



7543839815



The Building Regulations 2000

Fire safety

B

APPROVED DOCUMENT

B1	Means of warning and escape
B2	Internal fire spread (linings)
B3	Internal fire spread (structure)
B4	External fire spread
B5	Access and facilities for the fire service

RSL 02
B 1442

2000 EDITION
Amended 2000

The Requirement

This Approved Document deals with the following Requirement from Part B of Schedule 1 to the Building Regulations 2000.

Requirement

External fire spread

B4-(1) The external walls of the building shall adequately resist the spread of fire over the walls and from one building to another, having regard to the height, use and position of the building.

(2) The roof of the building shall adequately resist the spread of fire over the roof and from one building to another, having regard to the use and position of the building.

Limits on application

Guidance

Performance

In the Secretary of State's view the requirements of B4 will be met:

- a. if the external walls are constructed so that the risk of ignition from an external source, and the spread of fire over their surfaces, is restricted by making provision for them to have low rates of heat release;
- b. if the amount of unprotected area in the side of the building is restricted so as to limit the amount of thermal radiation that can pass through the wall, taking the distance between the wall and the boundary into account;
- c. if the roof is constructed so that the risk of spread of flame and/or fire penetration from an external fire source is restricted;

in each case so as to limit the risk of a fire spreading from the building to a building beyond the boundary, or vice versa.

The extent to which this is necessary is dependent on the use of the building, its distance from the boundary and, in some cases, its height.

Introduction

External walls

B4.i The construction of external walls and the separation between buildings to prevent external fire spread are closely related.

The chances of fire spreading across an open space between buildings, and the consequences if it does, depend on:

- a. the size and intensity of the fire in the building concerned;
- b. the distance between the buildings;
- c. the fire protection given by their facing sides; and
- d. the risk presented to people in the other building(s).

B4.ii Provisions are made in Section 13 for the fire resistance of external walls and to limit the susceptibility of the external surface of walls to ignition and to fire spread.

B4.iii Provisions are made in Section 14 to limit the extent of openings and other unprotected areas in external walls in order to reduce the risk of fire spread by radiation.

Roofs

B4.iv Provisions are made in Section 15 for reducing the risk of fire spread between roofs and over the surfaces of roofs.

Section 13

CONSTRUCTION OF EXTERNAL WALLS

Introduction

13.1 Provisions are made in this section for the external walls of the building to have sufficient fire resistance to prevent fire spread across the relevant boundary. The provisions are closely linked with those for space separation in Section 14 (following) which sets out limits on the amount of unprotected area of wall. As the limits depend on the distance of the wall from the relevant boundary, it is possible for some or all of the walls to have no fire resistance, except for any parts which are loadbearing (see paragraph B3.ii).

External walls are elements of structure and the relevant period of fire resistance (specified in Appendix A) depends on the use, height and size of the building concerned. If the wall is 1000mm or more from the relevant boundary, a reduced standard of fire resistance is accepted in most cases and the wall only needs fire resistance from the inside.

13.2 Provisions are also made to restrict the combustibility of external walls of buildings that are less than 1000mm from the relevant boundary and, irrespective of boundary distance, the external walls of high buildings and those of the Assembly and Recreation Purpose Group. This is in order to reduce the surface's susceptibility to ignition from an external source, and to reduce the danger from fire spread up the external face of the building.

In the guidance to Requirement B3, provisions are made in Section 8 for internal and external loadbearing walls to maintain their loadbearing function in the event of fire.

Fire resistance standard

13.3 The external walls of the building should have the appropriate fire resistance given in Appendix A, Table A1, unless they form an unprotected area under the provisions of Section 14.

Portal frames

13.4 Portal frames are often used in single storey industrial and commercial buildings where there may be no need for fire resistance of the structure (Requirement B3). However where a portal framed building is near a relevant boundary, the external wall near the boundary may need fire resistance to restrict the spread of fire between buildings.

It is generally accepted that a portal frame acts as a single structural element because of the moment-resisting connections used, especially at the column/rafter joints. Thus in cases where the external wall of the building cannot be wholly unprotected, the rafter members of the frame, as well as the column-members, may need to be fire protected.

Following an investigation of the behaviour of steel portal frames in fire, it is considered technically and economically feasible to design the foundation and its connection to the portal frame so that it would transmit the overturning moment caused by the collapse, in a fire, of unprotected rafters, purlins and some roof cladding while allowing the external wall to continue to perform its structural function. The design method for this is set out in *Fire and steel construction: The behaviour of steel portal frames in boundary conditions*, 1990 (2nd edition), which is available from the Steel Construction Institute, Silwood Park, Ascot, Berks SL5 7QN. This publication offers guidance on many aspects of portal frames, including multi-storey types.

