Building Regulations, 1991

TECHNICAL GUIDANCE DOCUMENT B
FIRE

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BUILDING REGULATIONS, 1991

TECHNICAL GUIDANCE DOCUMENT B - FIRE

INTRODUCTION

This document has been published by the Minister for the Environment under article 5 of the Building Regulations, 1991, for the purpose of providing guidance with regard to compliance with the requirements of Part B of the First Schedule to the Regulations. Where works are carried out in accordance with this guidance, this will, prima facie, indicate compliance with these requirements.

This document should be read in conjunction with the Regulations.

Guidance contained in this document with respect to the use of a particular material, method of construction, standard or other specification does not preclude the use of any other suitable material, method of construction, standard or specification.

TECHNICAL SPECIFICATION

Building Regulations are made for specific purposes i.e. health, safety and welfare of persons, energy conservation and the special needs of disabled people. Technical Specifications (including Harmonised European Standards, European Technical Approvals, National Standards and Agrément Certificates) are relevant to the extent that they relate to these considerations. Technical Specifications may also address other aspects of performance not covered by the Regulations.

The references in this document to named Technical Specifications, or to materials and methods which are likely to be suitable for the purposes of the Regulations, are not exclusive and other materials and methods may be suitable in the particular circumstances. A reference to a Technical Specification is to the latest edition (including any amendments, supplements or addenda) current at the date of publication of this Technical Guidance Document.

MATERIALS AND WORKMANSHIP

Any building work to which a requirement of the Regulations applies must, in accordance with Part D of the First Schedule to the Regulations, be carried out with proper materials and in a workmanlike manner. Relevant guidance is contained in Technical Guidance Document D.

Part D of the First Schedule to the Regulations defines "proper materials" as materials which are fit for the use for which they are intended and for the conditions in which they are to be used, and includes materials which:

(a) bear a CE Mark in Accordance with the provisions of the Construction Products Directive (89/108/EEC); or

(b) comply with an appropriate harmonized standard or European technical approval, as defined in the Construction Products Directive (89/106/EEC); or

(c) comply with an appropriate Irish Standard or Irish Agrément Board Certificate or with an alternative national technical specification of any Member State of the European Community which provides in use an equivalent level of safety and suitability.

Building Regulations - The Requirement

Part B of the First Schedule to the Building Regulations, 1991 provides as follows:

Means of escape in case of fire.	**B1**	A building shall be so designed and constructed that there are adequate means of escape in case of fire from the building to a place of safety outside the building, capable of being safely and effectively used.
Internal fire spread (linings).	**B2**	For the purpose of inhibiting the spread of fire within a building, the internal linings - (a) shall offer adequate resistance to the spread of flame over their surfaces; and (b) shall have, if ignited, a rate of heat release which is reasonable in the circumstances.
Internal fire spread (structure).	**B3**	(1) A building shall be so designed and constructed that, in the event of fire, its stability will be maintained for a reasonable period. (2) (a) A wall common to two or more buildings shall be so designed and constructed that it offers adequate resistance to the spread of fire between those buildings. (b) A building shall be sub-divided with fire resisting construction where this is necessary to inhibit the spread of fire within the building. (3) A building shall be so designed and constructed that the unseen spread of fire and smoke within concealed spaces in its structure or fabric is inhibited where necessary. (4) For the purposes of sub-paragraph 2(a), a house in a terrace and a semi-detached house are each to be treated as being a separate building.
External fire spread.	**B4**	The external walls and roof of a building shall be so designed and constructed that they afford adequate resistance to the spread of fire to and from neighbouring buildings.
Access and facilities for the fire service.	**B5**	A building shall be so designed and constructed that there is adequate provision for access for fire appliances and for such facilities as may be reasonably required to assist the fire service in the protection of life and property.

0.1 Sections B1 to B5

0.1.1 The provisions set out in the parts of this document, B1 to B5, deal with different aspects of fire safety. The five sections, in addition to this one dealing with general provisions, are :

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

B1 aims to ensure that a satisfactory standard of means of escape is provided for persons in the event of fire in a building;

B2 aims to ensure that fire spread over the internal linings of buildings is inhibited;

B3 aims to ensure the stability of buildings in the event of fire, that there is a sufficient degree of fire separation within buildings and between adjoining buildings, and to inhibit the unseen spread of fire and smoke in concealed spaces in buildings;

B4 aims to ensure that external walls and roofs have adequate resistance to the spread of fire over their external surfaces, and that spread of fire from one building to another is restricted; and

B5 aims to ensure satisfactory access for fire appliances to buildings and facilities in buildings to assist fire fighters in the protection of life and property.

0.1.2 Whilst provisions appropriate to each of these aspects are set out separately in this document, many of the provisions are closely interlinked. For example, there is a close link between the provisions for means of escape (B1) and those for the control of fire growth (B2), fire containment (B3), and facilities for the fire service (B5). Similarly there are links between B3 and the provisions for controlling external fire spread (B4), and between B3 and B5. Interaction between these different requirements should be recognised where variations in the standard of provision are being considered. A higher standard under one of the requirements may be of benefit in respect of one or more of the other requirements. Thus the provisions in the document as a whole should be considered as a package aimed at achieving an acceptable standard of fire safety.

0.2. Alternative approaches to safety requirements

0.2.1 Rigid compliance with the provisions set out in this document might prove unduly restrictive in the design of some large and complex buildings. A fire safety engineering approach that takes into account the total fire safety package can provide an alternative approach to providing fire safety. In such cases it would be appropriate to take into account a range of fire safety features, some of which are dealt with in this document, and some of which are not addressed in any detail, and to set these against an assessment of the hazard and risk peculiar to the particular case.

0.2.2 Factors that should be taken into account are:

- the probability of a fire occurring
- the resulting fire load
- the risk to persons in the event of fire.

0.2.3 A wide variety of measures could be considered and incorporated to a greater or lesser extent appropriate to the circumstances. These include:

- prevention of fire
- early fire warning by an automatic detection system
- the standard of means of escape
- provision of smoke control
- control of the rate of growth of a fire
- the adequacy of the structure to resist the effects of a fire
- the degree of fire containment
- fire separation between buildings or parts of buildings
- the standard of active measures for fire extinguishment or control
- facilities to assist the fire service
- the degree of fire safety management including the likely standard of maintenance of the fire safety systems
- consideration of the availability of any continuing control under other legislation that could ensure continued maintenance of such systems.

0.2.4 An instance in this document, where it has been found necessary to emphasise an overall approach to fire safety, can be found in the provisions relating to shopping complexes that are set out in sub-section 3.5.3. Similarly a building containing an atrium penetrating compartment floors will need special fire safety measures.

0.2.5 Codes of practice and standards listed under relevant sections (see sub-section 1.1 and at the end of this document) contain appropriate guidance.

0.3 Provisions common to Sections B1 to B5

0.3.1 Under the provisions in this document there are a number of items that are common to one or more of the requirements. These include a classification of purpose groups, fire performance of materials and structures, provisions regarding fire doors, methods of measurement, and definitions. For convenience these and other appropriate items have been drawn together for common reference as Appendices to this document.

Purpose groups

0.3.2 Many of the provisions in this document are related to the use of the building. The use classifications are termed purpose groups and from this it follows that the relevant purpose group should be decided before the provisions can be determined.

Purpose groups can apply to a whole building, or (where a building is compartmented) to a compartment in the building, and the relevant purpose group should be taken from the main use of the building or compartment. However, in some situations there may be more than one use involved in a building or compartment, and in certain circumstances it is appropriate to treat the different uses as belonging to a purpose group in its own right. These situations are:

(a) a flat or maisonette;
(b) storage for a shop if the area of storage is more than one-half of the total floor area of the shop; and
(c) in other buildings, any ancillary use if its area is more than one-quarter of the total floor area of the building or part.

Some buildings may have two or more main uses that are not ancillary to one another, for example, offices over shops from which they are independent. In such cases, each of the uses should be considered as belonging to a purpose group in its own right.

In other cases and particularly in some large buildings there may be a complex mix of uses. In such cases it is necessary to consider the possible risk that one part of a complex may have on another and special measures to reduce the risk may be necessary.

Table 0.1 sets out the purpose group classification.

Fire performance of materials and structures

0.3.3 Many of the provisions throughout this publication are given in terms of performance in relation to standard fire test methods. Details are drawn together in Appendix A to which reference is made where appropriate in Sections B1 to B5.

Fire doors

0.3.4 Provisions in respect of fire doors are set out in Appendix B.

Methods of measurement

0.3.5 Some form of measurement is an integral part of many of the provisions in this publication, and methods of measurement are set out in Appendix C (except for those methods particular to B1 set out in paragraph 1.0.10 to that Part).

Definitions

0.3.6 Whilst definitions that are only relevant to one of the sections in this publication are given in that section, there are other defined terms that are relevant to more than one section. These are defined in Appendix D, and for convenience that Appendix lists terms that are also defined elsewhere.

Assessment of risk in industrial and storage buildings

0.3.7 The purpose groups set out in Table 0.1 can encompass a broad range of activity within an individual group. This range may affect the determination of appropriate safety requirements.

Appendix E sets out guidelines for assessment of risk in Industrial and Storage buildings (Purpose Group 6 and 7(a) respectively)

Reference standards and publications

0.3.8 For convenience, standards and other references in this document are listed in Appendices F and G respectively.

Table 0.1 Classification of buildings by purpose group

	Group	Purpose for which a building or compartment of a building is intended to be used
Residential (Domestic)	1 (a)*	house which does not contain a habitable storey with a floor level more than 5 m above ground level.
	1 (b)*	house which contains a habitable storey with a floor level more than 5 m above ground level.
	1 (c)	flat or maisonnette.
Residential (Institutional)	2 (a)	hospital, nursing home, home for old people or for children, school or other similar establishment used as living accommodation or for the treatment, care or maintenance of people suffering from illness or mental or physical disability or handicap, where such people sleep on the premises.
Other residential	2 (b)	hotel, boarding house, residential college, hall of residence, hostel, and any other residential purpose not described above.
Office	3	premises used for the purpose of administration, clerical work (including writing, book keeping, sorting papers, filing, typing, duplicating, machine calculating, drawing and the editorial preparation of matter for publication, handling money (including banking and building society work), telephone system operating).
Shop and commercial	4	premises used for a retail or wholesale trade or business (including retail sales by auction, self-selection and over-the-counter wholesale trading, the business of lending books or periodicals for gain and the business of a barber or hairdresser) and premises to which the public is invited to deliver or to collect goods in connection with their hire, repair or other treatment, or where they themselves may carry out such repairs or other treatments.
Assembly and recreation	5	place of assembly or resort used for educational, social, religious or recreational purposes.
Industrial	6**	factories and other premises used for manufacturing, altering, repairing, cleaning, washing, breaking-up, adapting or processing any article, generating power or slaughtering livestock.
Storage and other non-residential	7(a)**	place for storage or deposit of goods or materials (other than described under 7(b)) and any building not within any of purpose groups 1 to 6.
	7(b)	car parks designed to admit and accommodate only cars, motorcycles and passenger or light goods vehicles weighing no more than 2500 kg gross.

Note: * Purpose Groups 1(a) and 1(b) include any ancillary acommodation not exceeding an aggregate of 46m² forming part of the house of any person providing professional or scientific services and use in his/her professional or scientific capacity,i.e. surgeries, consulting rooms or offices.

** See Appendix E for guidance on sub-division of buildings in Class 6 and 7(a).

Section 1

MEANS OF ESCAPE IN CASE OF FIRE

Means of escape in case of fire.	**B1**	**A building shall be so designed and constructed that there are adequate means of escape in case of fire from the building to a place of safety outside the building, capable of being safely and effectively used.**

Performance

The requirement of B1 may be met:

(a) if there are routes of sufficient number and size, which are suitably located, to enable persons to escape to a place of safety in the event of fire;

(b) if the routes are sufficiently protected from the effects of fire in terms of enclosure, where necessary, and in the use of materials on the routes; and

(c) if sufficient lighting, means of smoke control and an alarm system to warn the occupants of the existence of fire are provided to enable them to use the routes safely;

all to an extent necessary that is dependent on the use of the building, its size and height.

Contents

1.0 INTRODUCTION TO PROVISIONS

General

1.0.1 The provisions in Technical Guidance Document Section B1 are concerned with the measures necessary to ensure reasonable facilities for means of escape in case of fire and with structural fire precautions only where these are necessary to safeguard escape routes. They assume that the occupants of buildings will include a normal proportion of disabled people and that, in the design of the building, reliance should not be placed on external rescue by the fire brigade. The document, therefore, has been prepared on the basis that the occupants of any part of a building should be able to escape safely from a building in an emergency without any external assistance. Where it is proposed to use an alternative approach to that outlined in this document, Codes of Practice which rely on external rescue by fire brigades are not acceptable. Special considerations, however, apply to hospitals and similar health care buildings (see paragraphs 1.0.6 and 1.2.7).

Attention is drawn to the fact that other legislation may impose requirements for means of escape in case of fire with which the building must comply, and which operate when the building is brought into use. The main legislation in this area is the Fire Services Act, 1981. The Health, Safety and Welfare at Work Act, 1989, imposes similar responsibilities for industrial and storage premises.

This document has been written on the assumption that the building concerned will be properly managed. Failure to properly manage fire safety may result in the prosecution of a building owner or occupier under legislation such as the Fire Services Act, 1981 or the Safety, Health and Welfare at Work Act, 1989.

Analysis of the problem

1.0.2 The design of means of escape from a building must be based on an appreciation of the probable behaviour of fire, which may break out in any part of the building and then spread to other parts. The overall design of a building should therefore be carefully analysed part by part to determine the danger which might arise from a fire, either in the part where fire may originate or in any other part of the building to which it may spread.

Fires do not normally start in two different places in a building at the same time, and initially a fire will create a hazard only in the part in which it starts and is unlikely at this stage to involve a large area. Subsequently it may spread to other parts, usually along the circulation routes of the building. Furnishings, equipment, services and plant are among the usual sources of origin. It is less likely that the fire will originate in the structure of the building itself and the risk of it originating in circulation areas, such as passages, corridors, lobbies or stairways, bearing in mind the limited combustible contents of such areas, is very low.

The primary danger associated with fire in its early stages is not flame but the smoke and noxious gases produced by the fire. Most of the casualties in fires have been caused by smoke, which has often also obscured the way to escape routes and exits. Measures designed to provide safe means of escape must, therefore, include provisions to limit the spread of smoke and fumes.

Criteria for means of escape

1.0.3 The basic principles for the design of means of escape are:

(a) there should be alternative means of escape wherever possible;

(b) where direct escape to a place of safety is not possible, the means of escape should consist of two parts -

- an unprotected escape route which should be limited in extent and should lead to a protected escape route, and

- the protected escape route which should lead to a place of safety.

The ultimate place of safety is, of course, the open air clear of the effects of the fire. In modern large and complex buildings, however, reasonable safety may be reached within the building, provided planning and protection measures are incorporated in accordance with the guidance given in this document.

The following are not acceptable as a means of escape:

(a) lifts (except a suitably designed and installed evacuation lift for the use of disabled people);

(b) passenger conveyors or escalators;

(c) portable ladders and throw-out ladders; and

(d) manipulative apparatus and appliances.

Alternative means of escape

1.0.4 There is always the possibility of the path of a single escape route being rendered impassable by fire or a concentration of heavy smoke or fumes and, ideally, people should be able to turn their backs on a fire wherever it occurs and travel away from it to a protected escape route leading to a place of safety. When account is taken, however, of the way the building is to be used, there are many circumstances in which it is not reasonably possible to provide alternative means of escape from all parts of the floor or building. In limited conditions a dead-end can be accepted as providing reasonable safety. These conditions depend on the use of the building and its inherent fire risk, the size and height of the building and the numbers of persons accommodated within the dead-end.

Unprotected and protected escape routes

1.0.5 The unprotected part of an escape route is that part which a person has to traverse before reaching either the safety of a final exit or the comparative safety of a protected escape route. Unprotected escape routes, therefore, should be limited in extent so that people do not have to travel excessive distances exposed to the immediate danger of fire and smoke. Even with protected horizontal escape routes the distance to a final exit or protected stairway needs to be limited because protection is not given indefinitely and the possibility of premature failure exists.

Protected stairways are designed to provide virtually 'fire sterile' areas which lead to places of safety outside the building. Once inside a protected stairway, a person can be considered to be safe from immediate danger from flame and smoke and can then proceed to a place of safety at his or her own pace. To enable this to be done, flames, smoke and gases must be excluded from these escape routes (as far as is possible) by fire and smoke resisting structures or by an appropriate smoke control system, or a combination of both these methods. This does not preclude the use of unprotected stairways for day-to-day circulation, but these "accommodation" stairways can only play a very restricted role in terms of means of escape.

Progressive horizontal escape in hospitals and similar buildings

1.0.6 In areas designed for patients in hospitals and similar buildings the principle of total evacuation of a building in the event of fire may be initially inappropriate.

Able-bodied staff employed for the care and supervision of people in hospitals are normally available and trained to assist them in escaping from the immediate danger of fire, although the ratio of staff to disabled occupants can vary considerably. It is, therefore, appropriate to adopt the principle of progressive, staged evacuation of occupants from an area in which fire occurs to an adjoining area (or areas) on the same level which affords sufficient protection from the fire and smoke to enable them (and the occupants of the adjoining area) to remain safe until the fire has been dealt with. Progressive horizontal escape should always be planned to ensure that, if further stages of evacuation become necessary, ultimately a protected vertical escape route is reached. A whole floor would be evacuated by means of a stairway (or a suitably protected bed/evacuation lift) only as a last resort if the fire could not be brought under control. The principle could be of value to adopt in some other institutional buildings.

Security

1.0.7 There is potential for conflict between the need for easy and rapid evacuation of a building in case of fire, and the control of entry and exit in the interest of security. Measures to prevent unauthorised access can also hinder fire service entry to rescue people trapped by fire. It

is important that any potential conflicts are identified and resolved at the design stage and not left to ad-hoc expedients after completion.

Use of the document

1.0.8 Section 1.1 lists codes of practice which contain appropriate guidance in regard to means of escape in case of fire in buildings in certain purpose groups or parts of purpose groups.

Sections 1.2 and 1.3 give provisions for means of escape in case of fire in buildings other than those covered by Section 1.1.

Section 1.4 sets out provisions in respect of construction and protection of escape routes generally.

Section 1.5 sets out special provisions in the case of conversion of lofts in houses to habitable accommodation.

Definitions

1.0.9 The following definitions apply specifically to B1. Other terms applicable more widely throughout this technical guidance document are given in Appendix D.

Access room - Room through which passes the only escape route from an inner room.

Accommodation stairway - A stairway additional to that or those required for escape purposes, provided for the convenience of occupants.

Alternative escape routes - Escape routes sufficiently separated by either direction and space, or by fire-resisting construction, to ensure that one is still available should the other be affected by fire.

Alternative exit - One of two or more exits from within a flat or maisonette, each of which is separate from the other.

Common stairway - An escape stairway serving more than one flat or maisonette.

Dead-end - Area from which escape is possible in one direction only.

Direct distance - The shortest distance from any point within the floor area, measured within the external enclosures of the building, to the nearest storey exit, ignoring walls, partitions and fittings, other than the enclosing walls/partitions to protected stairways. (2/3rd permitted travel distance can be used for design purposes).

Emergency lighting - Lighting provided for use when the power supply to the normal lighting fails.

Escape lighting - That part of the emergency lighting which is provided to ensure that the escape route is illuminated at all material times.

Evacuation lift - A lift that may be used for the evacuation of disabled people in a fire.

Final exit - The termination of an escape route from a building giving direct access to a street, passageway, walkway or open space, and sited to ensure the rapid dispersal of persons from the vicinity of a building so that they are no longer in danger from fire and/or smoke.

Habitable room - A room used for living or sleeping purposes but does not include a kitchen having a floor area less than 6.5 m^2.

Inner room - A room from which escape is possible only by passing through an access room.

Means of escape - Physical means whereby a safe route or routes is or are provided for persons to travel from any point in a building to a place of safety.

Open spatial planning - The internal arrangement of a building in which more than one storey or level is contained in one undivided volume e.g. split-level floors and balconies or gallery floors overlooking an unenclosed atrium (but not atrium galleries used only for circulation).

Places of special fire risk - Transformer and switchgear rooms, boiler rooms, fuel or other highly flammable substance storage spaces, and rooms housing a fixed internal combustion engine.

Pressurization - A method of protecting escape routes against the ingress of smoke by maintaining an air pressure difference between the route and adjoining accommodation.

Protected corridor/lobby - A corridor or lobby which is adequately protected from fire in adjoining accommodation by fire-resisting construction.

Sheltered housing - Blocks of flats and/or maisonettes, with each dwelling incorporating its own cooking and sanitary facilities, designed specifically for persons who might require assistance, e.g. elderly people, and where some form of assistance is available at all times. (Sheltered housing usually includes amenities common to all occupiers such as lounges, guest rooms, etc).

Storey - means that part of a building which is situated between either -

(a) two vertically adjacent floors of the building, or

(b) the uppermost floor and the uppermost point of the roof covering of the building; and includes any :

(a) gallery;

(b) roof which is accessible for purposes other than only for maintenance and repair.

Storey exit - A final exit, or a doorway opening into a protected stairway, firefighting lobby or external escape route, or a doorway in a compartment wall that is common to two or more buildings (a separating wall). (N.B. A door in a compartment wall in a hospital is considered a storey exit for the purposes of paragraph 1.2.7.4) .

Travel distance - The actual distance to be travelled by a person from any point within the floor area to the nearest exit, having regard to the layout of walls, partitions and fittings.

Methods of measurement

1.0.10 The following methods of measurement apply specifically to B1. Other methods of measurement applicable more widely throughout this document are given in the definitions in Appendix D, and illustrated in Appendix C.

(a) Occupant capacity of a:

(i) room or storey - is the maximum number of persons it is designed to hold (where this is known) or the number calculated (using the occupancy load factors given in Table 1.1) from -

$$\frac{\text{area of room or storey } (m^2)}{\text{occupancy load factor}}$$

Note: 'area' excludes stairway enclosures, lifts and sanitary accommodation.

(ii) building or part of a building - is the sum of the number of occupants of the storeys in the building or part.

(b) Seatway - see Table 1.5.

(c) Travel distance - is by way of the shortest route, which if:

(i) there is fixed seating or other fixed obstructions, is along the centre line of the seatways and gangways;

(ii) it includes a stairway, is along the pitch line on the centre line of travel.

(d) Width of a:

(i) Doorway - is the width of the opening door leaf (or the sum of the widths of both opening door leaves in the case of double doors)

Note: It is assumed that the door leaf is free to open to an angle of at least 90°.

(ii) Escape route - is the width at shoulder level when defined by walls (handrails fixed to walls may be ignored) or, elsewhere, the minimum width of passage available between any fixed obstructions; and

(iii) Stairway - is the clear width between the walls or balustrades, strings and handrails intruding not more than 30 mm and 75 mm respectively may be ignored).

Table 1.1 Occupancy load factor		
	Accommodation [1]	**Occupancy load factor**
1.	Standing spectator areas	0.3
2.	Amusement arcade, assembly hall, (including a general purpose place of assembly), bar (public area), bingo hall, dance hall or dance floor	0.5
3.	Foyer, Queuing area	0.7
4.	Committee room, common room, conference room, dining room, licensed betting office (public area), lounge (other than a lounge bar), meeting room, reading room, restaurant, staff room, waiting room	1.0[2]
5.	Exhibition hall	1.5
6.	Shop sales area [3], skating rink, overall sales area and common public areas (shopping malls) in covered shopping complexes	2.0
7.	Art gallery, dormitory, factory production area, museum, office (room not exceeding 60 m² in area), workshop	5.0
8.	Kitchen, library, office (room exceeding 60 m² in area), shop sales area [4]	7.0
9.	Bedroom or study bedroom	8.0
10.	Bed-sitting room, billiards room	10.0
11.	Car park[5] storage and warehouse accommodation	30.0

Notes:

(1) Where accommodation is not directly covered by the descriptions given, the nearest reasonable value may be selected.

(2) Alternatively the occupant capacity may be taken as the number of seats provided, if the occupants will normally be seated. In the case of continuous seating, a width of 400 mm should be allowed per person.

(3) Shops other than those included under item 8, including - supermarkets and department stores (all sales areas), shops for personal services such as hairdressing and shops for the delivery or collection of goods for cleaning, repair or other treatment or for members of the public themselves carrying out such cleaning, repair or other treatment.

(4) Shops not in covered shopping complexes, trading predominantly in furniture, floor coverings, cycles, perambulators, large domestic appliances or other bulky goods, or trading on a wholesale self- selection basis.

(5) Alternatively 2 persons per parking space.

1.1 CODES OF PRACTICE FOR CERTAIN PURPOSE GROUPS OR PARTS OF PURPOSE GROUPS

Purpose Group 1 Residential (Domestic)

1.1.1 The requirement may be met by following those recommendations relevant to means of escape in BS 5588: Part 1 : 1990 Code of practice for residential buildings.

Purpose Group 2(a)(part) Hospitals

1.1.2 The requirement may be met by following those recommendations relevant to means of escape in Health Technical Memorandum 81 - Fire Code - Fire Precautions in New Hospitals.

Purpose Group 3 Offices

1.1.3 The requirement may be met by following those recommendations relevant to means of escape in BS 5588: Part 3 : 1983 Code of practice for office buildings.

Purpose Group 4 Shops and Commercial

1.1.4 The requirement may also be met by following those recommendations relevant to means of escape in BS 5588: Part 2 : 1985 Code of practice for shops.

Purpose Group 5 (part) Educational Buildings

1.1.5 The requirement may be met be following those recommendations relevant to means of escape in Building Bulletin 7 - Fire and the design of educational buildings.

1.2 CONSTRAINTS ON DESIGN FOR HORIZONTAL ESCAPE

Buildings other than those covered in Section 1.1

Introduction

1.2.1 The general principle to be followed when designing facilities for means of escape is that any person confronted by an outbreak of fire within a building can turn away from it and make a safe escape. This sub-section deals with the provision of means of escape from any point to the storey exit of the floor in question, for all types of building other than those covered by Section 1.1.

It should be read in conjunction with the general provisions in Section 1.4.

Number of escape routes and exits

1.2.2 The number of escape routes and exits to be provided depends on the number of occupants in the room, tier or storey in question, and the limits on travel distance given in Table 1.2, and illustrated in Diagram B 1.2.

Single escape routes and exits

1.2.2.1 In order to avoid occupants being trapped by fire or smoke, there should be alternative escape routes from all parts of the building except for the situations listed below where a single route can be acceptable. These exceptions should not be applied to Purpose Group 2(a) Residential (Institutional) Buildings:

(a) areas near enough to an exit to satisfy the limits on travel in one direction in Table 1.2;

(b) rooms which are not likely to contain more than 50 people, provided that the limits on travel in one direction only are satisfied (see Table 1.2);

(c) a storey which is not likely to contain more than 50 people, where the limits on travel in one direction only are satisfied (see Table 1.2).

In many cases there will not be an alternative at the beginning of the route. For example, there may be only one exit from a room to a corridor, from which point escape is possible in two directions. This is acceptable provided that the overall distance to the nearest storey exit is within the limits for routes where there is an alternative, and the 'one direction only' section of the route does not exceed the limit for travel where there is no alternative, see Table 1.2.

Table 1.2 Limitations on travel distance*

Use of the premises or part of the premises	Maximum travel distance (m) related to available directions of escape	
	In one direction only	In more than one direction
Institutional	10	20
Other residential		
(a) in bedrooms (1)	10	-
(b) in bedroom corridors	10	35
(c) elsewhere	20	35
Assembley or Recreation		
(a) buildings primarily for use by the disabled, except schools	10	20
(b) elsewhere	20	45
Industrial (2)		
high hazard	12	25
normal hazard	25	45
low hazard	45	60
Storage (2)		
hazardous materials	12	25
non-hazardous materials	45	60
Other non-residential	20	45
Place of special fire risk	10 (1)	20 (1)
Roof level plant or water tank room	20 (3)	35 (3)
	20 (3)	45 (3)
	60 (4)	100 (4)

Notes:

* Where the internal arrangement of walls and fixed furniture is not known at the time of design/construction, direct distances may be used. However, the final layout should not create travel distances which exceed those given above.

(1) Maximum part of travel distance within the room.

(2) See Appendix E for assessment of fire hazard and list of hazardous materials.

(3) Total travel distance, if escape route is not in the open air.

(4) Total travel distance, if escape route is in the open air.

Number of occupants and exits

1.2.2.2 The figure used for the number of occupants will normally be the design figure. When the number of occupants likely to use a room, tier or storey is not known, the appropriate capacity should be calculated on the basis of the occupant capacity. Guidance is set out in paragraph 1.0.10 of this Technical Guidance Document and Table 1.1. There may be cases where it will be reasonable to depart from the standard figures for density of occupation.

Table 1.3 gives the minimum number of escape routes and exits that should be provided from a room, tier or storey according to the number of occupants.

The width of exits is discussed in paragraph 1.2.4.

Special provisions apply for areas with fixed seating, which include the width of seatways and gangways. See paragraphs 1.2.8.3 and 1.2.8.4.

Table 1.3 Number of escape routes and exits

Maximum number of persons	Minimum number of escape routes/exits
500	2 [2]
1,000	3
2,000	4
4,000	5
7,000	6
11 ,000	7
16,000	8
>16,000	8 [2]

Notes:

(1) See paragraph 1.2.2.1 for permitted single exits and escape routes.

(2) Plus 1 per 5000 persons over 16,000.

Alternative escape routes

1.2.2.3 A choice of escape routes is of little value if they are all likely to be disabled simultaneously. Every escape route from a storey should be independent of any other escape route to which access may be obtained directly from that storey. Alternative escape routes from rooms should therefore satisfy the following criteria:

(a) they are in directions 45° or more apart (Diagram B1 .1 (a)); or

(b) they are in directions less than 45° apart, but are separated from each other by fire-resisting construction (Diagram B1 .1 (b)); or

(c) (from any point from which there is initially a single direction of escape) they are in directions apart equal to 45° plus 2.5° for every metre travelled in one direction (Diagram B1.1(c)).

Planning of escape routes and exits

1.2.3 The basic principle of escape route planning is that unless a route is very short, there should be an alternative which will not be affected if fire or smoke makes the first route impassable.

Every escape route should lead to a place of safety, and should give direct access to that place of safety, or give access thereto only by means of a circulation area.

Inner rooms

1.2.3.1 A room whose only escape route is through another room is at risk if a fire starts in that other room. It is termed an inner room and is at risk from a fire in the outer room (access room).

Such an arrangement is only acceptable if the following conditions are satisfied:

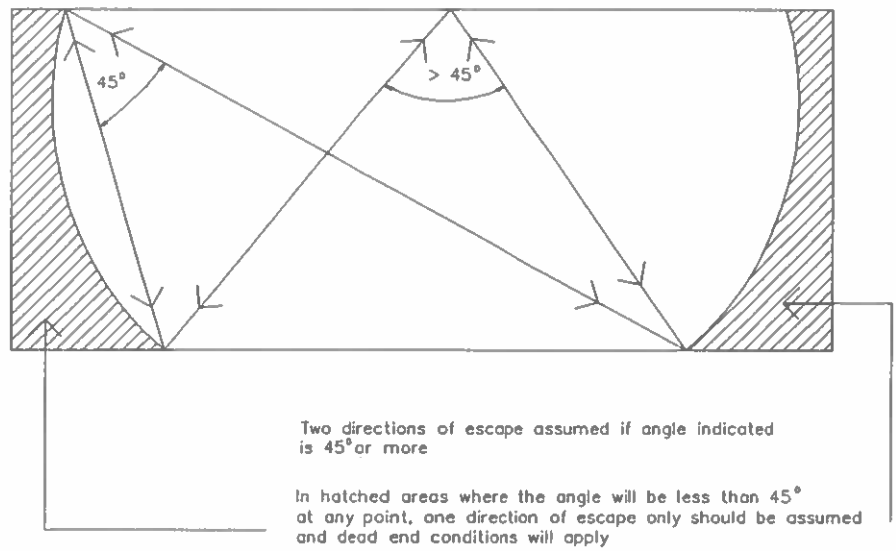
(a) the inner room should not be likely to have more than 20 occupants;

(b) the inner room should not be a bedroom;

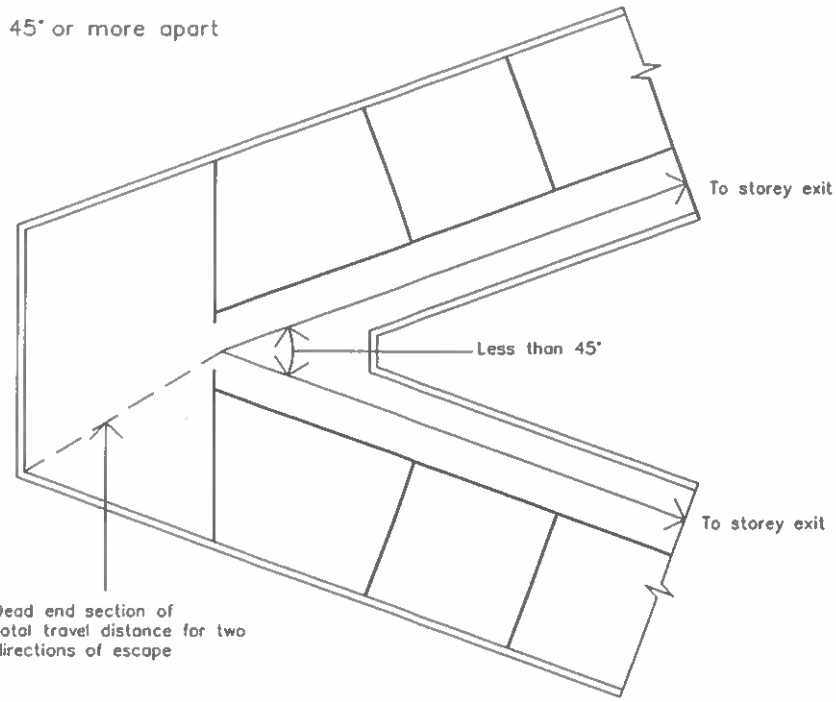
(c) the escape route from the inner room should not pass through more than one outer (access) room;

(d) the travel distance from any point in the inner room to the exit(s) from the access room should not exceed the limit given in Table 1.2 for single directions of travel;

Diagram B1.1 Alternative escape routes

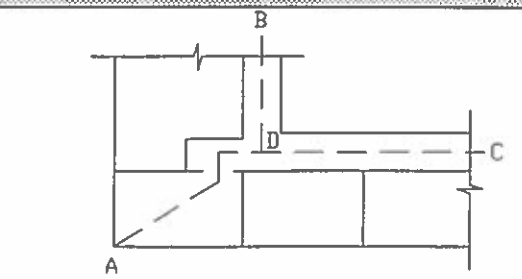


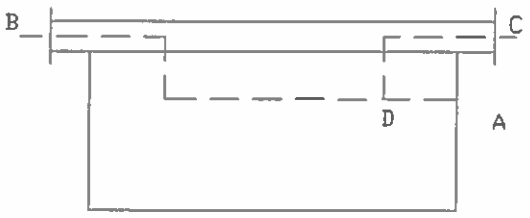
(a) In directions 45° or more apart



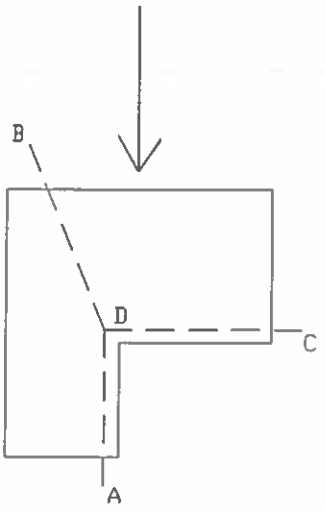
(b) In directions less than 45° apart

Diagram B1.1(C) Alternative escape routes





Angle BDC = 45° + 2.5° for every metre travelled from A to D.



