

BRITISH STANDARD

Code of practice for fire door assemblies

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Contents

Foreword *ii*

0	Introduction	<i>1</i>
1	Scope	<i>2</i>
2	Normative references	<i>2</i>
3	Terms and definitions	<i>2</i>
4	Determination of fire resistance of doors	<i>4</i>
5	Marking	<i>5</i>
6	Specifying fire doors	<i>6</i>
7	Door and frames	<i>7</i>
8	Handling and storage of doors on site	<i>9</i>
9	Installation of fire doors	<i>9</i>
10	Glazing	<i>12</i>
11	Building hardware	<i>13</i>
12	Installation of fire or smoke seals	<i>14</i>
13	Maintenance	<i>17</i>
14	Decoration	<i>19</i>

Annexes

Annex A (informative) Guidance on essential and non-essential building hardware *20*

Bibliography *21*

List of tables

Table 1	– Range of colour codes giving a method of performance identification for non-metallic doors and frames	<i>5</i>
Table 2	– Recommendations for the joint between timber door frames and walls to provide 30 min fire resistance	<i>11</i>
Table 3	– Recommendations for the joint between timber door frames and walls to provide 60 min fire resistance	<i>11</i>
Table A.1	– Essential building hardware	<i>20</i>

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 22, an inside back cover and a back cover.

Foreword

Publishing information

This British Standard is published by BSI and came into effect on 30 September 2008. It was prepared by Subcommittee B/538/2, *Doors*, under the authority of Technical Committee B/538, *Doors, windows, shutters, hardware and curtain walling*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This British Standard supersedes BS 8214:1990, which is withdrawn.

Information about this document

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

- The details regarding the manufacturing of a fire door have been removed.
- The guidance now concentrates on the selection of fire door sets, door assemblies and door leaves.
- The guidance is now applicable to fire doors of all materials.
- Guidance on site handling has been retained and expanded.

In recent years there has been an increase in performance-based regulations and codes and a corresponding decrease in the use of specified constructions for particular functional applications. Fire doors are now specified by the level of performance that they can attain when subjected to the standard method of test for the determination of the fire resistance of elements of construction. There are currently two methods of test, given in BS 476-22 and BS EN 1634-1 respectively. Whilst most of the advice given in this British Standard is based on testing performed in accordance with BS 476-22, it is expected that the guidance will be applicable to tests performed in accordance with BS EN 1634-1, and some changes in the advice are designed to reflect the differences between the methods.

Fire doors perform a vital function in the provision of an adequate means of escape from a building and, depending upon the intended use of the building, the appropriate part of BS 5588¹⁾ and other guidance documents recommend both the performance rating and the position of the fire doors required to ensure safe egress. Similarly, guidance in support of national building regulations includes provision for the control of the spread of internal fire, by means of compartmentation or other techniques, and again adequately rated fire doors contribute to this containment. The rating of such doors will be specified by the design team/designer, possibly in conjunction with fire safety professionals, using the recommendations given in these national guidance documents, or by the fire strategy that has been developed to meet the functional objectives. The fire resistance provisions of the structure, including the fire door assemblies, will have been generated, when designing to meet the functional requirements of the regulations, as that which is necessary to control the hazard from fire to acceptable levels of risk.

Subsequent to the acceptance by the regulatory controllers of the fire protection measures provided, the Regulatory Reform (Fire Safety) Order 2005 [1] requires all buildings to be subjected to ongoing fire risk assessment and the risk assessors will either endorse the measures provided or specify their own requirements.

This British Standard identifies the important parameters in the design, construction and use of fire doors that contribute to the successful attainment and maintenance of the level of performance deemed appropriate to contain the risk.

The information is of value to the specifier of such doors, including the risk assessor, as it identifies the key parameters to be specified and advises on any constraints that might apply to the design to be specified. Controlling authorities will find that the information will assist them in evaluating whether the evidence of performance submitted is relevant to the component under examination, and whether further evidence of performance is required.

Assistance is provided to the construction team by identifying the permissible site operations and by the provision of guidance relating to the installation of such assemblies. Finally, advice on how to maintain fire doors in an operating condition is provided for use by property management.

Use of this document

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

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

¹⁾ A Draft for Development, DD 9999, was published in 2005 and is expected to supersede a majority of the BS 5588 series when it is published as a full British Standard.

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.

Contractual and legal considerations

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.

0 Introduction

0.1 Role and use of fire doors

Fire doors are required to provide two main functions:

- a) to maintain any compartmentation of buildings, which has been introduced to limit the size and spread of fire in order to control the perceived risk;
- b) to allow access to protected escape routes, both vertically and horizontally, without any loss of fire resistance, and limit smoke movement in the structure forming these routes, i.e. protected corridors and protected shafts.

Recommended positions and ratings for fire doors for means of escape purposes are given in the BS 5588 series and in BS 7974. The recommendations in the BS 5588 series use a risk-based approach; those in BS 7974 are based on the principles of fire safety engineering.

NOTE A Draft for Development, DD 9999, was published in 2005 and is expected to supersede a majority of the BS 5588 series when it is published as a full British Standard. Recommended positions and ratings for fire doors are given in DD 9999:2005, Table 27.