Notes:

1. The recommendations in the SCI publication for designing the foundation to resist overturning need not be followed if the building is fitted with a sprinkler system meeting the relevant recommendations of BS 5306: Part 2 *Fire extinguishing installations and equipment on premises, Specification for sprinkler systems*, ie the relevant occupancy rating together with the additional requirements for life safety.
2. Normally, portal frames of reinforced concrete can support external walls requiring a similar degree of fire resistance without specific provision at the base to resist overturning.
3. Existing buildings may have been designed to the following guidance which is also acceptable:
 - a. the column members are fixed rigidly to a base of sufficient size and depth to resist overturning;
 - b. there is brick, block or concrete protection to the columns up to a protected ring beam providing lateral support; and
 - c. there is some form of roof venting to give early heat release. (The roof venting could be, for example, pvc rooflights covering some 10 per cent of the floor area and evenly spaced over the floor area.)

External wall construction

13.7 The external envelope of a building should not provide a medium for fire spread if it is likely to be a risk to health or safety. The use of combustible materials for cladding framework, or of combustible thermal insulation as an overcladding or in ventilated cavities, may present such a risk in tall buildings, even though the provisions for external surfaces in Diagram 40 may have been satisfied.

In a building with a storey 18m or more above ground level, insulation material used in ventilated cavities in the external wall construction should be of limited combustibility (see Appendix A). This restriction does not apply to masonry cavity wall construction which complies with Diagram 32 in Section 10.

Advice on the use of thermal insulation material is given in the BRE Report *Fire performance of external thermal insulation for walls of multi-storey buildings* (BR 135, 1988).

External surfaces

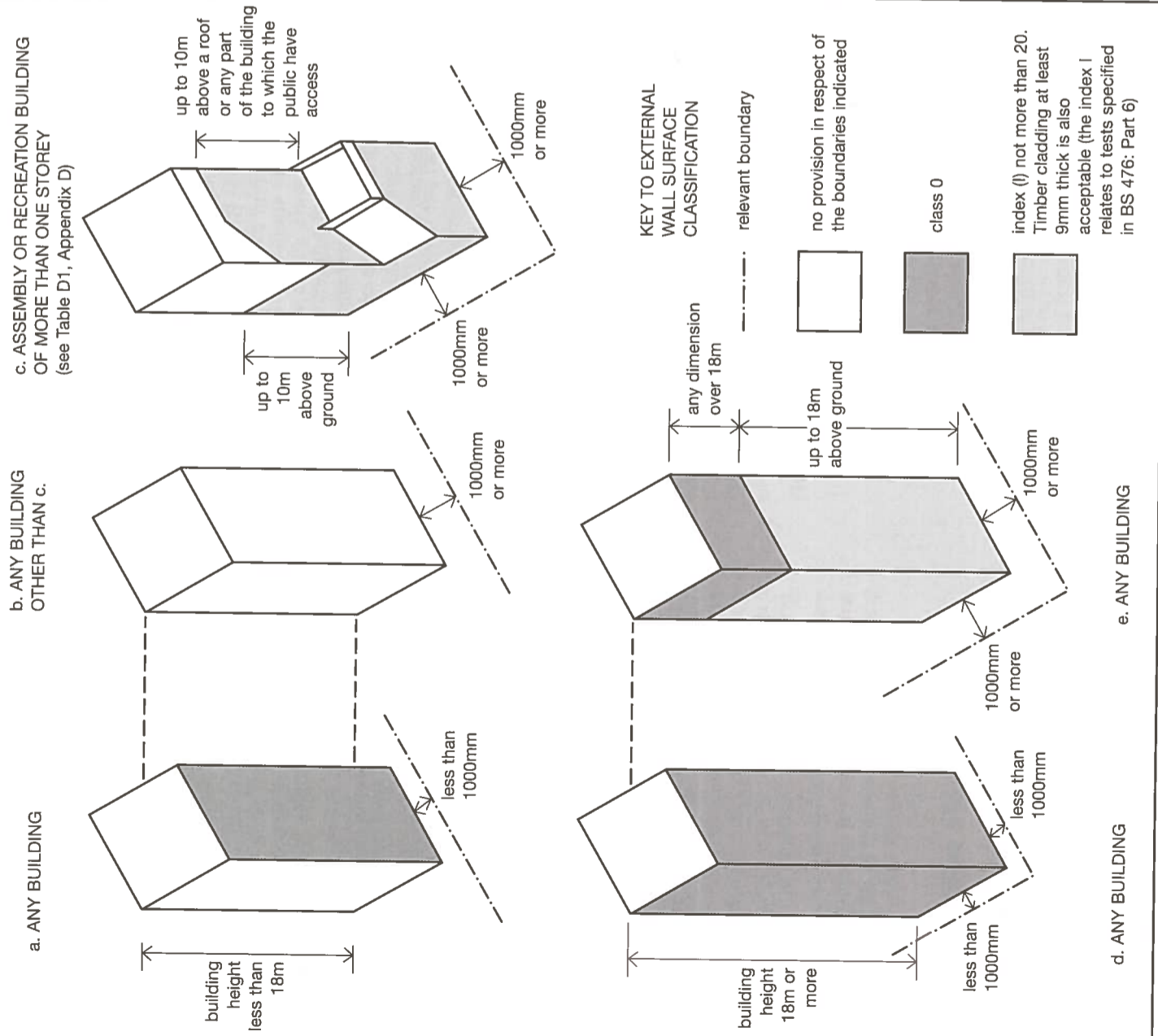
13.5 The external surfaces of walls should meet the provisions in Diagram 40. However, the total amount of combustible material may be limited in practice by the provisions for space separation in Section 14 (see paragraph 14.7 et seq). Where a mixed use building includes Assembly and Recreation Purpose Group accommodation, the external surfaces of walls should meet the provisions in Diagram 40c.

