

# The Gibraltar Building Rules – As Amended

**APPROVED DOCUMENT**

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**E**

**FIRE SAFETY**

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|-----------|--|
| <b>E1</b> | <b>Means of warning and escape</b>                           |
| <b>E2</b> | <b>Internal fire spread (linings)</b>                        |
| <b>E3</b> | <b>Internal fire spread (structure)</b>                      |
| <b>E4</b> | <b>External fire spread</b>                                  |
| <b>E5</b> | <b>Access and facilities for the fire and rescue service</b> |

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### E0 Introduction

#### E0.1 Description and objectives

- 1) This Approved Document provides practical guidance with respect to Part E of the Building Rules which deal with fire safety.
- 2) This Document is intended to provide guidance for some of the more common building situations. However, there may well be alternative ways of achieving an adequate level of fire safety. Thus there is no obligation to adopt any particular solution contained in this Document if you prefer to achieve an adequate level of fire safety in some other way, provided that the alternative solutions have the approval of the authority that enforces building control.
- 3) This Document does not require anything to be done except for the purpose of securing reasonable standards of health and safety for people in or about buildings (and any others who may be affected by buildings or matters connected with buildings).

#### E0.2 Materials and workmanship

- 1) Any building work to which the Building Rules apply should be carried out with proper materials and in a workmanlike manner.
- 2) There are many independent product certification schemes. Such schemes certify compliance with the requirements of a recognised document which is appropriate to the purpose for which the product is to be used.
- 3) Products which are not so certified may still conform to a relevant standard.
- 4) Many certification bodies which approve such schemes are accredited by the United Kingdom Accreditation Service (UKAS). Since the fire performance of a product, component or structure is dependent upon

satisfactory site installation and maintenance, independent schemes of certification and accreditation of installers and maintenance firms of such will provide confidence in the appropriate standard of workmanship being provided.

- 5) Building Control may accept the certification of products, components, materials or structures under such schemes as evidence of compliance with the relevant standard. Similarly, Building Control may accept the certification of the installation or maintenance of products, components, materials or structures under such schemes as evidence of compliance with the relevant standard. Nonetheless, Building Control will wish to establish, in advance of the work, that any such scheme is adequate for the purposes of the Building Rules.

#### E0.3 Technical specifications

- 1) Building Rules are made for specific purposes including: health and safety, energy conservation and the welfare and convenience of people. Standards and technical approvals are relevant guidance to the extent that they relate to these considerations. However, they may also address other aspects of performance such as serviceability, or aspects which, although they relate to health and safety, are not covered by the Rules.
- 2) When this Document makes reference to a named standard, if this version of the standard has been revised or updated by the issuing standards body, the new version may be used as a source of guidance provided it continues to address the relevant requirements of the Building Rules.
- 3) The appropriate use of a product which complies with a European Technical Approval as defined in the Construction Products Directive should meet the relevant requirements.

### E0.4 Arrangement of sections in this document

1) Fire safety recommendations are presented in five sections, E1 to E5. At the beginning of each section there are general functional requirements for that section. These are followed by an introduction to the subject and paragraphs containing appropriate recommendations on how the respective functional requirements may be achieved.

2) The provisions set out in this Document deal with different aspects of fire safety, with the following aims.

E1: To ensure satisfactory provision of means of giving an alarm of fire and a satisfactory standard of means of escape for people in the event of fire in a building.

E2: To ensure fire spread over the internal linings of buildings is inhibited.

E3: To ensure the stability of buildings in the event of fire; to ensure that there is a sufficient degree of fire separation within buildings and between adjoining buildings; to provide automatic fire suppression where necessary; and to inhibit the unseen spread of fire and smoke in concealed spaces in buildings.

E4: To ensure external walls and roofs have adequate resistance to the spread of fire over the external envelope and that spread of fire from one building to another is restricted.

E5: To ensure satisfactory access for fire appliances to buildings and the provision of facilities in buildings to assist firefighters in the saving of life of people in and around buildings.

3) Whilst guidance appropriate to each of these aspects is set out separately in this

Document, many of the provisions are closely interlinked.

4) For example, there is a close link between the provisions for means of escape, E1, and those for the control of fire growth, E2, fire containment, E3, and facilities for the fire and rescue service, E5. Similarly there are links between E3 and the provisions for controlling external fire spread, E4, and between E3 and E5. 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. The guidance in the document as a whole should be considered as a package aimed at achieving an acceptable standard of fire safety.

5) In the guidance on E1 the provisions for houses and flats are separated from those for all other types of building because there are important differences in the approach that has been adopted.

6) Appendices deal with guidance on matters that refer to more than one of the sections. They cover the following subjects:

- Appendix A: Performance of materials, products and structures
- Appendix B: Fire doors
- Appendix C: Methods of measurement
- Appendix D: Purpose groups
- Appendix E: Definitions
- Appendix F: Fire behaviour of insulating core panels used for internal structures
- Appendix G: Fire safety information
- Appendix H: Commentaries on some of the guidance.

7) Paragraph numbers with asterisks are, in electronic versions of this Document, hyperlinks to commentaries in Appendix H. Paragraph numbers in Appendix H are hyperlinks back to the respective paragraphs in the main body of text.

## E0 Introduction

### E0.4.1 Fire performance of materials, products and structures

1) Much of the guidance throughout this Document is 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 the case of fire protection systems, reference is made to standards for systems design and installation.

### E0.4.2 Fire doors

1) Guidance in respect of fire doors is set out in Appendix B.

### E0.4.3 Methods of measurement

1) Some form of measurement is an integral part of much of the guidance in this Document and methods are set out in Appendix C.

### E0.4.4 Purpose groups

1) Much of the guidance in this Document is related to the use of the building. The use classifications are termed purpose groups and they are described in Appendix D.

### E0.4.5 Definitions

1) Definitions are given in Appendix E.

### E0.4.6 Fire safety Information

1) Where building work is carried out which affects fire safety the person carrying out the work should provide sufficient information for people to operate and maintain the building in reasonable safety.

2) This information will assist the eventual owner/occupier/employer to meet their statutory fire safety duties.

3) The exact amount of information and level of detail necessary will vary depending

on the nature and complexity of the building's design.

4) For small buildings, basic information on the location and nature of fire protection measures may be all that is necessary.

5) For larger buildings, it will be necessary that a more detailed record of the fire safety strategy and procedures for operating and maintaining any fire protection measures of the building are passed to the building owner, occupier or manager as appropriate.

6) Appendix G provides advice on the sort of information that should be provided.

## E0.5 Application of the guidance in this Document

1) The guidance in this Document is designed to be applied to new buildings and to altered and extended parts of existing buildings. It is not designed to be applied to an existing building unless the risk in the existing building is worsened by proposed works.

## E0.6 Management of premises

1) This Document has been written on the assumption that the building concerned will be properly managed.

2) Building Rules do not impose any requirements on the management of a building. However, in developing an appropriate fire safety design for a building it may be necessary to consider the way in which it will be managed. A design which relies on an unrealistic or unsustainable management regime cannot be considered to have met the requirements of the Rules.

3) Once the building is in use the management regime should be maintained and any variation in that regime should be the subject of a suitable risk assessment.



## E0 Introduction

### E0.7 Property protection

1) There are often many stakeholders, including insurers, who have a valid interest in the fire protection measures which are incorporated into a building's design. To ensure that the most effective fire protection measures are applied which are appropriate to the specific property, early consultation with the main stakeholders is essential. Failure to consult with stakeholders at an early stage could result in additional measures being required after completion, the use of the building being restricted, or insurance premiums and/or deductibles being increased.

2) Building Rules are intended to ensure that a reasonable standard of life safety is provided, in case of fire. The protection of property, including the building itself, often requires additional measures and insurers will, in general, seek their own higher standards, before accepting the insurance risk.

3) Insurers' key objectives for achieving satisfactory standards of property protection are:

- a) to limit damage to the fabric of the building caused by heat, smoke and firefighting water.
- b) to limit damage to the contents of the building caused by heat, smoke and firefighting water.
- c) to allow the business to be trading in as short a time as possible following a fire, thus limiting business interruption.

### E0.8 Independent schemes of certification and accreditation

1) Since the performance of a system, product, component or structure is dependent upon satisfactory site installation, testing and maintenance, independent schemes of certification and accreditation of installers and maintenance firms of such will provide confidence in the appropriate standard of workmanship being provided.

2) Confidence that the required level of performance can be achieved will be demonstrated by the use of materials and products which are provided under the arrangements of a product conformity certification scheme.

3) Third party accredited product conformity certification schemes not only provide a means of identifying materials and designs of systems, products or structures which have demonstrated that they have the requisite performance in fire, but additionally provide confidence that the systems, materials, products or structures actually supplied are provided to the same specification or design as that tested or assessed.

4) Building Control may accept the certification of products, components, materials or structures under such schemes as evidence of compliance with the relevant standard. However, Building Control will wish to establish, in advance of the work, that any such scheme is adequate for the purposes of the Building Rules.

### E0.9 Sprinkler systems

#### E0.9.1 Buildings other than dwelling houses

1) Sprinkler systems installed in buildings can reduce the risk to life and significantly reduce the degree of damage caused by fire. Sprinkler protection can also sometimes be used as a compensatory feature where the provisions of this Document are varied in some way. Where sprinklers are provided, it is normal practice to provide sprinkler protection throughout a building. However, where the sprinklers are being installed as a compensatory feature to address a specific risk or hazard, it may be acceptable to protect only part of a building.

Further guidance can also be found in *Sprinklers for Safety: Use and Benefits of Incorporating Sprinklers in Buildings and Structures*, BAFSA, 2006.

## E0 Introduction

2) There are many alternative or innovative fire suppression systems available. Where these are used, it is necessary to ensure that such systems have been designed and tested for use in buildings and are fit for their intended purpose.

3) Where a sprinkler system is specifically recommended within this Document it should be provided throughout the building or separated part and be designed and installed in accordance with either:

- a) for dwellings and residential buildings, *BS 9251:2014 Sprinkler systems for residential and domestic occupancies – Code of practice* and *BS 9252:2011 Components for residential sprinkler systems – Specification and test methods for residential sprinklers*; or
- b) for non-residential buildings or dwellings and residential buildings outside the scope of *BS 9251*, the requirements of *BS EN 12845:2004*, including the relevant hazard classification together with the special requirements for life safety systems.

4) Any sprinkler system installed to satisfy the requirements of Part E of the Building Rules should be regarded as a life safety system. However, there may be some circumstances where a particular life safety requirement, specified in *BS EN 12845* is inappropriate or unnecessary.

5) Water supplies for non-residential sprinkler systems should consist of:

- a) two single water supplies complying with *BS EN 12845*, clause 9.6.1 where each is independent of the other; or
- b) two stored water supplies, where:
  - i. gravity or suction tanks should satisfy all the requirements of *BS EN 12845* clause 9.6.2 b) other than capacity; and
  - ii. any pump arrangements should comply with *BS EN 12845* clause 10.2 and
  - iii. the capacity of each tank is equivalent to half the specified

minimum water volume of a single full capacity tank, appropriate to the hazard; or

iv. one tank should be at least equivalent to half the specified water volume of a single full capacity tank and the other shall not be less than the minimum volume of a reduced capacity tank (the requirement for inflow should be met) *BS EN 12845* clause 9.3.4, appropriate to the hazard; and

v. whichever water storage arrangement is used at (3) or (4) above, the total capacity of the water supply, including any inflow for a reduced capacity tank should be at least equivalent to a single full holding capacity tank complying with *BS EN 12845*, Table 9, 10 or clause 9.3.2.3 as appropriate to the hazard and pipework design.

6) Where pumps are used to draw water from two tanks, then each pump should be arranged to draw water from either tank and arranged so that any one pump or either tank could be isolated. The sprinkler water supplies should generally not be used as connections for other services or other fixed firefighting systems.

### E0.9.2 Dwelling houses

1) Sprinkler systems installed in dwelling houses can reduce the risk to life and significantly reduce the degree of damage caused by fire. Sprinkler protection can also sometimes be used as a compensatory feature where the provisions of this document are varied in some way.

2) Where a sprinkler system is recommended within this Document it should be designed and installed in accordance with *BS 9251:2014 Sprinkler systems for residential and domestic occupancies – Code of practice* and *BS 9252:2011 Components for residential sprinkler systems – Specification and test methods for residential sprinklers*.

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3) Where sprinklers are provided, it is normal practice to provide sprinkler protection throughout the building. However, where the sprinklers are being installed as a compensatory feature to address a specific risk or hazard it may be acceptable to protect only part of a building.

4) Further guidance can also be found in *Sprinklers for Safety: Use and Benefits of Incorporating Sprinklers in Buildings and Structures*, BAFSA, 2006.

5) There are many alternative or innovative fire suppression systems available. Where these are used it is necessary to ensure that such systems have been designed and tested for use in domestic buildings and are fit for their intended purpose.

### E0.10 Inclusive design

1) The fire safety aspects of the Building Rules are made for securing reasonable standards of health and safety of people in and about buildings. This is intended to include all people, including people with disabilities.

2) Reasonable provision for access by people to buildings should be provided.

3) People, regardless of disability, age or gender, should be able to gain access to buildings and use their facilities, both as visitors and as people who live or work in them.

4) As such the fire safety measures incorporated into a building will need to take account of the needs of all those people who may have access to the building. It is not appropriate, except in exceptional circumstances, to presume that certain groups of people will be excluded from a building because of its use.

5) The provisions set out in this Document are considered to be a reasonable standard for most buildings. However, there may be some people whose specific needs are not addressed. In some situations additional

measures may be needed to accommodate these needs. This should be done on a case by case basis.

### E0.11 Material alteration

1) An alteration which, at any stage of the work, results in a building being less satisfactory than it was before in relation to compliance with the requirements of sections E1, E3, E4 or E5 is a material alteration.

2) Any building work carried out in relation to a material alteration should be such that once that building work has been completed, the building as a whole must comply with the Building Rules or, where it did not comply before, must be no more unsatisfactory than it was before the work was carried out.

### E0.12 Alternative approaches

1) The fire safety requirements of the Building Rules should be satisfied by following the relevant guidance given in this Document.

2) However, this Document is intended to provide guidance for some of the more common building situations and there may well be alternative ways of achieving compliance with the requirements.

3) If other codes or guides are adopted, the relevant recommendations concerning fire safety in the particular publication should be followed, rather than a mixture of the publication and provisions in the relevant sections of this Document. However, there may be circumstances where it is necessary to use one publication to supplement another.

4) Guidance documents intended specifically for assessing fire safety in existing buildings will often include provisions which are less onerous than those set out on this Document or other standards applicable to new buildings. As such, these documents are unlikely to be appropriate for use where building work, controlled by the Building Rules is proposed.

## E0 Introduction

5) Buildings for some particular industrial and commercial activities presenting a special fire hazard, e.g. those involved with the sale of fuels, may require additional fire precautions to those detailed in this Document.

### E0.12.1 British Standards

- 1) Compliance with a British Standard does not of itself confer immunity from legal obligations. British Standards can, however, provide a useful source of information which could be used to supplement or provide an alternative to the guidance given in this Document.
- 2) When this Document makes reference to a named standard, the relevant version of the standard is the one that is current at the time of publication of this Document. However, where standards have been revised or updated by the issuing standards body, the newer versions of standards may be used as sources of guidance provided that they continue to address the relevant requirements of the Building Rules.
- 3) Drafts for Development (DDs) are not British Standards. They are issued in the DD series of publications and are of a provisional nature. They are intended to be applied on a provisional basis so that information and experience of their practical application may be obtained and the document developed. Where the recommendations of a DD are adopted then care should be taken to ensure that the requirements of the Building Rules are adequately met. Any observations that a user may have in relation to any aspect of a DD should be passed on to BSI.

### E0.12.2 Health care premises

- 1) Health care premises are quite diverse and can be used by a variety of patients, often requiring different types of care to suit their specific needs. The choice of fire safety strategy is dependent upon the way a building is designed, furnished, staffed and managed and the level of dependency of the patients.

2) In parts of health care premises designed to be used by patients where there are people who are bedridden or who have very restricted mobility, the principle of total evacuation of a building in the event of fire may be inappropriate. It is also unrealistic to suppose that all patients will leave without assistance. In this and other ways the specialised nature of some health care premises demands a different approach to the provision of means of escape, from much of that embodied by the guidance in this Document.

3) The Department of Health in the UK has prepared a set of guidance documents on fire precautions in health care buildings, under the general title of 'Firecode', taking into account the particular characteristics of these buildings. These documents may also be used for non-NHS health care premises. The design of fire safety in health care premises is covered by *Health Technical Memorandum (HTM) 05-02 Guidance in support of functional provisions for healthcare premises*. Part E of the Building Rules will typically be satisfied where the guidance in that document is followed. Where work to existing healthcare premises is concerned the guidance in the appropriate section of the relevant *Firecode* should be followed.

### E0.12.3 Unsupervised group homes

- 1) Where an existing house of one or two storeys is to be put to use as an unsupervised group home for not more than six mental health service users, it should be regarded as a Purpose Group 1(c) building if the means of escape are provided in accordance with *HTM 88: Fire Precautions in Housing Providing NHS-Supported Living in the Community*.
- 2) Where the building is new, it may be more appropriate to regard it as being in Purpose Group 2(b).
- 3) *Firecode* contains managerial and other fire safety provisions which are outside the scope of Building Rules.

### E0.12.4 Shopping complexes

1) Although the guidance in this Document may be readily applied to individual shops, shopping complexes present a different set of escape problems. The design of units within a shopping complex should be compatible with the fire strategy for the complex as a whole. A suitable approach is given in *BS 9999 Code of practice for fire safety in the design, management and use of buildings*.

2) *BS 9999* applies more restrictive provisions to units with only one exit in covered shopping complexes.

### E0.12.5 Assembly buildings

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.

2) Guidance on this and other aspects of means of escape in assembly buildings is given in *BS 9999* Annex D and the relevant recommendations concerning means of escape in case of fire of that code should be followed in appropriate cases. In the case of stadia, the *Guide to safety at sports grounds*, TSO, should also be followed.

### E0.12.6 Schools

1) The design of fire safety in schools is covered by the UK guide *Schools* published by the DfES. Part E requirements will typically be satisfied where the life safety guidance in that document is followed.

### E0.12.7 Buildings containing one or more atria

1) A building containing an atrium passing through compartment floors may need special fire safety measures. Guidance on suitable fire safety measures in these circumstances is to be found in *BS 9999* Annexes B and C. For shopping complexes see paragraph 0.12.4.

### E0.12.8 Sheltered housing

1) Whilst many of the provisions in this Document for means of escape from flats are applicable to sheltered housing, the nature of the occupancy may necessitate some additional fire protection measures. The extent will depend on the form of the development. For example, a group of specially adapted bungalows or two-storey flats, with few communal facilities, need not be treated differently from other one or two-storey dwelling houses or flats.

### E0.12.9 Fire safety engineering

1) Fire safety engineering can provide an alternative approach to fire safety. It may be the only practical way to achieve a satisfactory standard of fire safety in some large and complex buildings and in buildings containing different uses, e.g. airport terminals. Fire safety engineering may also be suitable for solving a problem with an aspect of the building design which otherwise follows the provisions in this Document.

2) British Standard *BS 7974 Fire safety engineering* in buildings and supporting published documents (PDs) provide a framework and guidance on the design and assessment of fire safety measures in buildings. Following the discipline of *BS 7974* should enable designers and Building Control to be aware of the relevant issues, the need to consider the complete fire-safety system and to follow a disciplined analytical framework.

3) Factors that should be taken into account include:

- a) the anticipated probability of a fire occurring;
- b) the anticipated fire severity;
- c) the ability of a structure to resist the spread of fire and smoke; and
- d) the consequential danger to people in and around the building.

## E0 Introduction

4) A wide variety of measures could be considered and incorporated to a greater or lesser extent, as appropriate in the circumstances.

These include:

- a) the adequacy of means to prevent fire;
- b) early fire warning by an automatic detection and warning system;
- c) the standard of means of escape;
- d) provision of smoke control;
- e) control of the rate of growth of a fire;
- f) structural robustness and the adequacy of the structure to resist the effects of a fire;
- g) the degree of fire containment;
- h) fire separation between buildings or parts of buildings;
- i) the standard of active measures for fire extinguishment or control;
- j) facilities to assist the fire and rescue service;
- k) availability of powers to require staff training in fire safety and fire routines;
- l) consideration of the availability of any continuing control under other legislation that could ensure continued maintenance of such systems; and
- m) management.

5) It is possible to use quantitative techniques to evaluate risk and hazard. Some factors in the measures listed above can be given numerical values in some circumstances. The assumptions made when quantitative methods are used need careful assessment.

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.

### **E0.12.10 Buildings of special architectural or historic interest**

1) Some variation of the provisions set out in this Document may also be appropriate where Part E applies to existing buildings, particularly in buildings of special architectural or historic interest, where adherence to the guidance in this Document might prove unduly restrictive. In such cases



## E1 Means of warning and escape

### E1 Means of warning and escape

#### The Requirement

This section deals with the following requirement

##### Requirement

##### Means of warning and escape

E1. The building shall be designed and constructed so that there are appropriate provisions for the early warning of fire and appropriate 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 at all material times.

##### Limits on application

Requirement E1 does not apply to any prison or other place of legal internment.

## E1 Means of warning and escape

### E1 Guidance

#### E1.1 Performance

1) In the view of H.M. Government of Gibraltar the requirement of E1 will be met if:

- a) there are routes of sufficient number and capacity, which are suitably located to enable people to escape to a place of safety in the event of fire;
- b) the routes are sufficiently protected from the effects of fire where necessary;
- c) the routes are adequately lit;
- d) the exits are suitably signed;
- e) there are appropriate facilities to either limit the ingress of smoke to the escape route(s) or to restrict the fire and remove smoke; and
- f) there is sufficient means for giving early warning of fire for people in or on the building;

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

2) These provisions relate to building work and material changes of use which are subject to the functional requirement E1 and they may therefore affect new or existing buildings. They are concerned with the measures necessary to ensure reasonable facilities for means of warning and escape in case of fire. They are only concerned with structural fire precautions where these are necessary to safeguard escape routes.

3) They assume that, in the design of the building, reliance should not be placed on external rescue by the Fire and Rescue Service nor should it be based on a presumption that the Fire and Rescue Service will attend an incident within a given time. This Document has been prepared on the basis that, in an emergency, the occupants of any part of a building should be able to escape safely without any external assistance.

4) Special considerations, however, apply to some institutional buildings in which the principle of evacuation with assistance from staff is necessary.

#### E1.2 Overview of the problem

1) The design of means of escape and the provision of other fire safety measures such as a fire alarm system, emergency lighting or fire exit signage, should be based on an assessment of the risk to the occupants in the event of a fire. The assessment should take into account the use of the building and the processes undertaken therein, the nature of the occupancy of the building, the storage of materials, potential ignition sources, the potential for fire spread through the building and the standard of fire safety management. Where it is not possible to identify with any certainty any of these elements, a judgement as to the likely level of provision must be made.

2) It is a basic assumption in fire safety that there is only one fire in a building at any one time. That is, unless there is very good reason to believe otherwise, two or more fires in different locations within a building at the same time are unlikely to occur and therefore this scenario is not addressed. Fire safety principles do not, however, ignore the possibility that a fire may spread in different directions within a building.

3) It is a primary aim of fire safety that the evacuation phase of a building is completed very soon after ignition. At this stage of the fire development it is usually the contents of a building that contribute most to a fire rather than the structure of a building. For this reason, when considering means of escape, the ignitability and the combustibility of the contents are usually more important considerations than the structure of the building itself.

4) The structure of the building has more significance when considering compartmentation, external fire spread and access and facilities for firefighters.



## E1 Means of warning and escape

5) This Document will refer to protected escape routes such as protected corridors and protected staircases and these escape routes are critical to the safe occupancy of a building. It is therefore assumed throughout this Document that any protected escape routes, whether stairs or corridors or lobbies, will be kept free of any combustible items other than the very limited fixtures and fittings that one would normally expect in such an area.

6) The recommendations within this Document are designed to limit the effects of fire and smoke to such an extent that the occupants of the building are very unlikely to experience the effects of the fire during an evacuation and those occupants in the immediate area where ignition occurs will only be subjected to minimal exposure to fire, heat or smoke.

### E1.3 Means of escape

1) The basic principles for the design of means of escape are as follows:

#### a) Moving away from the fire to safety

There should be alternative means of escape from most locations within the building.

#### b) Passing the fire to reach safety

Where building occupants do not have alternative means of escape and have to pass the fire they should be protected in one of two ways. Firstly, they may be protected by being separated from the fire by fire resisting construction. An example of this would be people descending a protected staircase with a fire on the ground floor. Secondly, the people in the immediate vicinity of the outbreak of fire should be able to pass the fire and further their escape whilst the fire is in its very incipient stages. This latter requirement gives rise to the concept of travel distance. By limiting travel distances, especially in dead-end situations or in rooms

with a single exit, it can be ensured that everyone can pass the fire whilst it is still very small and before it becomes a danger to anyone who has to pass it.

#### c) Places of relative safety

Where direct and immediate escape to a place of ultimate safety outside the building is not possible it should be possible for people to reach a place of relative safety. Protected staircases are considered places of relative safety due to their historic resilience to the ingress of smoke or fire. Protected corridors are not considered places of relative safety due to their history of unreliability in remaining clear of fire or smoke. Another location that can be considered a place of relative safety is a fire separated compartment but such a compartment can only be considered a place of relative safety where the escape route via the fire separated compartment is not the only escape route available. That is, there should be at least one other escape route from the compartment where a fire originates. All places of relative safety whether a protected staircase or a fire separated compartment should have means available for people to continue their escape from the building.

#### d) People with impaired mobility

Some people, such as those with impaired mobility, may not be able to use stairways without assistance. For them evacuation involving the use of refuges within places of relative safety and either assistance down stairways or the use of suitable lifts will be necessary.

## E1 Means of warning and escape

### e) Phased or zoned evacuations

Modern buildings which are large and complex may have means of escape that are phased or zoned throughout the building. Application of either of these principles requires detailed analysis to demonstrate that adequate safety levels will be attained wherever a fire may occur.

### f) Unacceptable devices

For the purposes of these recommendations the following are not acceptable as means of escape:

- lifts (except for suitably designed and installed evacuation lifts),
- portable ladders and throw-out ladders, and
- manipulative apparatus and appliances, e.g. fold down ladders and chutes.

Such devices are not prohibited by the Building Rules but they are not considered to be suitable alternatives to adequate means of escape.

### g) Escalators

Escalators are not normally counted as providing predictable exit capacity although it is recognised that they are likely to be used by people who are escaping. There may be times when it is necessary for escalators to come to a halt or even reverse during an evacuation. In other situations it may be safe for escalators to continue to operate normally during an evacuation. Similar principles apply to moving walkways. In some cases it is possible to treat escalators in the same way that accommodation staircases are treated. Whenever escalators or moving walkways are included in the means of escape provisions it should be demonstrated that such inclusion is safe and reliable.

## E1.4 Unprotected and protected escape routes

1) The unprotected part of an escape route is that part which a person has to traverse before reaching the safety of either a final exit, a storey escape, or a compartment exit. Unprotected parts of escape routes should be limited in extent so that people do not have to travel excessive distances while exposed to the immediate danger of fire and smoke. Exits from unprotected escape routes to the places of safety (whether relative safety or ultimate safety) have to be sufficiently large to allow everyone who may need to pass through that route to do so before untenable conditions may arise within the unprotected area. Once a person has entered a place of relative safety they can be considered to be safe from immediate danger from fire or smoke. They can then proceed to a place of ultimate safety at their own pace. To enable this to be done the flames, smoke and gases must be excluded from the places of relative safety as far as is reasonably possible by fire resisting structures or by an appropriate smoke control system or by a combination of both of these methods. Travel distances do not apply within places of relative safety. The levels of fire resistance recommended within this Document are designed to maintain places of relative safety as tenable locations for as long as may be required to fully evacuate the building.

## E1.5 Security

1) The need for easy and rapid evacuation of a building in case of fire may conflict with the control of entry and exit in the interest of security. Measures intended to prevent unauthorised access can also hinder entry of the fire and rescue service to deal with the fire. Potential conflicts should be identified and resolved at the design stage and not left to ad hoc expedients after installation.

2) This document does not intend for the types of lock used on windows and entrance doors to dwelling houses to be controlled under the Building Regulations.

## E1 Means of warning and escape

### E1.6 Fire alarms and fire detection systems

1) Recommendations are made in this section for suitable arrangements to be made in all buildings to give early warning in the event of fire.

#### E1.6.1 Dwelling houses

1) The installation of smoke alarms, or automatic fire detection and alarm systems can significantly increase the level of safety by automatically giving an early warning of fire. The following guidance is appropriate for most dwelling houses. However, where it is known that the occupants of a proposed dwelling house are at a special risk from fire, it may be more appropriate to provide a higher standard of protection, e.g. additional detectors.

2) All new dwelling houses should be provided with a fire detection and fire alarm system in accordance with the relevant recommendations of *BS 5839-6:2013* to at least a Grade D Category LD3 standard.

3) The smoke and heat alarms should be mains-operated and conform to *BS 5446-1:2000* or *BS 5446-2:2003*, respectively: *Fire detection and fire alarm devices for dwelling houses, Part 1 Specification for smoke alarms*; or *Part 2 Specification for heat alarms*. They should have a standby power supply, such as a battery (either rechargeable or non-rechargeable) or capacitor. More information on power supplies is given in clause 15 of *BS 5839-6:2013*.

4) *BS 5446-1* covers smoke alarms based on ionization chamber smoke detectors and optical (photo-electric) smoke detectors. The different types of detector respond differently to smouldering and fast-flaming fires. Either type of detector is generally suitable. However, the choice of detector type should, if possible, take into account the type of fire that might be expected and the need to avoid false alarms. Optical detectors tend to be less affected by low levels of 'invisible' particles, such as fumes from kitchens, that often cause

false alarms. Accordingly, they are generally more suitable than ionization chamber detectors for installation in circulation spaces adjacent to kitchens.

#### E1.6.1.1 Large houses

1) A dwelling house is regarded as large if it has more than one storey and any of those storeys exceed 200m<sup>2</sup>.

2) A large dwelling house of 2 storeys (excluding basement storeys) should be fitted with a fire detection and fire alarm system of Grade B category LD3 as described in *BS 5839-6:2013*.

3) A large dwelling house of 3 or more storeys (excluding basement storeys) should be fitted with a Grade A Category LD2 system as described in *BS 5839-6:2013*, with detectors sited in accordance with the recommendations of *BS 5839-1:2013* for a Category L2 system.

#### E1.6.1.2 Material alterations

1) Where new habitable rooms are provided above the ground floor level, or where they are provided at ground floor level and there is no final exit from the new room, a fire detection and fire alarm system should be installed. Smoke alarms should be provided in the circulation spaces of the dwelling house in accordance with section E1.6.1.4 to ensure that any occupants of the new rooms are warned of any fire that may impede their escape.

## E1 Means of warning and escape

### E1.6.1.3 Sheltered housing

- 1) The detection equipment in a sheltered housing scheme with a warden or supervisor should have a connection to a central monitoring point (or alarm receiving centre) so that the person in charge is aware that a fire has been detected in one of the dwelling houses and can identify the dwelling house concerned.
- 2) These provisions are not intended to be applied to the common parts of a sheltered housing development, such as communal lounges, or to sheltered accommodation in the Institutional or Other residential purpose groups.

### E1.6.1.4 Positioning of smoke and heat alarms

- 1) Detailed guidance on the design and installation of fire detection and alarm systems in dwelling houses is given in *BS 5839-6:2013*. However, the following guidance is appropriate to most common situations.
- 2) Smoke alarms should normally be positioned in the circulation spaces between sleeping spaces and places where fires are most likely to start (e.g. kitchens and living rooms) to pick up smoke in the early stages of a fire.
- 3) There should be at least one smoke alarm on every storey of a dwelling house.
- 4) Where more than one alarm is installed they should be linked so that the detection of smoke or heat by one unit operates the alarm signal in all of them. The manufacturers' instructions about the maximum number of units that can be linked should be observed.

- 5) Smoke alarms/detectors should be sited so that:
  - a) there is a smoke alarm in the circulation space within 7.5m of the door to every habitable room;
  - b) they are ceiling-mounted and at least 300mm from walls and light fittings (unless, in the case of light fittings, there is test evidence to prove that the proximity of the light fitting will not adversely affect the efficiency of the detector). Units designed for wall-mounting may also be used provided that the units are above the level of doorways opening into the space and they are fixed in accordance with manufacturers' instructions; and
  - c) the sensor in ceiling-mounted devices is between 25mm and 600mm below the ceiling (25-150mm in the case of heat detectors or heat alarms).
- 6) This guidance applies to ceilings that are predominantly flat and horizontal.
- 7) It should be possible to reach the smoke alarms to carry out routine maintenance, such as testing and cleaning, easily and safely. For this reason smoke alarms should not be fixed over a stair or any other opening between floors.
- 8) Smoke alarms should not be fixed next to or directly above heaters or air-conditioning outlets. They should not be fixed in bathrooms, showers, cooking areas or garages, or any other place where steam, condensation or fumes could give false alarms.
- 9) Smoke alarms should not be fitted in places that get very hot (such as a boiler room) or very cold (such as an unheated porch). They should not be fixed to surfaces which are normally much warmer or colder than the rest of the space, because the temperature difference might create air currents which move smoke away from the unit.

## E1 Means of warning and escape

### E1.6.1.5 Power supplies

- 1) The power supply for a smoke alarm system should be derived from the dwelling house's mains electricity supply. The mains supply to the smoke alarm(s) should comprise a single independent circuit at the dwelling house's main distribution board (consumer unit) or a single regularly used local lighting circuit. This has the advantage that the circuit is unlikely to be disconnected for any prolonged period. There should be a means of isolating power to the smoke alarms without isolating the lighting.
- 2) The electrical installation should comply with appropriate electrical safety codes.
- 3) Any cable suitable for domestic wiring may be used for the power supply and interconnection to smoke alarm systems. It does not need any particular fire survival properties except in large houses (*BS 5839-6:2013* specifies fire resisting cables for Grade A and B systems). Any conductors used for interconnecting alarms (signalling) should be readily distinguishable from those supplying mains power, e.g. by colour coding.
- 4) Mains-powered smoke alarms may be interconnected using radio-links, provided that this does not reduce the lifetime or duration of any standby power supply below 72 hours. In this case, the smoke alarms may be connected to separate power circuits (see paragraph E1.6.1.5 1))
- 5) Other effective options exist and are described in *BS 5839-1:2013* and *BS 5839-6:2013*. For example, the mains supply may be reduced to extra low voltage in a control unit incorporating a standby trickle-charged battery, before being distributed at that voltage to the alarms.

### E1.6.1.6 Design and installation of systems

- 1) It is essential that fire detection and fire alarm systems are properly designed, installed and maintained. Where a fire alarm system is installed, an installation and commissioning certificate should be provided. Third party certification schemes for fire protection products are an effective means of providing the fullest possible assurances, offering a level of quality, reliability and safety.
- 2) A requirement for maintenance cannot be made as a condition of passing plans by Building Control. However, the attention of developers and builders is drawn to the importance of providing the occupants with information on the use of the equipment, and on its maintenance (or guidance on suitable maintenance contractors). See paragraph E0.4.6.
- 3) *BS 5839-1* and *BS 5839-6* recommend that occupiers should receive the manufacturers' instructions concerning the operation and maintenance of the alarm system.

### E1.6.2 Flats

- 1) In most flats the installation of smoke alarms or automatic fire detection and alarm systems can significantly increase the level of safety by automatically giving an early warning of fire. The following guidance is appropriate for most flats. However, where it is known that the occupants of a proposed flat are at special risk from fire it may be more appropriate to provide a higher standard of protection (e.g. additional detectors or warning devices).

## E1 Means of warning and escape

2) All new flats should be provided with a fire detection and a fire alarm system in accordance with the relevant recommendations of *BS5839-6: 2013 Code of practise for the design, installation and maintenance of fire detection and fire alarm systems in dwellings*. The standard of installation should be to at least a grade D category, LD1 standard.

3) The smoke and heat alarms should be mains operated and conform to *BS5446-1: 2000* or *BS5446-2: 2003* respectively: *Fire detection and fire alarm devices for dwellings, part 1 Specification for smoke alarms*; or *part 2 Specification for heat alarms*. They should have a standby power supply such as a battery (either rechargeable or non-rechargeable) or capacitor. More information on power supplies is given in clause 15 of *BS 5839-6*.

4) *BS 5446-1* covers smoke alarms based on ionisation chamber smoke detectors and optical smoke detectors. The different types of detector respond differently to smouldering and fast flaming fires. Either type of detector is generally suitable. However, the choice of detector type should, if possible, take into account the type of fire that might be expected and the need to avoid false alarms. Optical detectors tend to be less affected by low levels of invisible particles, such as fumes from kitchens that often cause false alarms. Accordingly, they are generally more suitable than ionisation chamber detectors for installations in circulation spaces adjacent to kitchens.

5) Smoke alarms should be provided in the circulation spaces and habitable rooms of flats and in any other access rooms to ensure that all occupants of the flats are warned of any fire that may impede their escape.

### E1.6.2.1 Sheltered housing

1) The detection equipment in a sheltered housing scheme with a warden or supervisor should have a connection to a central monitoring point (or alarm receiving centre) so that the person in charge is aware that a fire has been detected in one of the flats and can identify the flat concerned. These provisions are not intended to be applied to the common parts of a sheltered housing development, such as communal lounges, or to sheltered accommodation in the institution or other residential purpose groups. Means of warning in such facilities should be considered on a case by case basis following the general guidance for buildings other than flats.

### E1.6.2.2 Student accommodation

1) Some student residential accommodation is constructed in the same way as a block of flats. Where groups of approximately six students share a self-contained flat with its own entrance door constructed on the compartmentation principles for flats, it is appropriate to provide a separate automatic detection system within each flat. Where general evacuation is required (e.g. halls of residence) the alarm system should follow the guidance for buildings other than flats.

### E1.6.2.3 Positioning of smoke and heat alarms

1) Detailed guidance on the design and installation of fire detection and alarm systems in flats is given in *BS 5839-6*. However, the following guidance is appropriate to most common situations.

2) Smoke alarms should normally be positioned in the circulation spaces between sleeping spaces and places where fires are most likely to start (e.g. kitchens and living rooms) to pick up smoke in the early stages.



## E1 Means of warning and escape

- 3) There should be at least one smoke alarm for every storey of a flat.
- 4) Where more than one alarm is installed within a single dwelling they should be interlinked so that the detection of fire by one unit operates the alarm signal in all units. The manufacturer's instructions about the maximum number of units that can be interlinked should be observed. Smoke alarms/detectors should be sited so that the following apply:
- a) There should be a smoke alarm in the circulation space within 7.5m of the door to every habitable room.
  - b) Detector units should be ceiling mounted and at least 300mm from walls and light fittings. Units designed for wall mounting may also be used provided that the units are above the level of doorways opening into the space and that they are fixed in accordance with the manufacturer's instructions.
  - c) The sensors in ceiling mounted devices are between 25mm and 600mm below the ceiling (25mm to 150mm in the case of heat detectors or heat alarms). The above guidance assumes that ceilings are predominantly flat.
- 5) It should be possible to reach the smoke alarms to carry out routine maintenance such as testing and cleaning easily and safely. For this reason smoke alarms should not be fixed over a staircase or any other openings between floors. Smoke alarms should not be fixed next to or directly above heaters or air conditioning outlets. They should not be fixed in bathrooms, showers, cooking areas or garages, or any other places where steam, condensation or fumes could give rise to false alarms.

- 6) Smoke alarms should not be fitted in places that get very hot (such as a boiler room), or very cold (such as an unheated porch). They should not be fixed to surfaces which are normally much warmer or colder than the rest of the space because the temperature difference might create air currents which move smoke away from the unit. Developers and builders should provide the building users with information on the use of the equipment and on its maintenance. *BS 5839-1* and *BS 5839-6* recommend that occupiers should receive the manufacturer's instructions following the operation and maintenance of the alarm system.

### E1.6.2.4 Power supplies

- 1) The power supply for a smoke alarm system should be derived from a flat's mains electricity supply. The mains supply to the smoke alarm should comprise a single independent circuit at the flat's main distribution board (consumer unit) or a single regularly used local lighting circuit. This has the advantage that the circuit is unlikely to be disconnected for any prolonged periods. There should be a means of isolating power to the smoke alarms without isolating the lighting.
- 2) Any cable suitable for domestic wiring may be used for the power supply and interconnection to smoke alarm systems. It does not need any particular fire survival properties. Any cabling used for interconnecting alarms should be readily distinguishable from those that supply mains power to the alarms.
- 3) Mains powered smoke alarms may be interconnected using radio links provided that this does not reduce the lifetime or duration of any standby power supply below 72 hours.

## E1 Means of warning and escape

### E1.6.2.5 Design and installation of systems

1) It is essential that fire detection and fire alarm systems are properly designed, installed and maintained. Where a fire alarm system is installed, an installation and commissioning certificate should be provided. Third party certification schemes for fire protection products are an effective means of supporting the fullest possible assurances offering a level of quality, reliability and safety.

### E1.6.3 Buildings other than flats or dwelling houses

1) To select the appropriate type of fire alarm/detection system that should be installed into a particular building, the type of occupancy and means of escape strategy (e.g. simultaneous, phased or progressive horizontal evacuation) must be determined.

2) For example, if occupants normally sleep on the premises, the threat posed by a fire is much greater than that in premises where occupants are normally awake and alert. Where the means of escape is based on simultaneous evacuation, operation of a manual call point or fire detectors should give an almost instantaneous warning from all the fire alarm sounders. However, where the means of escape is based on phased evacuation, then the pattern of fire alarm sounder actuation will be more complex and will be tailored to the particular needs of the building.

3) The term 'fire detection system' is used here to describe any type of automatic sensor network and associated control and indicating equipment. Sensors may be sensitive to smoke, heat, gases, combustion products or radiation. Normally the control and indicating equipment operates a fire alarm system and it may perform other signalling or control functions as well. Sprinkler systems have heads that are heat detectors and it is normal for sprinkler systems to be interlinked with the fire alarm

system so that actuation of the sprinkler system initiates the fire warning system.

4) The factors which have to be considered when assessing what standard of fire alarm or automatic fire detection system is to be provided will vary widely from building to another. Therefore, the appropriate standard will need to be considered on a case by case basis.

5) General guidance on standards for automatic fire detection can be found in *BS 5839-1*.

6) All building should have arrangements for detecting fire. In many building fires are detected by people, either through observation or smell, and therefore often nothing more will be needed.

7) In small buildings or premises the means of raising the alarm may be simple. For instance where all occupants are near to each other a shouted warning, "FIRE", by the person discovering the fire may be all that is needed.

8) In assessing the situation it must be determined that the warning can be heard and understood throughout the premises including, for example, the toilet areas. In other circumstances manually operated sounders (such as rotary gongs or hand bells) may be used. Alternatively, a simple manual break glass call point combined with a bell, battery and charger may be suitable. In all other cases, the building should be provided with a suitable electrically operated fire warning system with manual call points sited adjacent to exit doors and sufficient sounders to be clearly audible throughout the building.

9) An electrically operated fire alarm system should comply with *BS 5839 part 1:2013 Fire detection and alarm systems for building, code of practise for system design, installation, commissioning and maintenance*.



## E1 Means of warning and escape

10) *BS 5839 part 1* specifies three categories of fire detection system, category L for the protection of life, category M which are manually operated fire alarm systems, and category P for property protection.

11) Category L systems are sub-divided into:

- L1 systems installed throughout the protected building,
- L2 systems installed only in defined parts of the building. A category L2 system would normally include the coverage required of a category L3 system and would also include higher risk areas.
- L3 systems designed to give a warning of fire at an early enough stage to enable all occupants to escape safely before the escape routes become impassable owing to the presence of fire, smoke or toxic gases. Coverage includes escape routes and adjoining spaces.
- L4 systems installed within the escape routes such as corridors and stairways.
- L5 systems in which detection is installed to perform specific fire safety actions.

12) Category P systems are sub-divided into P1, which are systems installed throughout the protected building or premises, and P2, systems installed only in specified parts of the protected building.

13) Category M systems have no automatic detection but they do have manual break glass call points adjacent to all final exits and all storey exits.

14) Call points for electrical alarm systems should comply with *BS 5839-2:1983*, or Type A of *BS EN 54-11:2001* and these should be installed in accordance with *BS 5839-1*. Type B call points should only be used with the approval of Building Control.

15) *BS EN 54-11* covers two types of call points:

- Type A (direct operation) in which the change to the alarm condition is automatic (i.e. without the need for further manual action) when the frangible element is broken or displaced; and
- Type B (indirect operation) in which the change to the alarm condition requires a separate manual operation of the operating element by the user after the frangible element is broken or displaced.

16) If it is considered that people might not respond quickly to a fire warning, or where people are unfamiliar with the fire warning arrangements, consideration may be given to installing a voice alarm system. Such a system could form part of a public address system and give both an audible signal and verbal instructions in the event of fire. The fire warning signal should be distinct from other signals which may be in general use and be accompanied by clear verbal instructions. If a voice alarm system is to be installed, it should comply with *BS 5839-8:2013 Code of practice for the design, installation and servicing of voice alarm systems*.

17) In certain premises, e.g. large shops and places of assembly, an initial general alarm may be undesirable because of the number of members of the public present. The need for fully trained staff to effect pre-planned procedures for safe evacuation will therefore be essential. Actuation of the fire alarm system will cause staff to be alerted, e.g. by discreet sounders, personal paging systems etc. Provision will normally be made for full evacuation of the premises by sounders or a message broadcast over the public address system. In all other respects, any staff alarm system should comply with *BS 5839-1*.

## E1 Means of warning and escape

### E1.6.3.1 Warnings for people with impaired hearing

1) A suitable method of warning (e.g. a visual and audible fire alarm signal) should be provided in buildings where it is anticipated that one or more people with impaired hearing may be in relative isolation (e.g. hotel bedrooms and sanitary accommodation) and where there is no other suitable method of alerting them.

2) In buildings such as schools, colleges and offices, where the population is controlled, a vibrating paging system may be more appropriate. This could also be used for alerting people with other disabilities.

3) Clause 18 of *BS 5839-1:2013* provides detailed guidance on the design and selection of fire alarm warnings for people with impaired hearing.

### E1.6.3.2 Automatic fire detection and alarm systems

1) Automatic fire detection and alarms in accordance with *BS 5839-1:2013* should be provided in Institutional and Other residential occupancies.

2) In non-residential occupancies there are often circumstances where a fire detection system in accordance with *BS 5839-1:2013* may be needed.

- 3) For example:
- To compensate for some departure from the guidance elsewhere in this Document.
  - As part of the operating system for some fire protection systems, such as pressure differential systems or automatic door releases;
  - where a fire could break out in an unoccupied part of the premises (e.g. a storage area or basement that is not visited on a regular basis, or a part of the building that has been temporarily vacated) and prejudice the means of escape from any occupied part(s) of the premises.

4) Guidance on the provision of automatic fire detection within a building which is designed for phased evacuation can be found in paragraph E1.10.6.4

5) Where an atrium building is designed in accordance with *BS 9999*, Annexes B and C then the relevant recommendations in that code for the installation of fire alarm/fire detection systems should be followed.

### E1.6.3.3 Design and installation of systems

1) It is essential that fire detection and fire warning systems are properly designed, installed and maintained. Where a fire alarm system is installed, an installation and commissioning certificate should be provided. Third party certification schemes for fire protection products are an effective means of supporting the fullest possible assurances, offering a level of quality, reliability and safety.

### E1.6.3.4 Interfaces between fire detection and alarm systems and other systems

1) Fire detection and fire alarm systems are sometimes used to initiate the operation, or change of state of other systems, such as smoke control systems, fire extinguishing systems, lift operations, air handling unit shut down, release arrangements for electrically held-open fire doors and electronically locked exit doors.

2) It is essential that the interfaces between the fire detection and fire alarm system and all other systems required for compliance with the Building Rules are designed to achieve a high degree of reliability. Particular care should be taken if the interface is facilitated via another system, such as an access control system. Where any part of electronically locked exit doors applies to actuation of other systems, the recommendations of that standard should be followed.

## E1 Means of warning and escape

### E1.7 Means of escape from dwelling houses

#### E1.7.1 Introduction

- 1) The means of escape from a typical one or two storey dwelling house is relatively simple to provide. Few provisions are specified in this Document beyond ensuring that means are provided for giving early warning in the event of fire (see Section E1.6.1) and that suitable means are provided for emergency egress from each storey via windows or doors.
- 2) With increasing height more complex provisions are needed because emergency egress through upper windows becomes increasingly hazardous. It is then necessary to protect the internal stairway. If there are floors more than 7.5m above ground level, the risk that the stairway will become impassable before occupants of the upper parts of the dwelling house have escaped is appreciable, and an alternative route from those parts should be provided. See Diagram 1.
- 3) Ground level is explained in Appendix C, Diagram C4.
- 4) In providing any kind of fire protection in houses it should be recognised that measures which significantly interfere with the day-to-day convenience of the occupants may be less reliable in the long term.

#### E1.7.2 Provisions for escape from the ground storey

- 1) Except for kitchens, all habitable rooms in the ground storey should either:
  - a) open directly onto a hall leading to the entrance or other suitable exit; or
  - b) be provided with a window (or door) which complies with section E1.7.5.1.

- 2) See also General Provisions.

#### E1.7.3 Provisions for escape from upper floors not more than 3.5m above ground level

- 1) Except for kitchens, all habitable rooms in the upper storey(s) of a dwelling house served by only one stair should be provided with:
  - a) a window (or external door) which complies with section E1.7.5.1; or
  - b) direct access to a protected stairway (as described in section E1.7.4.1).
- 2) A single window can be accepted to serve two rooms provided both rooms have their own access to the stairs. A communicating door between the rooms should also be provided so that it is possible to gain access to the window without passing through the stair enclosure.
- 3) See also General Provisions.

#### E1.7.4 Provisions for escape from upper floors more than 3.5m above ground level

- 1) The provisions described in sections E1.7.4.1 and E1.7.4.2 need not be followed if the dwelling house has more than one internal stairway, which afford effective alternative means of escape and are physically separated from each other.
- 2) The necessary degree of separation is a matter of judgement, e.g. stairs may be separated by fire-resisting construction or by a number of rooms.

## E1 Means of warning and escape

### E1.7.4.1 Dwelling houses with one floor more than 3.5m above ground level

1) The dwelling house may either have a protected stairway as described in (a) below, or the top floor can be separated and given its own alternative escape route as described in (b).

a) The upper storeys (those above ground storey) should be served by a protected stairway (protected at all levels) which should either:

- i. extend to a final exit, see Diagram 2(a); or
- ii. 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 fire doors, see Diagram 2(b); or

b) The top storey should be separated from the lower storeys by fire-resisting construction and be provided with an alternative escape route leading to its own final exit. See Diagram 3.

2) See also General Provisions.

ii. a landing within the protected stairway enclosure to an alternative escape route on the same storey; then

the protected stairway at or about 7.5m above ground level should be separated from the lower storeys or levels by fire-resisting construction, see Diagram 3; or

b) the dwelling house should be fitted throughout with a sprinkler system designed and installed in accordance with *BS 9251:2014*.

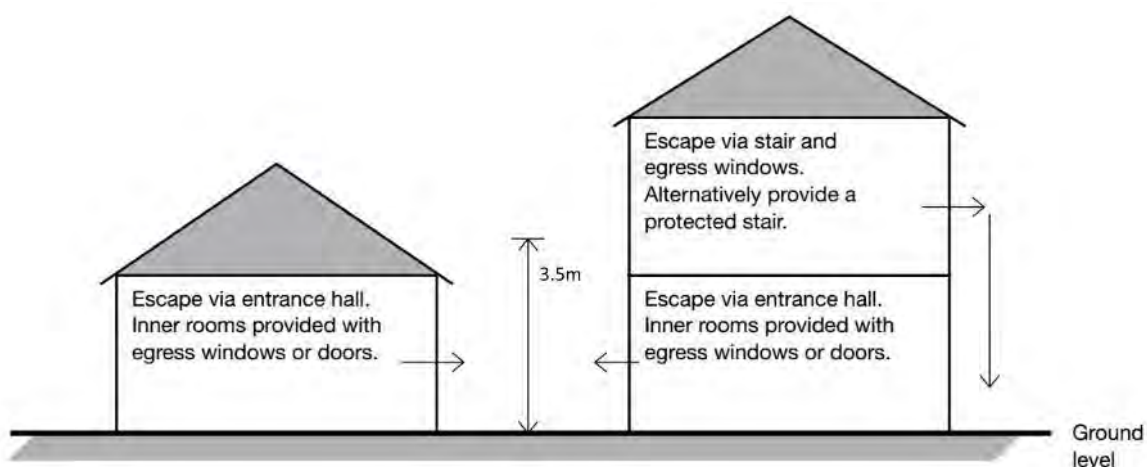
2) See also General Provisions.