0.2 Fire door rating

The method of expressing the results of fire resistance tests, both at international and national levels, only utilizes the criteria of integrity (E) and insulation (I). The performance of a fire door when tested in accordance with BS 476-22 or BS EN 1634-1 is judged by its time to failure (in minutes) for both integrity and insulation (see Clause 4); however, for the purposes of regulatory guidance, fire doors are designated by reference to their required performance for integrity. Such doors are identified by the prefix FD followed by the required integrity rating expressed in minutes, e.g. FD30, a fire-resisting door able to resist integrity failure for 30 min. The following ratings fall within the scope of this British Standard: FD20, FD30, FD45, FD60, FD90 and FD120.

NOTE 1 National building regulations [2]–[4] only apply to life safety. Higher performance levels (such as insulation) might be necessary for certain applications if property protection is required.

In a fire safety strategy it might be an additional requirement for a door to meet the criteria of insulation (I) and/or radiation (W) for a specified period of time.

NOTE 2 Insulation (I) and radiation (W) performances are totally different. Ratings for glasses should only be compared on the basis of fire test results.

In addition to the need to provide fire resistance, certain doors are also required, by legislation, to restrict the spread of ambient temperature (“cold”) smoke. These doors are identified by the suffix S, e.g. FD30S, and, when tested in accordance with BS EN 1634-3 or BS 476-31.1, are required to conform to BS EN 13501-2 or to the relevant part of BS 5588, respectively.

NOTE 3 See the Note to 0.1 regarding the BS 5588 series.

1 Scope

This British Standard gives recommendations for the specification, installation and maintenance of fire doors. The recommendations are applicable only to hinged or pivoted pedestrian doorsets, door assemblies, or door leaves of any material, fitted into frames of any material.

This British Standard is applicable only to doors that are designed to provide fire resistance ratings of up to and including 2 h when tested in accordance with BS 476-22 or BS EN 1634-1.

This British Standard is applicable only to the fire performance of the doors and doorsets. It does not cover security, ergonomic factors, functional performance other than with respect to fire resistance, or safety of glazing.

2 Normative references

BS 476-22, *Fire tests on building materials and structures – Part 22: Methods for determination of the fire resistance of non-loadbearing elements of construction*

BS 476-31.1, *Fire tests on building materials and structures – Part 31: Methods for measuring smoke penetration through doorsets and shutter assemblies – Section 31.1: Method of measurement under ambient temperature conditions*

BS EN 179, *Building hardware – Emergency exit devices operated by a lever handle or push pad – Requirements and test methods*

BS EN 1125, *Building hardware – Panic exit devices operated by a horizontal bar – Requirements and test methods*

BS EN 1634-1, *Fire resistance tests for door and shutter assemblies – Part 1: Fire doors and shutters*

BS EN 12209, *Building hardware – Locks and latches – Mechanically operated locks, latches and locking plates – Requirements and test methods*

3 Terms and definitions

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

3.1 building hardware

3.1.1 essential building hardware

items vital to achieve the fire-resisting performance of a fire door assembly when incorporated into a building

NOTE Guidance on essential building hardware is given in Annex A.

3.1.2 building hardware

small components, usually metal, used mainly for the operation or support of doors

3.1.3 non-essential building hardware

items that are not required to achieve the fire resistance performance of a fire door assembly, but which if fitted might affect the performance

NOTE Guidance on non-essential building hardware is given in Annex A.

3.2 door

building component for closing an opening in a wall that allows access and might or might not admit light when closed

NOTE The word “door” is used as a generic term for door leaves, door frames, doorsets, door assemblies and door kits.

3.3 door assembly

complete assembly as installed, including door frame and one or more leaves, together with its essential building hardware supplied from separate sources

3.4 door frame

fixed surround into which are fitted one or more door leaves

NOTE The door frame can also be designed to surround other panels, and can include sill, threshold, architraves or other cover moulds. The door frame can be a separate item to be fixed to the adjacent structure, or it can be an integral part of a wall or partition.

3.5 door kit

set of fully machined and fitted frame components together with a door leaf or leaves fully prepared for site assembly and fixing

NOTE Door kits might or might not include all the items of building hardware required for the finished door assembly.

3.6 door leaf

hinged or pivoted construction intended to allow or prevent access

3.7 doorset

door frame with its door leaf or leaves pre-hung on hinges or pivots, supplied as an assembled unit from a single source

NOTE Due to size or weight, some doorsets might need to be delivered in separate parts, although pre-hung and pre-assembled in the factory.

3.8 fire door

door provided for the passage of persons, air or objects which, together with its frame and furniture as installed in a building, is intended (when closed) to restrict the passage of fire and/or gaseous products of combustion, and is capable of meeting specified performance criteria to those ends

NOTE A fire door may have one or more leaves, and the term includes a cover or other form of protection to an opening in a fire-resisting wall or floor or in a structure surrounding a protected shaft.

3.9 fire door assembly

door assembly, intended, when closed, to restrict the passage of fire and/or gaseous products of combustion and to be capable of meeting specified performance criteria to those ends

3.10 fire resistance

ability of a component or construction of a building to meet for a stated period of time some or all of the appropriate criteria specified in BS 476-22 or BS EN 1634-1

NOTE These criteria can include stability and/or integrity and/or thermal insulation.

3.11 intumescent seal

seal used to impede the flow of heat, flame or gases, which only becomes active when subjected to elevated temperature

NOTE Intumescent seals are components which expand, helping to fill gaps and voids, when subjected to heat in excess of ambient temperatures.