Note: One alternative to meeting the provisions in Diagram 40 could be BRE Fire Note 9 *Assessing the fire performance of external cladding systems: a test method* (BRE, 1999).

13.6 In the case of the outer cladding of a wall of 'rainscreen' construction (with a drained and ventilated cavity), the surface of the outer cladding which faces the cavity should also meet the provisions of Diagram 40.

Diagram 40 Provisions for external surfaces of walls

See paras 13.5 and 13.6



Section 14

SPACE SEPARATION

Introduction

14.1 The provisions in this Section are based on a number of assumptions, and whilst some of these may differ from the circumstances of a particular case, together they enable a reasonable standard of space separation to be specified. The provisions limit the extent of unprotected areas in the sides of a building (such as openings and areas with a combustible surface) which will not give adequate protection against the external spread of fire from one building to another.

A roof is not subject to the provisions in this Section unless it is pitched at an angle greater than 70° to the horizontal (see definition for 'external wall' in Appendix E). Similarly, vertical parts of a pitched roof such as dormer windows (which taken in isolation might be regarded as a wall), would not need to meet the following 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 should be treated as a wall rather than a roof.

14.2 The assumptions are:

- that the size of a fire will depend on the compartmentation of the building, so that a fire may involve a complete compartment, but will not spread to other compartments;
- that the intensity of the fire is related to the use of the building (ie purpose group), but that it can be moderated by a sprinkler system;
- that Residential, and Assembly and Recreation, Purpose Groups represent a greater life risk than other uses;
- that apart from Residential, and Assembly and Recreation Purpose Groups, the spread of fire between buildings on the same site represents a low risk to life and can be discounted;
- that there is a building on the far side of the boundary that has a similar elevation to the one in question, and that it is at the same distance from the common boundary; and
- that the amount of radiation that passes through any part of the external wall that has fire resistance may be discounted.

14.3 Where a reduced separation distance is desired (or an increased amount of unprotected area) it may be advantageous to construct compartments of a smaller size.