Note: AD not to exceed that allowed for single direction of travel.

(c) Dead end condition.

(e) the access room should not be an area of high fire risk and it should be in the control of the same occupier; and

(f) one of the following arrangements are made -

(i) the enclosures (walls or partitions) of the inner room are stopped at least 500 mm below the ceiling, or

(ii) a vision panel is located in the enclosure of the inner room, to enable occupants of the inner room to see if a fire has started in the outer room, or

(iii) the access room is fitted with a suitable fire detection and alarm system to warn the occupants of the inner room should an outbreak of fire occur in the access room.

Open connections between floors

1.2.3.2 Routes and exits should not be prejudiced by open connections between floors. Where travel is in one direction only, it should not be within 5 m of an open connection between floors unless it is leading away from the opening. Where there is a choice of routes, at least one of them should lead away from the opening. (see Diagram B1.3).

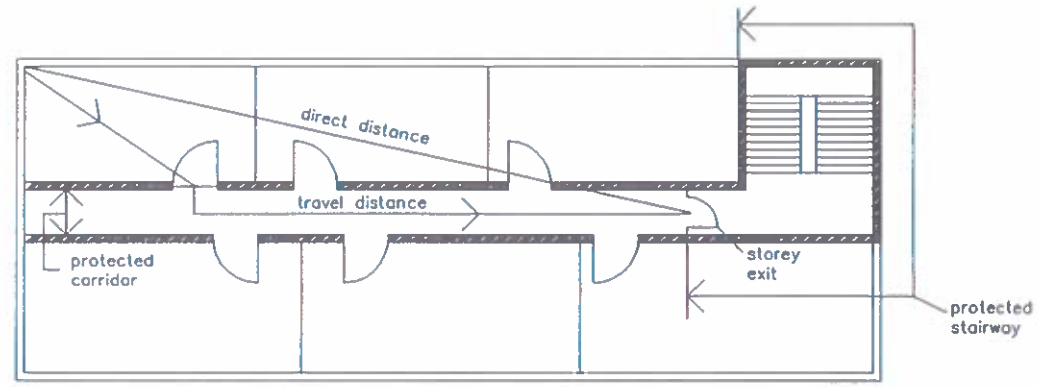
Planning of exits in a central core

1.2.3.3 Buildings with more than one exit in a central core should be planned so that storey exits are remote from one another, and so that no two exits are approached from the same lift hall, common lobby or undivided corridor, or linked by any of these. (see Diagram B1.4).

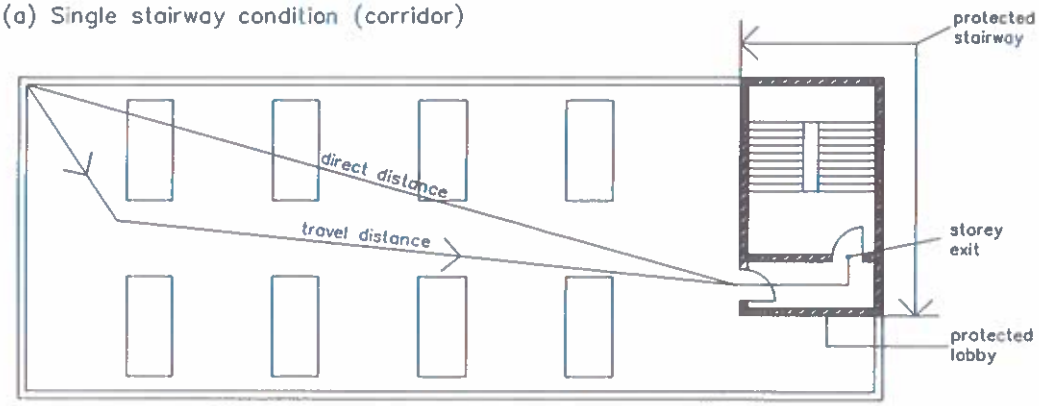
Access to storey exits

1.2.3.4 A storey which should have more than one escape stairway should be planned so that it is not necessary to pass through one stairway to reach another.

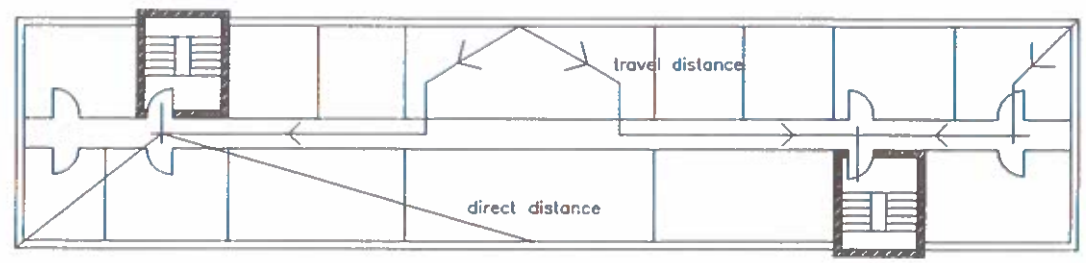
Diagram B1.2 Travel distances



(a) Single stairway condition (corridor)



(b) Single stairway condition (open floor plan)



(c) Multi-stairway conditions

Separation of circulation routes from stairways

1.2.3.5 An escape stairway should not form part of the primary circulation route between different parts of the building at the same level.

Storeys divided into different occupancies

1.2.3.6 Where any storey is divided into separate occupancies (i.e. where there are separate ownerships or tenancies of different organisations):

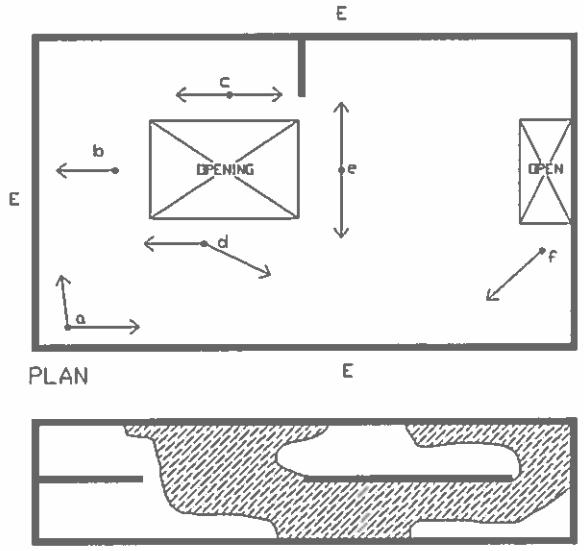
(a) the means of escape from each occupancy should not pass through any other occupancy; and

(b) either -

(i) any common corridor serving the different occupancies should comprise a protected corridor with a Type L3 fire detection and alarm system as defined in I.S. 3218: 1989 or

(ii) a suitable fire detection and alarm system should be installed throughout the storey.

Diagram B1.3 Exit routes in relation to openings between floors



SECTION
with smoke spreading between floors via openings.

- Where the exit route is not away from the opening there should be a choice of routes, as at 'a', 'c' or 'e'.
- It is preferable for routes from points near openings to lead away from the opening, i.e 'b', 'd' and 'f' are preferable to 'c'
- Routes should not all lead towards an opening.

Width of escape routes and exits

1.2.4 The width of escape routes and exits depends on the number of persons needing to use them, and should not be less than the dimensions given in Table 1.4.

Where the maximum number of people likely to use the escape route and exit is not known, the appropriate capacity should be calculated on the basis of the occupant capacity. Guidance is set out in paragraph 1.0.10 and Table 1.1.

In addition to other requirements as to the number and minimum width of escape routes in recreational buildings of purpose Group 5, such as dance halls (including discotheques), concert halls and public houses, the escape route provided by the main entrance to the building should be capable of discharging at least one third of the occupant capacity in accordance with the provisions of Table 1.4. The escape route leading into the vestibule or lobby forming part of the main entrance should be of appropriate width to facilitate this requirement. Information on the spacing of fixed seating for auditoria and the like, is given in paragraph 1.2.8.3 and Table 1.5.

Table 1.4. Widths of escape routes and exits

Maximum number of persons	Minimum width
50	800 mm[a]
100	900 mm
220	1100 mm
>220	5 mm per person

[a] may be reduced to 530 mm for gangways between fixed storage racking, other than in public areas of shopping.

In buildings of Purpose Group 2(a) Residential (Institutional) any escape route should be not less than 1150 mm in width and suitably designed to ensure the movement of beds along the escape route and to and from rooms as necessary.

1.2.5 Corridors

Protected corridors

1.2.5.1 A corridor which serves as part of the means of escape in any of the following circumstances should be a protected corridor:

(a) every corridor within residential accommodation;

(b) every dead-end corridor; and

(c) any corridor common to two or more different occupancies (see also paragraph 1.2.3.6).

Enclosure of corridors that are not protected corridors

1.2.5.2 The enclosures to all corridors used as means of escape (which are not protected corridors) should be carried up to the underside of the structural floor above (or to a suspended ceiling) and all openings in the corridor enclosures should be fitted with doors.

Sub-division of corridors

1.2.5.3 If a corridor provides access to alternative escape routes, there is a risk that smoke will spread along it and make both routes impassable before all occupants have escaped. To avoid this, every corridor connecting two or more storey exits where the distance between protected doorways exceeds 30 m should be sub-divided by self-closing fire doors (and any necessary associated screens) so that:

(a) no length of undivided corridor is common to two storey exits; and

(b) the fire door(s) are positioned to effectively safeguard the route from smoke, having regard to the layout of the corridor and to any adjacent fire risks.

Separation of dead-ends

1.2.5.4 If a dead-end portion of a corridor provides access to a point from which alternative escape routes are available, there is a risk that smoke from a fire could make both routes impassable before the occupants in the dead-end have escaped. To avoid this, unless the escape stairway(s) and corridors are protected by a pressurization system complying with BS 5588: Part 4; 1978; every dead end corridor exceeding 4.5 m in length should be separated by self-closing fire doors (together with any necessary associated screens) from any part of the corridor which:

(a) provides two directions of escape (Diagram B1.5(a)); or

(b) continues past one storey exit to another (Diagram B1.5(b)).

1.2.6 External escape routes

External escape stairway

1.2.6.1 If more than one escape route is available from a storey, or part of a building, one of those routes may be by way of an external escape stairway provided that:

(a) in the case of an assembly building, the route is not intended for use by members of the public; or

(b) in the case of an institutional building, the route serves only office or residential staff accommodation.

Provisions for the design of external escape stairways are given in paragraph 1.3.9.

Diagram B1.4 Central Core Arrangement

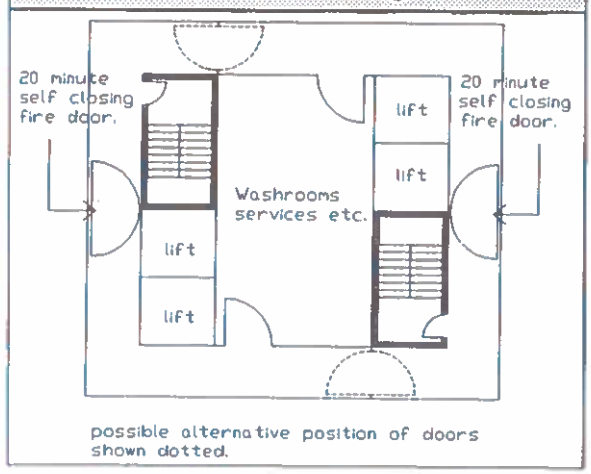
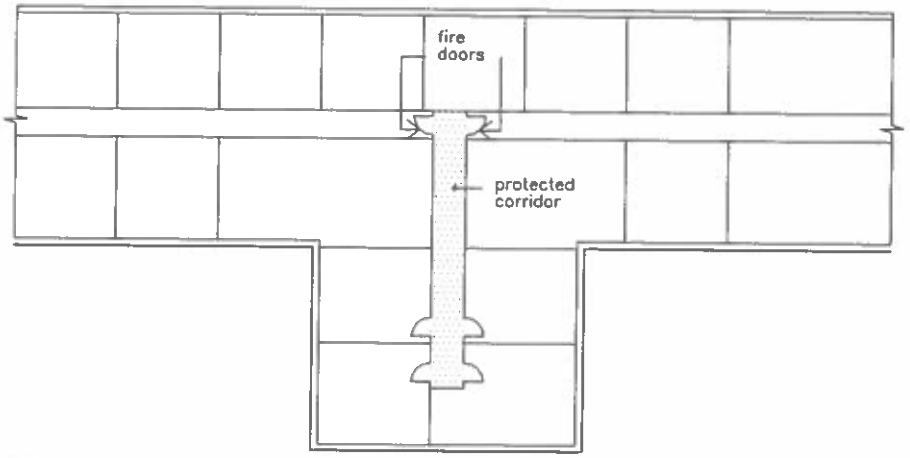
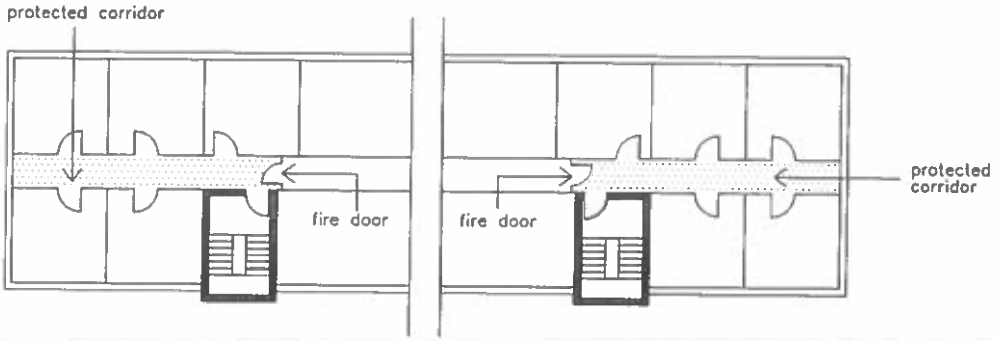


Diagram B1.5 Dead end corridors



(a) 'T' junction with main corridor



(b) Continuation past main corridor.

Escape over flat roofs

1.2.6.2 If more than one escape route is available from a storey, or part of a building, one of those routes may be by way of a flat roof, provided that:

(a) the route does not serve an institutional building, or a part of a building intended for use by members of the public;

(b) the roof is part of the same building from which escape is being made, or if it is part of another building, there is a legal agreement between the parties concerned which includes a right of entry into that building;

(c) the route across the roof leads to a storey exit;

(d) the part of the roof forming the escape route and its supporting structure, together with any opening within 3 m of the escape route, is fire-resisting; and

(e) the route is adequately defined and guarded by walls and/or protective barriers which meet the provisions in Technical Guidance Document K.

1.2.7 Premises requiring special consideration

General

1.2.7.1 In certain types of premises of Purpose Group 2(a) occupants may be totally dependant on other people for evacuation. Normal 'self-help' evacuation procedures are therefore

inappropriate and consideration must be given to designing escape routes to facilitate the planned mode of evacuation. The following provisions should be made to allow progressive horizontal escape to be made into adjoining compartments in those parts of buildings used to accommodate occupants of this type. The object is to provide a place of relative safety within a short distance, from which further evacuation can be made if necessary but under less pressure of time.

Compartmentation

1.2.7.2 Every storey used for occupants of this type should be divided into at least two compartments in such a way as to permit horizontal evacuation of each compartment.

Planning for progressive evacuation

1.2.7.3 In planning a storey which is divided into compartments for progressive horizontal evacuation, the following conditions should be observed:

(a) Adjoining compartments into which horizontal evacuation may take place should each have a floor area sufficient to accommodate not only their own occupants but the occupants from the adjoining compartment. This should be calculated on the basis of the design occupancy of the compartments.

(b) Each compartment should have at least one other escape route, independent of the route into the adjoining compartment. (see Diagram B1.6). This other route may be by way of a third compartment, provided the exit from that compartment is independent from the exits from the other compartments.

Planning for the disabled

1.2.7.4 The concepts contained in paragraph 1.2.7.1 are of relevance in premises which are subject to the requirements of Part M of the First Schedule to the Regulations. Guidance on planning of egress for the disabled is given in BS 5588 : Part 8 : 1988.

1.2.8 Closely-seated audiences

General

1.2.8.1 There are particular problems that arise when people are limited in their ability to escape by fixed seating. This may occur at sports events, theatres, lecture halls and conference centres etc. Any such arrangements made for a closely seated audience (or seated spectators) should meet the provisions in the paragraphs below.

Siting of exits

1.2.8.2 Not less than one-half of the exits for the audience should be sited remote from any stage, platform or performing area.

Consideration should be given to the need to site exits close to areas where there may be a tendency for the audience to congregate.

Additional provisions are given in Section 1.2.9 where the auditorium also incorporates a stage.

Seating layout

1.2.8.3 Seats should be arranged to allow free and ready access direct to the exits.

The seating layout should be subject to an overall limit on travel distance of 32 m from any seat to an exit from the room or auditorium, measured along the line of travel, by a route using the gangway nearest to that seat.

As the length of the rows of seats increases, so should the width of the seatway. Table 1.5 sets out the relationship between these two factors, according to whether escape is available to gangways at both ends of the row, or not.

Gangways

1.2.8.4 The ends of all rows of seats should be aligned to maintain a uniform width of gangway throughout its length.

Gangways should have a minimum clear width of 1100 mm. This dimension should be increased by 5 mm for every seat served over 220 seats.

Table 1.5 Limitations on rows of fixed seating

Number of seats[1] where gangway is at:		Minimum width of seatway (mm) [2][3]
One end only	Both ends	
≤7	≤14	300
8	16	325
9	18	350
10	20	375
11	22	400
12	24	425
12	26	450
12	28	475
12	30	500

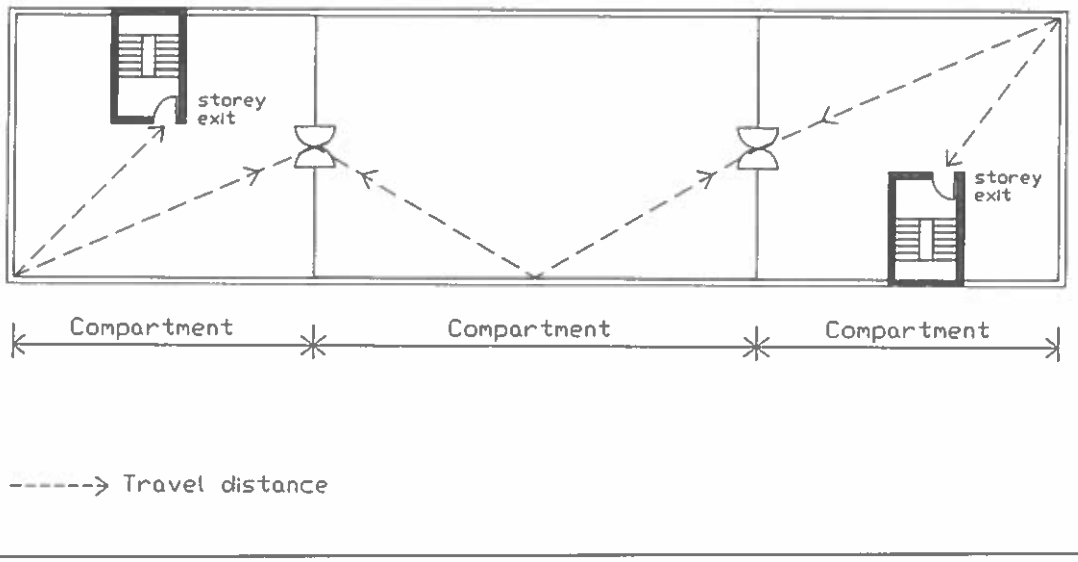
Notes:

(1) Subject to no seat being more than 32 m from an exit from the room or auditorium (measured along the line of travel).

(2) The clear horizontal distance between perpendiculars from the back of one seating unit to the front of the seat immediately behind. (In the raised position, in the case of weighted tip-up seats).

(3) 1350 mm if it also acts as a gangway.

Diagram B1.6 Horizontal evacuation



Any stepped side gangway should be provided with a handrail fixed at a height of 840 mm (measured vertically above the pitch line of the step) and projecting not more than 75 mm into the gangway.

Nothing should project into a gangway which would reduce its clear width, apart from the handrail described above.

1.2.9 Premises provided with a stage

General

1.2.9.1 Where an auditorium, hall or studio is provided with a stage, it should meet the relevant provisions in the paragraphs below.

Provisions of exits

1.2.9.2 At least two exits (sited remote from each other) should be provided from:

(a) the stage (one of which should be a final exit or lead to a final exit through a protected lobby);

(b) any flies or grids (either direct to the open air or to another part of the premises, other than the auditorium, through a protected escape route);

(c) any basement used in connection with the stage (one of which should lead to a final exit through a protected escape route separated from the remainder of the premises); and

(d) any dressing room for more than 15 people, or circulation area connecting dressing rooms, associated with a stage (one of which should be a final exit or lead to a final exit through a protected escape route independent of any access to the stage).

Compartmentation of hazardous areas

1.2.9.3 Any workshop, scene store, property store, wardrobe or painting room should be separated from the stage and the escape routes by fire-resisting construction in accordance with the requirements of Table A1 of Appendix A.

1.3 CONSTRAINTS ON DESIGN FOR VERTICAL ESCAPE Buildings other than those covered in Section 1.1

1.3.1 Introduction

An important aspect of means of escape in multi-storey buildings is the availability of a sufficient number of adequately-sized and protected escape stairways. This section deals with these matters, including measures necessary to protect escape stairways, for all types of building other than those covered by Section 1.1.

It should be read in conjunction with the general provisions in Section 1.4.

1.3.2 Number of escape stairways

1.3.2.1 The number of escape stairways needed in a building (or part of a building) will be determined by:

(a) the constraints imposed in Section 1.2 on the design of horizontal escape routes;

(b) whether independent stairways are required in mixed occupancy buildings (see 1.3.2.3 below);

(c) whether a single stairway is acceptable (see paragraph 1.3.3); and

(d) provision of adequate width for escape (see paragraph 1.3.4).

In larger buildings, provisions for access for the fire service may apply. Some escape stairways may need to serve also as fire-fighting stairways. The number of escape stairways may therefore be affected by the requirements of B5.

Where a building contains storeys (or parts of storeys) in different purpose groups, independent escape stairways, which should be imperforate in single stairway situations, should be provided from any parts used for residential or assembly purposes.

1.3.3. Single escape stairways

The situations where a building (or part of a building) other than buildings of Purpose Group 2(a) Residential (Institutional), may be served by a single escape stairway are:

(a) if there is no storey with a floor level in the case of a Purpose Group 5 building more than 5 m above ground level, or in other cases more than 10 m above ground level, and where (in accordance with paragraph 1.2.2.1) every storey may have a single escape route, or

(b) if there is a basement the floor of which is not more than 3 m below ground level where (in accordance with paragraph 1.2.2.1) every basement storey may have a single escape route.

1.3.4 Width of escape stairways

The width of escape stairways should:

(a) be not less than the width(s) required for any exit(s) affording access to them;

(b) conform with the minimum widths given in Table 1.6;

(c) not exceed 1400 mm if serving any storeys more than 30 m above ground level; and

(d) not narrow at any point on their way to a final exit.

If the resultant width of the stairway is more than 1800 mm, then for reasons of safety in use the stairway should have a central handrail. In such a case the stairway width on each side of the handrail needs to be considered separately for the purpose of assessing stairway capacity.

Where an exit route from a stairway also forms the escape route from the ground and/or basement storeys, the width may need to be increased accordingly. In buildings of Purpose Group 2(a) Residential Institutional, any landing associated with a stairway forming part of an escape route should have a width not less than 2800 mm and a depth clear of obstructions not less than 1950 mm.

1.3.5 Calculation of minimum stairway width

General

1.3.5.1 Every escape stairway should be wide enough to accommodate the number of persons needing to use it in an emergency. This will depend on the number of stairways provided and whether the escape strategy is based on the total or phased evacuation of the building (or part of the building).

Table 1.7 assumes the total evacuation of all storeys simultaneously. Escape based on total evacuation should be used for all stairways serving basements, all stairways serving buildings comprising open spatial planning, and all stairways serving residential or assembly buildings. Paragraph 1.3.5.2 deals with the concept of total evacuation.

Table 1.8 assumes the phased evacuation of not more than two floors at a time, and should be used for buildings over 30 m high, provided that the building is not one that is identified in the previous paragraph as needing to be designed on the basis of total evacuation. Paragraph 1.3.5.3 deals with the concept of phased evacuation, and sets out the special measures that are necessary if a system of phased evacuation is used.

Buildings not identified in paragraph 1.3.5.1 which are less than 30 m high may also be designed on the basis of phased evacuation if the provisions in paragraph 1.3.5.3 are met.

Whichever method of evacuation is used, where two or more stairways are provided it should be assumed that one of them might not be available due to fire or smoke. It is therefore necessary to discount each stairway in turn in order to ensure that the capacity of the remaining stairway is adequate for the number of persons needing to escape.

An exception to the above provision is if the escape stairway is approached on each storey through a protected lobby. In such a case the likelihood of a stairway not being available is significantly reduced and it is not necessary to discount a stairway. A protected lobby need not be provided on the topmost storey for the exception still to apply.

Another exception is if the stairways are protected by a suitable pressurization system. A design method for pressurization of escape routes is set out in BS 5588: Part 4.

The exceptions to the requirement for discounting each stairway in turn listed below should not be applied to :

(i) assembly and recreation buildings;

(ii) any building where, by virtue of the limits on travel distance and/or numbers of occupants, less than three stairways are required;

(iii) any building with a storey more than 18m above ground level.

As with the design of horizontal escape routes, where the maximum number of people needing to use the escape stairway is not known, the appropriate capacity should be calculated on the basis of the occupant capacity. Guidance is set out in paragraph 1.0.10 and Table 1.1 of this Technical Guidance Document.

Total evacuation

1.3.5.2 Where the means of escape design is based on total evacuation, Table 1.7 is relevant. The total width of stairway needed for each storey is found by multiplying the population of the storey and each storey above it (or below for basement stairway) by the relevant contributory width per person corresponding to the difference between the point of entry (taken to be level 0) and the level of the storey being calculated. An example of calculation of aggregate width is set out under Table 1.7.

The contributory widths set out in Table 1.7 have been derived from the formula:

$$P = 200w + 50\,(w - 0.3)(n - 1)$$

where- (P) is the number of people that can be accommodated;

(w) is the width of the stairway in metres; and

(n) is the number of storeys served.

This formula may be used as an alternative to Table 1.7.

Table 1.6 Minimum width of escape stairways

Situation	Maximum number of persons [1]	Minimum width (mm)
(1) In an institutional building (unless it will be used only by staff)		1150
(2) In an assembly building and serving an area used for assembly purposes (unless the area is less than 100 m²)	150 220 >220	1000 1100 5 mm per person[2][3]
(3) In any other building and serving an area which can be occupied by more than 50 people.		
(4) Any stairway not described above	50 100	800 900

Notes:
(1) Assessed as likely to use the stairway in a fire or emergency

(2) See Table 1.7 for contribution to stairway width at each floor level for each person escaping when designing for total evacuation

(3) See Table 1.8 for minimum width of stairway designed for phased evacuation.

Table 1.7 Total evacuation

Contribution to stairway width at each floor level below the floor of entry for each person escaping (or above the floor of entry where evacuation takes place up a stairway)

Level (1) difference (storey)	Width per person (mm)	Level (1) difference (storeys)	Width per person (mm)	Level (1) difference (storeys)	Width per person (mm)
0	5.00	17	1.26	34	0.72
1	4.26	18	1.20	35	0.70
2	3.70	19	1.16	36	0.68
3	3.28	20	1.11	37	0.67
4	2.94	21	1.07	38	0.65
5	2.67	22	1.03	39	0.64
6	2.44	23	1.00	40	0.63
7	2.25	24	0.96	41	0.61
8	2.08	25	0.93	42	0.60
9	1.94	26	0.90	43	0.59
10	1.82	27	0.87	44	0.57
11	1.71	28	0.85	45	0.56
12	1.61	29	0.82	46	0.55
13	1.53	30	0.80	47	0.54
14	1.45	31	0.78	48	0.53
15	1.38	32	0.76	49	0.52
16	1.32	33	0.74	50	0.51

Note:

(1) Level difference, is the difference in level between the top floor and the floor in question (or in the case of basements, between the lowest floor and the floor in question).

Example of calculation of stairway width using Table 1.7

A building having three storeys above the ground storey is assumed. Each upper storey has an assessed population of 240 people. Therefore the aggregate width at each level needs to be:

at level 3	-	1200 mm, i.e. (240x 5.0)
at level 2	-	2222 mm, i.e. (240x 5.0) + (240x 4.26)
at level 1	-	3110 mm, i.e. (240x 5.0) + (240x 4.26) + (240x 3.7)

To provide stairways of not unreasonable width (and allowing of one stairway to be discounted), this could result in 4 stairways each at least 1111 mm wide going from the ground to the first storey with 3 of the stairways continuing up to serve the top two storeys. (If the travel distances in the top storey could be met by 2 stairways, then only two need to be continued up from the second storey provided those stairways were at least 1200 mm wide). N.B. The stairway exit passageways in the ground storey and associated final exits will have to be increased in width if they also serve the ground storey and/or any basement(s).

Table 1.8 Minimum aggregate width of stairways designed for phased evacuation

Maximum number of persons in any storey	Stairway width (1) (mm)
100	1000
120	1100
130	1200
140	1300
150	1400
160	1500
170	1600
180	1700
190	1800

Notes:

(1) See paragraph 1.3.5.1 if the stairway serves any storeys more than 30m above ground level;

(2) As an alternative to using Table 1.8, where the maximum number of persons in any storey exceeds 100 the minimum width of a stairway may be calculated from -

((P x 10) - 100) mm
where P = the number of people on the most heavily occupied floor.

Phased Evacuation

1.3.5.3 The concept of phased evacuation is based on evacuating persons on a sequential basis, commencing with those on the storeys most affected by the fire in its initial stages. That is the storey of fire origin and the one immediately above. By designing on the basis of phased evacuation, stairway widths less than those needed for total evacuation are possible. However, a package of compensatory features are needed. These are set out below:

(a) the stairways should be approached through a protected lobby or protected corridor at each storey except a top storey consisting exclusively of plant rooms;
(b) every floor should be a compartment floor;
(c) the building should be protected throughout by an automatic sprinkler system if it has a floor over 30 m above ground level; and
(d) the building should be fitted with an appropriate fire detection and alarm system.

Success of a system of phased evacuation depends to a large extent on the satisfactory functioning of the measures set out in paragraph 1.3.5.3.

Arrangements for the proper maintenance of the systems are necessary, as are arrangements for sound management and training. These matters are not appropriate for control under Building Regulations, but satisfactory arrangements may be sought under other legislation relevant to the occupancy.

1.3.6 Protection of escape stairways

General

Escape stairways need to have a satisfactory standard of fire protection if they are to fulfil their role as areas of relative safety during a fire evacuation. The provisions set out in the paragraphs below should be followed.

Enclosure of escape stairways

1.3.6.2 Every internal escape stairway should be situated within a fire-resisting enclosure (i.e. it should be a protected stairway).

There may be additional provisions if the stairway also comprises a protected shaft (see Section B3) or if it is a fire-fighting stairway (see Section B5).

Exits from protected stairways

1.3.6.3 Every protected stairway should discharge:

(a) directly to a final exit; or

(b) by way of a protected exit passageway to a final exit.

Separation of adjoining stairways

1.3.6.4 Where two protected stairways (or exit passageways leading to different final exits) are adjacent, they should be separated by an imperforate enclosure.

Use of space within protected stairways

1.3.6.5 A protected stairway needs to be relatively free of potential sources of fire. Consequently, items that may be incorporated in a protected stairway are limited to the following:

(a) sanitary accommodation or washrooms are permitted, provided that the accommodation is not used as a cloakroom. A gas water heater or sanitary incinerator may be installed in the accommodation, but the accommodation should not include any other gas appliance.