3.12 latch

self-engaging fastener which secures a moveable component (e.g. door) in a closed position and which can be released by hand
[BS EN 12209]

3.13 lock

fastener which secures a moveable component in a closed position within an opening and which is operated by a key or other device
[BS EN 12209]

3.14 seal

fitting provided to close a gap for the purpose of controlling the passage of air, smoke, water, fire, sound, etc.

3.15 smoke seal

seal fitted to the leaf edge or frame reveal for the purpose of restricting the flow of smoke or hot gases
[BS EN 1634-1]

4 Determination of fire resistance of doors

The fire resistance of a door assembly is determined by subjecting a full-size construction to test in accordance with the procedures laid down in the appropriate fire resistance testing standard, i.e. BS 476-22 or BS EN 1634-1. The test standard requires the tested construction to be fully representative of the assembly to be used in practice in terms of materials and methods of construction, size, number of leaves and mode of operation including all glazed openings and essential building hardware.

NOTE 1 The test standard to be used for a particular application will be dictated by the relevant legislation.

The fire resistance is expressed in terms of the number of minutes for which the assembly meets the relevant criteria. Depending upon the test standard used for the evaluation, the criteria would be one or all of the following: stability, integrity, insulation.

For the purposes of classification, doors are classified to the last specific fire resistance period that has been passed during the test before failure occurs. Where more than one criterion is assessed during the test, it is possible that for each of these criteria a different classification period might apply (see BS EN 13501-2).

NOTE 2 The classification period required for a specific location will be dictated by the relevant legislation.

The building designer should ensure that all fire doors to be used are of a design that has been tested or assessed for the required fire resistance period, and that documentary evidence exists to that effect.

Where the elements of a fire door are to be obtained from different sources, the building designer should ensure that the elements to be used are compatible and are able to provide the required fire resistance period, and that documentary evidence exists to that effect.

Before proceeding with contractual commitments it should be established that evidence of performance exists which meets with the approval of the enforcing authority.

NOTE 3 When it is impossible, due to size or other constraints, or is impractical, to evaluate the constructions by test then it is appropriate to have the potential fire resistance of the construction determined by way of agreed expert opinion based on existing test evidence. This course of action might be required when evidence of performance of a particular component has been established in connection with another form of construction. As a successful fire resistance performance is often the result of complex interactions between materials it should never be assumed that a result obtained under one set of circumstances will be conferred on a different combination of components or materials. It might be possible, however, for the proposed combination to be determined as suitable by a competent expert, on the basis of evidence generated in other tests.

5 Marking

All fire doors should be clearly and permanently marked with their declared fire resistance period either immediately after manufacture or inspection, or before dispatch. A convenient way of providing this information is by means of a colour-coded permanent label or plug.

Table 1 shows the current range of colour codes for non-metallic door assemblies of up to 120 min integrity. It is essential to check that any applied intumescent seal is appropriate for the doorset.

Table 1 **Range of colour codes giving a method of performance identification for non-metallic doors and frames**

Core colour	Label colour or background colour	Integrity min	Colour code interpretation
Red	White	20 ^{A)}	Intumescent seals need to be added at time of original installation
	Yellow	30	
	Pink	45	
	Blue	60	
	Brown	90	
	Black	120 ^{B)}	
Green	White	20 ^{A)}	Intumescent seals will have been fitted at time of manufacture
	Yellow	30	
	Pink	45	
	Blue	60	
	Brown	90	
	Black	120 ^{B)}	

^{A)} FD 20 timber doors are not usually available. Use an FD 30 but the intumescent seal still has to be fitted.

^{B)} FD 120 rating is unlikely to be achieved with conventional timber frames.

NOTE 1 The existence of a colour code does not necessarily mean that the product is available.

NOTE 2 Attention is drawn to the fact that some marking systems are controlled within third-party certification schemes, whereas others are purely identification in their own right and do not imply such certification.

Every fire-resisting metal doorset should bear the label of an accredited product conformity certification scheme, when the doorset is installed within the scope of that certification scheme. Otherwise it is recommended that the doorset should bear a label showing the manufacturer's name, the fire rating of the doorset and a traceable serial number.

Fire-resisting glass should be identified with an appropriate designation. The mark on the glass should be permanent, legible and visible after glazing, including as a minimum the glass manufacturer's name, the product name and impact rating if required. Accompanying documentation should provide specification information for the glass, including the performance classification and applicable test or certification references.

NOTE 3 BS 6262-4 provides recommendations for the vertical use of glass in locations likely to be subject to accidental human impact.

6 Specifying fire doors

The specification of fire doors should be undertaken only by persons with appropriate expertise. Fire door manufacturers have considerable experience in the design, manufacture and testing of fire doors, and have many different proven designs available. Any deviation from tested or assessed designs will need careful evaluation.

It is important when specifying a fire door assembly to provide a full description of the element in addition to the level of fire resistance required. The description should include the following, as any of these can affect the potential fire resistance of the assembly:

- a) overall size;
- b) size and number of leaves;
- c) mode of operation;
- d) size and number of any glazed openings;
- e) details of the building hardware;
- f) details of frames;
- g) presence of any overpanels, fanlights, side panels, etc.;
- h) presence of any performance seals.

Fire resistance is a property that can be possessed by only a complete construction, and not by the individual components or materials from which the construction is formed. In the case of a fire door, it is only the complete assembly as described in the relevant fire test report, that can be deemed to provide the required performance. Therefore, a door leaf, door frame, building hardware or any other component part cannot be fire-resisting in isolation from other parts.