### E1.7.4.2 Dwelling houses with more than one floor over 3.5m above ground level

1) Where a dwelling house has two or more storeys with floors more than 3.5m above ground level (typically a dwelling house of four or more storeys) then, in addition to meeting the provisions in section E1.7.4.1:

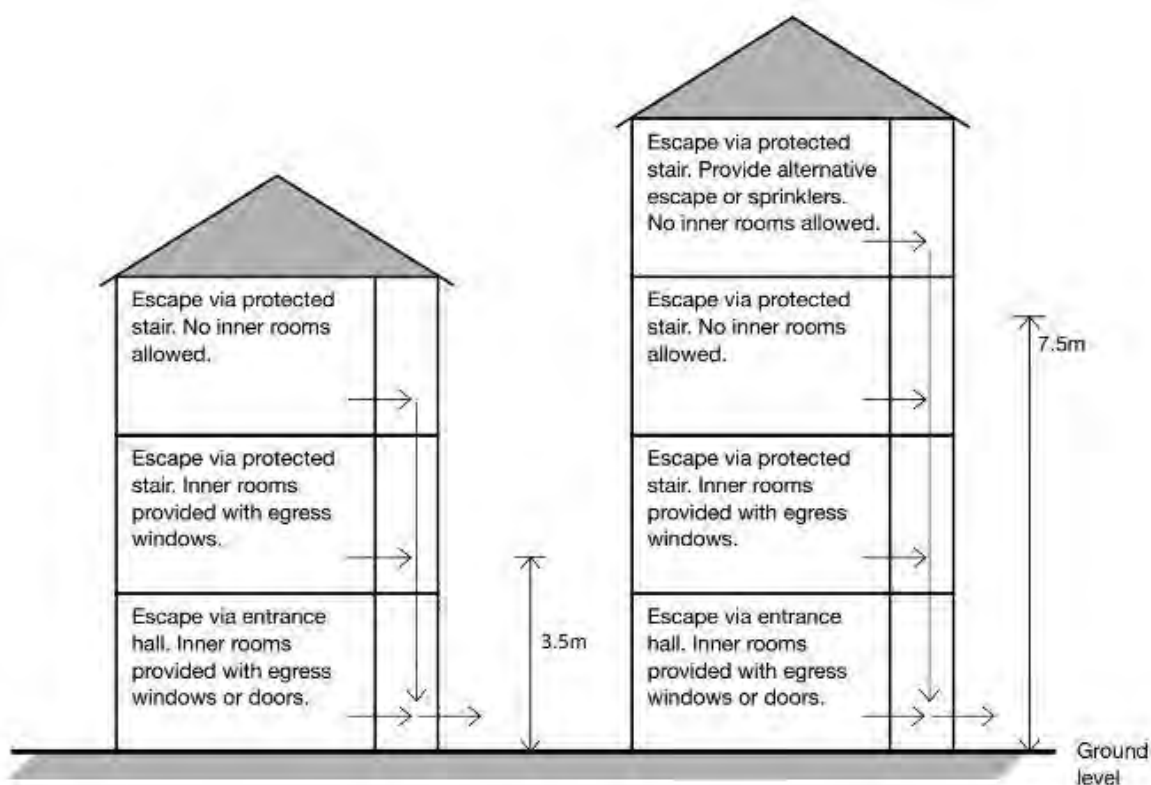
- a) an alternative escape route should be provided from each storey or level situated 7.5m or more above ground level. Where the access to the alternative escape route is via:
  - i. the protected stairway to an upper storey; or

## E1 Means of warning and escape



a) Single storey dwelling house.

b) Dwelling house with upper floors below 3.5m.



c) Dwelling house with one floor above 3.5m.

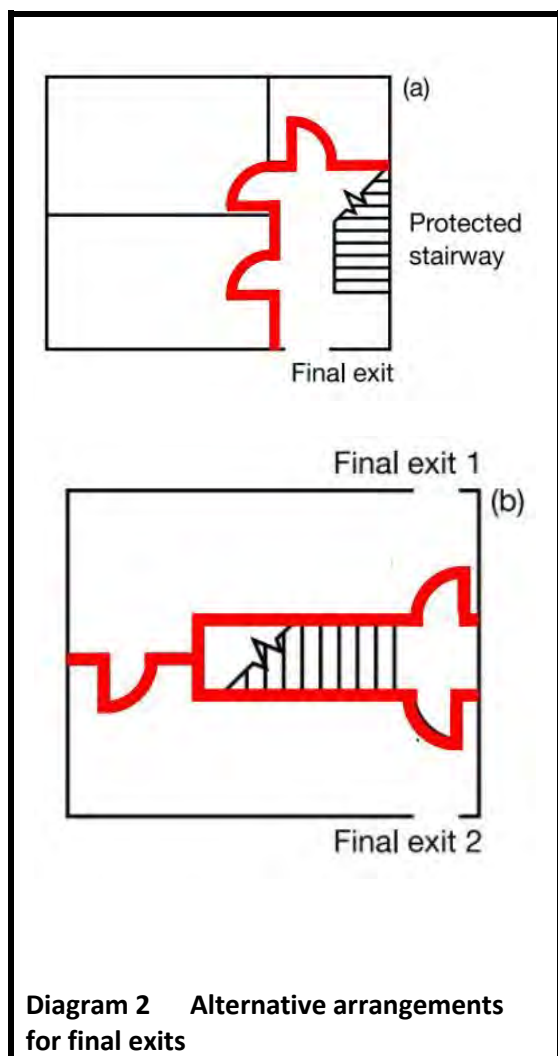
d) Dwelling house with more than one floor above 3.5m.

→ Direction of escape

This diagram must be read in conjunction with all the relevant guidance given in section E1.7

**Diagram 1** Means of escape from dwelling houses

## E1 Means of warning and escape

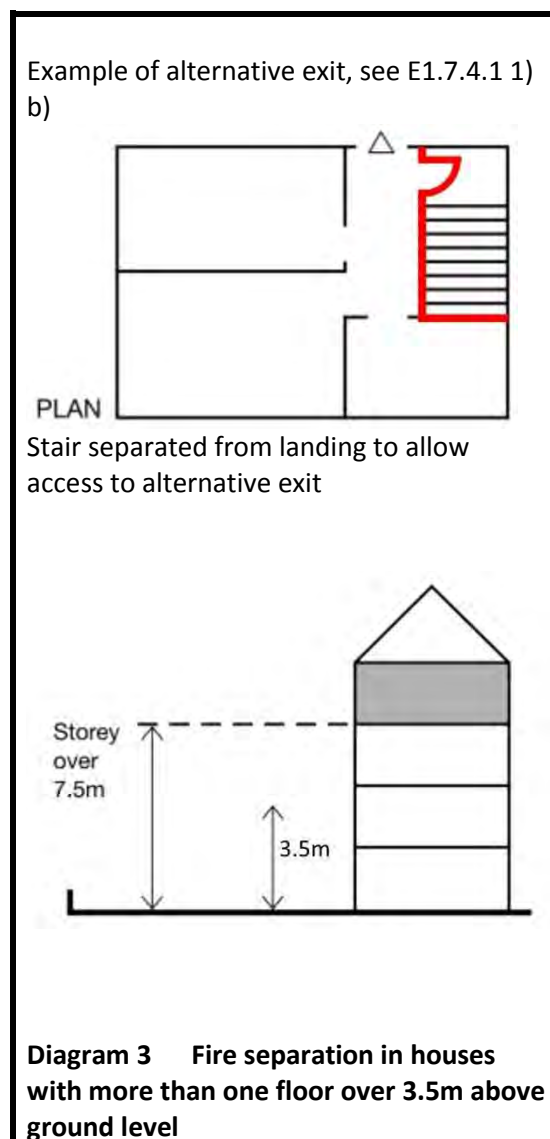


### E1.7.5 General provisions

#### E1.7.5.1 Emergency egress windows and external doors

1) Any window provided for emergency egress purposes and any external door provided for escape should comply with the following conditions:

- a) the window should have an unobstructed openable area that is at least  $0.33\text{m}^2$  and at least 450mm high and 450mm wide (the route through the window may be at an angle rather than straight through). The bottom of the openable area should be not more than 1100mm above the floor; and



- b) the window or door should enable the person escaping to reach a place free from danger from fire. This is a matter for judgement in each case, but, in general, a courtyard or back garden from which there is no exit other than through other buildings would have to be at least as deep as the dwelling house is high to be acceptable, see Diagram 4.

2) In the case of a window in a roof the bottom of the opening may be 600mm above the floor.



## E1 Means of warning and escape

3) Locks (with or without removable keys) and stays may be fitted to egress windows, subject to the stay being fitted with a release catch, which may be child resistant.

4) Windows should be designed such that they will remain in the open position without needing to be held by a person making their escape.

### E1.7.5.2 Inner rooms

1) A room whose only escape route is through another room is termed an inner room and is at risk if a fire starts in that other room (access room). This situation may arise with open-plan layouts and galleries. Such an arrangement is only acceptable where the inner room is:

- a) a kitchen;
- b) a laundry or utility room;
- c) a dressing room;
- d) a bathroom, WC, or shower room;
- e) any other room on a floor, not more than 3.5m above ground level, provided with an emergency egress window which complies with section E1.7.5.1; or
- f) a gallery which complies with section E1.7.5.4.

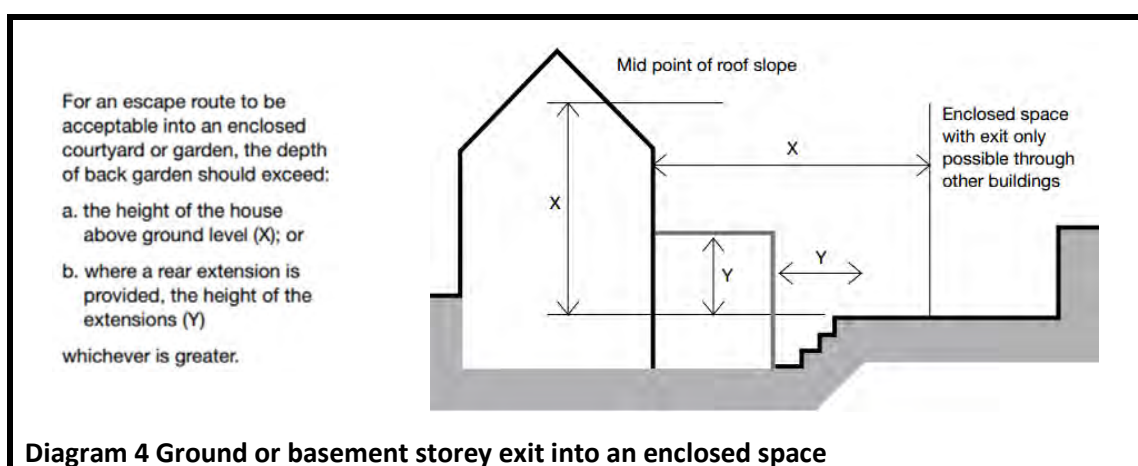
2) A room accessed only via an inner room (an inner-inner room) may be acceptable if it complies with the above, not more than one door separates the room from an interlinked smoke alarm and none of the access rooms is a kitchen.

### E1.7.5.3 Balconies and flat roofs

1) A flat roof forming part of a means of escape should comply with the following provisions:

- a) the roof should be part of the same building from which escape is being made;
- b) the route across the roof should lead to a storey exit or external escape route; and
- c) the part of the roof forming the escape route and its supporting structure, together with any opening within 3m of the escape route, should provide 30 minutes fire resistance (see Appendix A, Table A1).

2) Where a balcony or flat roof is provided for escape purposes appropriate guarding may be needed.



## E1 Means of warning and escape

### E1.7.5.4 Galleries

1) A gallery should be provided with an alternative exit or, where the gallery floor is not more than 3.5m above ground level, an emergency egress window which complies with section E1.7.5.1. Alternatively, where the gallery floor is not provided with an alternative exit or escape window, it should comply with the following;

- a) the gallery should overlook at least 50% of the room below (see Diagram 5);
- b) the distance between the foot of the access stair to the gallery and the door to the room containing the gallery should not exceed 3m;
- c) the distance from the head of the access stair to any point on the gallery should not exceed 7.5m; and
- d) any cooking facilities within a room containing a gallery should either:
  - i. be enclosed with fire-resisting construction; or
  - ii. be remote from the stair to the gallery and positioned such that they do not prejudice the escape from the gallery.

- i. provided with an alternative escape route; or
- ii. provided with an emergency egress window and the gallery floor is no more than 3.5m above ground level.

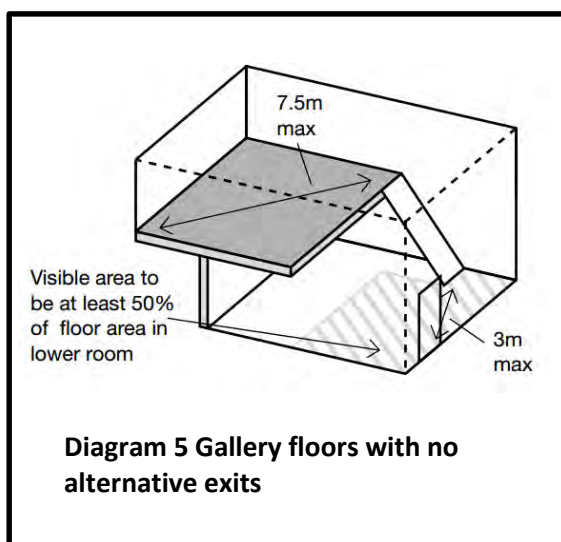
### E1.7.5.5 Basements

1) Because of the risk that a single stairway may be blocked by smoke from a fire in the basement or ground storey, if the basement storey contains any habitable room, the dwelling house should be provided with either:

- a) an external door or window suitable for egress from the basement (see section E1.7.5.1); or
- b) a protected stairway leading from the basement to a final exit.

### E1.7.5.6 Cavity barriers

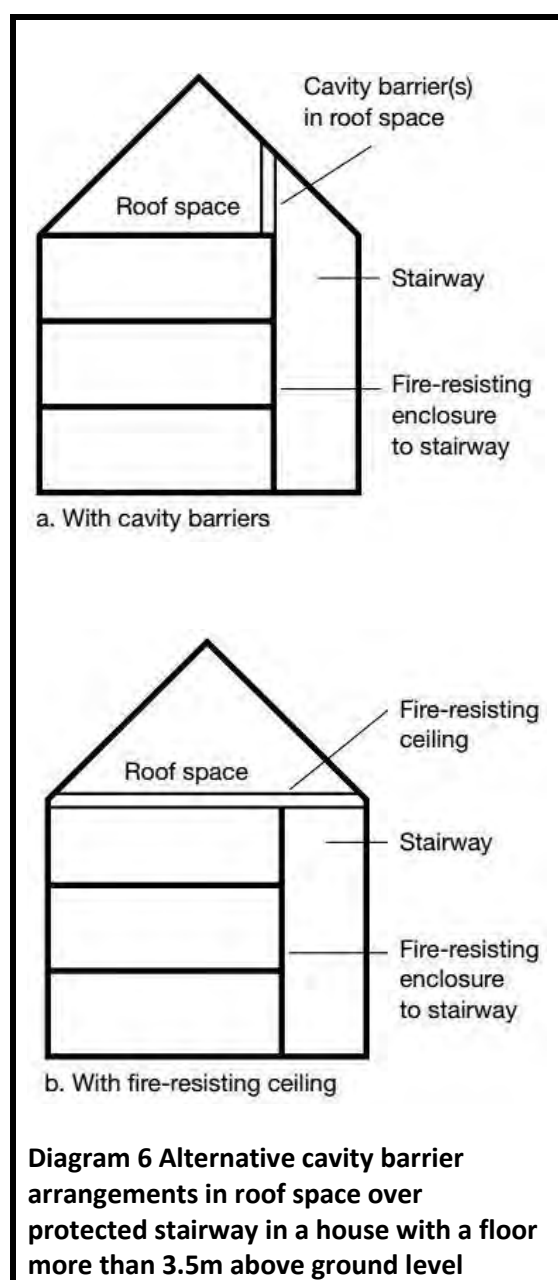
1) Cavity barriers should be provided above the enclosures to a protected stairway in a dwelling house with a floor more than 3.5m above ground level.



2) Diagram 5 does not apply where the gallery is:



## E1 Means of warning and escape



### E1.7.5.7 External escape stairs

1) Where an external escape stair is provided, it should meet the following provisions:

a) All doors giving access to the stair should be fire-resisting, except that a fire-resisting door is not required at the head of any stair leading downwards where there is only one exit from the building onto the top landing.

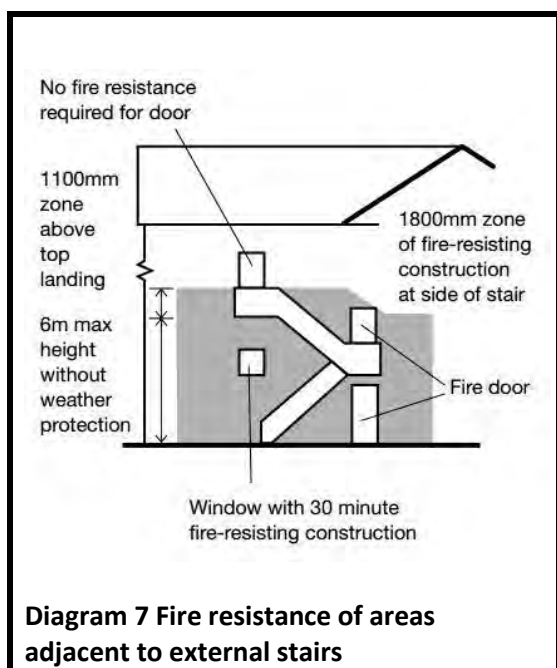
b) Any part of the external envelope of the building within 1800mm of (and 9m vertically below) the flights and landings of an external escape stair should be of fire-resisting construction, except that the 1800mm dimension may be reduced to 1100mm above the top level of the stair if it is not a stair up from a basement to ground level.

c) There is protection by fire-resisting construction for any part of the building (including any doors) within 1800mm of the escape route from the stair to a place of safety, unless there is a choice of routes from the foot of the stair that would enable the people escaping to avoid exposure to the effects of the fire in the adjoining building.

d) Any stair more than 6m in vertical extent is protected from the effects of adverse weather conditions. (This should not be taken to imply a full enclosure. Much will depend on the location of the stair and the degree of protection given to the stair by the building itself).

e) Glazing in areas of fire-resisting construction mentioned above should also be fire-resisting (integrity but not insulation) and fixed shut.

## E1 Means of warning and escape



### E1.7.5.8 Air circulation systems in houses with a floor more than 3.5m above ground level

1) Air circulation systems which circulate air within an individual dwelling house with a floor more than 3.5m above ground level should meet the guidance given in paragraphs E1.7.5.8 2) and 3).

2) Where a ventilation duct passes through a compartment wall into another building then either the duct should be fully fire resisting on one side of the compartment wall or the opening through which the duct passes should be protected by an appropriate means that will maintain the line of compartmentation even if the duct fails.

3) With these types of systems, the following precautions are needed to avoid the

possibility of the system allowing smoke or fire to spread into a protected stairway:

a) Transfer grilles should not be fitted in any wall, door, floor or ceiling enclosing a protected stairway.

b) Any duct passing through the enclosure to a protected stairway or entrance hall should be of rigid steel construction and all joints between the ductwork and the enclosure should be fire-stopped.

c) Ventilation ducts supplying or extracting air directly to or from a protected stairway, should not serve other areas as well.

d) Any system of mechanical ventilation which recirculates air and which serves both the stairway and other areas should be designed to shut down on the detection of smoke within the system.

e) A room thermostat for a ducted warm air heating system should be mounted in the living room, at a height between 1370mm and 1830mm, and its maximum setting should not exceed 27°C.

### E1.7.5.9 Passenger lifts

1) Where a passenger lift is provided in the dwelling house and it serves any floor more than 3.5m above ground level, it should either be located in the enclosure to the protected stairway or be contained in a fire-resisting lift shaft.

## E1 Means of warning and escape

### E1.7.6 Work on existing houses

#### E1.7.6.1 Replacement windows

- 1) Building works are deemed to include replacement windows.
- 2) Where windows are to be replaced (but not where they are to be repaired only, as repair work to windows does not fall within the definition of building work) the replacement work should satisfy Building Control that the fire safety features of the building have not been reduced in their effectiveness. That is, the building should not have a lesser level of compliance, after the work has been completed.
- 3) For the purposes of part E1, where a window is located such that, in a new dwelling house, an escape window would be necessary and the window is of sufficient size that it could be used for the purposes of escape then:
  - a) the replacement window opening should be sized to provide at least the same potential for escape as the window it replaces; or
  - b) where the original window is larger than necessary for the purposes of escape, the window opening could be reduced down to the minimum specified in section E1.7.5.1.
- 4) Part E3 makes provisions for cavity barriers around window openings in some forms of construction. Where windows are replaced it may be necessary to consider if adequate protection is maintained.

#### E1.7.6.2 Material alterations

- 1) Section E0.11 sets out the requirements relating to material alterations. What constitutes reasonable provision where undertaking material alterations would depend on the circumstances in the particular case and would need to take account of

historic value. Possible ways of satisfying the requirements include:

- a) **Smoke alarms.** Where new habitable rooms are provided then smoke alarms should be provided in accordance with section E1.6.1.2.
  - b) **Loft conversions.** Where a new storey is to be added by converting an existing roof space, the provisions for escape need to be considered throughout the full extent of the escape route. For example, a loft conversion to a two-storey house will result in the need to protect the stairway (by providing fire-resisting doors and partitions) where previously no protection may have existed.
- 2) If it is considered undesirable to replace existing doors (e.g. if they are of historical or architectural merit) it may be possible to retain the doors or upgrade them to an acceptable standard.
  - 3) Where an 'open-plan' arrangement exists at ground level it may be necessary to provide a new partition to enclose the escape route (see Diagram 2). Alternatively, it may be possible to provide sprinkler protection to the open-plan area, in conjunction with a fire-resisting partition and door (E20), in order to separate the ground floor from the upper storeys. This door should be so arranged to allow the occupants of the loft room to access an escape window at first floor level (in accordance with section E1.7.5.1) in the event of a fire in the open-plan area. Cooking facilities should be separated from the open-plan area with fire-resisting construction.

## E1 Means of warning and escape

### E1.8 Means of escape from flats

- 1) The means of escape from a flat with a floor not more than 3.5m above ground level is relatively simple to provide. Few provisions are specified in this Document beyond ensuring that means are provided for giving early warning in the event of fire and that suitable means are provided for emergency egress from these storeys.
- 2) With increasing height more complex provisions are needed because emergency egress through upper windows becomes increasingly hazardous.
- 3) The guidance in this section deals with some common arrangements of flat design. Other, less common, arrangements (for example flats entered above or below accommodation level, or flats containing galleries) are acceptable. Guidance on these is given in section 2 of *BS 9991:2011*.
- 4) The provisions for means of escape from flats are based on the assumptions that:
  - a) the fire is generally in a flat;
  - b) there is no reliance on external rescue (e.g. by a portable ladder);
  - c) measures in section E3 provide a high degree of compartmentation and therefore a low probability of fire spread beyond the flat of origin, so that simultaneous evacuation of the building is unlikely to be necessary; and
  - d) although fires may occur in the common parts of the building, the materials and construction used there should prevent the fabric from being involved beyond the immediate vicinity (although in some cases communal facilities exist which require additional measures to be taken).

- 5) There are two distinct components to planning means of escape from buildings containing flats:
  - a) escape from within each flat to the exit from that flat, and
  - b) escape from the flat exit to the final exit from the building.

#### E1.8.1 Inner rooms

- 1) A room whose only escape route is through another room is at risk if a fire starts in that other room. This situation may arise with open-plan layouts and galleries. Such an arrangement is only acceptable where the inner room is:
  - a. a kitchen;
  - b. a laundry or utility room;
  - c. a dressing room;
  - d. a bathroom, WC, or shower room;
  - e. any other room on a floor not more than 3.5m above ground level which complies with section E1.8.2 or paragraph E1.8.6 1) or E1.8.6 3) as appropriate; or
  - f. a gallery which complies with section E1.8.4.
- 2) A room accessed only via an inner room (an inner-inner room) may be acceptable if it complies with the above, not more than one door separates the room from an interlinked smoke alarm and none of the access rooms are a kitchen.

#### E1.8.2 Basements

- 1) As there is a risk that a single stairway may become blocked by smoke from a fire in a basement or ground storey, if a basement storey contains any habitable room, one of the following should be provided:
  - a) an external door or window suitable for egress from the basement (see section E1.8.5); or
  - b) a protected stairway leading from the basement to a final exit.

## E1 Means of warning and escape

### E1.8.3 Balconies and flat roofs

1) Any balcony outside an alternative exit to a flat more than 3.5m above ground level should be a common balcony and meet the conditions in section E1.8.7.3.

2) A flat roof forming part of a means of escape should comply with the following provisions:

- a) the roof should be part of the same building from which escape is being made;
- b) the route across the roof should lead to a storey exit or external escape route; and
- c) the part of the roof forming the escape route and its supporting structure, together with any opening within 3m of the escape route, should provide 30 minutes fire resistance (see Appendix A Table A1).

3) Where a balcony or flat roof is provided for escape purposes, guarding may be needed, in which case it should meet the appropriate guidance for guardrails.

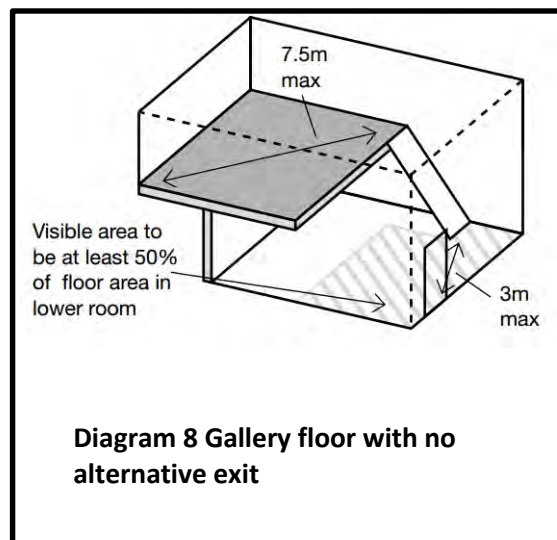
### E1.8.4 Galleries

1) A gallery should be provided with an alternative exit; or, where the gallery floor is not more than 3.5m above ground level, an emergency egress window which complies with section E1.8.5. Where the gallery floor is not provided with an alternative exit or escape window, it should comply with the following:

- a) the gallery should overlook at least 50% of the room below (see Diagram 8);
- b) the distance between the foot of the access stair to the gallery and the door to the room containing the gallery should not exceed 3m;
- c) the distance from the head of the access stair to any point on the gallery should not exceed 7.5m; and

d) any cooking facilities within a room containing a gallery should either:

- i. be enclosed with fire-resisting construction; or
- ii. be remote from the staircase to the gallery and positioned such that they do not prejudice the escape from the gallery.



**Diagram 8 Gallery floor with no alternative exit**

- 2) Diagram 8 does not apply where the gallery is:
- i. provided with an alternative escape route; or
  - ii. provided with an emergency egress window and the gallery floor is no more than 3.5m above ground level.

## E1 Means of warning and escape

### E1.8.5 Emergency egress windows and external doors

- 1) Any window provided for emergency egress purposes should comply with the following conditions:
  - a) the window should have an unobstructed openable area that is at least 0.33m<sup>2</sup> and at least 450mm high and 450mm wide (the route through the window may be at an angle rather than straight through). The bottom of the openable area should be not more than 1100mm above the floor;
  - b) the window should enable the person escaping to reach a place free from danger from fire; and
  - c) The vertical distance from the floor to the ground level immediately below the window should be no more than 3.5m.
- 2) At any escape window there should be a minimum guarding height of 800mm, except in the case of a window in a roof where the bottom of the opening should be no less than 600mm above the floor.
- 3) Locks (with or without removable keys) and stays may be fitted to egress windows, subject to the stay being fitted with a release catch, which may be child resistant.
- 4) Windows should be designed such that they will remain in the open position without the need to be held by a person making their escape.

### E1.8.6 Provisions for escape from flats where the floor is not more than 3.5m above ground level

- 1) The internal arrangement of flats (single or multi-storey) where no floor is more than 3.5m above ground level may either meet the provisions in paragraphs E1.8.6 3) to E1.8.6 4) or sections E1.8.7.1 to E1.8.7.4.
- 2) Where a flat is accessed via the common parts of a block of flats it may be necessary to provide a protected entrance hall to meet the provisions of section E1.8.8.2 and Diagram 16.
- 3) Except for kitchens, all habitable rooms in the ground storey should either:
  - a) open directly onto a hall leading to the entrance or other suitable exit; or
  - b) be provided with a window (or door) which complies with section E1.8.5.
- 4) Except for kitchens, all habitable rooms in upper storeys that are no more than 3.5m above ground level should be provided with:
  - a) a window (or external door) which complies with section E1.8.5; or
  - b) in the case of a multi-storey flat, direct access to its own internal protected stairway leading to a final exit.
- 5) A single emergency egress window can be accepted to serve two rooms provided that:
  - a) both rooms have their own access to the stairs, and
  - b) a communicating door between the rooms should be provided so that it is possible to gain access to the window from both rooms without anybody having to pass through the stair enclosure.



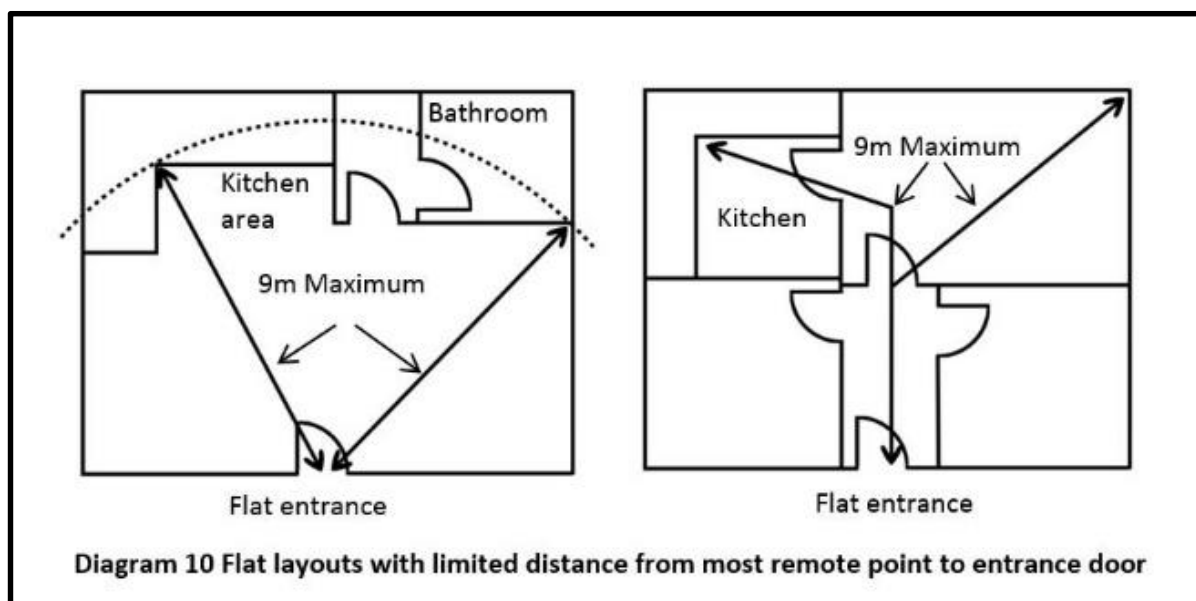
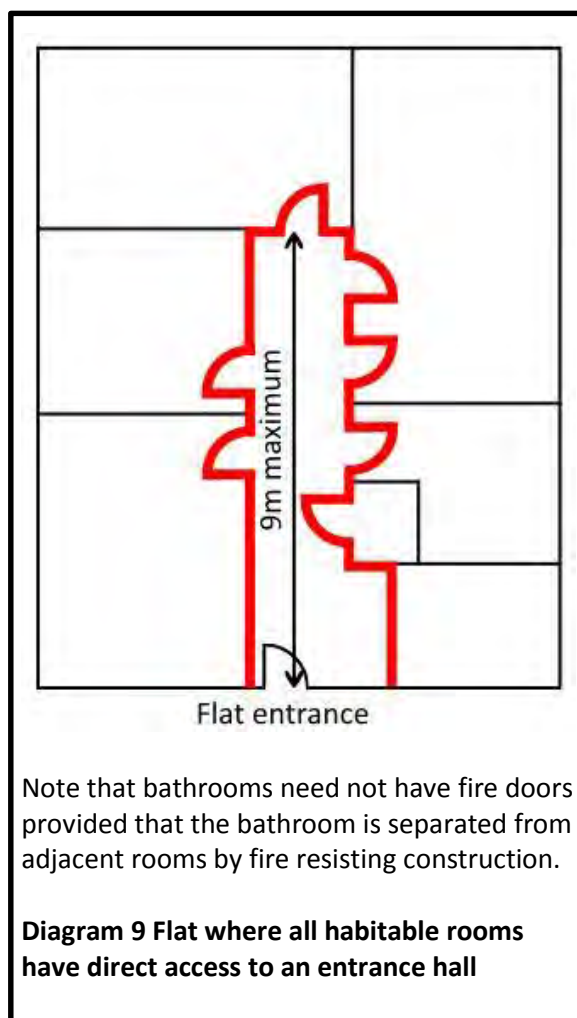
## E1 Means of warning and escape

### E1.8.7 Provisions for flats with a floor more than 3.5m above ground level

#### E1.8.7.1 Internal planning of flats

1) Three acceptable approaches (all of which should observe the restrictions concerning inner rooms given in section E1.8.1) when planning a flat which has a floor at more than 3.5m above ground level are:

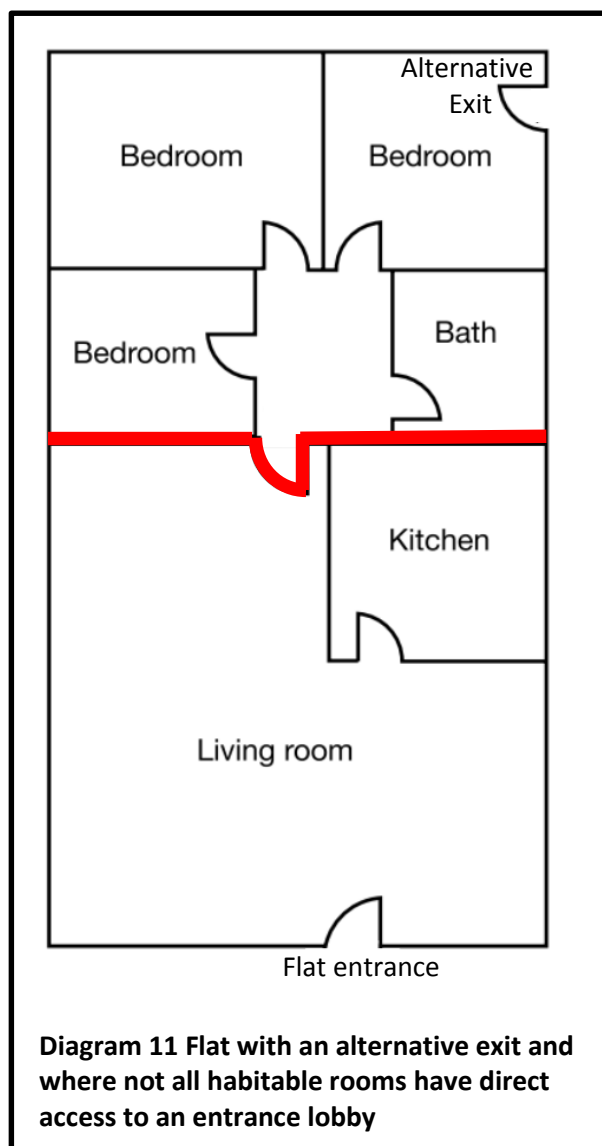
- a) to provide a protected entrance hall which serves all habitable rooms, planned so that the travel distance from the entrance door to the door to any habitable room is 9m or less (see Diagram 9); or
- b) to plan the flat so that the travel distance from the entrance door to any point in any of the habitable rooms does not exceed 9m and the cooking facilities are remote from the entrance door and do not prejudice the escape route from any point in the flat (see Diagram 10); or
- c) to provide an alternative exit from the flat, complying with paragraph E1.8.7.1 2).



## E1 Means of warning and escape

2) Where any flat has an alternative exit and the habitable rooms do not have direct access to the entrance hall (see Diagram 11):

- a) the bedrooms should be separated from the living accommodation by fire-resisting construction and fire door(s); and
- b) the alternative exit should be located in the part of the flat containing the bedroom(s).



### E1.8.7.2 Internal planning of flats with more than one storey

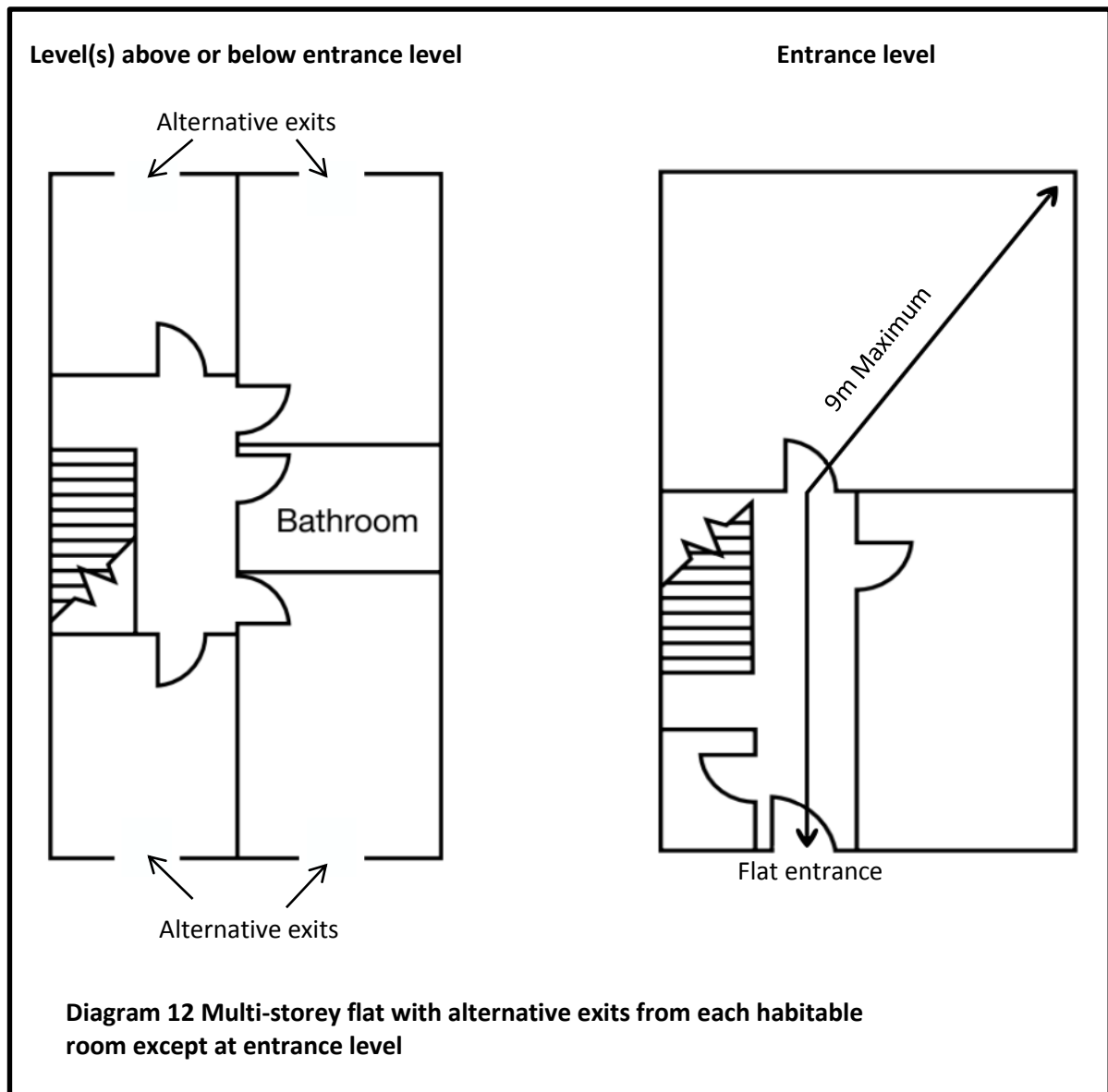
1) A multi-storey flat with an independent external entrance at ground level is similar to a dwelling house and means of escape should be planned on the basis of paragraphs E1.8.6 3) or E1.8.6 4) depending on the height of the top storey above ground level.

2) Four acceptable approaches to planning a multi-storey flat, which does not have its own external entrance at ground level but has a floor at more than 3.5m above ground level, are:

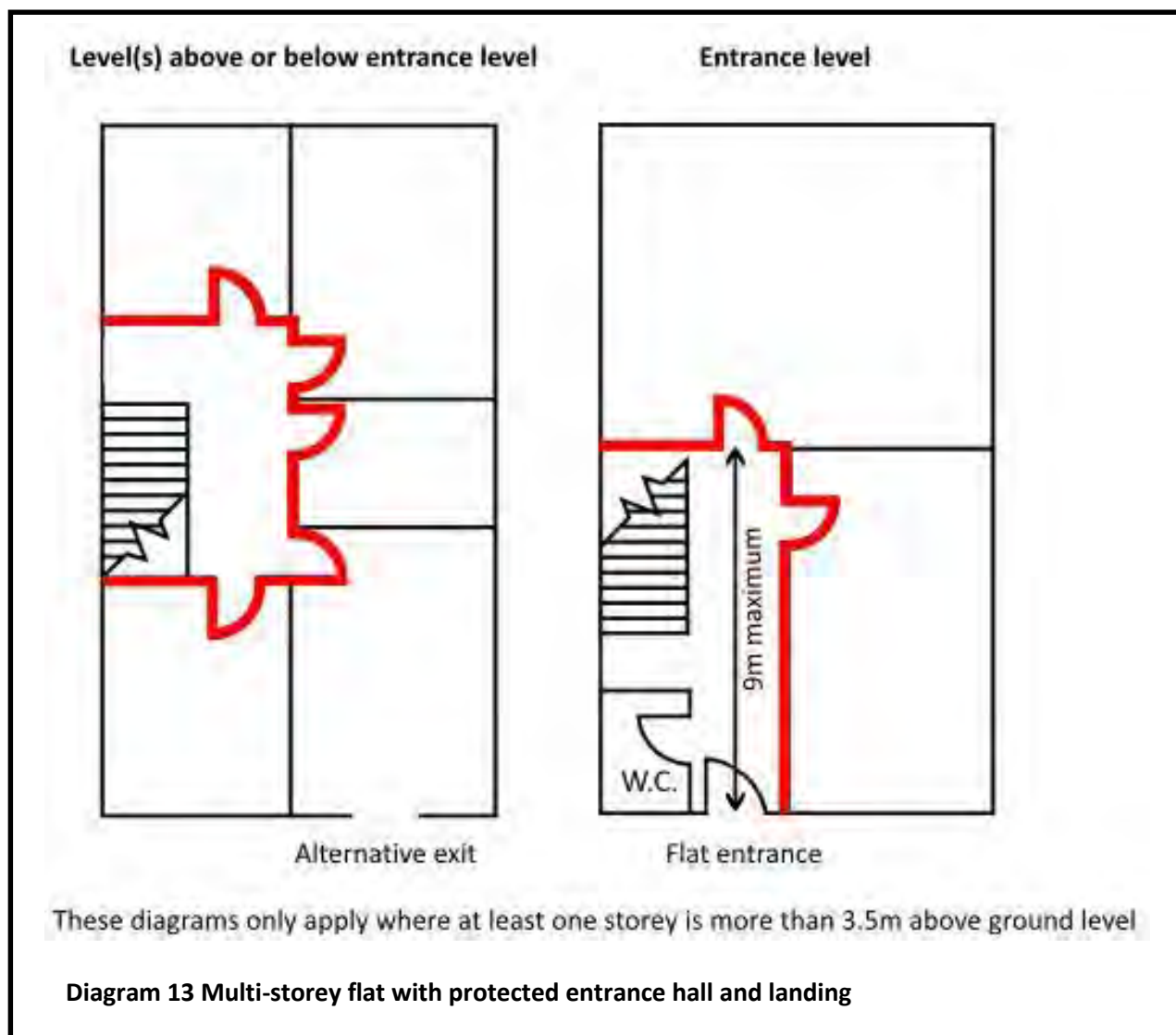
- a) to provide an alternative exit from each habitable room which is not on the entrance floor of the flat, (see Diagram 12); or
- b) to provide one alternative exit from each floor (other than the entrance floor), with a protected landing entered directly from all the habitable rooms on that floor, (see Diagram 13); or
- c) where the vertical distance between the floor of the entrance storey and the floors above and below it does not exceed 7.5m, to provide a protected stairway plus additional smoke alarms in all habitable rooms and a heat alarm in any kitchen; or
- d) to provide a protected stairway plus a sprinkler system in accordance section E0.9 (smoke alarms should also be provided in accordance with section E1.6.1.3).



## E1 Means of warning and escape



## E1 Means of warning and escape



### E1.8.7.3 Alternative exits

- 1) To be effective, an alternative exit from a flat should satisfy the following conditions:
  - a) be remote from the main entrance door to the flat; and
  - b) lead to a final exit or common stair by way of:
    - i. a door onto an access corridor, access lobby or common balcony;
    - or
    - ii. an internal private stair leading to an access corridor, access lobby or common balcony at another level; or
    - iii. a door into a common stair; or
    - iv. a door onto an external stair;
    - or

v. a door onto an escape route over a flat roof.

- 2) Any such access to a final exit or common stair should meet the appropriate provisions dealing with means of escape in the common parts of the building (see section E1.8.8).

## E1 Means of warning and escape

### E1.8.7.4 Air circulation systems in flats with a protected stairway or entrance hall

1) Where ventilation ducts pass through compartment walls, then the guidance given in sections E1.11.5.10, E3.4.9.4 and E3.6.3 to E3.6.4 should be followed. Where an air circulation system circulates air only within an individual flat with an internal protected stairway or entrance hall the following precautions are needed to avoid the possibility of the system allowing smoke or fire to spread into the protected space.

- a) Transfer grilles should not be fitted in any wall, door, floor or ceiling enclosing a protected stairway or entrance hall.
- b) Any duct passing through the enclosure to a protected stairway or entrance hall should be of rigid steel construction and all joints between the ductwork and the enclosure should be fire-stopped.
- c) Ventilation ducts supplying or extracting air directly to or from a protected stairway or entrance hall, should not also serve other areas.
- d) Any system of mechanical ventilation which recirculates air and which serves both the stairway or entrance hall and other areas should be designed to shut down on the detection of smoke within the system; and
- e) A room thermostat for a ducted warm air heating system should be mounted in the living room at a height between 1370mm and 1830mm and its maximum setting should not exceed 27°C.

### E1.8.8 Means of escape in the common parts of flats

1) The following paragraphs deal with means of escape from the entrance doors of flats to a final exit. They should be read in conjunction with the general provisions in section E1.11.

2) Paragraphs E1.8.8.1 to E1.8.8.12.13 are not applicable where the top floor is not more than 3.5m above ground level and the flats are designed in accordance with paragraphs E1.8.6 3) to 5). However, attention is drawn to the provisions in section E0.12.8 regarding sheltered housing, section E1.11 regarding general provisions, section E3.4 regarding the provision of compartment walls and protected shafts and section E5.4 to E5.5 regarding the provision of access for the Fire and Rescue Service.

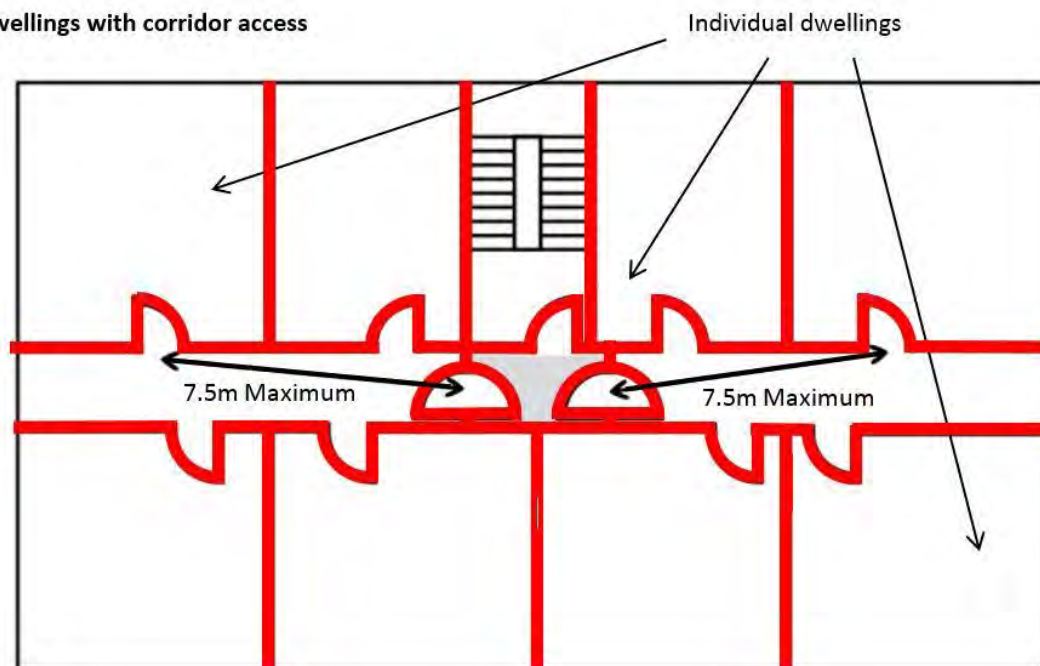
#### E1.8.8.1 Number of escape routes

1) Every flat should have access to alternative escape routes so that a person confronted by the effects of an outbreak of fire in another flat can turn away from it and make a safe escape.

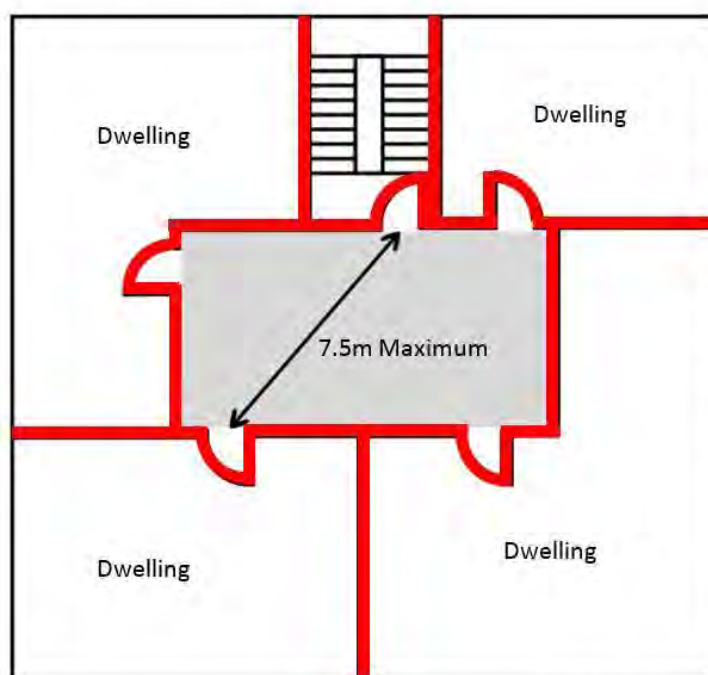
- 2) However, a single escape route from the flat entrance door is acceptable if either:
- a) the flat is situated in a storey served by a single common stair and:
    - i. every flat is separated from the common stair by a protected lobby or common corridor (see Diagram 14); and
    - ii. the travel distance limitations in Table 1 (see section E1.8.8.4), on escape in one direction only, are observed; or
  - b) alternatively, the flat is situated in a dead end part of a common corridor served by two (or more) common stairs and the travel distance complies with the limitations in Table 1 on escape in one direction only (see Diagram 15).

## E1 Means of warning and escape

a. Dwellings with corridor access



b. Dwellings with lobby access



Notes applicable to both a and b:

- a. The arrangements shown also apply to the top floor.
- b. See Diagram 16 for small single stair buildings.
- c. When travel distance is measured to a stair lobby, the lobby should not provide direct access to any storage room, flat or other space containing a potential fire hazard.
- d. Shaded areas indicate zones where ventilation should be provided in accordance with paragraph E1.8.8.7 (i.e. an external wall vent or smoke shaft within the

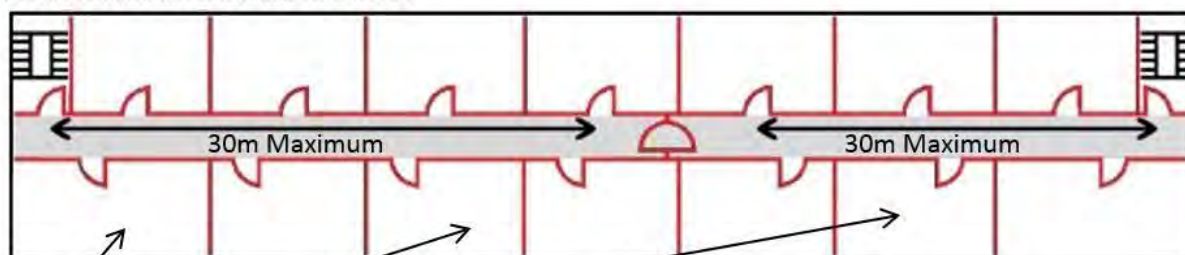
shaded area).