(b) a lift may be included in a protected stairway. There are other provisions about lifts in Section 1.4.9.

(c) if the protected stairway serves part of a building that has access to at least one other escape stairway, then a reception or enquiry area may be included in the stairway at ground or access level. The reception or enquiry area should not be more than 10m² in area. Cupboards enclosed with fire-resisting construction may also be included in such a protected stairway.

Fire resistance and openings in external walls of protected stairways

1.3.6.6 With some configurations of external wall, a fire in one part of a building could subject the external wall of a protected stairway to heat (for example, where the two are adjacent at an internal angle in the facade as shown in Diagram B1.7). If the external wall of the protected stairway has little fire resistance, there is a risk that this could prevent the safe use of the stairway. Therefore, if -

a protected stairway projects beyond, or is recessed from, or is in an internal angle of, the adjoining external wall of the building, then the distance between any unprotected area in the external enclosures to the building and any opening in the enclosure to the stairway should comply with Diagram B1.7.

Gas service pipes in protected stairways

1.3.6.7 Pipes intended to carry gaseous or liquid fuels or associated matters should not be incorporated within a protected stairway.

Basement stairways

1.3.7 Because of their situation, basement stairways are more likely to be filled with smoke and heat than are ground and upper storeys. Special measures are therefore needed in order to prevent a basement fire causing a hazard to upper storeys. These are set out in the paragraphs below.

If an escape stairway forms part of the only escape route from an upper storey of a building (or part of a building) it should not be continued down to serve any basement storey.

If there is more than one escape stairway from an upper storey of a building (or part of a building), only one of the stairways serving the upper storeys of the building (or part) need be terminated at ground level. Other stairways may connect with the basement storey(s) if they are separated at each basement level by a protected lobby or protected corridor.

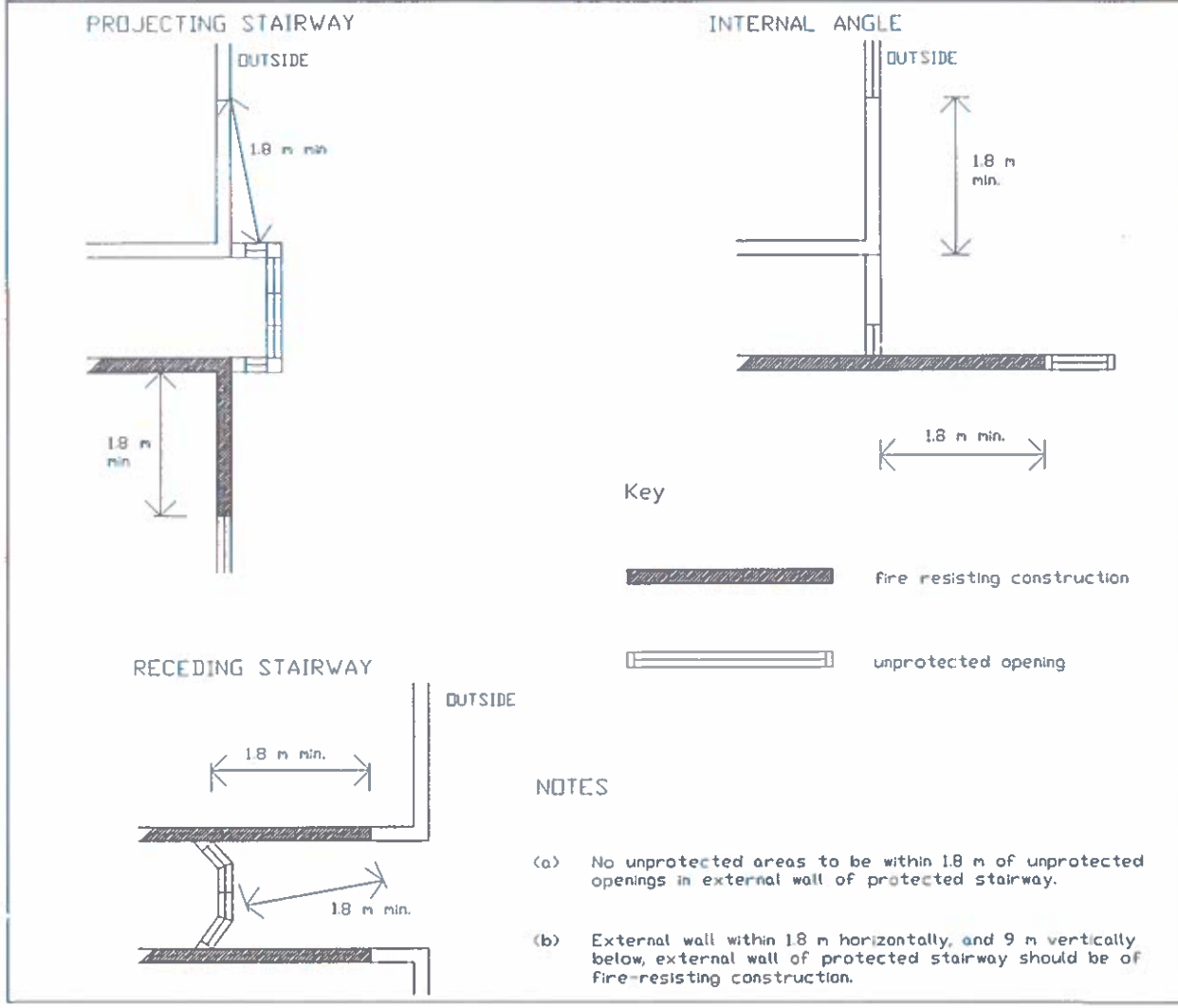
Provision of and ventilation requirements for lobbies and corridors to escape stairways

1.3.8 Apart from those in basements mentioned above, there are other situations where an escape stairway needs the added protection of a protected lobby or protected corridor. These are where the stairway is the only stairway serving a building (or part of a building) more than two storeys above or one storey below the ground storey; or where the stairway serves any storey at a height greater than 20m.

In these cases protected lobbies or protected corridors are needed at all levels, other than a top storey.

A protected lobby should be provided between an escape stairway and a place of special fire risk.

Diagram B1.7 External projection to protected stairways



Protected lobbies are also needed where a system of phased evacuation is used. This is dealt with in paragraph 1.3.5.3.

Every stairway which is required to be protected by lobby approach should also be ventilated as follows:

(i) where the stairway is sited adjoining an external wall, an opening to the external air of not less than 1.4 m² in area should be povided in the wall at each floor;

(ii) where the stairway is sited other than on an external wall, and no floor is at a height of greater than 20 m, the stairway should be provided with permanent ventilation at the top, of not less than 2.3 m² in area.

Every protected lobby which is required to be provided should comply with the following:-

(i) have a floor area not less than 5.5 m²;

(ii) be constructed with walls having fire resistance as required in Section B3 for the protecting structure of the stairway, and any door to the lobby should be a self-closing fire door having a fire resistance not less than half that required for the wall;

(iii) be constructed so that the clearance between the edges of the doors when fully open is not less than 500 mm, and the distance between the doors in the closed position is not less than 1 m, or when the distance between any two doors in the closed position is less than 1 m, the planes

of such doors are at an angle to one another of not less than 90 degrees.

(iv) be ventilated by:

(a) an opening to the external air of not less than 1.4 m² in area, or

(b) an openable window not less than 1.4 m² in area and a permanent ventilation opening or openings having an aggregate area of not less than 0.7% of the floor area of the lobby,

(c) where a lobby is in a basement storey, it should be provided with a smoke outlet (construction of non-combustible materials) which is independent of any other such outlets and discharges directly to the open air at a point not less than 3 metres from any exit from the building and having a minimum cross sectional area of 0.5 m².

External escape stairways

1.3.9 In limited situations, as set out in Section 1.2.6, external stairways are acceptable as forming part of an escape route. It is important that the external stairway is sufficiently protected from the weather and is adequately protected from a fire in the building. The following conditions should be met:

(a) unless the stairway is of limited rise, it should be protected from the effects of snow and ice. The situation where weather protection is not needed is if the stairway connects the ground floor with a floor or flat roof not more than 6 m above or below ground level. Where weather protection is necessary, this should not be taken to imply a full enclosure. Much will depend on the location of the stairway and the degree of protection that might be afforded to the stairway by the building itself.

(b) all doors affording access to the stairway should be fire-resisting, except that a fire-resisting door is not required at the head of any stairway leading downwards and where there is only one exit from the building onto the top landing.

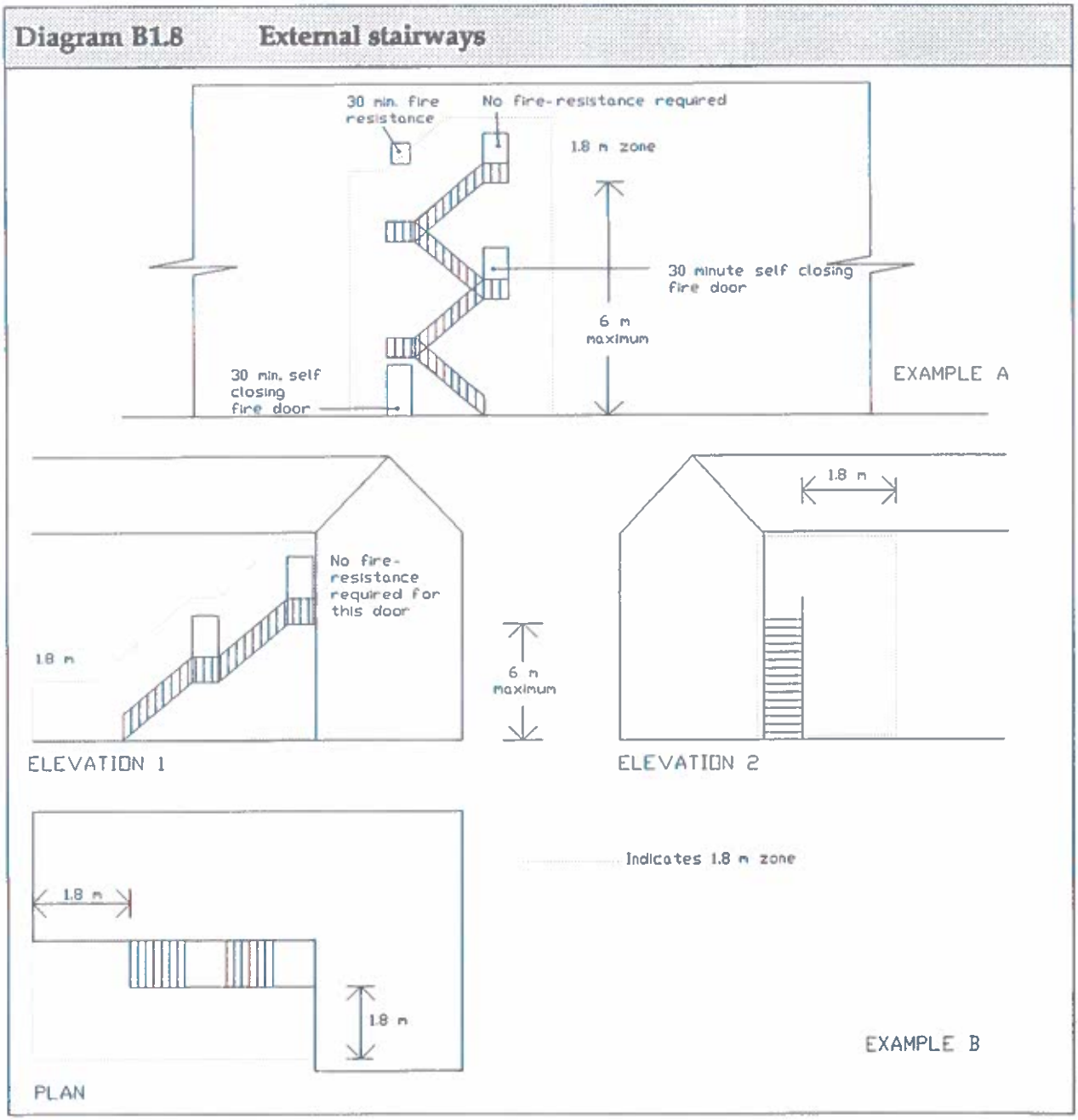
(c) any part of the external walls identified below should be of fire-resisting construction -

(i) within 1.8 m of, and 9 m vertically below, the flights and landings of a stairway leading downwards (Diagram B1.8),

(ii) within 1.8 m of, and vertically above, the flights and landings of a stairway leading upwards; and

(d) protection by fire-resisting construction in respect of any part of the building (including any doors) within 3 m of the escape route from the stairway to a place of safety is also needed.

Diagram B1.8 External stairways



1.4 GENERAL PROVISIONS FOR MEANS OF ESCAPE

Introduction

1.4.1 This section deals with a number of provisions about the construction and protection of escape routes generally, and about some services installations and other matters associated with the design of escape routes. It applies to all buildings other than Purpose Group 1(a) and 1(b) - Residential (Domestic).

It should therefore be read in conjunction with the other sections of this document.

1.4.2 Protection of escape routes

Fire resistance of enclosures

1.4.2.1 Details of fire resistance test criteria, and standards of performance, are set out in Appendix A.

All walls, partitions and other enclosures that need to be fire-resisting to meet the provisions in this Technical Guidance Document should have the appropriate performance given in Tables A1 and A2 of that Appendix.

They should also meet any limitations on the use of glass (see paragraph 1.4.2.3).

Fire resistance of doors

1.4.2.2 Details of fire resistance test criteria, and standards of performance, are set out in Appendix B.

All doors that need to be fire-resisting to meet the provisions in this Technical Guidance Document should have the appropriate performance given in Table B1 of that Appendix.

They should also meet any limitations on the use of glass (see paragraph 1.4.2.3).

Fire resistance of glazed elements

1.4.2.3 Where glazed elements in fire-resisting enclosures and doors are only able to satisfy the relevant performance in terms of integrity, the use of glass is limited. These limitations are set out in Appendix A, Table A4.

Where the relevant performance can be met in terms of both integrity and insulation, there is no restriction in this Technical Guidance Document on the use or amount of glass, but there may be some restriction under Section B5.

1.4.3 Doors on escape routes

1.4.3.1 The time taken to negotiate a closed door can be critical in an escape situation. Doors on escape routes (both within and from the building) should therefore be readily openable if undue delay is to be avoided. Accordingly the provisions in the paragraphs below should be met.

Door fastenings

1.4.3.2 In general, doors on escape routes, whether or not the doors are fire doors, should either not be fitted with lock, latch or bolt fastenings, or they should only be fitted with simple fastenings that can be readily operated in the direction of escape without the use of a key.

Where security on final exit doors is an important consideration, such as some assembly or commercial uses, panic bolts should be used to secure doors. Where additional security is required when the premises is not in use, hardware which is fully removable should be used. Attention is drawn to the provisions of the Fire Safety in Places of Assembly (Ease of Escape) Regulations, (S.I. No 249 of 1985) in this regard.

Information about door closing and hold open devices for fire doors is given in Appendix B.

Direction of opening

1.4.3.3 Doors on escape routes should be hung so that they open in the direction of escape. In the case of small rooms or buildings, this may not be practical or indeed necessary, but in the following situations doors on escape routes must always be hung to open in the direction of escape:

(a) from a place of special fire risk, or

(b) (in the case of premises comprising an industrial, storage or assembly use) if more than 20 people are expected to use them, or

(c) (in the case of any other premises) if more than 50 people are expected to use them.

Amount of opening and effect on associated escape routes

1.4.3.4 All doors on escape routes should be hung to open not less than 90°, and with a swing that is clear of any change of floor level and does not reduce the effective width of any escape route across a landing.

Similarly, where it is necessary to recess a door that is opening towards a corridor, then the depth of recess should be sufficient that the door swing does not reduce the effective width of the corridor.

Vision panels

1.4.3.5 These are needed where doors on escape routes subdivide corridors, or where the doors are hung to swing both ways.

Revolving and automatic doors

1.4.3.6 Revolving doors, automatic doors and turnstiles can obstruct the passage of persons escaping. Accordingly, they should not be provided across escape routes unless they are arranged to fail safely in the open position or be easily openable in an emergency. Alternatively, swing doors of the required width should be provided immediately adjacent.

1.4.4 Construction of escape stairways

General

1.4.4.1 Every escape stairway and its associated landings should be constructed of materials of limited combustibility in the following situations.

(a) if it is the only stairway serving the building, or part of the building,

(b) if it is within a basement storey,

(c) if it serves any storey having a floor level more than 20 m above ground or access level, or

(d) if it is external, except in the case of a stairway that connects the ground floor or paving level with a floor or flat roof not more than 6 m above or below ground level. There are other provisions about external escape stairways in paragraph 1.3.9.

In satisfying the above provision, combustible materials may be added to the upper surface of these stairways.

There are other provisions dealing with the construction of stairways in Section B5. Dimensional constraints on the design of stairways generally from the aspect of safety in use are given in Technical Guidance Document K.

Spiral stairways and fixed ladders

1.4.4.2 Except in respect of escape routes that would be used by members of the public, spiral stairways and fixed ladders may form part of an escape route in limited circumstances. These are as follows.

(a) In the case of spiral stairways, the stairway should rise no more than 9 m and should not be intended to serve more than 20 able-bodied adults.

(b) In the case of fixed ladders, these should only be intended for use by able-bodied adults, and in circumstances where it is not practical to provide a more satisfactory means of vertical egress. Fixed ladders are acceptable within plant rooms.

In addition, fixed ladders should be constructed of non-combustible materials.

Guidance on the design of spiral stairways and fixed ladders, from the aspect of safety in use, is given in Technical Guidance Document K.

1.4.5 Height of escape routes

All escape routes should have a clear headroom of not less than 2 m and there should be no projection below this height (except for door frames) which would impede the free flow of persons using them.

1.4.6 Floors of escape routes

The floors of all escape routes (including steps, ramps and landings) should have non-slippery even surfaces.

Where a ramp forms part of an escape route, it should not be steeper than 1 in 12 if it is shorter than 9m, otherwise it should not be steeper than 1 in 20.

Any sloping floor or tier should be constructed with a pitch of not more than 35° to the horizontal.

Further guidance on the design of ramps and associated landings, from the aspect of safety in use, is given in Technical Guidance Document K.

1.4.7 Final exits

Final exits need to be dimensioned and sited so that they facilitate the evacuation of persons out of the building, and away from the building. Accordingly, they should be not less in width than the escape route(s) they serve and also meet the following provisions in the paragraphs below.

Final exits should be sited to ensure rapid dispersal of persons from the vicinity of the building so that they are no longer in danger from fire and smoke. Direct access to a street, passageway, walkway or open space should be available. The route clear of the building should be well defined, and suitably guarded if necessary, in situations where the exit discharges other than to an open street or open space at street level.

Final exits also need to be apparent to persons who may need to use them. This is particularly important where the exit opens off a stairway that continues down, or up, beyond the level of the final exit.

Final exits also need to be sited so that they are clear of any risk from fire or smoke in a basement, or from openings to transformer chambers, boiler rooms and similar risks.

1.4.8 Lighting of escape routes

Adequate artificial lighting should be provided to all internal and external escape routes.

In addition to the system of artificial lighting, escape lighting should be provided in the areas indicated in Table 1.9.

Standards for the design and installation of a system of escape lighting are given in I.S.: 3217: 1989 : Code of Practice for Emergency Lighting.

Table 1.9 Provisions for escape lighting

Purpose group of the building or part of the building	Parts requiring escape lighting
Residential	All common escape routes
Office, Shop & Commercial (1) Industrial, Storage & Other non-residential (1)	(a) Underground or windowless accommodation (b) Stairways in a central core or serving storeys higher than 18 m above ground level; and (c) Internal corridors exceeding 30m in length.
Shop & Commercial (2) Other non-residential (2)	All escape routes except for - shops of less than 3 storeys with no sales floor exceeding 280 m².
Assembly & Recreation	All escape routes and accommodation except for - (a) accommodation open on one side to view sport or entertainment during normal daylight hours; (b) toilet accommodation having a gross floor area of not more than 8 m².
Any purpose group	(a) emergency generator rooms; and (b) switch rooms/battery rooms for emergency lighting systems.

Notes:

(1) those parts of the premises to which the public are not admitted
(2) those parts of the premises to which the public are admitted

1.4.9 Lifts

Evacuation lifts

1.4.9.1 In general it is not appropriate to use lifts when there is a fire in the building because there is always the danger of the lift becoming immobilised as a result of the fire, and of persons being trapped inside. However, in some circumstances a lift may be needed as part of a management plan for evacuating disabled persons. In such cases the lift installation needs to be appropriately sited and protected, and needs to contain a number of safety features that are intended to ensure that the lift may remain usable for evacuation purposes during the fire.

Guidance on the necessary measures is given in BS 5588: Part 8 : 1988.

Fire protection of lift installations generally

1.4.9.2 Because lifts by their nature connect floors, there is the possibility that they may prejudice escape routes. To safeguard against this, the following provisions in the paragraphs below should be met.

Lift wells should be either contained within the enclosures of a protected stairway, or be enclosed throughout their height with fire-resisting construction if they are sited such as to prejudice the means of escape. A lift well connecting different compartments should form a protected shaft (see Section B3, 3.2).

Lifts should be approached only by way of a protected lobby (or protected corridor) in basements, or in any storey that contains fire risk areas and where the lift also delivers directly into corridors serving sleeping accommodation. Examples of fire risk areas in this context are kitchens, lounges and stores. In buildings with any storey at a height greater than 20 m, lifts should be approached by way of a protected lobby

A lift should not be continued down to serve any basement storey if it is in a building (or part of a building) served by only one escape stairway, or within the enclosures to an escape stairway which is terminated at ground level.

Section 1.3 sets out restrictions on escape stairways that connect basements with the upper storeys of a building.

Lift machine rooms should be sited over the lift well whenever possible. (If the lift well is within the enclosures to a protected stairway being the only stairway serving the building (or part of the building), then the machine room should be located outside the stairway if it cannot be sited above the lift well).

1.4.10 Electrical installations and protected circuits

The electrical installation, comprising wiring, sockets, switches, fuse boards, distribution boards, circuit breakers, etc., should be installed in accordance with the Electro-Technical Council of Ireland's "National Rules for Electrical Installations".

Protected circuits are specified in a number of situations in this Technical Guidance Document where it is critical that electrical circuits are able to continue to function during a fire. A protected circuit for lighting or operation of equipment in the event of fire should consist of cable meeting the requirements for classification as CWZ in accordance with BS 6387: 1983. It should follow a route selected to pass only through parts of the building in which the fire risk is negligible and be separate from any circuit provided for another purpose.

1.4.11 Ventilation of escape routes

1.4.11.1 Natural ventilation : Guidance on designing for natural ventilation is contained in BS 5925 : 1991.

1.4.11.2 Mechanical ventilation and air conditioning systems: Any system of mechanical ventilation should be designed to ensure that in a fire the air movement is directed away from protected escape routes and exits. In the case of a system which recirculates air, the system should meet the relevant recommendation for recirculating distribution systems in BS: 5588: Part 9.

Any system of mechanical ventilation in a place of assembly should also comply with the relevant provisions below:

(a) any such system serving the parts of the premises to which the public are admitted should be independent of the remainder of the premises;

(b) if the premises is used for stage presentations, any such system should be designed to ensure that the air movement during performances is directed from the auditorium towards the stage;

(c) any such system above a stage provided with a proscenium opening should be entirely independent of the auditorium system.

Where a pressurization system is installed, any ventilation and air conditioning systems should be compatible with it.

Guidance on the design and installation of mechanical ventilation and air conditioning plant is given in BS 5720: 1979, and on ventilation and air conditioning ductwork in BS 5588: Part 9: 1989.

1.4.12 Refuse chutes and storage

(a) Refuse storage chambers, refuse chutes and refuse hoppers should be sited and constructed in accordance with BS 5906:1980.

(b) Refuse chutes and rooms provided for the storage of refuse should:

(i) be separated from other parts of the building with fire-resisting construction, and

(ii) not be located within protected stairways or protected lobbies;

(c) Rooms containing refuse chutes, or provided for the storage of refuse, should be approached only by way of a protected lobby provided with not less than 0.2 m^2 of permanent ventilation.

1.4.13 Exit signs

Appropriate exit signs and markings should be provided to all escape routes in purpose group 2 (residential) buildings, in assembly and recreational buildings, and in office, shop and commercial buildings to which the public are admitted. In other buildings they should be provided to those exits which are not in normal use for egress. Exit signs and markings should be in accordance with BS 5499: Part 1: 1990 and BS 5499 : Part 2 : 1986.

1.4.14 Fire detection and alarm systems

Buildings should be provided with a fire detection and alarm system to warn the occupants of the existence of fire where the building is of such a size, layout or occupancy that the fire itself may not provide adequate warning to the occupants so as to enable them to escape safely.

Where a fire detection alarm system is required, the system, whether manual or automatic, should be designed and installed in accordance with the relevant recommendations set out in I.S. 3218 : 1989.

1.5 Special Provisions

1.5.1 Loft conversions in houses

General

1.5.1.1 In the case of an existing two storey domestic house to which a storey is to be added by converting the existing roof space into habitable accommodation, the following provisions can be applied as an alternative to those in sections 4.3 and 4.4 of BS 5588 : Part 1 : 1990. However, these alternative provisions are not applicable if -

(a) the conversion involves raising the roofline above the existing ridge, or

(b) the new second storey accommodation exceeds 50 m^2 in area, or

(c) the new second storey is to contain more than two habitable rooms.

Enclosure of existing stairway

1.5.1.2 The stairway in the ground and first storeys should be enclosed with walls and/or partitions which are fire-resisting, and the enclosure should either:

(a) extend to a final exit (Diagram 2(a) of BS 5588 : Part 1 : 1990); or

(b) give access to at least two escape routes at ground level, each delivering to final exits and separated from each other by fire-resisting construction and self-closing fire doors (Diagram 2(b) of BS 5588 : Part 1 : 1990).

Doorways

1.5.1.3 Every doorway within the enclosure to the existing stairway should be fitted with a door which, in the case of doors to habitable rooms, should be fitted with a self-closing device.

Any such door to a habitable room in the ground storey should also be a fire door if the new storey is to contain two habitable rooms.

Glazing

1.5.1.4 Any glazing in the enclosure to the existing stairway, including glazing in doors (whether or not they need to be fire doors), should be fire-resisting, and should be fixed shut.

New stairway

1.5.1.5 The new storey should be served by a stairway meeting the provisions in Technical Guidance Document K.

Fire separation of new storey

1.5.1.6 The new storey should be separated from the rest of the house by fire-resisting construction (see B3, Section 3.1.6). To maintain this separation, measures should be taken to prevent smoke and fire in the stairway from entering the new storey. Two alternative approaches are given in (a) and (b) below.

(a) The new stairway may rise over the existing stairway and within the same enclosure, in which case the stairway should be separated from the new rooms(s) by a self-closing fire door set in fire-resisting construction.

(b) The new stairway may alternatively rise from the existing room, in which case the new stairway should be separated from the existing room and the rest of the dwellinghouse by fire-resisting construction with a self-closing fire door at the top or bottom of the new stairway.

Escape windows

1.5.1.7 The room (or rooms) in the new storey should each have an openable window or rooflight for escape or rescue purposes which meets the relevant provisions in Section 4.7 of BS 5588 : Part 1 : 1990.

Fire detection and alarm systems

1.5.1.8 Self-contained smoke detectors, in accordance with I.S. 409: 1988, should be installed on the landing ceilings to provide early warning of fire.

Section 2

INTERNAL FIRE SPREAD (LININGS)

Internal fire spread (linings).	**B2**	**For the purposes of inhibiting the spread of fire within a building, the internal linings -** **(a) shall offer adequate resistance to the spread of flame over their surfaces; and** **(b) shall have, if ignited, a rate of heat release which is reasonable in the circumstances.**

Performance

The requirement of B2 may be met if the spread of fire over the internal linings of the building is restricted by making provision for them to have low rates of surface spread of flame and in some cases to have a low rate of heat production, so as to limit the contribution that the fabric of the building makes to fire growth. The extent to which this is necessary is dependent on the location of the lining.

Contents

INTRODUCTION TO PROVISIONS

2.0 Fire spread and lining materials

2,0.1 The choice of materials for the lining of walls and ceilings can significantly affect the spread of a fire, and its rate of growth, even though they are not likely to be the materials first ignited. It is particularly important in circulation spaces where linings would offer the main vehicle for fire spread, and where rapid spread would be most likely to prevent occupants from escaping.

Two properties of lining materials that are most important in this connection are the rate of flame spread over the surface when it is subject to intense radiant heating, and the rate at which the lining material gives off heat when burning. This Technical Guidance Document provides information on how to control internal fire spread through control of these properties.

Floor and stairways

2.0.2 It is impractical to attempt to control the materials used to cover floors of stairways through Building Regulations, and no provisions are made in this Technical Guidance Document about them. Attention is directed however to the provisions of the 'Code of Practice for Fire Safety of Furnishings and Fittings in Places of Assembly" published by the Department of the Environment.

Furniture and fittings

2.0.3 Furniture and fittings can have a major effect on fire spread but it is impractical to attempt to control them through Building Regulations, and no provisions are made in this Technical Guidance Document about them. Attention is directed however to the provisions of the 'Code of Practice for Fire Safety of Furnishings and Fittings in Places of Assembly' published by the Department of Environment.

Other controls on linings properties

2.0.4 There are provisions for the control of flame spread in two other parts of this document. In B3 there are provisions in Section 3.3 for surfaces exposed in concealed spaces above fire-protecting suspended ceilings, and in Section 3.4 for enclosures to above-ground drainage system pipes. In B4, there are provisions in Section 4.3 concerning the surface of rooflights in connection with the performance of roof coverings.

Classification of performance

2.0.5 Appendix A describes the different classes of performance and the appropriate methods of test, including three performance ratings for thermoplastic materials, referred to as TP(a), TP(b) and TP(c). The main classifications used are based on tests in BS 476: Parts 6 and 7. Tests in BS 2782 and BS 5438 are used for classification of thermoplastic materials.

Table A6 of Appendix A gives typical performance ratings which may be achieved by some generic materials and products.

Definitions

2.0.6 The following definitions apply specifically to B2. Other terms applicable more widely throughout the document are given in Appendix D.

Cavity - Means any space enclosed by the elements of a building (including a suspended ceiling) or contained within an element other than a room, cupboard, circulation space, protected shaft or the space within a flue, chute, duct, pipe or conduit.

Ceiling - A part of a building which encloses and is exposed overhead in a room or circulation space. (The soffit of a rooflight is included as part of its surface, but not the frame).

Circulation space - A space (including a protected stairway) mainly used as a means of access between a room and an exit from the building or compartment.

Class 0 - See Appendix A, paragraph A10.

Rooflight - Any domelight, lantern light, skylight or other element intended to admit daylight through a roof.

Room - An enclosed space in a building that is not an enclosed circulation space. (Thus the term includes not only conventional rooms, but also cupboards that are not fittings, and large spaces such as warehouses and auditoria).

Thermoplastic material - See Appendix A, paragraph A14.

Wall - includes

(i) the surface of glazing (except glazing in doors), and

(ii) any part of a ceiling which slopes at an angle of 70° or more to the horizontal.

- excludes

(i) doors and door frames;

(ii) window frames and frames in which glazing is fitted;

(iii) architraves, cover moulds, picture rails, skirtings and similar narrow members; and

(iv) fireplace surrounds, mantleshelves and fitted furniture.

PROVISIONS MEETING THE REQUIREMENT

2.1 GENERAL PROVISIONS

Subject to the variations and specific provisions described in the paragraphs below, the surface linings of walls and ceilings should meet the following classifications -

(a) Class 3 in bathrooms and toilets,

(b) Class 1 in other rooms, (except those listed at (e) below),

(c) Class 1 in circulation spaces within dwellings,

(d) Class 0 in other circulation spaces (including the common areas of flats and maisonettes), and

(e) Class 0 in rooms exceeding 30m² in institutional and assembly buildings.

2.2 Variations and special provisions

Walls

2.2.1 Part of the surface of a wall in a room may be of a class lower than specified in 2.1, (but not lower than Class 3) if the area of that part (or, if there are two or more such parts, the total area of those parts) does not exceed, the lesser of the following -

(i) half the floor area of the room, or

(ii) 20 m² (in the case of a building or compartment of Purpose Group 1, 2 or 5) or 60 m² (in any other case); and

In the case of a wall surface in a building of Purpose Group 1, 2, or 5 the area of that part should not exceed 5 m² and should be separate from any other such part by a distance of not less than 2 m; or

In the case of a wall surface in a building of any other Purpose Group, the area of that part shall not exceed 15 m² and should be separated from any other such part by a distance of not less than 2 m.

Fire-protecting suspended ceilings

2.2.2 As well as satisfying paragraph 2.1, a suspended ceiling that is to qualify as a fire-protecting ceiling contributing to the fire resistance of a floor/ceiling assembly should be constructed of materials of limited combustibility if the floor is to have a fire resistance of more than 60 minutes (i.e. a type D ceiling, see Table A3 in Appendix A).

Fire-resisting ceilings

2.2.3 The need for cavity barriers in concealed floor or roof spaces, referred to in Section 3.3 of B3, can be reduced by the use of a fire-resisting ceiling below the cavity. Such a ceiling should comply with the following:

(a) it should have at least 30 minute fire resistance;

(b) it should be imperforate except for an opening allowed under paragraph 3.3.4;

(c) it should extend throughout the building or compartment;

(d) it should not be demountable; and

(e) it should have a Class 0 surface on the soffit, and at least a Class 1 surface facing the cavity.

2.3 Thermoplastic materials

2.3 Thermoplastic materials and other plastics products which have a lower classification than specified in paragraph 2.1 can be used for windows (suspended ceilings if they comply with the following provisions.

Windows

2.3.1 Windows to rooms (though not to circulation spaces) may be glazed with thermoplastic materials, if:

(a) the material can be classified as a TP (a) or TP (b) product; and

(b) in the case of TP(b) products, the glazed area does not exceed one half of the floor area of the room.