As the constituent parts of a fire door often interact in quite subtle ways, any changes from the original tested specification can significantly alter the performance of the assembly installed. Therefore in order to maintain the performance of doors manufactured subsequently, the quality of materials and components used should be carefully monitored and controlled.

NOTE 1 Guidance on the specification of building hardware for fire doors is given in the DHF/GAI Code of practice: hardware for fire and escape doors [5].

NOTE 2 Users of this British Standard are advised to consider the desirability of sourcing fire doors from a manufacturer that operates as a member of a third-party accreditation scheme, as such a scheme will be designed to ensure consistency of product conformity.

7 Door and frames

7.1 General

Ideally all fire doors should be purchased either as complete doorsets or as door assemblies. This is expected to ensure that all the correct components are fitted and that full assembly instructions are available. However, it is not always possible or practicable to do so; therefore the information given in this clause provides some general guidance. This guidance should not be considered as a substitute for the information which will be available from the various component manufacturers and that contained in the fire test report.

7.2 Door leaves

Door leaves can be constructed from metal, timber or composite materials.

There are various constructions used for the manufacture of fire doors. These can be used in a number of configurations (see Annex A), which vary from single leaf single swing through to double leaf double swing, with a possible option for storey-height doorsets using transoms or flush-over panels. It is important to note that doors tested in one configuration might not be suitable for another configuration. When a specific door design is to be used in a variety of configurations, the manufacturer's advice should be sought to ensure that the documentary evidence is not invalidated.

7.3 Door frames

7.3.1 General

The frame of a fire-resisting door assembly should provide not only support of the leaves in the cold state, but also adequate support of the leaves under fire exposure. There are no particular recommendations for the dimensions of door frames for fire-resisting door assemblies. The frame should be able to accept building hardware fixings to support the door leaf and fixings retaining the frame in the wall opening. The minimum dimensions for frame cross-section are dictated by cold state requirements, and are expected to be identified in the manufacturer's fire door test report.

7.3.2 Timber door frames

The dimensions, density and material of timber door frames should be not less than those tested or approved.

NOTE Guidance on timber types and classifications is given in BS EN 942.

7.3.3 Metal door frames

Metal door leaves should always be hung in metal frames unless substantiated by specific test evidence.

Timber-based door leaves should not be hung in metal frames unless substantiated by specific test evidence. Such door assemblies do not easily lend themselves to assessment.

If a metal frame has formed part of a door assembly with a timber-based door leaf and achieved a satisfactory fire test result, it does not follow that the metal frame is suitable for use with any other timber-based door leaf.

7.3.4 Composite door frames

The dimensions, density and material of composite door frames (e.g. MDF) should be not less than those tested or approved.

NOTE Guidance on types and classifications of composite materials is given in BS EN 14374.

7.4 Intumescent and smoke seals

There are various types of intumescent seal, all of which can react differently. Where such seals are obtained from a source other than the fire door manufacturer, it is essential that the intumescent seal to be used is of the same formulation, dimensions and configuration as that in the door manufacturer's fire test report.

There a number of different types of smoke seal available, and again the manufacturer's fire test report is expected to identify the most appropriate type for each specific fire type and configuration.

7.5 Apertures

Fire doors can be fitted with glazed apertures. However, glazing systems are sensitive to the substrate into which they are fitted. Apertures should only be cut into doors that are designed to receive apertures. Glazing apertures should therefore only be fitted into a fire door under the control of the fire door manufacturer. Apertures should not be cut on site. The position of the cut-out within the door should be the same and the aperture size should not exceed the area and aspect ratio of that previously tested.

Apertures other than those used for glazing should be discussed with the fire door manufacturer.

Where apertures are cut to take hardware, it is essential for them to be cut as accurately as possible to avoid an unspecified reduction in door thickness.

8 Handling and storage of doors on site

Delivery should be planned so as to reduce the storage time on site to the practical minimum. Where doors, doorsets and door kits have to be stored, they should be protected at all times from moisture and extremes of temperature, preferably in a ventilated building.

The manufacturer's specific handling and storage instructions should be followed.

9 Installation of fire doors

9.1 General

The fixing of door assemblies should be left as late in the building programme as possible to avoid damage arising from other operations. The manufacturer's specific installation instructions should be followed.

9.2 Installation of door frames

The frame should be plumb and square, and securely fixed into the opening, with packing if necessary to ensure that the gap between the frame and surround is equal on both sides. The need to provide solid fixings for normal day-to-day use will probably override any special fixing considerations for fire.

Doorsets should be installed plumb and square within the aperture, without twist, racking or distortion of any member, in accordance with the manufacturer's recommended tolerances, to operate correctly after installation.

It is critical that correct methods of installation are adopted to ensure that a doorset, when fixed into the wall, will achieve the fire rating designated for the door opening.

NOTE Approved Document B of the Building Regulations 2000 [6] recommends that the installation of fire-resisting products be covered by product conformity certification or by independent registered installer schemes, where such schemes are available.

Metal frames, if used, should be fixed in accordance with the manufacturer's specific instructions.

It is strongly recommended that installation of metal doorsets is carried out by the manufacturer or, alternatively, by installers trained in fixing metal doorsets in accordance with the manufacturer's fixing instructions.