Diagram 14 Flats served by one common stair

## E1 Means of warning and escape

### a. Dwellings accessed via corridors with no dead ends

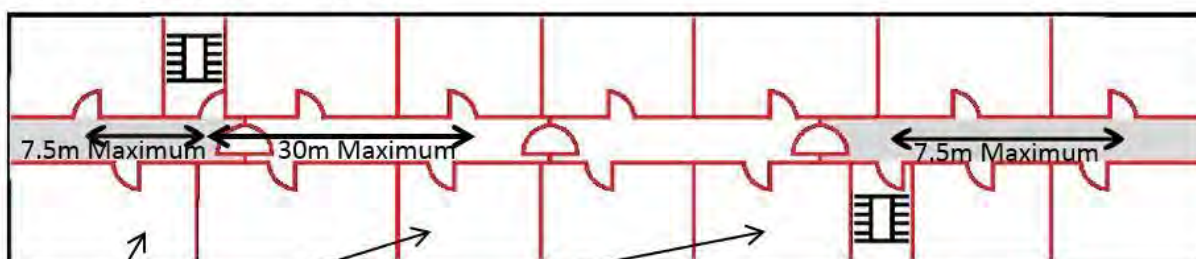
All doors shown here are fire doors



Individual dwellings

### b. Dwellings accessed via corridors with dead ends

All doors shown here are fire doors

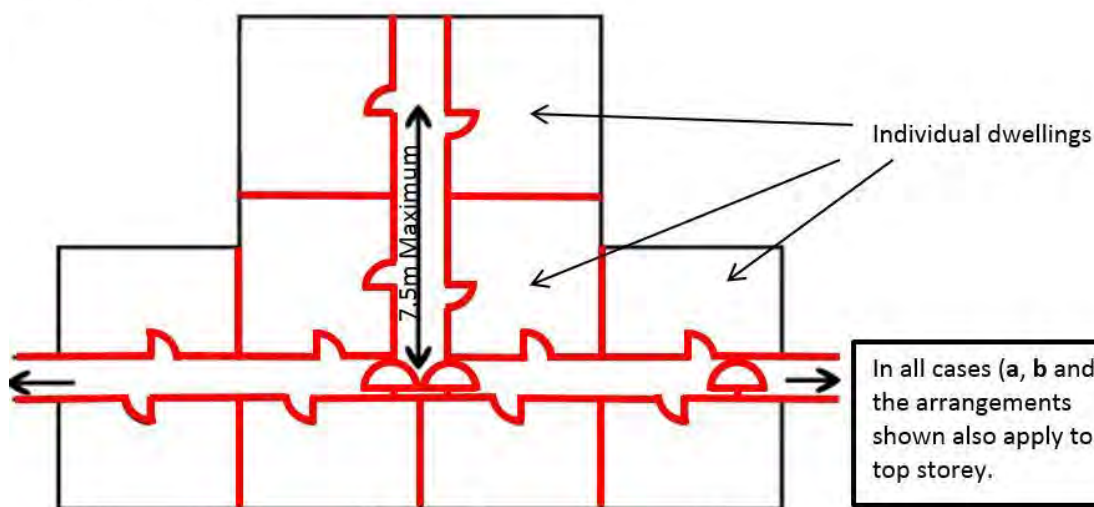


Individual dwellings

In this case, the central sub-dividing door may be omitted if the travel distances from all flat front doors to their nearest storey exits are no more than 15m.

### c. T-junction with main corridor

All doors shown here are fire doors



In all cases (a, b and c) the arrangements shown also apply to the top storey.

Diagram 15 Flats served by more than one common stair



## E1 Means of warning and escape

### E1.8.8.2 Small single-stair buildings

1) The provisions in section E1.8.8 may be modified and a single stair, protected in accordance with Diagram 16, may be used provided that:

- a. the top floor of the building is no more than 11m above ground level;
- b. there are no more than 3 storeys above the ground level storey;
- c. the stair does not connect to a covered car park;
- d. the stair does not serve ancillary accommodation unless the ancillary accommodation is separated from the stair by a protected lobby, or protected corridor, which has not less than 0.4m<sup>2</sup> permanent ventilation or is protected from the ingress of smoke by a mechanical smoke control system; and
- e. a high level openable vent for fire and rescue service use is provided at each floor level with a minimum free area of 1m<sup>2</sup>. Alternatively, a single openable vent may be provided at the head of the stair which can be remotely operated from fire and rescue service access level. The ventilator(s) can be permanently open if desired.

### E1.8.8.3 Flats with balcony or deck access

1) The provisions of section E1.8.8 may also be modified in the case of flats with balcony or deck approach. Guidance on these forms of development is set out in *BS 9991*.

**Table 1 Limitations on travel distance in common areas of blocks of flats**

| Maximum travel distance from flat entrance door to common stair or stair lobby <sup>(1)</sup> |                                   |
|---|-----------------------------------|
| Escape in one direction only  | Escape in more than one direction |
| 7.5m <sup>(2)(3)</sup>  | 30m <sup>(3)(4)</sup>             |

**Notes on Table 1:**

(1) Where travel distance is measured to a stair lobby the lobby must not provide direct access to any storage room, flat or other space containing a potential fire hazard.

(2) Reduced to 4.5m in the case shown in Diagram 16.

(3) Where all flats on a storey have independent alternative means of escape, the maximum distance of travel does not apply. However, see paragraphs E5.4.2 2) to 3) which specifies Fire and Rescue Service access requirements.

(4) For sheltered housing see section E0.12.8.

### E1.8.8.4 Planning of common escape routes

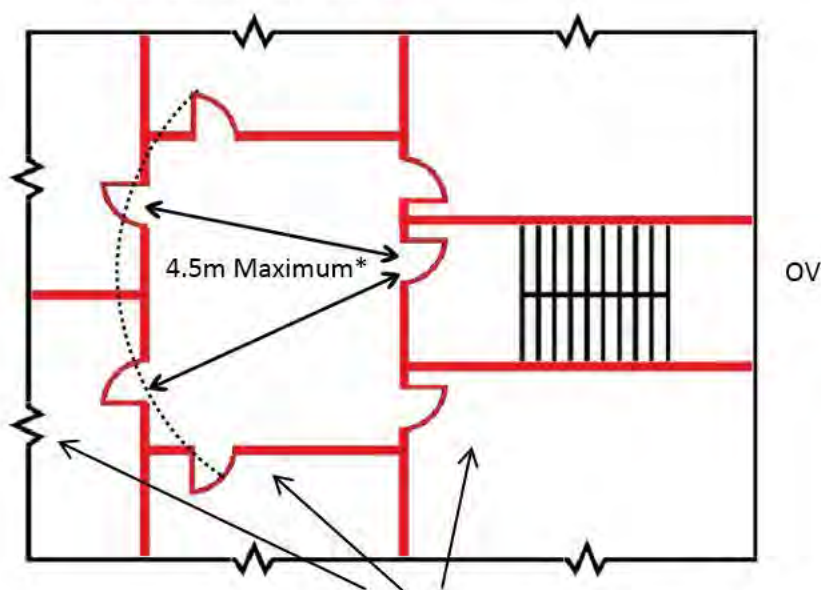
1) Escape routes in the common areas should comply with the limitations on travel distance in Table 1.

2) Escape routes should be planned so that people do not have to pass through one stairway enclosure to reach another. However, it is acceptable to pass through a protected lobby of one stairway in order to reach another.

## E1 Means of warning and escape

### a. Small single stair buildings

All doors shown are fire doors

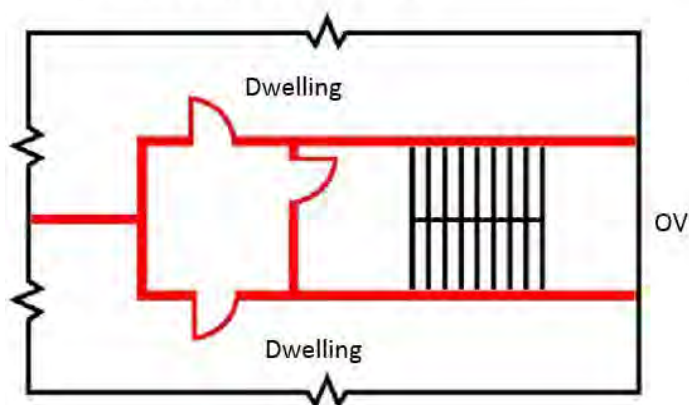


Individual dwellings

\* If smoke control is provided in the lobby then the travel distance can be increased to a maximum of 7.5m (see Diagram 14b).

### b. Small single stair building with no more than two dwellings per storey

All doors shown are fire doors



The door between the staircase and the lobby should be free from security fastenings.

If the dwellings have protected entrance halls then the lobby between the staircase and the dwelling entrances is not essential. Where the lobby is omitted an AOV with a geometric area of at least  $1\text{m}^2$  is required at the top of the staircase, to be operated on detection of smoke at any storey in the staircase.

Notes applicable to all cases (except as stated);

1. These arrangements also apply to the top storey.
2. If the travel distance across the lobby in Diagram 16a exceeds 4.5m the Diagram 14 applies.

**Diagram 16 Common escape routes in small single stair buildings**



## E1 Means of warning and escape

### E1.8.8.5 Protection of common escape routes

- 1) To reduce the risk of a fire in a flat affecting the means of escape from other flats and common parts of the building, the common corridors should be protected corridors.
- 2) The wall between each flat and the corridor should be a compartment wall (see section E3.4).

### E1.8.8.6 Smoke control of common escape routes

- 1) Despite the provisions described in this Document, it is probable that some smoke will get into a common corridor or lobby from a fire in a flat, if only because the entrance door will be opened when the occupants escape or when the fire service make access to the fire.
- 2) There should therefore be some means of ventilating the common corridors/lobbies to control smoke and so protect the common stairs. This offers additional protection to that provided by the fire doors to the stair. The ventilation also affords some protection to the corridors/lobbies.
- 3) This can be achieved by either natural means in accordance with section E1.8.8.7 or by means of mechanical ventilation as described in section E1.8.8.8.

### E1.8.8.7 Smoke control of common escape routes by natural smoke ventilation

- 1) In buildings, other than small ones complying with Diagram 16, the corridor or lobby adjoining the stair should be provided with a vent. The vent from the corridor/lobby should be located as high as practicable and such that the top edge is at least as high as the top of the door to the stair.

- 2) There should also be a vent, with a free area of at least  $1.0\text{m}^2$ , from the top storey of the stairway to the outside.

- 3) In single stair buildings the smoke vents on the fire floor and at the head of the stair should be actuated by means of smoke detectors in the common access space providing access to the flats. In buildings with more than one stair the smoke vents may be actuated manually (and accordingly smoke detection is not required for ventilation purposes). Where manual actuation is used it should be ensured that the vent at the head of the stair will be opened either before, or at the same time, as the vent on the fire floor. This may be achieved by providing an operating device (mechanical or electrical) for the vent at the head of the stair in the staircase enclosure at the access level for the fire and rescue service.

- 4) Vents should either:
  - a. be located on an external wall with minimum free area of  $1.5\text{m}^2$  (see Appendix C); or
  - b. discharge into a vertical smoke shaft (closed at the base) meeting the following criteria:
    - i. Minimum cross-sectional area  $1.5\text{m}^2$  (minimum dimension  $0.85\text{m}$  in any direction), opening at roof level at least  $0.5\text{m}$  above any surrounding structures within a horizontal distance of  $2.0\text{m}$ . The shaft should extend at least  $2.5\text{m}$  above the ceiling of the highest storey served by the shaft;
    - ii. The minimum free area of the vent from the corridor/lobby into the shaft and at the opening at the head of the shaft and at all internal locations within the shaft (e.g. safety grilles) should be at least  $1.0\text{m}^2$  (see Appendix C);

## E1 Means of warning and escape

- iii. The smoke shaft should be constructed from non-combustible material and all vents should have a fire/smoke resistance performance at least that of an E30S<sub>a</sub> fire door. The shaft should be vertical from base to head, with no more than 4m at an inclined angle (maximum 30°); and
- iv. On detection of smoke in the common corridor/lobby, the vent(s) on the fire floor, the vent at the top of the smoke shaft and to the stairway should all open simultaneously. The vents from the corridors/lobbies on all other storeys should remain closed.

### E1.8.8.8 Smoke control of common escape routes by mechanical ventilation

- 1) As an alternative to the natural ventilation provisions in section E1.8.8.7, mechanical ventilation to the stair and/or corridor/lobby may be provided to protect the stair(s) from smoke.
- 2) Guidance on the design of smoke control systems using pressure differentials is available in *BS EN 12101-6:2005*.

### E1.8.8.9 Sub-division of common escape routes

- 1) A common corridor that connects two or more storey exits should be sub-divided by a self-closing fire door with, if necessary, any associated fire-resisting screen (see Diagram 15). The door(s) should be positioned so that smoke will not affect access to more than one stairway.
- 2) A dead-end portion of a common corridor should be separated from the rest of the corridor by a self-closing fire door with, if

necessary, any associated fire-resisting screen (see Diagram 14a and Diagram 15b and 15c).

### E1.8.8.10 Ancillary accommodation, etc.

- 1) Stores and other ancillary accommodation should not be located within, or entered from, any protected lobby or protected corridor forming part of the only common escape route from a flat on the same storey as that ancillary accommodation.
- 2) Reference should be made to section E1.11.5.11 for special provisions for refuse chutes and storage areas.

### E1.8.8.11 Escape routes over flat roofs

- 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 a flat roof provided that it complies with the provisions in section E1.11.5.5.
- 2) Access to designs described in paragraph E1.8.8.12.12 1) may also be via a flat roof if the route over the roof complies with the provisions in section E1.11.5.5.

### E1.8.8.12 Common stairs

#### E1.8.8.12.1 Number of common stairs

- 1) Sections E1.8.8 to E1.8.8.2 describe particular circumstances where a single common stair can be acceptable. In other cases there should be access to more than one common stair for escape purposes.

#### E1.8.8.12.2 Width of common stairs

- 1) A stair of acceptable width for everyday use will be sufficient for escape purposes, but if it is also a firefighting stair, it should be at least 1100mm wide (see Appendix C for measurement of width).

## E1 Means of warning and escape

### **E1.8.8.12.3 Protection of common stairs**

1) Common stairs 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 in paragraphs E1.8.8.12.3 2) to E1.8.8.12.11 1) should be followed.

2) Stairs provide a potential route for fire spread from floor to floor. In section E3.4 under the requirement of E3 to inhibit internal fire spread, there is guidance on the enclosure of stairs to avoid this. A stair may also serve as a firefighting stair in accordance with the requirement E5, in which case account will have to be taken of the guidance in section E.5.5.

### **E1.8.8.12.4 Enclosure of common stairs**

1) Every common stair should be situated within a fire-resisting enclosure (i.e. it should be a protected stairway), to reduce the risk of smoke and heat making use of the stair hazardous.

2) The appropriate level of fire resistance is given in Appendix A, Tables A1 and A2.

### **E1.8.8.12.5 Exits from protected stairways**

1) Every protected stairway should discharge:

- a. directly to a final exit; or
- b. by way of a protected exit passageway to a final exit.

2) Any protected exit passageway which connects a protected staircase with a final exit should have the same standard of fire resistance and lobby protection as the stairway it serves.

### **E1.8.8.12.6 Separation of adjoining protected stairways**

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

### **E1.8.8.12.7 Use of space within protected stairways**

1) A protected stairway needs to be relatively free of potential sources of fire. Consequently, it should not be used for anything else, except a lift well or electricity meter(s). There are other provisions for lifts in paragraphs E1.11.5.9.1 to E1.11.5.9.2. In single stair buildings, meters located within the stairway should be enclosed within a secure cupboard which is separated from the escape route with fire-resisting construction.

### **E1.8.8.12.8 Fire resistance and openings in external walls of protected stairways**

1) The external enclosures to protected stairways should meet the provisions in paragraph E1.11.4.3.1).

## E1 Means of warning and escape

### E1.8.8.12.10 Basement stairs

- 1) Because of their situation, basement stairways are more likely to be filled with smoke and heat than stairs in ground and upper storeys.
- 2) Special measures are therefore needed in order to prevent a basement fire endangering upper storeys. These are set out in the following two paragraphs.
- 3) If an escape stair forms part of the only escape route from an upper storey of a building (or part of a building) which is not a small building (see section E1.8.8.2), it should not be continued down to serve any basement storey. The basement should be served by a separate stair.
- 4) If there is more than one escape stair from an upper storey of a building (or part of a building), only one of the stairs serving the upper storeys of the building (or part) need be terminated at ground level. Other stairs may connect with the basement storey(s) if there is a protected lobby or a protected corridor between the stair(s) and accommodation at each basement level.

### E1.8.8.12.11 Stairs serving accommodation ancillary to flats

- 1) Except in small buildings described in section E1.8.8.2, where a common stair forms part of the only escape route from a flat, it should not also serve any covered car park, boiler room, fuel storage space or other ancillary accommodation of similar fire risk.
- 2) Any common stair which does not form part of the only escape route from a flat may also serve ancillary accommodation if it is separated from the ancillary accommodation by a protected lobby or a protected corridor.
- 3) If the stair serves an enclosed (non-open-sided) car park, or place of special fire hazard, the lobby or corridor should have not less than 0.4m<sup>2</sup> permanent ventilation or be

protected from the ingress of smoke by a mechanical smoke control system.

### E1.8.8.12.12 External escape stairs

- 1) If the building (or part of the building) is served by a single access stair, that stair may be external if it:
  - a. serves a floor not more than 6m above the ground level; and
  - b. meets the provisions in section E1.11.4.4.
- 2) Where more than one escape route is available from a storey (or part of a building), some of the escape routes from that storey or part of the building may be by way of an external escape stair, provided that there is at least one internal escape stair from every part of each storey (excluding plant areas) and the external stair(s):
  - a. serves a floor not more than 6m above either the ground level or a roof or podium which is itself served by an independent protected stairway; and
  - b. meets the provisions in section E1.11.4.4.

### E1.8.8.12.13 Flats in mixed use buildings

- 1) In buildings with not more than three storeys above the ground storey, stairs may serve both flats and other occupancies, provided that the stairs are separated from each occupancy by protected lobbies at all levels.
- 2) In buildings with more than three storeys above the ground storey, stairs may serve both flats and other occupancies provided that:
  - a. the flat is ancillary to the main use of the building and is provided with an independent alternative escape route;
  - b. the stair is separated from any other occupancies on the lower storeys by protected lobbies (at those storey levels).

## E1 Means of warning and escape

- c. any automatic fire detection and alarm system with which the main part of the building is fitted also covers the flat; and
- d. any security measures should not prevent escape at all material times.

3) Additional measures, including increased periods of fire resistance may be required between the flat and any storage area where fuels such as petrol and LPG are present.

4) Stair enclosures should have at least the same standard of fire resistance as stipulated in Table A2 for the elements of structure of the building and take account of any additional provisions in section E3.3 if they are firefighting stairs.

### E1.8.9 Live/work units

1) Where a flat is intended to serve as a workplace for its occupants, the following additional fire precautions will be necessary:

- a. The maximum travel distance to the flat entrance door or an alternative means of escape (not a window) from any part of the working area should not exceed 18m; and
- b. Any windowless accommodation should have escape lighting which illuminates the route if the main supply fails. Standards for the installation of a system of escape lighting are given in *BS 5266-1:2011*.

2) Where the unit is so large that the travel distance in a. cannot be met then the assumptions set out in paragraph E1.8 4) may no longer be valid. In such circumstances the design of the building should be considered on a case by case basis.

## E1 Means of warning and escape

### E1.9 Design for horizontal escape in buildings other than flats or dwelling houses

#### E1.9.1 Introduction

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 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. It should be read in conjunction with the guidance on the vertical part of the escape route in section E1.10 and the general provisions in section E1.11.

2)\* It should be noted that guidance in this section is directed mainly at simpler types of buildings. Detailed guidance on the needs of larger, more complex or specialised buildings, can be found elsewhere (see section E0.12).

3) It should also be noted that although most of the information contained in this section is related to general issues of design, special provisions apply to the layouts of certain institutional buildings (see section E1.9.14).

4) In the case of small shop, office, industrial, storage and other similar premises (ones with no storey larger than 280m<sup>2</sup> and having no more than 2 storeys plus a basement storey), the guidance in section E1.12 may be followed instead of the other provisions in this section.

#### E1.9.2 Number of escape routes and exits

1) 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 to the nearest exit given in Table 2.

\* see corresponding entry in Appendix H

2)\* It is only the distance to the nearest exit that should be so limited. Any other exits may be further away than the distances in Table 2.

3) In multi-storey buildings (see section E1.10) more than one stair may be needed for escape. This does not prevent areas from being in a dead-end condition provided that the alternative stair is accessible in case the first one is not usable.

4)\* In multi-storey buildings with more than one stair there may be parts of some of the lower storeys that only have access to one of the stairs. This is acceptable provided that not more than 60 people per floor have to use the single staircase, that the highest floor that is restricted to using the single staircase is no more than 11m above ground and that the stair has the appropriate protection required for a single stair (see sections E1.10.7 to E1.10.12).

5) In mixed-use buildings, separate means of escape should be provided from any storeys (or parts of storeys) used for Residential or Assembly and Recreation purposes.

#### E1.9.3\* Single escape routes and exits

1) In order to avoid occupants being trapped by fire or smoke, there should be alternative escape routes from all parts of the building.

2) However a single route is acceptable for any location within a building from which a storey or final exit can be reached within the single direction travel distance limit set in Table 2 (see also section E1.9.5). This is provided that no one room in this situation has an occupant capacity of more than 60 people or 30 people if the building is in Institutional use (Purpose Group 2a). The calculation of expected occupant capacity is described in Appendix C.

3)\* In many cases there will not be an alternative at the beginning of the route but

## E1 Means of warning and escape

there will be alternative routes available closer to the exit. 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 or final exit is within the travel distance limit for routes where there is an alternative and the 'one direction only' section of the route does not exceed the single direction travel distance limit (see Table 2).

4) Diagram 17 shows an example of dead-end conditions in an open plan layout.

### E1.9.4 Access control measures

1) Measures incorporated into the design of a building to restrict access to the building or parts of it should not adversely affect fire safety provisions.

2)\* Whilst it may be reasonable to secure some or all escape routes outside normal business hours, the measures in place at any one time should be sufficient to allow safe evacuation of the people inside the building at that time (see section E1.11.3.1).

### E1.9.5 Travel distance

| Table 2 Limitations on Travel distance |  |               | Maximum acceptable travel distance <sup>(1)</sup> where travel is possible in: |                             |
|--|--|---------------|--|-----------------------------|
| Purpose Group                          | Use of the premises or relevant part of the premises |               | One direction only (m)   | More than one direction (m) |
| 2(a)                                   | Institutional  |               | 9  | 18                          |
| 2(b)                                   | Other residential:                                   |               |  |                             |
|  | (i) In bedrooms <sup>(2)</sup>                       |               | 9  | 18                          |
|  | (ii) In bedroom corridors                            |               | 9  | 35                          |
|  | (iii) Elsewhere                                      |               | 18   | 35                          |
| 3                                      | Office   |               | 18   | 45                          |
| 4                                      | Shop and commercial <sup>(3)</sup>                   |               | 18 <sup>(4)</sup>  | 45                          |
| 5                                      | Assembly and recreation:                             |               |  |                             |
|  | (i) Buildings primarily for disabled people          |               | 9  | 18                          |
|  | (ii) Areas with seating in rows                      |               | 15   | 32                          |
|  | (iii) Elsewhere                                      |               | 18   | 45                          |
| 6                                      | Industrial <sup>(5)</sup>                            | Normal hazard | 25   | 45                          |
|  |  | Higher hazard | 12   | 25                          |
| 7                                      | Storage and other non-residential <sup>(5)</sup>     | Normal hazard | 25   | 45                          |
|  |  | Higher hazard | 12   | 25                          |
| 2-7                                    | Place of special fire hazard <sup>(6)</sup>          |               | 9 <sup>(7)</sup>   | 18 <sup>(7)</sup>           |
| 2-7                                    | Plant room or roof top plant:                        |               |  |                             |
|  | (i) distance within the room                         |               | 9  | 35                          |
|  | (ii) Escape route not in open air                    |               | 18   | 45                          |
|  | (iii) Escape route in open air                       |               | 60   | 100                         |

\* see corresponding entry in Appendix H



## E1 Means of warning and escape

### Notes on Table 2:

(1)\* The dimensions in the Table are travel distances. If the internal layout of partitions, fittings, etc. is not known when plans are deposited, direct distances may be used for assessment. The direct distance is taken as 2/3rds of the travel distance.

(2) Maximum part of travel distance within the room. (This limit applies within the bedroom (and any associated dressing room, bathroom or sitting room, etc.) and is measured to the door to the protected corridor serving the room or suite. Sub-item (ii) applies from that point along the bedroom corridor to a storey exit.)

(3) Maximum travel distances within shopping malls are given in *BS 9999 Annex E*. Guidance on associated smoke control measures is given in *BR368 Design methodologies for smoke and heat exhaust ventilation* and in other fire engineering guides.

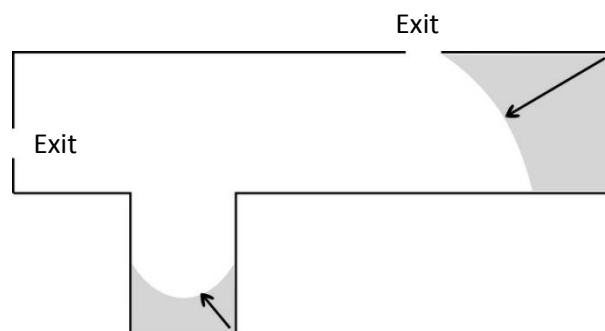
(4) *BS 9999 Annex E* applies more restrictive provisions to units with only one exit in covered shopping complexes.

(5) In industrial and storage buildings the appropriate travel distance depends on the level of fire hazard associated with the processes and materials being used or stored. Higher hazard includes manufacturing, processing or storage of significant amounts of hazardous goods or materials, including:

- a) any compressed, liquefied or dissolved gas,
- b) any substance which becomes dangerous by interaction with either air or water,
- c) any liquid substance with a flash point below 65°C including whisky or other spirituous liquor,
- d) any corrosive substance,
- e) any oxidising agent,
- f) any substance liable to spontaneous combustion,
- g) any substance that changes or decomposes readily giving out heat when doing so,
- h) any combustible solid substance with a flash point less than 120°C,
- i) any substance likely to spread fire by flowing from one part of a building to another.

(6) Places of special fire hazard are listed in the definitions in Appendix E.

(7) Maximum part of travel distance within the room/area. Travel distance outside the room/area to comply with the limits for the purpose group of the building or part.



From anywhere within the shaded areas the exits are less than 45° apart.

From anywhere within the unshaded areas the exits are more than 45° apart.

1. The distance that has to be travelled from any part of the shaded areas to reach the unshaded area should be no more than the appropriate single direction travel distance limit given in Table 2; and

2. The distance of travel from any part of the open plan room (shaded or unshaded) to the nearest exit should be less than the appropriate travel distance limit for more than one direction.

**Diagram 17**      **Travel distances from dead ends in open plan rooms**

\* see corresponding entry in Appendix H

## E1 Means of warning and escape

### E1.9.6 Number of occupants and exits

1)\* The figure used for the number of occupants will normally be that specified as the basis for the design. When the number of occupants likely to use a room, tier or storey is not known, the capacity should be calculated on the basis of the appropriate floor space factors. Guidance for this is set out in Appendix C.

2) Table 3 gives the minimum number of escape routes and exits from a room or storey according to the number of occupants. (This number is likely to be increased by the need to observe travel distances and by other practical considerations.)

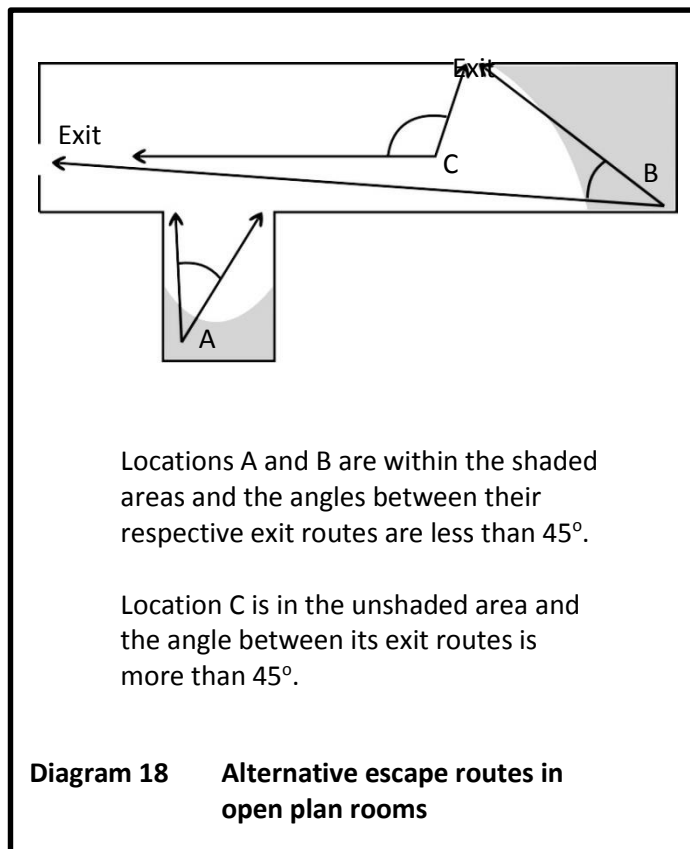
| Table 3 Minimum number of escape routes and exits from a room, tier or storey |                                 |
|---|---------------------------------|
| Maximum number of people  | Minimum number of escape routes |
| 60  | 1                               |
| 600   | 2                               |
| More than 600   | 3                               |

3)\* A choice of escape routes is of little value if they are all likely to be disabled simultaneously. Alternative escape routes should therefore satisfy the following criteria:

- they are in directions  $45^\circ$  or more apart (see Diagrams 17 and 18); or
- they are in directions less than  $45^\circ$  apart, but are separated from each other by fire-resisting construction.

4)\* In locations where two or more exits do not satisfy these criteria, for the purposes of the people in those locations, the exits are deemed to be a single exit.

\* see corresponding entry in Appendix H



### E1.9.7 Inner rooms

1) A room from which the only escape route is through another room is called an inner room. It is at risk if a fire starts in the other room, called the access room (see Diagram 19a).

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

- the occupant capacity of the inner room should not exceed 60 (30 in the case of a building in purpose group 2a (Institutional));
- the inner room should not be a bedroom;
- the inner room should be entered directly off the access room and not via a corridor;
- the escape route from the inner room should not pass through more than one access room;

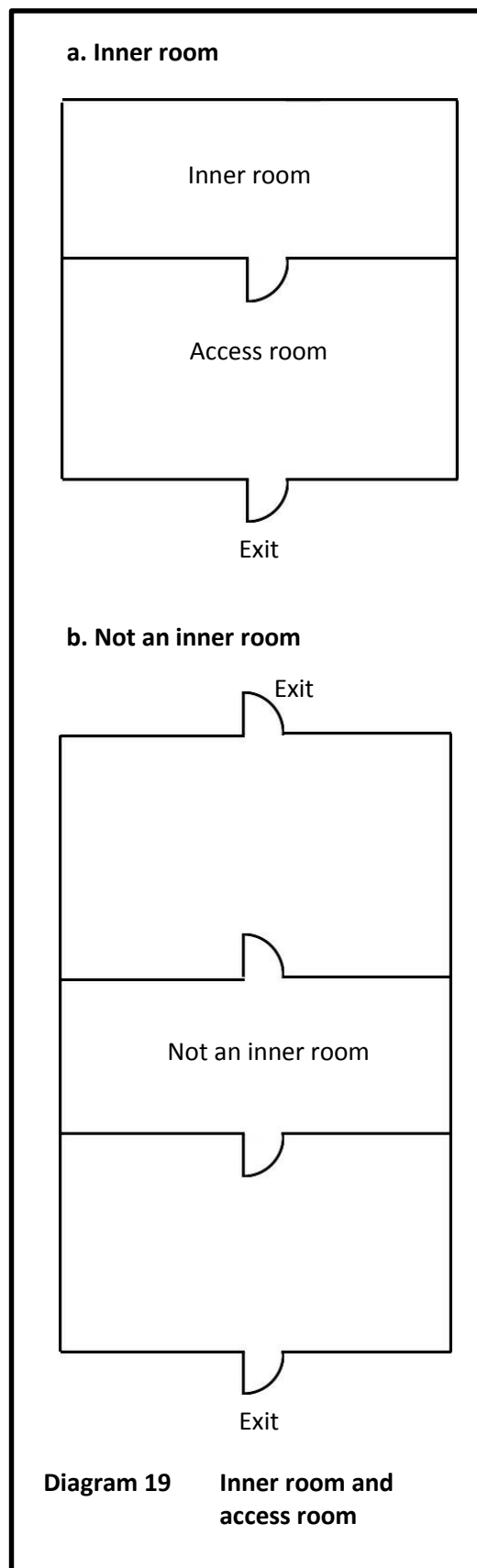
## E1 Means of warning and escape

- e) the travel distance from any point in the inner room to the nearest exit from the access room should not exceed the appropriate limit given in Table 2;
- f) the access room should not be a place of special fire hazard and should be in the control of the same occupier; and
- g) one of the following arrangements should be made:
  - i. the enclosures (walls or partitions) of the inner room should be stopped at least 1000mm below the ceiling; or
  - ii. a suitably sited vision panel not less than 0.1m<sup>2</sup> should be located in the door or walls 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 should be fitted with a suitable automatic fire detection and alarm system to warn the occupants of the inner room of the outbreak of a fire in the access room.

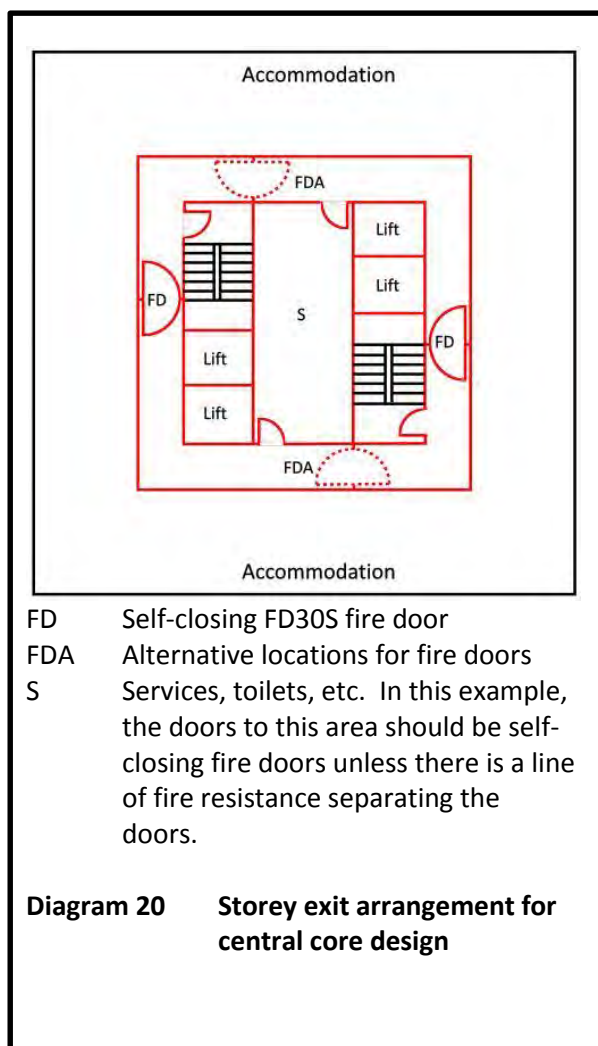
3) The scenario depicted in Diagram 19b is not an inner room situation and no special provisions are required.

### E1.9.8 Planning of exits in a central core

1) 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 20).



## E1 Means of warning and escape

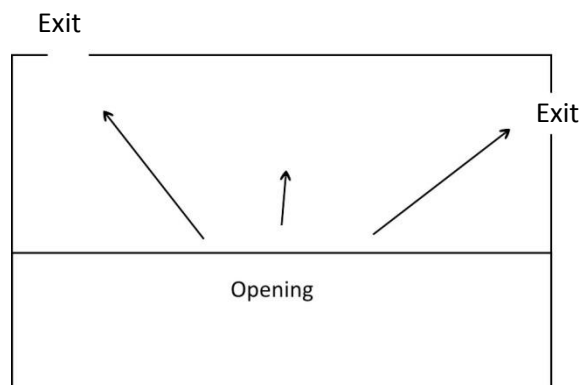


### E1.9.9 Vertical open spatial planning

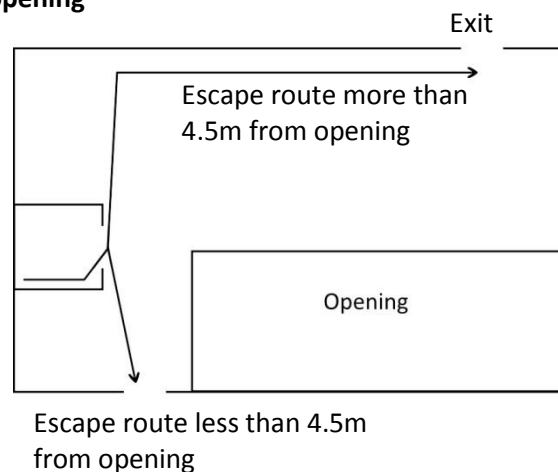
- 1) Where an open-plan space connects more than one storey, rooms accessed from the space should be treated as inner rooms (see paragraph E1.9.7) with the space/balcony regarded as the access room.
- 2) Escape routes should not be prejudiced by openings between floors, such as an escalator, an accommodation stair or a simple opening in the floor (see Diagram 21).
- 3)\* An escape route should not be within 4.5m of the openings unless:
  - a) the direction of travel is away from the opening;
  - b) there is an alternative escape route which does not pass within 4.5m of the opening; or

- c) the travel distance from the most remote point is no more than the single direction limit applicable for that part of the building.

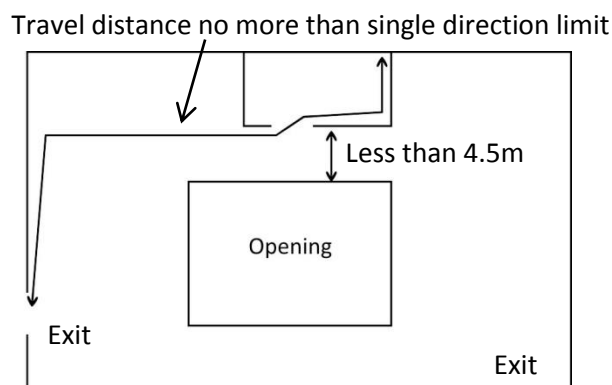
#### a. Escape routes away from opening



#### b. Alternative route more than 4.5m from opening



#### c. Travel distance no more than single direction limit



**Diagram 21** Openings between floors

## E1 Means of warning and escape

### E1.9.10 Layouts

1)\* Any storey which has more than one escape stair should be planned so that it is not necessary to pass through one stairway to reach another. However it would be acceptable to pass through one stairway's protected lobby to reach another stair.

2)\* Unless the doors to a protected stairway and any associated exit passageway are fitted with an automatic release mechanism (see Appendix B, paragraph B1 8)), the stairway and any associated exit passageway should not form part of the primary circulation route between different parts of the building at the same level.

3)\* Where a storey contains an area, which is ancillary to the main use of the building, for the consumption of food and/or drink, then:

- a) not less than two escape routes should be provided from each such area (except inner rooms which meet the provisions in section E1.9.7); and
- b) at least one of the escape routes from each such area should lead directly to a storey exit without entering any kitchen or similar area of high fire hazard.

4) 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) if the means of escape include a common corridor or circulation space, either it should be a protected corridor, or a suitable automatic fire detection and alarm system should be installed throughout the storey.

5) All escape routes should have a clear headroom of not less than 2m except in doorways.

6) The width of escape routes and exits depend on the number of people who need to use them. They should not be less than the dimensions given in Table 4. Attention is also drawn to guidance for access for people with impaired mobility.

7) Where the maximum number of people likely to use the escape routes and exits is not known the appropriate occupant capacity should be calculated on the basis of the guidance set out in Appendix C.

**Table 4 Minimum widths of escape routes and exits**

| Maximum number of people |                      | Minimum width (mm) <sup>(1)(2)(3)</sup> |
|--------------------------|----------------------|---|
| If the only exit         | If not the only exit |   |
| 60                       | 100                  | 750 <sup>(4)</sup>                      |
| 60                       | 110                  | 850                                     |
| 60                       | 220                  | 1050                                    |
| 60                       | Over 220             | 5mm per person <sup>(5)</sup>           |

**Notes for Table 4:**

1. Refer to Appendix C for methods of measurement.
2. The widths given in the table may need to be increased to provide better access for disabled people.
3. Widths less than 1050mm should not be interpolated.
4. May be reduced to 530mm for gangways between fixed storage racking, other than in public areas of shops and commercial buildings.
5. 5mm/person does not apply to an opening serving less than 220 people.

8) Guidance on the spacing of fixed seating for auditoria is given in BS 9999 Annex D.

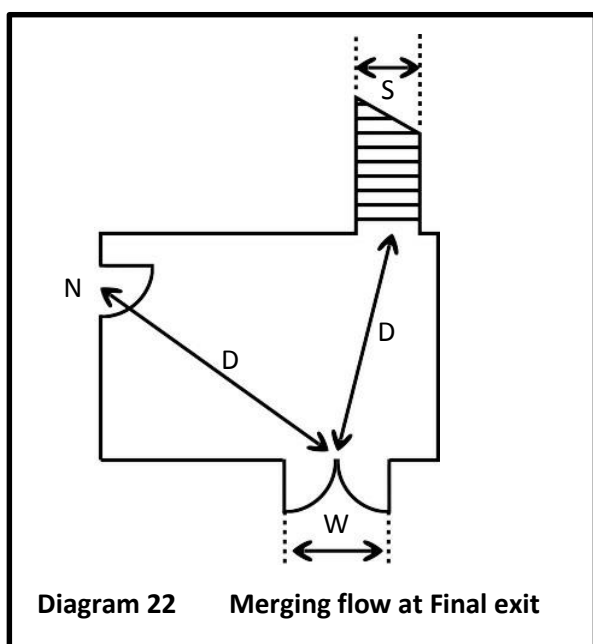
\* see corresponding entry in Appendix H

## E1 Means of warning and escape

9)\* If a storey or room has two or more storey exits it has to be assumed that a fire might prevent the occupants from using one of them. The remaining exit(s) need to be wide enough to allow all the occupants to leave quickly. Therefore, when deciding on the total width of exits needed according to Table 4, the largest exit should be discounted. This may have implications for the width of stairs, because they should be at least as wide as any storey exit leading onto them. Although some stairs are not subject to discounting (see section E1.10.6.2), the storey exits onto them will be.

10) The total number of people which two or more available exits (after discounting) can accommodate is found by adding the maximum number of people that can be accommodated by each individual exit width. For example, 3 exits each 850mm wide will accommodate  $3 \times 110 = 330$  people (not the 510 people that would be accommodated by a single exit which is  $3 \times 850 = 2550$ mm wide).

11) Where a ground floor storey exit shares a final exit with a stair via a ground floor lobby, the width of the final exit should be sufficient to enable a maximum evacuation flow rate equal to or greater than that from the storey exit and stair combined (see Diagram 22).



12) The minimum width of the final exit can be calculated with the following formula:

$$W = 5N + 0.75S$$

Where:

W = width of final exit, in mm

N = number of people served by ground floor storey exit

S = stair width in mm

13) If W is calculated to be less than S, then W should be increased to be equal to or greater than S.

14) Where the number of people (N) entering the lobby from the ground floor is more than 60 then the distance (D) from the foot of the stair and from the storey exit, to the final exit should be a minimum of two metres (see Diagram 22). Where this cannot be achieved then the width of the final exit (W) should be no less than the width of the stair plus the width of the storey exit. Where N is less than 60 there is no restriction on D.

### 15) Worked example

A ground floor storey exit serving 250 people shares a common final exit with a 1200 mm wide stair.

The required final exit width is calculated as follows:

$$W = 5N + 0.75S$$

$$W = 5 \times 250 + 0.75 \times 1200$$

$$= 1250 + 900$$

$$= 2150\text{mm}$$

\* see corresponding entry in Appendix H

## E1 Means of warning and escape

### E1.9.11 Corridors

1)\* A corridor which serves a part of the means of escape in any of the following circumstances should be a protected corridor:

- a) every corridor serving bedrooms;
- b) \*every dead end corridor (excluding recesses and extensions not exceeding 2m deep as described in *BS 9999* and excluding dead ends where the corridor and all adjoining rooms and spaces are protected by automatic fire detection in accordance with *BS 5839 part 1* – see Diagram 25); and
- c) any corridor common to two or more different occupancies, except where the corridor and all adjoining rooms are covered by automatic fire detection complying with the recommendations of *BS 5839 part 1*. Detection of fire in any of these spaces should raise the alarm in all occupancies that share the corridor.

2)\* Where a corridor that is used as a means of escape, but is not a protected corridor, is enclosed by partitions, those partitions provide some defence against the spread of smoke in the early stages of a fire, even though they may have no fire resistance rating. To maintain this defence the partitions should be carried up to the soffit of the structural floor above, or to a suspended ceiling and openings into rooms from the corridor should be fitted with doors, which need not be fire doors.

3) Horizontal open planning, while offering no impediment to smoke spread, has the compensation that occupants can become aware of a fire quickly.

4)\* 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 more than 12m long which connects two or more storey exits, should be sub-divided by self-closing fire doors (and any necessary associated screens). The fire door(s) and any

associated screen(s) should be positioned approximately mid-way between the two storey exits to effectively safeguard the route from smoke (having regard to the layout of the corridor and to any adjacent fire risks). In a building of Purpose Group 2 to 7, where a cavity exists above or below the enclosures to any such corridor, because the enclosures are not carried to full storey height, the potential for smoke to bypass the sub-division should be restricted by:

- a) fitting cavity barriers on the line of the enclosure(s) to and across the corridor (see Diagram 23a); or
- b) enclosing the cavity by a fire-resisting ceiling or fire resisting floor which extends throughout the building, compartment or separated part (see Diagram 23b).

5)\* Any door which could provide a path for smoke to bypass the sub-division should be made self-closing (but need not necessarily be fire-resisting).

6) 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 pressure differential system complying with *BS EN 12101-6:2005*, every dead end corridor exceeding 4.5m in length should be separated by doors from those parts of the corridor which:

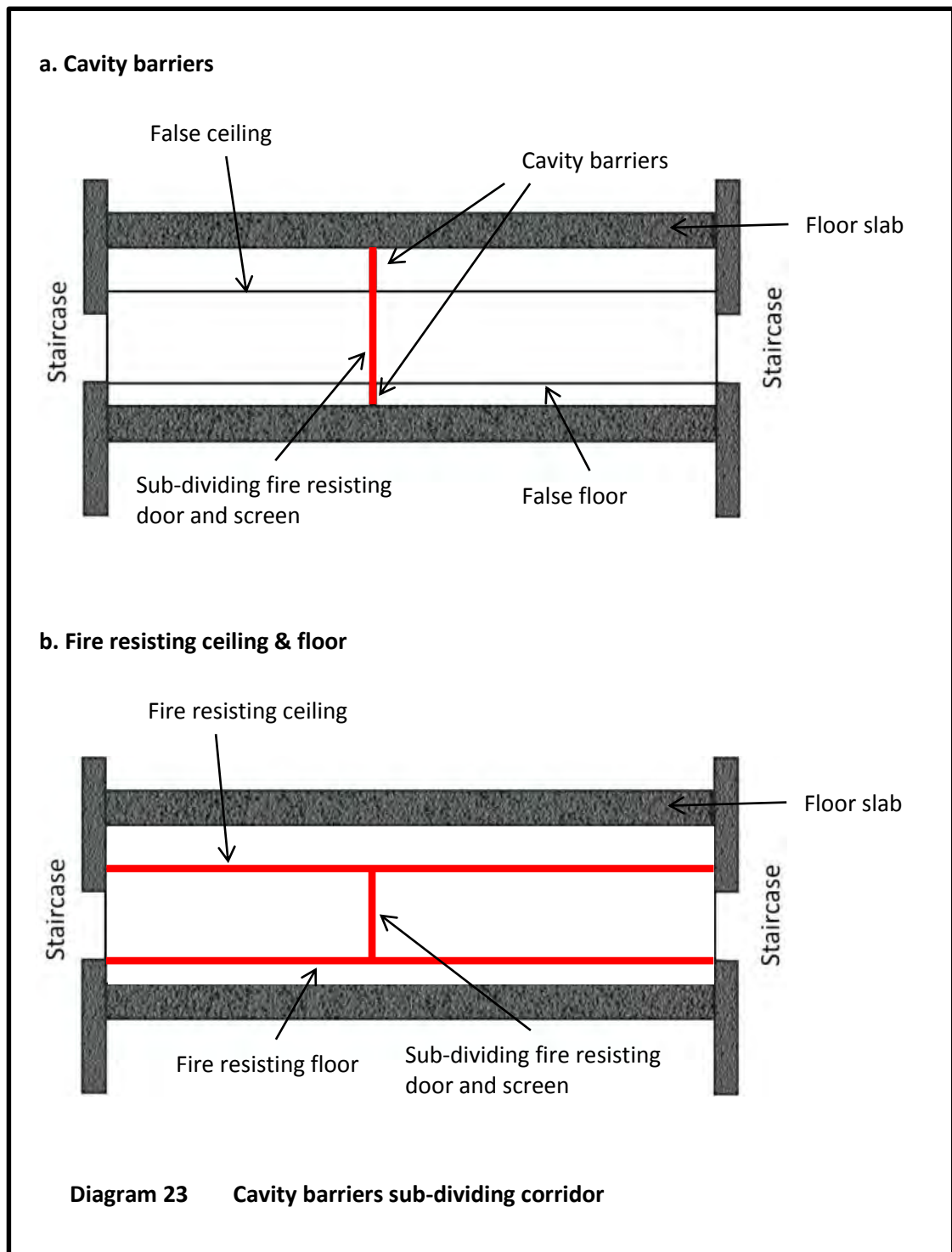
- a) provide alternative directions of escape (see Diagrams 24a and 25a); or
- b) continue past one storey exit to another (see Diagrams 24b and 25b).

7) If the dead end corridor is enclosed in fire resisting construction then the separating doors and their associated screens should be fire resisting. If the dead end corridor is protected by automatic fire detection and is not enclosed in fire resisting construction then the doors need not be fire resisting.

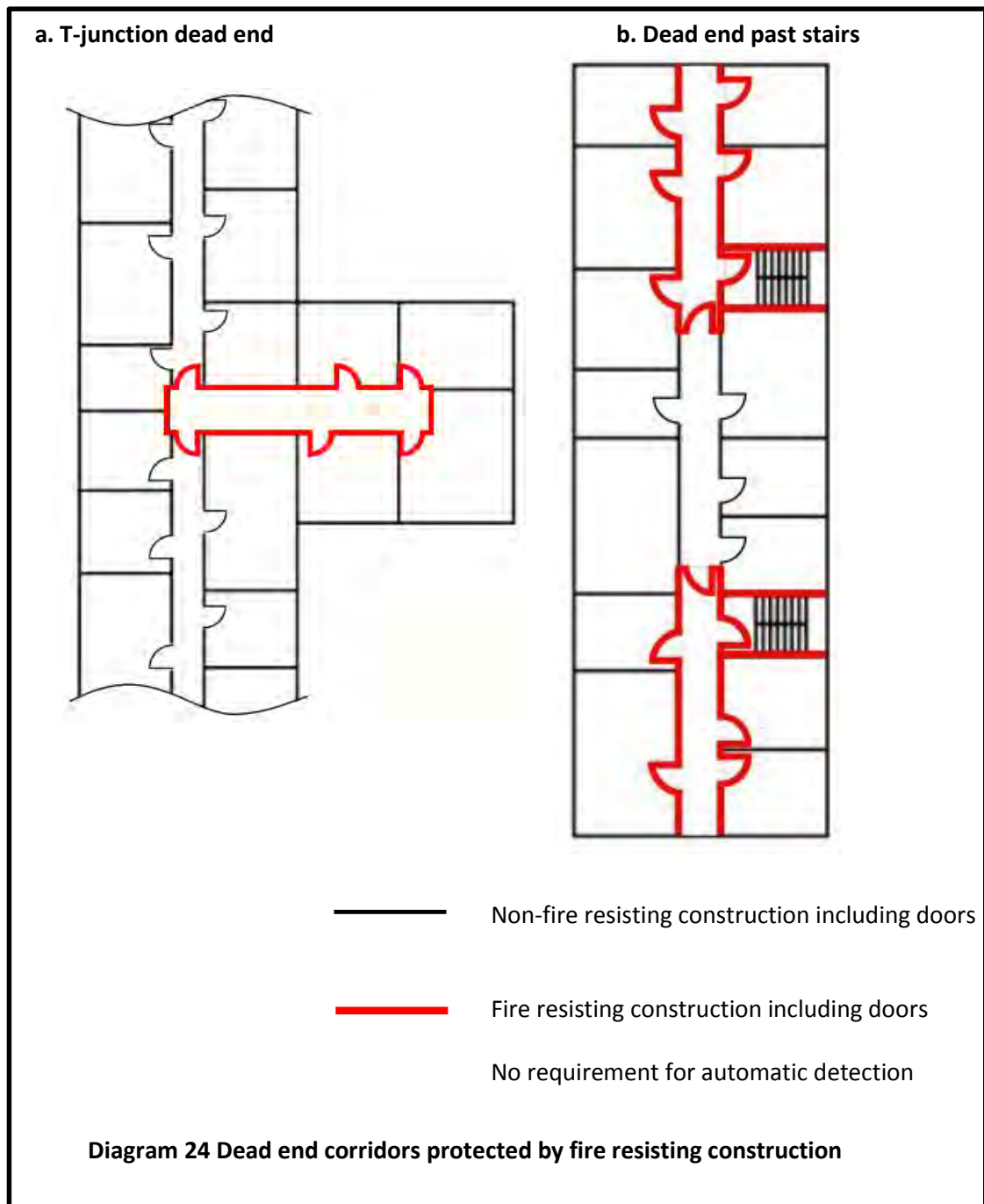
\* see corresponding entry in Appendix H



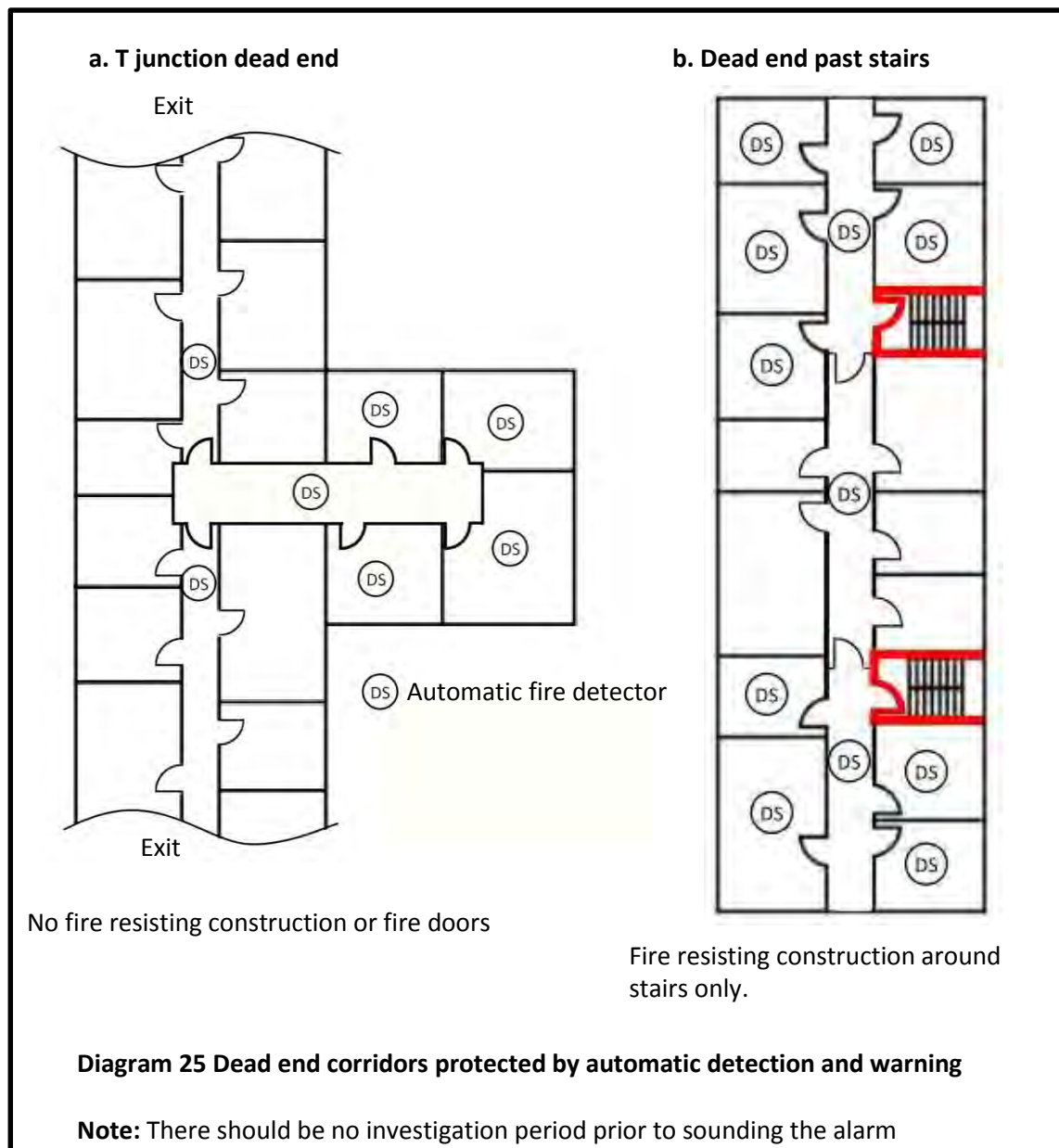
## E1 Means of warning and escape



## E1 Means of warning and escape



## E1 Means of warning and escape



## E1 Means of warning and escape

### E1.9.12 Cavity barriers

1) Additional measures to safeguard escape routes from smoke are given in section E3.4 to E3.6).

