and leakage) classified (Grey Book)*. Second edition. Bordon: ASFP, 2010.

[28] ASSOCIATION FOR SPECIALIST FIRE PROTECTION. *Fire stopping and penetration seals for the construction industry (Red Book)*. Third edition. Bordon: ASFP, 2011.

[29] GLASS AND GLAZING FEDERATION. *A guide to best practice in the specification and use of fire-resistant glazed systems*. Edition 3. London: GGF, 2011.

[30] ARCHITECTURAL AND SPECIALIST DOOR MANUFACTURERS' ASSOCIATION. *Best practice guide to timber fire doors*. Second edition. High Wycombe, ASDMA, 2015.

[31] LOSS PREVENTION COUNCIL. *LPC design guide for the fire protection of buildings*. London: Fire Protection Association, 2000.

[32] DOOR AND HARDWARE FEDERATION. *Code of practice for fire-resisting metal doorsets*. CP 102. Tamworth: DHF, 2010.

[33] COMMUNITIES AND LOCAL GOVERNMENT. *Fire performance of escape stairs: BD 2569*. London: CLG, 2009.

[34] BUILDING CONTROL ALLIANCE. *Use of timber stairs in residential buildings exceeding three storeys*. Guidance Note 19. BCA, 2014.

[35] GREAT BRITAIN. Gas Safety (Installation and Use) Regulations 1998. London: The Stationery Office.

[36] INSTITUTION OF GAS ENGINEERS AND MANAGERS. *Recommendations on transmission and distribution practice – PE and steel gas services and service pipework*. IGE/TD/4 Edition 4 (1725). Loughborough: IGEM.

[37] GREAT BRITAIN. Pipelines Safety Regulations 1996. London: HMSO.

[38] INSTITUTION OF GAS ENGINEERS AND MANAGERS. *Gas in multi-occupancy dwellings*. IGEM/G/5. Loughborough: IGEM, 2012.

[39] GREAT BRITAIN. Petroleum (Consolidation) Regulations 2014. London: The Stationery Office.

[40] GREAT BRITAIN. Dangerous Substances and Explosive Atmospheres Regulations 2002. London: The Stationery Office.

[41] FIRE INDUSTRY ASSOCIATION. *Code of practice for the provision of premises information boxes in high-rise residential buildings*. Hampton: FIA, 2020.

[42] NATIONAL FIRE CHIEFS COUNCIL (NFCC). *Fire safety in specialised housing – Guidance*. London: NFCC, 2017.[7)]

[43] SCOTTISH GOVERNMENT. *Practical fire safety guidance: the evacuation of disabled persons from buildings*. Edinburgh: Scottish Government, 2014.

[44] GREAT BRITAIN. Construction (Design and Management) Regulations 2015. London: The Stationery Office.

[45] NORTHERN IRELAND. Construction (Design and Management) Regulations (Northern Ireland) 2007. Belfast: The Stationery Office.

[46] HEALTH AND SAFETY EXECUTIVE. *Fire safety in construction*. HSG 168. London: HSE Books, 2010.

[47] CONSTRUCTION CONFEDERATION AND FIRE PROTECTION ASSOCIATION. *Fire prevention on construction sites – The joint code of practice on the protection from fire of construction sites and buildings undergoing renovation*. London: Construction Confederation and Fire Protection Association, 2009.

[48] FIRE PROTECTION ASSOCIATION. *Design guide for the fire protection of buildings: Essential principle*s. London: FPA, 2003.

[49] COMMUNITIES AND LOCAL GOVERNMENT. *Arson control forum annual report*. London: CLG, 2006.

[50] ARSON PREVENTION BUREAU. *How building design can reduce the threat from arson*. London: Arson Prevention Bureau, 1997.

[51] CHARTERED INSTITUTION OF BUILDING SERVICES ENGINEERS. *Fire safety engineering: CIBSE Guide E*. London: CIBSE, 2010.

[52] GREAT BRITAIN. Furniture and Furnishings (Fire) (Safety) Regulations 2010. London: The Stationery Office.

[7)] Available from https://www.nationalfirechiefs.org.uk/write/MediaUploads/NFCC%20Guidance%20publications/NFCC_Specialised_Housing_Guidance_-_Copy.pdf.