9.3 Compatibility of door frames with surrounding structure

The type of surrounding structure or wall/partition into which a fire door can be installed will have been determined by fire resistance test and should not be changed without agreed expert opinion or test evidence (see BS EN 1634-1 for further guidance).

The type of surrounding structure or wall/partition can exert an influence upon the fire performance of the assembly. The manufacturer's recommendations should be followed with regard to the approved types of surrounding structure within which the door may be fitted.

The method of fixing and the location of fixings should be suitable for the particular structure into which the doorset is to be installed.

NOTE Users of this British Standard are advised to consider the desirability of employing members of a third-party accredited fire door installation scheme to install fire doors.

9.4 Sealing between door assembly and surrounding structure

In order to maintain the fire resistance of a fire-resisting wall or partition when fitted with a door assembly, the junction between the two elements should be adequately sealed (see Table 2 and Table 3).

Ideally a wall or partition should be built up to the rear of the door frame without gaps. This is not always possible, and to ensure easy installation of the door assembly, the opening should be made within the permissible tolerance. The gap between door frame and wall opening can vary greatly and is usually masked with an architrave.

9.5 Hanging of a timber door leaf

9.5.1 General

Any adjustment to the door size necessary on site to achieve the equal gap should only be performed in accordance with any limitations given in the manufacturer's installation instructions applicable to the particular door type.

If, in the process of installation, any intumescent seals or smoke seals are damaged, they should be replaced by identical products.

Intumescent seals usually incorporate a protective coating and it is important that the exposed surfaces are not damaged in the adjustment process. In certain environments this could lead to a loss of effectiveness in the longer term. In some cases the intumescent seal is concealed within the door construction and is not immediately obvious. It should be established before alteration on site whether the doorset incorporates a concealed system and, if so, adjustment (e.g. planing) should be limited accordingly.

Table 2 Recommendations for the joint between timber door frames and walls to provide 30 min fire resistance

Wall construction	Maximum frame to wall gap width mm	Architrave condition	Examples of additional protection
Walls unlikely to exhibit significant distortion during fire exposure, e.g. timber stud walls and masonry walls built without fair face	Up to 10	Intimately fitted softwood or hardwood architraves at least 15 mm thick with a 15 mm overlap onto wall and door frame	Nil
	More than 10	Imperfectly fitted architraves	2 mm × 10 mm of intumescent material as a pre-formed strip or seal
Loading walls likely to exhibit distortion during fire exposure, e.g. steel stud walls	All gap sizes	All architrave conditions	or
		Fit of architrave cannot be guaranteed due to likely distortion of wall. Seek specialist advice.	Mineral or glass wool packed to a depth of at least 10 mm or Intumescent paste, mastic or other suitable material
Loadbearing or non-loadbearing walls; fair-faced masonry walls	Up to 10	Intimately fitted 10 mm hardwood quadrant bead	Nil
	More than 10	All architrave conditions	2 mm × 10 mm of intumescent material as a pre-formed strip seal or Mineral or glass wool packed to a depth of at least 10 mm or Intumescent paste, mastic or other suitable material

NOTE There is a risk that wall finishes with a surface spread of flame rating of Class 3, as defined in BS 476-7:1997, might contribute to ignition and flaming of the architrave on the unexposed face due to leakage of hot gases. For smoke control door assemblies, frame-to-wall gaps should always be packed with mineral or glass wool or sealed with a bead of intumescent paste or mastic.

Table 3 Recommendations for the joint between timber door frames and walls to provide 60 min fire resistance

Wall construction	Maximum frame to wall gap width mm	Architrave condition	Additional protection
Walls unlikely to exhibit significant distortion during fire exposure, e.g. timber stud walls and masonry walls built without fair face	Up to 10	Intimately fitted softwood or hardwood architraves at least 15 mm thick with a 15 mm overlap onto wall and door frame	2 mm × 10 mm of intumescent material as a pre-formed strip or seal or Mineral or glass wool packed to a depth of at least 10 mm or Intumescent paste, mastic or other suitable material
	More than 10	Imperfectly fitted architraves	2 mm × 20 mm of intumescent material as a pre-formed strip or seal
Loading walls likely to exhibit distortion during fire exposure, e.g. steel stud walls	All gap sizes	All architrave conditions	or
		Fit of architrave cannot be guaranteed due to likely distortion of wall. Seek specialist advice.	Mineral or glass wool packed to a depth of at least 10 mm or Intumescent paste, mastic or other suitable material
Loadbearing or non-loadbearing walls; fair-faced masonry walls	All gap sizes	All architrave conditions	

NOTE There is a risk that wall finishes with a surface spread of flame rating of Class 3, as defined in BS 476-7:1997, might contribute to ignition and flaming of the architrave on the unexposed face due to leakage of hot gases. For smoke control door assemblies, frame-to-wall gaps should always be packed with mineral or glass wool or sealed with a bead of intumescent paste or mastic.

9.5.2 Clearance gaps

Failure of fire-resisting door assemblies under test is very often due to burn-through at the clearance gap between the door leaf edge and the door frame. Doors should be hung to give an equal gap across the head and down both jambs. A typical gap to achieve good fire performance is between 2 mm and 4 mm. With the exception of metal fire doors, it is recommended that all fire doors including those of 20 min fire integrity are fitted with intumescent seals or combined intumescent and smoke seals. Certain smoke seals might require a larger gap in order to operate without causing significant frictional increases, but the gap should remain within tested tolerances. Where required, metal fire doors can be fitted with smoke or other performance seals.