### E1.9.13 External escape routes

1) Guidance on the use of external escape stairs from buildings is given in section E1.10.13.

2) Where an external escape route (other than a stair) is beside an external wall of the building, that part of the external wall within 1800mm of the escape route should be of fire resisting construction, up to a height of 1100mm above the paving level of the route. For guidance on external escape stairs see section E1.11.4.4.

3) 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 part of a building intended for use by members of the public; and
- b) it meets the provisions in section E1.11.5.5.

### E1.9.14 Residential care homes

1) Residential care homes are quite diverse and can be used by a variety of residents, often requiring different types of care to suit their specific needs. They can include homes for the elderly, children and people who are physically or mentally disabled. The choice of fire safety strategy is dependent upon the way a building is designed, furnished, staffed and managed and the level of dependency of the residents.

2) Generally, in care homes for the elderly it is reasonable to assume that at least a proportion of the residents will need some assistance to evacuate. As such these buildings should be designed for progressive

horizontal evacuation (PHE) in accordance with paragraphs E1.9.14 4) to E1.9.14 16) below. For other types of care home a judgement should be made as to whether PHE or a simultaneous evacuation strategy is appropriate. Whatever approach is adopted in the design of a building this must be recorded and communicated to the building management to ensure that procedures are adopted that are compatible with the building design.

3) The guidance on PHE given in paragraphs E1.9.14 4) to E1.9.14 16) is for those care homes, to which the provisions of the “Firecode” documents are not applicable (see section E0.12.2).

4) The concept of PHE requires those areas used for the care of residents to be subdivided into protected areas separated by compartment walls and compartment floors. This allows horizontal escape to be made by evacuating into adjoining protected areas. The objective 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.

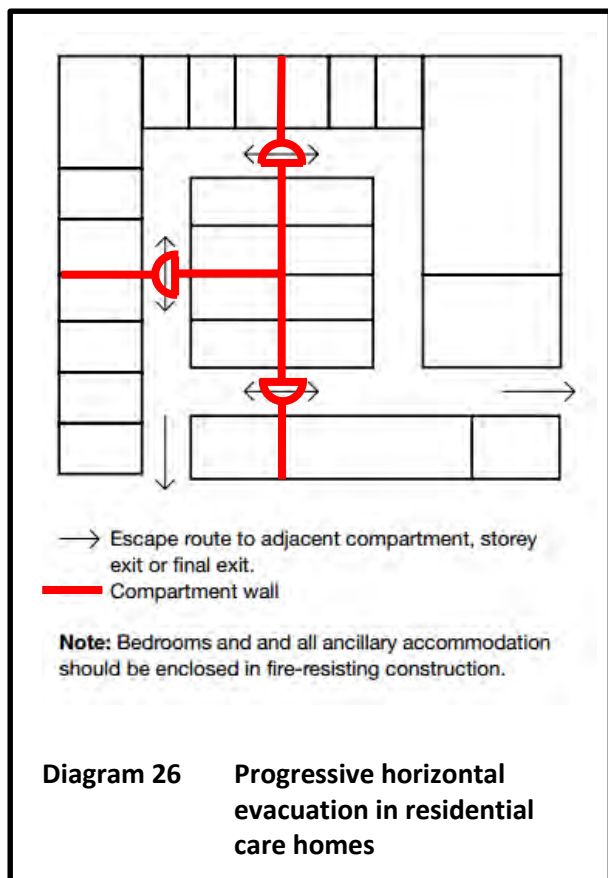
5) Each storey, used for the care of residents, should be divided into at least three protected areas by compartment walls and all floors should be compartment floors.

6) Every protected area should be provided with at least two exits to adjoining, but separate protected areas. Travel distances within a protected area to these exits should not exceed those given in Table 2. The maximum travel distance from any point should be not more than 64m to a storey exit or a final exit.

7) A fire in any one protected area should not prevent the occupants of any other area from reaching a final exit (see Diagram 26). Escape routes should not pass through ancillary accommodation such as that listed in paragraph E1.9.14 13).

## E1 Means of warning and escape

8) The number of residents' beds in protected areas should be established based on assessment of the number of staff likely to be available and the level of assistance that residents may require. In no case should this exceed 10 beds in any one protected area.



9) Adjoining protected areas into which horizontal evacuation may take place should each have a floor area sufficient to accommodate not only their own occupants but also the occupants from the largest adjoining protected area.

10) A fire detection and alarm system should be provided to an L1 standard in accordance with *BS 5839-1:2013*.

11) Each bedroom should be enclosed in fire-resisting construction with fire resisting doors and every corridor serving bedrooms should be a protected corridor (see paragraph E1.9.11 1)).

12) Bedrooms should not contain more than one bed (this includes a double bed).

13) Ancillary accommodation such as the following, should be enclosed by fire-resisting construction.

- a) chemical stores;
- b) cleaners' rooms;
- c) clothes' storage;
- d) day rooms;
- e) smoking rooms;
- f) disposal rooms;
- g) plant rooms;
- h) linen stores;
- i) kitchens;
- j) laundry rooms;
- k) staff changing and locker rooms; and
- l) all other store rooms.

14) The specification of door-closing devices for fire doors should take account of the needs of residents. In particular where self-closing doors could present an obstacle to the residents of the building then the following hardware in accordance with *BS EN 1155:1997* would be appropriate;

- a) For bedrooms: free-swing door closers.
- b) Circulation spaces: hold-open devices.

15) Where a sprinkler system is provided in accordance with section E0.9 the following variations to the guidance given in paragraphs E1.9.14 4) to E1.9.14 14) are acceptable.

- a) Fire doors to bedrooms need not be fitted with self-closing devices.
- b) Protected areas may contain more than 10 beds.
- c) Bedrooms may contain more than one bed.

16) Management procedures will need to take account of the larger number of residents that may need assistance and the need to manually close bedroom doors during sleeping hours.

## E1 Means of warning and escape

### E1.10 Design for vertical escape in buildings other than flats or dwelling houses

#### E1.10.1 Introduction

1) An important aspect of means of escape in multi-storey buildings is the availability of a sufficient number of adequately sized and protected escape stairs. This section deals with escape stairs and includes measures necessary to protect them in all types of building.

2) The limitation of distances of horizontal travel for means of escape purposes means that most people should be able independently to reach the safety of a protected escape route or final exit. However, some people, for example those who use wheelchairs, may not be able to use stairways without assistance. For them evacuation involving the use of refuges on escape routes and either assistance down (or up) stairways, or the use of suitable lifts, will be necessary.

3) This section should be read in conjunction with the general provisions in section E1.11.

#### E1.10.2 Number of escape stairs

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

- a) the constraints imposed in section E1.9 on the design of horizontal escape routes;
- b) whether independent stairs are required in mixed occupancy buildings (see section E1.10.3);
- c) whether a single stair is acceptable (see section E1.10.4); and
- d) provision of adequate width for escape (see section E1.10.6.1) while allowing for the possibility that a stair may have to be discounted because of fire or smoke (see section E1.10.6.2).

2) In larger buildings, provisions for access for the Fire and Rescue Service may apply, in which case, some escape stairs may also need to serve as firefighting stairs. The number of escape stairs may therefore be affected by provisions made in section E5.5.3.

#### E1.10.3 Mixed use buildings

1) Where a building contains storeys (or parts of storeys) in different purpose groups, it is important to consider the effect of one risk on another. A fire in a shop, or unattended office, could have serious consequences on, for example, a residential or hotel use in the same building. It is therefore important to consider whether completely separate routes of escape should be provided from each different use within the building or whether other effective means to protect common escape routes can be provided.

#### E1.10.4 Single escape stairs

1) Provided that independent escape routes are not necessary from areas in different purpose groups in accordance with paragraph E1.8.8.12.13 1) or section E1.10.3, the situations where a building (or part of a building) may be served by a single escape stair are:

- a) from a basement which is allowed to have a single escape route in accordance with paragraph E1.9.3 2) and Table 2;
- b) from a building, other than small premises (see E1.12), which has no storey with a floor level more than 11m above ground level and in which every storey is allowed to have a single escape route in accordance with paragraph E1.9.3 2) and Table 1;
- c) in the case of small premises, as per the guidance in E1.12.

Where a single stair is provided each floor is limited to 60 people and the single direction travel distance limits must be complied with on each floor.



## E1 Means of warning and escape

### E1.10.5 Provision of refuges

1) Refuges are relatively safe waiting areas for short periods. They are not areas where disabled people should be left alone until rescued by the fire and rescue service, or until the fire is extinguished.

2)\* A refuge should be provided for each protected stairway affording egress from each storey, except storeys consisting exclusively of plant rooms.

3) Whilst a refuge should be provided for each stairway, they need not necessarily be located within the stair enclosure but should enable direct access to the stair. The number of refuge spaces need not necessarily equal the sum of the number of wheelchair users who can be present in the building. Refuges form a part of the management plan and it may be that more than one disabled person will use a single refuge as they pass through as a part of the evacuation procedure.

4) The following are examples of satisfactory refuges:

- a) an enclosure such as a compartment (see Diagram 27), protected lobby, protected corridor or protected stairway (see Diagram 28); and
- b) an area in the open air such as a flat roof, balcony, podium or similar place which is sufficiently protected (or remote) from any fire risk and provided with its own means of escape.

5) Each refuge should provide an area accessible to a wheelchair of at least 900mm x 1400mm in which a wheelchair user can await assistance. Where a refuge is in a protected stairway or protected lobby or protected corridor, the wheelchair space should not reduce the width of the escape route. Where the wheelchair space is within a protected stairway, access to the wheelchair space should not obstruct the flow of people escaping.

6) Refuges and evacuation lifts should be clearly identified by appropriate fire safety signs. Where a refuge is in a lobby or stairway the sign should be accompanied by a blue mandatory sign worded "Refuge – keep clear".

#### E1.10.5.1 Communications

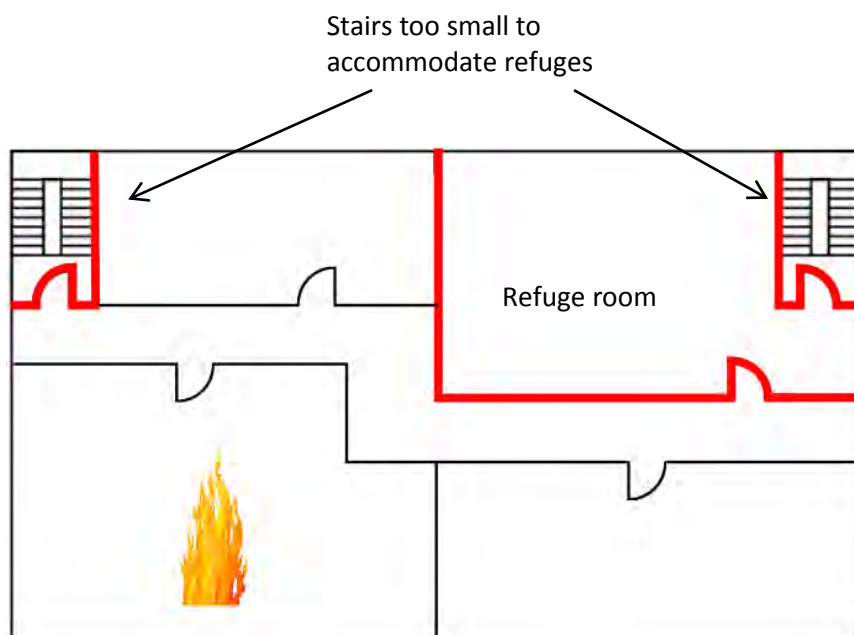
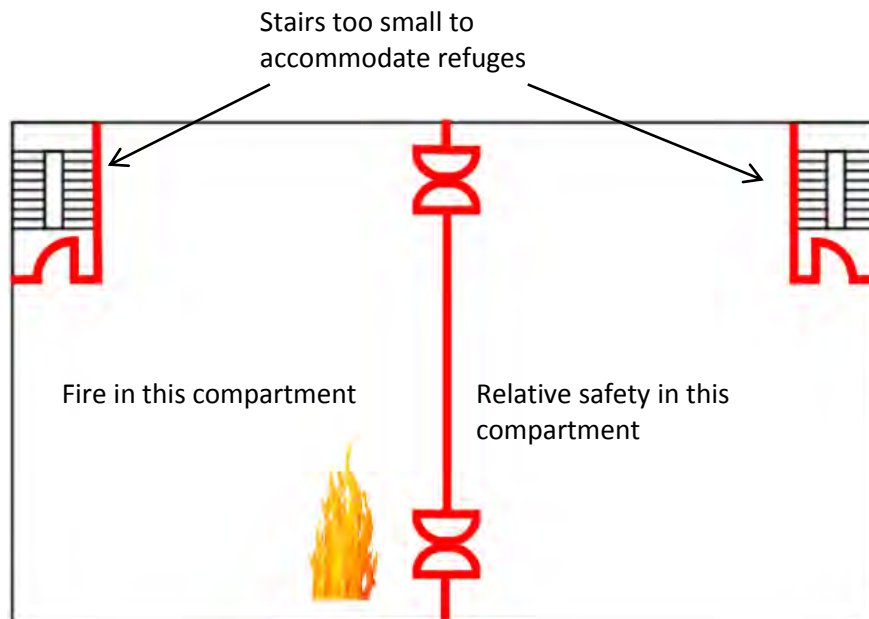
1) To facilitate the effective evacuation of people from refuges an emergency voice communication (EVC) system should be provided. It is essential that the occupants of each refuge are able to alert other people that they are in need of assistance and for them to be reassured that this assistance will be forthcoming.

2) The EVC system should comply with *BS 5839-9:2011* and consist of Type B outstations which communicate with a master station located in the building control room (where one exists) or adjacent to the fire alarm panel.

3) In some buildings it may be more appropriate to use an alternative approach such as the use of wireless technology.



## E1 Means of warning and escape



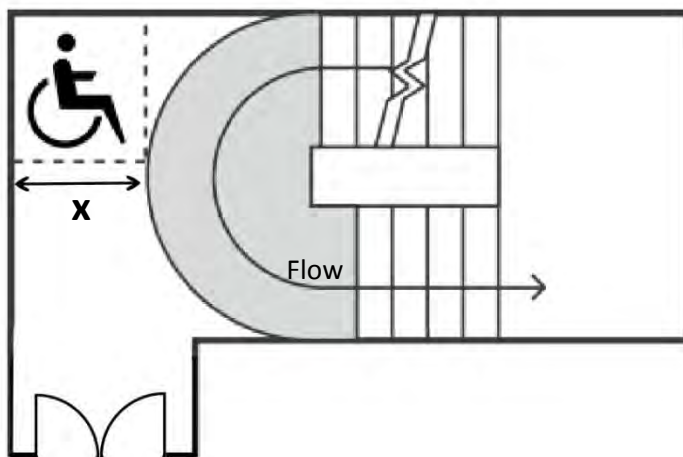
If a fire were to break out in the room marked as the 'refuge room' then the larger part of the floor would provide the required refuge.

A cellular layout is more likely to require some automatic fire detection.

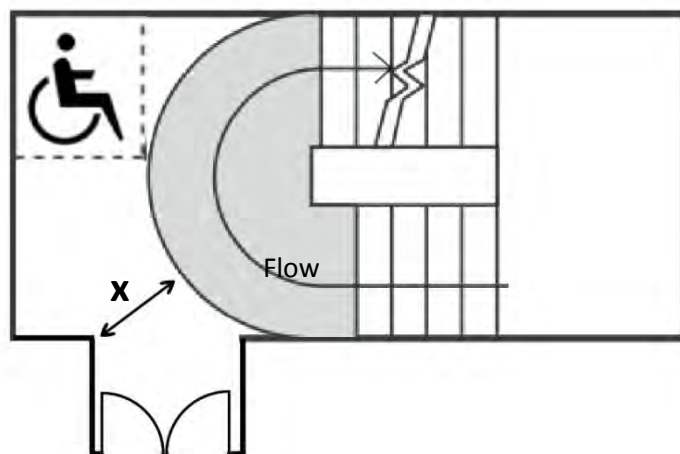
**Diagram 27**      **Refuges formed by compartmentation**

## E1 Means of warning and escape

a. Flow in staircase going against route to refuge



b. Flow in staircase going in same direction as route to refuge



In case a. the dimension, x, must be at least 900mm

In case b. the dimension, x, can be less than 900mm



Area that is notionally occupied by the flow of people in the staircase

**Diagram 28**      **Refuges in staircase enclosures**

## E1 Means of warning and escape

### E1.10.5.2 Evacuation lifts

1) Guidance on the use of lifts when there is a fire is given in section E1.11.5.9.1. See also the document, *Guidance on the emergency use of lifts or escalators for evacuation and fire and rescue service operations - BD 2466*

### E1.10.6 Width of escape stairs

- 1) The width of escape stairs 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 Tables 5 and 6;
  - c) not exceed 1400mm if their vertical extent is more than 30m, unless it is provided with a central handrail (see paragraphs E1.10.6 2) and 3)); and
  - d) not reduce in width at any point on the way to a final exit.

2) The 1400mm width has been given for stairs in tall buildings because research indicates that people prefer to stay within reach of a handrail when making a prolonged descent, so much so that the centre part of a wider stair is little used and could be hazardous. Thus additional stair(s) may be needed.

3)\* Where a stair wider than 1400mm is provided with a central handrail, then the stair width on each side of the central handrail needs to be considered separately for the purpose of assessing stair capacity.

4)\* If the required width of a stair is more than 1800mm, then the stair should have a central handrail.

5) Where an exit route from a stair also forms the escape from the ground and/or basement storeys, the width may need to be increased accordingly. (see paragraph E1.9.10 11)).

| Table 5 Minimum widths of escape stairs  |  |  |                             |
|--|--|--|-----------------------------|
| Situation of stair   |  | Maximum number of people served <sup>(1)</sup> | Minimum width of stair (mm) |
| 1a.  | In an institutional building (unless the stair will only be used by staff)   | 150  | 1000 <sup>(2)</sup>         |
| 1b.  | In an assembly building and serving an area used for assembly purposes (unless the area is less than 100m <sup>2</sup> ) | 220  | 1100                        |
| 1c.  | In any other building and serving an area with an occupancy of more than 50  | <sup>(3)</sup>                                 |                             |
| 2  | Any stair not described above  | 50   | 800 <sup>(4)</sup>          |
| <b>Notes on Table 5:</b> <ol style="list-style-type: none"> <li>1) Assessed as likely to use the stair in a fire emergency.</li> <li>2) BS 9999 recommends that firefighting stairs should be at least 1100mm wide.</li> <li>3) See Table 6 for sizing stairs for simultaneous evacuation, and Table 7 for phased evacuation.</li> <li>4) In order to comply with recommendations on minimum widths for areas accessible to disabled people, this may need to be increased to 1000mm.</li> </ol> |  |  |                             |

\* see corresponding entry in Appendix H

## E1 Means of warning and escape

### E1.10.6.1 Calculation of minimum stair width

1) Every escape stair should be wide enough to accommodate the number of people needing to use it in an emergency. This width will depend on the number of stairs provided and whether the escape strategy for the building (or part of the building) is based on simultaneous evacuation (see paragraph E1.10.6.3 1)) or phased evacuation (see section E1.10.6.4).

2) As with the design of horizontal escape routes, where the maximum number of people needing to use the escape stairs is not known, the occupant capacity should be calculated on the basis of the appropriate floor space factors. Guidance for this is set out in Appendix C.

### E1.10.6.2 Discounting of stairs

1) Whether phased or simultaneous evacuation is used, where two or more stairs are provided it should be assumed that one of them might not be available due to fire. It is therefore necessary to discount each stair in turn in order to ensure that the capacity of the remaining stair, or stairs are adequate for the number of people who need to escape.

2) The stair discounting rule applies to a building fitted with a sprinkler system as it does to buildings without sprinklers.

3) Two exceptions to the above discounting rules are if the escape stairs:

- a) are protected by a smoke control system designed in accordance with *BS EN 12101-6:2005*.
- b) are approached on each storey through a protected lobby (a protected lobby need not be provided on the topmost storey for the exception still to apply).

4) Section E1.10.7.3 identifies several cases where stairs need lobby protection. In such cases the likelihood of a stair not being available is significantly reduced and it is not necessary to discount a stair. However,

a storey exit still needs to be discounted, see paragraph E1.9.10 9). See also paragraph E1.10.6.4 3) for additional guidance on the potential need to discount stairs in tall buildings utilising phased evacuation.

### E1.10.6.3 Simultaneous evacuation

1)\* In a building designed for simultaneous evacuation, the escape stairs (in conjunction with the rest of the means of escape) should have the capacity to allow all floors to be evacuated simultaneously. In calculating the width of the stairs account is taken of the number of people temporarily housed in the stairways during the evacuation.

2) Escape based on simultaneous evacuation should be used for:

- a) all stairs serving basements;
- b) all stairs serving buildings with vertical open spatial planning;
- c) all stairs serving Other Residential or Assembly and Recreation buildings; and
- d) all stairs serving large department stores.

3)\* Where simultaneous evacuation is to be used, the capacity of stairs of widths from 1000 to 1800mm is given in Table 6. The minimum acceptable width in non-domestic buildings is 1000mm except where Table 5 allows narrower stairs.

\* see corresponding entry in Appendix H

## E1 Means of warning and escape

**Table 6 Stair capacities for simultaneous evacuation**

| No. of floors served | Maximum number of people served by a stair of width (mm): |      |      |      |      |      |      |      |      |
|----------------------|---|------|------|------|------|------|------|------|------|
|                      | 1000  | 1100 | 1200 | 1300 | 1400 | 1500 | 1600 | 1700 | 1800 |
| 1                    | 150   | 220  | 240  | 260  | 280  | 300  | 320  | 340  | 360  |
| 2                    | 190   | 260  | 285  | 310  | 335  | 360  | 385  | 410  | 435  |
| 3                    | 230   | 300  | 330  | 360  | 390  | 420  | 450  | 480  | 510  |
| 4                    | 270   | 340  | 375  | 410  | 445  | 480  | 515  | 550  | 585  |
| 5                    | 310   | 380  | 420  | 460  | 500  | 540  | 580  | 620  | 660  |
| 6                    | 350   | 420  | 465  | 510  | 555  | 600  | 645  | 690  | 735  |
| 7                    | 390   | 460  | 510  | 560  | 610  | 660  | 710  | 760  | 810  |
| 8                    | 430   | 500  | 555  | 610  | 665  | 720  | 775  | 830  | 885  |
| 9                    | 470   | 540  | 600  | 660  | 720  | 780  | 840  | 900  | 960  |
| 10                   | 510   | 580  | 645  | 710  | 775  | 840  | 905  | 970  | 1035 |

**Notes for Table 6:**

- (1) The capacity of stairs serving more than 10 storeys may be obtained by using linear extrapolation.
- (2) Interpolating between columns is acceptable.
- (3) The capacity of stairs not less than 1100mm wide may also be obtained by using the formula in paragraphs E1.10.6.3 4) to E1.10.6.3 7).
- (4) Stairs with a rise of more than 30m should not be wider than 1400mm unless provided with a central handrail (see paragraphs E1.10.6 1) to E1.10.6 3)).
- (5) Stairs wider than 1800mm should be provided with a central handrail (see paragraph E1.10.6 4)).

4) As an alternative to using Table 6, the capacity of stairs 1100mm or wider (for simultaneous evacuation) can be derived from the formula:

$$P = 200w + 50(w - 0.3)(n - 1), \text{ or}$$

$$w = P + 15n - 15 / (150 + 50n)$$

where:

- P is the number of people that can be served;
- w is the width of the stair, in metres;
- n is the number of storeys served.

5) The formula is particularly useful when determining the width of stairs serving a building (or part of a building) where the occupants are not distributed evenly - either within a storey or between storeys.

6) In the formula, the first part (200w) represents the number of people estimated to have left the stair after 2.5 minutes of evacuation. The second part (50(w-0.3)(n-1)) represents the number of people estimated to be accommodated on the stair after this time.

7) Separate calculations should be made for stairs/flights serving basement storeys and those serving upper storeys.

## E1 Means of warning and escape

### 8) Worked examples:

#### Question.

A 13-storey building (ground plus 12) is used as offices at every level. The ground floor has exits which are independent of the stairs.

There are two stairs that serve the offices and they satisfy the travel distance limitations.

a. When a population of 1,200 (excluding the ground floor) is distributed evenly, what is the minimum width needed for the two stairs using simultaneous evacuation?

#### Answer

As the top office storey is at a height greater than 18m, both stairs need lobby protection at each level (see section E1.10.7.3). Therefore, both stairs can be assumed to be available (see paragraphs E1.10.6.2 3) to E1.10.6.2 4).

However, the location of the fire may mean that the people on the fire floor do not have access to both stairs and all have to use just one of the staircases.

First, the maximum number of users for each stair has to be established. This will be the value of P that is used in the formula.

Population of each floor =  $1200/12 = 100$

$n = 12$

There will be  $n - 1$  non-fire floors and one fire floor.

On  $(n - 1)$  floors the population are assumed to split themselves evenly between the two stairs.

On the one fire floor the population are assumed to all use one stair.

Therefore,

$$P = (n - 1) \times (100/2) + 1 \times 100$$

$$= 11 \times 50 + 100$$

$$= 650$$

Using the first formula:

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

$$650 = 200w + 50 (w - 0.3)(12 - 1)$$

$$650 = 200w + (50w - 15)(11)$$

$$650 = 200w + 550w - 165$$

$$815 = 750w$$

$$w = 815/750 = 1087\text{mm}$$

[Alternatively, using the second formula:

$$w = P + 15n - 15 / (150 + 50n)$$

$$= 650 + 15 \times 12 - 15 / (150 + 50 \times 12)$$

$$= 650 + 180 - 15 / (150 + 600)$$

$$= 815/750$$

$$= 1087\text{mm}]$$

Therefore both stairs should be at least 1087mm wide. But this needs to be increased to 1100mm as the formulae apply only to stairs 1100mm or wider (see paragraphs E1.10.6.3 4) to E1.10.6.3 7)).

[The storey exits, leading to the stairs, will need to be at least 750mm wide (see Table 4) so 1100mm wide stairs will be satisfactory as they will not reduce the width of the escape route as it travels towards the exit.]



## E1 Means of warning and escape

b. What minimum width is required for the stairs, using simultaneous evacuation, when the population is not distributed evenly but is distributed as follows?

|          |     |
|----------|-----|
| Floor 1  | 100 |
| Floor 2  | 150 |
| Floor 3  | 200 |
| Floor 4  | 200 |
| Floor 5  | 150 |
| Floor 6  | 50  |
| Floor 7  | 100 |
| Floor 8  | 50  |
| Floor 9  | 50  |
| Floor 10 | 50  |
| Floor 11 | 50  |
| Floor 12 | 50  |

Total 1200 (same as previous example)

Answer

As the top office storey is at a height greater than 18m, both stairs need lobby protection at each level (see paragraphs E1.10.7.3 1) to 3)). Therefore, both stairs can be assumed to be available (see paragraphs E1.10.6.2 3) to 4)).

However, the location of the fire may mean that the people on the fire floor do not have access to both stairs and all have to use just one of the staircases. The worst case will be when the fire is on one of the floors with the largest population (i.e. 200).

The maximum number of users for each stair has to be established. This will be the value of P that is used in the formula.

$n = 12$

There will be  $n - 1$  non-fire floors and one fire floor.

On  $(n - 1)$  floors the population are assumed to split themselves evenly between the two stairs.

On the one fire floor (population = 200) the population are assumed to all use one single stair.

Therefore,

$$P = (1200 - 200)/2 + 1 \times 200$$

$$= 1000/2 + 200$$

$$= 700$$

Using the first formula:

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

$$700 = 200w + 50 (w - 0.3)(12 - 1)$$

$$700 = 200w + (50w - 15)(11)$$

$$700 = 200w + 550w - 165$$

$$865 = 750w$$

$$w = 865/750 = 1153\text{mm}$$

[Alternatively, using the second formula:

$$w = P + 15n - 15/(150 + 50n)$$

$$= 700 + 15 \times 12 - 15/(150 + 50 \times 12)$$

$$= 700 + 180 - 15/(150 + 600)$$

$$= 865/750$$

$$= 1153\text{mm}]$$

Therefore both stairs should be at least 1153mm wide. The formulae apply to stairs 1100mm or wider so this is satisfactory.

[The largest storey exits, leading to the stairs, will need to be at least 1050mm wide (see Table 4) so 1153mm wide stairs will be satisfactory as they will not reduce the width of the escape route as it travels towards the exit.]

## E1 Means of warning and escape

### E1.10.6.4 Phased evacuation

1) Where it is appropriate to do so, it may be advantageous to design stairs in high buildings on the basis of phased evacuation.

2) In phased evacuation the first people to be evacuated are all those of reduced mobility and those on the storey most immediately affected by the fire.

Subsequently, if there is a need to evacuate more people, it is done two floors at a time. This is a method which cannot be used in every type of building and it depends on the provision (and maintenance) of certain supporting facilities such as fire alarms. It does however enable narrower stairs to be incorporated than would be the case if simultaneous evacuation were used and has the practical advantage of reducing disruption in large buildings.

3) In tall buildings over 30m in height, where phased evacuation is adopted, there is a potential that people attempting to escape could be impeded by firefighters entering and operating within the building. This potential varies with the height of the building and with the number of escape stairs that are available. Generally, this can be addressed by incorporating special management procedures into the evacuation strategy in consultation with Fire and Rescue Service. However, in some very tall buildings, typically those over 45m in height, physical measures may need to be incorporated into the building (e.g. by discounting a stair or by some other suitable means).

4) Phased evacuation may be used for any building provided it is not identified in paragraph E1.10.6.3 2) as needing simultaneous evacuation.

5) The following criteria should be satisfied in a building (or part of a building) that is designed on the basis of phased evacuation:

- a) the stairways should be approached through a protected lobby or protected corridor at each storey, except a top storey;
- b) the lifts should be approached through a protected lobby at each storey (see section E1.11.5.9.2);
- c) every floor should be a compartment floor;
- d) if the building has a storey with a floor over 30m above ground level, the building should be protected throughout by an automatic sprinkler system in accordance with section E0.9;
- e) the building should be fitted with an appropriate fire warning system, conforming to at least the L3 standard given in *BS 5839-1:2013*; and
- f) an internal speech communication system should be provided to permit conversation between a control point at fire and rescue service access level and a fire warden on every storey.
- g) the recommendations relating to phased evacuation provided in *BS 5839-1* should be followed. Where it is deemed appropriate to install a voice alarm, this should be in accordance with *BS 5839-8:1998*.

6) The minimum width of stair needed when phased evacuation is used is given in Table 7.

7) This table assumes a phased evacuation of the fire floor first followed by evacuation of not more than two floors at a time.

## E1 Means of warning and escape

| Table 7 Minimum widths of stairs for phased evacuation |                           |
|--|---------------------------|
| Maximum number of people per storey exit:              | Minimum stair width (mm): |
| 100  | 1000                      |
| 120  | 1100                      |
| 130  | 1200                      |
| 140  | 1300                      |
| 150  | 1400                      |
| 160  | 1500                      |
| 170  | 1600                      |
| 180  | 1700                      |
| 190  | 1800                      |

8) As an alternative to using this table, provided that the minimum width of a stair is at least 1000mm, the width (w) may be calculated from the formula:

$$w = 10P - 100 \text{ (mm)}$$

where

P = the number of people per storey exit

9) Worked example using Table 7

### Question

What is the minimum width needed for the stairs serving a 15 storey office building (ground plus 14 upper floors) assuming a maximum population of 2500 people (excluding the ground floor population which does not use the stairs)?

Three stairs satisfy the travel distance limitations.

The building is over 45 metres in height and designed for phased evacuation. It has been decided to discount one stair to take account of fire and rescue service operations as described in paragraph E1.10.6.4 3).

### Answer

$$\text{No. of people per storey} = 2500/14 = 179;$$

$$\text{No of people per storey exit} = 179/2 = 90$$

This assumes even distribution between the two available stairs.

From Table 7, each stair requires a width of 1000mm (maximum capacity 100 people).

Note that there is no need to consider a worst case scenario where the fire obstructs access to one of the storey exits as it has already been assumed that an entire staircase is unavailable.

This width of 1000mm will also be adequate when considering the minimum required width of the storey exit as the storey exits require a minimum width of 750mm (see Table 4).

Finally, note that at least one of the stairs will need to be a fire fighting stair and a minimum width of 1100mm will be needed for all fire-fighting stairs.

## E1 Means of warning and escape

10)\* Worked example using the formula

What is the minimum width needed for the stairs serving a 9 storey office building (ground plus 8 upper floors) assuming a maximum population of 1920 people (excluding the ground floor population which does not use the stairs)?

Two stairs satisfy the travel distance limitations.

Both stairs need to be entered at each level by a protected lobby so both stairs can be assumed to be available.

Answer

No. of people per storey =  $1920/8 = 240$

No of people per storey exit =  $240/2 = 120$

Using the formula,

$w = 10P - 100 \text{ (mm)}$

$= 10 \times 120 - 100$

$= 1100\text{mm}$

Both stairs would require a width of 1100mm (maximum capacity 120 people), but each storey exit needs to be able to serve 240 people due to discounting a storey exit and the minimum exit width needed for 240 people in Table 4 is 1200mm.

The stair width should be at least as wide as the storey exit serving it so the required stair width is 1200mm.

### E1.10.7 Protection of escape stairs

#### E1.10.7.1 General

1) Escape stairs 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 guidance in section E1.10.7.2 should be followed to achieve this.

#### E1.10.7.2 Enclosure of escape stairs

1) Every internal escape stair should be a protected stairway (i.e. it should be within a fire-resisting enclosure). However an unprotected stair (e.g. an accommodation stair) may form part of an internal route to a storey exit, compartment exit or final exit, provided that the distance of travel and the number of people involved are suitably limited.

2) There may be additional measures if the protected stairway is also a protected shaft, where it penetrates one or more compartment floors (see section E3.4) or if it is a firefighting shaft (see section E5.5).

\* see corresponding entry in Appendix H

## E1 Means of warning and escape

### E1.10.7.3 Access lobbies and corridors

- 1) There are situations where an escape stair needs the added protection of a protected lobby or protected corridor. These are:
  - a) where the stair is the only one serving a building (or part of a building) which has more than one storey above or below the ground storey, except for:
    - (i) small premises covered in section E1.12;
    - (ii) a building (or part of a building) with a top floor up to 11m above ground level where an automatic fire detection and warning system meeting (at least) the L3 standard detailed in BS 5839-1:2011 is installed;
  - b) where the stair serves any storey at a height greater than 18m;
  - c) where the building is designed for phased evacuation.

In cases a), b) and c) protected lobbies or protected corridors are needed at all levels, except the top storey and at all basement levels.

- d) where the stair is a firefighting stair.
- 2) Lobbies are also needed where the option in paragraph E1.10.6.2 3) b) has been used so as not to discount one stairway when calculating stair widths.
- 3) An alternative that may be considered in 1) (a) to 1) (c) above is to use a smoke control system as described in paragraph E1.10.6.2.3) a).
- 4) A protected lobby should be also provided between an escape stairway and a place of special fire hazard. In this case, the lobby should have not less than 0.4m<sup>2</sup> permanent ventilation, or be protected from the ingress of smoke by a mechanical smoke control system.

### E1.10.8 Exits from protected stairways

- 1) Every protected stairway should discharge:
  - a) directly to a final exit; or
  - b) by way of a protected exit passageway to a final exit.
- 2) Any such protected exit passageway should have the same standard of fire resistance and lobby protection as the stairway it serves.
- 3) The exit from a protected stairway should meet the provisions in section E1.11.5.4.

### E1.10.9 Separation of adjoining stairways

- 1) Where two protected stairways are adjacent, they and any protected exit passageways linking them to final exits, should be separated by an imperforate enclosure.

## E1 Means of warning and escape

### E1.10.10 Use of space within protected stairways

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

- a) sanitary accommodation or washrooms, so long as the accommodation is not used as a cloakroom. A gas water heater or sanitary towel incinerator may be installed in the accommodation but not any other gas appliance;
- b) a lift well may be included in a protected stairway, if it is not a firefighting stair;
- c) a reception desk or enquiry office area at ground or access level, if it is not in the only stair serving the building or part of the building. The reception or enquiry office area should not be more than 10m<sup>2</sup> in area; and/or
- d) cupboards enclosed with fire-resisting construction, if it is not in the only stair serving the building or part of the building.

### E1.10.11 Gas service pipes in protected stairways

1) Gas service and installation pipes or associated meters should not be incorporated within a protected stairway.

### E1.10.12 Basement stairs

1) Because of their situation, basement stairways are more likely to be filled with smoke and heat than stairs in ground and upper storeys. Special measures are therefore needed in order to prevent a basement fire endangering upper storeys. These are set out in the following two paragraphs.

2) If an escape stair 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. The basement should be served by a separate stair.

3) If there is more than one escape stair from an upper storey of a building (or part of a building), only one of the stairs serving the upper storeys of the building (or part) need be terminated at ground level. Other stairs may connect with the basement storey(s) if there is a protected lobby, or a protected corridor between the stair(s) and accommodation at each basement level.

### E1.10.13 External escape stairs

1) If more than one escape route is available from a storey (or part of a building), some of the escape routes from that storey or part of the building may be by way of an external escape stair, provided that:

- a) there is at least one internal escape stair from every part of each storey (excluding plant areas);
- b) in the case of an Assembly and Recreation building, the route is not intended for use by members of the public; or
- c) in the case of an Institutional building, the route serves only office or residential staff accommodation.

2) Where external stairs are acceptable as forming part of an escape route, they should meet the provisions in section 1.11.4.4.



## **E1 Means of warning and escape**

### **E1.11 General provisions for buildings other than dwelling houses**

#### **E1.11.1 Introduction**

1) This section gives guidance on the construction and protection of escape routes generally, service installations and other matters associated with the design of escape routes. It applies to all buildings.

2) It should therefore be read in conjunction with section E1.8 (in respect of flats) and in conjunction with sections E1.9 and E1.10 (in respect of other buildings).

#### **E1.11.2 Protection of escape routes**

##### **E1.11.2.1 Fire resistance of enclosures**

1) Details of fire resistance test criteria and standards of performance, are set out in Appendix A. Generally, a 30-minute standard is sufficient for the protection of means of escape. The exceptions to this are when greater fire resistance is required by the guidance on requirements E3 or E5, or some other specific instance to meet requirement E1.

2) All walls, partitions and other enclosures that need to be fire-resisting to meet the provisions in this document (including roofs that form part of a means of escape), should have the appropriate performance given in Tables A1 and A2 of Appendix A.

3) Elements protecting a means of escape should meet any limitations on the use of glass (see paragraph E1.11.2.3 1)).

##### **E1.11.2.2 Fire resistance of doors**

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

2) All doors that need to be fire-resisting to meet the provisions in this document should have the appropriate performance given in Table B1 of Appendix B. Doors should also meet any limitations on the use of glass (see paragraph E1.11.2.3 1)).

##### **E1.11.2.3 Fire resistance of glazed elements**

1) 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 depend on whether the enclosure forms part of a protected shaft (see section E3.4) and the provisions set out in Appendix A, Table A4.

2) Where the relevant performance can be met in terms of both integrity and insulation, there is no restriction in this document on the use or amount of glass.

##### **E1.11.3 Doors on escape routes**

1) The time taken to negotiate a closed door can be critical in escaping. 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 sections E1.11.3.1 to E1.11.3.5 should be met.

## E1 Means of warning and escape

### E1.11.3.1 Door fastenings

1) 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 from the side approached by people making an escape. The operation of these fastenings should be readily apparent; without the use of a key and without having to manipulate more than one mechanism.

2) This is not intended to prevent doors being fitted with hardware to allow them to be locked when the rooms are empty. There may also be situations such as hotel bedrooms where locks may be fitted that are operated from the outside by a key and from the inside by a knob or lever, etc.

3) Where a door on an escape route has to be secured against entry when the building or part of the building is occupied, it should only be fitted with a lock or fastening which is readily operated, without a key, from the side approached by people making their escape. Similarly, where a secure door is operated by a code, combination, swipe or proximity card, biometric data or similar means, it should also be capable of being overridden from the side approached by people making their escape.

4) Electrically powered locks should return to the unlocked position:

- a) on operation of the fire alarm system;
- b) on loss of power or system error;
- c) on activation of a manual door release unit (Type A) to *BS EN 54-11:2001* positioned at the door on the side approached by people making their escape. Where the door provides escape in either direction, a unit should be installed on both sides of the door.

5) In the case of places of assembly, shop and commercial buildings, doors on escape routes from rooms with an occupant capacity of more than 60 should either not be fitted with lock, latch or bolt fastenings, or be fitted with panic fastenings in accordance

with *BS EN 1125:2008*. In non-residential buildings it may also be appropriate to accept on some final exit doors locks for security that are used only when the building is empty. In these cases the emphasis for the safe use of these locks must be placed on management procedures.

6) Guidance about door closing and hold-open devices for fire doors is given in Appendix B.

### E1.11.3.2 Direction of opening

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

2) Where there is a very high fire risk with potential for rapid fire growth, such as with some industrial activities, doors should open in the direction of escape even where the number of people does not exceed 60.

### E1.11.3.3 Amount of opening and effect on associated escape routes

1) All doors on escape routes should be hung to open not less than 90 degrees with a swing that is clear of any change of floor level, other than a threshold or single step on the line of the doorway (see paragraph E1.11.4.1 5)) and which does not reduce the effective width of any escape route across a landing.

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

## E1 Means of warning and escape

### E1.11.3.4 Vision panels in doors

- 1) Vision panels are needed where doors on escape routes sub-divide corridors, or where any doors are hung to swing both ways.
- 2) Other recommendations on vision panels in doors can be found in guidance documents on access to and use of buildings and on the safety of glazing in relation to impact, opening and cleaning.

### E1.11.3.5 Revolving and automatic doors

- 1) Revolving doors, automatic doors and turnstiles can obstruct the passage of people escaping. Accordingly, they should not be placed across escape routes unless:
  - a) they are to the required width and are automatic doors and either they:
    - (i) are arranged to fail safely to outward opening from any position of opening; or
    - (ii) are provided with a monitored failsafe system for opening the doors if the mains supply fails; or
    - (iii) they fail safely to the open position in the event of power failure; or
  - b) non-automatic swing doors of the required width are provided immediately adjacent to the revolving or automatic door or turnstile.

### E1.11.4 Stairs

#### E1.11.4.1 Construction of escape stairs

- 1) The flights and landings of every escape stair should be constructed of materials of limited combustibility in the following situations:
  - a) if it is the only stair serving the building, or part of the building, unless the building is of two or three storeys and is in Purpose Group 1(a) or Purpose Group 3;
  - b) if it is within a basement storey (this does not apply to a private stair in a flat);
  - c) if it serves any storey having a floor level more than 18m above ground or access level;
  - d) if it is external, except in the case of a stair that connects the ground floor or paving level with a floor or flat roof not more than 6m above or below ground level. (There is further guidance on external escape stairs in section E1.11.4.4); or
  - e) if it is a firefighting stair (see section E5.5).
- 2) In satisfying the above conditions, combustible materials may be added to the horizontal surface of these stairs (except in the case of firefighting stairs).
- 3) There is further guidance on the construction of firefighting stairs in section E5.5.
- 4) Dimensional constraints on the design of stairs generally, to meet requirements for safety in use, are given in other documents and it is expected that these constraints are adhered to.
- 5) Single steps may cause falls and should only be used on escape routes where they are prominently marked. A single step on the line of a doorway is acceptable, subject to paragraph E1.11.5.4 3).

## E1 Means of warning and escape

### E1.11.4.2 Helical stairs, spiral stairs and fixed ladders

- 1) Helical stairs, spiral stairs and fixed ladders may form part of an escape route subject to the following restrictions:
  - a) helical and spiral stairs should be designed in accordance with *BS 5395-2:1984* and, if they are intended to serve members of the public, should be a type E (public) stair, in accordance with that standard; and
  - b) fixed ladders should not be used as a means of escape for members of the public and should only be intended for use in circumstances where it is not practical to provide a conventional stair, for example, as access to plant rooms that are not normally occupied.
- 2) Guidance on the design of helical and spiral stairs and fixed ladders, from the aspect of safety in use, is given in Approved Document K.

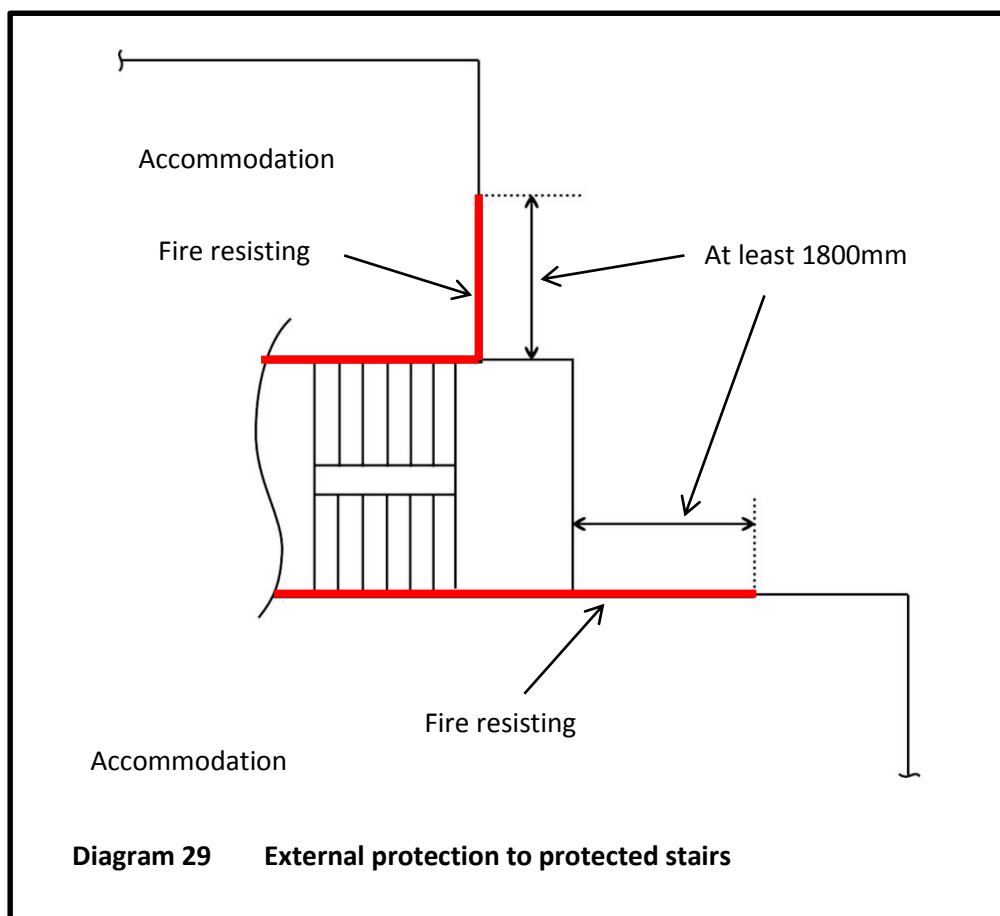
### E1.11.4.3 External walls of protected stairways

- 1) 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 29). 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 stair.
- 2) 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 unprotected area in the enclosure to the stairway should be at least 1800mm (see Diagram 29).

### E1.11.4.4 External escape stairs

- 1) Where an external escape stair is provided in accordance with section E1.10.13, it should meet the following provisions:
  - a) all doors giving access to the stair should be fire-resisting and self-closing, except that a fire-resisting door is not required at the head of any stair leading downwards where there is only one exit from the building onto the top landing;
  - b) any part of the external envelope of the building within 1800mm of (and 9m vertically below) the flights and landings of an external escape stair should be of fire-resisting construction, except that the 1800mm dimension may be reduced to 1100mm above the top level of the stair if it is not a stair up from a basement to ground level (see Diagram 30);
  - c) there is protection by fire-resisting construction for any part of the building (including any doors) within 1800mm of the escape route from the stair to a place of safety, unless there is a choice of routes from the foot of the stair that would enable the people escaping to avoid exposure to the effects of the fire in the adjoining building;
  - d) any stair more than 6m in vertical extent is protected from the effects of adverse weather conditions. This should not be taken to imply a full enclosure. Much will depend on the location of the stair and the degree of protection given to the stair by the building itself; and
  - e) glazing in areas of fire-resisting construction mentioned above should also be fire-resisting (integrity but not insulation) and fixed shut.

## E1 Means of warning and escape



### E1.11.5 General

#### E1.11.5.1 Headroom in escape routes

- 1) All escape routes should have a clear headroom of not less than 2m and there should be no projection below this height (except for door frames).

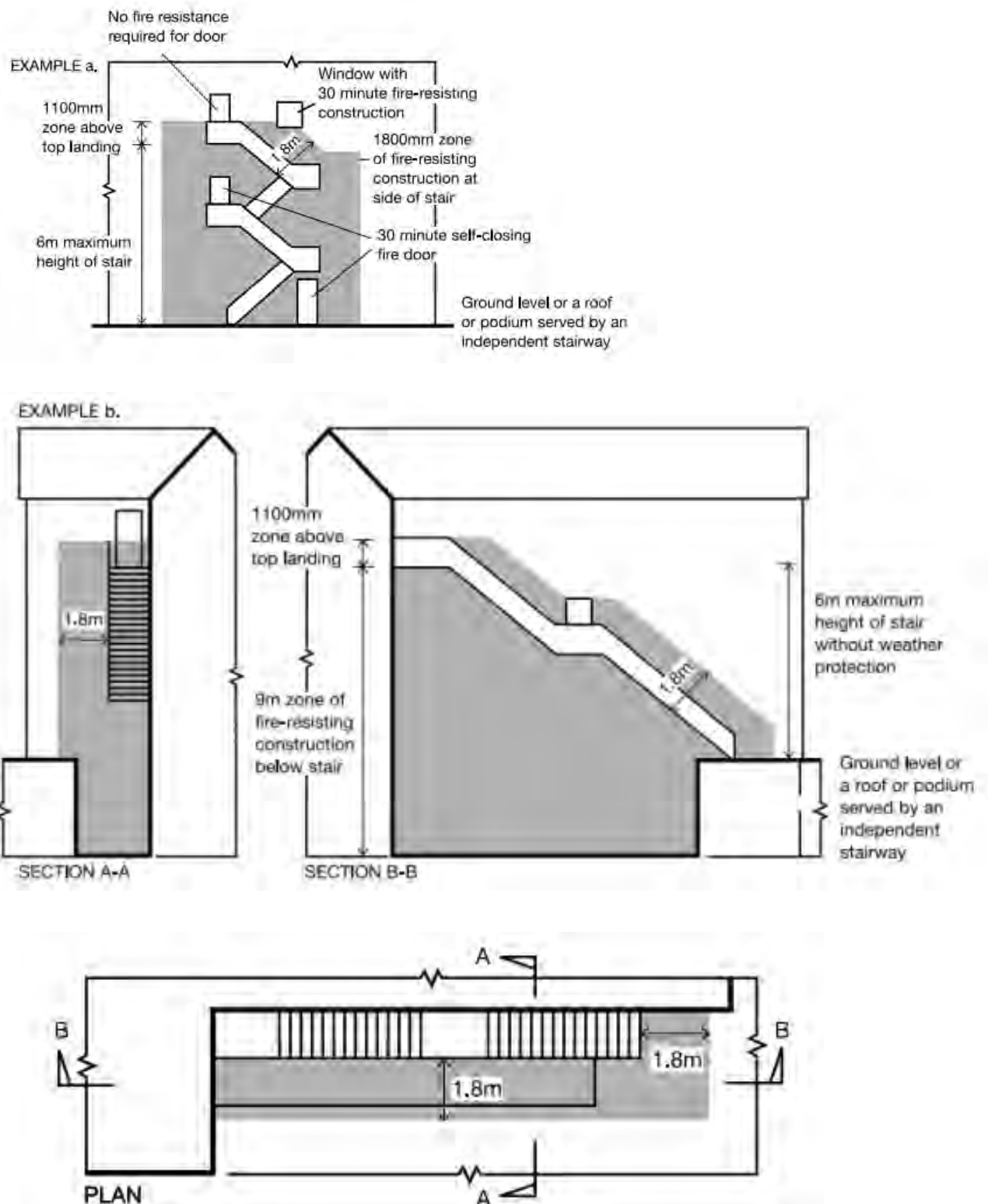
#### E1.11.5.2 Floors of escape routes

- 1) The floorings of all escape routes (including the treads of steps and surfaces of ramps and landings) should be chosen to minimise their slipperiness when wet.