Rooflights

2.3.2 Rooflights to rooms and circulation spaces may be constructed of any thermoplastic material if the lower surface is not less than Class 3 (or TP(c)) and the rooflight satisfies the relevant provisions of Section B4.

Lighting diffusers

2.3.3 Ceilings to rooms and circulation spaces (but not protected stairways) may incorporate thermoplastic lighting diffusers if the following provisions are observed, provided that the ceiling is not a fire protecting or fire-resisting one.

(a) Wall and ceiling surfaces exposed within the space above the suspended ceiling (other than the upper surfaces of the thermoplastic panels) should comply with the general provisions of paragraph 2.1, according to the type of space below the suspended ceiling.

(b) If the diffusers are of classification TP(a), there are no restrictions (except in the case of stretched skin panels which should not exceed 4 m^2 in area).

(c) If the diffusers are of classification TP(b), each panel should not exceed 4 m^2 in area.

(d) If the diffusers are of classification TP(c), they should be loosely mounted so that they will fall out of their mountings on initial heating, and should be limited in extent as indicated in Table 2.1.

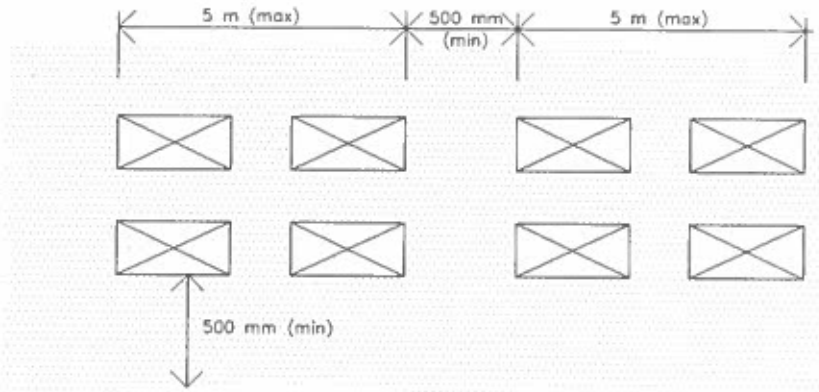
Table 2.1 Limitations applied to type TP(c) thermoplastic materials used for lighting diffusers in suspended ceilings

Limitations			
		Maximum area	
Maximum length of side of panel (m)	Minimum distance between panels (mm)	Any one panel (m^2)	Total area as percentage of floor area of space in which ceiling is situated
5	500	circulation spaces: 2	15%
		rooms: 4	residential and assembly purpose groups: 30% elsewhere: 50%

Note:

Smaller panels can be grouped together provided that the overall size of the group and the space between one group and any other satisfies the dimensions shown in Diagram B2.1.

Diagram B21 Suspended ceilings with type TP(c) thermoplastic lighting diffusers



panels of plastics material

ceiling between plastics panels complying with paragraph 2.1 on upper and lower surfaces

Maximum area of group – 2 m^2 in circulation spaces
4 m^2 in rooms

Section 3

INTERNAL FIRE SPREAD (STRUCTURE)

Internal fire spread (structure).	**B3**	(1)		A building shall be so designed and constructed that, in the event of fire, its stability will be maintained for a reasonable period.
		(2)	(a)	A wall common to two or more buildings shall be so designed and constructed that it offers adequate resistance to the spread of fire between those buildings.
			(b)	A building shall be sub-divided with fire resisting construction where this is necessary to inhibit the spread of fire within the building.
		(3)		A building shall be so designed and constructed that the unseen spread of fire and smoke within concealed spaces in its structure or fabric is inhibited where necessary.
		(4)		For the purposes of sub-paragraph 2(a), a house in a terrace and a semi-detached house are each to be treated as being a separate building.

Performance

The requirements of B3 may be met:

(a) if the structural elements of the building are capable of withstanding the effects of fire for an appropriate period without loss of stability,

(b) if the building is sub-divided by elements of fire-resisting construction into compartments,

(c) if any openings in fire separating elements are suitably protected in order to maintain the fire integrity of the element, and

(d) if any hidden voids in the construction are sealed and subdivided to inhibit the unseen spread of fire and products of combustion,

in order to reduce the risk of structural failure, and the spread of fire, in so far as they pose a threat to life, to people in and around the building.

The extent to which any of these measures are necessary is dependent on the use of the building and, in some cases its size, and on the location of the element of construction.

Contents

INTRODUCTION TO PROVISIONS

3.0.1 Provisions for loadbearing elements of structure are given in Section 3.1. Section 3.2 is concerned with the subdivision of a building into compartments, and Section 3.3 makes provisions about concealed spaces (or cavities). Section 3.4 gives information on the protection of openings and on fire-stopping which relates to compartmentation and to fire spread in concealed spaces. Section 3.5 is concerned with special provisions which apply to car parks and shopping complexes. Common to all these sections, and to other provisions of this document is the property of fire resistance.

Fire resistance

3.0.2 The fire resistance of an element of construction is a measure of its ability to withstand the effects of fire in one or more ways:

- resistance to collapse, i.e. the ability to maintain loadbearing capacity (which applies to loadbearing members);
- resistance to fire penetration, i.e. an ability to maintain the integrity of the element (which applies to fire separating elements);
- resistance to the transfer of excessive heat, i.e. an ability to provide insulation from high temperatures (which applies to fire separating elements).

Provisions elsewhere in Technical Guidance Document B concerning fire resistance

3.0.3 There are provisions in Section B1 concerning the use of fire-resisting construction to protect means of escape.

There are provisions in Section B4 for fire resistance of external walls to restrict the spread of fire between buildings.

There are provisions in Section B5 for fire resistance in the construction of fire-fighting shafts.

Appendix A gives information on methods of test and performance for elements of construction.

Appendix B gives information on fire-resisting doors.

DEFINITIONS

3.0.4 The following definitions apply specifically to Section B3. Other terms applicable more widely throughout this document are given in Appendix D.

Appliance ventilation duct - A duct provided to convey combustion air to a gas appliance.

Cavity barrier - A construction provided to close a concealed space against penetration of smoke or flame, or provided to restrict the movement of smoke or flame within such a space.

Concealed space (cavity) - A space enclosed by elements of a building (including a suspended ceiling) or contained within an element, but not a room, cupboard, circulation space, protected shaft or space within a flue, chute, duct, pipe or conduit.

Fire stop - A seal provided to close an imperfection of fit or design tolerance between elements or components, to restrict or prevent the passage of fire and smoke.

Pipe - includes: pipe fittings and accessories; excludes: a flue pipe and a pipe used for ventilating purposes (other than a ventilating pipe for an above ground drainage system).

Platform floor (access or raised floor) - A floor supported by a structural floor, but with an intervening concealed space which is intended to house services.

3.1. LOADBEARING ELEMENTS OF STRUCTURE

Introduction

3.1.1 Premature failure of the structure can be prevented by provision for loadbearing elements of structure to have a minimum standard of fire resistance, in terms of resistance to collapse or failure of loadbearing capacity.

The purpose in providing the structure with fire resistance is threefold:

- to protect the occupants, some of whom may have to remain in the building for some time while evacuation proceeds, if the building is a large one;
- to protect fire fighters who may be engaged in search or rescue operations (though this is limited and is not intended to cover fire-fighting operations generally);
- to reduce the danger to people in the vicinity of the building who might be hurt by falling debris or by the impact of the collapsing structure on other buildings.

Fire resistance standard

3.1.2 Structural frames, beams, columns, loadbearing walls (internal and external), floor structures and gallery structures, should have at least the fire resistance given in Appendix A, Table A1.

Application of the fire resistance standards for loadbearing elements

(See Appendix A, Tables A1 and A2)

3.1.2 The measures set out in Appendix A include provisions to ensure that where one element of structure supports or gives stability to another element of structure, the supporting element has no less fire resistance than the other element.

3.1.3 The measures also provide for elements of structure that are common to more than one building or compartment, to be constructed to the standard of the greater of the relevant provisions.

Special provisions about fire resistance of elements of structure in single storey buildings are also given, and there are concessions in respect of fire resistance of elements of structure in basements where at least one side of the basement is open at ground level.

Exclusions from the provisions for elements of structure

3.1.4 The following are excluded from the definition of elements of structure for the purposes of these provisions:

(a) a structure that only supports a roof, unless the roof performs the function of a floor, e.g. for parking vehicles, or as a means of escape (see B1);

(b) the lowest floor of the building; and

(c) a platform floor.

Additional provisions

3.1.5 If a loadbearing wall is also -

(a) a compartment wall, see Section 3.2;

(b) a wall between a house and a small garage, see Section 3.2, paragraph 3.2.8;

(c) protecting a means of escape, see B1;

(d) an external wall, see B4; or

(e) enclosing a fire-fighting shaft, see B5.

If a floor is also a compartment floor, see Section 3.2.

Floors in domestic loft conversions

3.1.6 In altering an existing two storey single family dwellinghouse to provide additional storeys, the floor(s), both old and new, should have the full 30 minute standard of fire resistance shown in Appendix A, Table A1. However, where only one new storey not exceeding 50 sq.m in area and containing one or two habitable rooms is added in the roof space of a two storey house, it would be reasonable to provide the existing first floor with a modified 30 minute standard of fire resistance where:

(a) the floor only separates rooms; and

(b) the provisions in B1, Section 1.5.1 are met.

The 'modified 30 minute' standard satisfies the test criteria for the full 30 minutes in respect of loadbearing capacity, but allows reduced performances for integrity and insulation (see Table A1, item 3(a)).

Raised storage areas

3.1.7 Raised free-standing floors (which may be supported by racking) are frequently erected in single storey industrial buildings. Whether the structure is considered as a gallery or is of sufficient size that it is considered as a floor forming an additional storey, the provisions for fire resistance of elements of structure set out in Appendix A, Table A1, would apply to the structure.

In the case of automated storage systems in which people do not normally go onto any of the raised storage tiers, it may not be necessary to provide the storage structure with fire resistance to ensure the safety of occupants of the building.

Where people do go onto the storage tiers in the course of their normal use, reduced levels of fire resistance in the construction of the raised storage platforms (or even little fire resistance so as to permit an unprotected steel structure) may also be acceptable provided the following conditions are satisfied:

(a) the structure has only one tier and is used for storage purposes only;

(b) the number of persons likely to be on the floor at any one time is low and does not include members of the public;

(c) the layout is such that any persons on the floor would be readily aware of any fire starting at the lower level; and

(d) the stairway serving the floor discharge near exits from the building.

Features of layout or design that would allow occupants to be aware of a fire starting at the lower level include the use of perforations in the floor of the structure, or leaving a space between the edge of the platform and the walls of the room housing it, to make the smoke and the sounds of the fire obvious. If the floor is more than 10 m in width or length, an automatic fire detection and alarm system should be used to provide sufficiently early warning.

3.2. COMPARTMENTATION

Introduction

3.2.1 The spread of fire within a building can be restricted by sub-dividing it into compartments separated from one another by walls and/or floors of fire-resisting construction. The object is twofold:

(a) to prevent rapid fire spread which could trap occupants of the building; and

(b) to reduce the chance of fires becoming large, on the basis that large fires are more dangerous, not only to occupants but to people in the vicinity of the building.

Compartmentation is complementary to provisions made under Section B1 for the protection of escape routes, and to provisions made under Section B4 against the spread of fire between buildings.

The degree of sub-division that is appropriate, depends on:

(a) the use of the building, which affects the potential for fires and the severity of fires, as well as the ease of evacuation;

(b) the height of the top storey in the building, which is an indication of the ease of evacuation and the ability of the fire service to intervene effectively; and

(c) the availability of a sprinkler system which affects the growth rate of the fire, and may suppress it altogether.

Forms of compartmentation

3.2.2 Sub-division is achieved using compartment walls and compartment floors, and provisions for their construction are given in paragraphs 3.2.5 et seq. These construction provisions vary according to the function of the wall or floor.

Special forms of compartmentation to which particular construction provisions apply, are:

(a) walls common to two or more buildings;

(b) walls dividing buildings into separated parts (in which the parts can be assessed independently for the purpose of determining the appropriate standard of fire resistance); and

(c) walls protecting houses from attached or integral small garages.

Junctions and protected shafts

3.2.3 For compartmentation to be effective, there should be continuity at the junctions of the fire-resisting elements enclosing a compartment, and any openings from one compartment to another should not present a weakness.

Spaces that connect compartments, such as stairways and service shafts, need to be protected to restrict fire spread between the compartments, and they are termed protected shafts.

Provision of compartment walls and compartment floors

3.2.4 Compartment walls and compartment floors should be provided in the circumstances described below, with the provision that the lowest floor in a building does not need to be constructed as a compartment floor.

Information on the construction of compartment walls and compartment floors in different circumstances is given in paragraphs 3.2.5 and 3.2.5.3.

Provisions for the protection of openings in compartment walls and compartment floors are given in paragraphs 3.2.6 and 3.2.7.6.

All purpose groups

3.2.4.1 (a) A wall common to two or more buildings (separating wall) should be constructed as a compartment wall.

(b) Compartment walls and/or compartment floors should be provided to separate parts of a building that are occupied mainly for different purposes or by different tenancies, from one another. This does not apply where one of the different purposes is ancillary to the other. See Section 3.2 for guidance on determining whether a function is ancillary or not.

Flats and maisonettes

3.2.4.2 In buildings containing flats or maisonettes the following should be constructed as compartment walls or compartment floors:

(a) any floor (unless it is within a maisonette, i.e. between one storey and another within one dwelling), and

(b) any wall separating a flat or maisonette from any other part of the building, and

(c) any wall enclosing a refuse storage chamber.

Institutional buildings

3.2.4.3 (a) In institutional buildings (purpose group 2(a)) all floors should be constructed as compartment floors.

(b) Any walls needed to divide the storeys of a hospital into at least two compartments to comply with the means of escape provisions in B1, Section 1.2.7, should be constructed as compartment walls.

Other residential buildings

3.2.4.3 Any floors in buildings of the Other Residential (purpose group 2(b)) should be constructed as compartment floors.

Non-residential buildings

3.2.4.4 The following walls and floors should be constructed as compartment walls and compartment floors in buildings of a non-residential purpose group (i.e. Office, Shop & Commercial, Assembly & Recreation, Industrial, Storage or Other Non-Residential):

(a) any wall (unless the building is a single storey building) needed to sub-divide the building to observe the size limits on compartments given in Table 3.1;

(b) any floor if the building, or separated part of the building, has a storey with a floor at a height of more than 30 m above ground level;

(c) the floor of the ground storey if the building has one or more basements;

(d) any basement floor if the building, or separated part, has a basement at a depth of more than 10 m below ground level; and

(e) if the building forms part of a shopping complex, any wall and floor described in Section 3.5 as needing to be constructed to the standard for a compartment wall or compartment floor.

Construction of compartment walls and compartment floors

3.2.5 Every compartment wall and compartment floor should:

(a) form a complete barrier to fire between the compartments they separate (see Diagram B3.1); and

(b) have the appropriate fire resistance as indicated in Appendix A, Table A1.

Any compartment wall or compartment floor which is required to have a fire resistance of one hour or more should be constructed of non-combustible materials apart from any floor finish, or any wall surface finish complying with the requirements of B2.

Table 3.1 Maximum area and cubic capacity of a building or compartment

Purpose group or sub-group		Building form	Maximum area [1] (m^2)	Maximum cubic capacity [1] (m^3)
2(a)	(institutional)	any	1500	8500
2(b)	(other residential)	any	2000	14000
3	(offices)	any	4600	28000
4	(shops and commercial)	any	2800	7100
5	(assembly)	any	1900	21000
6	(high hazard industrial) [2]	single storey more than one storey	33000 2800	no limit 17000
6	(low hazard industrial) [2]	single storey more than one storey	93000 7500	no limit no limit
7	(high hazard storage) [2]	single storey more than one storey	1000 500	no limit 4200
7	(low hazard storage) [2]	single storey more than one storey	14000 2800	no limit 21000
7	(open sided car parks)	any	no limit	no limit

Note:
1. For buildings of all purpose groups, except 2, these figures may be doubled if the building or compartments is provided with an appropriate automatic sprinkler system meeting the relevant recommendations of BS 5306: Part 2, i.e. the relevant occupancy rating together with additional requirements for life safety.

2. See Appendix E for guidance on assessment of risk in Industrial and Storage buildings

An exception to this requirement may be permitted in the case of separating walls between Purpose Group 1(a) buildings (Residential) - houses of one or two stories only, where the wall is part of a timber frame construction scheme consisting only of a structural frame of combustible materials, and containing no pipes, wires or other services, and the design, materials and workmanship used in the manufacture and construction of the wall are in accordance with the provisions of Technical Guidance Document D.

An exception may also be permitted to the requirement for compartment floors to be of non-combustible materials in the case of any existing floor in a building of any Purpose Group, other than in Purpose Group 2(a) (Institutional), which is altered or extended, and where after alteration or extension the building does not exceed 15m. in height.

Separating walls

3.2.5.1 Compartment walls that are common to two or more buildings should run the full height of the building in a continuous vertical plane. Thus adjoining buildings should only be separated by walls, not floors.

Separated parts

3.2.5.2 Compartment walls used to form a separated part of a building should run the full height of the building in a continuous vertical plane.

Junction of compartment wall or compartment floor with other walls

3.2.5.3 Where a compartment wall or compartment floor meets another compartment wall, or an external wall, the junction should resist fire penetration for a period not less than that for the wall or floor.

Junction of compartment wall and roof

3.2.5.4 (a) A compartment wall should be taken up to meet the underside of the roof covering or deck, with fire-stopping where necessary at the wall/roof junction to maintain the continuity of fire resistance. A compartment wall should not be stopped at ceiling level while using a cavity barrier in the roof space to continue the line of compartmentation to the roof. This is because the performance standard for a cavity barrier is lower than for a compartment wall.

(b) If a fire penetrates a roof near a compartment wall there is a risk that it will spread over the roof to the adjoining compartment. To reduce this risk, and subject to (c) below, a zone of the roof 1.5 m wide on either side of the wall should have a covering of designation AA, AB or AC (see Appendix A) on a noncombustible substrata or deck as set out in Diagram B.3.2(a).

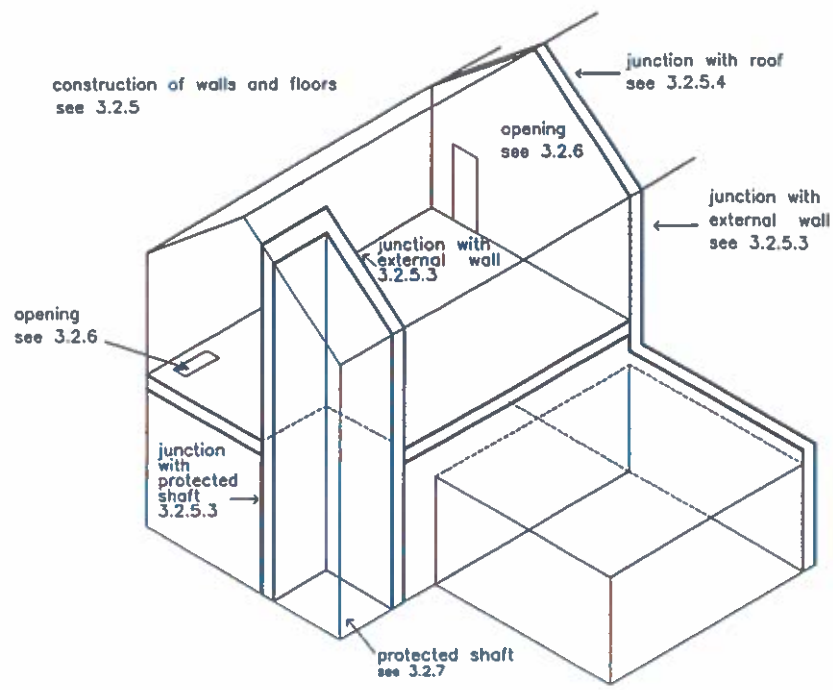
(c) In buildings not more than 15 m high, of the purpose groups listed below, combustible boarding used as a substrata to the roof covering, wood wool slabs, or timber tiling battens, may be carried over the compartment wall provided that they are fully bedded in mortar or other suitable material over the width of the wall (see Diagram B 3.2(b)). This applies to:

- Dwelling houses
- Buildings or compartments in Residential use (other than institutional)
- Office buildings
- Assembly buildings

Openings between compartments

3.2.6 Information on fire doors will be found in Appendix B.

Diagram B3.1 Compartment walls and compartment floors



Note

The references indicate where the provisions are given in the paragraphs

Openings in separating walls

3.2.6.1 Any openings in a wall which is common to two or more buildings should be limited to those for:

(a) a door which is needed to provide a means of escape in case of fire and which has the same fire resistance as that required for the wall (see Appendix B, Table B1) and is fitted in accordance with the provisions of Appendix B; and

(b) the passage of a pipe which meets the provisions in Section 3.4.

Openings in other compartment walls or in compartment floors

3.2.6.2 Openings in compartment walls (other than those described in paragraph 3.2.6.1) or compartment floors should be limited to those for:

(a) doors which have the appropriate fire resistance given in Appendix B, Table B1, and are fitted in accordance with the provisions of Appendix B; and

(b) the passage of pipes, ventilation ducts, chimneys, appliance ventilation ducts or ducts encasing one or more flue pipes, which meet the provisions in Section 3.4; and

(c) refuse chutes of non-combustible construction; and

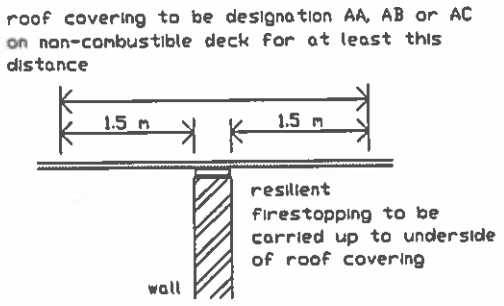
(d) protected shafts which meet the relevant provisions below.

Protected shafts

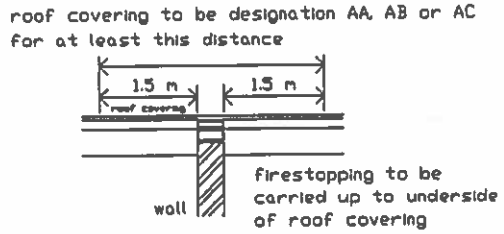
3.2.7 Any stairway or other shaft passing directly from one compartment to another, should be enclosed so as to delay or prevent the spread of fire between compartments, and is termed a protected shaft.

If the protected shaft is a stairway, see also B1 for provisions relating to protected stairways, and B5 if the stairway also serves as a fire-fighting stairway.

Diagram B3.2 Junction of compartment wall with roof



(a) Building or compartment at any height and use



boarding (used as a substrate),wood wool slabs, or timber tiling battens may be carried over the wall provided that they are fully bedded in mortar (or other not less suitable material)

(b) Dwelling house and building or compartment in residential (except institutional) office or assembly use and not more than 15 m above mean ground level

Note :
Under the provisions of Section B4 Table 4.4 if the wall is a separating wall every part of the roof covering less than 6 m from the wall should be designation AA, AB or AC.

Construction of protected shafts

3.2.7.1 The construction enclosing a protected shaft (see Diagram B3.3) should:

(a) form a complete barrier to fire between the different compartments which the shaft connects;

(b) have the appropriate fire resistance given in Appendix A, Table A1, except for glazed screens which meet the provisions of paragraph 3.2.7.3; and

(c) satisfy the provisions about their use, ventilation and the treatment of openings in the paragraphs below.

Use for protected shafts

3.2.7.2 The uses of protected shafts should be restricted to stairways, lifts, escalators, chutes, ducts, pipes, and/or as sanitary accommodation and washrooms.

Glazed screens to protected shafts

3.2.7.3 Where a protected shaft contains a stairway, but is not a fire-fighting shaft (see B5), and is entered from a corridor or lobby, the part of the enclosure between the shaft and the corridor or lobby may incorporate glass so as to provide at least 30 minutes fire resistance in terms of integrity only, if the principles in Diagram B3.4 are met.

Pipes for oil or gas in protected shafts

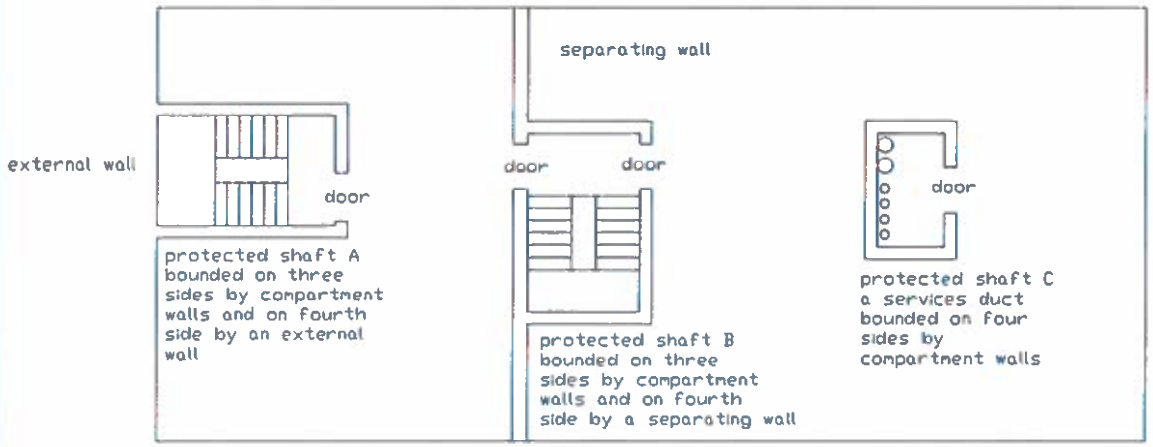
3.2.7.4 If a protected shaft contains a stairway and/or lift, it should not also contain a pipe conveying oil or gas (other than hydraulic oil in the mechanism of a hydraulic lift) or contain a ventilating duct (other than a duct provided for the purposes of pressurizing the stairway to keep it smokefree).

Ventilation of protected shafts conveying gas

3.2.7.5 A protected shaft conveying piped flammable gas should be adequately ventilated direct to the outside.

Diagram B3.3 Protected shafts (construction)

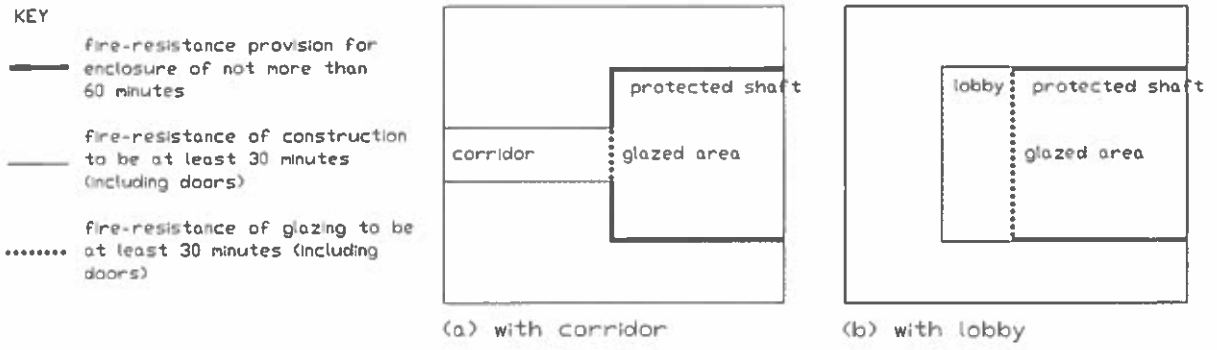
protected shafts provide for the movement of people (eg. stairways, lifts), or things (eg. services, pipes) or air (eg. ventilation shaft) between different compartments. The structure enclosing the shaft (unless formed by adjacent external or separating walls) is formed by compartment walls. The diagram shows three common examples which illustrate the principles.



plan

The shaft structure (including any openings) should meet the relevant provisions :
for compartment walls see paragraphs 3.2.5, 3.2.6. 3.2.7
for external walls see Section B4
for separating walls see paragraph 3.2.5, 3.2.6, 3.2.7

Diagram B3.4 Glazed screen separating protected shaft from lobby or corridor



Openings into protected shafts

3.2.7.6 An external wall of a protected shaft does not normally need to have fire resistance, unless it is a fire-fighting shaft, (see B5), or if it contains a stairway, and the layout is such that it may expose persons to risk. Openings in other parts of the enclosure to a protected shaft should be limited as follows:

(a) Where part of the enclosure to a protected shaft is a wall common to two or more buildings (i.e. a separating wall), only the following openings should be made in that wall:

(i) a door which is needed to provide a means of escape in case of fire and which has the same fire resistance as that required for the wall (see Appendix B, Table B1) and is fitted in accordance with the provisions of Appendix B; and

(ii) the passage of a pipe which meets the provisions in Section 3.4.

(b) Other parts of the enclosure (other than an external wall) should only have openings for:

(i) doors which have the appropriate fire resistance given in Appendix B, Table B1, and are fitted in accordance with the provisions of Appendix B; and

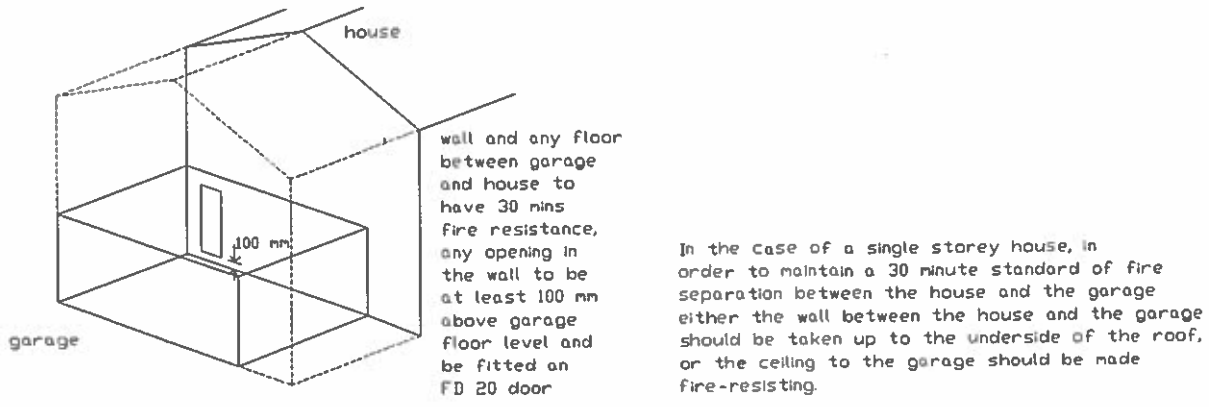
(ii) the passage of pipes which meet the provisions in Section 3.4; and

(iii) inlets to, outlets from and openings for a ventilation duct, (if the shaft contains or serves as a ventilating duct) which meet the provisions in Section 3.4; and

(iv) the passage of lift cables into a lift motor room (if the shaft contains a lift). If the motor room is at the bottom of the shaft, the openings should be as small as practicable.

3.2.8 If a small garage is attached to (or forms part of) a house, any wall and floor between the garage and the house should comply with Diagram B3.5.

Diagram B3.5 Separation between garage and house



3.3 CONCEALED SPACES (Cavities)

Introduction

3.3.1 Hidden voids in the construction of a building provide a ready route for smoke and flame spread. This is particularly so in the case of voids above other spaces in a building, e.g. above a suspended ceiling or in a roof space. As the spread is concealed, it presents a greater danger than would a more obvious weakness in the fabric of the building. Provisions are made to restrict this by interrupting cavities which could form a pathway around a barrier to fire, and sub-dividing extensive cavities.

It should be noted that cavity barriers should not be provided above compartment walls as these walls are required to be carried up full storey height, to a compartment floor or to the roof as appropriate, (see paragraph 3.2.5.4). The fire resistance standards for cavity barriers are lower than for a compartment wall, and it is important to use a compartment wall in this situation to maintain the standard of fire resistance.

Provision of cavity barriers

3.3.2 Cavity barriers should be provided in accordance with Table 3.2 (see also Diagram B3.6), and the dimensions of cavities should not exceed those specified in Table 3.3.

Construction and fixings for cavity barriers

3.3.3 Every cavity barrier should be constructed to provide at least 30 minutes fire resistance (see Appendix A, Table A1, item 15).

Notes:

(a) any cavity barrier required in a stud wall or partition may, however, be formed of -

(i) steel at least 0.5 mm thick, or

(ii) timber at least 38 mm thick, or

(iii) polythene sleeved mineral wool, or mineral wool slab, in either case under compression when installed in the cavity.

(b) a cavity barrier may be formed by any construction provided for another purpose if it meets the provisions for cavity barriers.

Cavity barriers should be tightly fitted to rigid construction and mechanically fixed in position wherever possible. Where this is not possible (for example, in the case of a junction with slates, tiles, corrugated sheeting or similar materials) the junction should be fire-stopped.

Cavity barriers should also be fixed so that their performance is unlikely to be made ineffective by:

(a) movement of the building due to subsidence, shrinkage or thermal change; and

(b) collapse in a fire of any services penetrating them; and

(c) failure in a fire of their fixings; and

(d) failure in a fire of any material or construction which they abut.

For example, if a suspended ceiling is continued over the top of a fire-resisting wall or partition and direct connection is made between the ceiling and the cavity barrier above the line of the wall or partition, premature failure of the cavity barrier can occur when the ceiling collapses. However, this does not arise if the ceiling is designed to provide fire protection of 30 minutes or more.

Openings in cavity barriers

3.3.4 Any openings in a cavity barrier should be limited to those for:

(a) doors which have at least 20 minutes fire resistance (see Appendix B, Table B1, item 8(a)) and are fitted in accordance with the provisions of Appendix B; and

(b) the passage of pipes which meet the provisions in Section 3.4; and

(c) the passage of cables or conduits containing one or more cables; and

(d) openings fitted with a suitably mounted automatic fire shutter; and

(e) ducts which (unless they are fire-resisting) are fitted with a suitably mounted automatic fire shutter where they pass through the cavity barrier.