NOTE Guidance on operating gaps for timber doorsets is given in BS 4787-1 and BS 5588-11²⁾.

9.5.3 Under-door (threshold) gaps

Under-door (threshold) gaps should be in accordance with the manufacturer's installation instructions for the particular doorset design.

When fitted, smoke seals should give an even contact with the floor but should not exhibit significant increased frictional forces that could interfere with the closing action of the door (see BS 5588-11²⁾).

9.6 Frame doorstops

Where a door frame incorporates a doorstop to prevent the door swinging through the frame, the dimension of the doorstop is irrelevant provided that it fulfils its intended function.

For example, a 12 mm deep doorstop would be just as effective as a 25 mm deep doorstop.

10 Glazing

NOTE 1 For replacement of glass, see 13.5. For marking of glass, see Clause 5.

Glazed apertures can potentially be the weakest part of any fire door if glazed incorrectly. For this reason, factory-glazed doors should be used wherever practicable, rather than glazing on site. Some fire glass is able to provide ratings in excess of 120 min when correctly glazed.

NOTE 2 Users of this British Standard are advised to consider the desirability of employing members of a third-party accredited scheme to install glazing, where factory-glazed doors are unavailable.

Some integrity-only glasses, most notably modified toughened glasses, are sensitive with regard to edge cover and bead profile, and should always be installed in accordance with the manufacturer's instructions. Insulating glasses are more tolerant of glazing methods, but the bead fixings are critical and again the advice of the manufacturer should be sought and followed.

²⁾ A Draft for Development, DD 9999, was published in 2005 and is expected to supersede a majority of the BS 5588 series when it is published as a full British Standard.

Only complete tested glazing systems should be used. These should identify the glass product type and thickness, glazing seals, beads and fixings. Components within a glazing system should not be interchanged without relevant test evidence.

Timber beads are able to provide up to 60 min fire resistance, subject to:

- suitable section size;
- timber density;
- bead profile;
- retained by screws or pins of adequate length;

and when used in conjunction with proprietary glazing tapes, e.g.:

- intumescent strips;
- graphite channels;
- ceramic fibre tapes, etc.

Each component cannot be tested in isolation and therefore the compatibility of components is essential when fitting fire glass.

Due allowance should be made for expansion between glass edge and aperture. It is important, therefore, that apertures are cut accurately as recommended by the manufacturer. For this reason the cutting on site of apertures for glass is strongly deprecated and is not permitted within some independent certification schemes. Any cut-outs made to a door are likely to invalidate its certification.

It should not be assumed that glass that has been tested with timber doorsets will perform satisfactorily with metal doorsets, and vice versa, unless supported by independent test evidence.

11 Building hardware

11.1 General

It should not be assumed that building hardware that has been tested with timber doorsets will perform satisfactorily with metal doorsets, and vice versa, unless supported by independent test evidence.

The intumescent materials that have been used to achieve a particular performance in test conditions, with the building hardware and/or the door, should be present in the finished assembly to maintain the stated performance. This includes any additional intumescent protection used in conjunction with the element of building hardware.

NOTE 1 It is the responsibility of the person who fits the building hardware to ensure that this recommendation is met.

Building hardware falls into two categories: essential and non-essential. The selection of building hardware is vital to the performance of fire-resisting doors and it should be selected and fitted with care in accordance with the manufacturer's instructions.

Non-essential items of building hardware should fulfil their intended function at all times.

NOTE 2 Guidance on essential and non-essential building hardware is given in Annex A.

Panic bolts and other emergency exit devices might constitute essential building hardware on internal compartmentation doors in multi-occupancy buildings. In all circumstances they should conform to BS EN 179, BS EN 1125 or BS EN 12209 as appropriate.

11.2 Fitting of building hardware

All door furniture should be fitted in such a way as to ensure that the fire-resisting properties of the doorset are not compromised. It is recommended in most instances that building hardware be bedded in intumescent mastic or pre-shaped intumescent pads to restrict heat transfer to the door edge via the metal products.

Interruption of intumescent seals at the positions of building hardware should be avoided where possible (see also **7.4** and **12.1**).

Bored lock and latch sets (knob sets) should not be used unless tested in the relative fire door type.

11.3 Letter plates

Where a letter plate is fitted into a door it should be fitted together with an intumescent liner, as the use of intumescent liners significantly inhibits the spread of fire through the letter plate aperture of the door leaf. Only letter plates that have achieved the appropriate fire resistance period when tested in situ in a fire door should be used.

NOTE A third-party accreditation scheme exists for these products.

Since it is not possible to predetermine in which position a letter plate will be fitted, all letter plates for use in fire doors are usually tested in both the top and bottom of a door. Letter plates should be fitted in accordance with the manufacturer's information provided with the door, identifying the acceptable locations for fitting.

Letter plates with larger apertures should not be used unless they have been tested and have achieved the appropriate classification with respect to fire resistance and smoke leakage.

12 Installation of fire or smoke seals

12.1 General

The intumescent materials that have been used to achieve a particular performance in test conditions should be present in the finished assembly to maintain the stated performance. This includes any additional intumescent protection used in conjunction with the element of building hardware.

NOTE The substitution of seals might be possible under a third-party accreditation scheme.