#### E1.11.5.3 Ramps and sloping floors

- 1) Where a ramp forms part of an escape route it should meet the provisions in Approved Document M for access to and use of buildings. Any sloping floor or tier should be constructed with a pitch of not more than 35° to the horizontal.
- 2) Further guidance on the design of ramps and associated landings and on aisles and gangways in places where there is fixed seating, from the aspect of safety in use, is given in the appropriate Approved Documents.
- 3) The design of means of escape in places with fixed seating is dealt with in section E1.9 and in BS 9999 Annex D.

## E1 Means of warning and escape



**Diagram 30** Fire resistance of areas adjacent to protected stairs



## E1 Means of warning and escape

### E1.11.5.4 Final exits

- 1) Final exits need to be dimensioned and sited to facilitate the evacuation of people out of and away from the building. Accordingly, they should be not less in width than the minimum width required for the escape route(s) they serve and should also meet the conditions in paragraphs E1.11.5.4 2) to 5).
- 2) Final exits should be sited to ensure rapid dispersal of people from the vicinity of the building so that they are no longer in danger from fire and smoke. Direct access to a street, passageway, walkway or open space should be available. The route clear of the building should be well defined and, if necessary, have suitable guarding.
- 3) Final exits should not present an obstacle to wheelchair users and other people with disabilities. Where a final exit is accessed without the need to first traverse steps then a level threshold and, where necessary, a ramp should be provided.
- 4) Final exits need to be apparent to people who may need to use them. This is particularly important where the exit opens off a stair that continues down, or up, beyond the level of the final exit.
- 5) Final exits should be sited so that they are clear of any risk from fire or smoke in a basement (such as the outlets to basement smoke vents), or from openings to transformer chambers, refuse chambers, boiler rooms and similar risks.

### E1.11.5.5 Escape routes over flat roofs

- 1) Where an escape route over a flat roof is provided in accordance with sections E1.8.8.11 or E1.9.13 3), it should meet the following provisions:
  - a) the roof should be part of the same building from which escape is being made;

- b) the route across the roof should lead to a storey exit or external escape route;
- c) the part of the roof forming the escape route and its supporting structure, together with any opening within 3m of the escape route, should be fire-resisting (see Appendix A Table A1); and
- d) the route should be adequately defined and guarded by walls and/or protective barriers which meet the recommendations in the appropriate guidance.

### E1.11.5.6 Lighting of escape routes

- 1) All escape routes should have adequate artificial lighting. Routes and areas listed in Table 8 should also have escape lighting which illuminates the route if the main supply fails.
- 2) Lighting to escape stairs should be on a separate circuit from that supplying any other part of the escape route. Standards for the installation of a system of escape lighting are given in *BS 5266-1:2011*.

### E1.11.5.7 Exit signs

- 1) Except within a flat, every escape route (other than those in ordinary use) should be distinctively and conspicuously marked by emergency exit sign(s) complying with *BS EN 7010:2012* or *BS 5499-1:2002*.
- 2) Suitable signs should be provided for refuges (see paragraph E1.10.5 6)).

## E1 Means of warning and escape

| Table 8 Provisions for escape lighting                |   |  |   |
|---|---|--|---|
| Purpose group of the building or part of the building |   | Areas requiring escape lighting  |   |
| 1   | Residential                               | All common escape routes <sup>(1)</sup> , except in 2-storey flats   |   |
| 2   | Office, Storage and Other non-residential | a  | Underground or windowless accommodation   |
|   |   | b  | Stairways in a central core or serving storey(s) more than 18m above ground level   |
|   |   | c  | Internal corridors more than 30m long   |
|   |   | d  | Open-plan areas of more than 60m <sup>2</sup>   |
| 3   | Shop and Commercial and car parks         | a  | Underground or windowless accommodation   |
|   |   | b  | Stairways in a central core or serving storey(s) more than 18m above ground level   |
|   |   | c  | Internal corridors more than 30m long   |
|   |   | d  | Open-plan areas of more than 60m <sup>2</sup>   |
|   |   | e  | All escape routes to which the public are admitted <sup>(1)</sup> (except in shops of three or fewer storeys with no sales floor more than 280m <sup>2</sup> , provided that the shop is not a restaurant or bar) |
| 4   | Assembly and Recreation                   | All escape routes <sup>(1)</sup> and accommodation except for accommodation open on one side to view sport or entertainment during normal daylight hours |   |
| 5   | Any Purpose Group                         | a  | All toilet accommodation with a floor area over 8m <sup>2</sup>   |
|   |   | b  | Electricity and generator rooms   |
|   |   | c  | Switch room/battery room for emergency lighting system  |
|   |   | d  | Emergency control room  |

**Notes for Table 8:**

(1) Including external escape routes

## E1 Means of warning and escape

### E1.11.5.8 Protected power circuits

- 1) Where it is critical for electrical circuits to be able to continue to function during a fire, protected circuits are needed.
- 2) The potential for damage to cables forming protected circuits should be limited by the use of sufficiently robust cables, careful selection of cable routes and/or by the provision of physical protection in areas where cables may be susceptible to damage.
- 3) Methods of cable support should generally be non-combustible and such that circuit integrity will not be reduced below that afforded by the cable.
- 4) A protected circuit for operation of equipment in the event of fire should consist of cable meeting at least the requirements for PH 30 classification when tested in accordance with *BS EN 50200:2006* (incorporating Appendix E), or an equivalent standard. It should follow a route selected to pass only through parts of the building in which the fire risk is negligible and should be separate from any circuit provided for another purpose.
- 5) In large or complex buildings there may be fire protection systems that need to operate for an extended period during a fire.
- 6) Further guidance on the selection of cables for such systems is given in *BS 5839*, *BS 5266* and *BS 7346-6*.

### E1.11.5.9 Lifts

#### E1.11.5.9.1 Evacuation lifts

- 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 people being trapped in a lift that has become immobilised as a result of the fire. However, in some circumstances a lift may be provided as part of a management plan for evacuating

people. In such cases the lift installation may need to be appropriately sited and protected and may need to contain a number of safety features that are intended to ensure that the lift remains usable for evacuation purposes during the fire. Guidance on the design and use of evacuation lifts is given in *BS 9999*.

- 2) Where a firefighting lift has been provided to satisfy requirement E5, this can be utilised as part of a management plan for evacuating disabled people. Any such plan should include a contingency for when the Fire and Rescue Service arrive.

#### E1.11.5.9.2 Fire protection of lift installations

- 1) Because lifts connect floors, there is the possibility that they may prejudice escape routes. To safeguard against this, the conditions in paragraphs E1.11.5.9.2 2) to 9) should be met.
- 2) Lifts, such as wall-climber or feature lift which rise within a large volume, such as a mall or atrium, and do not have a conventional well, may be at risk if they run through a smoke reservoir, in which case care is needed to maintain the integrity of the smoke reservoir and protect the occupants of the lift.
- 3) Lift wells should be either:
  - a) contained within the enclosures of a protected stairway; or
  - b) enclosed throughout their height with fire-resisting construction if they are sited so as to prejudice the means of escape.
- 4) A lift well connecting different compartments should form a protected shaft (see section E3.4).
- 5) In buildings designed for phased or progressive horizontal evacuation, where the lift well is not contained within the enclosures of a protected stairway, the lift entrance should be separated from the floor area on every storey by a protected lobby.

## E1 Means of warning and escape

6) In basements and enclosed (i.e. not open-sided) car parks the lift should be approached only by a protected lobby (or protected corridor), unless it is within the enclosure of a protected stairway. This is also the case in any storey that contains high fire risk areas, if the lift also delivers directly into corridors serving sleeping accommodation. Examples of fire risk areas in this context are kitchens, communal lounges and stores.

7) A lift shaft should not be continued down to serve any basement storey if it is:

- a) in a building (or part of a building) served by only one escape stair and smoke from a basement fire would be able to prejudice the escape routes in the upper storeys; or
- b) within the enclosure to an escape stair which is terminated at ground level.

8) Lift machine rooms should be sited over the lift well whenever possible. If the lift well is within a protected stairway which is the only stairway serving the building (or part of the building), then if the machine room cannot be sited above the lift well, it should be located outside the stairway (to avoid smoke spread from a fire in the machine room).

9) Any protected shaft containing a lift or lifts shall be ventilated to the external air by means of one or more permanent openings situated at the top of the shaft and having a total unobstructed area of not less than  $0.1\text{m}^2$  for each lift in the shaft.

### E1.11.5.10 Mechanical ventilation and air-conditioning systems

1) Any system of mechanical ventilation should be designed to ensure that, in a fire, the ductwork does not assist in transferring fire and smoke through the building and put at risk the protected means of escape from the accommodation areas. Any exhaust points should be sited so as not to further jeopardize the building, i.e. away from final exits, combustible building cladding or roofing materials and openings into the building.

2) Ventilation ducts supplying or extracting air directly to or from a protected escape route, should not also serve other areas. A separate ventilation system should be provided for each protected stairway.

3) Guidance on ventilation systems that circulate air only within an individual flat is given in section E1.8.7.4.

4) Where the ductwork system serves more than one part of a sub-divided escape route (see paragraphs E1.9.11 4) to 5)), a fire damper should be provided where ductwork enters each section of the escape route operated by a smoke detector or suitable fire detection system (see also section E3.6). The fire dampers should close when smoke is detected.

5) Ducts passing through the enclosure of a protected escape route should be fire-resisting, i.e. the ductwork should be constructed in accordance with Method 2 or Method 3, (see section E3.6.3).

6) Fire dampers activated only by fusible links are not suitable for protecting escape routes. However an ES classified fire and smoke damper which is activated by a suitable fire detection system may be used. See paragraph E3.6.3.1 7).

## E1 Means of warning and escape

7) In the case of a system which recirculates air, smoke detectors should be fitted in the extract ductwork before the point of separation of the recirculated air and the air to be discharged to the open air and before any filters or other air cleaning equipment. Such detector(s) should:

- a) cause the system to immediately shut down; or
- b) switch the ventilation system from recirculating mode to extraction to open air, so as to divert any smoke to the outside of the building.

8) Non-domestic kitchens, car parks and plant rooms should have separate and independent extraction systems and the extracted air should not be recirculated.

9) Guidance on the use of mechanical ventilation in a place of assembly is given in *BS 9999*.

10) Where a pressure differential system is installed, ventilation and air-conditioning systems in the building should be compatible with it when operating under fire conditions.

11) Further guidance on the design and installation of mechanical ventilation and air conditioning plant is given in *BS 5720:1979*.

12) Guidance on the provision of smoke detectors in ventilation ductwork is given in *BS 5839-1:2013*.

13) Section E3.4.9.5 and paragraph E3.6.3 2) also deal with ventilation and air-conditioning ducts.

### E1.11.5.11 Refuse chutes and storage

1) Refuse storage chambers, refuse chutes and refuse hoppers should be sited and constructed in accordance with *BS 5906 Code of practice for storage and on-site treatment of solid waste from buildings*.

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

- a) be separated from other parts of the building by fire-resisting construction; and
- b) not be located within protected stairways or protected lobbies.

3) Rooms containing refuse chutes, or provided for the storage of refuse, should be approached either directly from the open air or by way of a protected lobby provided with not less than 0.2m<sup>2</sup> of permanent ventilation.

4) Access to refuse storage chambers should not be sited adjacent to escape routes or final exits, or near to windows of flats.

### E1.11.5.12 Shop store rooms

1) Fully enclosed walk-in store rooms in shops (unless provided with an automatic fire detection and alarm system or fitted with sprinklers) should be separated from retail areas with fire-resisting construction (see Appendix A, Table A1), if they are sited so as to prejudice the means of escape.

### E1.12\* Small premises

1) In small premises, as described in this section, the number of people is generally limited and the size of the premises will tend to enable unobstructed visibility throughout the premises. Therefore, in an emergency, the occupants will be able to reach an exit rapidly and a reduction in the number of exits and stairs, as set out in this section, is acceptable.

2) The paragraphs in this section apply in place of only those provisions relating to the number and positioning of exits and protected stairs and measurement of distances of travel.

\* see corresponding entry in Appendix H

## E1 Means of warning and escape

3) This section may be applied to small premises but the extent of application is limited and does not include:

- a) premises used principally for the storage and/or sale of highly flammable liquids or materials,
- b) premises in covered shopping complexes, as these have their own specific guidance in Annex E of BS 9999,
- c) premises with more than a single occupant,
- d) premises which comprise more than basement, ground and first floor,
- e) premises with a floor area greater than 280m<sup>2</sup>.

4) Any kitchen or other open cooking arrangement should be sited at the extremity of any dead end remote from the exit(s).

5)\* The planned seating accommodation or the assessed standing accommodation (see Table C1) for small premises occupied as, or partly as, a bar or restaurant should not exceed 30 people per storey. This figure may be increased to 100 people for the ground storey if that storey has a final exit independent of the escape routes from other parts of the premises.

6) The floor areas should be generally undivided (except for kitchens, ancillary offices and stores) to ensure that exits are clearly visible from all parts of the floor areas.

7) Store rooms should be enclosed with fire-resisting construction.

8) Sufficient clear glazed areas should be provided in any partitioning separating a kitchen or ancillary office from the open floor area to enable any person within the kitchen or office to obtain early visual warning of an outbreak of fire. Alternatively, an automatic fire detection and alarm system may be provided in the outer room.

9) The escape routes from any storey should be of such a number and so situated that the distance of travel from any point to the nearest exit does not exceed the appropriate limits set out in Table 9.

10)\* The distance of travel in small premises with an open stairway is measured to the foot of the stair in a basement or to the head of the stair in a first storey.

11) The siting of two or more exits or stairs should be such that they afford effective alternative directions of travel from any relevant point in a storey.

12) A stair in a small premises, which is not a bar or restaurant, may be open if it does not connect more than two storeys and delivers into the ground storey not more than 3m from the final exit and either:

- a) the storey is also served by a protected stairway; or
- b) it is a single stair in a small premises with the floor area in any storey not exceeding 90m<sup>2</sup> and, if the premises contains three storeys, the stair serving either the top or bottom storey is enclosed with fire-resisting construction at the ground storey level and discharges to a final exit independent of the ground storey.

**Table 9 Small premises travel distance limitations**

| Situation   | Maximum travel distance (m) |
|---|-----------------------------|
| Ground storey with a single exit                    | 27                          |
| Basement or first floor, with a single stair        | 18                          |
| Storey with more than one final exit or storey exit | 45                          |

\* see corresponding entry in Appendix H



## E2 Internal fire spread (linings)

### E2 INTERNAL FIRE SPREAD (LININGS)

#### The requirement

This section deals with the following requirements

| Requirement   | Limits on application |
|---|-----------------------|
| <b>Internal fire spread (linings)</b>   |                       |
| E2.(1) To inhibit the spread of fire within the building, the internal linings shall:<br>(a) adequately resist the spread of flame over their surfaces; and<br>(b) have, if ignited, a rate of heat release or a rate of fire growth, which is reasonable in the circumstances. |                       |
| (2) In this paragraph 'internal linings' mean the materials or products used in lining any partition, wall, ceiling or other internal structure.  |                       |

## E2 Internal fire spread (linings)

### E2 Guidance

#### E2.1 Performance

1) In the view of H.M. Government of Gibraltar the requirement of E2 will be met if the spread of flame 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 release, so as to limit the contribution that the fabric of the building makes to fire growth.

2) In relation to the European fire tests and classification system, the requirements of E2 will be met if the heat released from the internal linings is restricted by making provision for them to have a resistance to ignition and a rate of fire growth which are reasonable in the circumstances. The extent to which this is necessary is dependent on the location of the lining.

#### E2.2 Introduction

##### E2.2.1 Fire spread and lining materials

1) The choice of materials for 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.

2) It is particularly important in circulation spaces where linings may offer the main means by which fire spreads and where rapid spread is most likely to prevent occupants from escaping.

3) Several properties of lining materials influence fire spread. These include the ease of ignition and the rate at which the lining material gives off heat when burning. The guidance relating to the European fire tests and classification provides for control of internal fire spread through control of these properties. This Document does not give detailed guidance on other properties such as the generation of smoke and fumes.

##### E2.2.2 Floors and stairs

1) The provisions do not apply to the upper surfaces of floors and stairs because they are not significantly involved in a fire until well developed and thus do not play an important part in fire spread in the early stages of a fire that are most relevant to the safety of occupants.

2) However, it should be noted that, in the case of firefighting stairs, the construction of some stairs and landings is controlled under section E5.5.

##### E2.2.3 Other controls on internal surface properties

1) There is also guidance on the control of flame spread inside buildings in two other sections. In section E3.4 there is guidance on surfaces exposed in concealed spaces above fire-protecting suspended ceilings and in section E3.6 on enclosures to above ground drainage system pipes.

3) External flame spread is dealt with in sections E4.3 to E4.5; the fire behaviour of insulating core panels used for internal structures is dealt with in Appendix F.

##### E2.2.4 Furniture and fittings

1) Furniture and fittings can have a major effect on fire spread but it is not possible to control them through Building Rules and they are not dealt with in this Document.

2) Fire characteristics of furniture and fittings may be controlled in some buildings under legislation that applies to a building in use, such as licensing conditions.

## E2 Internal fire spread (linings)

### E2.2.5 Classification of performance

- 1) Appendix A describes the different classes of performance and the appropriate methods of test (see paragraphs A4 to A8 1)).
- 2) The National classifications used are based on tests in *BS 476 Fire tests on building materials and structures*, namely *Part 6: Method of test for fire propagation for products* and *Part 7 Method of test to determine the classification of the surface spread of flame of products*. However, *Part 4: Non-combustibility test for materials* and *Part 11: Method for assessing the heat emission from building products* are also used as one method of meeting Class 0. Other tests are available for classification of thermoplastic materials if they do not have the appropriate rating under *BS 476-7* and three ratings, referred to as TP(a) rigid and TP(a) flexible and TP(b), are used.
- 3) The European classifications are described in *BS EN 13501-1:2007, Fire classification of construction products and building elements, Part 1– Classification using data from reaction to fire tests*. They are based on a combination of four European test methods, namely:
  - *BS EN ISO 1182:2010 Reaction to fire tests for building products – Non-combustibility test*;
  - *BS EN ISO 1716:2010 Reaction to fire tests for building products – Determination of the gross calorific value*;
  - *BS EN 13823:2002 Reaction to fire tests for building products – Building products excluding floorings exposed to the thermal attack by a single burning item*; and
  - *BS EN ISO 11925-2:2010, Reaction to fire tests for building products. Ignitability when subjected to direct impingement of flame*.
- 4) For some building products, there is currently no generally accepted guidance on the appropriate procedure for testing and classification in accordance with the harmonised European fire tests. Until such a time that the appropriate European test and classification methods for these building

products are published, classification may only be possible using existing national test methods.

- 5) Table A8, in Appendix A, gives typical performance ratings which may be achieved by some generic materials and products.

## E2.3 Wall and ceiling linings

### E2.3.1 Classification of linings

- 1) Subject to the variations and specific provisions described in sections E2.3.2 to E2.3.4.3, the surface linings of walls and ceilings should meet the following classifications:

| Table 10 Classification of linings   |                               |                                     |
|--|-------------------------------|-------------------------------------|
| Location   | National class <sup>(1)</sup> | European class <sup>(1)(3)(4)</sup> |
| Small rooms <sup>(2)</sup> of area not more than:<br>a. 4m <sup>2</sup> in residential accommodation<br>b. 30m <sup>2</sup> in non-residential accommodation | 3                             | D-s3, d2                            |
| Domestic garages of area not more than 40 m <sup>2</sup>   |                               |                                     |
| Other rooms <sup>(2)</sup> (including garages)   | 1                             | C-s3, d2                            |
| Circulation spaces within dwellings  |                               |                                     |
| Other circulation spaces, including the common areas of blocks of flats  | 0                             | B-s3, d2                            |

## E2 Internal fire spread (linings)

### Notes for Table 10:

- (1) See section E2.2.5.
- (2) For meaning of room, see definition in Appendix E.
- (3) The National classifications do not automatically equate with the equivalent classifications in the European column, therefore, products cannot typically assume a European class, unless they have been tested accordingly.
- (4) When a classification includes 's3, d2', this means that there is no limit set for smoke production and/or flaming droplets/particles.

### E2.3.2 Definition of walls

- 1) For the purpose of the performance of wall linings, a wall includes:
  - a) the surface of glazing (except glazing in doors); and
  - b) any part of a ceiling which slopes at an angle of more than 70° to the horizontal.
- 2) A wall does not include:
  - a) doors and door frames;
  - b) window frames and frames in which glazing is fitted;
  - c) architraves, cover moulds, picture rails, skirtings and similar narrow members; or
  - d) fireplace surrounds, mantle shelves and fitted furniture.

### E2.3.3 Definition of ceilings

- 1) For the purposes of the performance of ceiling linings, a ceiling includes:
  - a) the surface of glazing;
  - b) any part of a wall which slopes at an angle of 70° or less to the horizontal;
  - c) the underside of a mezzanine or gallery; and
  - d) the underside of a roof exposed to the room below.

- 2) A ceiling does not include:
  - a) trap doors and their frames;
  - b) the frames of windows or roof-lights (see Appendix E) and frames in which glazing is fitted; or
  - c) architraves, cover moulds, picture rails, exposed beams and similar narrow members.

### E2.3.4 Variations and special provisions

#### E2.3.4.1 Walls

- 1) Parts of walls in rooms may be of a poorer performance than specified in section E2.3.1 and Table 10 (but not poorer than Class 3 (National class) or Class D-s3, d2 (European class)), provided that the total area of those parts in any one room does not exceed one half of the floor area of the room; and subject to a maximum of 20m<sup>2</sup> in residential accommodation and 60m<sup>2</sup> in non-residential accommodation.

#### E2.3.4.2 Fire-protecting suspended ceilings

- 1) A suspended ceiling can contribute to the overall fire resistance of a floor/ceiling assembly. Such a ceiling should satisfy section E2.3.1 and Table 10. It should also meet the provisions of Appendix A, Table A3.

#### E2.3.4.3 Fire-resisting ceilings

- 1) Cavity barriers are needed in some concealed floor or roof spaces (see section E3.5); however, this need can be reduced by the use of a fire-resisting ceiling below the cavity. Such a ceiling should comply with Diagram 41.

## E2 Internal fire spread (linings)

### E2.3.4.4 Roof-lights

1) Roof-lights should meet the relevant classification in E2.3.1 and Table 10. However plastic roof-lights with at least a Class 3 rating may be used where E2.3.1 calls for a higher standard, provided the limitations in Table 11 and Table 18 are observed.

2) No guidance is currently possible on the performance requirements in the European fire tests as there is no generally accepted test and classification procedure.

### E2.3.4.5 Special applications

1) Any flexible membrane covering a structure (other than an air supported structure) should comply with the recommendations given in Appendix A of BS 7157:1989.

2) Guidance on the use of PTFE-based materials for tension-membrane roofs and structures is given in a BRE report Fire safety of PTFE based materials used in buildings (BR 274, BRE 1994).

## E2.3.5 Thermoplastic materials

### E2.3.5.1 General

1) Thermoplastic materials (see Appendix A, paragraph A8 1)) which cannot meet the performance given in Table 10, can nevertheless be used in windows, roof-lights and lighting diffusers in suspended ceilings if they comply with the provisions described in sections E2.3.5.2 to E2.3.5.4.

2) Flexible thermoplastic material may be used in panels to form a suspended ceiling if it complies with the guidance in section E2.3.5.5. The classifications used in sections E2.3.5.2 to E2.3.5.5, Table 11 and Diagram 32 are explained in Appendix A, paragraph A8 4).

3) No guidance is currently possible on the performance requirements in the European fire tests as there is no generally accepted test and classification procedure.

### E2.3.5.2 Windows and internal glazing

1) External windows to rooms (though not to circulation spaces) may be glazed with thermoplastic materials, if the material can be classified as a TP(a) rigid product.

2) Internal glazing should meet the provisions in section 2.3.1 and Table 10 above.

3) A 'wall' does not include glazing in a door (see section E2.3.2).

4) Attention is drawn to the requirement for the safe use of glazing and the appropriate guidance in that respect.

### E2.3.5.3 Roof-lights

1) Roof-lights to rooms and circulation spaces (with the exception of protected stairways) may be constructed of a thermoplastic material if:

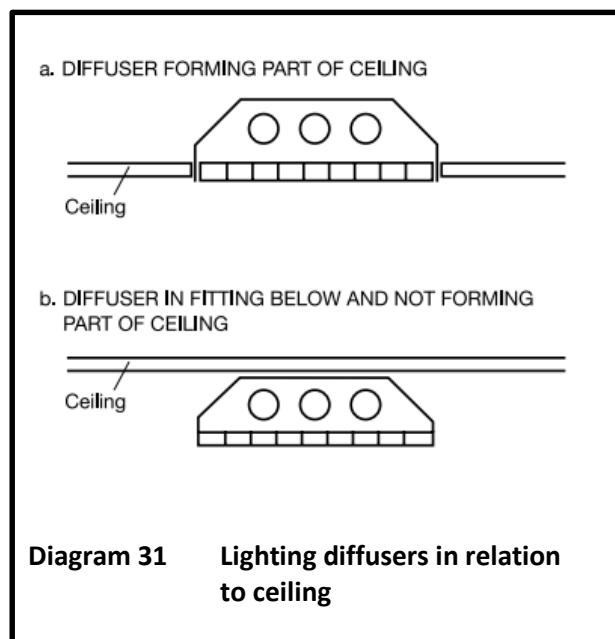
- a) the lower surface has a TP(a) (rigid) or TP(b) classification;
- b) the size and disposition of the roof-lights accords with the limits in Table 11 and with the guidance to E4 in Tables 17 and 18.

### E2.3.5.4 Lighting diffusers

1) The following provisions apply to lighting diffusers which form part of a ceiling and are not concerned with diffusers of light fittings which are attached to the soffit of, or suspended beneath, a ceiling (see Diagram 31).

2) Lighting diffusers are translucent or open structured elements that allow light to pass through. They may be part of a luminaire or used below roof-lights or other sources of light.

## E2 Internal fire spread (linings)



### E2.3.5.5 Suspended or stretched-skin ceilings

1) The ceiling of a room may be constructed either as a suspended or as a stretched skin membrane from panels of a thermoplastic material of the TP(a) flexible classification, provided that it is not part of a fire-resisting ceiling. Each panel should not exceed 5m<sup>2</sup> in area and should be supported on all its sides.

3) Thermoplastic lighting diffusers should not be used in fire-protecting or fire-resisting ceilings, unless they have been satisfactorily tested as part of the ceiling system that is to be used to provide the appropriate fire protection.

4) Subject to the above paragraphs, ceilings to rooms and circulation spaces (but not protected stairways) may incorporate thermoplastic lighting diffusers if the following provisions are observed:

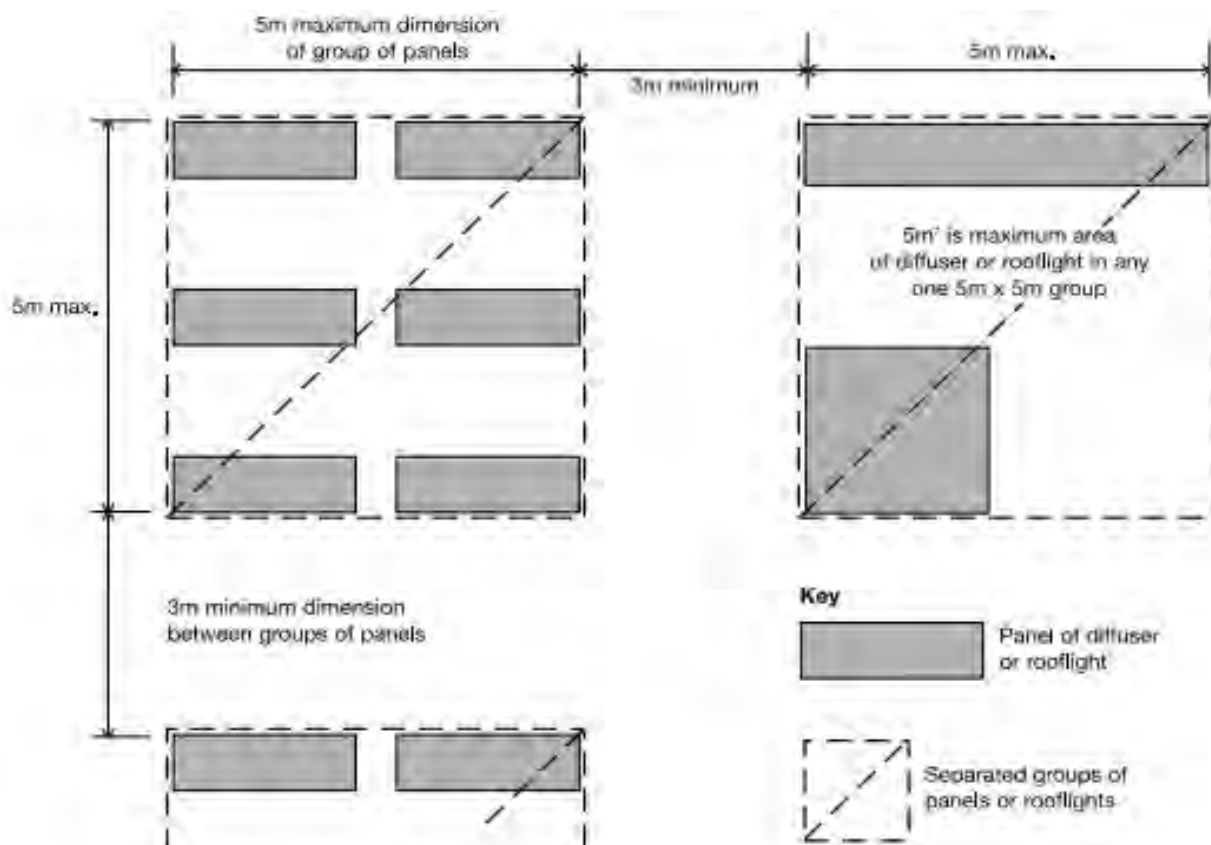
- a) Wall and ceiling surfaces exposed within the space above the suspended ceiling (other than the upper surfaces of the thermoplastic panels) should comply with the general provisions of section E2.3.1 and Table 10, according to the type of space below the suspended ceiling.
- b) If the diffusers are of classification TP(a) (rigid), there are no restrictions on their extent.
- c) If the diffusers are of classification TP(b), they should be limited in extent as indicated in Table 11 and Diagram 32.

## E2 Internal fire spread (linings)

| <b>Table 11</b> <b>Limitations applied to thermoplastic roof-lights and lighting diffusers in suspended ceilings and Class 3 plastic roof-lights</b>   |  |   |   |  |
|--|--|---|---|--|
| Minimum classification of lower surface  | Use of space below the diffusers or roof-light | Maximum area of each diffuser panel or roof-light <sup>(1)</sup><br><br>(m <sup>2</sup> ) | Max total area of diffuser panels and roof-lights as percentage of floor area of the space in which the ceiling is located<br><br>(%) | Minimum separation distance between diffuser panels or roof-lights <sup>(1)</sup><br><br>(m) |
| TP(a)  | Any except protected stairway                  | No limit <sup>(2)</sup>   | No limit  | No limit   |
| Class 3 <sup>(3)</sup> or TP(b)  | Rooms  | 5   | 50 <sup>(4)(5)</sup>  | 3 <sup>(5)</sup>   |
|  | Circulation spaces except protected stairways  | 5   | 15 <sup>(4)</sup>   | 3  |
| <b>Notes for Table 11:</b> <p>(1) Smaller panels can be grouped together provided that the overall size of the group and the space between one group and any others satisfies the dimensions shown in Diagram 32.</p> <p>(2) Lighting diffusers of TP(a) flexible rating should be restricted to panels of not more than 5m<sup>2</sup> each, see section E2.3.4.3.</p> <p>(3) There are no limits on Class 3 material in small rooms. See section E2.3.1 and Table 10.</p> <p>(4) The minimum 3m separation specified in Diagram 32 between each 5m<sup>2</sup> must be maintained. Therefore, in some cases it may not also be possible to use the maximum percentage quoted.</p> <p>(5) Class 3 roof-lights to rooms in industrial and other non-residential purpose groups may be spaced 1800mm apart provided the roof-lights are evenly distributed and do not exceed 20% of the area of the room.</p> |  |   |   |  |



## E2 Internal fire spread (linings)



### Notes:

a Upper and lower surface of suspended ceiling, between plastic panels, to comply with section E1.11.1

b No restriction on Class 3 roof-lights in small rooms

c See Note 5 to Table 11

**Diagram 32** Layout restrictions on Class 3 plastic roof-lights, TP(b) roof-lights and TP(b) lighting diffusers

## E3 Internal fire spread (structure)

### E3 INTERNAL FIRE SPREAD (STRUCTURE)

#### The requirement

This section deals with the following requirements

| Requirement   | Limits on application  |
|---|--|
| <b>Internal fire spread (structure)</b>   |  |
| E3. (1) The building shall be designed and constructed so that, in the event of fire, its stability will be maintained for a reasonable period.   |  |
| (2) A wall common to two or more buildings shall be designed and constructed so that it adequately resists the spread of fire between those buildings. For the purposes of this sub-paragraph a house in a terrace and a semi-detached house are each to be treated as a separate building.   |  |
| (3) Where reasonably necessary to inhibit the spread of fire within the building, measures shall be taken, to an extent appropriate to the size and intended use of the building, comprising either or both of the following:<br>(a) sub-division of the building with fire-resisting construction;<br>(b) installation of suitable automatic fire suppression systems. | Requirement E3(3) does not apply to material alterations to any prison or other place of legal internment. |
| (4) The building shall be designed and constructed so that the unseen spread of fire and smoke within concealed spaces in its structure and fabric is inhibited.  |  |

## E3 Internal fire spread (structure)

### E3 Guidance

#### E3.1 Performance

- 1) In the view of H.M. Government of Gibraltar the Requirements of E3 will be met:
  - a) if the loadbearing elements of structure 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 (see Appendix E) are suitably protected in order to maintain the integrity of the element (i.e. the continuity of the fire separation); and
  - d) if any hidden voids in the construction are sealed and sub-divided 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 the safety of people in and around the building.
- 2) 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.

#### E3.2 Introduction

- 1) Guidance on loadbearing elements of structure is given in section E3.3. Section E3.4 is concerned with the sub-division of a building into compartments and section E3.5 makes provisions about concealed spaces (or cavities). Section E3.6 gives information on the protection of openings and on fire-stopping. Section E3.7 and E3.8 are concerned with special measures which apply to car parks and shopping complexes. Common to all these sections and to other provisions of Part E, is the property of fire resistance.

#### E3.2.1 Fire resistance

- 1) 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, as follows:
  - a) resistance to collapse, i.e. the ability to maintain loadbearing capacity (which applies to loadbearing elements only);
  - b) resistance to fire penetration, i.e. an ability to maintain the integrity of the element; and
  - c) resistance to the transfer of excessive heat, i.e. an ability to provide insulation from high temperatures.
- 2) “Elements of structure” is the term applied to the main structural loadbearing elements, such as structural frames, floors and loadbearing walls. Compartment walls are treated as elements of structure although they are not necessarily loadbearing. Roofs, unless they serve the function of a floor, are not treated as elements of structure. External walls, such as curtain walls or other forms of cladding which transmit only self-weight and wind loads and do not transmit floor load, are not regarded as loadbearing for the purposes of E3.2.1 1) a), although they may need fire resistance to satisfy requirement E4 (see sections E4.3 and E4.4).
- 3) Loadbearing elements may or may not have a fire-separating function. Similarly, fire-separating elements may or may not be loadbearing.

#### E3.2.2 Guidance elsewhere in this document concerning fire resistance

- 1) There is guidance in sections E1.7 to E1.11 concerning the use of fire-resisting construction to protect means of escape. There is guidance in section E4.3 about fire resistance of external walls to restrict the spread of fire between buildings. There is guidance in section E5.5 about fire resistance in the construction of firefighting shafts. Appendix A gives information on methods of test and performance for elements of

## E3 Internal fire spread (structure)

construction. Appendix B gives information on fire doors. Appendix C gives information on methods of measurement. Appendix D gives information on purpose group classification. Appendix E gives definitions.

### E3.3 Loadbearing elements of structure

1) Premature failure of the structure can be prevented by provisions 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, namely:

- a) to minimise the risk to 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;
- b) to reduce the risk to firefighters, who may be engaged on search or rescue operations; and
- c) to reduce the danger to people in the vicinity of the building, who might be hurt by falling debris or as a result of the impact of the collapsing structure on other buildings.

#### E3.3.1 Fire resistance standard

1) Elements of structure such as 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.

##### E3.3.1.1 Application of the fire resistance standards for loadbearing elements

1) 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 (see notes to Table

A2). 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.

#### E3.3.1.2 Exclusions from the provisions for elements of structure

1) The following are excluded from the definition of element of structure for the purposes of these provisions:

- a) a structure that only supports a roof, unless:
  - i. the roof performs the function of a floor, such as for parking vehicles, or as a means of escape (see sections E1.8 to E1.10); or
  - ii. the structure is essential for the stability of an external wall which needs to have fire resistance;
- b) the lowest floor of the building;
- c) a platform floor; and
- d) a loading gallery, fly gallery, stage grid, lighting bridge, or any gallery provided for similar purposes or for maintenance and repair (see definition of “Element of structure” in Appendix E).

#### E3.3.1.3 Additional guidance

1) Guidance in other sections of this Document may also apply if a loadbearing wall is:

- a) a compartment wall (this includes a wall common to two buildings), (see section E3.4);
- b) a wall enclosing a place of special fire hazard (see section E3.4, paragraph E3.4.1 3));
- c) protecting a means of escape, (see sections E1.7 to E1.11);

## E3 Internal fire spread (structure)

- d) an external wall, (see sections E4.3 and E4.4); or
  - e) enclosing a firefighting shaft, (see section E5.5).
  - f) a wall between a dwelling house and an integral garage, (see section E3.4.6.6);
- 2) If a floor is also a compartment floor, see section E3.4.

### E3.3.2 Raised storage areas

- 1) Raised free-standing floors (sometimes supported by racking) are frequently erected in single storey industrial and storage 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 normal provisions for fire resistance of elements of structure may be onerous if applied to the raised storage area.
- 2) A structure which does not have the appropriate fire resistance given in Appendix A, Table A1 is 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 people likely to be on the floor at any one time is low and does not include members of the public;
  - c) the floor is not more than 10m in either width or length and does not exceed one half of the floor area of the space in which it is situated;
  - d) the floor is open above and below to the room or space in which it is situated; and
  - e) the means of escape from the floor meets the relevant provisions in sections E1.9, E1.10 and E1.11.
- 3) Where the lower level is provided with an automatic detection and alarm system, meeting the relevant recommendations of *BS 5839-1:2013*, the floor size may be increased to not more than 20m in either width or length.

4) The maximum dimensions provided above have been set in order to limit the distance that a firefighter may need to travel over or under the floor to effect a rescue. Where agreed locally it may be possible to vary these dimensions, however the safety of firefighters who may be on or underneath these floors must be taken into account.

5) Where the building is fitted throughout with an automatic sprinkler system in accordance with section E0.9, there are no limits on the size of the floor.

### E3.3.3 Floors in loft conversions in dwelling houses

- 1) In altering an existing two-storey single family dwelling house to provide additional storeys, the provisions in this section are for the floor(s), both old and new, to have the full 30 minute standard of fire resistance shown in Appendix A, Table A1. However, provided that the following conditions are satisfied, namely:
- a. only one storey is being added;
  - b. the new storey contains no more than 2 habitable rooms; and
  - c. the total area of the new storey does not amount to more than 50m<sup>2</sup>;
- then the existing first floor construction may be accepted if it has at least a modified 30 minute standard of fire resistance, in those places where the floor separates only rooms (and not circulation spaces).
- 2) 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 Appendix A, Table A1, item 3(a)).
- 3) A floor which forms part of the enclosure to the circulation space between the loft conversion and the final exit needs a full 30 minute standard.

## E3 Internal fire spread (structure)

### E3.3.4 Conversion to flats

- 1) Where an existing house or other building is converted into flats, there is a material change of use to which Part E of the regulations applies. Where the existing building has timber floors and these are to be retained, the relevant provisions for fire resistance may be difficult to meet.
- 2) Provided that the means of escape conform to section E1.9 and are adequately protected, a 30 minute standard of fire resistance could be accepted for the elements of structure in a building having not more than three storeys.
- 3) Where the altered building has four or more storeys the full standard of fire resistance given in Appendix A would normally be necessary.

## E3.4 Compartmentation

### E3.4.1 Introduction

- 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 and fire and rescue service personnel, but also to people in the vicinity of the building.
- 2) Compartmentation is complementary to provisions made in sections E1.7 to E1.11 for the protection of escape routes and to provisions made in section E4 against the spread of fire between buildings.
- 3) The appropriate degree of sub-division depends on:
  - a) the use of and fire load in the building, which affects the potential

- for fires and the severity of fires, as well as the ease of evacuation;
- b) the height to the floor of the top storey in the building, which is an indication of the ease of evacuation and the ability of the fire and rescue 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.

- 4) Sub-division is achieved using compartment walls and compartment floors. The circumstances in which they are needed are given in paragraphs E3.5.6 1) to E3.5.6.5 3).

- 5) Provisions for the construction of compartment walls and compartment floors are given in section E3.5.7 onwards. These construction provisions vary according to the function of the wall or floor.

### E3.4.2 Special forms of compartmentation

- 1) Special forms of compartmentation to which particular construction provisions apply, are:
  - a) walls common to two or more buildings, see paragraph E3.5.6 3);
  - b) walls dividing buildings into separated parts, see paragraph E3.5.6 4); and
  - c) construction enclosing places of special fire hazard, see paragraph E3.5.6.1 1) and 2).

### E3.4.3 Junctions

- 1) 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.

## E3 Internal fire spread (structure)

### E3.4.4 Protected shafts

1) 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. Any walls or floors bounding a protected shaft are considered to be compartment walls or floors for the purpose of this section.

### E3.4.5 Buildings containing one or more atria

1) Detailed advice on all issues relating to the incorporation of atria in buildings is given in *BS 9999* Annexes B and C. However, it should be noted that for the purposes of this Document the standard is relevant only where the atrium breaches any compartmentation.

### E3.4.6 Provision of compartmentation

1) Compartment walls and compartment floors should be provided in the circumstances described below, with the proviso that the lowest floor in a building does not need to be constructed as a compartment floor. Paragraphs E3.5.6 3) to E3.5.6.5 3) give guidance on the provision of compartmentation in different building types.

2) Information on the construction of compartment walls and compartment floors in different circumstances is given in paragraphs E3.5.7 to E3.5.7.5 6). Provisions for the protection of openings in compartment walls and compartment floors are given in sections E3.5.8.1 to E3.5.8.3.

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

4) Parts of a building that are occupied mainly for different purposes should be separated from one another by compartment walls and/or compartment floors. This does not apply where one of the different purposes is ancillary to the other. Refer to Appendix D

for guidance on whether a function should be regarded as ancillary or not.

### E3.4.6.1 Places of special fire hazard

1) Every place of special fire hazard (see Appendix E) should be enclosed with fire-resisting construction; see Table A1, Item 13.

2) Any such walls and floors are not compartment walls and compartment floors.

### E3.4.6.2 Flats

1) In buildings containing flats, the following should be constructed as compartment walls or compartment floors:

- a) every floor (unless it is within a flat, i.e. between one storey and another within one individual dwelling); and
- b) every wall separating a flat from any other part of the building (excluding external balconies and deck access); and
- c) every internal wall enclosing a refuse storage chamber.

2) Blocks of flats with a floor more than 30m above ground level should be fitted with a sprinkler system in accordance with section E0.9.

3) Sprinklers need only be provided within the individual flats, they are not required in the common areas such as stairs, corridors or landings. For the purposes of this paragraph any limit on the scope of *BS 9251* to buildings below 20m in height can be ignored.

### E3.4.6.3 Institutional buildings including health care

1) All floors should be constructed as compartment floors.

2) Paragraphs E1.9.14 4) to 16) give guidance on the provisions for compartment walls in care homes utilising progressive horizontal evacuation.



## E3 Internal fire spread (structure)

### E3.4.6.4 Other residential buildings

- 1) All floors should be constructed as compartment floors.

### E3.4.6.5 Non-residential buildings

- 1) 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 and Commercial, Assembly and Recreation, Industrial, Storage or Other non-residential):

- a) every wall needed to sub-divide the building to observe the size limits on compartments given in Table 12 (see Diagram 34b);
- b) every floor, if the building or separated part (see section E3.5.7.2) of the building, has a storey with a floor at a height of more than 30m above ground level (see Diagram 34ab);
- c) the floor of the ground storey if the building has one or more basements (see Diagram 34c), with the exception of small premises (see section E1.12.);
- d) the floor of every basement storey (except the lowest floor) if the building, or separated part (see paragraphs E3.5.6 1) and 2)), has a basement at a depth of more than 10m below ground level (see Diagram 34d);
- e) if the building forms part of a shopping complex, every wall and floor described in BS 9999 as needing to be constructed to the standard for a compartment wall or compartment floor; and
- f) if the building comprises Shop and Commercial, Industrial or Storage premises, every wall or floor provided to divide a building into separate occupancies, (i.e. spaces used by different organisations whether they fall within the same Purpose Group or not).

- 2) See also the provision in section E1.11.5.12 for store rooms in shops to be separated from retail areas by fire-resisting construction to the standard given in Table A1.

- 3) In a two storey building in the Shop and Commercial or Industrial Purpose Groups, where the use of the upper storey is ancillary to the use of the ground storey, the ground storey may be treated as a single storey building for fire compartmentation purposes, provided that:

- a) the area of the upper storey does not exceed 20% of the area of the ground storey, or 500m<sup>2</sup>, whichever is less;
- b) the upper storey is compartmented from the lower one; and
- c) there is a means of escape from the upper storey that is independent of the routes from the lower storey.

### E3.4.6.6 Dwelling houses

- 1) Every wall separating semi-detached houses, or houses in terraces, should be constructed as a compartment wall and the houses should be considered as separate buildings.

- 2) If a domestic garage is attached to (or forms an integral part of) a dwelling house, the garage should be separated from the rest of the dwelling house, as shown in Diagram 33.

- 3) Where a door is provided between a dwelling house and the garage, the floor of the garage should be laid to fall to allow fuel spills to flow away from the door and towards the outside. Alternatively, the door opening should be positioned at least 100mm above garage floor level.

## E3 Internal fire spread (structure)

### E3.4.7 Construction of compartment walls and compartment floors

- 1) Every compartment wall and compartment floor should:
  - a) form a complete barrier to fire between the compartments they separate; and
  - b) have the appropriate fire resistance as indicated in Appendix A, Tables A1 and A2.
- 2) Timber beams, joists, purlins and rafters may be built into or carried through a masonry or concrete compartment wall if the openings for them are kept as small as practicable and then fire-stopped. If trussed rafters bridge the wall, they should be designed so that failure of any part of the truss due to a fire in one compartment will not cause failure of any part of the truss in another compartment.
- 3) Where services are incorporated within the construction that could provide a potential source of ignition, care should be taken to ensure the risk of fire developing and spreading prematurely into adjacent compartments is controlled.

#### E3.4.7.1 Compartment walls between buildings

- 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.

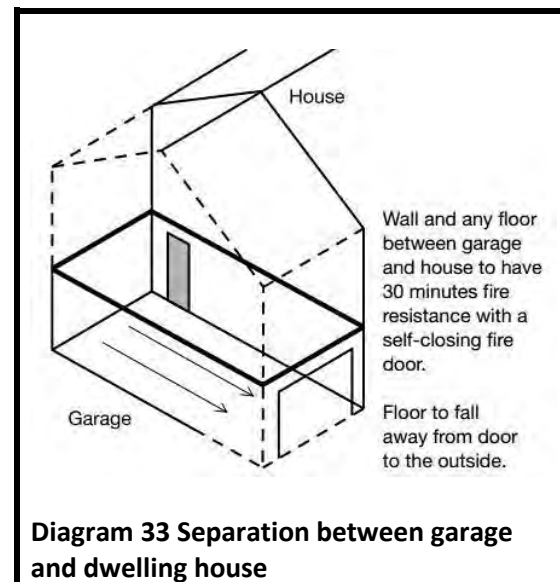
#### E3.4.7.2 Separated parts of buildings

- 1) Compartment walls used to form a separated part of a building (so that the separated parts can be assessed independently for the purpose of determining the appropriate standard of fire resistance) should run the full height of the building in a continuous vertical plane. The two separated

parts can have different standards of fire resistance.

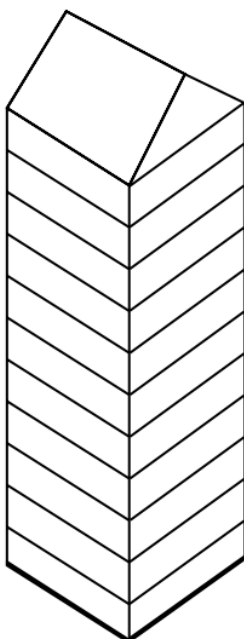
#### E3.4.7.3 Other compartment walls

- 1) Compartment walls not described in sections E3.5.7.1 and E3.5.7.2 should run the full height of the storey in which they are situated.
- 2) Compartment walls in a top storey beneath a roof should be continued through the roof space (see definition of compartment in Appendix E).



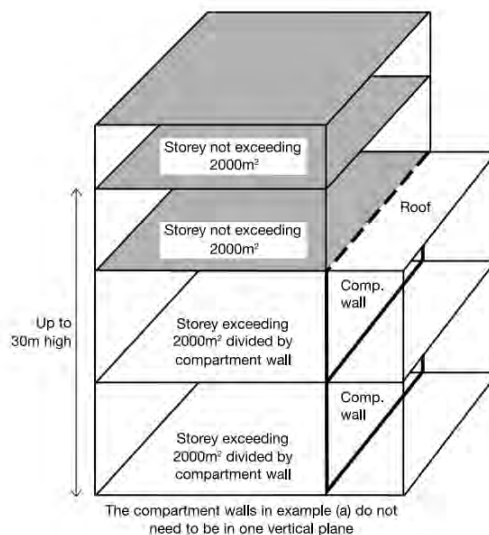
## E3 Internal fire spread (structure)

### a. Compartmentation in tall buildings



In a building over 30m in height all storeys should be separated by compartment floors. For atriums see *BS 9999* Annexes B and C.

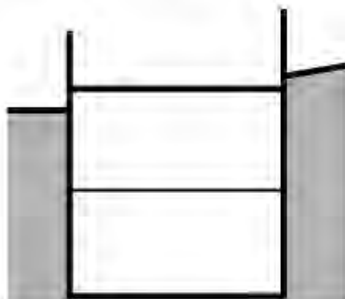
### b. Compartmentation in, for example, an unsprinklered shop



None of the floors in this case would have to be compartment floors but the two storeys exceeding 2000m<sup>2</sup> would need to be divided into compartments not more than 2000m<sup>2</sup> by compartment walls.