Table 3.2 Provision of cavity barrier

Cavity barriers to be provided	Purpose group in which the provision applies			
	1(a) & 1(b)	1(c)	2	3-7
1. At the junction between an external cavity wall which does not comply with Diagram B3.7, and a separating wall.	✓	✓	✓	✓
2. Above the enclosures to a protected stairway in a house of 3 or more storeys (see Diagram B3.8(a)) [1]	✓	-	-	-
3. At the junction between an external cavity wall which does not comply with Diagram B3.7, and every compartment floor and compartment wall.	-	✓	✓	✓
4. At the junction between a cavity wall which does not comply with Diagram B3.7, and every compartment floor, compartment wall, or other wall or door assembly which forms a fire-resisting barrier.	-	✓	✓	✓
5. In a protected escape route, above any fire-resisting construction which is not carried full storey height, or (in the case of a top storey) to the underside of the roof covering [1]	-	✓	✓	✓
6. Above any bedroom partitions which are not carried full storey height, or (in the case of a top storey) to the underside of the roof covering. [1]	-	-	✓	-
7. Where a corridor (which is not a protected corridor) should be sub-divided to prevent fire or smoke from affecting the routes to two exits simultaneously (see B1, Section 1.2), above any corridor enclosures which are not carried full storey height, or (in the case of a top storey) to the underside of the roof covering. [2]	-	-	-	✓
8. To sub-divide any cavity (including any roof space) so that the distance between cavity barriers does not exceed the dimensions given in Table 3.3.	-	-	-	✓

Notes:

1. The provisions in items 2, 5 and 6 of this table do not apply where the cavity is enclosed on the lower side by a fire-resisting ceiling (as shown in Diagram B3.9) which extends throughout the building, compartment or separated part.
2. The provision in item 7 of this table does not apply where the storey is sub-divided by fire-resisting construction carried full storey height and passing through the line of sub-division of the corridor (see Diagram B3. 10), or where the caity is enclosed on the lower side as described in Note (1).

Table 3.3 Maximum dimensions of cavities (Non-residential purpose groups)		
Location of Cavity	**Class of surface exposed in cavity (excluding surface of any pipe, cable or conduit, or insulation to any pipe)**	**Maximum dimension in any direction (m)**
Between a roof and a ceiling	Any	20
Any other cavity	Class 1	20
	Any other class	10

Notes:

(1) Where any room under a cavity exceeds the dimensions given, cavity barriers need only be provided on the line of the enclosing walls/partitions of that room - subject to no cavity barrier being more than 40m apart in any direction; or

(2) Where the cavity is over an undivided area and is used as a plenum and exceeds this size, there is no limit to the size of the cavity if:

(a) the room and the cavity together are compartmented from the rest of the building;
(b) an automatic fire detection and alarm system is fitted in the building with smoke detectors in the cavity and in the return air ducting, and which stops circulation of the ventilation system and switches it to extract;
(c) the suspended ceiling and its supports are of non-combustible construction;
(d) the flame spread rating of any pipe insulation system is Class 1;
(e) any electrical wiring in the void is laid in metal trays; and
(f) any other materials in the cavity are of limited combustibility.

(3) The provisions in this table do not apply to any cavity described below:

(a) in a wall which should be fire-resisting only because it is loadbearing; and
(b) in a masonry or concrete external cavity wall shown in Diagram B3.7 and
(c) in a floor or a roof space where the cavity is enclosed on the lower side by a fire-resisting ceiling (as shown in Diagram B3.9) which extends throughout the building, compartment or separated part; and
(d) below a floor next to the ground or oversite concrete, if the cavity is less than 1m in height or if the cavity is not normally accessible by persons, unless there are openings in the floor such that it is possible for litter to accumulate in the cavity (in which case cavity barriers should be provided, and access should be provided to the cavity for cleaning); and
(e) formed by over-cladding an existing masonry (or concrete) external wall, or an existing concrete roof, provided that the cavity does not contain combustible insulation; and
(f) between double-skinned corrugated or profiled insulated roof and wall sheeting if the sheeting is a material of limited combustibility and both surfaces of the insulating layer have a surface spread of flame of at least Class 1 (see Appendix A) and make contact with the inner and outer skins of cladding (see Diagram B3.11).

Diagram B3.6 Interrupting concealed spaces (cavities)

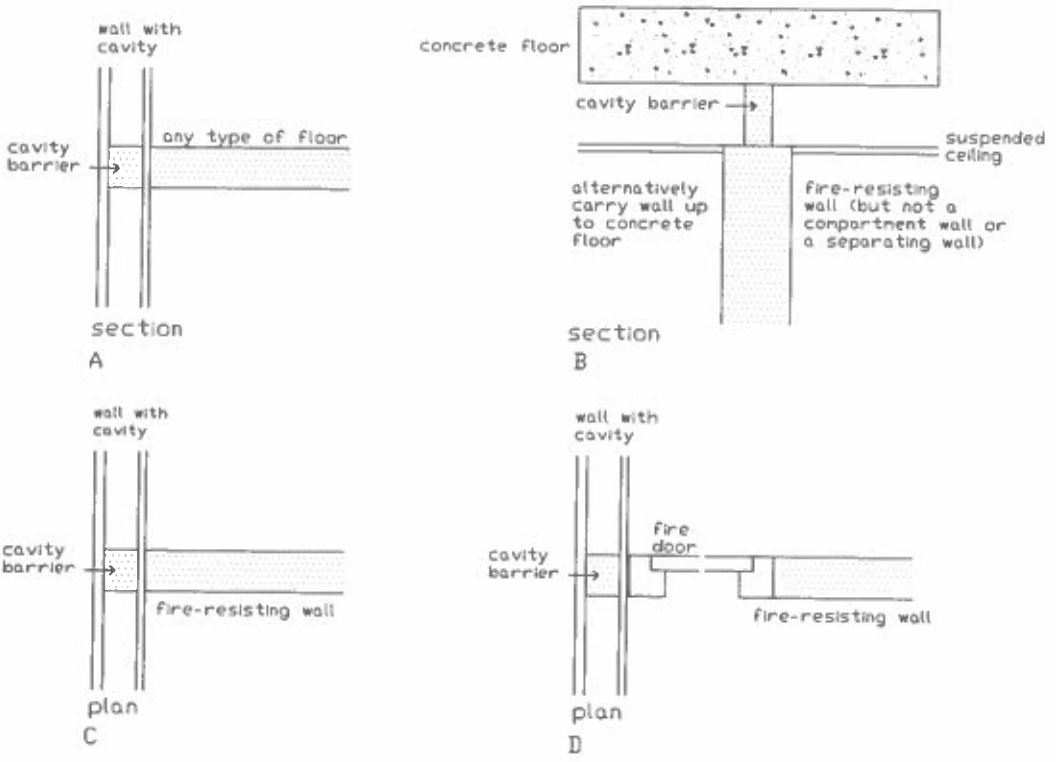
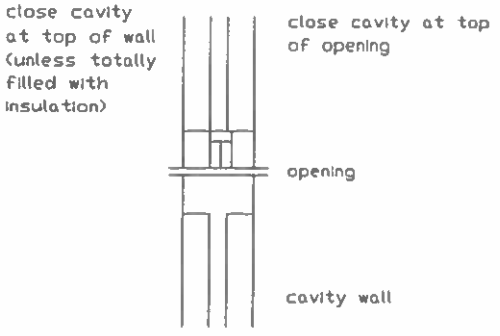


Diagram B3.7 Cavity walls excluded from provisions



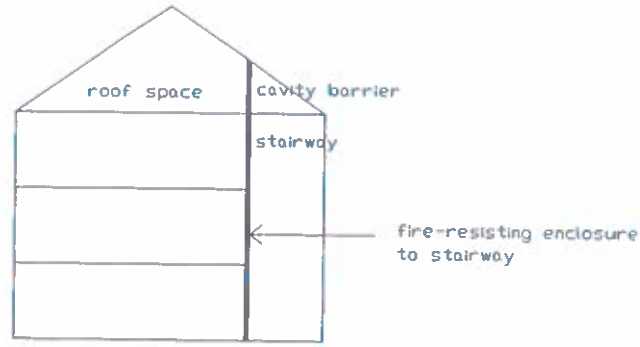
two brick or block leaves (or concrete)
at least 75 mm thick
cavity not more than 110 mm wide

NOTES

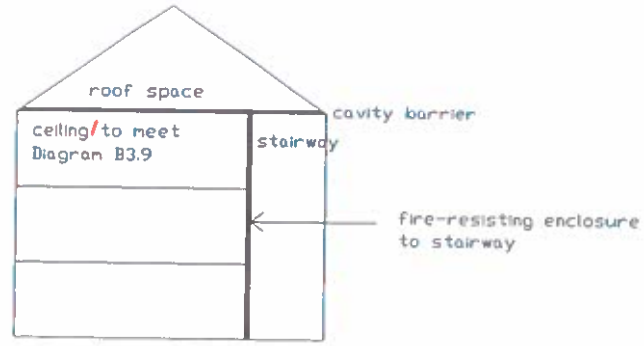
Combustible material should not be placed,or exposed to, the cavity except for :

(a) timber lintel, window or door frame, or end of timber joist.
(b) pipe, conduit or cable,
(c) DPC, flashing closer or wall tie.
(d) thermal insulating material
(e) domestic meter cupboard provided that
- there are not more than 2 cupboards to a dwelling
- the opening in the outer wall leaf is not more than 800 mm x 500 mm for each cupboard, and
- the inner leaf is not penetrated except by a sleeve not more than 80 mm x 80 mm which is firestopped

Diagram B3.8 Three storey or more houses (alternative arrangements)

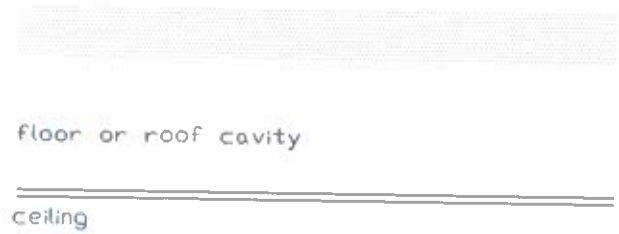


(a) With cavity barrier(s)



(b) With fire-resisting ceiling

Diagram B3.9 Fire resisting ceiling below a concealed space

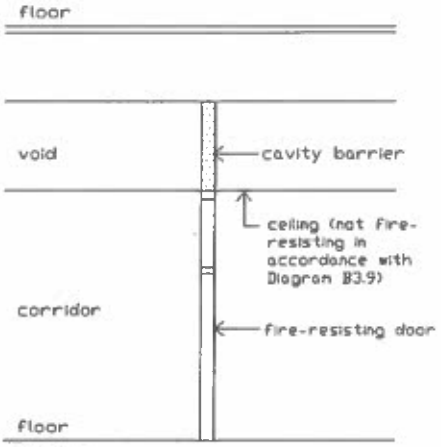


ceiling surface facing cavity to have surface spread of flame at least Class 1
exposed ceiling surface to be Class 0
additionally the ceiling should:

1 have at least 30 minute fire-resistance; and
2 be imperforate except for an opening allowed under paragraph 3.3.4,
3 extend throughout the building or compartment, and
4 not be demountable

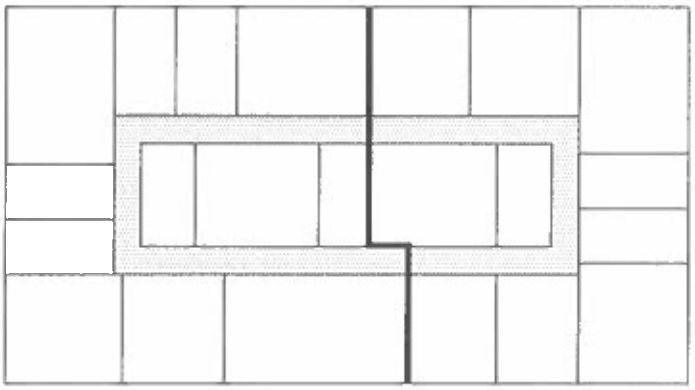
Diagram B3.10 Corridor sub-division (alternative arrangements)

(a) Cavity barriers above corridor enclosure

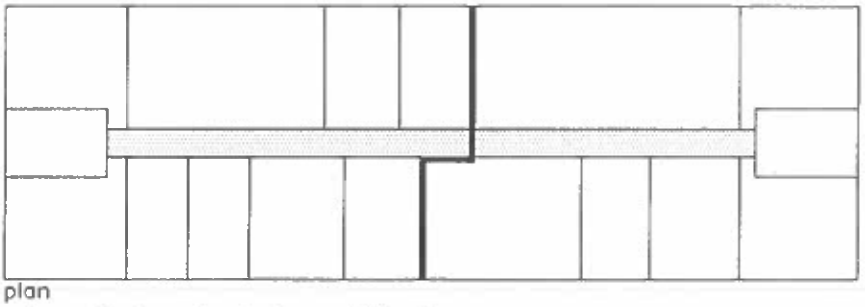


section

(b) Sub-division of storey



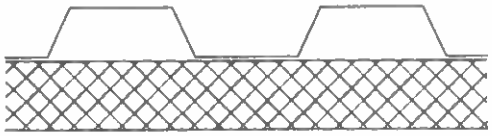
plan



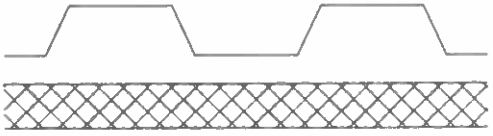
plan

Unless a fire-resisting ceiling is provided as shown in Diagram B3.9 either
(a) install cavity barriers above the corridor enclosures, or
(b) sub-divide storey, including ceiling void.

Diagram B3.11 Double-skinned insulated roof and wall sheeting excluded from provisions in Table 3.3



Acceptable without cavity barriers



Cavity barriers necessary

The insulation should make contact with both skins over as wide an area as possible

3.4. PROTECTION OF OPENINGS AND FIRE-STOPPING

Introduction

3.4.1 Earlier sections of this document describe the provision of barriers to fire, and the circumstances in which there may be openings in them. This section deals with the protection of openings in such barriers.

If an element that is intended to provide fire separation (i.e. it has requirements for fire resistance in terms of integrity and insulation) is to be effective, then every joint, or imperfection of fit, or opening to allow services to pass through the element, should be adequately protected by sealing or fire-stopping so that the fire resistance of the element is not impaired. Building service installations should be designed in accordance with BS 8313: 1989 (section 12).

Provisions for door openings and fire doors are given in Appendix B because they are relevant to B1 and B5, as well as B3.

The measures are intended to delay the passage of fire. They generally have the additional benefit of retarding smoke spread but the test specified in Appendix A for integrity does not stipulate criteria for the passage of smoke as such.

Openings for pipes

3.4.2 Pipes which pass through a compartment wall or compartment floor (unless the pipe is in a protected shaft), or cavity barrier, should meet the appropriate provisions in alternatives A, B or C below.

Alternative A: Proprietary seals (any pipe diameter)
Provide a proprietary sealing system which has been shown by test to maintain the fire resistance of the wall, floor or cavity barrier.

Alternative B: Pipes with a restricted diameter
Where a proprietary sealing system is not used, fire-stopping may be used around the pipe, keeping the opening as small as possible. The nominal internal diameter of the pipe should not be more than the relevant dimension given in Table 3.4.

The diameters given in Table 3.4 for pipes of specification (b) used in situation (2) assume that the pipes are part of an above ground drainage system and are enclosed as shown in Diagram B3.12. If they are not, the smaller diameter given in situation (3) should be used instead.

Alternative C: Sleeving
A pipe of lead, aluminium, aluminium alloy, asbestos-cement or uPVC, with a maximum nominal internal diameter of 160 mm, may be used with a sleeving of non-combustible pipe as shown in Diagram B3.13. The specification for non-combustible and uPVC pipes is given in the notes to Table 3.4.

Ventilating ducts

3.4.3 Ventilation and air conditioning ducts which pass from one compartment to another should be protected in accordance with BS 5588: Part 9.

Flues, etc

3.4.4 If a flue, or duct containing flues or appliance ventilation duct(s), passes through a compartment wall or compartment floor, or is built into a compartment wall, the walls of the flue or duct should have a fire resistance of at least half that of the wall or floor in order to prevent the by-passing of the compartmentation (see Diagrams B3.14 and B3.15).

Fire-stopping

3.4.5 In addition to any other provisions in this document for fire-stopping:

(a) joints between elements which serve as a barrier to the passage of fire should be fire-stopped; and

(b) all openings for pipes, ducts, conduits or cables to pass through any part of an element which serves as a barrier to the passage of fire should be -

Table 3.4 Maximum nominal internal diameter of pipes			
Situation	Pipe material and maximum nominal internal diameter (mm)		
	(a)	(b)	(c)
	Non-combustible material [1]	Lead, aluminium or aluminium alloy, asbestos-cement or upvc [2]	
1. Structure (but not a separating wall) enclosing a protected shaft which is not a stairway or lift shaft	160	110	40
2. Separating wall between houses [4], or compartment wall or compartment floor between flats	160	160 (stack pipe) [3] 110 (branch pipe [3]	40
3. Any other situation	160	40	40

Notes:

1. A non-combustible material (such as cast iron or steel) which, if exposed to a temperature of 800°C will neither soften nor fracture to the extent that flame or hot gases will pass through the wall of the pipe.
2. uPVC pipes complying with BS 4514: 1983, and uPVC pipes complying with BS 5255: 1989.
3. Pipes forming part of an above ground drainage system and enclosed as shown in Diagram B3.12.
4. See 3.2.5 for situations where no pipes, wires or other services are allowed in separating walls between houses.

(i) kept as few in number as possible, and
(ii) kept as small as practicable, and
(iii) fire-stopped (which in the case of a pipe or ducts, should allow thermal movement).

To prevent displacement, materials used for fire-stopping should be reinforced with (or supported by) materials of limited combustibility in the following circumstances:

(a) in all cases where the unsupported span is greater than 100 mm, and

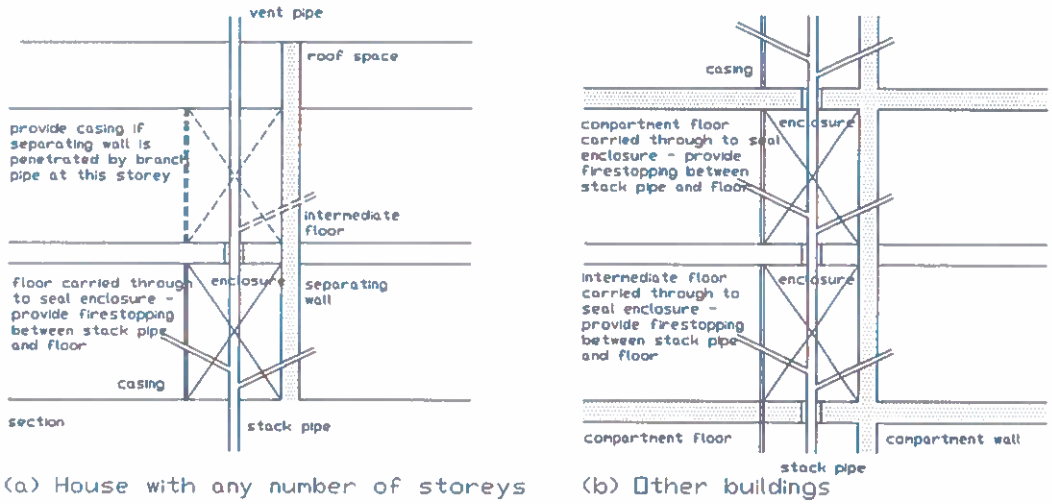
(b) in any other case where non-rigid materials are used (unless they have been shown to be satisfactory by test).

Proprietary sealing systems (including those designed for service penetrations) which have been shown by test to maintain the fire resistance of the wall or other element are available.

Other suitable fire-stopping materials are:

* cement mortar,
* gypsum based plaster,
* cement or gypsum based vermiculite/perlite mixes,
* glass, crushed rock, blast furnace slag or ceramic based products (with or without resin binders), and
* intumescent mastics.

Diagram B3.12 Enclosures for drainage or water supply pipes



(a) House with any number of storeys (b) Other buildings

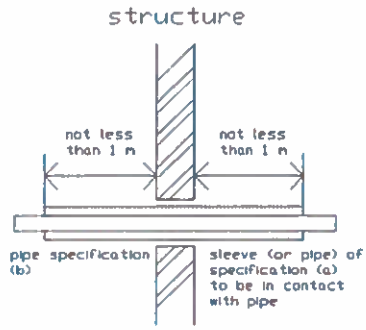
Notes

1 The enclosure should :
- (a) be bounded by a separating wall, a compartment wall or floor, an outside wall, an intermediate floor, or a casing (see specification at 2 below) and,
- (b) have internal surfaces (except framing members) of Class 0 and
- (c) not have an access panel which opens into a circulation space or a bedroom, and
- (d) be used only for drainage, water supply or vent pipes

2 The casing should :
- (a) be imperforate except for an opening for a pipe or an access panel, and
- (b) not be of sheet metal, and
- (c) have (including an access panel) not less than 30 minute fire resistance.

3 The opening for a pipe,either in the structure or the casing should be as small as possible and firestopped around the pipe.

Diagram B3.13 Pipes penetrating a structure (alternative method 'C')

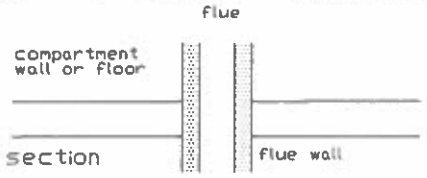


Notes

1 Make the opening in the structure as small as possible and provide firestopping between pipe and structure

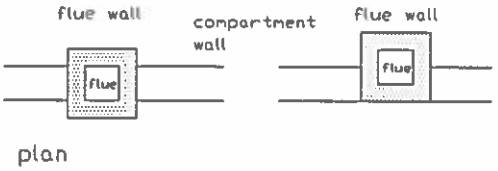
2 See Table 3.4 for materials specification.

DIAGRAM B3.14 Flue passing through a compartment wall or floor



Flue walls should have a fire-resistance at least one half of that required for the compartment wall or floor and be of non-combustible construction.

DIAGRAM B3.15 Flue built into compartment wall



In each case the flue walls should have a fire-resistance at least one half of that required for the compartment wall and be of non-combustible construction.

3.5. SPECIAL PROVISIONS

Introduction

3.5.1 This section describes additional considerations which apply to the design and construction of car parks and shopping complexes.

Car parks

3.5.2 Buildings or parts of buildings used as parking for cars and other light vehicles are unlike other buildings in certain respects, and merit some departures from the usual provisions for the restriction of fire spread within buildings because:

* the fire load is well defined; and
* there is evidence that fire spread is not likely to occur between one vehicle and another, in well-ventilated above ground parking, and there is a correspondingly low probability of fire spread from one storey to another. Ventilation is all important in car parks, and as heat and smoke cannot be dissipated so readily from a car park that is not open-sided fewer concessions are made.

Provisions common to all car park buildings

3.5.2.1 All materials used in the construction of the building, compartment or separated part should be non-combustible, except for:

(a) any surface finish applied -

(i) to a floor or roof of the car park, or

(ii) within any adjoining building, compartment or separated part to the structure enclosing the car park,

if the finish meets any relevant provisions in B2 and B4;

(b) any fire door; and

(c) any attendant's kiosk not exceeding 15 sq.m in area.

Open sided car parks

3.5.2.2 If the building, or separated part containing the car park, complies with the following provisions (in addition to those in paragraph 3.5.2.1) it may be regarded as an opensided car park for the purposes of fire resistance assessment in Appendix A, Table A2, and for the purposes of space separation in B4, Table 4.3, it may be regarded as a small building or compartment.

(a) There should not be any basement storeys.

(b) Each storey should be naturally ventilated by permanent openings at each level having an aggregate area not less than 5% of the floor area at that level, of which at least half should be in two opposing walls.

(c) If the building is also used for any other purpose, the part forming the car park is a separated part.

Car parks which are not open sided

3.5.2.3 Where it is not possible to provide the degree of natural ventilation set out in paragraph 3.5.2.2 above, then a lesser standard of natural ventilation can be accepted. Alternatively, ventilation should be provided by mechanical means. Provisions are set out in paragraph 3.5.2.4 and 3.5.2.5 below. The provisions in paragraph 3.5.2.1 above apply in all cases.

Natural ventilation

3.5.2.4 Each storey should be naturally ventilated by permanent openings at each level having an aggregate area not less than 2.5% of the floor area at that level, of which at least half should be in two opposing walls.

Smoke vents at ceiling level may be used as an alternative to the provision of permanent openings in the walls. They should have an aggregate area of permanent opening totalling not less than 2.5% of the floor area and be arranged to provide a through draught.

Mechanical ventilation

3.5.2.5 In some basement car parks, and enclosed car parks, it may not be possible to obtain the minimum standard of natural ventilation openings set out in paragraph 3.5.2.4 above. In such cases a system of mechanical ventilation should be provided as follows:

(a) the system should be independent of any other ventilating system and be designed to operate at 6 air changes per hour for normal petrol vapour extraction, and at 10 air changes per hour in a fire condition;

(b) the system should be designed to run in two parts, each part capable of extracting 50% of the rates set out in (a) above, and designed so that each part may operate singly or simultaneously;

(c) part of the system should have an independent power supply which would operate in the event of failure of the main supply;

(d) outlets for exhaust air should be arranged so that 50% of the outlets are at high level, and 50% at low level; and

(e) the fans should be rated to run at 300°C for a minimum of 60 mins, and the ductwork and fixings should be constructed of materials having a melting point not less than 800°C.

Shopping complexes

3.5.3 Whilst the provisions in this document about shops should generally be capable of application in cases where a shop is contained in a single separate building, complications may arise where a shop forms part of a complex or comprehensive development. These may include covered malls providing access to a number of shops and common servicing areas. In particular, the provisions about maximum compartment size may be difficult to meet bearing in mind that it would generally not be practical to compartment a shop from a mall serving it. To a lesser extent the provisions about fire resistance, separating walls, surfaces and boundary distances may pose problems.

To ensure a satisfactory standard of fire safety in shopping complexes, alternative measures and additional compensatory features to those set out in this document would be appropriate. These include:

(a) unified management of the complex;

(b) adequate means of escape and smoke control provisions;

(c) sprinkler protection of all shop units, storage and service areas, and any parts of malls used for a purpose that might introduce a fire load into the mall;

(d) a fire detection and alarm system incorporating automatic fire detection in non-public areas;

(e) access for fire fighting purposes;

(f) construction consisting generally of materials of limited combustibility except for limited decorative features and limited amounts of materials in shop fascias having a lesser standard of surface spread of flame characteristics than those for walls in circulation areas;

(g) walls and floors between shop units constructed as compartment walls and compartment floors;

(h) floors in any shop unit exceeding 2000 sq.m plan area of largest floor constructed as compartment floors;

(i) floors in any shop unit opening onto a mall at more than one level constructed as compartment floors; and

(j) compartmentation also provided between a large shop unit (over 3700 sq.m) and a mall, or between opposing large shop units (each over 2000 sq.m) and a mall. This compartmentation could be provided by fire shutters. (Smaller shop units would normally not be compartmented from a mall).

The above items are not exhaustive but draw attention to the need to consider proposals for shopping complexes as a comprehensive fire safety package. Guidance on these matters is set out in 'Fire Prevention Guide No. 1 Fire precautions in town centre redevelopment', (being revised as BS 5588: Part 10.)

Guidance on smoke control methods in enclosed shopping complexes is given in a 1990 BRE Report - 'Design principles for smoke ventilation in enclosed shopping centres'.

Section 4

EXTERNAL FIRE SPREAD

External fire spread.	**B4**	**The external walls and roof of a building shall be so designed and constructed that they afford adequate resistance to the spread of fire to and from neighbouring buildings.**

PERFORMANCE

The requirements of B4 may 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 spread of flame, and in some cases 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, and

(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.

Contents

4.0 INTRODUCTION TO PROVISIONS

4.0.1 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:

* the size and intensity of the fire in the building concerned
* the risk it presents to people in the other building(s)
* the distance between the buildings, and
* the fire protection given by their facing sides

Provisions are made in Section 4.1 for the fire resistance of external walls, and to limit the susceptibility of the external surface of walls to ignition and to fire spread.

Provisions are made in Section 4.2 to limit the extent of openings and other unprotected areas in external walls in order to reduce the risk of fire spread by radiation.

Provisions are made in Section 4.3 for reducing the risk of fire spread between and over roofs.

DEFINITIONS

4.0.2 The following definitions apply specifically to B4. Other terms applicable more widely throughout this document are given in Appendix D.

Boundary - The boundary of the land belonging to the building, or where the land abuts a road, railway, canal or river, the centreline of that road, railway, canal or river (see Diagram B4.1).

Class O - See Appendix A, paragraph A.10.

Conservatory - A single storey part of a building where the roof and walls are substantially glazed with a transparent or translucent material.

External wall - (or side of a building) includes a part of a roof pitched at an angle of 70 °or more to the horizontal - if that part of the roof adjoins a space within the building to which persons have access (but not access only for repair or maintenance).

Notional boundary - A boundary presumed to exist between buildings on the same site (see Diagram B4.2).

Relevant boundary - The boundary which the side of the building faces (see Diagram B4.1). A notional boundary can be a relevant boundary.

Rooflight - Any domelight, lantern light, skylight or other element intended to admit daylight through a roof.

Thermo-plastic material - See Appendix A, paragraph A14.

Unprotected area - In relation to a side or external wall of a building means:

(a) a window, door or other opening, and

(b) any part of the external wall which has less than the relevant fire resistance set out in Section 4.1, and

(c) any part of the external wall which has combustible material more than 1 mm thick attached or applied to its external face, whether for cladding or any other purpose. (Combustible material in this context is any material that is not included in Tables A7 or A8 in Appendix A).

4.1 CONSTRUCTION OF EXTERNAL WALLS

Introduction

4.1.1 Under B3, provisions are made in Section 3.1 for internal and external loadbearing walls to maintain their loadbearing function in the event of fire.

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 4.2 which sets out limits on the amount of wall area that need not be fire-resisting (termed unprotected area). 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 be permitted to have no fire resistance except for any parts which are loadbearing.

External walls are elements of structure and the relevant period of fire resistance (which is specified in Appendix A) depends on the use, height and size of the building concerned, and whether the wall is within 1 m of the relevant boundary.

Provisions are also made to restrict the amount of combustible surfaces on buildings that are very close (less than 1 m) to the relevant boundary and/or on high buildings. This is in order to reduce the susceptibility of ignition of the surface from an external source, and to reduce the possibility of fire spread up the external face of the building.

Fire resistance standard

4.1.2 The external walls of the building should have the appropriate fire resistance given in Appendix A, Table A1, unless they are permitted to form an unprotected area under Section 4.2.

Portal frames

4.1.3 Portal frames are often used in single storey industrial and commercial buildings where there may be no provisions under B3 for fire resistance of the structure. Where, however, the building is near a relevant boundary, then the provisions in paragraph 4.1.2 require the external wall to be fire-resisting.

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

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

Normally, portal frames of reinforced concrete can support external walls requiring the same degree of fire resistance without specific provision at the base to resist overturning.

External surfaces

4.1.4 The external surfaces of walls should meet the provisions in Table 4.1. However, the total amount of combustible material may be limited in practice by the provisions for space separation in Section 4.2. (See paragraph 4.2.6).

Table 4.1 Provisions for external surface of walls		
Maximum height of building (m)	**Distance from any point on the relevant boundary***	
	Less than 1m	1m or more
20	Class 0	No provision (unless it is a building described in Note) (1)
30	Class 0	Class 0 (2)
over 30	Non-combustible (3)	Non-combustible (2)(4)

Notes:

* The relevant boundary might be a notional boundary.

(1) Any part of the wall of a building comprising flats or maisonettes, or a building in the institutional, other residential, assembly and recreation purpose groups, which is 10m or less above the ground or above a roof or any other part of the building to which people have access, should have an index of performance (I) not more than 20. (Timber cladding at least 9mm thick is also acceptable).

(2) Surfaces not more than 20m above the ground may comprise any material with an index of performance (I) not more than 20. (Timber cladding at least 9mm thick is also acceptable).

(3) Surfaces not more than 30m above the ground may be Class 0.

(4) Surfaces between 20m and 30m above the ground may be Class 0.

Index of performance (I) relates to performance under BS 476: Part 6, (see Appendix A).

4.2. SPACE SEPARATION

Introduction

4.2.1 The provisions in this section limit the extent of openings and other unprotected areas in the sides of the building (including areas with a combustible surface) which will not give adequate protection against the spread of fire.

The provisions assume:

(a) that the size of the fire will depend on the compartmentation of the building, so that the fire will involve a complete compartment, but will not spread across lines of compartmentation;

(b) that the intensity of the fire is related to the use of the building (i.e. purpose group), but that it can be moderated by a sprinkler system;

(c) that residential and assembly and recreation purpose groups represent a greater life risk than other uses;

(d) that the building on the adjoining site has an identical elevation to the one in question, and is at the same distance from the common boundary; and

(e) that no significant radiation will pass through any parts of the external wall that have fire resistance.

It may sometimes be advantageous to construct compartments of a smaller size than indicated by B3, or to provide compartments where none would otherwise be necessary, in order to reduce the separation distance (or to increase the amount of unprotected area in the wall without increasing the separation distance).

Boundaries

4.2.2 The use of the distance to a boundary rather than to another building in measuring the separation distance makes it possible to calculate the allowable proportion of unprotected areas, even where another building does not exist but may do.

A wall should be treated as facing a boundary if it makes an angle with it of 80° or less (see Diagram B4.1).

Usually only the distance to the boundary of the site needs to be considered. The meaning of the term boundary is explained in Diagram B4.1.