Generally the optimum performance from narrow strip intumescent seals is achieved when they are fitted into the leaf or frame of a conventionally sized, latched, single leaf, single swing door at the mid position of the leaf thickness. Interrupting intumescent seals at building hardware positions can have a detrimental effect on doors intended to provide 30 min fire resistance. For doors intended to provide fire resistance of 60 min or more, it is essential to adhere to the door manufacturer's specified materials and configurations.

When it is necessary to fit seals on site, either in the frame or the door edge, it is important to follow the manufacturer's recommendations precisely for the type and mode of operation of the door concerned. Intumescent seals are normally fitted into a groove and can be a friction fit, self-adhesive, glued or mechanically fixed. Care is necessary when fitting self-adhesive seals to ensure that the groove is dry and free from dust or sawdust to ensure a good bond. The self-adhesive action deteriorates at lower temperatures, and additional mechanical fixing might be necessary if the seals are fitted at temperatures below 10 °C. Seals may be surface-mounted if they are sufficiently thin, but such seals are more prone to detachment than those fitted into grooves.

It should not be assumed that seals that have been tested with timber doorsets will perform satisfactorily with metal doorsets, and vice versa, unless supported by independent test evidence.

12.2 Concealed intumescent

Several manufacturers offer door assemblies in which pressure-forming intumescent material is concealed behind the timber lipping of the door leaf. The methods of achieving concealed intumescent details are all proprietary. Doors fitted with concealed intumescents are expected to be marked accordingly by the manufacturer. Special attention should be given to smoke seals (see 12.3) when fitting these to doors with concealed intumescents.

12.3 Smoke seals

COMMENTARY ON 12.3

The test standards for determining smoke leakage are BS 476-31.1 and BS EN 1634-3. Smoke leakage is essentially the transfer of airborne particles of the products of combustion, and sealing systems are used to restrict this air flow. Seals are used to fill the gaps between the door leaf and the frame. As such, they can have an adverse effect on the operating forces required to use the door if not carefully fitted (see BS 8300). Removal of seals to accommodate building hardware will increase the leakage rate.

Seals that fit in the centre thickness of the door will generally be subjected to friction effects detrimental to the durability of the seal and the easy use of the door. Seals applied to the face of the doorstop might be effective when subjected to pressure applied to the opening face of the door but less effective when subjected to pressure to the closing face of the door. Doorstop-fitted seals might prevent the door from latching or closing correctly.

Fire doors that are required by the appropriate building regulations [2–4] to restrict the flow of ambient temperature smoke, identified by the suffix S, e.g. FD30S, should be fitted with smoke seals.

NOTE BS 5588-11³⁾ recommends that when installed, the threshold gap should where practicable be sealed by a (flexible edge) seal either with a leakage rate not exceeding 3 m³/h per metre at 25 Pa or just contacting the floor. Where this is impracticable, the threshold gap should not exceed 3 mm at any point.

The seal manufacturer's recommended installation instructions should be followed whether the intumescent and smoke seals are separate or combined.

Painting of smoke seals or combined intumescent and smoke seals should be avoided as such coatings can inhibit the door from closing completely, and the seal could be damaged as a consequence of adhesion to the adjacent element.

12.4 Air transfer grilles

12.4.1 General

Where a fire door is required to be fitted with an air transfer grille, it should only be fitted with one that is capable of sealing both by thermal initiation and by interface with smoke sensors either directly or via a fire alarm panel.

Mechanical fire-resisting air transfer grilles are closed by the activation of a thermal release mechanism usually preset to operate between 70 °C and 74 °C. The majority of fire doors now require smoke control and consequently any fire-resisting air transfer grille fitted should also be able to seal automatically when activated by interface with smoke sensors or a fire alarm panel. The installation of air transfer grilles should only be undertaken when full fitting instructions and relevant wiring diagrams are available, and should only be undertaken by competent persons.

In the case of electrically interactive air transfer grilles, the installer should liaise with the persons responsible for the fire alarm panel or building management system.

All air transfer grilles should be installed in accordance with the manufacturer's installation and commissioning instructions.

12.4.2 Over-panels and side panels

An air transfer grille to be fitted in an over-panel or side panel should be fitted only if it has been provided with the grille manufacturer's information confirming that the grille has been tested in a similar construction to determine fire integrity at the pressure differentials appropriate to the height above the zero axis of its intended application.

It should not be assumed that air transfer grilles that have been tested with timber doorsets will perform satisfactorily with metal doorsets, and vice versa, unless supported by independent test evidence.

³⁾ A Draft for Development, DD 9999, was published in 2005 and is expected to supersede a majority of the BS 5588 series when it is published as a full British Standard. This recommendation has not been changed.

13 Maintenance

13.1 General

Fire doors have to provide a similar level of fire resistance as the fixed elements of building, e.g. walls and floors, and are evaluated by the same stringent procedures and criteria. However, since such doors are often opened and closed many times a day, this mobility is likely to cause a more rapid deterioration in the fire resistance performance. This deterioration can take two main forms:

- a) damage to the leaf or the components making up the assembly;
- b) wear in the building hardware, or a reduction in the effectiveness of fixings, causing the door to fail to self-close, thereby resulting in a breach of the fire barrier.

It is important, therefore, for periodic inspection, maintenance and repair of any damage to be undertaken on a regular basis if the required fire resistance is to be maintained.

The marking of individual components can be an aid to the correct replacement of those components when necessary.