### c. Shallow basements

Only the floor of the ground storey need be a compartment floor if the lower basement is at a depth of not more than 10m



### d. Deep basements

All basement storeys to be separated by compartment floors if any storey is at a depth of more than 10m



Diagram 34 Compartment floors

## E3 Internal fire spread (structure)

| <b>Table 12 Maximum dimensions of building or compartment (non-residential buildings)</b> |   |   |                                      |                                   |
|---|---|---|--------------------------------------|-----------------------------------|
| Purpose group of building or part   | Height of floor of top storey above ground level (m)  | Floor area of any one storey in the building or any one storey in a compartment (m <sup>2</sup> ) |                                      |                                   |
|   |   | In multi-storey buildings   | In single storey buildings           |                                   |
| Office  | No limit  | No limit  | No limit                             |                                   |
| Assembly and recreation, & Shop and commercial:   |   |   |                                      |                                   |
| a. Shops – not sprinklered  | No limit  | 2000  | 2000                                 |                                   |
| Shops – sprinklered <sup>(1)</sup>  | No limit  | 4000  | No limit                             |                                   |
| b. Elsewhere – not sprinklered  | No limit  | 2000  | No limit                             |                                   |
| Elsewhere - sprinklered <sup>(1)</sup>  | No limit  | 4000  | No limit                             |                                   |
| Industrial <sup>(2)</sup>   |   |   |                                      |                                   |
| Not sprinklered   | Not more than 18  | 7000  | No limit                             |                                   |
| Sprinklered <sup>(1)</sup>  | More than 18  | 2000 <sup>(3)</sup>   | N/A                                  |                                   |
|   | Not more than 18  | 14000   | No limit                             |                                   |
|   | More than 18  | 4000 <sup>(3)</sup>   | N/A                                  |                                   |
|   | Height of floor of top storey above ground level (m)  | Multi- storey buildings   | Single storey buildings              |                                   |
|   |   | Maximum compartment volume  | Maximum floor area (m <sup>2</sup> ) | Maximum height (m) <sup>(4)</sup> |
| Storage <sup>(2)</sup> and other non-residential  |   |   |                                      |                                   |
| a. Car park for light vehicles  | No limit  | No limit  | No limit                             | No limit                          |
| b. Any other building or part:  |   |   |                                      |                                   |
| Not sprinklered   | Not more than 18  | 20000   | 20000                                | 18                                |
| Sprinklered   | More than 18  | 4000 <sup>(3)</sup>   | N/A                                  | N/A                               |
|   | Not more than 18  | 40000   | No limit                             | No limit                          |
|   | More than 18  | 8000 <sup>(3)</sup>   | N/A                                  | N/A                               |
| <b>Notes on Table 12:</b>   |   |   |                                      |                                   |
| (1)   | 'Sprinklered' means that the building is fitted throughout with an automatic sprinkler in accordance with section E0.9.   |   |                                      |                                   |
| (2)   | There may be additional limitations on floor area and/or sprinkler provisions in certain industrial and storage uses under other legislation, for example in respect of storage of LPG and certain chemicals. |   |                                      |                                   |
| (3)   | This reduced limit applies only to storeys that are more than 18m above ground level. Below this height the higher limit applies.   |   |                                      |                                   |
| (4)   | Compartment height is measured from finished floor level to underside of roof or ceiling.   |   |                                      |                                   |

## E3 Internal fire spread (structure)

### E3.4.7.4 Junction of compartment wall or compartment floor with other walls

- 1) Where a compartment wall or compartment floor meets another compartment wall or an external wall, the junction should maintain the fire resistance of the compartmentation. Fire-stopping should meet the provisions of paragraphs E3.6.4 1) to 6).
- 2) At the junction of a compartment floor with an external wall that has no fire resistance (such as a curtain wall) the external wall should be restrained at floor level to reduce the movement of the wall away from the floor when exposed to fire.
- 3) Compartment walls should be able to accommodate the predicted deflection of the floor above by either:
  - a) having a suitable head detail between the wall and the floor, that can deform but maintain integrity when exposed to a fire; or
  - b) the wall may be designed to resist the additional vertical load from the floor above as it sags under fire conditions and thus maintain integrity.
- 4) Where compartment walls are located within the middle half of a floor between vertical supports, the predicted deflection may be assumed to be 40mm unless a smaller value can be justified by assessment. Outside this area the limit can be reduced linearly to zero at the supports. For steel beams that do not have the required fire resistance, reference should be made to *SCI Publication 288 Fire safe design: A new approach to multi-storey steel framed buildings (Second Edition) 2000 (ISBN: 85942 69 5)*.
- 5)\* Where a compartment floor meets an external wall there is a risk that fire will spread from one floor to the next via the outside (i.e. it will go around the

compartment floor). To avoid this one of two solutions should be provided. Either:

- a) The external wall should be fire resisting for a height of 1.8m at the junction of the fire resisting floor and external wall (in relation to the compartment floor, the 1.8m of fire resistance may be above it, below it or partly above and partly below ) ; or
- b) A fire resisting horizontal projection should continue the line of the compartment floor outside the building for a distance of at least 1.0m. For example, this projection could be formed by an external balcony floor. The projection should continue for the full width of the junction of the compartment floor and the wall.

### E3.4.7.5 Junction of compartment wall with roof

- 1) 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. The compartment wall should also be continued across any eaves cavity (see paragraph E3.5.7a).
- 2) 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 paragraph E3.5.7.5 5), a zone of the roof 500mm wide on either side of the wall should have a covering of designation AA, AB or AC (see Appendix A, paragraph A3) on a substrate or deck of a material of limited combustibility, as set out in Diagram 36a.
- 3) Thermoplastic roof-lights which, by virtue of paragraphs E4.5.5 2), are regarded as having an AA (National class) designation or B<sub>ROOF</sub>(t4) (European class) classification are not suitable for use in the zone described above.

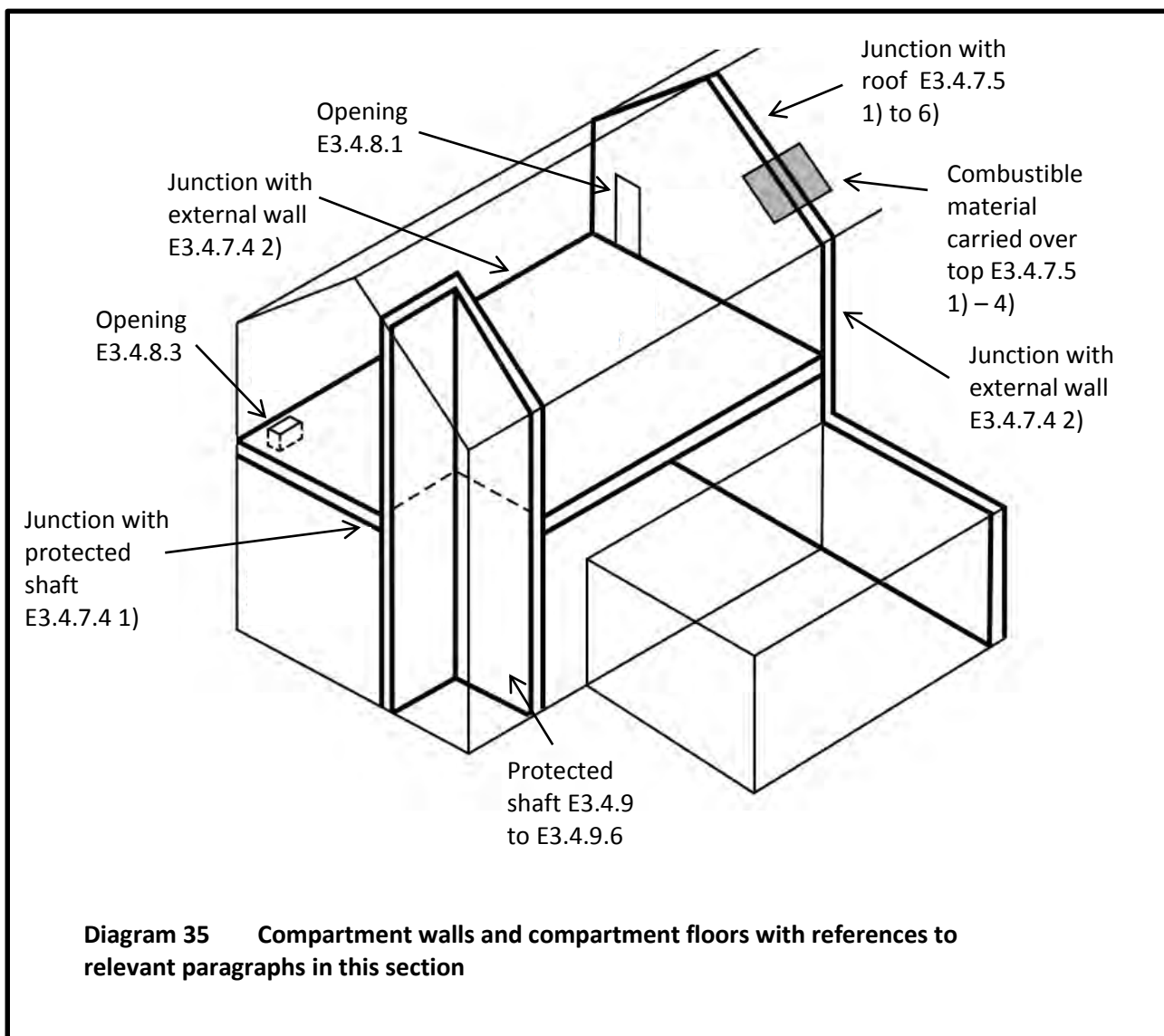
## E3 Internal fire spread (structure)

4) Double-skinned insulated roof sheeting, with a thermoplastic core, should incorporate a band of material of limited combustibility at least 300mm wide centred over the wall.

5) In buildings not more than 5m high, of the purpose groups listed below, combustible boarding used as a substrate 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 36b). This applies to, buildings or compartments in

Residential use (other than Institutional), Office buildings, Assembly and Recreation buildings.

6) As an alternative to paragraphs E3.5.7.5 2) to 4) or E3.5.7.5 5) the compartment wall may be extended up through the roof for a height of at least 375mm above the top surface of the adjoining roof covering. Where there is a height difference of at least 375mm between two roofs or where the roof coverings on either side of the wall are AA, AB or AC this height may be reduced to 200mm (see Diagram 36c).

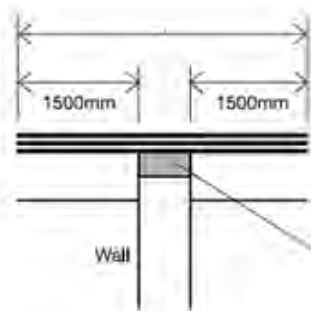


**Diagram 35** Compartment walls and compartment floors with references to relevant paragraphs in this section



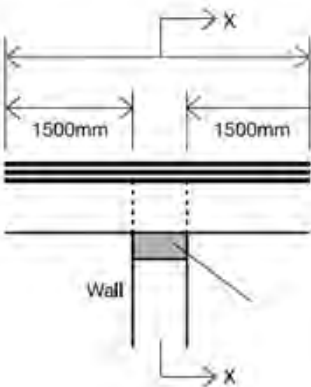
## E3 Internal fire spread (structure)

### a. Any building or compartment



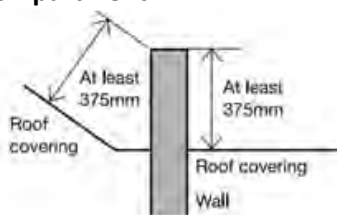
Roof covering over this distance to be designated AA, AB or AC on deck of material of limited combustibility. Roof covering and deck could be composite structure, e.g. profiled steel cladding. Double-skinned insulated roof sheeting should incorporate a band of material of limited combustibility at least 300mm wide centred over the wall. If roof support members pass through the wall, fire protection to these members for a distance of 1500mm on either side of the wall may be needed to delay distortion at the junction (see note to section E3.4.7). Resilient fire-stopping to be carried up to underside of roof covering, e.g. roof tiles

### b. Residential (not institutional), office or assembly – not more than 15m high



Roof covering to be designated AA, AB or AC for at least this distance. 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 no less suitable material) where over the wall. Thermoplastic insulation materials should not be carried over the wall. Double-skinned insulated roof sheeting with a thermoplastic core should incorporate a band of material of limited combustibility at least 300mm wide centred over the wall. Sarking felt may also be carried over the wall. If roof support members pass through the wall, fire protection to these members for a distance of 1500mm on either side of the wall may be needed to delay distortion at the junction (see note to section E3.4.7). Fire-stopping to be carried up to underside of roof covering, boarding or slab

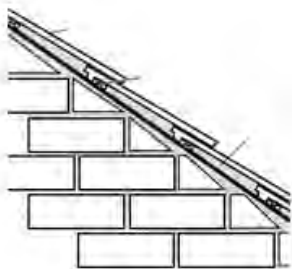
### c. Any building or compartment



The wall should be extended up through the roof for a height of at least 375mm above the top surface of the adjoining roof covering. Where there is a height difference of at least 375 mm between two roofs or where the roof coverings on either side of the wall are AA, AB or AC the height of the up-stand/parapet wall above the highest roof may be reduced to 200mm.

### Section X - X

Section X-X



Roof covering to be designated AA, AB or AC for at least 1500mm either side of wall. Roofing battens and sarking felt may be carried over the wall. Fire-stopping to be carried up to underside of roof covering. Above and below sarking felt. Notes:  
1 Fire-stopping should be carried over the full thickness of the wall.  
2 Fire-stopping should be extended into any eaves.  
3 The compartment wall need not necessarily be constructed of masonry.

**Diagram 36 Junction of compartment wall with roof**



## E3 Internal fire spread (structure)

### E3.4.8 Openings in compartmentation

#### E3.4.8.1 Openings in compartment walls separating buildings or occupancies

- 1) Any openings in a compartment wall which is common to two or more buildings, or between different occupancies in the same building, 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 E3.6.

#### E3.4.8.2 Doors

- 1) Information on fire doors may be found in Appendix B.

#### E3.4.8.3 Openings in other compartment walls or in compartment floors

- 1) Openings in compartment walls (other than those described in section E3.5.8.1) or compartment floors should be limited to those for:
  - a) doors which have the appropriate fire resistance given in Appendix B, Table B1 and re fitted in accordance with the provisions of Appendix B;
  - b) the passage of pipes, ventilation ducts, service cables, chimneys, appliance ventilation ducts or ducts encasing one or more flue pipes, which meet the provisions in section E3.5;
  - c) refuse chutes of non-combustible construction;
  - d) atria designed in accordance with Annexes B and C of BS 9999; and
  - e) protected shafts which meet the relevant provisions below.

### E3.4.9 Protected shafts

- 1) Any stairway or other shaft passing directly from one compartment to another should be enclosed in a protected shaft so as to delay or prevent the spread of fire between compartments.

- 2) There are additional provisions in sections E1.7 to E1.11 for protected shafts that are protected stairways and in section E5.5 if the stairway also serves as a firefighting stair.

#### E3.4.9.1 Uses for protected shafts

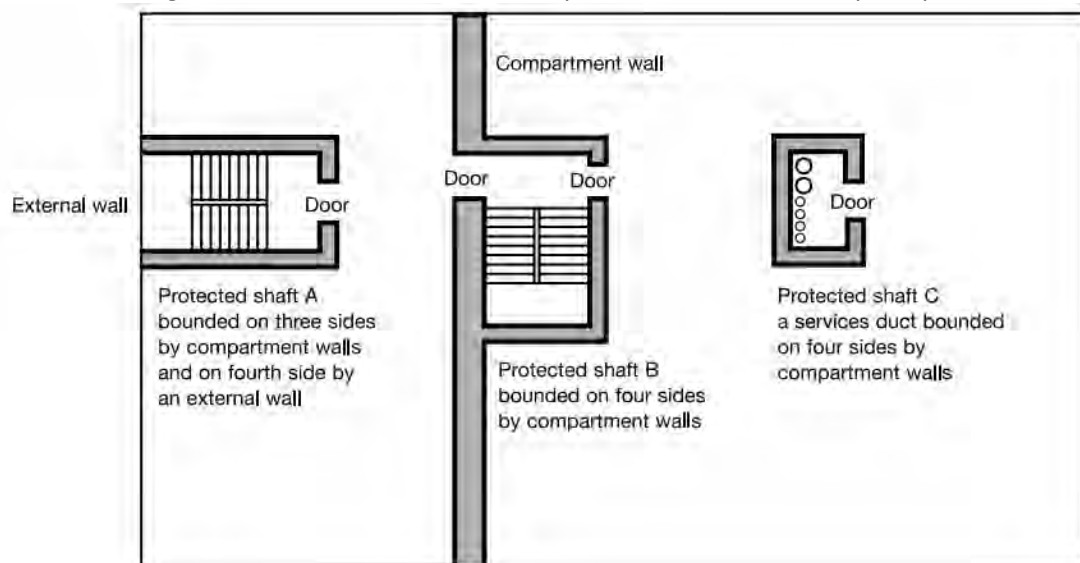
- 1) The uses of protected shafts should be restricted to stairs, lifts, escalators, chutes, ducts and pipes. Sanitary accommodation and washrooms may be included in protected shafts.

#### E3.4.9.2 Construction of protected shafts

- 1) The construction enclosing a protected shaft (see Diagram 37) 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 uninsulated glazed screens which meet the provisions of paragraph E3.5.9.3 1); and
  - c) satisfy the provisions about their ventilation and the treatment of openings in sections E3.5.9.5 and E3.5.9.6.

## E3 Internal fire spread (structure)

Protected shafts provide for the movement of people (e.g. stairs and lifts) or the passage of goods, air or services such as pipes or cables between different compartments. The elements enclosing the shaft (unless formed by adjacent external wall) are compartment walls and floors. The diagram shows three common examples which illustrate the principles.



The shaft structure (including any openings) should meet the relevant provisions for: compartment walls (see sections E3.4.7 to E3.4.8.1), external walls (see sections E4.3 and E4.4 and Diagram 30)

**Diagram 37**      **Protected shafts**

### E3.4.9.3    Uninsulated glazed screens to protected shafts

1) If the conditions given below and described in Diagram 37 are satisfied, an uninsulated glazed screen may be incorporated in the enclosure to a protected shaft between a stair and a lobby or corridor which is entered from the stair. The conditions to be satisfied are:

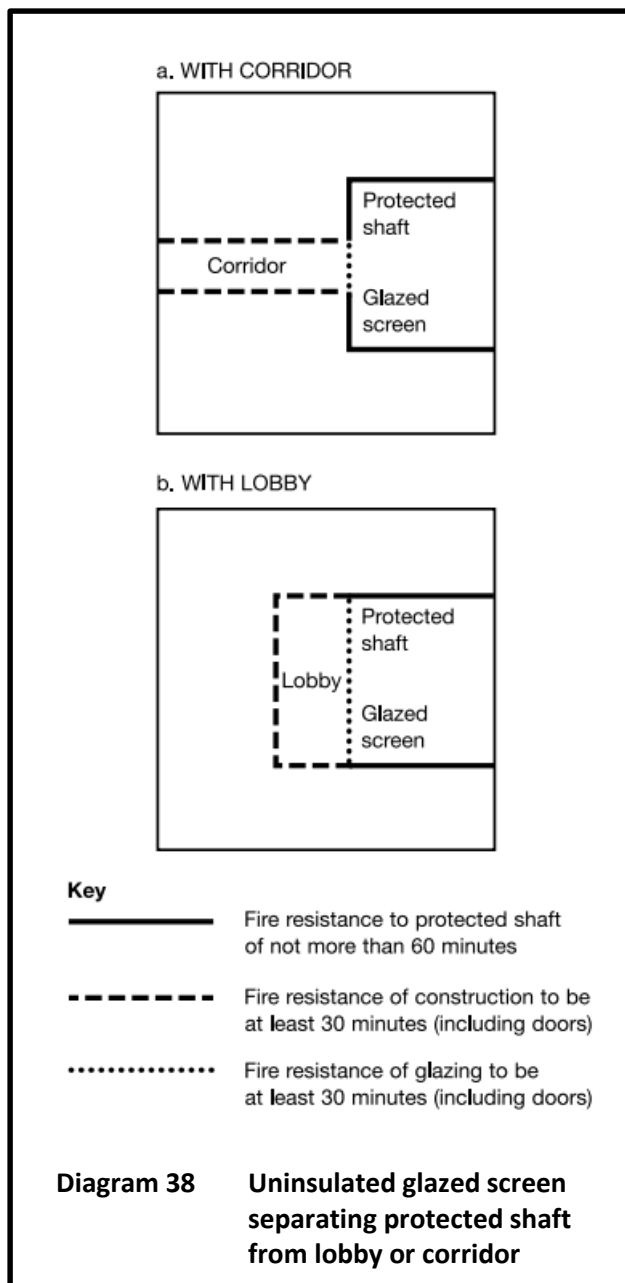
- a) the standard of fire resistance for the stair enclosure is not more than 60 minutes; and
- b) the glazed screen:
  - i. has at least 30 minutes fire resistance in terms of integrity; and
  - ii. meets the guidance in Appendix A, Table A4, on the limits on areas of uninsulated glazing; and
- c) the lobby or corridor is enclosed to at least a 30 minute standard.

2) Where the measures in Diagram 37 to protect the lobby or corridor are not provided, the enclosing walls should comply with Appendix A, Table A1 (item 8c) and the doors with the guidance in Appendix A, Table A4.

### E3.4.9.4    Pipes for oil or gas and ventilation ducts in protected shafts

1) If a protected shaft contains a stair and/or a lift, it should not also contain a pipe conveying oil (other than 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 smoke free; or a duct provided solely for ventilating the stairway).

## E3 Internal fire spread (structure)



### E3.4.9.5 Ventilation of protected shafts conveying gas

1) A protected shaft conveying piped flammable gas should be adequately ventilated direct to the outside air by ventilation openings at high and low level in the shaft.

2) Any extension of the storey floor into the shaft should not compromise the free movement of air over the entire length of the shaft. Guidance on such shafts, including sizing of the ventilation openings, is given in *BS 8313:1997*.

### E3.4.9.6 Openings into protected shafts

1) Generally an external wall of a protected shaft does not need to have fire resistance. However, there are some provisions for fire resistance of external walls of firefighting shafts in *BS 9999*, which is the relevant guidance called up by paragraphs E5.5.4 1) to 3) and of external walls to protected stairways (which may also be protected shafts) in paragraph E1.11.4.3 1).

2) 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, 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/or
- ii. the passage of a pipe which meets the provisions in section E3.6.

2) Any pipe carrying natural gas or LPG in such a shaft should be of screwed steel or of all welded steel construction, installed in accordance with appropriate pipeline safety guidance.

3) A pipe is not considered to be contained within a protected shaft if the pipe is completely separated from that protected shaft by fire resisting construction.

## E3 Internal fire spread (structure)

- 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;
  - ii. the passage of pipes which meet the provisions in section E3.6;
  - 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 E3.6; and/or
  - iv. the passage of lift cables into a lift machine room (if the shaft contains a lift). If the machine room is at the bottom of the shaft, the openings should be as small as practicable.

### E3.5 Concealed spaces (Cavities)

#### E3.5.1 Introduction

1) Concealed spaces or cavities in the construction of a building provide a ready route for smoke and flame spread. This is particularly so in the case of voids in, above and below the construction of a building, e.g. walls, floors, ceilings and roofs. As any spread is concealed, it presents a greater danger than would a more obvious weakness in the fabric of the building.

#### E3.5.2 Provision of cavity barriers

1) Provisions for cavity barriers are given below for specified locations. The provisions necessary to restrict the spread of smoke and flames through cavities are broadly for the purpose of sub-dividing:

- a) cavities which could otherwise form a pathway around a fire-separating element, in order to reduce the potential for unseen fire spread (this should not be confused with fire

stopping details, see section E3.6, Diagram 39 and sections E3.6.3.1 to E3.6.3.6); and

- b) extensive cavities (see paragraphs E3.6.4 to E3.6.4.1 7)).

2) Consideration should also be given to the construction and fixing of cavity barriers provided for these purposes and the extent to which openings in them should be protected. For guidance on these issues, see paragraphs E3.6.5 1) to 9) respectively.

### E3.5.3 Pathways around fire-separating elements

#### E3.5.3.1 Junctions and cavity closures

1) Cavity barriers should be provided to close the edges of cavities, including around openings.

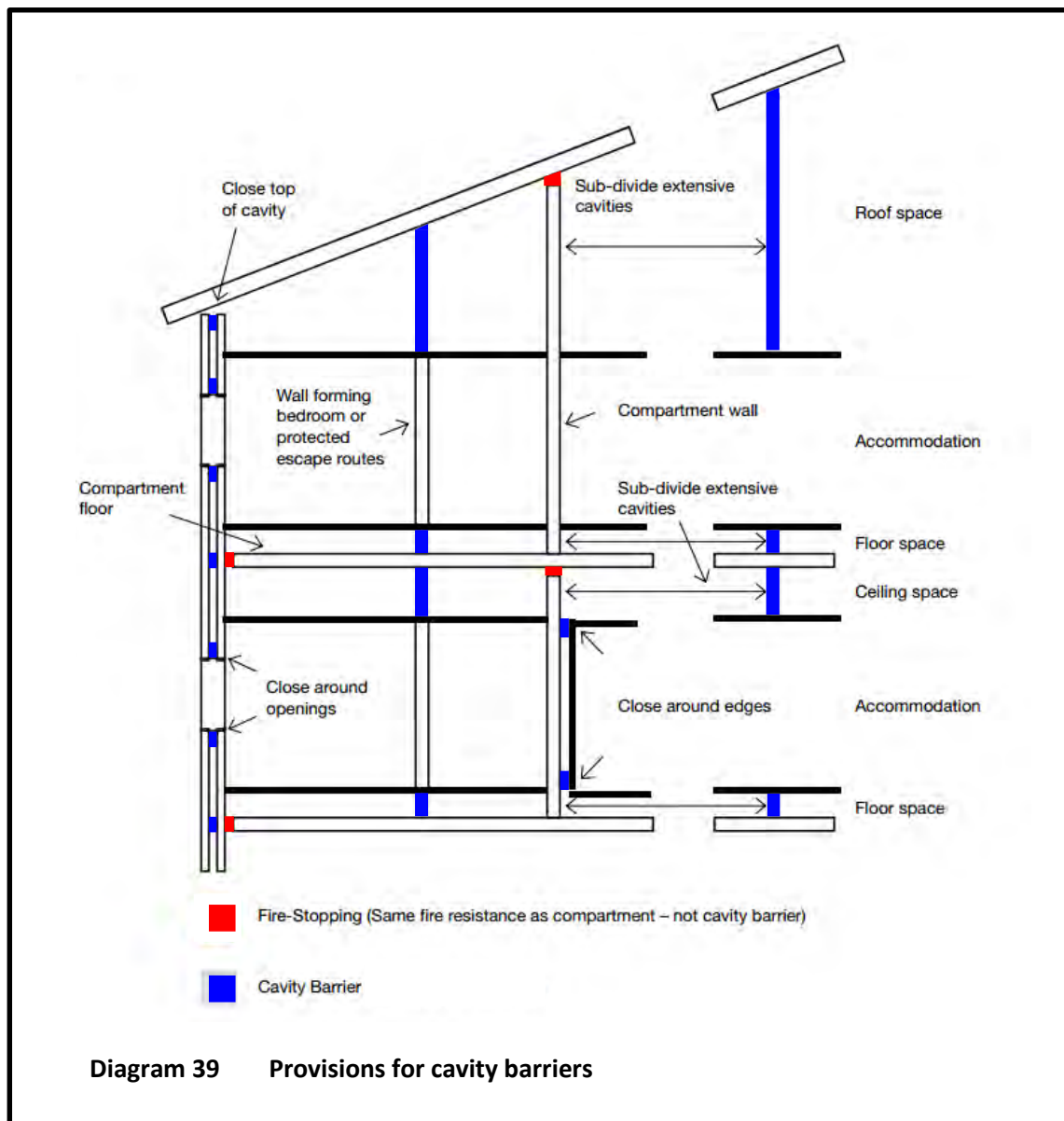
2) Cavity barriers should also be provided:

- a) at the junction between an external cavity wall (except where the cavity wall complies with Diagram 40) and every compartment floor and compartment wall; and
- b) at the junction between an internal cavity wall (except where the cavity wall complies with Diagram 40) and every compartment floor, compartment wall, or other wall or door assembly which forms a fire-resisting barrier.
- c) at the junction between an external cavity wall and a compartment wall that separates buildings and at the top of such an external cavity wall, except where the cavity wall complies with Diagram 40.

## E3 Internal fire spread (structure)

3) It is important to continue any compartment wall up through a ceiling or roof cavity to maintain the standard of fire resistance – therefore compartment walls should be carried up full storey height to a

compartment floor or to the roof as appropriate, see paragraphs E3.5.7.1 to E3.5.7.3 2). It is therefore not appropriate to complete a line of compartmentation by fitting cavity barriers above them.



## E3 Internal fire spread (structure)

### E3.5.3.2 Protected escape routes

1) For a protected escape route, a cavity that exists above or below any fire-resisting construction because the construction is not carried to full storey height or, in the case of a top storey, to the underside of the roof covering, should either be:

- a) fitted with cavity barriers on the line of the enclosure(s) to the protected escape route; or
- b) for cavities above the fire-resisting construction, enclosed on the lower side by a fire-resisting ceiling which extends throughout the building, compartment or separated part (see Diagram 41).

### E3.5.3.3 Double-skinned corrugated or profiled roof sheeting

1) Cavity Barriers need not be provided between double-skinned corrugated or profiled insulated roof 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 0 or 1 (National class) or Class Cs3, d2 or better (European class) (see Appendix A) and make contact with the inner and outer skins of cladding (see Diagram 42).

2) See also paragraph E3.5.7.5 4) regarding the junction of a compartment wall with a roof.

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

### E3.5.3.4 Cavities affecting alternative escape routes

1) Cavity barriers may be needed where corridors are sub-divided to prevent alternative escape routes being simultaneously affected by fire and/or smoke (see paragraphs E1.9.11 4) and 5) and Diagram 23).

### E3.5.3.5 Separation of bedrooms

1) In Institutional and Other Residential buildings, a cavity that exists above or below partitions between bedrooms because the enclosures are not carried to full storey height, or, (in the case of the top storey) to the underside of the roof covering, should either be:

- a) fitted with cavity barriers on the line of the partitions; or
- b) for cavities above the partitions, enclosed on the lower side by a fire-resisting ceiling which extends throughout the building, compartment or separated part.

### E3.5.4 Extensive Cavities

1) Cavity barriers should be used to sub-divide any cavity, including any roof space, so that the distance between cavity barriers does not exceed the dimensions given in Table 13.

## E3 Internal fire spread (structure)

### E3.5.4.1 Maximum dimensions of concealed spaces

- 1) Table 13 sets out maximum dimensions for undivided concealed spaces. With the exceptions given in paragraphs E3.6.4.1 2) to 7), extensive concealed spaces should be sub-divided to comply with the dimensions in Table 13.
- 2) The provisions in Table 13 do not apply to any cavity described below:
  - a) in a wall which should be fire-resisting only because it is loadbearing;
  - b) in a masonry or concrete external cavity wall shown in Diagram 40;
  - c) in any floor or roof cavity above a fire resisting ceiling, as shown in Diagram 41 and which extends throughout the building or compartment subject to a 30m limit on the extent of the cavity; or
  - d) formed behind the external skin of an external cladding system with a masonry or concrete inner leaf at least 75mm thick, or 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 the building is not put to a residential or institutional use; or
  - e) between double-skinned corrugated or profiled insulated roof 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 0 or 1 (National class) or Class C-s3, d2 or better (European class) (see Appendix A) and make contact with the inner and outer skins of cladding (see Diagram 42) ; or
  - f) below a floor next to the ground or over-site concrete, if the cavity is less than 1000mm in height or if the cavity is not normally accessible by people, unless there are openings in the floor such that it is possible for combustibles to accumulate in the

cavity (in which case cavity barriers should be provided and access should be provided to the cavity for cleaning).

- 3) When a classification includes “s3, d2”, this means that there is no limit set for smoke production and/or flaming droplets/particles.
- 4) Where any single room with a ceiling cavity or underfloor service void exceeds the dimensions given in Table 13, cavity barriers need only be provided on the line of the enclosing walls/partitions of that room, subject to:
  - a) the cavity barriers being no more than 40m apart; and
  - b) the surface of the material/product exposed in the cavity being Class 0 or Class 1 (National class) or Class C-s3, d2 or better (European class).
- 5) When a classification includes “s3, d2”, this means that there is no limit set for smoke production and/or flaming droplets/particles.



## E3 Internal fire spread (structure)

| <b>Table 13 Maximum dimensions of cavities in non-domestic buildings (purpose groups 2 – 7)</b>  |   |  |  |
|--|---|--|--|
| Location of cavity   | Class of surface/product exposed in cavity, excluding the surface of any pipe, cable or conduit or any insulation to any pipe |  | Maximum dimension in any direction (m) |
|  | National class  | European class   |  |
| Between roof and a ceiling   | Any   | Any  | 20                                     |
| Any other cavity   | Class 0 or class 1  | Class A1 or Class A2-s3, d2 or Class B-s3,d2 or Class C-s3, d2 | 20                                     |
|  | Not Class 0 or Class 1  | Not any of the above Classes                                   | 10                                     |
| <b>Notes for Table 13:</b><br>1. Exceptions to these provisions are given in paragraphs E3.5.4.1 2) to 7)<br>2. The national Classifications do not automatically equate with the equivalent classifications in the European column, therefore products cannot typically assume a European Class unless they have been tested accordingly.<br>3. When a Classification includes 's2, d3' this means that there is no limit set for smoke production and/or flaming droplets/particles. |   |  |  |

6) Where the concealed space is an undivided area which exceeds 40m (this may be in both directions on plan) there is no limit to the size of the cavity if:

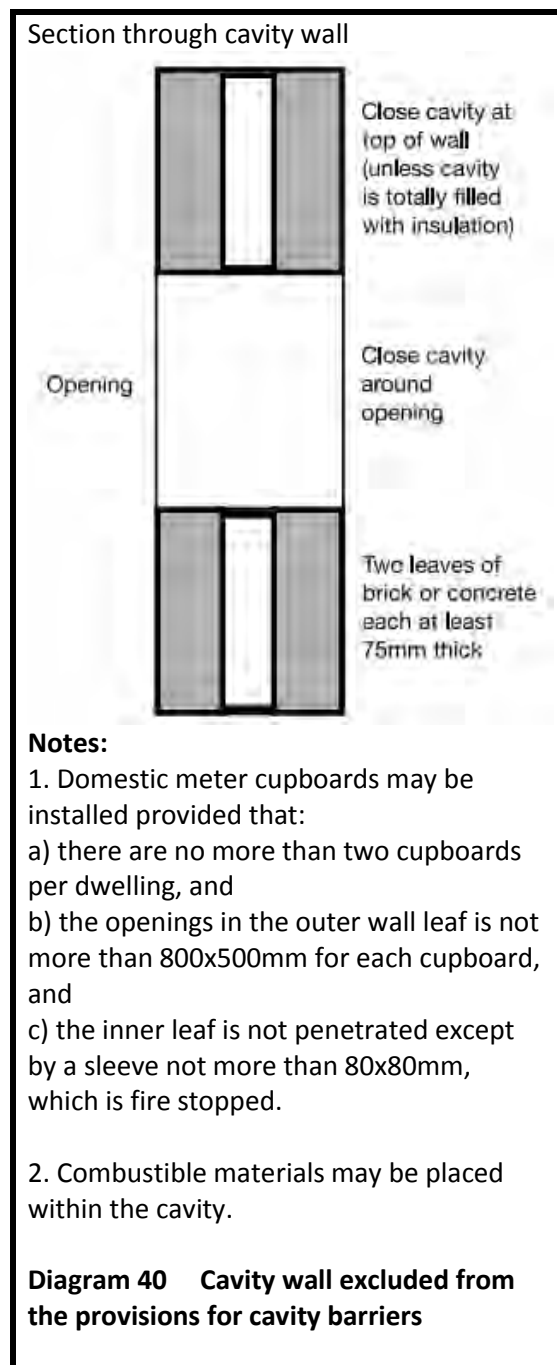
- a) the room and the cavity together are compartmented from the rest of the building;
- b) an automatic fire detection and alarm system meeting the relevant recommendations of *BS 5839-1:2013* is fitted in the building. Detectors are only required in the cavity to satisfy *BS 5839-1*.
- c) the cavity is used as a plenum and the recommendations about recirculating air distribution systems in *BS 9999* are followed;
- d) the surface of the material/product used in the construction of the cavity which is exposed in the cavity is Class 0 (National class) or Class B-s3, d2 or better (European class) and the supports and fixings in the cavity are of non-combustible construction;
- e) the flame spread rating of any pipe insulation system is Class 1 or Class C-

s3, d2 or better (European class) (see Appendix A);

- f) any electrical wiring in the void is laid in metal trays, or in metal conduit; and
- g) any other materials in the cavity are of limited combustibility or Class A2 or better (European class) (see Appendix A).

7) When a classification includes "s3, d2", this means that there is no limit set for smoke production and/or flaming droplets/particles.

## E3 Internal fire spread (structure)



2) Cavity barriers in a stud wall or partition, or provided around openings may be formed of:

- steel at least 0.5mm thick;
- timber at least 38mm thick;
- polythene-sleeved mineral wool, or mineral wool slab, in either case under compression when installed in the cavity; or
- calcium silicate, cement-based or gypsum based boards at least 2mm thick.

3) Cavity barriers provided around openings may be formed by the window or door frame if the frame is constructed of steel or timber of the minimum thickness in a) or b) above as appropriate.

4) A cavity barrier should, wherever possible, be tightly fitted to a rigid construction and mechanically fixed in position. 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. Provisions for fire-stopping are set out in section E3.6.

### E3.5.5 Construction and fixings for cavity barriers

1) Every cavity barrier should be constructed to provide at least 30 minutes fire resistance. It may be formed by any construction provided for another purpose if it meets the provisions for cavity barriers (see Appendix A, Table A1, item 5).

## E3 Internal fire spread (structure)

5) 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 temperature change and movement of the external envelope due to wind;
- b) collapse in a fire of any services penetrating them;
- c) failure in a fire of their fixings (but see paragraph 6) below); 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 may not arise if the ceiling is designed to provide fire protection of 30 minutes or more.)

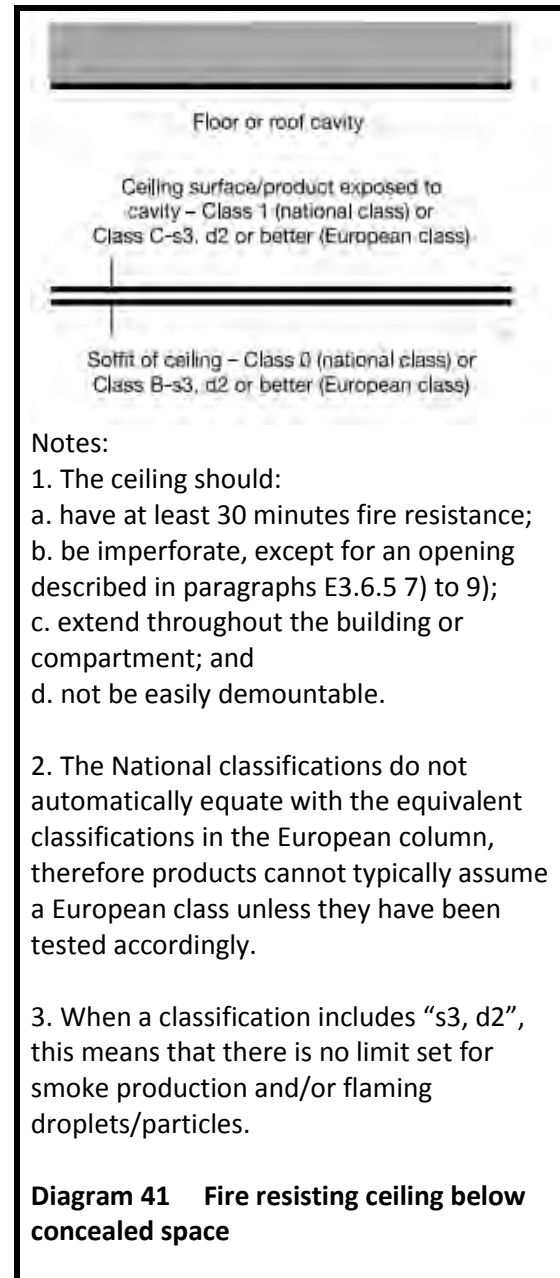
6) Where cavity barriers are provided in roof spaces, the roof members to which they are fitted are not expected to have any fire resistance – for the purpose of supporting the cavity barrier(s).

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

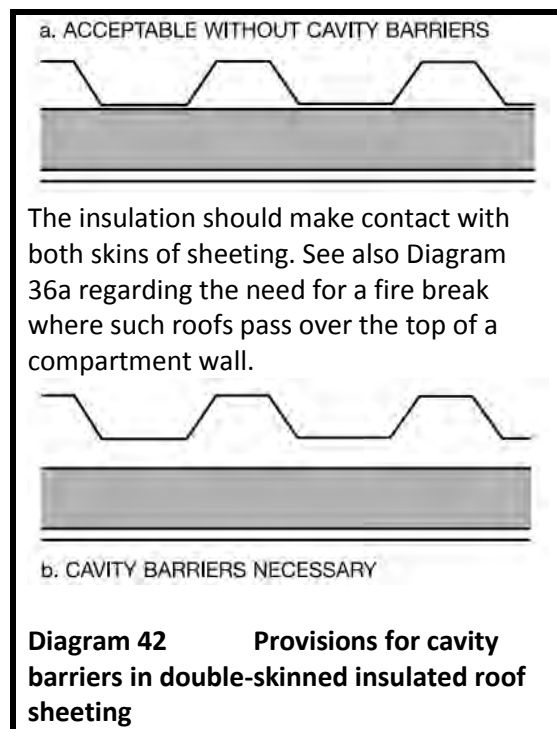
- a) doors which have at least 30 minutes fire resistance (see Appendix B, Table B1) and are fitted in accordance with the provisions of Appendix B;
- b) the passage of pipes which meet the provisions in section E3.6;
- c) the passage of cables or conduits containing one or more cables;
- d) openings fitted with a suitably mounted automatic fire damper (see paragraphs E3.6.3.1 1) 9)); and
- e) ducts which (unless they are fire-resisting) are fitted with a suitably mounted automatic fire damper where they pass through the cavity barrier.

8) If a cavity barrier is provided above a partition separating bedrooms in accordance with section E3.6.3.5 which do not need to be fire resisting partitions then a) to e) need not apply.

9) However, openings in the barrier should be kept to a minimum and any penetrations should be sealed to restrict the passage of smoke.



## E3 Internal fire spread (structure)



### E3.6 Protection of openings and fire stopping

#### E3.6.1 Introduction

1) Sections E3.4 and E3.5 make provisions for fire-separating elements and set out the circumstances in which there may be openings in them. This section deals with the protection of openings in such elements.

2) If a fire-separating element is to be effective, 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.

3) The measures in this section are intended to delay the passage of fire. They generally have the additional benefit of retarding smoke spread, but the tests specified in Appendix A for integrity does not directly stipulate criteria for the passage of smoke.

4) Detailed guidance on door openings and fire doors is given in Appendix B.

#### E3.6.2 Openings for pipes

1) Pipes which pass through a fire-separating element (unless the pipe is in a protected shaft), should meet the appropriate provisions in alternatives A, B or C below.

##### E3.6.2.1 Alternative A: Proprietary seals (any pipe diameter)

1) Provide a proprietary sealing system which has been shown by test to maintain the fire resistance of the wall, floor or cavity barrier.

##### E3.6.2.2 Alternative B: Pipes with a restricted diameter

1) Where a proprietary sealing system is not used, fire-stopping may be used around the pipe, keeping the opening as small as possible.

2) The nominal internal diameter of the pipe should not be more than the relevant dimension given in Table 4.

3) The diameters given in Table 14 for pipes of specification (b) used in situation (2) assumes that the pipes are part of an above ground drainage system and are enclosed as shown in Diagram 44 if they are not, the smaller diameter given for situation (3) should be used.

##### E3.6.2.3 Alternative C: Sleeving

1) A pipe of lead, aluminium, aluminium alloy, fibre-cement or uPVC, with a maximum nominal internal diameter of 60mm, may be used with a sleeving of non-combustible pipe as shown in Diagram 43. The specification for non-combustible and uPVC pipes is given in the notes to Table 14.

## E3 Internal fire spread (structure)

| <b>Table 14 Maximum nominal internal diameter of pipes passing through a compartment wall/floor</b>                   |  |   |                           |
|---|--|---|---------------------------|
| Situation   | Pipe material and maximum nominal internal diameter (mm) |   |                           |
|   | (a)<br>Non-combustible material <sup>(1)</sup>           | (b)<br>Lead, aluminium, aluminium alloy, uPVC <sup>(2)</sup> , fibre cement | (c)<br>Any other material |
| 1 Structure (but not a wall separating buildings) enclosing a protected shaft which is not a stairway or a lift shaft | 160  | 110   | 40                        |
| 2 Compartment wall or compartment floor between flats   | 160  | 160 (stack pipe) <sup>(3)</sup><br>110 (branch pipe) <sup>(3)</sup>         | 40                        |
| 3 Any other situation   | 160  | 40  | 40                        |

**Notes on Table 14:**

1. Any non-combustible material (such as cast iron, copper or steel) which, if exposed to a temperature of 800°C, will not soften or fracture to the extent that flame or hot gas will pass through the wall of the pipe.

2. uPVC pipes complying with *BS 4514:2001* and uPVC pipes complying with *BS 5255:1989*.

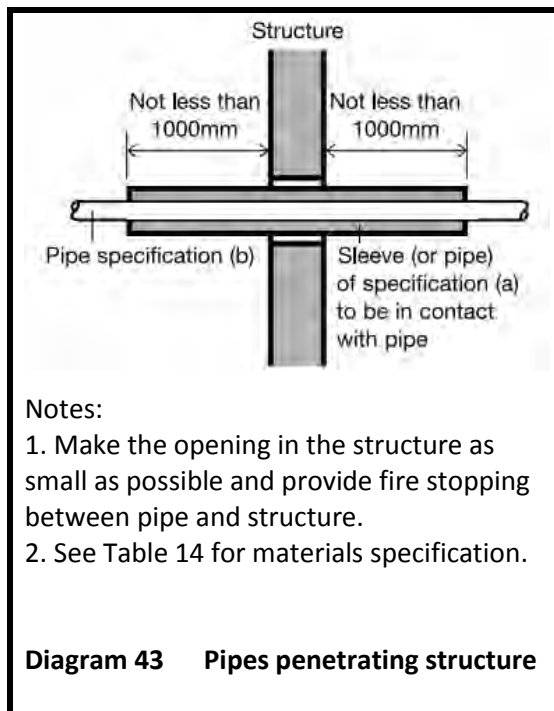
3. These diameters are only in relation to pipes forming part of an above-ground drainage system and enclosed as shown in Diagram 44. In other cases the maximum diameters against situation 3 apply.

### E3.6.3 Ventilation ducts, flues etc.

- 1) Where air handling ducts pass through fire separating elements the integrity of those elements should be maintained.
- 2) There are three basic methods and these are:
  - a) Method 1 Protection using fire dampers;
  - b) Method 2 Protection using fire-resisting enclosures;
  - c) Method 3 Protection using fire-resisting ductwork.

- 3) Method 1 is not suitable for extract ductwork serving kitchens. This is due to the likely build-up of grease within the duct which can adversely affect the effectiveness of any dampers. Further information on fire resisting ductwork is given in the *ASFP Blue Book: Fire resisting ductwork (ISBN: 87040 926 4)* published by the Association for Specialist Fire Protection and freely available from the ASFP website at [www.asfp.org.uk](http://www.asfp.org.uk).

## E3 Internal fire spread (structure)



### E3.6.3.1 Fire dampers

- 1) Fire dampers should be situated within the thickness of the fire-separating elements and be securely fixed. It is also necessary to ensure that, in a fire, expansion of the ductwork would not push the fire damper through the structure.
- 2) Adequate means of access should be provided to allow inspection, testing and maintenance of both the fire damper and its actuating mechanism.
- 3) Where the use of the building involves a sleeping risk, such as a hotel or residential care home, fire dampers should be actuated by smoke detector-controlled automatic release mechanisms, in addition to being actuated by thermally actuated devices. However, in a situation where all occupants of the building can be expected to make an unaided escape and an L1 fire alarm system is installed in accordance with BS 5839-1:2013, the following exceptions may be made:
  - a) If, on the detection of smoke, the alarm system signals the immediate evacuation of all the occupants of the building, then fire/smoke dampers are not needed; and

- b) If the building is divided into fire compartments and the alarm system is arranged to signal the immediate evacuation of the occupants of the fire compartment in which the fire has been detected, then smoke detector operated fire/smoke dampers need only be provided where ductwork enters or leaves the fire compartment.

- 4) Fire dampers actuated only by fusible links are not suitable for protecting escape routes. However an ES classified fire and smoke damper which is activated by a suitable fire detection system may be used. See paragraph E3.6.3.1 7) to 9).
- 5) Further guidance on the design and installation of mechanical ventilation and air conditioning plant is given in BS 5720:1979 on ventilation and air-conditioning ductwork and in BS 9999.
- 6) Further information on fire and smoke-resisting dampers is given in the ASFP Grey Book: *Fire and smoke resisting dampers* (ISBN: 87040 924 8) published by the Association for Specialist Fire Protection and freely available from the ASFP website at [www.asfp.org.uk](http://www.asfp.org.uk).
- 7) Fire dampers should be tested to BS EN 1366-2:1999 and be classified to BS EN 13501-3:2005. They should have an ES classification equal to, or greater than, 60 minutes.
- 8) Fire dampers tested using ad-hoc procedures based on BS 476 may only be appropriate for fan-off situations. In all cases, fire dampers should be installed as tested.
- 9) Paragraphs E1.11.5.10 1) and E3.4.9.4 also deal with ventilation and air-conditioning ducts.

## E3 Internal fire spread (structure)

### E3.6.3.2 Flues, etc.

1) If a flue, or duct containing flues or appliance ventilation duct(s), passes through a compartment wall or compartment floor, or is built into a compartment wall, each wall of the flue or duct should have a fire resistance of at least half that of the wall or floor in order to prevent the by-passing of the compartmentation (see Diagram 45).

### E3.6.4 Fire-stopping

1) In addition to any other provisions in this section for fire-stopping:

- a) joints between fire-separating elements should be fire-stopped; and
- b) all openings for pipes, ducts, conduits or cables to pass through any part of a fire-separating element should be:
  - 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 duct, should allow thermal movement).

2) 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 100mm; and
- b) in any other case where non-rigid materials are used (unless they have been shown to be satisfactory by test).

3) Proprietary fire-stopping and 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 and may be used.

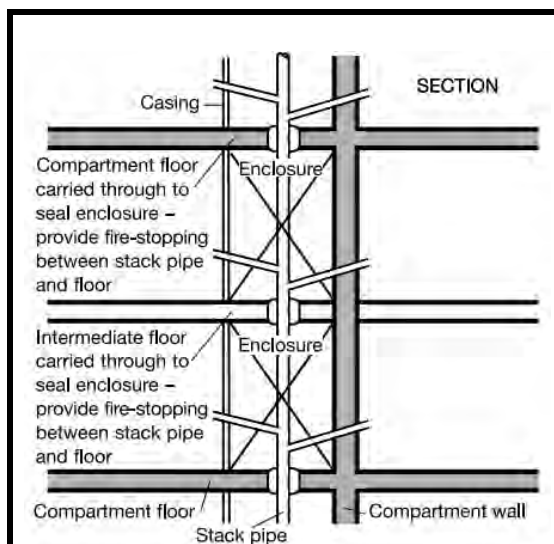
- 4) Other fire-stopping materials include:
- a) cement mortar;
  - b) gypsum-based plaster;
  - c) cement-based or gypsum-based vermiculite/perlite mixes;
  - d) glass fibre, crushed rock, blast furnace slag or ceramic-based products (with or without resin binders); and
  - e) intumescent mastics.

5) These may be used in situations appropriate to the particular material. Not all of them will be suitable in every situation.

6) Guidance on the process of design, installation and maintenance of passive fire protection is available in *Ensuring best practice for passive fire protection in buildings* (ISBN: 87040 99 ) produced by the Association for Specialist Fire Protection (ASFP). Further information on the generic types of systems available, information about their suitability for different applications and guidance on test methods is given in the *ASFP Red Book: Fire Stopping and Penetration Seals for the Construction Industry – the 'Red Book'* (ISBN:87040 923 X) published by the Association for Specialist Fire Protection and freely available from the ASFP website at [www.asfp.org.uk](http://www.asfp.org.uk).



## E3 Internal fire spread (structure)

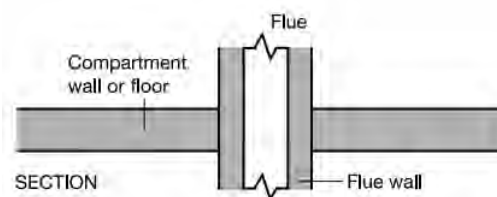


Notes:

1. The enclosure should:
  - a. be bounded by a compartment wall or floor, an outside wall, an intermediate floor, or a casing (see specification at 2 below);
  - b. have internal surfaces (except framing members) of Class 0 (National class) or Class B-s3, d2 or better (European class)  
Note: When a classification includes 's3, d2', this means that there is no limit set for smoke production and/or flaming droplets/particles);
  - c. not have an access panel which opens into a circulation space or bedroom;
  - d. be used only for drainage, or water supply, or vent pipes for a drainage system.
2. The casing should:
  - a. be imperforate except for an opening for a pipe or an access panel;
  - b. not be of sheet metal;
  - c. have (including any access panel) not less than 30 minutes fire resistance.
3. The opening for a pipe, either in the structure or the casing, should be as small as possible and fire-stopped around the pipe.

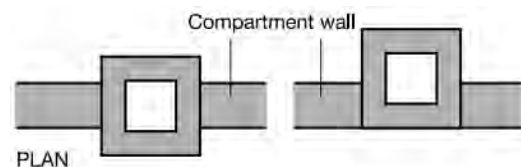
**Diagram 44 Enclosure for drainage or water supply pipes**

a. Flue passing through compartment wall or floor



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

b. Flue built into compartment wall



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

**Diagram 45 Flues penetrating compartment walls or floors**

## E3 Internal fire spread (structure)

### E3.7 Special provisions for car parks

- 1) This section describes additional provisions for car parks.
- 2) Buildings or parts of buildings used as parking for cars and other light vehicles are unlike other buildings in certain respects. These buildings require some departures from the usual measures to restrict fire spread within buildings. Those are:
  - a) The fire load is well defined; and
  - b) Where the car park is well ventilated, there is a low probability of fire spread from one storey to another. Ventilation is the important factor and, as heat and smoke cannot be dissipated so readily from a car park that is not open-sided, fewer concessions are made. The guidance in sections E3.7.1 to E3.7.2.2 is concerned with three ventilation methods: open-sided (high level of natural ventilation), natural ventilation and mechanical ventilation.
- 3) Any car park that has a particular arrangement for cars that may result in a higher than normal fire load density should have provisions that have been calculated and shown by a fire engineer to possess a level of safety in terms of the requirements for each of E1 to E5 that is equal to or better than a normal car park that follows the guidance in this Document.

#### E3.7.1 Open-sided car parks

- 1) If the building, or separated part containing the car park, complies with the following provisions it may be regarded as an open-sided car park for the purposes of fire resistance assessment in Appendix A, Table A2. The provisions are that:
  - a) there should not be any basement storeys;
  - b) each storey should be naturally ventilated by permanent openings at

- each car parking level, having an aggregate vent area not less than  $1/20^{\text{th}}$  of the floor area at that level, of which at least half ( $1/40^{\text{th}}$ ) should be equally provided between two opposing walls;
- c) 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).
- d) if the building is also used for any other purpose, the part forming the car park is a separated part and the fire resistance of any element of structure that supports or carries or gives stability to another element in the other part of the building should be no less than the minimum period of fire resistance for the elements it supports; and
- e) all materials used in the construction of the building, compartment or separated part should be non-combustible, except for:
  - i. any surface finish applied to a floor or roof of the car park, or within any adjoining building, compartment or separated part to the structure enclosing the car park, if the finish meets all relevant aspects of the guidance on requirements E2 and E4;
  - ii. any fire door;
  - iii. any attendant's kiosk not exceeding  $5\text{m}^2$  in area; and
  - iv. any shop mobility facility.