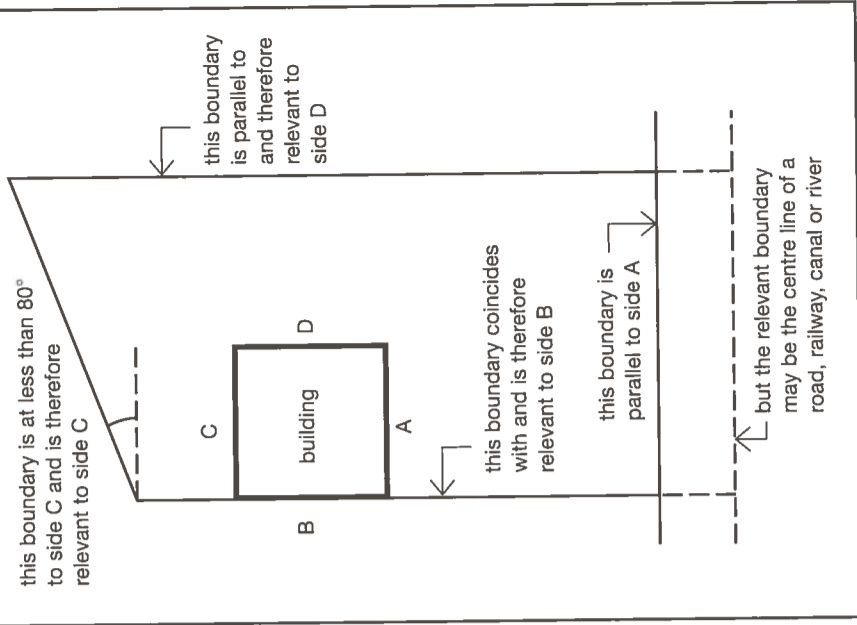
Diagram 41 Relevant boundary

See paras 14.4 and 14.5

This diagram sets out the rules that apply in respect of a boundary for it to be considered as a relevant boundary

For a boundary to be relevant it should:

- coincide with, or
- be parallel to, or
- be at an angle of not more than 80° to the side of the building



of the fire resistance of loadbearing elements of construction, Part 22 Methods for determination of the fire resistance of non-loadbearing elements of construction, Part 23 Methods for determination of the contribution of components to the fire resistance of a structure, and Part 24 Method for determination of the fire resistance of ventilation ducts (or to BS 476: Part 8: 1972 in respect of items tested or assessed prior to 1 January 1988) in respect of one or more of the following criteria:

- resistance to collapse (loadbearing capacity), which applies loadbearing elements only;
- resistance to fire penetration (integrity); and
- resistance to the transfer of excessive heat (insulation).

Table A1 gives the specific requirements for each element in terms of the three performance criteria above. (Provisions for fire doors are set out in Appendix B, Table B1.)

Table A2 sets out the minimum periods of fire resistance for elements of structure.

Table A3 sets out criteria appropriate to the suspended ceilings that can be accepted as contributing to the fire resistance of a floor.

Table A4 sets out limitations on the use of uninsulated fire-resisting glazed elements. These limitations do not apply to the use of insulated fire-resisting glazed elements.

Information on tested elements is frequently given in literature available from manufacturers and trade associations.

Information on tests on fire-resisting elements is also given in such publications as:

Association for Specialist Fire Protection/Steel Construction Institute/Fire Test Study Group *Fire protection for structural steel in buildings*, second edition - revised, 1992. (Available from the ASFP, Association House, 235 Ash Road, Aldershot, Hants GU12 4DD and the Steel Construction Institute, Silwood Park, Ascot, Berks SL5 7QN).

Roofs

6 Performance in terms of the resistance of roofs to external fire exposure is determined by reference to the methods specified in BS 476: Part 3: 1958 *External fire exposure roof tests* under which constructions are designated by 2 letters in the range A to D, with an AA designation being the best. The first letter indicates the time to penetration, and the second letter a measure of the spread of flame.

Note: This is not the most recent version of the standard.

In some circumstances roofs, or parts of roofs, may need to be fire-resisting, for example if used as an escape route or if the roof performs the function of a floor. Such circumstances are covered in Sections 2, 6 and 8.

Table A5 gives notional designations of some generic roof coverings.

Non-combustible materials

7 Non-combustible materials are defined in Table A6 either as listed products, or in terms of performance when tested to BS 476: Part 4: 1970 *Non-combustibility test for materials* or Part 11: 1982 *Method for assessing the heat emission from building products*.

Table A6 identifies non-combustible products and materials, and lists circumstances where their use is necessary.

Materials of limited combustibility

8 Materials of limited combustibility are defined in Table A7 by reference to the method specified in BS 476: Part 11: 1982.

Table A7 also includes composite products (such as plasterboard) which are considered acceptable, and where these are exposed as linings they should also meet any appropriate flame spread rating.

Internal linings

9 Flame spread over wall or ceiling surfaces is controlled by providing for the lining materials or products to meet given performance levels in tests appropriate to the materials or products involved.

10 Lining systems which can be effectively tested for 'surface spread of flame' are rated for performance by reference to the method specified in BS 476: Part 7: 1971 *Surface spread of flame tests for materials*, or 1987 *Method for classification of the surface spread of flame of products*, or 1997 *Method of test to determine the classification of the surface spread of flame of products* under which materials or products are classified 1, 2, 3 or 4 with Class 1 being the highest.