13.2 Door leaves and door frames

13.2.1 General

Door leaves and door frames should be examined at six-monthly intervals for superficial damage, structural damage and excessive bowing or deformation. It is not easy to repair doors and maintain the interactive behaviour of the various component parts, except for minor repairs, which should only be undertaken with the approval of the door manufacturer. When any other damage is detected, the complete door leaf or door frame should be replaced. It is important to ensure that the replacement door is able to provide the same level of fire resistance as the damaged door and, if intumescent seals are fitted in the frame, that the new door is compatible with the fitted seals.

13.2.2 Double leaf doors

In the event of damage that necessitates the replacement of one leaf of a double door, both leaves should be replaced with a new matching pair, since it would be virtually impossible to ensure that a replacement single leaf would be of identical construction to that being removed. Any difference in construction is likely to cause different movement when exposed to fire, severely reducing the likelihood of the doors maintaining their integrity.

13.2.3 Doors leaves with 60 min fire resistance

Doors leaves designed to provide fire resistance periods greater than 60 min should be replaced, not repaired.

13.3 Replacement of intumescent seals, smoke seals, combined intumescent and smoke seals

There are three types of door seal available for fire and smoke containment:

- intumescent seals designed to maintain the integrity of the doorset;
- smoke seals to restrict the flow of smoke before intumescent seals become effective;
- combined intumescent and smoke seals where both intumescent and smoke seals are incorporated in one assembly.

Damage or degradation of these seals can have a significant adverse impact on the ability of the doorset to perform its designed function.

The condition of all intumescent and smoke seals should be examined at not more than six-monthly intervals. If a seal is missing in part or in total, it should be replaced immediately. To maintain the potential (or design) integrity performance, the replacement seal should be of the same formulation, dimensions and configuration as that in the door manufacturer's fire test report.

Seals should be fitted in accordance with the manufacturer's instructions. New seals may be butt jointed to existing seals but cut edges should be sealed, if appropriate, with a suitable water-resistant sealant as recommended by the seal manufacturer.

Smoke seals and combined intumescent and smoke seals should be replaced if they are damaged or are not making adequate contact with adjacent doorset components. Such seals should be replaced as continuous lengths, as joints are a further source of potential leakage.

For complete smoke containment effectiveness, smoke seals should be replaced by identical products as originally supplied and tested to the method described in BS 476-31.1 by the manufacturer of the doorset.

13.4 Replacement of building hardware

Where it is necessary to replace essential building hardware as a result of natural wear or damage, the fire door manufacturer's technical information should be followed.

13.5 Replacement of glass

NOTE 1 For fitting of glass on site, see Clause 10.

Any damaged glass or associated retaining system should be replaced with an identical product. The manufacturer should be consulted to determine whether or not the replacement can be carried out on site. Any reglazing of a fire door should be carried out by a competent person.

NOTE 2 Users of this British Standard are advised to consider the desirability of employing members of a third-party accredited fire door installation scheme to replace glass and associated retaining systems.

14 Decoration

Fire door leaves are generally not required to provide a specific surface spread-of-flame barrier, and may therefore be decorated as desired.

There is no evidence to suggest that overpainting of intumescent seals has any detrimental effect on the ability of the seals to perform efficiently. There are some benefits in overpainting the seals as they are less likely to absorb atmospheric moisture. However, there are limits on how much paint can be applied without there being a risk of the seal being rendered inoperative. It is recommended that overpainting be limited to a maximum of five coats of conventional oil-bound paint or varnish.

When preparing a frame for redecorating, the use of heat or chemical strippers should be avoided if intumescent seals are incorporated. If seals are damaged by either of these processes, they should be replaced in accordance with **13.3**.

If glazing beads have been painted with intumescent paint, it is essential that they be repainted with a similar paint.

Annex A (informative)**Guidance on essential and non-essential building hardware****A.1 Essential building hardware**

Essential building hardware for the various types of fire door assemblies is shown in Table A.1.

Table A.1 **Essential building hardware**

Type of door assembly as tested	Hanging devices	Securing devices (where required)	Self-closing devices (where required)
Single swing, single leaf, latched	Hinges or pivots	Latch or lock	Controlled door closing device ^{A)}
Single swing, double leaf with plain meeting stiles, latched	Hinges or pivots	Latch or lock Bolts (one leaf only)	Controlled door closing device(s) ^{A)}
Single swing, single leaf or double leaf with plain meeting stiles, unlatched	Hinges or pivots	—	Controlled door closing device(s)
Double swing, single leaf or double leaf with plain meeting stiles, unlatched	Pivots	—	Double action controlled door closing device(s)

^{A)} According to Approved Document B of the Building Regulations 2000 [6], there are two exceptions, where a self-closing device is not essential:

- fire doors which are normally kept locked shut, and are labelled as such, e.g. plant rooms and stores;
- internal fire doors in domestic dwellings and flats, but not fire doors to integral garages, or flat entrance doors, which still require self-closing devices.

The continuing correct performance of these items is critical to the achievement of the potential fire resistance of the assemblies.

A.2 Non-essential building hardware

Examples of items that might not be vital for fire resistance but might be vital for means of escape or general fire performance include:

- latch and lock furniture;
- pull handles;
- automatic release mechanisms;
- self-closing devices fitted to latched doors;
- panic bolts and other emergency exit devices.

Non-essential items can be provided for aesthetic or protective reasons. These items include:

- push plates;
- kick plates;
- number or name plates;
- signs, accessories, etc.

Such items can affect the fire performance of the door.

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