#### E3.7.2 Car parks which are not open-sided

- 1) Where car parks do not have the standard of ventilation set out in paragraph E3.7.1 (b), they are not regarded as open-sided and a different standard of fire resistance is necessary (the relevant provisions are given in Appendix A, Table A2).

## E3 Internal fire spread (structure)

2) Such car parks still require some ventilation, which may be by natural or mechanical means, as described in sections E3.7.2.1 or E3.7.2.2 below.

### E3.7.2.1 Natural ventilation

1) Where car parks that are not open-sided are provided with some, more limited, natural ventilation, each storey should be ventilated by permanent openings (which can be at ceiling level) at each car parking level.

2) These should have an aggregate free vent area not less than  $1/40^{\text{th}}$  of the floor area at that level, of which at least half should be split equally and provided between two opposing walls ( $1/160^{\text{th}}$  on each side). (See other building rules guidance for additional comments and advice on normal ventilation of car parks.)

### E3.7.2.2 Mechanical ventilation

1) In most basement car parks and in enclosed car parks, it may not be possible to obtain the minimum standard of natural ventilation openings set out in section E3.7.2.1. In such cases a system of mechanical ventilation should be provided as follows:

- a) the system should be independent of any other ventilating system (other than any system providing normal ventilation to the car park) and be designed to operate at 10 air changes per hour in a fire condition. (See other building rules guidance for additional comments and advice on normal ventilation of car parks);
- 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) each part of the system should have an independent power supply which would operate in the event of failure of the main supply;

- d) extract points 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  $300^{\circ}\text{C}$  for a minimum of 60 minutes and the ductwork and fixings should be constructed of materials having a melting point not less than  $800^{\circ}\text{C}$ .

2) For further information on equipment for removing hot smoke, refer to *BS EN 12101-3:2002*.

3) An alternative method of providing smoke ventilation from enclosed car parks is given *BS 7346-7:2013*.

## E3.8 Special provisions for shopping complexes

1) 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, the provisions may not be appropriate where a shop forms part of a complex. 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, walls separating shop units, surfaces and boundary distances may pose problems.

2) To ensure a satisfactory standard of fire safety in shopping complexes, alternative measures and additional compensatory features to those set out in this Document are appropriate. Such features are set out in Annex E of *BS 9999* and the relevant recommendations of those sections should be followed.

E4 External fire spread

E4 EXTERNAL FIRE SPREAD

The requirement

This section deals with the following requirements

| Requirement   | Limits on application |
|---|-----------------------|
| <p><b>External fire spread</b></p> <p>E4. (1) The external walls of the building shall adequately resist the spread of fire over the walls and from one building to another, having regard to the height, use and position of the building.</p> <p>(2) The roof of the building shall adequately resist the spread of fire over the roof and from one building to another, having regard to the use and position of the building.</p> |                       |

## E4 External fire spread

### E4 Guidance

#### E4.1 Performance

- 1) In the view of H.M. Government of Gibraltar the requirements of E4 will be met:
  - a) if the external walls are constructed so that the risk of ignition from an external source and the spread of fire over their surfaces, is restricted, by making provision for them to have low rates of heat release;
  - b) if the amount of unprotected area in the side of the building is restricted so as to limit the amount of thermal radiation that can pass through the wall, taking the distance between the wall and the boundary into account; 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.
- 2) 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.
- 3) 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.

#### E4.2 Introduction

##### E4.2.1 External walls

- 1) The construction of external walls and the separation between buildings to prevent external fire spread are closely related.
- 2) The chances of fire spreading across an open space between buildings and the consequences if it does, depend on:
  - a) the size and intensity of the fire in the building concerned;
  - b) the distance between the buildings;
  - c) the fire protection given by their facing sides; and
  - d) the risk presented to people in the other building(s).

- 3) Provisions are made in section E4.3 for the fire resistance of external walls and to limit the susceptibility of the external surface of walls to ignition and to fire spread.

- 4) Provisions are made in section E4.4 to limit the extent of openings and other unprotected areas in external walls in order to reduce the risk of fire spread by radiation.

##### E4.2.2 Roofs

- 1) Provisions are made in section E4.5 for reducing the risk of fire spread between roofs and over the surfaces of roofs.

#### E4.3 Construction of external walls

##### E4.3.1 Introduction

- 1) Provisions are made in this section for the external walls of the building to have sufficient fire resistance to prevent fire spread across the relevant boundary. The provisions are closely linked with those for space separation in section E4.4 which sets out limits on the amount of unprotected area of wall. As the limits depend on the distance of the wall from the relevant boundary, it is possible for some or all of the walls to have no fire resistance, except for any parts which are loadbearing (see paragraph E3.2.1 1)).
- 2) External walls are often elements of structure and the relevant period of fire resistance (specified in Appendix A) depends on the use, height and size of the building concerned. If the wall is 1000mm or more from the relevant boundary, a reduced standard of fire resistance is accepted in most cases and the wall only needs fire resistance from the inside.

## E4 External fire spread

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

4) In the guidance to requirement E3, provisions are made in section E3.3 for internal and external loadbearing walls to maintain their loadbearing function in the event of fire.

### E4.3.2 Fire resistance standard

1) The external walls of the building should have the appropriate fire resistance given in Appendix A, Table A1, unless they form an unprotected area under the provisions of section E4.4.

### E4.3.3 Portal frames

1) Portal frames are often used in single storey industrial and commercial buildings where there may be no need for fire resistance of the structure (Requirement E3). However, where a portal framed building is near a relevant boundary, the external wall near the boundary may need fire resistance to restrict the spread of fire between buildings.

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

3) Following an investigation of the behaviour of steel portal frames in fire, it is considered technically and economically feasible to design the foundation and its

connection to the portal frame so that it would transmit the overturning moment caused by the collapse, in a fire, of unprotected rafters, purlins and some roof cladding, while allowing the external wall to continue to perform its structural function.

4) The design method for this is set out in the *SCI publication P313 Single storey steel framed buildings in fire boundary conditions, 2002 (ISBN: 185942 135 0)*.

5) The recommendations in the SCI publication for designing the foundation to resist overturning need not be followed if the building is fitted with a sprinkler system in accordance with section E0.9.

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

7) Existing buildings may have been designed to the following guidance which is also acceptable:

- a) the column members are fixed rigidly to a base of sufficient size and depth to resist overturning;
- b) there is brick, block or concrete protection to the columns up to a protected ring beam providing lateral support; and
- c) there is some form of roof venting to give early heat release. (The roof venting could be, for example, PVC roof-lights covering some 10 per cent of the floor area and evenly spaced over the floor area.)

## E4 External fire spread

### E4.3.4 External wall construction

- 1) The external envelope of a building should not provide a medium for fire spread if it is likely to be a risk to health or safety. The use of combustible materials in the cladding system and extensive cavities may present such a risk in tall buildings.
- 2) External walls should either meet the guidance given in paragraphs E4.3.5 to E4.3.5.2 2) or meet the performance criteria given in the *BRE Report Fire performance of external thermal insulation for walls of multi-storey buildings (BR 135)* for cladding systems using full scale test data from BS 8414-1:2002 or BS 8414-2:2005.
- 3) The total amount of combustible material may also be limited in practice by the provisions for space separation in section E4.4 (see paragraph E4.4.3 onwards).

### E4.3.5 External surfaces

- 1) The external surfaces of walls should meet the provisions in Diagram 46. Where a mixed use building includes Assembly and Recreation Purpose Group(s) accommodation, the external surfaces of walls should meet the provisions in Diagram 46c.

#### E4.3.5.1 Insulation Materials/Products

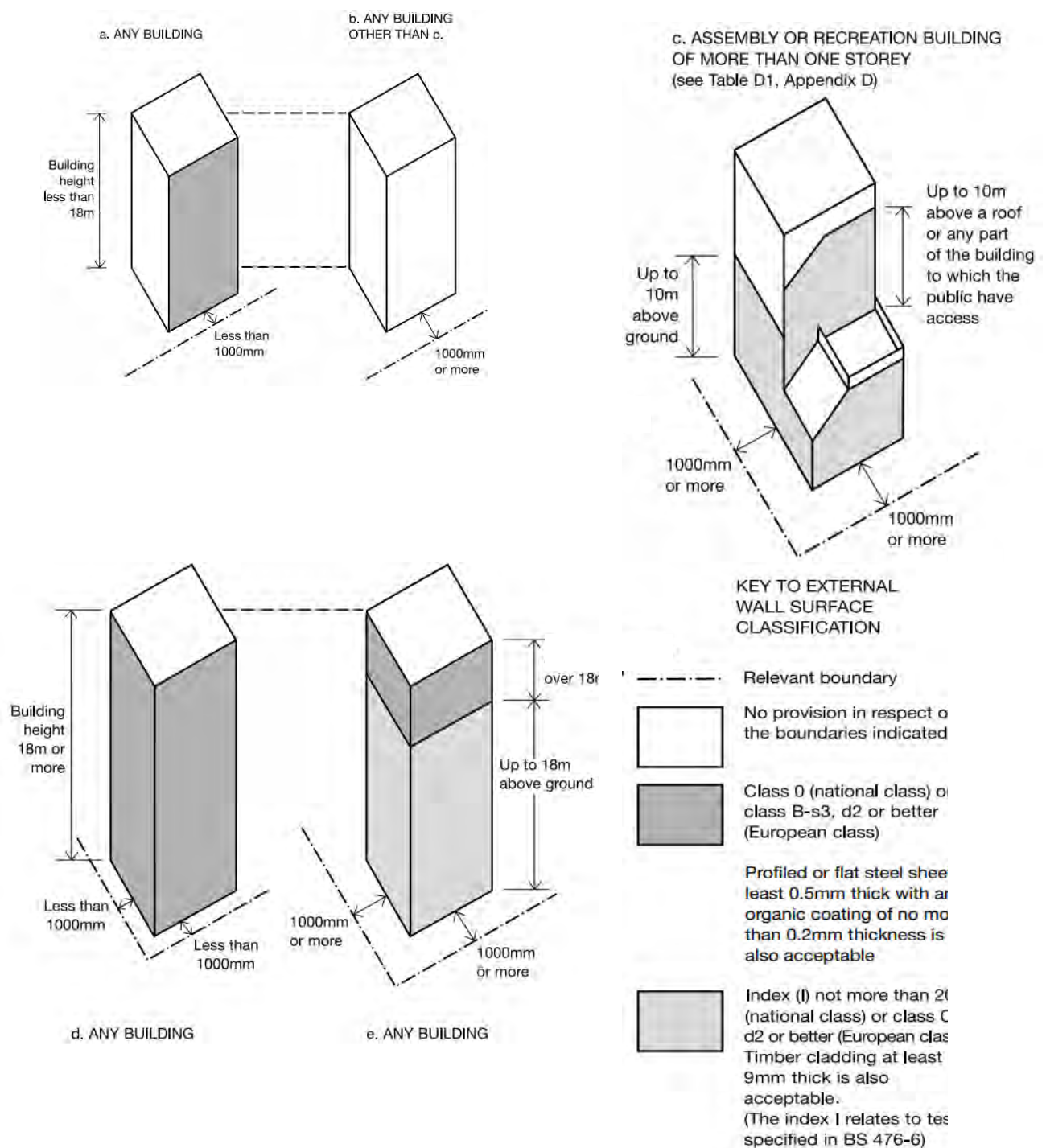
- 1) In a building with a storey 18m or more above ground level any insulation product, filler material (not including gaskets, sealants and similar) etc. used in the external wall construction should be of limited combustibility (see Appendix A).
- 2) This restriction does not apply to masonry cavity wall construction which complies with Diagram 40 in section E3.5.

#### E4.3.5.2 Cavity barriers

- 1) Cavity barriers should be provided in accordance with section E3.5.
- 2) In the case of an external wall construction which, by virtue of paragraph E3.5.4.1 2) d) (external cladding system with a masonry or concrete inner leaf), is not subject to the provisions of Table 13 Maximum dimensions of cavities in non-domestic buildings, the surfaces which face into cavities should also meet the provisions of Diagram 46.



## E4 External fire spread



### Notes:

1. The national classifications do not automatically equate with the equivalent European classifications, therefore products cannot typically assume a European class unless they have been tested accordingly.
2. When a classification includes, 's3, d2', this means that there is no limit set for smoke production and/or flaming droplets/particles.

**Diagram 46 Provisions for external surfaces or walls**

## E4 External fire spread

### E4.4 Space separation

#### E4.4.1 Introduction

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

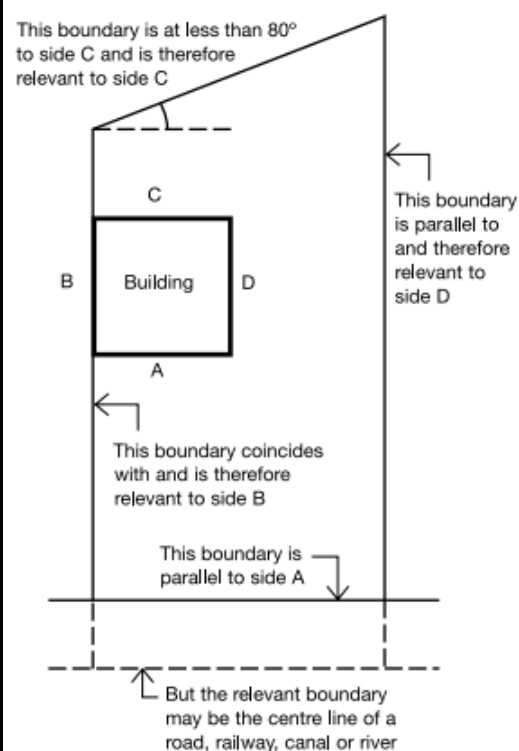
2) A roof is not subject to the provisions in this section unless it is pitched at an angle greater than  $70^\circ$  to the horizontal (see definition for 'external wall' in Appendix E). Similarly, vertical parts of a pitched roof such as dormer windows (which taken in isolation might be regarded as a wall), would not need to meet the following provisions unless the slope of the roof exceeds  $70^\circ$ . It is a matter of judgement whether a continuous run of dormer windows occupying most of a steeply pitched roof should be treated as a wall rather than a roof.

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

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

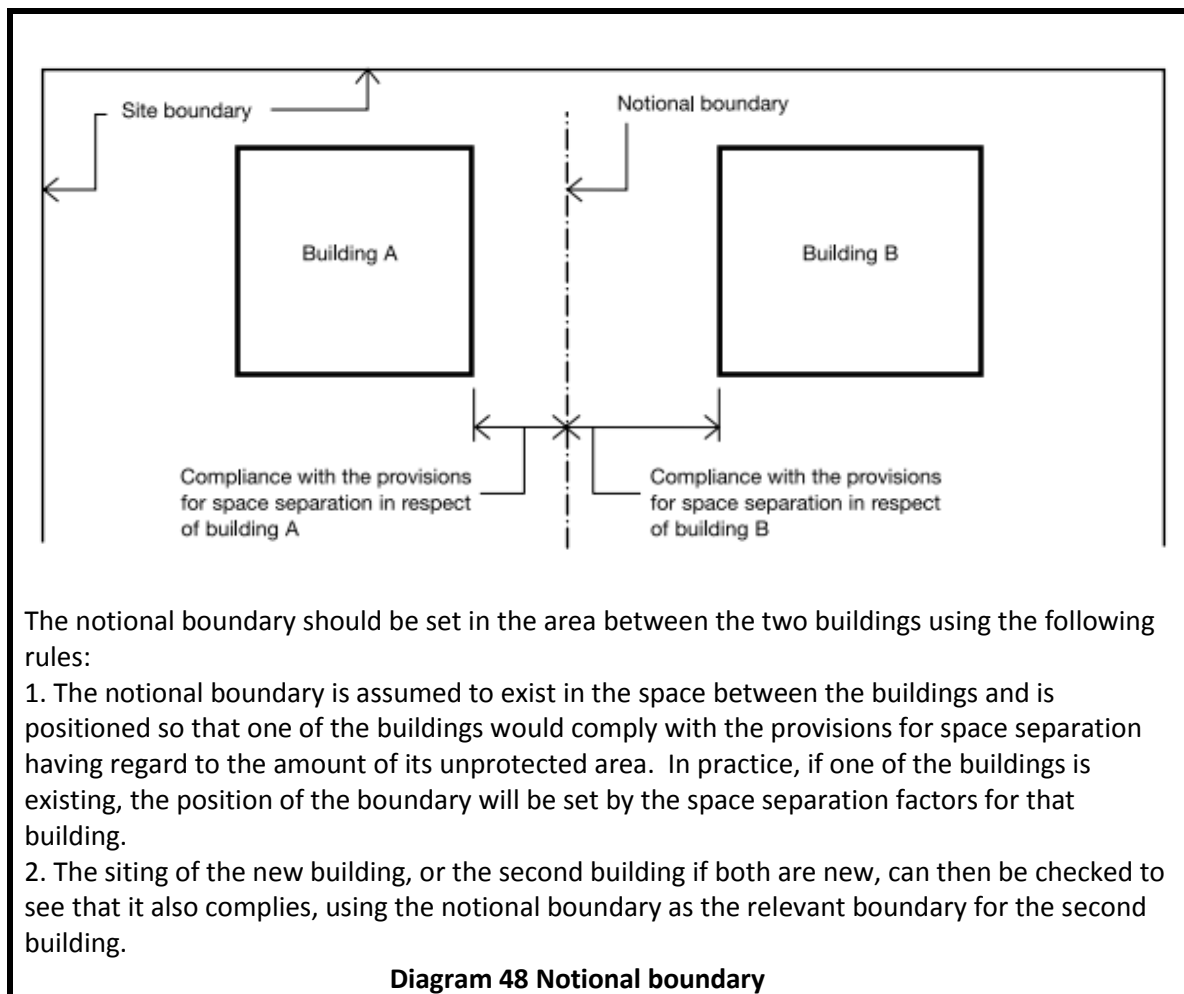
This diagram sets out the rules that apply in respect of a boundary for it to be considered as a relevant boundary.

For a boundary to be relevant it should coincide with, be parallel to or be at an angle of not more than  $80^\circ$  to the side of the building.



**Diagram 47 Relevant boundary**

## E4 External fire spread



### E4.4.2 Boundaries

1) 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, regardless of whether there is a building on an adjoining site and regardless of the site of that building or the extent of any unprotected areas that it might have.

2) A wall is treated as facing a boundary if it makes an angle with it of  $80^\circ$  or less (see Diagram 47).

3) Usually only the distance to the actual boundary of the site needs to be considered. But in some circumstances, when the site boundary adjoins a space where further development is unlikely, such as a road, then

part of the adjoining space may be included as falling within the relevant boundary for the purposes of this section. The meaning of the term boundary is explained in Diagram 47.

#### E4.4.2.1 Relevant boundaries

1) The boundary which a wall faces, whether it is the actual boundary of the site or a notional boundary, is called the relevant boundary (see Diagrams 47 and 48).

## E4 External fire spread

### E4.4.2.2 Notional boundaries

- 1) Generally separation distance between buildings on the same site is discounted. In some circumstances the distances to other buildings on the same site need to be considered. This is done by assuming that there is a boundary between those buildings. This assumed boundary is called a notional boundary.
- 2) A notional boundary is assumed to exist where:
  - a) either or both of the buildings concerned are in the Residential or Assembly and Recreation Purpose Groups; or
  - b) more than one building is constructed on the same site but is to be operated/managed by different organisations.

The appropriate rules are given in Diagram 48.

### E4.4.3 Unprotected areas and fire resistance

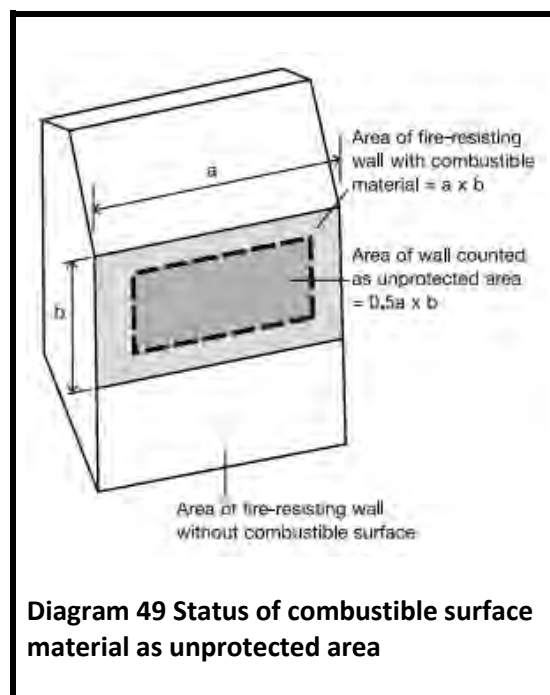
- 1) Any part of an external wall which has less fire resistance than the appropriate amount given in Appendix A, Table A2, is considered to be an unprotected area.

#### E4.4.3.1 External walls of protected shafts forming stairways

- 1) Any part of an external wall of a stairway in a protected shaft is excluded from the assessment of unprotected area.
- 2) There are provisions in the guidance to E1 (Diagram 29) and E5 (paragraph E5.5.4 1)) which refers to BS 9999 about the relationship of external walls for protected stairways to the unprotected areas of other parts of the building.

### E4.4.3.2 Status of combustible surface materials as unprotected area

- 1) If an external wall has the appropriate fire resistance, but has combustible material more than 1mm thick as its external surface, then that wall is counted as an unprotected area amounting to half the actual area of the combustible material, see Diagram 49. (For the purposes of this provision, a material with a Class 0 rating (National class) or Class B-s3, d2 rating (European class) (see Appendix A, paragraphs A4 and A7 5)) need not be counted as unprotected area).
- 2) When a classification includes “s3, d2”, this means that there is no limit set for smoke production and/or flaming droplets/particles.



## E4 External fire spread

### E4.4.3.3. Small unprotected areas

1) Small unprotected areas in an otherwise protected area of wall are considered to pose a negligible risk of fire spread and may be disregarded. Diagram 50 shows the constraints that apply to the placing of such areas in relation to each other and to lines of compartmentation inside the building. These constraints vary according to the size of each unprotected area.

### E4.4.3.4 Canopies

1) In the case of a canopy attached to the side of a building, provided that the edges of the canopy are at least 2m from the relevant boundary, separation distance may be determined from the wall rather than the edge of the canopy (see Diagram 51).

2) In the case of a free-standing canopy structure above a limited risk or controlled hazard (for example over petrol pumps), in view of the high degree of ventilation and heat dissipation achieved by the open sided construction and provided the canopy is 1000mm or more from the relevant boundary, the provisions for space separation could reasonably be disregarded.

### E4.4.3.5 Large uncompartmented buildings

1) Parts of the external wall of an uncompartmented building which are more than 30m above mean ground level, may be disregarded in the assessment of unprotected area.

### E4.4.3.6 External walls within 1000mm of the relevant boundary

1) A wall situated within 1000mm from any point on the relevant boundary and including a wall coincident with the boundary, will meet the provisions for space separation if:

- a) the only unprotected areas are those shown in Diagram 50 or referred to in section E4.4.3.5; and
- b) the rest of the wall is fire-resisting from both sides.

### E4.4.3.7 External walls 1000mm or more from the relevant boundary

- 1) A wall situated at least 1000mm 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 methods referred to in section E4.4.4; and
  - b) the rest of the wall (if any) is fire-resisting from the inside of the building.

### E4.4.4 Methods for calculating acceptable unprotected area

1) Two simple methods are given in this section for calculating the acceptable amount of unprotected area in an external wall that is at least 1000mm from any point on the relevant boundary. (For walls within 1000mm of the boundary see E4.4.3.6 above.)

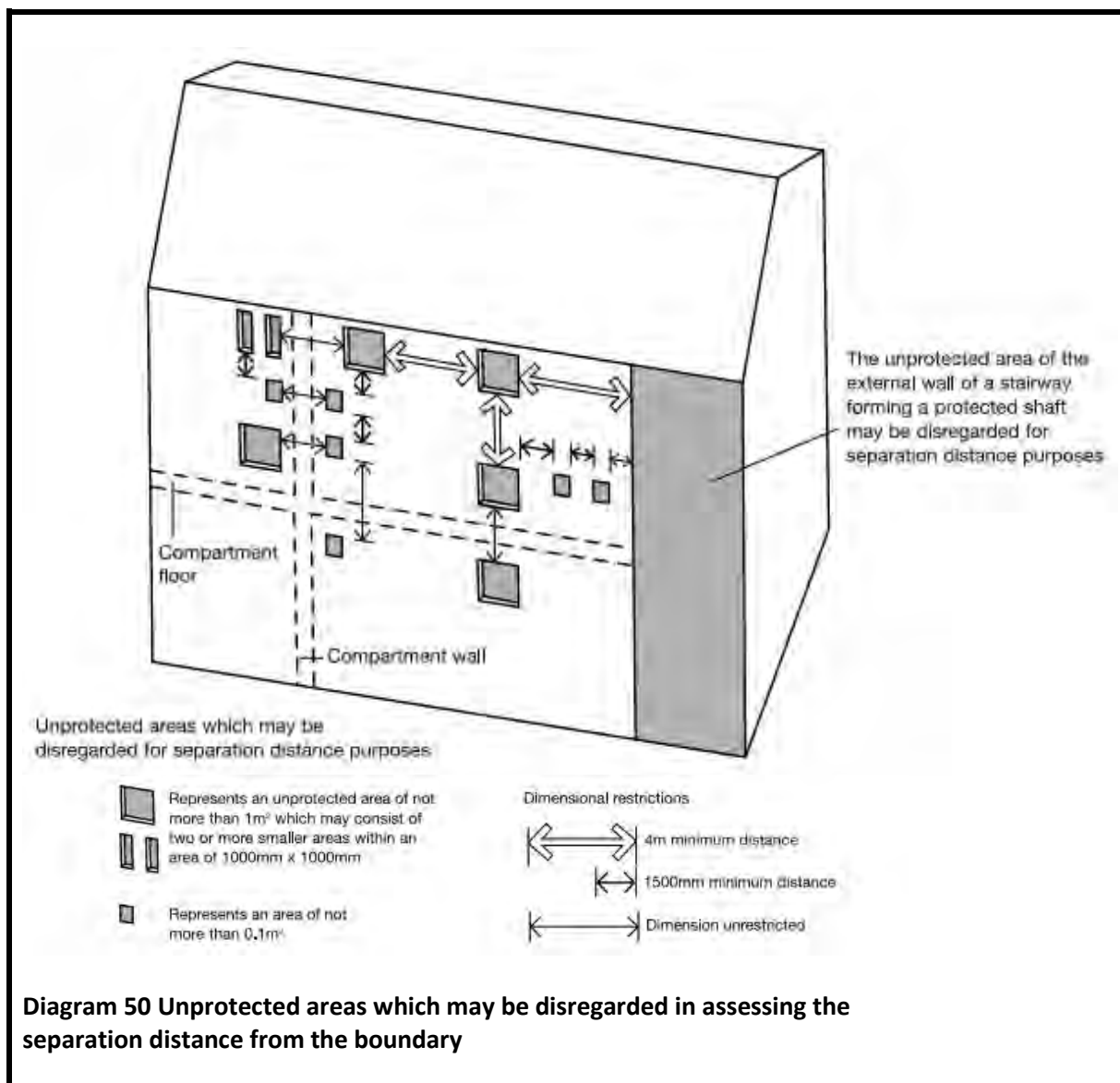
2) Method 1 may be used for small residential buildings which do not belong to Purpose Group 2a (Institutional type premises) and is set out in section E4.4.4.4.

3) Method 2 may be used for most buildings or compartments for which Method 1 is not appropriate and is set out in section E4.4.4.5.

4) There are other more precise methods, described in a BRE report External fire spread: Building separation and boundary distances (*BR 187, BRE 99*), which may be used instead of Methods 1 and 2.

5) The “Enclosing Rectangle” and “Aggregate Notional Area” methods are included in the BRE report.

## E4 External fire spread



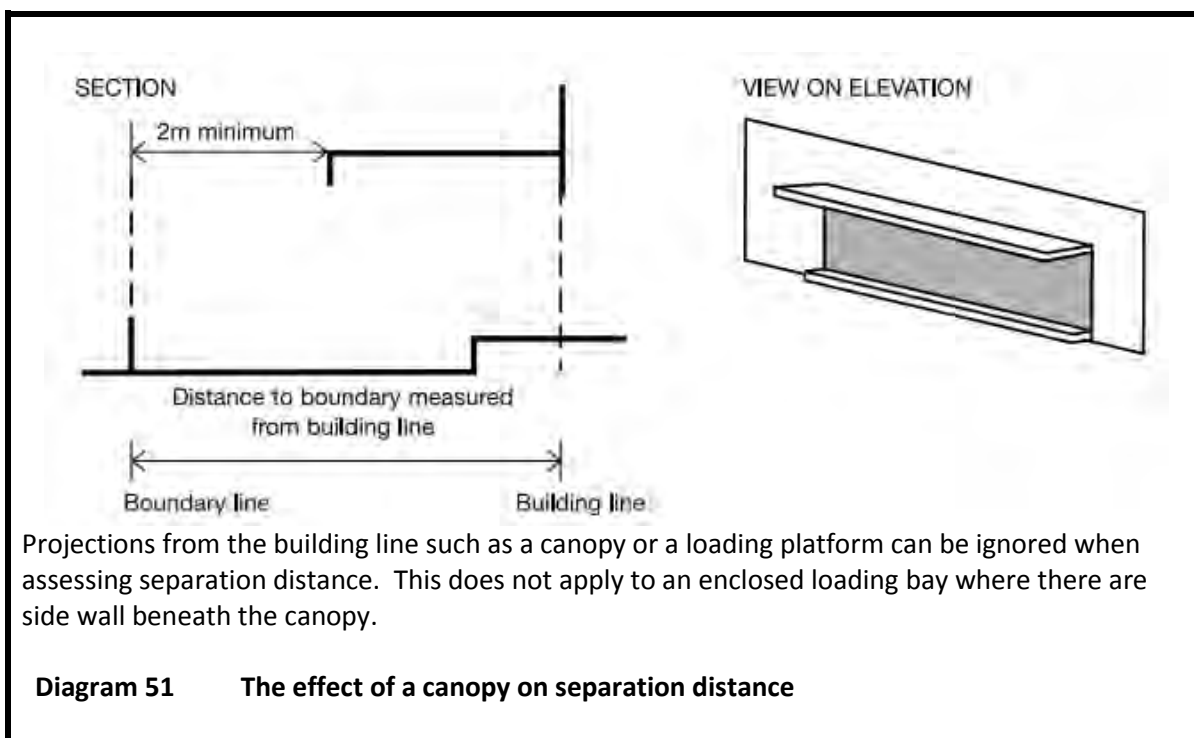
### E4.4.4.1 Basis for calculating acceptable unprotected area

1) 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 in section E4.4.4. 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 received from all unprotected areas in the wall would be  $12.6 \text{ kW/m}^2$  (in still air), assuming the radiation intensity at each unprotected area is:

- $84 \text{ kW/m}^2$ , if the building is in the Residential, Office or Assembly and Recreation Purpose Groups, or is an open-sided multi-storey car park in Purpose Group 7(b); and
- $68 \text{ kW/m}^2$ , if the building is in the Shop and Commercial, Industrial, Storage or Other non-residential Purpose Groups.



## E4 External fire spread



### E4.4.4.2 Sprinkler systems

- 1) If a building is fitted throughout with a sprinkler system, it is reasonable to assume that the intensity and extent of a fire will be reduced.
- 2) The sprinkler system should be in accordance with section E0.9. In these circumstances the boundary distance may be half that for an otherwise similar, but unsprinklered, building, subject to there being a minimum distance of 1m.
- 3) Alternatively, the amount of unprotected area may be doubled if the boundary distance is maintained.
- 4) The presence of sprinklers may be taken into account in a similar way when using the BRE report referred to in section E4.4.4.

### E4.4.4.3 Atrium buildings

- 1) If a building contains one or more atria, the recommendations of *BS 9999* Annexes B and C should be followed.

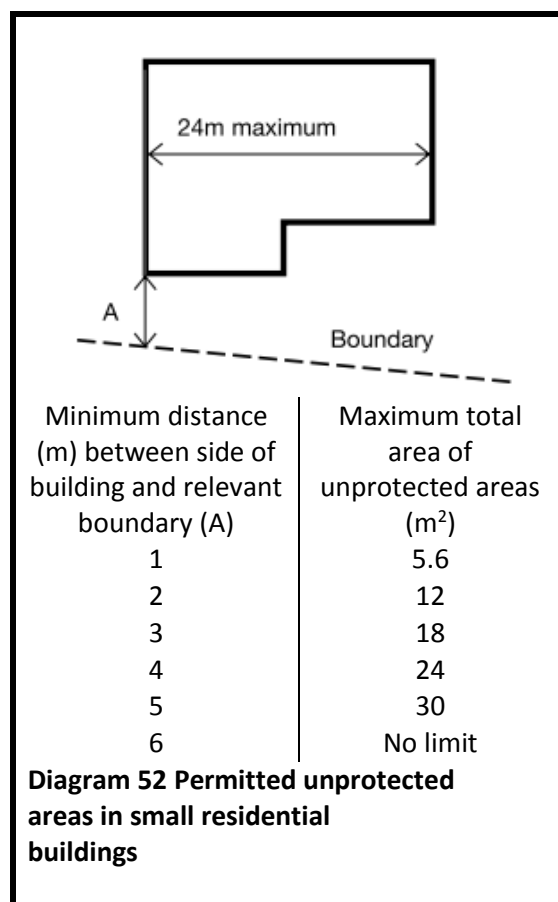
### E4.4.4.4 Method 1

- 1) This method applies only to a building intended to be used for block of flats or other residential purposes (not Institutional), which is 1000mm or more from any point on the relevant boundary.
- 2) The following rules for determining the maximum unprotected area should be read with Diagram 52.
  - a) The building should not exceed 3 storeys in height (basements not counted) or be more than 24m in length.
  - b) Each side of the building will meet the provisions for space separation if:
    - i. the distance of the side of the building from the relevant boundary; and
    - ii the extent of the unprotected area, are within the limits given in Diagram 52.
  - c) Any parts of the side of the building in excess of the maximum unprotected area should be fire-resisting.



## E4 External fire spread

3) In calculating the maximum unprotected area, any areas falling within the limits shown in Diagram 50 and referred to in section E4.4.3.3, can be disregarded.



b) Each side of the building will meet the provisions for space separation if either:

- i. the distance of the side of the building from the relevant boundary; and
- ii. the extent of unprotected area, are within the appropriate limits given in Table 15.

c) any parts of the side of the building in excess of the maximum unprotected area should be fire-resisting.

3) In calculating the maximum unprotected area, any areas shown in Diagram 50 and referred to in section E4.4.3.3, can be disregarded.

### E4.4.4.5 Method 2

1) This method applies to a building or compartment intended for any use and which is not less than 1000mm from any point on the relevant boundary.

2) The following rules for determining the maximum unprotected area should be read with Table 15.

- a) The building or compartment should not exceed 10m in height except for an open sided car park in Purpose Group 7(b) (see section E3.7.1). For any building or compartment more than 10m in height, the methods set out in the BRE report External fire spread: Building separation and boundary distances can be applied.

## E4 External fire spread

| Table 15  |   |  | Permitted unprotected areas in small buildings or compartments |
|---|---|--|--|
| Minimum distance between side of building and relevant boundary (m) |   | Maximum total percentage of unprotected area % |  |
| Purpose group   |   |  |  |
| Residential, office, assembly and recreation                        | Shop and commercial industrial, storage and other non-residential |  |  |
| (1)   | (2)   | (3)  |  |
| N/A   | 1   | 4  |  |
| 1   | 2   | 8  |  |
| 2.5   | 5   | 20   |  |
| 5   | 10  | 40   |  |
| 7.5   | 15  | 60   |  |
| 10  | 20  | 80   |  |
| 12.5  | 25  | 100  |  |

**Notes for Table 15:**

1 Intermediate values may be obtained by interpolation.

2 For buildings which are fitted throughout with an automatic sprinkler system, see section E4.4.4.2

3 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 The total percentage of unprotected area is found by dividing the total unprotected area by the area of a rectangle that encloses all the unprotected areas and multiplying the result by 100.

## E4.5 Roof coverings

### E4.5.1 Introduction

1) The provisions in this section limit the use, near a boundary, of roof coverings which will not give adequate protection against the spread of fire over them. The term roof covering is used to describe constructions which may consist of one or more layers of material, but does not refer to the roof structure as a whole. The provisions in this section are principally concerned with the performance of roofs when exposed to fire from the outside.

2) The circumstances when a roof is subject to the provisions in section E4.4 for space separation are explained in paragraphs E4.4.1 1) to 2).

### E4.5.2 Other controls on roofs

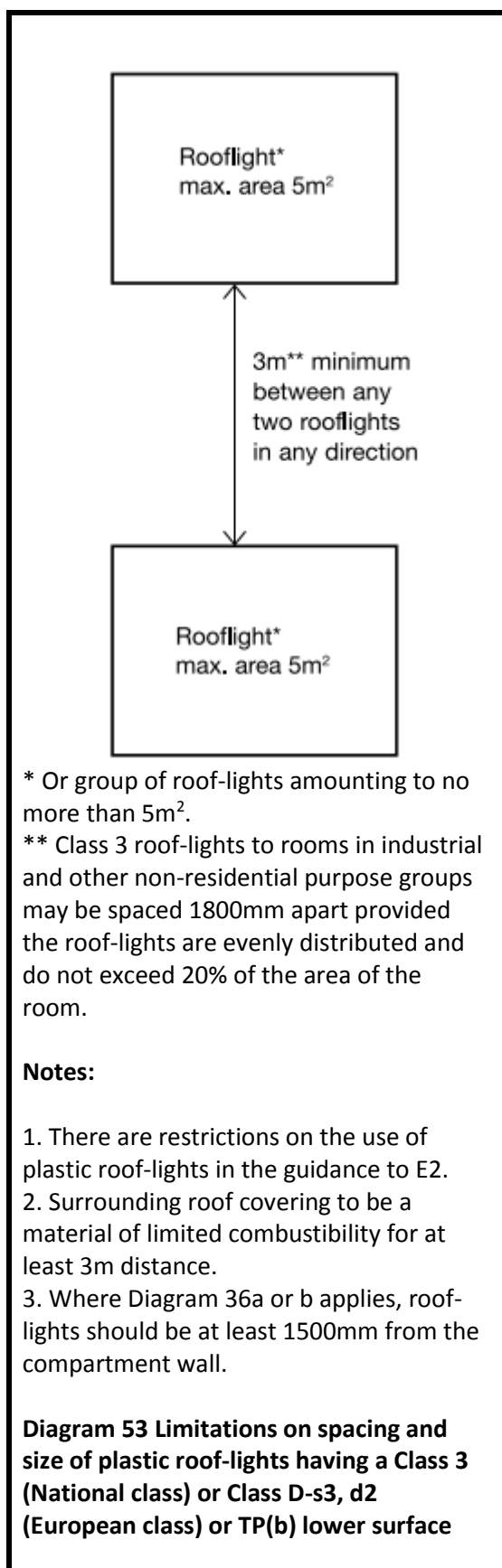
1) There are provisions concerning the fire properties of roofs in three other sections of this Document. In the guidance to E1 (paragraph E1.11.2.1 2)) there are provisions for roofs that are part of a means of escape. In the guidance to E2 (section E2.3.5.3) there are provisions for the internal surfaces of roof-lights as part of the internal lining of a room or circulation space. In the guidance to E3 there are provisions in section E3.3 for roofs which are used as a floor and in section E3.4 for roofs that pass over the top of a compartment wall.

### E4.5.3 Classification of performance

1) The performance of roof coverings is designated by reference to the test methods specified in *BS 476-3: 2004* or determined in accordance with *BS EN 13501-5:2005*, as described in Appendix A. The notional performance of some common roof coverings is given in Table A5 of Appendix A.

2) Roof-lights are controlled on a similar basis and plastic roof-lights described in paragraphs E4.5.5 1) to 2) may also be used.

## E4 External fire spread



### E4.5.4 Separation distances

1) The separation distance is the minimum distance from the roof (or part of the roof) to the relevant boundary, which may be a notional boundary.

2) Table 16 sets out separation distances according to the type of roof covering and the size and use of the building. There are no restrictions on the use of roof coverings designated AA, AB or AC (National class) or B<sub>ROOF</sub> (t4) (European class) classification. In addition, roof covering products (and/or materials) as defined in *Commission Decision 2000/553/EC of 6th September 2000* implementing *Council Directive 89/06/EEC* as regards the external fire performance of roof coverings can be considered to fulfil all of the requirements for performance characteristic “external fire performance” without the need for testing provided that any national provisions on the design and execution of works are fulfilled. That is, the roof covering products (and/or materials) defined in this Commission Decision can be used without restriction.

### E4.5.5 Plastic roof-lights

1) Table 17 sets out the limitations on the use of plastic roof-lights which have at least a Class 3 (National class) or Class D-s3, d2 (European class) lower surface and Table 8 sets out the limitations on the use of thermoplastic materials with a TP(a) rigid or TP(b) classification (see also Diagram 53). The method of classifying thermoplastic materials is given in Appendix A.

2) When used in roof-lights, a rigid thermoplastic sheet product made from polycarbonate or from un-plasticised PVC, which achieves a Class 1 (National class) rating for surface spread of flame when tested to *BS 476-7:1971(or 1987 or 1997) Surface spread of flame tests for materials*, or Class C-s3, d2 (European class) can be regarded as having an AA (National class) designation or B<sub>ROOF</sub>(t4) (European class) classification, other than for the purposes of Diagram 36.

## E4 External fire spread

### E4.5.6 Unwired glass in roof-lights

1) When used in roof-lights, unwired glass at least 4mm thick can be regarded as having an AA designation (National class) designation or B<sub>ROOF</sub>(t4) (European class) classification.

### E4.5.7 Thatch and wood shingles

1) Thatch and wood shingles should be regarded as having an AD/BD/CD designation or E<sub>ROOF</sub>(t4) (European class) classification in Table 16 if performance under *BS 476-3: 1958, 2004* or *EN 1187* (test 4) respectively cannot be established.

## E4 External fire spread

**Table 16** Limitations on roof coverings\*

| Designation† of covering of roof or part of roof |                        | Minimum distance from any point on relevant boundary |                     |                  |                     |
|--|------------------------|--|---------------------|------------------|---------------------|
| National Class                                   | European Class         | Less than 6m   | At least 6m         | At least 12m     | At least 20m        |
| AA, AB or AC                                     | B <sub>ROOF</sub> (t4) | ✓  | ✓                   | ✓                | ✓                   |
| BA, BB or BC                                     | C <sub>ROOF</sub> (t4) | ✗  | ✓                   | ✓                | ✓                   |
| CA, CB or CC                                     | D <sub>ROOF</sub> (t4) | ✗  | ✓ <sup>(1)(2)</sup> | ✓ <sup>(1)</sup> | ✓                   |
| AD, BD or CD                                     | E <sub>ROOF</sub> (t4) | ✗  | ✓ <sup>(1)(2)</sup> | ✓ <sup>(1)</sup> | ✓ <sup>(1)</sup>    |
| DA, DB, DC or DD                                 | F <sub>ROOF</sub> (t4) | ✗  | ✗                   | ✗                | ✓ <sup>(1)(2)</sup> |
| ✓ Acceptable                                     |                        |  | ✗ Not acceptable    |                  |                     |

**Notes on Table 16:**

\* See section E4.5.6 for limitations on glass; section E4.5.7 for limitations on thatch and wood shingles; and paragraphs E4.5.5 1) and 2) and Tables 18 and 19 for limitations on plastic roof-lights.

† The designation of external roof surfaces is explained in Appendix A. (See Table A5, for notional designations of roof coverings.)

Separation distances do not apply to the boundary between roofs of a pair of semi-detached houses (see E4.5.4) and to enclosed/covered walkways. However, see Diagram 36 if the roof passes over the top of a compartment wall. Polycarbonate and PVC roof-lights which achieve a Class 1 rating by test may be regarded as having an AA designation.

Openable polycarbonate and PVC roof-lights which achieve a Class 1(National class) or Class C-s3, d2 (European class) rating by test, see section E3.6.2.2, may be regarded as having an AA (National class) designation or B<sub>ROOF</sub>(t4) (European class) classification.

(1) Not acceptable on any of the following buildings:

- Houses in terraces of three or more houses.
- Industrial, storage or other non-residential Purpose Group buildings of any size.
- Any other buildings with a cubic capacity of more than 1500m<sup>3</sup>.

(2) Acceptable on buildings not listed in Note (1), if part of the roof is no more than 3m<sup>2</sup> in area and is at least 1500mm from any similar part, with the roof between the parts covered with a material of limited combustibility

## E4 External fire spread

| Table 17                      Class 3 (National class) or Class D-s3, d2 (European class) plastic roof-lights: limitations on use and boundary distance   |  |   |   |
|---|--|---|---|
| Minimum classification on lower surface <sup>(1)</sup>  | Space which roof-light can serve   | Minimum distance from any point on relevant boundary to roof-light with an external designation† of:  |   |
|   |  | AD BD CD (National class) or E <sub>ROOF</sub> (t4) (European class)<br>CA CB CC or DROOF(t4) (European class)  | DA DB DC DD (National class) or F <sub>ROOF</sub> (t4) (European class) |
| Class 3   | a. Balcony, verandah, carport, covered way or loading bay, which has at least one longer side wholly or permanently open | 6m  | 20m   |
|   | b. Detached swimming pool  |   |   |
|   | c. Conservatory, garage or outbuilding, with a maximum floor area of 40m <sup>2</sup>                                    |   |   |
|   | d. Circulation space <sup>(2)</sup> (except a protected stairway)  | 6m <sup>(3)</sup>   | 20m <sup>(3)</sup>  |
|   | e. Room <sup>(2)</sup>   |   |   |
| <b>Notes for Table 17:</b>  |  |   |   |
| † The designation of external roof surfaces is explained in Appendix A.<br>None of the above designations are suitable for protected stairways – see section E2.3.5.3.<br>Polycarbonate and PVC roof-lights which achieve a Class 1 (National class) or Class C-s3, d2 (European class) rating by test, see paragraph E4.5.5.2), may be regarded as having an AA designation or B <sub>ROOF</sub> (t4) (European class) classification.<br>Where Diagram 36a or b applies, roof-lights should be at least 1.5m from the compartment wall.<br>Products may have upper & lower surfaces with different properties if they have double skins or are laminates of different materials. In which case the more onerous distance applies. |  | (1) See also the guidance to E2<br><br>(2) Single skin roof-light only, in the case of non-thermoplastic material.<br><br>(3) The roof-light should also meet the provisions of Diagram 53. |   |

(1) See also the guidance to E2

(2) Single skin roof-light only, in the case of non-thermoplastic material.

(3) The roof-light should also meet the provisions of Diagram 53.

## E4 External fire spread

| Table 18   | TP(a) and TP(b) plastic roof-lights: limitations on use and boundary distance  |  |                   |
|--|--|--|-------------------|
| Minimum classification on lower surface <sup>(1)</sup> | Space which roof-light can serve   | Minimum distance from any point on relevant boundary to roof-light with an external surface classification (1) of: |                   |
|  |  | TP(a)  | TP(b)             |
| 1. TP(a) rigid   | Any space except a protected stairway  | 6m <sup>(2)</sup>  | Not applicable    |
| 2. TP(b)   | a. Balcony, verandah, carport, covered way or loading bay, which has at least one longer side wholly or permanently open | Not applicable   | 6m                |
|  | b. Detached swimming pool  |  |                   |
|  | c. Conservatory, garage or outbuilding, with a maximum floor area of 40m <sup>2</sup>                                    |  |                   |
|  | d. Circulation space <sup>(3)</sup> (except a protected stairway)  | Not applicable   | 6m <sup>(4)</sup> |
|  | e. Room <sup>(3)</sup>   |  |                   |

**Notes for Table 18:**

None of the above designations are suitable for protected stairways – see section E2.3.5.3.

Polycarbonate and PVC roof-lights which achieve a Class 1 rating by test, see paragraph E4.5.5 2), may be regarded as having an AA designation.

Where Diagram 36a or b applies, roof-lights should be at least 1.5m from the compartment wall.

Products may have upper and lower surfaces with different properties if they have double skins or are laminates of different materials; in which case the more onerous distance applies.

1. See also the guidance to E2.

2. No limit in the case of any space described in 2a, b and c.

3. Single skin roof-light only, in the case of non-thermoplastic material.

4. The roof-light should also meet the provisions of Diagram 53.



## E5 Access and facilities for fire fighters

### E5 ACCESS AND FACILITIES FOR THE FIRE AND RESCUE SERVICE

#### The requirement

This section deals with the following requirements

| Requirement   | Limits on application |
|---|-----------------------|
| <b>Access and facilities for the fire and rescue service</b>  |                       |
| E5. (1) The building shall be designed and constructed so as to provide reasonable facilities to assist firefighters in the protection of life. |                       |
| (2) Reasonable provision shall be made within the site of the building to enable fire appliances to gain access to the building.                |                       |

## E5 Access and facilities for fire fighters

### E5 Guidance

#### E5.1 Performance

- 1) In the view of H.M. Government of Gibraltar the requirements of E5 will 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 firefighting personnel to effect search and rescue and fight fire;
  - c) if the building is provided with sufficient internal fire mains and other facilities to assist firefighters in their tasks; and
  - d) if the building is provided with adequate means for venting heat and smoke from a fire in a basement.
- 2) These access arrangements and facilities are only required in the interests of the health and safety of people in and around the building. The extent to which they are required will depend on the use and size of the building in so far as it affects the health and safety of those people.

#### E5.2 Introduction

- 1) The guidance given here covers the selection and design of facilities for the purpose of protecting life by assisting the fire and rescue service. To assist the fire and rescue service some or all of the following facilities may be necessary, depending mainly on the size of the building:
  - a) vehicle access for fire appliances;
  - b) access for firefighting personnel;
  - c) the provision of fire mains within the building;
  - d) venting for heat and smoke from basement areas;
  - e) the provision of adequate water supplies.
- 2) If it is proposed to deviate from the general guidance in sections E5.3 to E5.6 then it would be advisable to seek advice from Gibraltar Fire and Rescue Service at the

earliest opportunity, even where there is no statutory duty to consult.

#### E5.2.1 Facilities appropriate to a specific building

- 1) The main factor determining the facilities needed to assist the fire and rescue service is the size of the building. Generally speaking firefighting is carried out within the building.
  - a) In deep basements and tall buildings (see paragraph E5.5.2 1)) firefighters will invariably work inside. They need special access facilities (see section E5.5), equipped with fire mains (see section E5.3). Fire appliances will need access to entry points near the fire mains (see section E5.4).
  - 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, will generally be adequate without special internal arrangements. Vehicle access may be needed to some or all of the perimeter, depending on the size of the building (see section E5.3). Where an alternative approach outside the scope of this Document has been used to justify the means of escape it may be necessary to consider additional provisions for firefighting access.
  - c) For small buildings, it is usually only necessary to ensure that the building is sufficiently close to a point accessible to fire and rescue service vehicles (see paragraph E5.4.2 1)).
  - d) In taller blocks of flats, fire and rescue service personnel access facilities are needed within the building, although the high degree of compartmentation means that some simplification is possible compared to other tall buildings (see paragraph E5.5.4 2)).
  - e) Products of combustion from basement fires tend to escape via stairways, making access difficult for

## E5 Access and facilities for fire fighters

fire and rescue service personnel. The problem can be reduced by providing vents (see section E5.5). Venting can improve visibility and reduce temperatures, making search, rescue and firefighting less difficult.

### E5.2.2 Insulating core panels

1) Guidance on the fire behaviour of insulating core panels used for internal structures is given in Appendix F.

## E5.3 Fire mains and hydrants

### E5.3.1 Introduction

1) Fire mains are installed in a building and equipped with valves etc. so that the fire and rescue service may connect hoses for water to fight fires inside the building.

2) Fire mains may be of the 'dry' type which are normally empty and are supplied through hose from a fire and rescue service pumping appliance.

3) Alternatively, they may be of the 'wet' type where they are kept full of water and supplied from tanks and pumps in the building. There should be a facility to allow a wet system to be replenished from a pumping appliance in an emergency.

### E5.3.2 Provision of fire mains

1) Buildings with firefighting shafts should be provided with fire mains in those shafts and, where necessary, in protected escape stairs. The criteria for the provision of firefighting shafts and fire mains in such buildings are given in section E5.5.

2) Fire mains may also be provided in other buildings where vehicle access is not provided in accordance with Table 19 (see paragraphs E5.4.3 1) to 3)) or paragraphs E5.4.2 1) or E5.4.2 2) and 3).

### E5.3.3 Number and location of fire mains

1) In buildings provided with fire mains for the purposes of paragraph E5.3.2 2), outlets from fire mains should be located to meet the hose criterion set out in paragraph E5.5.3 1). This does not imply that these stairs need to be designed as firefighting shafts.

### E5.3.4 Design and construction of fire mains

1) The outlets from fire mains should be located within the protected enclosure of a stairway or a protected lobby where one is provided (see Diagram 58).

2) Guidance on other aspects of the design and construction of fire mains, not included in the provisions of this section, should be obtained from *BS 9990:2015*.

3) Wet fire mains should be provided in buildings with a floor at more than 50m above fire and rescue service vehicle access level. In lower buildings where fire mains are provided, either wet or dry mains are suitable.

### E5.3.5 Provision of private hydrants

1) Where a building, which has a compartment of 280m<sup>2</sup> or more in area, is being erected more than 50m from an existing fire-hydrant additional hydrants should be provided as follows:

- a) Buildings provided with fire mains – hydrants should be provided within 50m of dry fire main inlets.
- b) Buildings not provided with fire mains – hydrants should be provided within 50m of an entry point to the building and not more than 50m apart. Each fire hydrant should be clearly indicated by a plate, affixed nearby in a conspicuous position, in accordance with *BS 3251:1976*.