Notional boundaries

4.2.3 In some circumstances the distances to other buildings on the same site needs to be considered. This should be done by assuming a boundary called a notional boundary between those buildings.

Relevant boundaries

4.2.4 The boundary which a wall faces whether it is the boundary of the site or a notional boundary is called the relevant boundary. (See Diagram B4.1 and B4.2).

Unprotected areas and fire resistance

4.2.5 Any part of an external wall which has fire resistance in accordance with Section 4.1 is not considered an unprotected area.

Status of combustible surfaces as unprotected area

4.2.6 Besides the restrictions on combustible surfaces in Section 4.1, their extent may also be limited by the result of the calculation of unprotected area if they are more than 1 mm in thickness.

(a) If the combustible material is used as a surface on a wall that has the necessary fire resistance, then half of the area of combustible material should be counted as unprotected area.

(b) If the combustible material is used as a surface on a wall that does not have the necessary fire resistance, then the whole of the area of combustible material is counted as unprotected area.

External walls within 1 m of the relevant boundary

4.2.7 A wall situated within 1 m from any point on the relevant boundary will meet the provisions for space separation if:

(a) the only unprotected areas are those shown in Diagram B4.3, and

(b) the rest of the wall is fire-resisting.

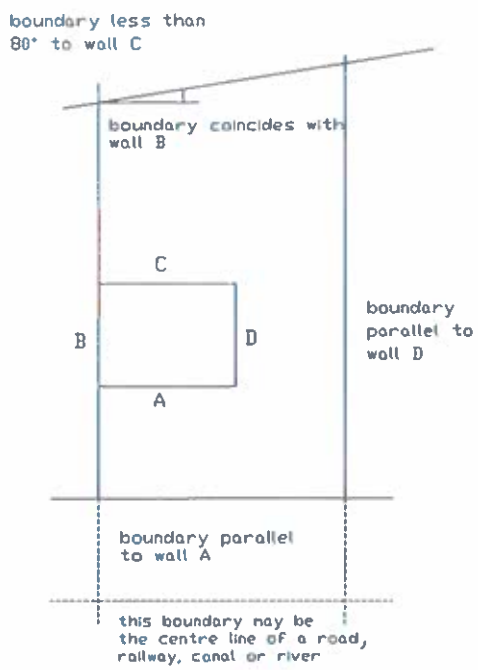
External walls 1 m or more from the relevant boundary

4.2.8 A wall situated at least 1 m from any point on the relevant boundary will meet the provisions for space separation if:

(a) the extent of unprotected area does not exceed that given by one of the calculation methods referred to in paragraph 4.2.9, and

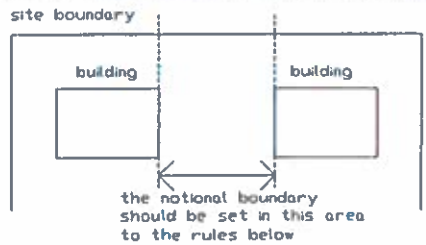
(b) the rest of the wall (if any) is fire-resisting.

Diagram B4.1 Relevant boundary



For a boundary to be relevant it should
(A) coincide with or
(B) be parallel to or
(C) be at an angle of not more than 80° to the external wall .

Diagram B4.2 Notional boundary



Rules

1 these rules only apply when two or more buildings are on the same site and when one of the buildings (new or existing) is of residential or assembly use.

2 a notional boundary should be set between a building of a use given in Rule 1 and another building of any use.

3 an existing building should be taken as if it was a a new building of the same use but having the existing unprotected area and fire-resistance on the outside wall facing the notional boundary.

4 the notional boundary should be so situated that all buildings comply with the safe distance requirement.

5 when set the notional boundary becomes the relevant boundary.

Methods for calculating acceptable unprotected area

4.2.9 Two methods are given in this Document for calculating the acceptable amount of unprotected area in an external wall that is at least 1 m from any point on the relevant boundary. (For walls within 1 m of the boundary see 4.2.7 above).

Method 1 is only suitable for small residential buildings which do not belong to purpose group 2a (institutional premises).

Method 2 may be used for buildings or compartments for which Method 1 is not appropriate.

Other methods are described in the BRE Report 'Building separation and boundary distances'.

Basis for calculating acceptable unprotected area

4.2.10 The basis of methods 1 and 2 is set out in Fire Research Technical Paper No. 5 (1963). This has been reprinted as part of the BRE Report referred to above. The aim is to ensure that the building is separated from the boundary by at least half the distance at which the total thermal radiation intensity emitted from all unprotected areas in the wall would be 1.6 kW/m² (in still air) assuming the radiation intensity at each unprotected area is:

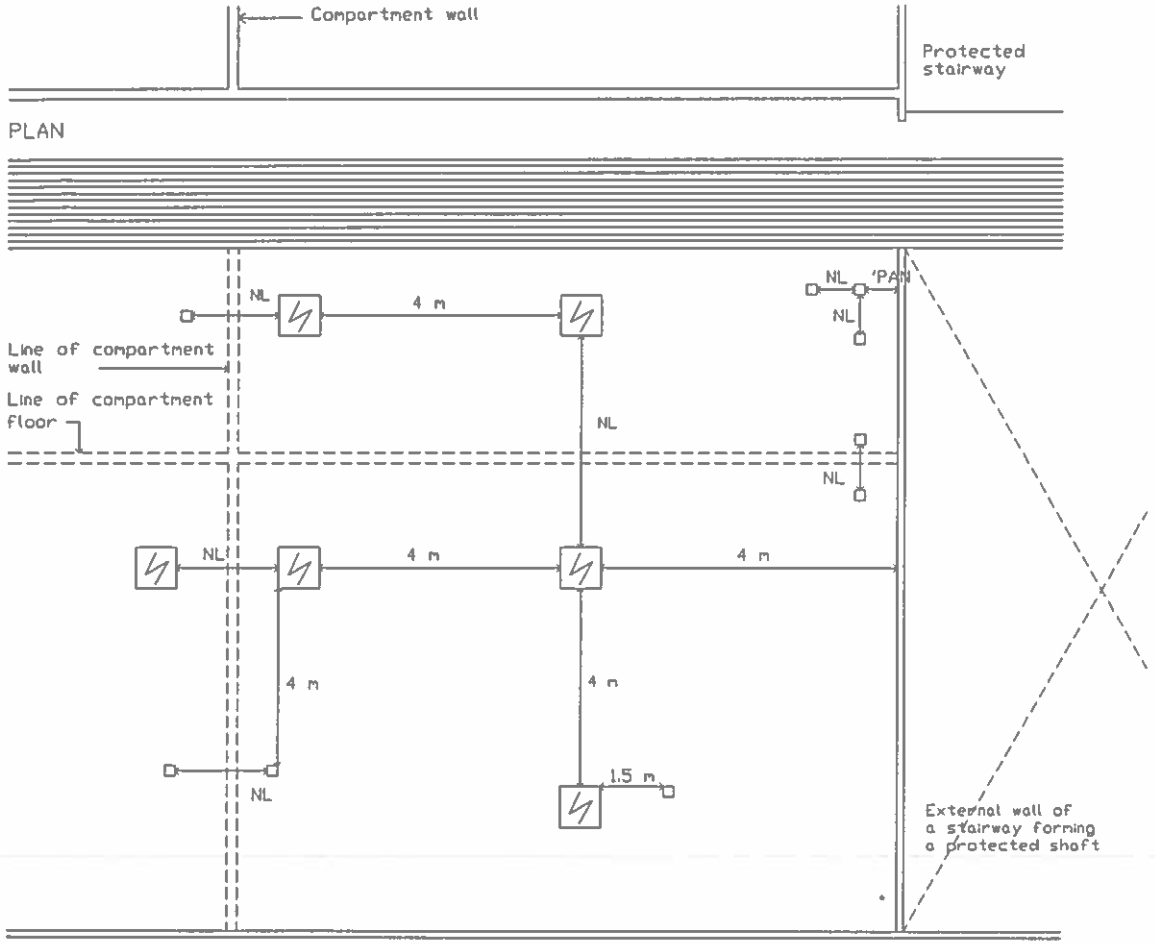
(a) 84 kW/m², if the building is in the residential, office or assembly or Recreation purpose groups, and

(b) 168 kW/m², if the building is in the shop, commercial, industrial, storage or other non-residential purpose groups.

Sprinkler systems

4.2.11 It may be assumed that the intensity of radiation from a fire in a compartment which is fitted throughout with a sprinkler system will be half the values given in 4.2.10(a) and (b). The sprinkler system should meet the relevant recommendations of BS 5306 : Part 2 : 1990, i.e. the relevant occupancy rating together with the additional requirements for life safety.

Diagram B4.3 Unprotected areas which may be disregarded



Dimensions shown are minimum separation distances between unprotected areas of limited size if those areas to be disregarded for space separation purposes.

KEY

□ Unprotected area of 0.1 m^2 maximum

Unprotected area of 1 m^2 maximum ; or group of unprotected areas with a total area of 1 m^2 maximum

NL Means no limit

The countable unprotected area is not to include an area falling within the following rules -

(1) In the outside wall of a stairway forming a protected shaft : the whole area.
(2) In the outside wall of a building not compartmented : any unprotected area which is 30 m or more above the mean ground level.
(3) An area meeting the requirements in this diagram.

Enclosing rectangle and aggregate notional area methods

4.2.12 Part II of the BRE Report 'Building separation and boundary distances' covers the Enclosing Rectangle' and 'Aggregate Notional Area' methods, which may also be used to calculate permitted unprotected areas.

Methods for calculating space separation

Method 1 - Small Residential

4.2.13 This method applies only to a building intended to be used as a dwelling house, or for flats or other residential purposes (not Institutional), which is not less than 1 m from any point on the relevant boundary.

The following rules for determining the maximum permitted unprotected area should be read with Diagram B4.4 and Table 4.2:

1. The building should not exceed 3 storeys in height (basements not counted) or be more than 24 m in length.
2. Each side of the building will meet the provisions for space separation if:

   (a) the distance of the side of the building from the relevant boundary, and

   (b) the length of the side of the building, and

   (c) the extent of unprotected area,

   are within the limits given in Table 2.

Note:
In calculating the maximum permitted unprotected area, any areas shown in Diagram B4.3 can be disregarded.

3. Any parts of the side of the building in excess of the maximum permitted unprotected area should be fire-resisting.

Diagram B4.4 Small residential building

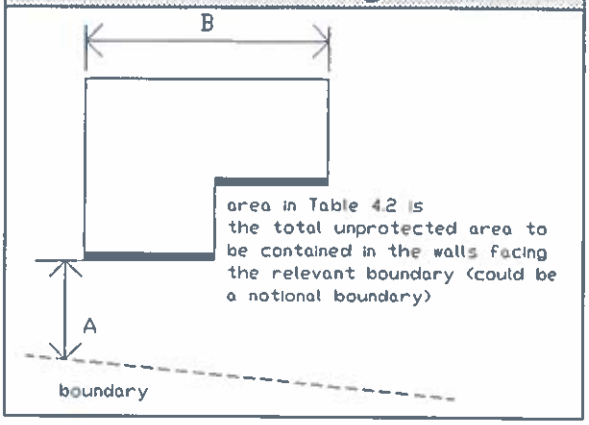


Table 4.2 Permitted unprotected areas in small residential buildings

Minimum distance (A) between side of building and relevant boundary (m)	Maximum length of side (B) (m)	Maximum total area of unprotected areas (m^2)
1.0	24	5.6
2.5	24	15.0
5.0	24	no limit
6.0	24	no limit

Method 2 - Other Buildings or Compartments

4.2.14 This method applies to a building or compartment intended for any use and not less than 1 m from any point on the relevant boundary. The following rules for determining the maximum permitted unprotected area should be read with Table 4.3.

1. Except for open sided car parks in Purpose Group 7(b), the building or compartment should not exceed 10 m in height.

Note:
For any building or compartment more than 10 m in height, the methods set out in the BRE Report 'Building separation and boundary distances' can be applied.

2. Each side of the building will meet the provisions for space separation if:

   (a) the distance of the side of the building from the relevant boundary, and

   (b) the extent of unprotected area,

   are within the limits of unprotected area.

Note:
In calculating the maximum permitted unprotected area, any areas shown in Diagram B4.3 can be disregarded.

3. Any parts of the side of the building in excess of the maximum permitted unprotected area should be fire-resisting.

Table 4.3 Permitted unprotected areas in small buildings or compartments

Minimum distance between side of building and relevant boundary (m)		Maxmum total per cent of unprotected areas (%)
Purpose Groups		
Residential, Office, Assembly and Recreation	Shop & Commercial Industrial, Storage & other Non-residential	
0	0	0
2.5	5	20
5.0	10	40
7.5	15	60
10.0	20	80
12.5	25	100

Notes

* Intermediate values may be obtained by interpolation.

* For buildings which are fitted throughout with an automatic sprinkler system meeting the relevant recommendations of BS 5306: Part 2 : 1990, the values in columns (1) and (2) may be halved.

* In the case of open sided car parks in Purpose Group 7(b) the distances set out in column (1) may be used instead of those in column (2).

4.3. ROOF COVERINGS

Introduction

4.3.1 The provisions in this section limit the proximity to the boundary of those types of roof covering which will not give adequate protection against the spread of fire.

Other controls on roofs

4.3.2 There are provisions concerning the fire properties of roofs elsewhere. In B3, there are provisions in Section 3.2 for roofs that pass over the top of a compartment wall or separating wall. In B2, there are provisions for the internal surfaces of rooflights as part of the internal lining of a room or circulation space.

Classification of performance

4.3.3 The performance of roof coverings is designated by reference to the test methods specified in BS 476: Part 3: 1958, as described in Appendix A. The notional performance of some common roof coverings is given in Table A5 of Appendix A.

Rooflights are controlled on a similar basis, although there is a different method of classification for plastic rooflights.

Separation distances

4.3.4 The separation distance is the minimum distance from the roof (or part of the roof) in question to the nearest boundary, which may be a notional boundary.

Table 4.4 sets out separation distances according to the type of roof covering and the size and use of the building. However, there are no restrictions on the use of roof coverings designated AA, AB or AC.

Plastic rooflights

4.3.5 Table 4.5 sets out the limitations on the use of plastic rooflights which do not meet the basic provisions described in Table 4.4.

Glass in rooflights

4.3.6 When used in rooflights, unwired glass at least 4 mm thick can be regarded as having an AA designation. Thinner glass should only be used where the separation distance is 6 m or more, unless the glass is over one of the following:

(a) a balcony, verandah, open carport, covered way, loading bay or detached swimming pool; or

(b) a garage, conservatory or outbuilding, with a maximum floor area of 40 m^2.

Table 4.4 Limitations on roof coverings*

Designation or covering of roof, or part of roof	Minimum distance from any point on relevant boundary			
	Less than 6m	At least 6m	At least 12m	At least 20m
AA, AB or AC	✓	✓	✓	✓
BA, BB or BC	x	✓	✓	✓
CA, CB or CC	x	x (1)	x (2)	✓
AD, BD or CD	x	x (2)	x (2)	x (2)
DA, DB, DC or DD	x	x	x	x (1)
thatch or wood shingles	x	x (1)	x (2)	x (2)

* See paragraph 4.3.6 for limitations on glass, and Table 4.5 for limitations on plastic rooflights

Key:

✓ - Acceptable

x - Not acceptable

x(1) - Not acceptable on any building listed below, and only acceptable on other buildings if the part of the roof is no more than 3 sq. m area and is at least 1.5 m from any similar part, with the roof between the parts covered with a material of limited combustibility

x(2) - Not acceptable on any of the following buildings:

(a) houses in terraces of three or more houses;

(b) industrial, storage or other non-residential purpose group buildings of any size; and

(c) any other buildings with a cubic capacity of more than 1500 m^3.

Table 4.5 Limitations on plastic rooflights

Minimum classification on lower side*	Space which rooflight serves	Minimum distance from any point on relevant boundary for rooflight with an external surface of -		
		TP(a), or TP (b)	AD, BD, CA, CB CC, CD or TP(c)	DA, DB DC or DD
1. TP(a)	any space	6m (1)	-	-
2. TP(b)	any space (except a protected stairway)	6m (1)	-	-
3. Class 3 or TP(c)	a) balcony, verandah, carport, covered way or loading bay, which has at least one longer side wholly or permanently open. b) detached swimming pool	-	6m	20m
	c) garage, conservatory or outbuilding, with a maximum floor area of 40 sq.m	-	6m	20m
	d) circulation space (2) (except a protected stairway) e) room in a residential, office shop & Commercial, assembly, or recreation purpose group (2)	-	6m (2)	20m (2)
	f) room in an industrial, Storage or Other non-residential purpose group (2)	-	6m (2)	20m (2)

Notes to Table 4.5:

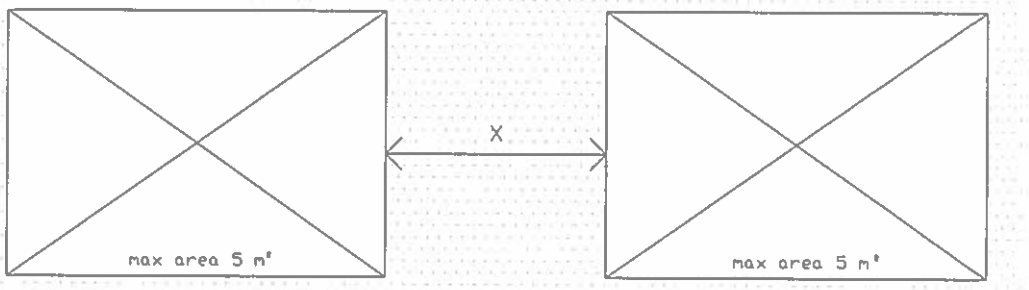
* As required under B2.

(1) No limit in the case of any space described in column (2), items 3(a) (b) and (c).

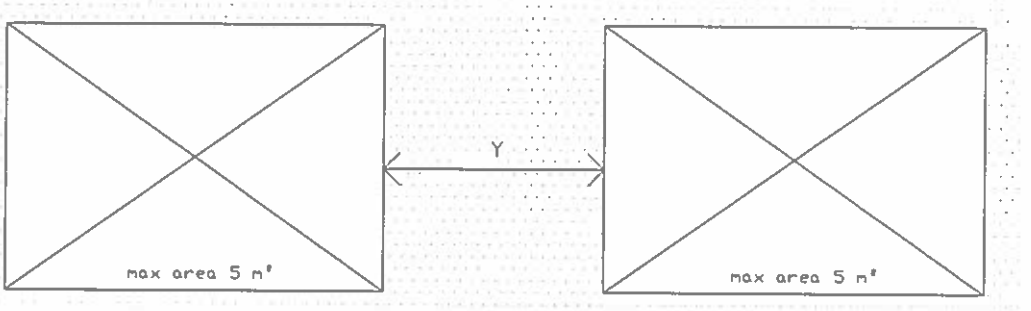
(2) Single skin only in the case of non-thermoplastic materials.

(3) The rooflight should also meet the provisions in Diagram B4.5.

Diagram B4.5 Limitations on plastic rooflights having a class 3 or TP(c) lower surface

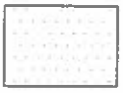


room in a building or compartment of purpose group 1,2,3,4 or 5 or a circulation space in a building or compartment in any purpose group.



Room in a building or compartment of purpose group 6 or 7 -Total area of panels not to exceed 20% of room area and to be evenly distributed over the whole area of the room.

rooflight



roof covering a material of limited combustiblity

X 3 m minimum between any two panels in any direction.

Y 18 m minimum between any two panels in any direction.

Section 5

ACCESS AND FACILITIES FOR THE FIRE SERVICE

Access and facilities for the fire service.	**B5**	**A building shall be so designed and constructed that there is adequate provision for access for fire appliances and for such other facilities as may be reasonably required to assist the fire service in the protection of life and property.**

PERFORMANCE

The requirement of B5 may be met:

(a) if there is sufficient means of external access to enable fire appliances to be brought near to the building for effective use;

(b) if there is sufficient means of access into, and within, the building for fire-fighting personnel to effect rescue and fight fire; and

(c) if the building is provided with sufficient fire mains and other facilities to assist fire fighters in their tasks;

all to an extent dependent on the use and size of the building.

Contents

5.0 INTRODUCTION TO PROVISIONS

Scope

5.0.1 Guidance is given on the selection and design of facilities for the purpose of protecting life and mitigating property damage due to fire by assisting the fire service.

To assist the fire service some or all of the following facilities may be necessary, depending mainly on the size of the building:

* vehicle access for fire appliances
* access for fire fighting personnel
* the provision of fire mains about and within the building

Factors determining facilities appropriate to a specific building

5.0.2 The main factor determining the facilities needed to assist the fire service is the size of the building.

The facilities provided also depend on the expected method of fire fighting; whether this will be from outside or inside the building:

(a) Generally speaking fire fighting is carried out within the building. In deep basements and tall buildings fire fighters will invariably work inside. They need special access facilities (see Section 5.3), equipped with fire mains, as described in Section 5.1. Fire appliances need access to entry points near the fire mains, as described in Section 5.2.

(b) In other buildings the combination of personnel access facilities offered by the normal means of escape, and the ability to work from ladders and appliances on the perimeter, is sufficient without special internal arrangements. Depending on the size of the building, vehicle access may be needed to some or all of the perimeter, as explained in Section 5.2.

DEFINITIONS

5.0.3 The following definitions apply specifically to B5. Other terms applicable more widely throughout this document are given in Appendix D.

Fire-fighter lift - A lift designed to have additional protection, with controls that enable it to be used under the direct control of the fire brigade in fighting a fire.

Fire-fighter lobby - A protected lobby for providing access from a fire-fighter stairway to the accommodation area and to any associated fire-fighter lift.

Fire-fighter shaft - a protected shaft containing a fire-fighter stairway, fire-fighter lobbies and, if provided, a fire-fighter lift.

Fire-fighter stairway - A protected stairway communicating with the accommodation area only through a fire-fighter lobby.

Perimeter (of building) - see Diagram B5.2.

5.1. FIRE MAINS

Introduction

5.1.1 Fire mains are pipes installed in and around a building and equipped so that the fire service may connect hoses to receive a supply of water for fire fighting. Fire mains are divided into two types, internal fire mains covered in Section 5.1.2 and external fire mains and hydrants covered in Section 5.1.6. Internal rising fire mains serve floors above ground or access level and falling mains serve levels below ground or access level. Internal fire mains may be of the "dry" type which are normally empty and are supplied through hose from a fire service pumping appliance, or they may be of the "wet" type kept full of water and supplied from tanks and pumps in the building.

Provision of internal fire mains

5.1.2 (a) Storeys above ground level, in buildings with a floor at more than 20 m above ground level, should be equipped with wet or dry rising fire mains.

(b) Basements in buildings with a basement at more than 10 m below ground level should be equipped with wet or dry fire mains.

(c) Storeys above ground level, in buildings with any floor at more than 60 m above ground level, should be equipped with wet rising fire mains.

Number and location of internal fire mains

5.1.3 Where internal fire mains are installed, they should be positioned so that at each level other than ground level there is one main for every fire-fighter shaft provided to meet the provisions in paragraph 5.3.3.

If there are no fire-fighter shafts but it is decided that internal fire mains are to be installed, the criteria in paragraph 5.3.3 for the number and location of fire-fighter shafts may be used to determine the provision of internal fire mains, even though the building may not have a storey at more than 20 m above ground level.

5.1.4 The outlets from internal fire mains should be sited in:

(a) a fire-fighter shaft (see Section 5.3), or
(b) a protected stairway, or
(c) a balcony or walkway in the open air.

Design and construction of internal fire mains

5.1.5 The design and construction of internal fire mains should be in a accordance with the relevant sections of BS 5306: Part 1: 1988 (excluding clause 6).

External fire mains and hydrants

5.1.6 Most urban areas are supplied with water through water mains. Where such mains are provided it is normal to find hydrants (outlets) provided for the fire brigade to obtain a ready supply of water for fire fighting. The siting of these hydrants is important both from the point of view of accessibility for fire brigade use and proximity to buildings so that fire fighting can be quick and effective.

The following buildings should be provided with one or more external fire hydrants:

- every building provided with an internal fire main, wet or dry,

- every building having a floor area on any storey of more than 1000m².

The fire hydrants should be located as shown in Figure B5.1 and such that:

- the distance from the building is not more than 46 m;

- they are on the land in the same occupancy as the building; and

- no part of the perimeter of the building is more than 60 m from a hydrant as measured along a route suitable for laying hose.

At least one hydrant should be provided for every 930 m² of the area covered by the building at ground level. All hydrants should be conspicuously marked in accordance with BS 3251: 1976.

These requirements can also be satisfied by a hydrant provided by a Sanitary Authority which meets the requirements above. A hydrant situated inside a building is also acceptable provided it is:

- in a separate fire compartment i.e. separated from the rest of the building by compartment walls;

- not more than 4.5m, and visible, from an entrance to the building; and

- indicated by a suitable notice at the entrance

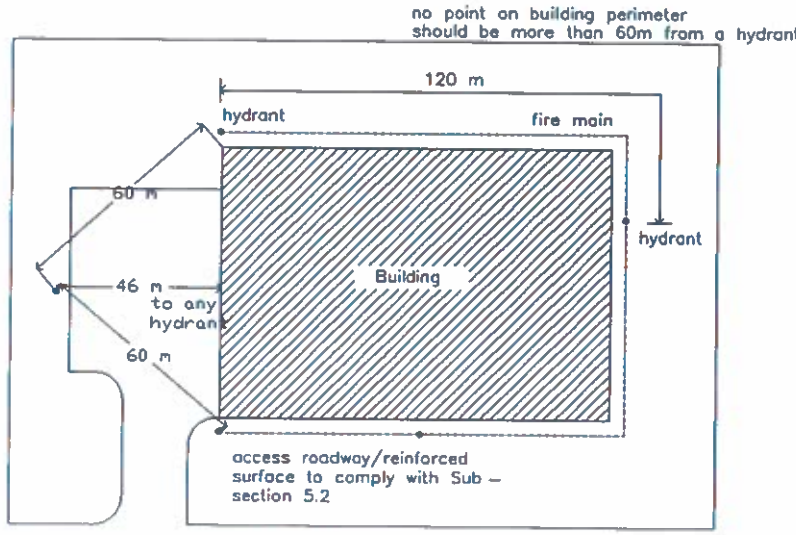
Diagram B5.1 External fire mains and hydrants

Hydrants should be

(a) within 46 m of the building
(b) within land in the same occupation as the building
(c) provided at the rate of one per 930 m² of ground floor area and
(d) clearly marked

Hydrants may be

(a) connected to a local authority water main
(b) within a building if
(i) separated from the rest of the building by compartment walls
(ii) within 4.5 m of the building entrance and visible therefrom and
(iii) presence is marked at the entrance.



5.2. VEHICLE ACCESS

Introduction

5.2.1 Fire brigade vehicle access to the exterior of a building is to enable high reach appliances, such as turntable ladders and hydraulic platforms, to be deployed, and to enable pumping appliances to supply water and equipment for firefighting.

Access requirements increase with building size, as described in Table 5.1.

Vehicle access routes and hardstandings should meet the criteria described in Section 5.2.3 if they are to be used by fire service vehicles.

Provisions of vehicle access

5.2.2 Vehicle access to buildings should be provided in accordance with Table 5.1.

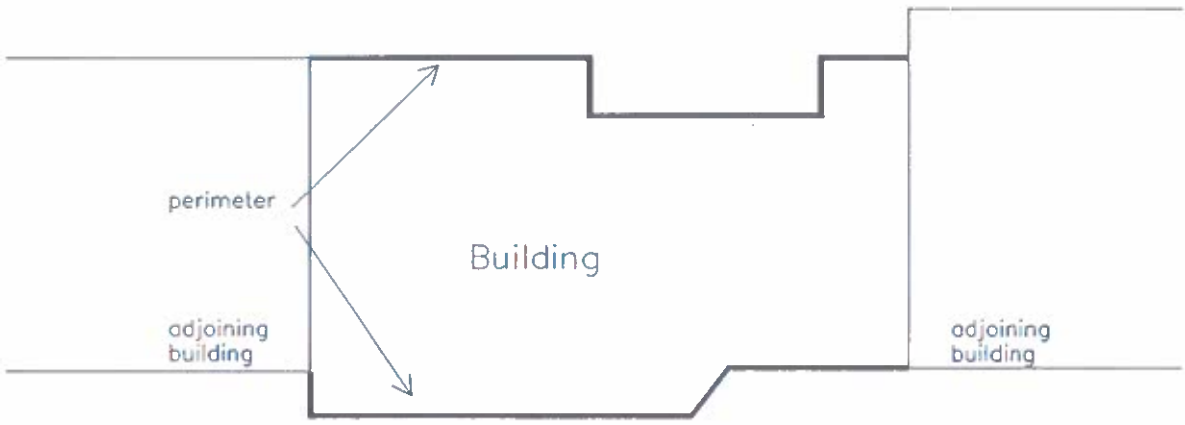
Any elevation to which vehicle access is provided in accordance with Table 5.1 should contain a door giving access to the interior of the building.

Table 5.1 Vehicle access to buildings

Volume of building (m^3)	Height of top storey above ground (m)	Provide vehicle access	Type of appliance
	under 10	at rate of 2.4m in length for every 90 m^2 of ground floor area	pump
up to 7000	over 10	to 15% of perimeter	high reach
7000-28,000	up to 10	to 15% of perimeter	pump
	over 10	to 50% of perimeter	high reach
28,000-56,000	up to 10	to 50% of perimeter	pump
	over 10	to 50% of perimeter	high reach
56,000-85,000	up to 10	to 75% of perimeter	pump
	over 10	to 75% of perimeter	high reach
over 85,000	up to 10	to 100% of perimeter	pump
	over 10	to 100% of perimeter	high reach

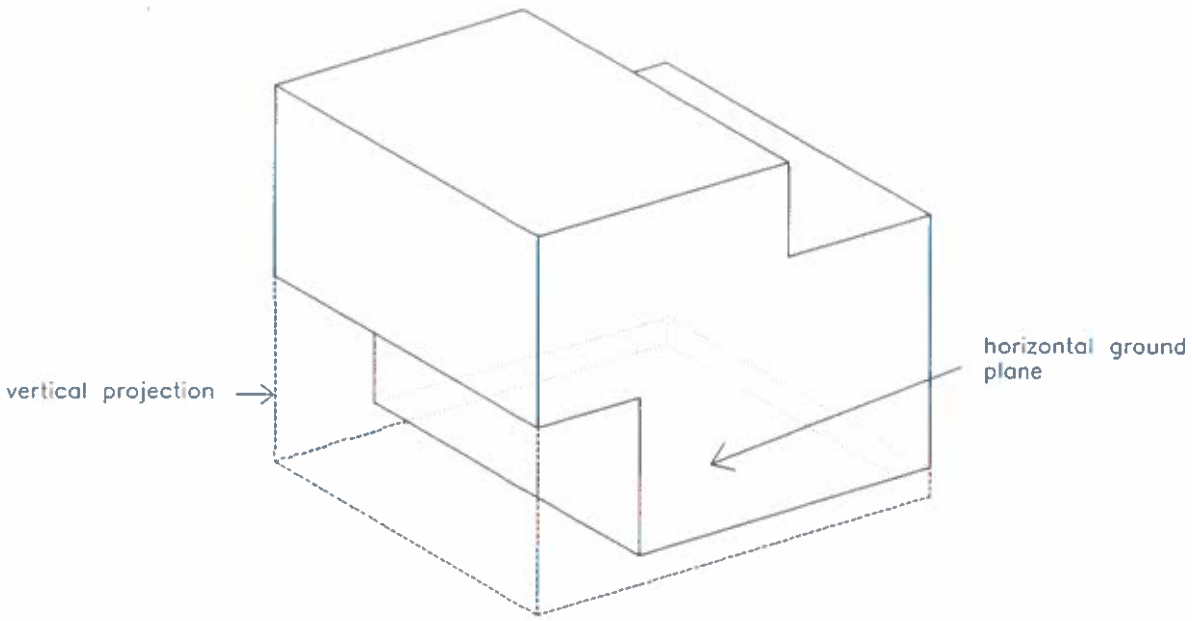
Note: See Diagram B5.2 for the definition of 'perimeter'.

Diagram B5.2 Building perimeter (for purposes of Table 5.1)



(a) Perimeter excludes separating walls

Application to terrace building.



(b) Perimeter is the maximum aggregate plan perimeter found by vertical projection onto a horizontal ground plane

Application to free standing building

Design of access routes and hardstandings

5.2.3 A vehicle access route may be a public or private road, or other route, which, including any manhole or other covers, meets the standards in Table 5.2, Diagram B5.3 and the following paragraphs.

Access routes to buildings with any storey at more than 10 m above ground level should meet the standards for high reach appliances. For lower buildings the access should be to the standards for pumping appliances.

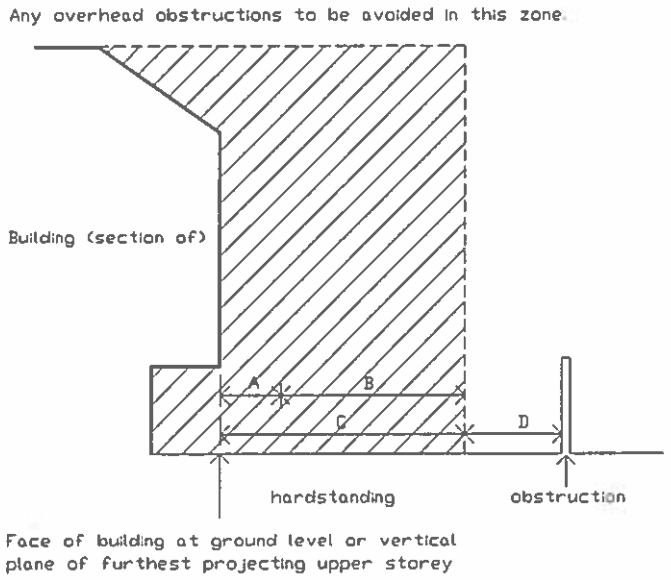
Where access is provided to an elevation in accordance with Table 5.2, overhead obstructions such as cables and branches that would interfere with the setting of ladders etc., should be avoided in the area shown on Diagram B5.3.