11 To restrict the use of materials which ignite easily, which have a high rate of heat release and/or which reduce the time to flash over, maximum acceptable 'fire propagation' indices are specified. These are determined by reference to the method specified in BS 476: Part 6: 1981 or 1989 *Method of test for fire propagation of products*. Index of performance (I) relates to the overall test performance, whereas sub-index (I₁) is derived from the first three minutes of test.

12 The highest product performance classification for lining materials is Class 0. This is achieved if a material or the surface of a composite product is either:

- composed throughout of materials of limited combustibility; or

b. a Class 1 material which has a fire propagation index (I) of not more than 12 and sub-index (I₁) of not more than 6.

Note: Class 0 is not a classification identified in any British Standard test.

13 Composite products defined as materials of limited combustibility (see paragraph 8 above and Table A7) should in addition comply with the test requirement appropriate to any surface rating specified in the guidance on requirements B2, B3 and B4.

14 The notional performance ratings of certain widely used generic materials or products are listed in Table A8 in terms of their performance in the traditional lining tests BS 476 Parts 6 and 7.

15 Results of tests on proprietary materials are frequently given in literature available from manufacturers and trade associations.

Any reference used to substantiate the surface spread of flame rating of a material or product should be carefully checked to ensure that it is suitable, adequate and applicable to the construction to be used. Small differences in detail, such as thickness, substrate, colour, form, fixings, adhesive etc, may significantly affect the rating.

Thermoplastic materials

16 A thermoplastic material means any synthetic polymeric material which has a softening point below 200°C if tested to BS 2782 *Methods of testing plastics*, Part 1 *Thermal properties*, Method 120A: 1990 *Determination of the Vicat softening temperature of thermoplastics*. Specimens for this test may be fabricated from the original polymer where the thickness of material of the end product is less than 2.5mm.

17 A thermoplastic material in isolation cannot be assumed to protect a substrate, when used as a lining to a wall or ceiling. The surface rating of both products must therefore meet the required classification. If however, the thermoplastic material is fully bonded to a non-thermoplastic substrate, then only the surface rating of the composite will need to comply.

18 Concessions are made for thermoplastic materials used for window glazing, rooflights, and lighting diffusers within suspended ceilings, which may not comply with the criteria specified in paragraphs 10 et seq. They are described in the guidance on requirements B2 and B4.

19 For the purposes of the requirements B2 and B4 thermoplastic materials should either be used according to their classification 0-3, under the BS 476: Parts 6 and 7 tests as described in paragraphs 10 et seq, if they have such a rating, or they may be classified TP(a) rigid, TP(a) flexible, or TP(b) according to the following methods:

TP(a) rigid:

- Rigid solid pvc sheet;
- Solid (as distinct from double- or multiple-skin) polycarbonate sheet at least 3mm thick;
- Multi-skinned rigid sheet made from unplasticised pvc or polycarbonate which has a Class 1 rating when tested to BS 476: Part 7: 1971, 1987 or 1997;
- Any other rigid thermoplastic product, a specimen of which (at the thickness of the product as put on the market), when tested to BS 2782: 1970 as amended in 1974: Method 508A *Rate of burning (Laboratory method)*, performs so that the test flame extinguishes before the first mark, and the duration of flaming or afterglow does not exceed 5 seconds following removal of the burner.

TP(a) flexible:

Flexible products not more than 1mm thick which comply with the Type C requirements of BS 5867 *Specification for fabrics for curtains and drapes* Part 2 *Flammability requirements* when tested to BS 5438 *Methods of test for flammability of textile fabrics when subjected to a small igniting flame applied to the face or bottom edge of vertically oriented specimens*, Test 2, 1989 with the flame applied to the surface of the specimens for 5, 15, 20 and 30 seconds respectively, but excluding the cleansing procedure; and

TP(b):

- Rigid solid polycarbonate sheet products less than 3mm thick, or multiple-skin polycarbonate sheet products which do not qualify as TP(a) by test; or
 - Other products which, when a specimen of the material between 1.5 and 3mm thick is tested in accordance with BS 2782: 1970, as amended in 1974: Method 508A, has a rate of burning which does not exceed 50mm/minute.
- Note:** If it is not possible to cut or machine a 3mm thick specimen from the product then a 3mm test specimen can be moulded from the same material as that used for the manufacture of the product.

Fire test methods

20 A guide to the various test methods in BS 476 and BS 2782 is given in PD 6520 *Guide to fire test methods for building materials and elements of construction* (available from the British Standards Institution).

