BS 9991:2015

BSI Standards Publication

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

bsi.

...making excellence a habit.™

Publishing and copyright information

Published by BSI Standards Limited 2015

ISBN 978 0 580 86739 2

ICS 13.220.01; 91.040.30

The following BSI references relate to the work on this document:
Committee reference FSH/14
Draft for comment 15/30301829 DC

Publication history

First published December 2011
Second (present) edition, October 2015

Amendments issued since publication

Date	Text affected

Contents

List of tables

Summary of pages

This document comprises a front cover, an inside front cover, pages i to viii, pages 1 to 174, an inside back cover and a back cover.

Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 October 2015. 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 its secretary.

Supersession

This British Standard supersedes BS 9991:2011, which is withdrawn.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:

- change from "sheltered or extra care housing" to "specialized housing" and expansion of related recommendations;
- expanded recommendations for escape from basements;
- updating of recommendations relating to lifts;
- inclusion of new recommendations for power supplies;
- inclusion of new recommendations for cluster accommodation;
- inclusion of new guidance on the management of additional needs and disabilities;
- general update to take into account new and revised standards published since 2011.

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 to ensure that an integrated approach is used in any one building.

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

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

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

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 fire-fighting 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].

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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

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;

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;

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 fire suppression systems 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;

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 ensure that an adequate standard of life safety can be achieved 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, fire-fighter 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 ensure that a fire is contained within the flat of origin and that common escape routes and stairways remain 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 **3.58** 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 fire-fighting is in progress. As such, the measures in this British Standard for the protection of common stairs are designed to ensure 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 **17** 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 fire-fighters. 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 some protection to the stair core, and to aid fire-fighters 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 alarm and fire detection system

In most flats, the installation of smoke alarms or fire detection and 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 to ensure 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 alarm and fire detection systems are given in Section **3**.

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 [1)].

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' vulnerabilities.

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 ensure that they are sufficiently robust to accommodate the increasing needs of occupants over time, whether that is a change to physical ability or mental cognisance. 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.

[1)] Last accessed 27 October 2015.

Table 1 **Housing typology**

Category [A)]	Sub-categories [B)]	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' additional needs*
	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 needs of its residents
Specialized housing		*Housing specifically for people with a level of need who require support and care services*
	Sheltered/retirement	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	Institutional accommodation (suites of bedrooms) with 24 h nursing care
	Specialized care homes	Institutional accommodation for specific needs including dementia

[A)] Shaded categories fall outside the scope of BS 9991.

[B)] 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.

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 are otherwise vulnerable to 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 ensure that the building is future-proofed for an ageing population. This may 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 has 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, ensure 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 fire-fighting and evacuation generated by buildings in excess of 50 m high might mean that specific evaluation of all fire safety provisions is needed using a qualitative design review 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.

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.

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].

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 needs;

e) by ensuring that all of the fire safety measures in the building are kept in working order, and in particular that the means of escape are always available;

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) 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;

c) specialized housing.

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, residential care homes, 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 regional 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 ensure that the overall design of a building assists and enhances 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 fire-fighters. 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, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 – Part 5: Carbon steel oil storage tanks – Specification*

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