Table 5.2 Vehicle access route specifications

Appliance type	Minimum width of road between kerbs (m)	Minimum width of gateways between kerbs (m)	Minimum turning circle between walls (m)	Minimum turning circle (m)	Minimum clearance height (m)	Minimum carrying capacity (tonnes)
Pump	3.7	3.1	16.8	19.2	3.7	12.5
High reach	3.7	3.1	26	29	4	16.25

Note: Fire appliances are not standardised. Use of these figures will cater for nearly all of the machines in use at present. Some fire authorities use different sized appliances and it is therefore advisable that the relevant fire authority be consulted.

Diagram B5.3 Fire appliance access to building (diagrammatic section showing relationship between building and access road/hardstanding)



Dimension		Type of appliance	
	PUMP	T.L	H.P.
A. Minimum distance of hardstanding from building		4.9 m	2.0 m
B. Minimum width of hardstanding		5.0 m	5.5 m
C. Maximum distance of hardstanding from building		10.0 m	7.5 m
D. Minimum width of unobstructed space for swing of H.P.	--	-----	2.2 m

NOTES T.L = Turntable ladder. H.P = Hydraulic platform

5.3. PERSONNEL ACCESS TO BUILDINGS FOR FIRE FIGHTING

Introduction

5.3.1 In low rise buildings without deep basements fire service personnel access requirements may be met by a combination of the normal means of escape, and the measures for vehicle access in Section 5.2, which facilitate ladder access to upper storeys. In other buildings the problems of reaching the fire, and working inside near the fire, merit the provision of additional facilities to avoid delay and to provide a sufficiently secure operating base to allow effective action to be taken.

These additional facilities include fire-fighter lifts, fire-fighter stairways and fire-fighter lobbies, which are combined in a protected shaft known as the fire-fighter shaft (Diagram B5.4).

There are provisions for protected shafts in general in Section B3.

Provision of fire-fighter shafts

5.3.2 Buildings with a floor at more than 20 m above ground level or with a basement at more than 10 m below ground level, should be provided with fire-fighter shafts.

Every fire-fighter stairway and fire-fighter lift should be approached through a fire-fighter lobby.

A fire-fighter stairway should serve every storey of the building. However in large buildings where the floor area at upper levels is significantly less than at lower levels (the podium and tower for example) it may be acceptable to terminate a fire-fighter shaft at an intermediate storey, provided that the criteria for the number and location of fire-fighter shafts are satisfied, and that there is clear indication at the ground level entrance to the shaft that it does not serve every storey.

A fire-fighter lift does not necessarily have to serve every storey:

(a) a fire-fighter lift should serve every storey above ground, including the ground floor, in a building with any floor 20 m or more above ground (but see (c) below);

(b) a fire-fighter lift should serve every storey below ground, and the ground floor, in a building with a basement at more than 10 m below ground;

(c) however a fire-fighter lift need not serve a storey in a building used as flats (purpose group 1(c)) on which there is no entrance to a dwelling, and it need not serve the top storey of a building (although the fire-fighter stairway and associated lobby will have to).

Number and location of fire-fighter shafts

5.3.3 The number of fire-fighter shafts should:

(a) (if the building is fitted throughout with an automatic sprinkler system meeting the relevant recommendations of BS 5306: Part 2) comply with Table 5.3; or

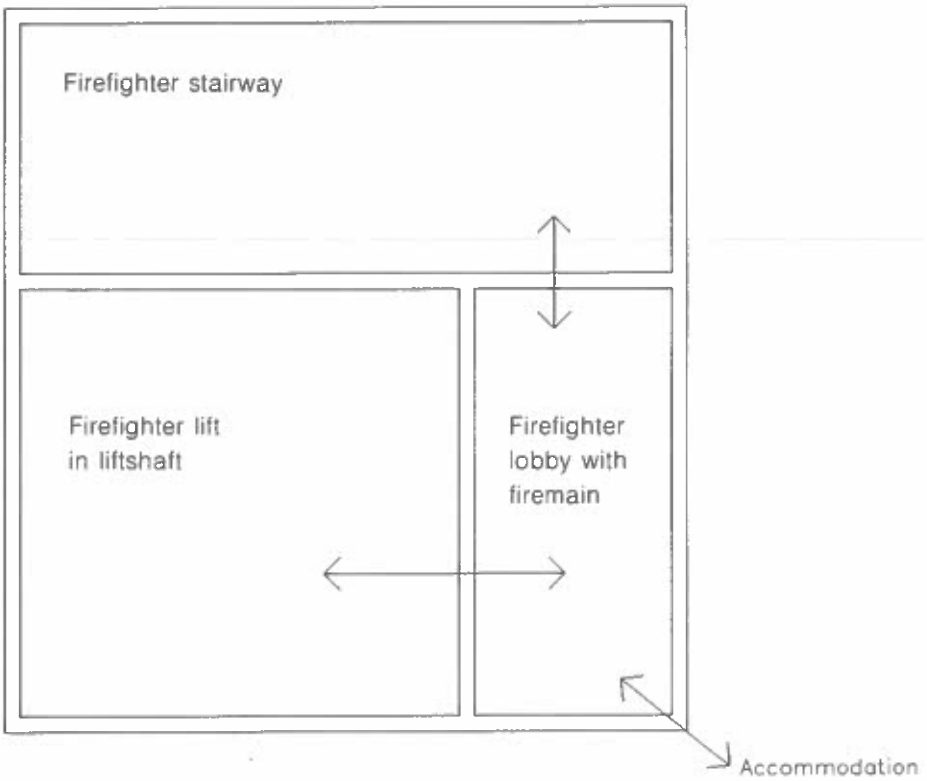
(b) (if the building is not fitted with sprinklers) be such that there is at least one for every 900 m^2 (or part thereof) of floor area of the largest floor that is more than 20 m above ground level.

The location of fire-fighter shafts should be such that every part of every storey, other than fire service access level, is no more than 60 m from the entrance to a fire-fighter lobby, measured on a route suitable for laying hose. If the internal layout is unknown at the design stage, then every part of every such storey should be no more than 40 m in a direct line from the entrance to a fire-fighter lobby.

Table 5.3 Minimum number of firefighter shafts in buildings fitted with sprinklers

Floor area of the largest storey over 20m above ground level (sq. m)	Minimum number of firefighter shafts
less than 900	1
900 to 2000	2
2001 to 3500	3
over 3500	1, for every 1500 m² of floor area, or part thereof

Diagram B5.4 Firefighter shaft components (diagrammatic)



Design and construction of fire-fighter shafts

5.3.4 All fire-fighter shafts should be equipped with internal fire mains having outlet connections and valves in every fire-fighter lobby except at access level.

Fire-fighter shafts should be designed and installed in accordance with the recommendations of BS 5588: Part 5: [1986] in respect of the following:

- planning within the fire-fighter shaft
- fire mains and landing valves
- smoke control
- fire resistance
- fire doors
- glazed areas
- fire-fighter lift installation
- electrical supply
- fire brigade communications system

Fire-fighter shaft walls should be of robust construction so that their fire resistance is unlikely to be impaired by mechanical damage.

5.4 Areas requiring special consideration

There are a number of situations which pose particular difficulties and where additional facilities should be provided to assist the fire brigades.

5.4.1 Boiler rooms and fuel stores.

In buildings where the heating installation is oil-fuelled, and in particular where the oil storage tanks and oil burning equipment are situated below ground level, a fire involving the fuel and equipment can be tackled by the fire brigade using foam, introduced into the heating or storage chamber through foam inlets.

Every room which contains oil burning equipment or has storage tanks of greater capacity and situated as in Table 5.4 should be provided with a foam inlet for use by the fire brigade.

The inlet should be sited on an external wall not more than 900 mm above ground level and at least 3 m horizontally from any opening to the protected room to ensure that the fire brigade personnel are able to use the inlet without hindrance from heat and smoke which may emerge from the opening.

The pipe from its inlet coupling should have an internal diameter of 80 mm (nominal), be without acute bends and not exceed 10 m in length to the point of discharge of the foam. Inlets should be fitted with a 63.5 mm instantaneous coupling complying with BS 336: 1989.

The discharge of foam should be so arranged to impinge on a wall approximately 900 mm above the floor level of the room or 150 mm above the catchpit level, whichever is the higher.

Table 5.4 Provision of foam inlets

Situation of room	Contents	Provision of foam inlets
Wholly belowground and area greater than 45 m²	- heating appliance(s) > 45 kW - oil storage tank(s) > 2,000 litres	One inlet per 45 m² of floor area of room
Accessible only from inside the building	- heating appliance(s) > 45 kW - oil storage tank(s) > 2000 litres	One inlet per 45 m² of floor area of room

5.4.2 High voltage discharge lighting

Where high voltage discharge lighting is used inside or outside buildings, fire brigade personnel could be in considerable danger during fire fighting operations. It is therefore necessary to provide a switch, readily accessible to fire-fighters, which will enable them to turn off and isolate this high voltage lighting before commencing fire fighting.

Provision of switches

5.4.2.1 One or more switches should be provided to enable the fire brigade personnel to switch off the discharge lighting in the event of a fire. Such switches are needed where exterior discharge lighting (e.g. advertising signs) and/or interior discharge lighting systems are provided. The switches should be readily accessible and conspicuously marked to enable fire-fighters to switch them off without delay. These should be installed in accordance with the Institution of Electrical Engineers "Regulations for Electrical Installations" (476-12 & 476-13) 15th Edition 1981.

A fire-fighter's emergency switch should be provided for:

- exterior discharge lighting installations operating at a voltage exceeding low voltage; and

- interior discharge lighting installations operating unattended at a voltage exceeding low voltage.

For the purposes of this section an installation in a closed market or in an arcade is considered to be an exterior installation. A temporary installation in a permanent building used for exhibitions is considered not to be an exterior installation. This requirement does not apply to a portable discharge lighting luminarie or sign of rating not exceeding 100 W and fed from a readily accessible socket outlet.

Requirements for switches

5.4.2.2 Every fire-fighter's emergency switch provided should comply with all the relevant requirements of the following items (i) to (iv).

(i) For exterior installations, the switch should be outside the building and adjacent to the discharge lamp(s), or, alternatively, a notice indicating the position of the switch shall be placed adjacent to the discharge lamp(s) and a nameplate should be fixed near the switch so as to render it clearly distinguishable.

(ii) For interior installations, the switch should be in the main entrance to the building or in another position to be agreed with the local fire authority.

(iii) The switch should be placed in a conspicuous position, reasonably accessible to firemen and, except where otherwise agreed with the local fire authority, at not more than 2.75 m from the ground.

(iv) Where more than one switch is installed on any one building, each switch should be clearly marked to indicate the installation or part of the installation which it controls, and the local fire authority should be notified accordingly.

Note:
Wherever practicable, all exterior installations on any one building should be controlled by a single fireman's switch. Similarly, all internal installations in any one building should be controlled by a single fireman's switch independent of the switch for any external installation.

It should be noted that for the purpose of IEE Regulation low voltage is defined as not exceeding 1000 V a.c, or 1500 V d.c. between conductors, or 600 V a.c. or 900 d.c. between any conductor and earth.

APPENDICES

Contents

APPENDIX A

PERFORMANCE OF MATERIALS AND STRUCTURES

General

A1 Many of the provisions in this document are given in terms of performance in relation to standard methods of test identified below. In such cases the material, product or structure should:

(a) be shown by test to be capable of meeting that performance, or

(b) have been assessed, analysed and appraised as meeting that performance. (For this purpose, competent persons, laboratories accredited for conducting the relevant test, and other approving bodies might be expected to have the necessary expertise), or

(c) (where tables of notional performance are included in this document) conform with an appropriate specification given in these tables, or

(d) (in the case of fire-resisting elements) conform with an appropriate specification given in Part II of the Building Research Establishments' Report 'Guidelines for the construction of fire-resisting structural elements' (BRE, 1988).

A2 Building Regulations deal with fire safety in buildings as a whole and they are aimed at limiting fire hazard.

The aim of standard fire tests is to measure or assess the response of a material, product, structure or system to one or more aspects of fire behaviour. Standard fire tests cannot normally measure fire hazard. They form only one of a number of factors that need to be taken into account. Other factors are those set out in these documents.

Fire resistance

A3 Factors having a bearing on fire resistance, that are considered in this document, are:

(a) fire severity,

(b) building height, or depth,

(c) building occupancy, and

(d) intervention by fire fighters.

A4 The standards of fire resistance given are based on assumptions about the severity of fires and the consequences should an element fail. Fire severity is estimated in very broad terms from the use of the building (its purpose group), on the assumption that the building contents (which constitute the fire load) are the same for buildings in the same use. In the simplest terms, the concentration of combustible material indicates the maximum temperature to which construction elements may be heated.

From estimates of the amount of combustible material per unit of floor area in various types of building (the fire load density), which were made for the Post-War Building Study No. 20 on the Fire Grading of Buildings, minimum standards have been devised for fire resistance. In this document, these basic standards have been modified according to particular features of the building affecting the risk to life, which are:

(a) height of the top floor above ground, which affects the ease of escape and of fire fighting operations, and the consequences should large scale collapse occur;

(b) occupancy, which reflects the ease with which the building can be evacuated quickly;

(c) basements, where the lack of an external wall through which to vent heat and smoke may increase heat build-up as well as complicating fire-fighting, thereby prolonging the fire; and

(d) single storey construction, where escape is direct and structural failure is unlikely to precede evacuation.

Because the use of buildings is subject to change, a precise estimate of fire severity based on the fire load due to a particular use may be misleading. A fire engineering approach of this kind must show a suitable factor of safety, to cater for these possible variations in fire load.

A5 Performance in terms of the fire resistance to be met by elements of structure, doors and other forms of construction is determined by reference to BS 476: Parts 20-24: 1987 (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:

(a) resistance to collapse (loadbearing capacity), which applies to loadbearing elements;

(b) resistance to fire, smoke and hot gases penetration (integrity), which applies to fire separating elements; and

(c) resistance to the transfer of excessive heat (insulation), which applies to fire separating elements.

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.

Results of tests on fire-resisting elements are given in the following publications:

Fire Protection Association

- Fire test results on building products: fire resistance, 1983. (Available from the FPA, 140 Aldersgate Street, London EC1A 4HX England).

Association of Structural Fire Protection Contractors and Manufacturers

- Fire protection for structural steel in buildings, 1988. (Available from the ASFPCM, PO Box 111, Aldershot, Hants, GU11 1YW England).

Loss Prevention Council

- Rules for the construction and installation of firebreak doors and shutters, 1988. (Available from the LPC (Technical), Melrose Avenue, Borehamwood, Herts WD6 2BJ England).

Information on tested elements is also frequently given in literature available from manufacturers and trade associations, and in the case of doors providing protection for high periods of fire resistance there are specifications approved by the Loss Prevention Council (previously Fire Officers' Committee). Any reference used to substantiate the fire resistance rating of a construction 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 fixing method, joints, dimensions, etc.) may significantly affect the rating.

Roofs

A6 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 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 that this is not the current version of the standard. (The current version was published in 1975 but is under revision).

Table A5 gives notional designations of some generic roof coverings.

Internal linings

A7 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.

A8 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 or 1987 under which materials or products are classified 1, 2, 3, or 4 - with Class 1 being the highest. (Class 4 ratings are not acceptable under the provisions in this document).

A9 To restrict to a minimum the use of materials which ignite easily, have a high rate of heat release and/or which reduce the time to flashover, maximum acceptable 'fire propagation' indices are specified. These are determined by reference to the method specified in BS 476: Part 6: 1968, 1981 or 1989. Index of performance (I) relates to the overall test performance, whereas sub-index (i) is derived from the first three minutes of test.

A10 The highest product performance classification is Class 0. This is achieved if a material or the surface together with its substrate of a composite product is either:

(a) composed throughout of materials of limited combustibility (see A16), or

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

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

A11 Composite products defined as materials of limited combustibility (see A16) in Table A7 should in addition comply with the test requirement appropriate to any surface rating specified in Sections B2, B3 and B4.

A12 No thermoplastic material in isolation can be assumed to protect a surface underlying it. The surface rating of both products must meet the required classification. If however, the thermoplastic material is fully bonded to a nonthermoplastic substrate, then only the surface rating of the composite will need to comply.

A13 The notional performance ratings of certain widely-used generic materials or products are listed in Table A6 in terms of their performance in the traditional lining (tests BS 476: Parts 6 and 7).

Note:
Results of tests on proprietary materials are given in the following publications. Information on tested materials is also frequently given in literature available from manufacturers and trade associations.

Fire Protection Association

- Fire test results on building products: surface spread of flame, 1979 (updated 1981).

- Fire test results on building products; fire propagation, 1980 (updated 1986).

(Available from the FPA, 140 Aldersgate Street, London EC1A 4HX, England).

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, fixings, adhesive etc., may significantly affect the rating.

A14 A thermoplastic material means any polymeric material which has a softening point below 200°C if tested to BS 2782: Part 1: Method 120A: 1990. 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.

For the purposes of Sections B2 and B4 thermoplastic materials are classified as TP(a), TP(b) or TP(c) as follows:

TP(a)

(1) Specimens of the finished product should comply with the Type C requirements of BS 5867 when tested to BS 5438, Test 2 (surface application only and excluding the cleansing procedure); and

(2) If a specimen of the material is tested to:

(a) BS 2782: Method 508A: 1970, the test flame should not reach the first mark, and the duration of flaming or afterglow should not exceed 5 seconds following removal of the burner, or

(b) (if the method in (2)(a) above cannot be applied because of the flexibility of the product) either

(i) BS 2782: Method 508C: 1970 (or BS 2782: Part 1: Method 140D: 1980), the distance of travel of the flame should not be more than 75 mm, or

(ii) BS 2782: Method 508D: 1970 (or BS 2782: Part 1: Method 140E: 1982), the specimen should not flame or glow for more than 5 seconds, charring or scorching should not extend over more than 20% of the area of the underside of the specimen, and the length of the charred or scorched edge on the underside of the specimen should not be more than 50 mm; and

(3) No flaming drops are generated which ignite cotton wool placed 150 mm below the specimen in the tests to BS 5438: 1976 or BS 2782: Methods 508A, 508D or 140E.

TP(b)

Compliance with the test criteria specified for TP(a) in (2) and (3) above.

TP(c)

Compliance with a rate of burning of not more than 50 mm/min when a specimen of the basic material 3 mm thick is tested to BS 2782: Method 508A: 1970.

A15 Concessions are made for thermoplastic materials used for windows, rooflights and within suspended ceilings if they cannot be tested as specified in paragraphs A8 and A9. They are described in Sections B2 and B4.

Materials of limited combustibility

A16 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.

Non-combustible materials

A17 Non-combustible materials are defined in Table A8 either as listed products, or in terms of performance when tested to BS 476: Part 4: 1970 or Part 11: 1982.

Only these materials may be used where there is a provision for non-combustibility and also for the specific applications in the elements listed in Table A8. Noncombustible materials may be used whenever there is a requirement for materials of limited combustibility.

Fire test methods

A18 A guide to the various test methods in BS 476 and BS 2782 is given in PD 6520: 1988.

A guide to the development and presentation of fire tests and their use in hazard assessment is given in BS 6336: 1982.

Table A1 Specific provisions of test for fire resistance of elements of structure, etc.

Part of building	Minimum provisions when tested to the relevant parts of BS 476 [1] (minutes)			Method of exposure
	Loadbearing capacity [2]	Integrity	Insulation	
1. Structural frame beam or column	*	No provision	No provision	Exposed faces
2. Loadbearing wall (which is not also a wall described in any of the following items)	*	No provision	No provision	each side separately
3. Floors				
(a) floor in upper storey of a 2 storey house (but not over a garage)	30	15	15	from underside [3]
(b) any other floor	*	*	*	from underside [3]
4. Roofs				
any part forming an escape route	30	30	30	from underside [3]
5. External walls				
(a) any part less than 1m from any point on relevant boundary	*	*	*	each side separately
(b) any part 1m or more from the relevant boundary	*	*	15 [4]	from inside
6. Separating wall [5]	* (min 60)	* (min 60)	* (min 60)	each side separately
7. Compartment wall	*	*	*	each side separately
8. Protected shafts (including any fire-fighting stairway)				
(a) any glazing described in Part B. Section 3.2.7.3., Diagram 3.4	30	30	No provision [6]	each
(b) any part between the shaft and a protected lobby/ corridor described in Diagram 3.4 above	30	30	30	side
(c) any part not described in (a) or (b) above	*	*	*	separately

Table A1 Specific provisions of test for fire resistance of elements of structure, etc.

Part of building	Minimum provisions when tested to the relevant parts of BS 476 [1] (minutes)			Method of exposure
	Loadbearing capacity [2]	Integrity	Insulation	
9. Enclosure to a -				
(a) protected stairway	60	60	60 [3]	each
(b) lift shaft, or	30	30	30	side
(c) service shaft,	30	30	30	separately
which does not form part of a compartment wall or a protected shaft.				
10. Enclosure to a -				
(a) protected lobby, or	30	30	30 [7]	each side separately
(b) protected corridor	30	30	30	
which is not a compartment wall or described in item 8.				
11. Subdivision of a corridor	30	30	30 [7]	each side separately
12. Wall separating an attached or integral garage from a house	30	30	30	from garage side
13. Enclosure to a -				
(a) protected entrance hall, or	30	30	30 [7]	each side separately
(b) protected landing, in a flat or maisonette				
14. Fire-resisting construction -				
(a) enclosing communal areas in sheltered housing,	30	30	30	each side separately
(b) in dwellings not described elsewhere	30	30	30 [7]	each side separately
15. Cavity barrier	no provision	30	15	each side separately
16. Ceiling described	no provision	30	30	from underside

Table A1 Specific provisions of test for fire resistance of elements of structure, etc.

Part of building	Minimum provisions when tested to the relevant parts of BS 476 [1] (minutes)			Method of exposure
	Loadbearing capacity [2]	Integrity	Insulation	
17. Duct described in Part B3, paragraph 3.3.4(e)	no provision	30	no provision	from outside
18. Casing around a drainage system described in Part B3, Section 4, Diagram 3.12	no provision	30	no provision	from outside
19. Flue walls described in Part B3, Section 3.4.4 Diagrams 3.14 and 3.15	no provision	*	*	from outside
20. Fire doors	See Table B1 of Appendix B			

NOTES

* Minimum period of fire resistance is set out in Table A2.

1. Part 21 for loadbearing elements, Part 22 for non-loadbearing elements, Part 23 for fire-protecting suspended ceilings; and Part 24 for ventilation ducts. (Tests to BS 476: Part 8 are permitted subject to paragraph A5).
2. Applies to loadbearing elements only.
3. A suspended ceiling should only be relied on to contribute to the fire resistance of the floor if the ceiling meets the appropriate provisions given in Table A3.
4. 30 mins for any part adjacent to an external escape route (but no provision for glazed elements).
5. See Part B3, Section 3.2.5.1 for requirements for construction of separating walls.
6. Except for any limitations on glased elements given in Table A4.
7. See Table A4 for permitted extent of uninsulated glazed elements.

Table A2 Minimum periods of fire resistance for elements of structure

Purpose group of buildings	Minimum period (mins) + for elements of structure in a -					
	Basement storey ≠ (including floor over)			Ground or upper storey		
	Depth (m) of lowest basement			Height (m) of top storey in building or of separated part		
	⊦10	⊦10	⊦5	⊦20	⊦30	>30
1. **Residential (Domestic)**						
- Houses	-	30*	30*	30*	-	-
- Flats and maisonettes	90	60	30*	60**	90**	120**
2. **Residential**						
(a) Institutional	90	60	60	60	90	120ø
(b) Other residential	90	60	30*	60	90	120ø
3. **Office**						
- not sprinklered	90	60	30*	60	90	x
- sprinklered	60	30*	30*	30*	60	120ø
4. **Shop and Commercial**						
- not sprinklered						
floor area ⊦350 m²	90	60	30*	30*	60	x
floor area > 350 m²	90	60	30*	60	90	x
- sprinklered ϖ	60	30*	30*	30*	60	120ø
5. **Assembly and Recreation**						
- not sprinklered	90	60	30*	60	90	x
- sprinklered ϖ	60	30*	30*	30*	60	120ø
6. **Industrial**						
- not sprinklered	90	60	30*	60	90	x
- sprinklered ϖ	60	30*	30*	30*	60	120ø
7. **Storage and Other non-residential**						
(a) any building or part, not described elsewhere						
- not sprinklered	90	60	30*	60	90	x
- sprinklered	60	30*	30*	30*	60	120ø
(b) car park for light vehicles						
(i) open sided ϖ	x	x	15*	15*	15*	x
(ii) any other	90	60	30*	60	90	120ø

x Not permitted
⊦ means not more than
> means more than

Modifications

* Increased to 60 minutes for separating walls
** Reduced to 30 minutes for any floor within a maisonette (but not if the floor contributes to the support of the building as a whole)
ø Reduced to 90 minutes for elements not forming part of the structural frame
\+ See also guidance on application of the fire resistance standards below
≠ The floor over a basement (or if there is more than 1 basement, the floor over the topmost basement) should meet the provisions for the ground and upper storeys if that period is higher.

Notes

1. "Sprinklered" means that the building is fitted throughout with an automatic sprinkler system meeting the relevant recommendations of BS 5306: Part 2, i.e. the relevant occupancy rating together with the additional requirements for life safety.
2. The car park should comply with the relevant provisions in B3, Section 3.5.2.

Refer to Table A1 for specific provisions of test.

Application of the fire resistance standards in Table A2

(a) Where one element of structure supports or carries or gives stability to another, the fire resistance of the supporting element should be no less than the minimum period of fire resistance for the other element (whether that other element is loadbearing or not).

There are circumstances where it may be reasonable to vary this principle, for example where the supporting structure is in the open air; or

(b) Where an element of structure forms part of more than one building or compartment, that element should be constructed to the standard of the greater of the relevant provisions.

(c) Although some elements of structure in a single storey building may be excluded from needing fire resistance (see B3, paragraph 3.1.4(a)), fire resistance will be needed if the element:

(i) is part of (or supports) an external wall and there is provision in B4 to limit the extent of openings and other unprotected areas in the wall; or

(ii) is part of (or supports) a compartment wall, a separating wall or a wall between a dwelling house and an attached or integral garage; or

(iii) supports a gallery.

For the purposes of this paragraph, the ground storey of a building which has one or more basement storeys and no upper storeys, may be considered as single storey. The fire resistance of the basement storeys should be that appropriate to basements.

(d) Where one side of a basement is (due to the slope of the ground) open at ground level, giving an opportunity for smoke venting and access for fire fighting, it may be appropriate to adopt for elements of structure in that storey, the standard of fire resistance applicable to above ground structure.

Table A3 Limitations on fire-protecting suspended ceilings

Height of building or of separated part (m)	Type of floor	Provisions of fire resistance of floor (mins)	Description of suspended ceiling
Less than 15	not compartment	60 or less	Type A, B, C, or D
	compartment	60 or less	
		60	Type B, C or D
15 or more	any	60 or less	Type C or D
no limit	any	more than 60	Type D

Notes:

Ceiling Type		Description
A	-	Surface of ceiling exposed to the cavity should be Class 0 or Class 1
B	-	Surface of ceiling exposed to the cavity should be Class 0.
C	-	Surface of ceiling exposed to the cavity should be Class 0. Ceiling should not contain easily openable access panels.
D	-	Ceiling should be of a material of limited combustibility and not contain easily openable access panels. Any insulation above the ceiling should be of a material of limited combustibility.

Table A4 Limitations on the use of uninsulated fire resisting glazed elements on escape routes

Position of glazed element	Maximum total glazed area in parts of a building with access to:			
	a single stairway		more than one stairway	
	Walls	Door leaf	Walls	Door leaf
(1) Single family houses (a) within the enclosures to a protected stairway or within fire-resisting separation shown in Figure 1(b) of BS 5588: Part 1	Fixed fanlights only	Unlimited	Fixed	Unlimited fanlights only
(2) Within the enclosures to a protected entrance hall or protected landing of a flat or maisonette	Fixed fanlights only	Unlimited above 1.1m	Fixed fanlights	Unlimited above 1.1m only
(3) Between residential/sleeping accommodation and a common escape route (corridor, lobby or stairway)	Nil	Nil	Nil	Nil
(4) * Between a protected stairway (+) and - (a) the accommodation; or (b) a corridor which is not a protected corridor	Nil	25% of door area	Unlimited above 1.1m≠	50% of door area
(5) *Between - (a) a protected stairway (+) and a protected lobby or protected corridor; (b) the accommodation and a protected lobby	Unlimited above 1.1m	Unlimited above 1.1m	Unlimited above 1.1m	Unlimited above 1.1m
(6) *Between the accommodation and a protected corridor forming a dead end	Unlimited above 1.1m	Unlimited above 0.1m	Unlimited above 0.1m	Unlimited above 0.1m
(7) *(a) Between the accommodation and any other corridor; (b) Subdividing corridors	N/A	N/A	Unlimited above 0.1m	Unlimited above 0.1m

Notes:

* But not any such part included in item 3

(+) If the protected stairway is also a protected shaft (see Part B3) or a firefighting stairway (see Parts B5), the use of glazed elements may be further restricted.

≠ Measured vertically from the landing floor level or the stairway pitch line

Table A5 Notional designations of roof coverings

PART 1: PITCHED ROOFS COVERED WITH SLATES OR TILES

Covering Material	Supporting Structure	Designation
1. Natural slates 2. Asbestos-cement slates 3. Clay tiles 4. Concrete tiles	1. Timber rafters with or without underfelt, sarking, boarding, wood wool slabs, plywood, wood or flax chipboard, or fibre insulating board	AA
5. Strip slates of bitumen felt Class 1 or 2	2. Timber rafters and boarding, plywood, wood wool slabs, compressed straw slabs, wood or flax chipboard, or fibre insulating board	CC
6. Bitumen felt strip slates Type 2E, with underlay of bitumen felt Type 2B	3. Timber rafters and boarding, plywood, wood wool slabs, compressed straw slabs, wood or flax chipboard, or fibre insulating board	BB

Note:

Any reference in this Table to bitumen felt of a specified type is a reference to bitumen felt as so designated in I.S. 36 : Part 1: 1986 and Part 2 : 1987

Table A5 Notional designations of roof coverings

PART II: PITCHED ROOFS COVERED WITH PREFORMED SELF-SUPPORTING SHEETS

DETAILS OF COVERING

Material	Construction	Supporting Structure	Designation
Corrugated sheets of: (i) galvanised steel (ii) aluminum (iii) composite steel and asbestos (iv) asbestos-cement or (v) pvc coated steel	1. single skin without underlay or with underlay of - (i) plasterboard (ii) fibre insulating (iii) compressed strawslabs or (iv) wood wool slab	structure of timber, steel or concrete	AA
Corrugated sheets of: (i) galvanised steel (ii) aluminum (iii) composite steel and asbestos (iv) asbestos-cement or (v) pvc coated steel	2. double skin without underlay or with underlay of - (i) resin-bonded glass fibre (ii) bitumen-bonded glass fibre (iii) mineral wool slab or blanket (iv) polystyrene or (v) polyurethane	structure of timber, steel or concrete	AA

Table A5 Notional designations of roof coverings

PART III: PITCHED OR FLAT ROOFS COVERED WITH FULLY SUPPORTING MATERIAL

Covering material	Supporting Structure	Designation
1. Aluminum sheet 2. Cooper sheet 3. Zinc sheet 4. Lead sheet 5. Mastic asphalt	1. Timber joists and - (i) tongued and grooved boarding, or (ii) plain edged boarding	AA*
6. Vitreous enamelled steel sheet	2. Steel or timber joists with deck of - (i) wood wool slab (ii) compressed straw slab (iii) wood or flax chipboard (iv) fibre insulating board, or (v) 9.5mm plywood	AA
	3. Concrete or clay pot slab (cast in situ or precast), or non-combustible deck of steel, aluminum or asbestos-cement (with or without insulation)	AA

Note:
*Lead sheet supported by timber joists and plain edged boarding shall be deemed to be of designated BA.

Table A5 Notional designations of roof coverings

PART IV: ROOFS COVERED WITH BITUMEN FELT

Part IV(A): Flat roofs covered with bitumen felt

A flat roof comprising a covering of bitumen felt shall (irrespective of the felt specification) be deemed to be of designation AA if the felt is laid on a deck constructed of any of the materials prescribed in the Table in Part IV(B) and has a surface finish of:

(a) bitumen bedded stone chippings covering the shole surface to a depth of not less than 12.5mm

(b) bitumen bedded tiles of a non-combustible material

(c) sand and cement screed or

(d) tarmacadam

Table A5 Notional designations of roof coverings

PART IV(B): PITCHED ROOFS COVERED WITH BITUMEN FELT

Details of felt								
Number of layers	Type of upper layer	Type of under-layer(s)	Deck of either of the following (having minimum thickness stated) plywood (6mm). wood or flax chipboard (12.5mm). T&G boarding (16mm finished) or PE boarding (19mm finished)	Deck of compressed straw slab	Deck of screeded wood slab	Asbestos-cement or steel single skin or cavity deck (without overlay or with overlay of fibre insulating board)	Aluminium single skin cavity deck without overlay or with overlay of fibre insulating board)	Concrete or clay or pot slab (cast in situ or precast)
1. two or three layers built up in accordance with CP144: Part 3. 1970	1. Type 1E	Type 1B (minimum mass 13kg/10m)	CC	AC	AC	AC	AC	AB
	2. Type 3B	Type 1B (minimum mass 13kg/10m)	BB	AB	AB	AB	AB	AB
	3. Type 3E	Type 3B or 3G	BC	AC	AB	AB	AB	
2. single layer	Type 1E		CC	AC	AC	AC	CC	AC

Note:

Any reference in this Table to bitumen felt of a specified type is a reference to bitumen felt as so designated in I.S. 36 : Part 1 : 1986 and Part 2 : 1987

Table A6 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 the test requirements given in paragraph A10(b).
	2. Brickwork, blockwork, concrete and ceramic tiles.
	3. Plasterboard (painted or not, 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 400 kg/m3, painted or unpainted.
	7. Wood particle board or hardboard, either treated or painted.
	8. Standard glass reinforced polyesters.