A guide to the development and presentation of fire tests and their use in hazard assessment is given in BS 6336 *Guide to development and presentation of fire tests and their use in hazard assessment*.

Table A6 Use and definitions of non-combustible materials

References in AD.B guidance to situations where such materials should be used	Definitions of non-combustible materials
1. ladders referred to in the guidance to B1, paragraph 6.22.	a. Any material which when tested to BS476:Part 11 does not flame nor cause any rise in temperature on either the centre (specimen) or furnace thermocouples.
2. refuse chutes meeting the provisions in the guidance to B3, paragraph 9.35c.	b. Totally inorganic materials such as concrete, fired clay, ceramics, metals, plaster and masonry containing not more than 1% by weight or volume of organic material. (Use in buildings of combustible metals such as magnesium/aluminium alloys should be assessed in each individual case).
3. suspended ceilings and their supports where there is provision in the guidance to B3, paragraph 10.13, for them to be constructed of non-combustible materials.	c. Concrete bricks or blocks meeting BS 6073:Part 1
4. pipes meeting the provisions in the guidance to B3, Table 15.	d. Products classified as non-combustible under BS 476:Part 4
5. flue walls meeting the provisions in the guidance to B3, Diagram 39.	
6. construction forming car parks referred to in the guidance to B3, paragraph 12.3.	

Table A7 Use and definitions of materials of limited combustibility

References in AD.B guidance to situations where such materials should be used	Definitions of material of limited combustibility
1. stairs where there is provision in the guidance to B1 for them to be constructed of materials of limited combustibility (see 6.19).	a. Any non-combustible material listed in Table A6.
2. materials above a suspended ceiling meeting the provisions in the guidance to B3, paragraph 10.13.	b. Any material of density 300/kg/m ³ or more, which when tested to BS476:Part 11, does not flame and the rise in temperature on the furnace thermocouple is not more than 20°C.
3. reinforcement/support for fire-stopping referred to in the guidance to B3, see 11.13.	c. Any material with a non-combustible core at least 8mm thick having combustible facings (on one or both sides) not more than 0.5mm thick. (Where a flame spread rating is specified, these materials must also meet the appropriate test requirements.)
4. roof coverings meeting provisions: a. in the guidance to B3, paragraph 10.11 or b. in the guidance to B4, Table 17 or c. in the guidance to B4, Diagram 47.	
5. roof deck meeting the provisions of the guidance to B3, Diagram 28a.	
6. class 0 materials meeting the provisions Appendix A, paragraph 12(a).	
7. ceiling tiles or panels of any fire protecting suspended ceiling (Type D) in Table A3.	
8. compartment walls and compartment floors in hospitals referred to in paragraph 9.32.	
9. insulation material in external wall construction referred to in paragraph 13.7.	Any of the materials (a), (b) or (c) above, or;
10. insulation above any fire-protecting suspended ceiling (Type D) in Table A3.	d. Any material of density less than 300kg/m ³ , which when tested to BS476:Part 11, does not flame for more than 10 seconds and the rise in temperature on the centre (specimen) thermocouple is not more than 35°C and on the furnace thermocouple is not more than 25°C.

Table A8 Typical performance ratings of some generic materials and products

Rating	Material or product
Class 0	1. any non-combustible material or material of limited combustibility. (Composite products listed in Table A7 must meet test requirements given in Appendix A, paragraph 12(b).) 2. brickwork, blockwork, concrete and ceramic tiles. 3. plasterboard (painted or not with a PVC facing not more than 0.5mm thick) with or without an air gap or fibrous or cellular insulating material behind. 4. woodwool cement slabs. 5. mineral fibre tiles or sheets with cement or resin binding.
Class 3	6. timber or plywood with a density more than 400kg/m ³ , painted or unpainted. 7. wood particle board or hardboard, either untreated or painted. 8. standard glass reinforced polyesters.
Notes:	
1. Materials and products listed under Class 0 also meet Class 1.	3. The following materials and products may achieve the ratings listed below. However, as the properties of different products with the same generic description vary, the ratings of these materials/products should be substantiated by test evidence. Class 0 – aluminium faced fibre insulating board, flame retardant decorative laminates on a calcium silicate board, thick polycarbonate sheet, phenolic sheet and UPVC; Class 1 – phenolic or melamine laminates on a calcium silicate substrate and flame retardant decorative laminates on a combustible substrate.
2. Timber products listed under Class 3 can be brought up to Class 1 with appropriate proprietary treatments.	