Notes:

(1) Materials and products listed under Class0 also meet Class 1.

(2) Timber products listed under Class 3 can be brought up to Class 1 with appropriate proprietary treatments.

(3) The following materials and products may achieve the ratings listed below. However, as to their performance variable, the ratings of these materials/products should be substantiated by tested evidence. Materials/products should also be assessed by reference to the toxic hazard they pose on combustion

Class 0 - aluminium faced fibre insulating board, flame retardant decorative laminates on a calcium sillicate 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.

Table A7 Use of materials of limited combustibility

	Use	Material
1.	stairways where there is provision in Part B1, paragraph 1.4.1 for them to be constructed of materials of limited combustibility	(a), (b) or (c) below
2.	materials above a suspended ceiling meeting the provisions in Part B3, Table 3.3 Note 2(f)	
3.	reinforcement/support for fire-stopping referred to in Part B3, paragraph 3.4.5	
4.	construction forming shopping complexes referred to in Part B3, paragraph 3.5.3(f)	
5.	roof covering meeting the provisions: (a) in Part B3, Table 3.3 or (b) in Part B4, Table 4.3 or (c) in Part B4, Diagram 4.5	
6.	Class 0 materials meeting the provision in Appendix A, paragraph A10(a)	
7.	Ceiling tiles or panels of any fire-protecting suspended ceiling (Type D) in Table A3	
8.	insulation above any fire-protecting suspended ceiling (Type D) in Table A3	any material listed below

Materials of limited combustibility

(a) Any non-combustibile material listed in Table A8.

(b) any material of density 300 kg/m or more which when tested to BS 476: Part 11, does not flame, and the rise in temperature on the furnace thermocouple is not more than 20°C.

(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. (When a flame spread rating is specified, these materials must also meet the appropriate test requirements).

(d) Any material of density less than 300 kg/m³, which when tested to BS 476: 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 Use of non-combustible materials

	Use	Material
1.	ladders referred to in Part B, paragraph 1.4.4.2	any material listed below
2.	roof coverings meeting the provision in Part B3, Diagram 3.2(a)	
3.	refuse chutes meeting the provisions in Part B3, paragraph 3.2.6.2(c)	
4.	suspended ceilings and their supports where provision in Part B3, Table 3.3 for them to be constructed of non-combustible materials	
5.	pipes meeting the provsiions in Part B3, Table 3.4	
6.	flue walls meeting the provisions in Part B3, Diagram 3.14 or 3.15	
7.	construction forming car parks referred to in Part B3, paragraph 3.5.2.1	
8.	external surfaces of walls where there is provision in Part B4, table 4.1, for them to be constructed of non-combustible materials	
9.	hinges meeting the provisions in Appendix B, paragraph B5	
10.	separating walls as required in Part B3, section 3.2.5 section 3.2.5.1	

Non-combustible materials

(a) Any material which when tested to BS 476: Part 11: 1982 does not flame and there is no rise in temperature on either the centre (specimen) or furnace thermocouples.

(b) Totally inorganic materials such as concrete, fired clay, ceramics, metals, plaster and masonry containing not more than 1 per cent 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).

(c) Concrete bricks or blocks meeting I.S. 20 : 1974; I.S. 20 Part 1 : 1987 or I.S. 189 : 1974.

(d) Products classified as non-combustible under BS 476 : Part 4 : 1970.

APPENDIX B

FIRE DOORS

FIRE DOORS

B1 BS 8214 : 1990 Code of Practice for fire door assemblies with non-metallic leaves, makes recommendations relating to the specification, design, manufacture, installation and maintenance of timber fire doors.All fire doors should have the appropriate performance given in Table B1.

B2 All fire doors should be fitted with an automatic self-closing device which is capable of closing the door from any angle and against any latch fitted to the door.

Note:
Fire doors to cupboards and to service ducts may be normally kept locked shut in lieu of being fitted with a self-closing device.

B3 Where a self-closing device would be considered a hindrance to the normal use of the building, fire doors may be held open by:

(a) a fusible link (but not if the door is fitted in an opening provided as a means of escape unless it complies with paragraph B4 below); or

(b) an electro-magnetic or electro-mechanical device susceptible to smoke if the door can also be closed manually and it is not to be -

(i) the only escape stairway serving a building (or part of a building), or

(ii) a fire-fighting stairway, or

(iii) an escape stairway serving a building in any residential purpose group; or

(c) a door closure delay device.

B4 Where two fire doors are fitted in the same opening that is provided as a means of escape, one door may be fitted with an automatic self-closing device and be held open by a fusible link if the other door is capable of being easily opened by hand and has at least 30 minutes fire resistance.

B5 Any hinge on which a fire door is hung should be made entirely from non-combustible materials having a melting point of at least 800°C.

B6 (a) Except for doors identified in (b) below, all fire doors should be marked (at about eye level) with the appropriate fire safety sign complying with BS 5499: Part 1: 1990. Signs according to whether the door is:

(i) to be kept closed when not in use,

(ii) to be kept locked when not in use, or

(iii) held open by an electro-magnetic or electromechanical device.

Fire doors to cupboards and to service ducts should be marked on the outside; all other fire doors on both sides.

(b) The following fire doors are not required to comply with (a) above:

(i) doors within dwellinghouses,

(ii) doors to and within flats or maisonettes,

(iii) bedroom doors in 'other residential' premises, and

(iv) lift entrance doors.

B7 All fire doors should be identified by a permanently fixed small metal plate, indicating the period of resistance, manufacturer, year of manufacture, and other pertinent details.

Table B1. Provision for fire doors

Position of door	Minimum fire resistance in terms of integrity [1-4] (minutes)
1. Within a separating wall	FD *S (min 60)
2. Within a compartment wall-	
(a) if it separates a flat or maisonette from a space in common use,	FD 30S
(b) enclosing a protected shaft forming a stairway situated wholly or partly above the adjoining ground in a building used for flats, other residential, assembly and recreation or office purposes,	FD 30S
(c) enclosing a protected shaft forming a stairway not described in (b) above,	FD +S (Min 30)
(d) not described in (a), (b) or (c) above	FD * ∞
3. Within a compartment floor	FD *S
4. Forming part of the enclosures of a -	
(a) protected stairway (except where described in item 9 below);	FD 30S
(b) lift shaft, or	
(c) service shaft,	
5. Forming part of the enclosure of a -	
(a) a protected lobby approach (or corridor) to a stairway,	FD 30S
(b) any other protected corridor,	FD 20S
6. Affording access to an external escape route	FD 30
7. Sub-dividing -	
(a) corridors connecting alternative exists,	FD 20S
(b) dead-end portions of corridors from the remainder of the corridor	FD 20S
8. Any door -	
(a) within a cavity barrier,	FD 20
(b) between a house and a garage,	FD 20
(c) forming part of the enclosures to a communal area in sheltered housing	FD 30S
9. Any door -	
(a) forming part of the enclosures to a protected stairway in a single family dwelling house,	FD 20
(b) forming part of the enclosures to a protected entrance hall or protected landing in a flat or maisonette,	FD 20
(c) within any other fire-resisting construction in a dwelling not described elsewhere	FD 20

Notes:

* Period of fire resistance (see Table A1 of Appendix A) for the wall or floor in which the door is situated.

\+ Half the period of fire resistance (see Table A1 of Appendix A) for the wall in which the door is situated.

S Unless pressurization techniques complying with BS 5588: Part 4: 1979 are used, these doors should also have leakage rate not exceeding 3 $m^3/m/hour$ (head and jambs only) when tested at 25 Pa under BS 476: Section 31.1.

(1) To BS 476: Part 22: 1987 (or BS 476: Part 8 subject to paragraph A5 of Appendix A).

(2) Method of exposure is from each side separately (except for doors to lift shafts, which is from the landing side only).

(3) Two fire-resisting doors may be fitted in an opening if each door by itself is capable of closing the opening and the two doors together achieved the required level of fire resistance.

(4) See also Appendix A, Table A4, for limitation on use of uninsulated glazed elements.

(5) FD*S if the door is in a compartment wall used for horizontal evacuation in a hospital (see B1, Section 2).

APPENDIX C

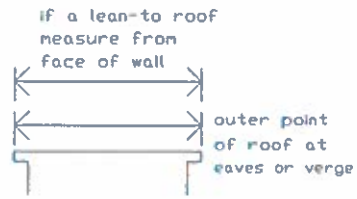
METHODS OF MEASUREMENT

METHODS OF MEASUREMENT

C1 Some form of measurement is an integral part of many of the provisions in this document. Diagrams C1 to C5 show how the various forms of measurement should be made, based on definitions in Appendix D.

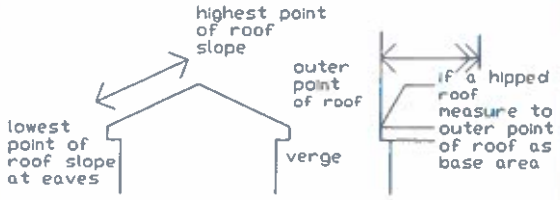
Note:
See Part Document B1, paragraph 1.0.10 for methods of measurement specific to means of escape in case of fire.

Diagram C1 Measurement of areas



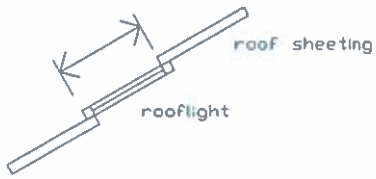
Section

1 Flat or monopitch roof



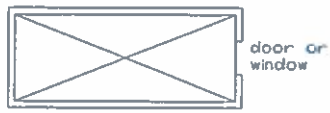
Section Elevation

2 Double pitch



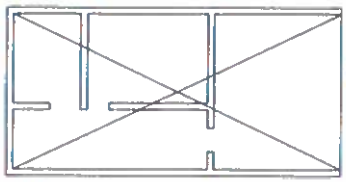
3 Rooflight

A Surface area roofs and rooflights
In each case measure the visible area



plan

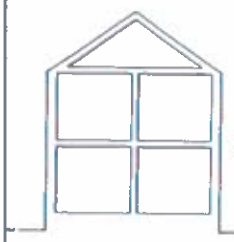
B Floor area room, garage, conservatory or outbuilding measure to inner surface of enclosing walls



plan

C Floor area of storey part or compartment measure to inner surface of enclosing walls and include internal walls and partitions

Diagram C2 Cubic capacity



Section

measure the volume contained by

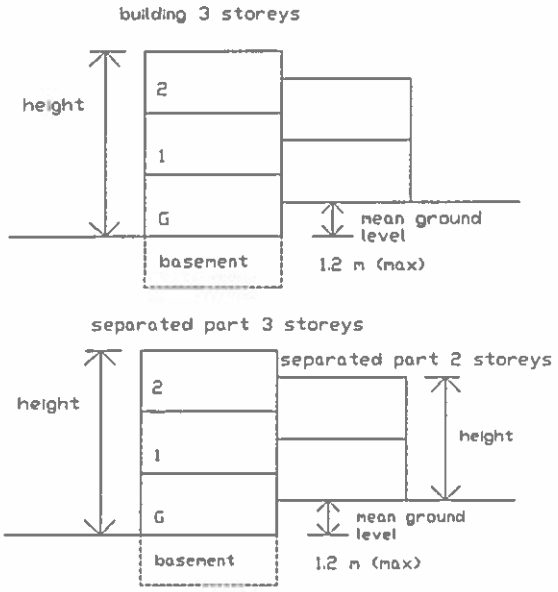
(a) undersurface of roof

(b) upper surface of lowest floors

(c) the inner surface of enclosing walls when there is not an enclosing outside wall measure to the outermost edge of the floor and ignore internal walls and partitions

Diagram C3 Number of storeys

To count the number of storeys in a building, or or in a separated part of a building count only at the position which gives the greatest number and and exclude any basement storeys.

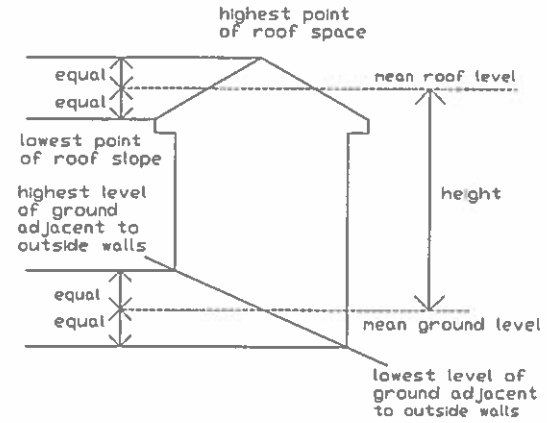


Note

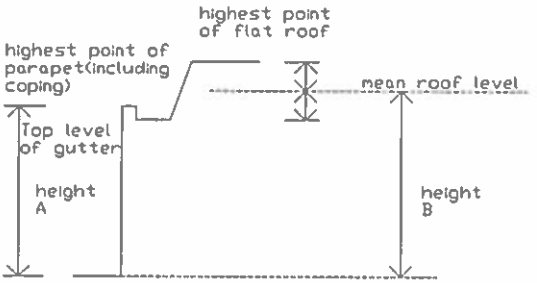
In assembly buildings a gallery is included as a storey but not if it is a loading gallery, fly gallery, stage grid, lighting bridge or any gallery provided for similar purposes or for maintainence or repair.

In other purpose group buildings galleries are not counted as storeys.

Diagram C4 Height

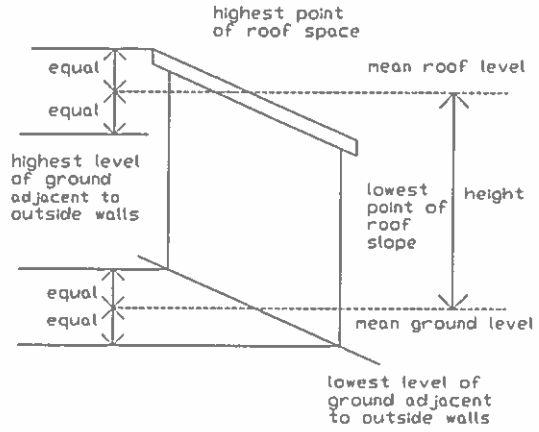


A Double pitch roof



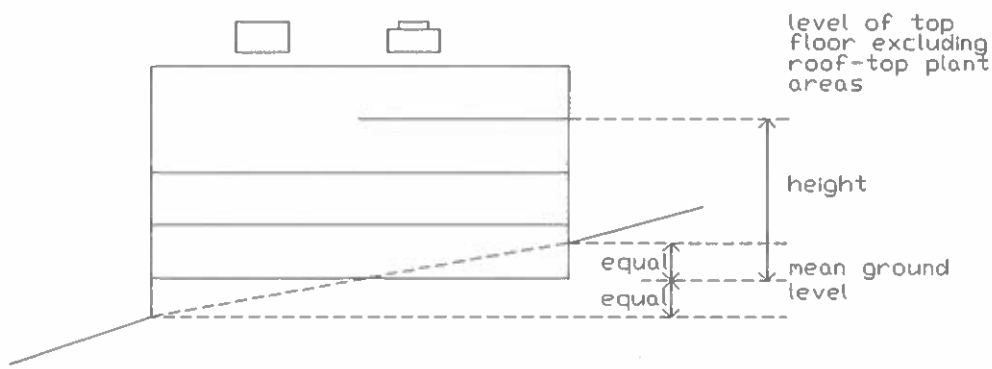
use height A or height B whichever is higher

B Mansard type roof



C Flat or monopitch roof

Diagram C5 Height of top storey in building



APPENDIX D

DEFINITIONS

DEFINITIONS

Access room - See B1

Accommodation stairway - See B1

Alternative escape routes - See B1

Alternative exit - see B1

Appliance ventilation duct - See B3

Automatic self-closing device - does not include rising butt hinges unless the door is:

(a) to (or within) a dwelling;

(b) between a house and its garage; or

(c) in a cavity barrier

Basement storey - means a storey which is below the ground storey or, where there is no ground storey, means a storey the top surface of the floor of which is situated at such a level or levels that some point on its perimeter is more than 1.2 m below the level of the finished surface of the ground adjoining the building in the vicinity of that point. (However, see Appendix A, Table A2, for concessions where the storey is considered to be a basement only because of a sloping site).

Boundary - See B4

Cavity - See B2

Cavity Barrier - See B3

Ceiling - See B2

Circulation space - See B2

Class O - See Appendix A, paragraph A10

Common Stairway - See B1

Compartment (fire compartment) - A building or part of a building, comprising one or more rooms, spaces or storeys, constructed to prevent the spread of fire to or from another part of the same building, or an adjoining building. (A roof space above the top storey of a compartment is included in that compartment). (See also 'Separated Part').

Compartment wall/floor - A fire-resisting wall/floor used in the separation of one fire compartment from another. (Constructional requirements are given in B3, Section 2).

Competent person means a person possessing adequate education, training, knowledge, experience and ability to perform his/her work or duties in such a manner as to prevent as far as practicable, risk of injury.

Concealed space (cavity) - See B3

Conservatory - See B4

Dead-end - See B1

Direct distance - See B1

Electro-magnetic, or electro-mechanical device susceptible to smoke - A device which will allow a door held open by it to close automatically in the event of each or any one of the following:

(a) detection of smoke by automatic apparatus suitable in nature, quality and location, and

(b) operation of a manually operated switch fitted in a suitable position, and

(c) failure of the electricity supply to the device, apparatus or switch, and

(d) operation of the fire alarm system, if any.

Element of structure -

(a) a member forming part of the structural frame of a building or any other beam or column, and

(b) a loadbearing wall or loadbearing part of a wall, and

(c) a floor, and

(d) a gallery, and

(e) an external wall, and

(f) a compartment wall (including a separating wall).

(However, see B3, paragraph 1.4, for exclusions from the provisions for elements of structure).

Emergency lighting - See B1

Escape Lighting - See B1

Evacuation lift - See B1

External wall - See B4

Final exit - See B1

Fire door - A door or shutter, 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 resist the passage of fire and/or gaseous products of combustion, and is capable of meeting specified performance criteria to those ends. (It may have one or more leaves and 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).

Firefighting lift - See B5

Firefighting lobby - See B5

Firefighting shaft - See B5

Firefighting stairway - See B5

Fire stop - See B3

Flat - A dwelling forming part of a large building that has all its rooms on one level or, in the case of 'split level' flats, not more than half a storey height.

Floor area - in relation to a building means the area bounded by the inner finished surfaces of the enclosing walls, or, on any side where there is no enclosing wall, by the outermost edge of the floor on that side and in calculating the area of a building or part of a building there shall be included in such area the space occupied by any walls, shafts, ducts or structure within the area being measured. (See Diagram C1 of Appendix C).

Gallery - A floor, including a raised storage area, which is less than one-half of the area of the space into which it projects.

Habitable room - See B1

Height (of a building or storey) - (or of part of a building which is completely separated throughout, both below and above ground, by a compartment wall or compartment walls in the same continuous vertical plane) means the height of such building or part measured from the mean level of the ground adjoining the outside of the external wall of the building to the level of half the vertical height of the roof of the building or part, or to the top of the walls or of the parapet (if any), whichever is the higher. (See Diagram C4 of Appendix C).

Inner room - See B1

Maisonette - A dwelling forming part of a large building, which has its rooms divided between two or more levels which are more than half a storey height apart.

Materials of limited combustibility - See Appendix A, paragraph A16 and Table A7.

Means of escape - See B1

Measurement
For area, cubic capacity, height of a building and number of storeys) - See Appendix C, Diagrams C1 to C5. For occupant capacity, seatway, travel distance and width of a doorway, escape route and a stairway - See B1, paragraph 1.0.10.

Non-combustible - See Appendix A, paragraph A17 and Table A8

Notional boundary - See B4

Occupancies - See B

Open spatial planning - See B1

Perimeter (of Building) - See B5

Pipe - See B3

Places of special fire risk - See B1

Platform floor - See B3

Pressurization - See B1

Protected corridor/escape route lobby - See B1

Protected shaft - A shaft which enables persons, air or objects to pass from one compartment to another and is enclosed with fire-resisting construction

Protected stairway - An internal stair which is adequately protected from fire in the accommodation through which it passes by fire-resisting construction, and discharges through a final exit to a place of safety.

Purpose group - See Paragraph 0.3.2, and Table 0.1

Relevant boundary - See B4

Rooflight - See B2 or B4

Room - See B2

Separated part (of a building) - A form of compartmentation that is a part which is separated from another part of the same building by a compartment wall which runs full height of the part and is in one plane. (See Appendix C, Diagram C3).

Separating wall - A compartment wall which separates adjoining buildings

Sheltered Housing - See B1

Single storey building - A building consisting of a ground storey or a basement storey only. (A separated part which consists of a ground storey only, with a roof to which access is just for repair or maintenance, may be treated as a part of a single storey building).

Storey - See B1

Storey exit - See BI

Suspended ceiling (fire protecting) - See Appendix A, Table A3, for different types.

Thermoplastic material - See Appendix A, paragraph A14

Travel distance - See B1

Unprotected area - See B4

Wall - (for the purpose of B2) See B2.

APPENDIX E

ASSESSMENT OF RISK IN INDUSTRIAL AND STORAGE BUILDINGS

APPENDIX E

E1 Assessment of fire risk and associated life risk

As premises covered by this document can vary greatly in size and layout, the risk of fire can also vary considerably from one situation to another, particularly in industrial buildings where widely differing processes may be carried out and hazardous substances are stored or used. It is essential, therefore, that the fire precautions to be provided should be determined having regard to all relevant circumstances.

It is not possible to offer clear-cut, hard and fast rules for making these assessments but it is possible to describe in broad terms the kind of factors which will need to be considered to determine the level of fire risk which would place the premises, or part of the premises, into one of three categories of risk, ie: "high", "normal" or "low", thus enabling adoption of the appropriate fire precautions.

The details contained in the following paragraphs should be treated as broad indicators. It does not necessarily follow that the presence (or indeed the absence) of one of the factors mentioned in the description of risk category inevitably means that the premises or part of the premises have to be placed in the "high" or "low" categories. It is likely that in many industrial buildings there will be a mixture of risks. It is emphasised that all factors should be considered, including any automatic fire detection and suppression system which may be installed, such as sprinklers installed for the overall protection of the building, or other fire extinguishing systems covering specific areas of special fire risk. The presence of any of these systems may significantly reduce the dangers of rapid fire growth and consequently may have a bearing on the final risk assessment.

E2 Assessment of high risk

Factors which lead to the assessment of premises or parts of the premises as being of high risk include the following:-

(a) the presence of materials likely, when ignited, to cause the rapid spread of fire, smoke or fumes. This is the factor most likely to justify treating the risk as high. The materials may be solid, liquid, or gaseous and as well as the normal forms may be present as dust, spray, mist or vapour.

(b) the presence of undesirable features such as complex escape routes caused by extensive sub-division of large floor areas by partitions, or machinery.

(c) unusual circumstances relating to occupants, either those permanently at work in the premises or the public resorting thereto, such as:-

  (i) large numbers of persons present relative to the size of the building;

  (ii) a high proportion of disabled occupants;

  (iii) individuals or small groups of people working in isolated parts of the building;

(d) certain areas which, due to their function, may present a greater risk of fire occurring and developing than elsewhere such as:-

  (i) manufacturing processes handling highly flammable liquids;

(ii) large kitchens associated with restaurants (public or staff);

(iii) oil-fired boiler rooms;

(iv) transformer or switchgear rooms.

E3 Assessment of normal risk

Where a risk is regarded as "normal" it is considered that the circumstances are such that any outbreak of fire is likely to remain localised or is likely to spread only slowly; and where there is little risk of any part of the structure of the building taking fire readily.

E4 Assessment of low risk

In a very small percentage of premises all the factors to be considered will be favourable and it will be reasonable to accept standards of precautions in some respects much lower than those recommended for normal situations in industrial (or parts of buildings) where there are very few flammable and no explosive materials present and where the risk of fire breaking out and smoke or fumes spreading rapidly is minimal. Buildings (or parts of buildings) used for heavy engineering can often be placed in this category. Other examples are places where the process is entirely a wet one and non-combustible materials predominate.

E5 Hazardous materials

Materials falling within the following general descriptions should be considered as hazardous materials

(i) any compressed, liquified or dissolved gas;

(ii) any substance which becomes dangerous by interaction with either water or air;

(iii) any liquid substance with a flash point below 65° Celsius including whiskey or other spirituous liquor;

(iv) any corrosive substance;

(v) any substance that emits poisonous fumes when heated;

(vi) any oxidising agent;

(vii) any substance liable to spontaneous combustion;

(viii) any substance that changes or decomposes readily giving out heat when doing so;

(ix) any combustible solid substance with a flash point less than 121° Celcius;

(x) any substance likely to spread fire by flowing from one part of a building to another.

APPENDIX F

REFERENCE STANDARDS

STANDARDS REFERRED TO IN B1

BS 5266 Emergency lighting
Part 1: 1988 Code of practice for the emergency lighting of premises other than cinemas and certain other specified premises used for entertainment.

BS 5499 Fire safety signs, notices and graphic symbols
Part 1: 1984 Specification for fire safety signs

BS 5588 Fire precautions in the design, construction and use of buildings
Part 1: 1990 Code of practice for residential buildings
Part 2: 1985 Code of practice for shops
Part 3:1983 Code of practice for office buildings
Part 4: 1978 Code of practice for smoke control in protected escape routes using pressurization
Part 8: 1988 Code of practice for means of escape for disabled people
Part 9:1989 Code of practice for ventilation and air conditioning ductwork

BS 5720: 1979 Code of practice for mechanical ventilation and air conditioning in buildings

BS 5839 Fire detection and alarm systems for buildings
Part 1: 1988 Code of practice for system design, installation and servicing

BS 5906: 1980 Code of practice for storage and on-site treatment of solid waste from buildings

BS 5925 : 1991 Code of practice for ventilation principles and designing for natural ventilation

BS 6387: 1983 Specification for performance requirements for cables required to maintain circuit integrity under fire conditions

CP 1007: 1955 Maintained lighting for cinemas

IS 409 : 1988: Self-contained smoke detectors for private dwellings.

IS 3217: 1989: Code of Practice for Emergency Lighting

IS 3218: 1989 Fire Detection and Alarm Systems

STANDARDS REFERRED TO IN B2

BS 476 Fire tests on building materials and structures
Part 6 : 1989 Method of test for fire propogation for products
Part 7 : Method for the classification of the surface spread of flame of products

BS 2782 Methods of testing plastics
Part 1 : Thermal properties : methods 120A to 120E : 1990
Part 1 : Thermal properties : Method 140D : 1987
Part 1 : Thermal properties : method 140E : 1988

BS 5438 : 1976 Methods of test for flammability of vertically oriented textile fabrics and fabric assemblies subject to a small igniting flame.

STANDARDS REFERRED TO IN B3

BS 4514: 1983 Specification for unplasticized PVC soil and ventilating pipes, fittings and accessories

BS 5255: 1989 Specification for plastic waste pipe and fittings

BS 5306 Fire extinguishing installations and equipment on premises
Part 2: 1990 Specification for sprinkler systems

BS 5588 Fire precautions in the design, construction and use of buildings
Part 9: 1989 Code of practice for ventilation and airconditioning ductwork

BS 5720: 1979 Code of practice for mechanical ventilation and air conditioning in buildings

STANDARDS REFERRED TO IN B4

BS 476: Fire tests on building materials and structures

Part 3: 1958 External fire exposure roof tests

BS 5306 Fire extinguishing installations and equipment on premises

Part 2: 1979 Sprinkler systems

STANDARDS REFERRED TO IN B5

BS 336:1989 Specification for fire hose couplings and ancillary equipment

BS 3251 : 1976 Specification Indicator plates for fire hydrants and emergency water supplies

BS 5306 Fire extinguishing installations and equipment on premises

Part 1: 1976 Hydrant systems, hose reels and foam inlets

Part 2: 1979 Sprinkler systems

BS 5588 Fire precautions in the design, construction and use of buildings

Part 5: 1991 Code of practice for firefighting stairways and lifts

STANDARDS REFERRED TO IN APPENDIX A

BS 476: Fire tests on building materials and structures

Part 3: 1958 External fire exposure roof tests

Part 4: 1970 Non-combustibility test for materials

Part 6: 1968 Fire propagation test for materials

Part 6: 1981 Method of test for fire propagation for products

Part 6: 1989 Method of test for fire propagation for products

Part 7: 1971 Surface spread of flame tests for materials

Part 7: 1987 Method for classification of the surface spread of flame of products

Part 8: 1972 Test methods and criteria for the fire resistance of elements of building construction

Part 11: 1982 Method for assessing the heat emission from building products

Part 20: 1987 Method for determination of the fire resistance of elements of construction (general principles)

Part 21: 1987 Methods for determination of the fire resistance of loadbearing elements of construction

Part 22: 1987 Methods for determination of the fire resistance of non-loadbearing elements of construction

Part 23: 1987 Methods for determination of the contribution of components to the fire resistance of a structure

Part 24: 1987 Method for determination of the fire resistance of ventilation ducts

BS 2782: 1970 Methods of testing plastics

BS 2782 Methods of testing plastics. Part 1. Thermal properties.

Methods 120A to 120E: 1976
Determination of the Vicat softening temperature of thermoplastics

Method 140D: 1980
Flammability of a test piece 550 mm X 35 mm of thin polyvinyl chloride sheeting (laboratory method)

Method 140E: 1982
Flammability of a small inclined test piece exposed to an alcohol flame (laboratory method)

BS 5306 : Part 2: 1990 Specification for sprinkler systems

BS 5438: 1976 Methods of test for flammability of vertically oriented textile fabrics and fabric assemblies subjected to a small igniting flame

BS 5588 Fire precautions in the design, construction and the use of buildings

Part 1 : 1990 Code of practice for residential buildings

BS 5867 Specification for fabrics for curtains and drapes

Part 2: 1980 Flammability requirements

I.S. 20 : 1974 Concrete Building Blocks

I.S. 20: Part 1:1987 Concrete Building Blocks Part 1, Normal Density Blocks

I.S. 189 : 1974 Concrete Building Bricks

BS 6336: 1982 Guide to development and presentation of fire tests and their use in hazard assessment

P 144 Roof coverings

Part 3: 1970 Built-up bitumen felt

PD 6520: 1988 Guide to fire test methods for building materials and elements of construction

STANDARDS REFERRED TO IN APPENDIX B

BS 476 Fire tests on building materials and structures

Part 8: 1972 Test methods and criteria for the fire resistance of elements of building construction

Part 22: 1987 Methods for determination of the fire resistance of non-loadbearing elements of construction

Section 31.1: 1983.

Methods of measuring smoke penetration through doorsets and shutter assemblies. Measurement under ambient temperature conditions

BS 5499: Fire safety signs, notices and graphic symbols

Part 1: 1984 Specification for fire safety signs

BS 5588. Fire precautions in the design, construction and use of buildings

Part 4: 1978 Code of practice for smoke control in protected escape routes using pressurization.

I.S. 36 : Part 1 : 1987 Bitumen Roofing Felts, Part 1, Fibre and Glass Fibre Based Felts

I.S. 36 : Part 2 : 1987 Bitumen Roofing Felts, Part 2, Polyester Based Felts.

I.S. 413: 1989 Safety Colours and Safety Signs

APPENDIX G

REFERENCE PUBLICATIONS

OTHER PUBLICATIONS REFERRED TO

B1

* S.I. No. 249 of 1985 Fire Safety in Places of Assembly (Ease of Escape) Regulations.
* Technical Guidance Document K. Stairways, ramps and guards.
* Fire Prevention Guide No. 1. Fire precautions in town centre redevelopment. (Home Office) HMSO, 1972.
* Design principles for smoke ventilation in enclosed shopping centres. BRE, [1990]. (Revision of Smoke control methods in enclosed shopping complexes of one or more storeys. A design summary. (BRE) HMSO, 1979).
* Firecode. HTM 81. Fire precautions in new hospitals. (DHSS) HMSO, 1987.
* Firecode. Nucleus fire precautions recommendations (D of H) HMSO, 1989.
* Building Bulletin 7. Fire and the design of educational buildings. (DES) HHSO, 1988.

B2

* Code of Practice for Fire Safety of Furnishings and Fittings in Places of Assembly (DoE).

B3

* Fire Prevention Guide No. 1. Fire precautions in town centre redevelopment. (Home Office) HMSO, 1972.
* Design principles for smoke ventilation in enclosed shopping centres. BRE, [1990]. (Revision of Smoke control methods in enclosed shopping complexes of one or more storeys. A design summary. (BRE) HMSO, 1979).

B4

* Building separation and boundary distances, BRE, [1990]
* Portal frames in boundary conditions, 19XX (available from the Steel Construction Institute, Silwood Park, Ascot, Berks, SL5 7PY).
* Fire Research Technical Paper No. 5, 1963.

Appendix A

* Guidelines for the construction of fire-resisting structural elements. BRE, 1988.
* Increasing the fire resistance of existing timber floors. BRE Digest 208, 1988.
* Fire Grading of Buildings, Part 1. General Principles and Structural Precautions. Post-War Building Studies No. 20. HMSO, 1946.
* Fire test results on building products: surface spread of flame. FPA, 1979 (updated 1981).
* Fire test results on building products: fire propagation. FPA, 1980 (updated 1986).
* Fire test results on building products: fire resistance. FPA, 1983.
* Rules for the construction and installation of firebreak doors and shutters. LPC, 1988.
* Fire protection for structural steel in buildings. ASFPCM, 1988.
* Regulations for Electrical Installations 15th Edition 1981 Institution of Electrical Engineers.

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