## E5 Access and facilities for fire fighters

2) Where no piped water supply is available, or there is insufficient pressure and flow in the water main, or an alternative arrangement is proposed, the alternative source of supply should be provided in accordance with the following recommendations:

- a) a charged static water tank of at least 45,000 litre capacity; or
- b) open water, such as the sea or swimming pools, capable of providing or storing at least 45,000 litres of water at all times of the year, to which access, space and a hard standing are available for a pumping appliance; or
- c) any other means of providing a water supply for firefighting operations considered appropriate by the fire and rescue authority.

### E5.4 Vehicle access

#### E5.4.1 Introduction

1) For the purposes of this section vehicle access to the exterior of a building is needed to enable high reach appliances, such as turntable ladders and hydraulic platforms, to be used and to enable pumping appliances to supply water and equipment for firefighting, search and rescue activities.

2) Access requirements increase with building size and height.

3) Fire mains (see section E5.3) enable firefighters within the building to connect their hoses to a water supply. In buildings fitted with fire mains, pumping appliances need access to the perimeter at points near the mains, where firefighters can enter the building and where in the case of dry mains, a hose connection will be made from the appliance to pump water into the main.

4) The vehicle access requirements described in Table 18 for buildings without fire mains, do not apply to blocks of flats, because access is required to each individual dwelling (see paragraphs E5.4.2 2) to 3)), or to buildings with fire mains.

5) Vehicle access routes and hard-standings should meet the criteria described in paragraphs E5.4.3 2) to E5.4.4 3) where they are to be used by fire and rescue service vehicles.

6) Requirements cannot be made under the Building Rules for work to be done outside the site of the works shown on the deposited plans.

7) In this connection it may not always be reasonable to upgrade an existing route across a site to a small building. The options in such a case, from doing no work to upgrading certain features of the route, e.g. a sharp bend, should be considered by Building Control in consultation with the Fire and Rescue Service.

#### E5.4.2 Buildings not fitted with fire mains

1) There should be vehicle access for a pump appliance to small buildings (those of up to 2000m<sup>2</sup> with a top storey up to 11m above ground level) to either:

- a) 15% of the perimeter; or
- b) within 45m of every point on the projected plan area (or 'footprint', see Diagram 54) of the building; whichever is the less onerous.

2) There should be vehicle access for a pump appliance to blocks of flats and dwelling houses to within 45m of all points within each dwelling.

3) If the provisions in paragraph E5.4.2 1) or 2) to 3) cannot be met, a fire main should be provided in accordance with paragraph E5.3.2 2) and vehicle access should meet paragraph E5.4.3 1).

4) Vehicle access to buildings that do not have fire mains (other than buildings described in paragraph E5.4.2 1)) should be provided in accordance with Table 19.

## E5 Access and facilities for fire fighters

| <b>Table 19 Fire and rescue service vehicle access to buildings (excluding blocks of flats) not fitted with fire mains</b>  |   |  |                   |
|---|---|--|-------------------|
| Total floor area <sup>(1)</sup> of building (m <sup>2</sup> )   | Height of floor of top storey above ground <sup>(2)</sup> | Provide vehicle access <sup>(3)(4)</sup> to: | Type of appliance |
| Up to 2000  | Up to 11m   | See paragraph E5.4.2                         | Pump              |
|   | Over 11m  | 15% of perimeter <sup>(5)</sup>              | High reach        |
| 2000–8000   | Up to 11m   | 15% of perimeter <sup>(5)</sup>              | Pump              |
|   | Over 11m  | 50% of perimeter <sup>(5)</sup>              | High reach        |
| 8000–16,000   | Up to 11m   | 50% of perimeter <sup>(5)</sup>              | Pump              |
|   | Over 11m  | 50% of perimeter <sup>(5)</sup>              | High reach        |
| 16,000–24,000   | Up to 11m   | 75% of perimeter <sup>(5)</sup>              | Pump              |
|   | Over 11m  | 75% of perimeter <sup>(5)</sup>              | High reach        |
| Over 24,000   | Up to 11m   | 100% of perimeter <sup>(5)</sup>             | Pump              |
|   | Over 11m  | 100% of perimeter <sup>(5)</sup>             | High reach        |
| <b>Notes for Table 19:</b> <p>(1) The total floor area is the aggregate of all floors in the building (excluding basements).</p> <p>(2) In the case of Purpose Group 7(a) (storage) buildings, height should be measured to mean roof level, see Methods of measurement in Appendix C.</p> <p>(3) An access door is required to each such elevation (see paragraph E5.4.2 5)).</p> <p>(4) See paragraph E5.4.4 1) for meaning of access.</p> <p>(5) Perimeter is described in Diagram 54.</p> |   |  |                   |

5) Every elevation to which vehicle access is provided in accordance with paragraph E5.4.2 1) or Table 19 should have a suitable door(s), not less than 750mm wide, giving access to the interior of the building. Door(s) should be provided such that there is no more than 60m between each door and/or the end of that elevation (e.g. a 50m elevation would need at least 2 doors).

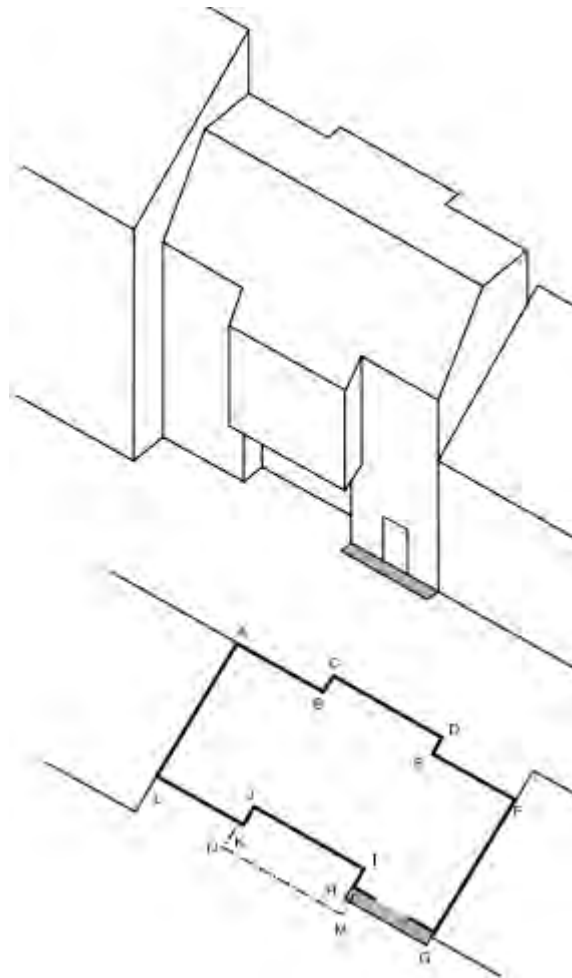
### E5.4.3 Buildings fitted with fire mains

1) In the case of a building fitted with dry fire mains there should be access for a pumping appliance to within 18m of each fire main inlet connection point, typically on the face of the building. The inlet should be visible from the appliance.

2) In the case of a building fitted with wet mains the pumping appliance access should be to within 18m and within sight of, a suitable entrance giving access to the main and in sight of the inlet for the emergency replenishment of the suction tank for the main.

3) Where fire mains are provided in buildings for which sections E5.3 and E5.5 make no provision, vehicle access may be to paragraph E5.4.3 1) or E5.4.3 2) to 3) rather than Table 19.

## E5 Access and facilities for fire fighters



Plan of building AFGL where AL and FG are walls in common with other buildings.

The footprint of the building is the maximum aggregate plan perimeter found by the vertical projection of any overhanging storey onto a ground storey (i.e. ABCDEFGHNMKL).

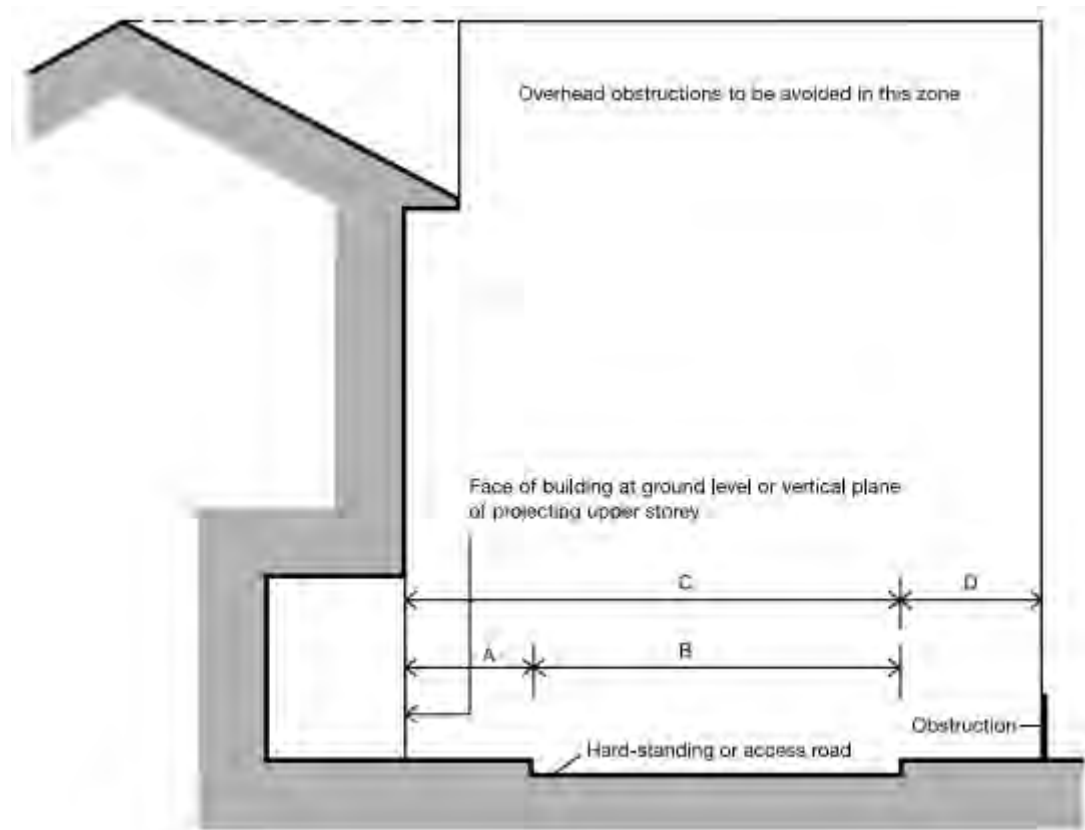
The perimeter of the building for the purposes of Table 20 is the sum of the lengths of the two external walls, taking account of the footprint i.e. (A to B to C to D to E to F) + (G to H to M to N to K to L).

If the dimensions of the building are such that Table 20 requires vehicle access, the shaded area illustrates one possible example of 15% of the perimeter. **Note:** There should be a door into the building in this length).

If the building does not have walls in common with other buildings, the lengths AL and FG would be included in the perimeter.

**Diagram 54**      **Example of building footprint and perimeter**

## E5 Access and facilities for fire fighters



|  | Type of appliance              |                                 |
|--|--------------------------------|---------------------------------|
|  | Turntable ladder dimension (m) | Hydraulic platform dimension(m) |
| A. Maximum distance of near edge of hard-standing from building          | 4.9                            | 2.0                             |
| B. Minimum width of hardstanding   | 5.0                            | 5.5                             |
| C. Minimum distance of further edge of hard-standing from building       | 10.0                           | 7.5                             |
| D. Minimum width of unobstructed space (for swing of appliance platform) | NA                             | 2.2                             |

### Notes:

- 1 Hard-standing for high reach appliances should be as level as possible and should not exceed a gradient of 1 in 12.

- 2 Fire appliances are not standardised. Gibraltar Fire and Rescue Service have appliances of different weights and sizes. In consultation with Gibraltar Fire and Rescue Service, Building Control may adopt other dimensions in certain circumstances.

**Diagram 55 Relationship between building and hard-standing/access roads for high reach fire appliances**



## E5 Access and facilities for fire fighters

**Table 20 Typical fire and rescue service vehicle access route specification**

| Appliance type | Minimum width of road between kerbs (m) | Minimum width of gateways (m) | Minimum turning circle between kerbs (m) | Minimum turning circle between walls (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                           | 26.0                                     | 29.0                                     | 4.0                          | 17.0                               |

**Notes for Table 20:**

- 1 Fire appliances are not standardised. Gibraltar Fire and Rescue Service have appliances of different weights and sizes. In consultation with Gibraltar Fire and Rescue Service, Building Control may adopt other dimensions in certain circumstances.
- 2 Because the weight of high reach appliances is distributed over a number of axles, it is considered that their infrequent use of a carriageway or route designed to 12.5 tonnes should not cause damage. It would therefore be reasonable to design the road base to 12.5 tonnes, although structures such as bridges should have the full 17 tonnes capacity.

### E5.4.4 Design of access routes and hard-standings

1) A vehicle access route may be a road or other route which, including any inspection covers and the like, meets the standards in Table 20 and the following paragraphs.

2) Where access is provided to an elevation in accordance with Table 19 for:

- a) buildings up to 11m in height (excluding buildings covered by paragraph E5.4.2 1) b)), there should be access for a pump appliance adjacent to the building for the percentage of the total perimeter specified;
- b) buildings over 11m in height, the access routes should meet the guidance in Diagram 55.

3) Where access is provided to an elevation for high reach appliances in accordance with Table 19, overhead obstructions such as cables and branches that would interfere with the setting of ladders etc., should be avoided in the zone shown in Diagram 55.

4) Turning facilities should be provided in any dead-end access route that is more than 20m long (see Diagram 56). This can be by a hammerhead or turning circle, designed on the basis of Table 20.

## E5 Access and facilities for fire fighters

Fire and rescue service vehicles should not have to reverse more than 20m from the end of an access road

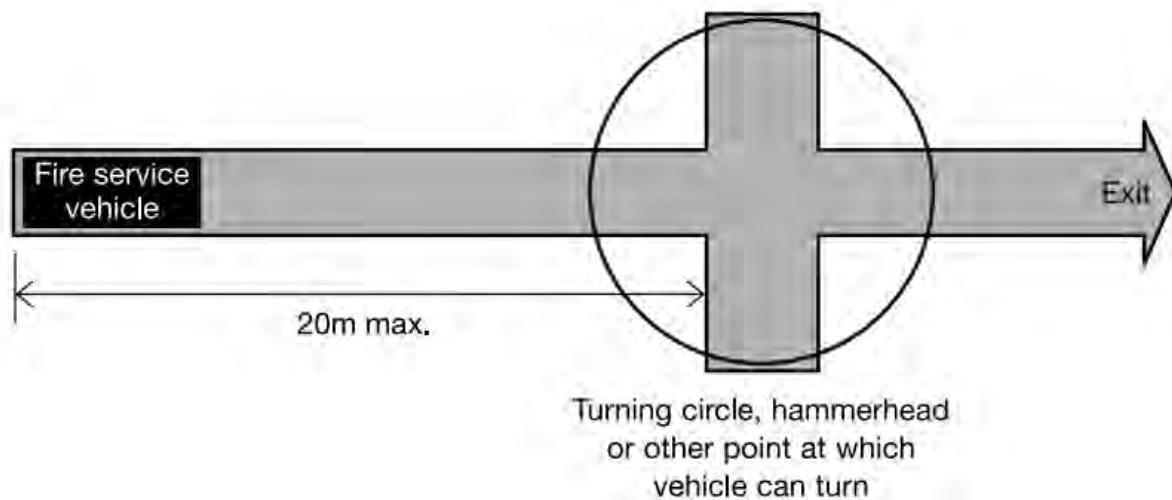


Diagram 56

Turning facilities

### E5.5 Access to buildings for firefighting personnel

#### E5.5.1 Introduction

1) In low-rise buildings without deep basements fire and rescue service personnel access requirements will be met by a combination of the normal means of escape and the measures for vehicle access in section E5.4, which facilitate ladder access to upper storeys. In other buildings, the problems of reaching the fire and working inside near the fire, necessitate the provision of additional facilities to avoid delay and to provide a sufficiently secure operating base to allow effective action to be taken.

2) These additional facilities include firefighting lifts, firefighting stairs and firefighting lobbies, which are combined in a protected shaft known as the firefighting shaft (Diagram 58).

3) Guidance on protected shafts in general is given in section E3.4.

4) Because of the high degree of compartmentation in blocks of block of flats, the provisions for the design and construction of firefighting shafts is different to other buildings.

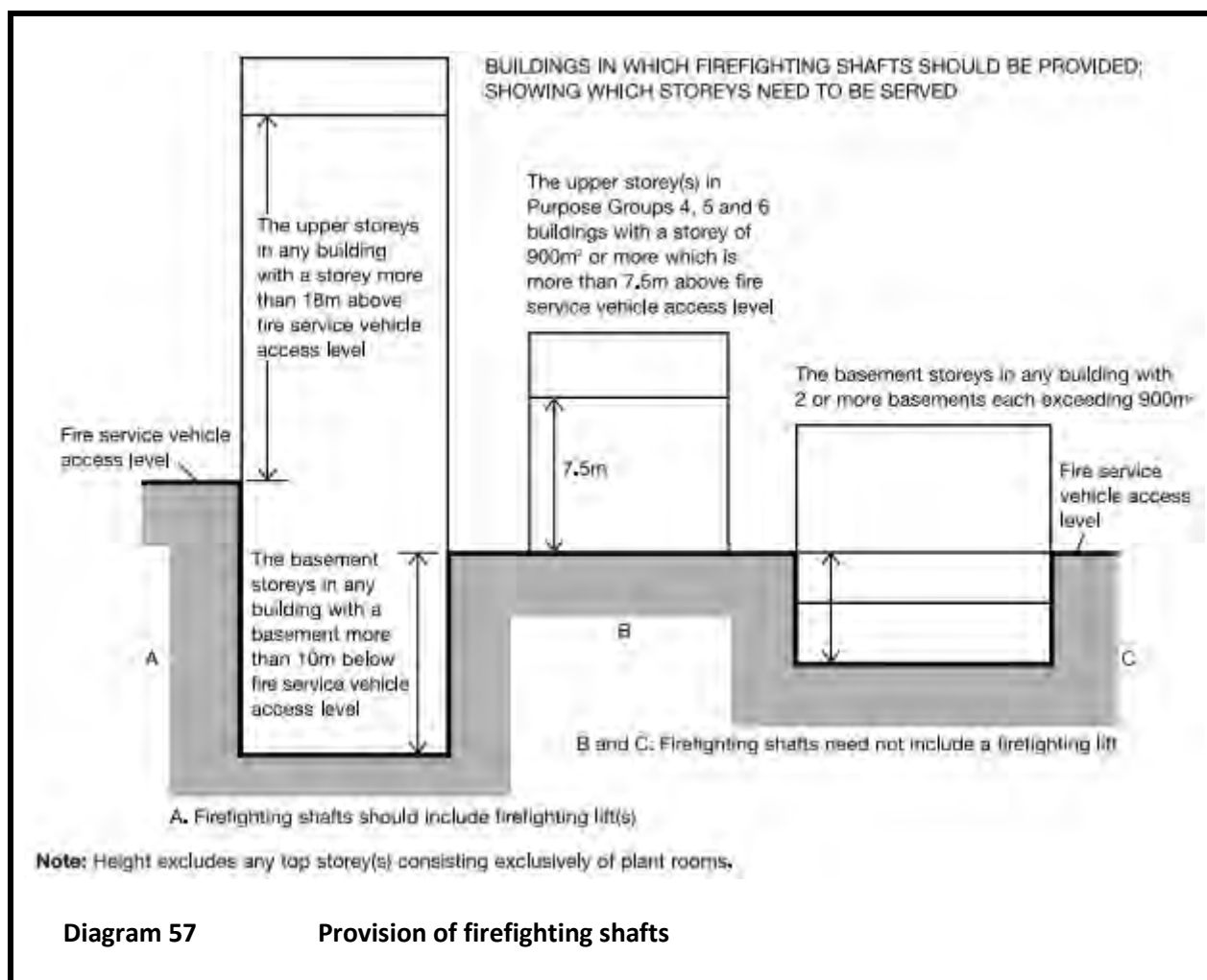
#### E5.5.2 Provision of firefighting shafts

1) Buildings with a floor at more than 18m above fire and rescue service vehicle access level, or with a basement at more than 10m below fire and rescue service vehicle access level, should be provided with firefighting shafts containing firefighting lifts (see Diagram 57).

2) Buildings in Purpose Groups 4, 5 and 6 with a storey of 900m<sup>2</sup> or more in area, where the floor is at a height of more than 7.5m above fire and rescue service vehicle access level, should be provided with firefighting shaft(s), which need not include firefighting lifts.

3) Buildings with two or more basement storeys, each exceeding 900m<sup>2</sup> in area, should be provided with firefighting shaft(s), which need not include firefighting lifts.

## E5 Access and facilities for fire fighters



4) If a firefighting shaft is required to serve a basement it need not also serve the upper floors unless they also qualify because of the height or size of the building. Similarly a shaft serving upper storeys need not serve a basement which is not large or deep enough to qualify in its own right.

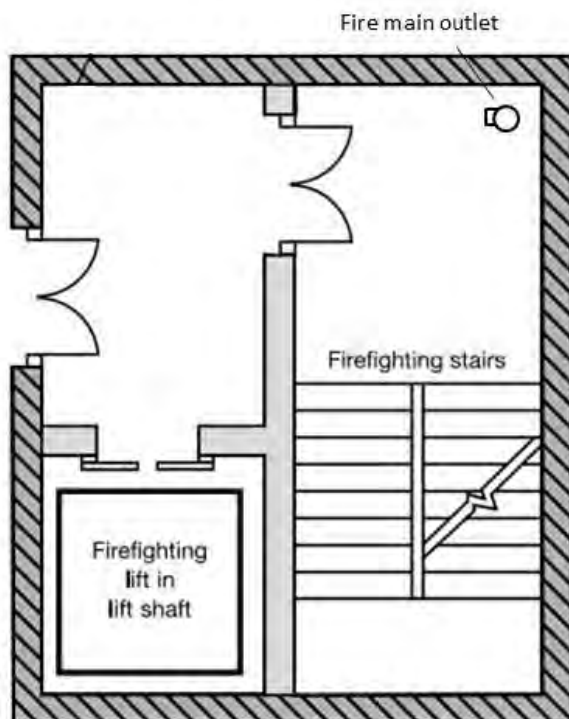
5) However, a firefighting stair and any firefighting lift should serve all intermediate storeys between the highest and lowest storeys that they serve.

6) Firefighting shafts should serve all floors through which they pass.

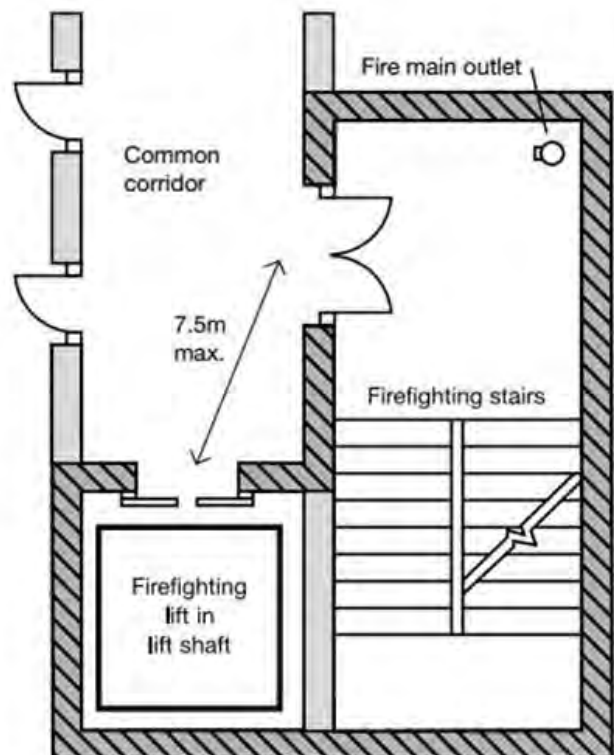
7) Shopping complexes should be provided with firefighting access in accordance with the recommendations of Annex E of BS 9999.

## E5 Access and facilities for fire fighters

a. Any building



b. Shaft serving flats



□ Minimum fire resistance 60 minutes from both sides with 30 minute fire doors

▨ Minimum fire resistance 120 minutes from accommodation side and 60 minutes from inside the shaft with 60 minute fire doors

### Notes:

1. Outlets from a fire main should be located in the firefighting stairway (see above) but it may be acceptable to locate them in the firefighting lobbies where approved by Gibraltar Fire and Rescue Service.
2. Smoke control should be provided in accordance with BS 9999 or, where the shaft only serves flats, the provisions for smoke control given in paragraph E1.8.8.6 may be followed instead.
3. A firefighting lift is required if the building has a floor more than 18m above, or more than 10m below, fire service vehicle access level.
4. This Diagram is only to illustrate the basic components and is not meant to represent the only acceptable layout. The shaft should be constructed generally in accordance with the recommendations of BS 9999.
5. Depending upon relative locations of inlets and outlets it may be acceptable to omit the outlet at firefighting access level.

**Diagram 58 Components of a firefighting shaft**

## E5 Access and facilities for fire fighters

### E5.5.3 Number and location of firefighting shafts

1) Firefighting shafts should be located to meet the maximum hose distances set out on paragraph E5.5.3 2) or E5.5.3 3) to 4) and at least two should be provided in buildings with a storey of 900m<sup>2</sup> or more in area, where the floor is at a height of more than 18m above fire and rescue service vehicle access level (or above 7.5m where covered by paragraph E5.5.2 2)).

2) If the building is fitted throughout with an automatic sprinkler system in accordance with section E0.9, then sufficient firefighting shafts should be provided such that every part of every storey, that is more than 18m above fire and rescue service vehicle access level (or above 7.5m where covered by paragraph E5.5.2 2)), is no more than 60m from a fire main outlet in a firefighting shaft, measured on a route suitable for laying hose.

3) If the building is not fitted with sprinklers then every part of every storey that is more than 18m above fire and rescue service vehicle access level (or above 7.5m where covered by paragraph E5.5.2 2)), should be no more than 45m from a fire main outlet contained in a protected stairway and 60m from a fire main in a firefighting shaft, measured on a route suitable for laying hose.

4) In order to meet the 45m hose criterion it may be necessary to provide additional fire mains in escape stairs. This does not imply that these stairs need to be designed as firefighting shafts.

### E5.5.4 Design and construction of firefighting shafts

1) Except in blocks of flats (see section E5.5.4.1), every firefighting stair and firefighting lift should be approached from the accommodation, through a firefighting lobby.

2) All firefighting shafts should be equipped with fire mains having outlet connections and valves at every storey.

3) A firefighting lift installation includes the lift car itself, the lift well and the lift machinery space, together with the lift control system and the lift communications system. The shaft should be constructed generally in accordance with the recommendations of *BS 9999*. Firefighting lift installations should conform to *BS EN 81-72:2003* and to *BS EN 81-1:1998+A3:2009* or *BS EN 81-2:1998+A3:2009* as appropriate for the particular type of lift.

#### E5.5.4.1 Variations for block of flats

1) Where the design of means of escape in case of fire and compartmentation in blocks of flats has followed the guidance in sections E1.9 and E3.5, the addition of a firefighting lobby between the firefighting stair(s) and the protected corridor or lobby provided for means of escape purposes is not necessary. Similarly, the firefighting lift can open directly into such protected corridor or lobby, but the firefighting lift landing doors should not be more than 7.5m from the door to the firefighting stair.

### E5.5.5 Rolling shutters in compartment walls

1) Rolling shutters should be capable of being opened and closed manually by the fire and rescue service without the use of a ladder.

## E5 Access and facilities for fire fighters

### E5.6 Venting of heat and smoke from basements

#### E5.6.1 Introduction

1) The build-up of smoke and heat as a result of a fire can seriously inhibit the ability of the fire and rescue service to carry out rescue and firefighting operations in a basement. The problem can be reduced by providing facilities to make conditions tenable for firefighters.

2) Smoke outlets (also referred to as smoke vents) provide a route for heat and smoke to escape to the open air from the basement level(s). They can also be used by the fire and rescue service to let cooler air into the basement(s). (See Diagram 59.)

#### E5.6.2 Provision of smoke outlets

1) Where practicable each basement space should have one or more smoke outlets, but it is not always possible to do this where, for example, the plan is deep and the amount of external wall is restricted by adjoining buildings. It is therefore acceptable to vent spaces on the perimeter and allow other spaces to be vented indirectly by opening connecting doors. However if a basement is compartmented, each compartment should have direct access to venting, without having to open doors etc. into another compartment.

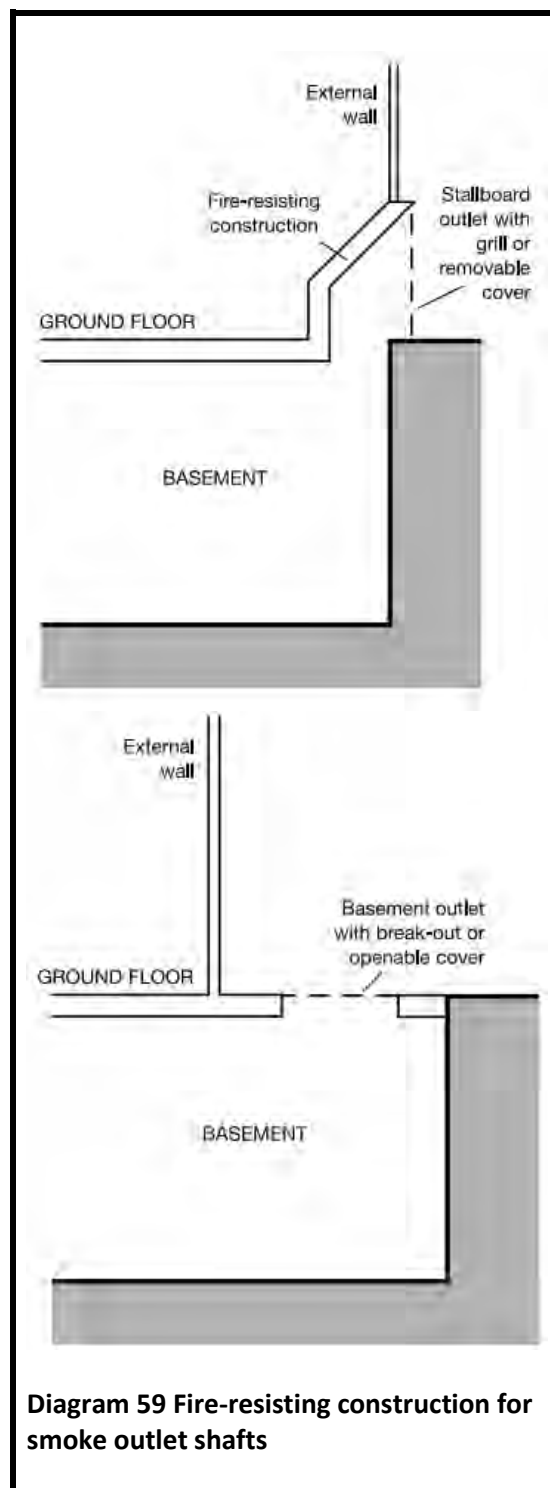
2) Smoke outlets, connected directly to the open air, should be provided from every basement storey, except for any basement storey that has:

- a) a floor area of not more than 200m<sup>2</sup> and
- b) a floor not more than 3m below the adjacent ground level.

3) Strong rooms need not be provided with smoke outlets.

4) Where basements have external doors or windows, the compartments

containing the rooms with these doors or windows do not need smoke outlets. It is common for basements to be open to the air on one or more elevations. This may be the result of different ground levels on different sides of the building.



**Diagram 59 Fire-resisting construction for smoke outlet shafts**



## E5 Access and facilities for fire fighters

### E5.6.2.1 Natural smoke outlets

- 1) Smoke outlets should be sited at high level, either in the ceiling or in the wall of the space they serve. They should be evenly distributed around the perimeter to discharge in the open air outside the building.
- 2) The combined clear cross-sectional area of all smoke outlets should not be less than  $1/40^{\text{th}}$  of the floor area of the storey they serve.
- 3) Separate outlets should be provided from places of special fire hazard.
- 4) If the outlet terminates at a point that is not readily accessible, it should be kept unobstructed and should only be covered with a non-combustible grille or louvre.
- 5) If the outlet terminates in a readily accessible position, it may be covered by a panel, stallboard or pavement light which can be broken out or opened. The position of such covered outlets should be suitably indicated.
- 6) Outlets should not be placed where they would prevent the use of escape routes from the building.

### E5.6.2.2 Mechanical smoke extract

- 1) A system of mechanical extraction may be provided as an alternative to natural venting to remove smoke and heat from basements, provided that the basement storey(s) are fitted with a sprinkler system in accordance with section E0.9 (It is not considered necessary in this particular case to install sprinklers on the storeys other than the basement(s) unless they are needed for other reasons.)
- 2) Car parks are not normally expected to be fitted with sprinklers (see paragraph E3.7 2)).

- 3) The air extraction system should give at least 10 air changes per hour and should be capable of handling gas temperatures of 300°C for not less than one hour. It should come into operation automatically on activation of the sprinkler system; alternatively activation may be by an automatic fire detection system which conforms to *BS 5839-1:2013* (at least L3 standard).
- 4) For further information on equipment for removing hot smoke refer to *BS EN 12101-3:2002*.

### E5.6.3 Construction of outlet ducts or shafts

- 1) Outlet ducts or shafts, including any bulkheads over them (see Diagram 59), should be enclosed in non-combustible construction having not less fire resistance than the element through which they pass.
- 2) Where there are natural smoke outlet shafts from different compartments of the same basement storey, or from different basement storeys, they should be separated from each other by non-combustible construction having not less fire resistance than the storey(s) they serve.

### E5.6.4 Basement car parks

- 1) The provisions for ventilation of basement car parks in section E3.7 to E3.8 may be taken as satisfying the requirements in respect of the need for smoke venting from any basement that is used as a car park.



### Appendix A Performance of materials, products and structures

#### A1 Introduction

1) Much of the guidance in this Document is given in terms of performance in relation to British or European Standards for products or methods of test or design or in terms of European Technical Approvals. In such cases the material, product or structure should comply with one of the following:

- a) They should be in accordance with a specification or design which has been shown by test to be capable of meeting that performance. For this purpose, laboratories accredited by the United Kingdom Accreditation Service (UKAS) for conducting the relevant tests would be expected to have the necessary expertise. Or
- b) They should have been assessed from test evidence against appropriate standards, or by using relevant design guides, as meeting that performance. For this purpose, laboratories accredited by UKAS for conducting the relevant tests and suitably qualified fire safety engineers might be expected to have the necessary expertise. For materials/products where European standards or approvals are not yet available and for a transition period after they become available, British Standards may continue to be used. Any body notified to the UK Government by the Government of another member state of the European Union as capable of assessing such materials/products against the relevant British Standards, may also be expected to have the necessary expertise. Where European materials/products standards or approvals are available, any body notified to the European Commission as competent to assess such materials or products against the relevant European standards or technical

approval can be considered to have the appropriate expertise. Or

- c) where tables of notional performance are included in this Document, they should conform with an appropriate specification given in these tables. Or
- d) in the case of fire-resisting elements, they should:
  - i. conform with an appropriate specification given in Document II of the Building Research Establishment's report Guidelines for the construction of fire resisting structural elements (*BR 128, BRE 1988*); or
  - ii. be designed in accordance with a relevant British Standard or Eurocode.

2) Different forms of construction can present different problems and opportunities for the provision of structural fire protection. Further information on some specific forms of construction can be found in:

Timber – *BRE 454 Multi-storey timber frame buildings – a design guide 2003 (ISBN: 186081605 3)*

Steel – *SCI P197 Designing for structural fire safety: A handbook for architects and engineers 1999 (ISBN: 185942 074 5)*

3) Any test evidence used to substantiate the fire resistance rating of a construction should be carefully checked to ensure that it demonstrates compliance that is adequate and applicable to the intended use. Small differences in detail (such as fixing method, joints, dimensions and the introduction of insulation materials etc.) may significantly affect the rating.

4) Building Rules deal with fire safety in buildings as a whole. Thus 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

## E Appendix A Performance of materials, products and structures

factors that need to be taken into account. Other factors are set out in this publication.

### A2 Fire resistance

1) Factors having a bearing on fire resistance, that are considered in this

Document, are:

- a) fire severity;
- b) building height; and
- c) building occupancy.

2) 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 similar for buildings in the same use.

3) A number of factors affect the standard of fire resistance specified. These are:

- a) the amount of combustible material per unit of floor area in various types of building (the fire load density);
- b) the height of the top floor above ground, which affects the ease of escape and of firefighting operations and the consequences should large scale collapse occur;
- c) occupancy type, which reflects the ease with which the building can be evacuated quickly;
- d) whether there are basements, because the lack of an external wall through which to vent heat and smoke may increase heat build-up and thus affect the duration of a fire, as well as complicating firefighting; and
- e) whether the building is of single storey construction (where escape is direct and structural failure is unlikely to precede evacuation).

4) Because the use of buildings may change, a precise estimate of fire severity based on the fire load due to a particular use may be misleading. Therefore if a fire engineering approach of this kind is adopted

the likelihood that the fire load may change in the future needs to be considered.

5) 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 either:

- a) (National tests) *BS 476 Fire tests on building materials and structures, Parts 20 - 24: 1987, i.e. Part 20 Method for determination of the fire resistance of elements of construction (general principles), Part 21 Methods for determination of the fire resistance of load bearing elements of construction, Part 22 Methods for determination of the fire resistance of non-load bearing elements of construction, Part 23 Methods for determination of the contribution of components to the fire resistance of a structure and Part 24 Method for determination of the fire resistance of ventilation ducts (or to BS 476-8:1972 in respect of items tested or assessed prior to 1 January 1988); or*
- b) (European tests) *Commission Decision 2000/367/EC of 3rd May 2000 implementing Council Directive 89/106/EEC as regards the classification of the resistance to fire performance of construction products, construction works and parts thereof.*

6) All products are classified in accordance with:  
*BS EN 13501-2:2007 +A1:2009, Fire classification of construction products and building elements – Classification using data from fire resistance tests (excluding products for use in ventilation systems).*  
*BS EN 13501-3:2005 +A1:2009, Fire classification of construction products and building elements – Classification using data from fire resistance tests on components of normal building service installations (other than smoke control systems).*  
*BS EN 13501-4:2007 +A1:2009, Fire classification of construction products and building elements – Classification using data*

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from fire resistance tests on smoke control systems.

7) The relevant European test methods under *BS EN 1364, 1365, 1366 and 1634* are listed in Appendix G.

8) Table A1 gives the specific requirements for each element in terms of one or more of the following performance criteria:

- a) resistance to collapse (loadbearing capacity), which applies to loadbearing elements only, denoted R in the European classification of the resistance to fire performance;
- b) resistance to fire penetration (integrity), denoted E in the European classification of the resistance to fire performance; and
- c) resistance to the transfer of excessive heat (insulation), denoted I in the European classification of the resistance to fire performance.

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

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

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

12) Information on tested elements is frequently given in literature available from manufacturers and trade associations. Information on tests on fire-resisting elements is also given in such publications as the *Association for Specialist Fire Protection's Fire protection for structural steel in buildings 4<sup>th</sup> Edition (ISBN: 187040 925 6)*.

### A3 Roofs

1) Performance in terms of the resistance of roofs to external fire exposure is determined by reference to either:

- a) (National tests) *BS 476-3:2004 External fire exposure roof tests*; or
- b) (European tests) *Commission Decision 2005/823/EC amending Decision 2001/671/EC* establishing a classification system for the external fire performance of roofs and roof coverings.

2) Constructions are classified within the National system by 2 letters in the range A to D, with an AA designation being the best. The first letter indicates the time to penetration; the second letter a measure of the spread of flame.

3) Constructions are classified within the European system as  $B_{ROOF}(t_4)$ ,  $C_{ROOF}(t_4)$ ,  $D_{ROOF}(t_4)$ ,  $E_{ROOF}(t_4)$  or  $F_{ROOF}(t_4)$  (with  $B_{ROOF}(t_4)$  being the highest performance and  $F_{ROOF}(t_4)$  being the lowest) in accordance with *BS EN 13501-5:2005, Fire classification of construction products and building elements – Classification using test data from external fire exposure to roof tests*.

4) *BS EN 13501-1* refers to four separate tests. The suffix (t<sub>4</sub>) used above indicates that Test 4 is to be used for the purposes of this Document.

5) Some roof covering products (and/or materials) can be considered to fulfil all of the requirements for the performance characteristic “external fire performance” without the need for testing, subject to any national provisions on the design and execution of works being fulfilled. These roof covering products are listed in *Commission Decision 2000/553/EC of 6th September 2000* implementing *Council Directive 89/106/EEC* as regards the external fire performance of roof coverings.

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6) In some circumstances roofs, or parts of roofs, may need to be fire-resisting, for example if used as an escape route or if the roof performs the function of a floor. Such circumstances are covered in sections E1.8, E1.10 and E2.3.

7) Table A5 gives notional designations of some generic roof coverings.

### A4 Reaction to fire

1) Performance in terms of reaction to fire to be met by construction products is determined by *Commission Decision 200/147/EC of 8th February 2000* implementing *Council Directive 89/106/EEC* as regards the classification of the reaction to fire performance of construction products.

2) All products, excluding floorings, are classified as † A1, A2, B, C, D, E or F (with class A1 being the highest performance and F being the lowest) in accordance with *BS EN 13501-1:2007 +A1:2009, Fire classification of construction products and building elements, Part 1 – Classification using data from reaction to fire tests*.

3) The relevant European test methods are specified as follows:  
*BS EN ISO 1182:2010, Reaction to fire tests for building products - Non-combustibility test*.

*BS EN ISO 1716:2010, Reaction to fire tests for building products – Determination of the gross calorific value*.

*BS EN 13823:2002, Reaction to fire tests for building products – Building products excluding floorings exposed to the thermal attack by a single burning item*.

*BS EN ISO 11925-2:2010, Reaction to fire tests for building Products, Part 2 – Ignitability when subjected to direct impingement of a flame*.

*BS EN 13238:2010, Reaction to fire tests for building products – conditioning procedures and general rules for selection of substrates*.

† The classes of reaction to fire performance of A2, B, C, D and E are accompanied by additional classifications related to the production of smoke (s1, s2, s3) and/or flaming droplets/particles (d0, d1, d2).

### A5 Non-combustible materials

1) Non-combustible materials are defined in Table A6 either as listed products, or in terms of performance:

- a) (National classes) when tested to *BS 476-4:1970 Non-combustibility test for materials* or *BS 476-11:1982 Method for assessing the heat emission from building products*; or
- b) (European classes) when classified as class A1 in accordance with *BS EN 13501-1:2007 +A1:2009, Fire classification of construction products and building elements, Part 1- Classification using data from reaction to fire tests when tested to BS EN ISO 1182:2010, Reaction to fire tests for building products – Non combustibility test* and *BS EN ISO 1716:2010 Reaction to fire tests for building products – Determination of the gross calorific value*.

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

### A6 Materials of limited combustibility

1) Materials of limited combustibility are defined in Table A7:

- a) (National classes) by reference to the method specified in *BS 476: Part 11:1982*; or
- b) (European classes) in terms of performance when classified as class A2-s3, d2 in accordance with *BS EN 13501-1:2007 +A1:2009, Fire classification of construction products and building elements, Part 1 – Classification using data from reaction to fire tests when tested to BS EN ISO 1182:2010, Reaction to fire tests for*

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*building products – Non combustibility test or BS EN ISO 1716:2010 Reaction to fire tests for building products – Determination of the gross calorific value and BS EN 13823:2002, Reaction to fire tests for building products – Building products excluding floorings exposed to the thermal attack by a single burning item.*

- 2) 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.

### A7 Internal linings

- 1) 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.
- 2) Under the National classifications, lining systems which can be effectively tested for 'surface spread of flame' are rated for performance by reference to the method specified in *BS 476-7:1971 Surface spread of flame tests for materials*, or *1987 Method for classification of the surface spread of flame of products*, or *1997 Method of test to determine the classification of the surface spread of flame of products* under which materials or products are classified 1, 2, 3 or 4 with Class 1 being the highest.
- 3) Under the European classifications, lining systems are classified in accordance with *BS EN 13501-1:2007 +A1:2009, Fire classification of construction products and building elements, Part 1– Classification using data from reaction to fire tests*. Materials or products are classified as A1, A2, B, C, D, E or F, with A1 being the highest. When a classification includes "s3, d2", it means that there is no limit set for smoke production and/or flaming droplets/particles.
- 4) To restrict the use of materials which ignite easily, which have a high rate of heat release and/or which reduce the time to flashover, maximum acceptable 'fire propagation' indices are specified, where the National test methods are being followed. These are determined by reference to the method specified in *BS 476-6:1981 or 1989 Method of test for fire propagation of products*. Index of performance (I) relates to the overall test performance, whereas sub-index (i1) is derived from the first three minutes of test.
- 5) The highest National product performance classification for lining materials is Class 0. This is achieved if a material or the surface of a composite product is either:
- a) composed throughout of materials of limited combustibility; or
  - b) a Class 1 material which has a fire propagation index (I) of not more than 12 and sub-index (i1) of not more than 6.
- 6) Class 0 is not a classification identified in any British Standard test.
- 7) Composite products defined as materials of limited combustibility (see section A6 above and Table A7) should in addition comply with the test requirement appropriate to any surface rating specified in the guidance on requirements E2, E3 and E4.
- 8) The notional performance ratings of certain widely used generic materials or products are listed in Table A8 in terms of their performance in the traditional lining tests *BS 476 Parts 6 and 7* or in accordance with *BS EN 13501-1:2007 +A1:2009, Fire classification of construction products and building elements, Part 1– Classification using data from reaction to fire tests*.
- 9) Results of tests on proprietary materials are frequently given in literature available from manufacturers and trade associations.
- 10) 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



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and applicable to the construction to be used. Small differences in detail, such as thickness, substrate, colour, form, fixings, adhesive etc., may significantly affect the rating.

### A8 Thermoplastic materials

1) A thermoplastic material means any synthetic polymeric material which has a softening point below 200°C if tested to *BS EN ISO 306:2004 method A120 Plastics –*

*Thermoplastic materials – Determination of Vicat softening temperature*. 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.

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

3) Concessions are made for thermoplastic materials used for window glazing, roof-lights and lighting diffusers within suspended ceilings, which may not comply with the criteria specified in paragraphs 11 onwards. They are described in the guidance on requirements E2 and E4.

4) For the purposes of the requirements E2 and E4 thermoplastic materials should either be used according to their classification 0-3, under the *BS 476: Parts 6 and 7* tests as described in paragraphs 11 onwards, (if they have such a rating), or they may be classified TP(a) rigid, TP(a) flexible, or TP(b) according to the following methods:

TP(a) rigid:

- i. rigid solid PVC sheet;
- ii. solid (as distinct from double- or multiple-skin) polycarbonate sheet at least 3mm thick;
- iii. multi-skinned rigid sheet made from un-plasticised PVC or polycarbonate which has a Class 1

rating when tested to *BS 476-7:1971, 1987 or 1997*; or

iv. any other rigid thermoplastic product, a specimen of which (at the thickness of the product as put on the market), when tested to *BS 2782-0:2011 Method 508A Rate of burning, Laboratory method*, performs so that the test flame extinguishes before the first mark and the duration of flaming or afterglow does not exceed 5 seconds following removal of the burner.

TP(a) flexible:

Flexible products not more than 1mm thick which comply with the Type C requirements of *BS 5867-2:2008 Specification for fabrics for curtains and drapes – Flammability requirements* when tested to *BS 5438:1989 Methods of test for flammability of textile fabrics* when subjected to a small igniting flame applied to the face or bottom edge of vertically oriented specimens, Test 2, with the flame applied to the surface of the specimens for 5, 15, 20 and 30 seconds respectively, but excluding the cleansing procedure; and

TP(b):

- i. rigid solid polycarbonate sheet products less than 3mm thick, or multiple-skin polycarbonate sheet products which do not qualify as TP(a) by test; or
- ii. other products which, when a specimen of the material between 1.5 and 3mm thick is tested in accordance with *BS 2782-0:2011 Method 508A*, has a rate of burning which does not exceed 50mm/minute.

5) If it is not possible to cut or machine a 3mm thick specimen from the product then a 3mm test specimen can be moulded from the same material as that used for the manufacture of the product.

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6) Currently, no new guidance is possible on the assessment or classification of thermoplastic materials under the European system since there is no generally accepted European test procedure and supporting comparative data.

### A9 Fire test methods

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

2) A guide to the development and presentation of fire tests and their use in hazard assessment is given in *BS 6336:1998 Guide to development and presentation of fire tests and their use in hazard assessment*.



## E Appendix A Performance of materials, products and structures

| <b>Table A1 Specific provisions of test for fire resistance of elements of structure etc.</b>   |  |   |   |   |                               |
|---|--|---|---|---|-------------------------------|
| Part of building  | Minimum provisions when tested to the relevant part of BS 476 <sup>(1)</sup> (minutes) |   |   | Minimum provisions when tested to the relevant European standard (minutes) <sup>(9)</sup> | Method of exposure            |
|   | Loadbearing capacity <sup>(2)</sup>  | Integrity                                 | Insulation                                |   |                               |
| 1. <b>Structural</b> frame, beam or column.   | See Table A2   | N/A                                       | N/A                                       | R see Table A2  | Exposed faces                 |
| 2. <b>Load bearing wall</b> (which is not also a wall described in any of the following items). | See Table A2   | N/A                                       | N/A                                       | R see Table A2  | Each side separately          |
| 3. <b>Floors</b> <sup>(3)</sup>   |  |   |   |   |                               |
| a. between a shop and flat above;   | 60 or see Table A2 (whichever is greater)  | 60 or see Table A2 (whichever is greater) | 60 or see Table A2 (whichever is greater) | REI 60 or see Table A2 (whichever is greater)   | From underside <sup>(4)</sup> |
| b. In upper storey of 2 storey dwelling house, but not over garage or basement                  | 30   | 15  | 15  | R 30 and REI 15   |                               |
| c. Any other floor – including compartment floors.  | See Table A2   | See Table A2                              | See Table A2                              | REI see Table A2  |                               |
| 4. <b>Roofs</b>   |  |   |   |   |                               |
| a. any part forming an escape route;  | 30   | 30  | 30  | REI 30  | From underside <sup>(4)</sup> |
| b. any roof that performs the function of a floor.  | See Table A2   | See Table A2                              | See Table A2                              | REI see Table A2  |                               |
| 5. <b>External walls</b>  |  |   |   |   |                               |
| a. any part less than 1000mm from any point on the relevant boundary <sup>(5)</sup>             | See Table A2   | See Table A2                              | See Table A2                              | REI see Table A2  | Each side separately          |
| b. any part 1000mm or more from the relevant boundary <sup>(5)</sup>                            | See Table A2   | See Table A2                              | 15  | RE see Table A2 and REI 15  | From inside the building      |
| c. any part adjacent to an external escape route (see Section E1.11, Diagram 23).               | 30   | 30  | No provision <sup>(6)(7)</sup>            | RE 30   | From inside the building      |
| 6. <b>Compartment walls</b>   |  |   |   |   |                               |
| a. separating a flat from any other part of the building (see E3.4.6.2 1))                      | 60 or see Table A2 (whichever is less)   | 60 or see Table A2 (whichever is less)    | 60 or see Table A2 (whichever is less)    | REI 60 or see Table A2 (whichever is less)  | Each side separately          |
| b. separating occupancies (see E3.4.6.5 1) f))  |  |   |   |   |                               |

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| Table A1 continued  |  | Specific provisions of test for fire resistance of elements of structure etc. |                             |   |                             |
|---|--|---|-----------------------------|---|-----------------------------|
| Part of building  | Minimum provisions when tested to the relevant part of BS 476 <sup>(1)</sup> (minutes) |   |                             | Minimum provisions when tested to the relevant European standard (minutes) <sup>(9)</sup> | Method of exposure          |
|   | Loadbearing capacity <sup>(2)</sup>  | Integrity   | Insulation                  |   |                             |
| <b>7. Compartment walls</b><br>(other than in item 6)   | See Table A2   | See Table A2  | See Table A2                | REI see Table A2  | Each side separately        |
| <b>8. Protected shafts</b><br>excluding any firefighting shaft                                  |  |   |                             |   |                             |
| a. any glazing described in section E3.4, Diagram 38  | N/A  | 30  | No provision <sup>(7)</sup> | E 30  | Each side separately        |
| b. any other part between the shaft and a protected lobby/corridor described in Diagram 38      | 30   | 30  | 30                          | REI 30  |                             |
| c. any part not described in (a) or (b) above   | See Table A2   | See Table A2  | See Table A2                | REI see Table A2  |                             |
| <b>9. Enclosure</b> (which does not form part of a compartment wall or a protected shaft) to a: |  |   |                             |   |                             |
| a. protected stairway   | 30   | 30  | 30 <sup>(8)</sup>           | REI 30 <sup>(8)</sup>   | Each side separately        |
| b. lift shaft   | 30   | 30  | 30                          | REI 30  |                             |
| <b>10. Firefighting shafts</b>  | 120  | 120   | 120                         | REI 120   | From side remote from shaft |
| a. construction separating firefighting shaft from rest of building                             | 60   | 60  | 60                          | REI 60  | From shaft side             |
| b. construction separating firefighting stair, firefighting lift shaft and firefighting lobby   | 60   | 60  | 60                          | REI 60  | Each side separately        |
| <b>11. Enclosure</b> (which is not a compartment wall or described in item 8) to a:             |  |   |                             |   |                             |
| a. protected lobby  | 30   | 30  | 30 <sup>(8)</sup>           | REI 30 <sup>(8)</sup>   | Each side separately        |
| b. protected corridor   | 30   | 30  | 30 <sup>(8)</sup>           |   |                             |
| <b>12. Sub-division of a corridor</b>   | 30   | 30  | 30 <sup>(8)</sup>           | REI 30 <sup>(8)</sup>   | Each side separately        |

## E Appendix A Performance of materials, products and structures

| Table A1 continued  |  | Specific provisions of test for fire resistance of elements of structure etc. |  |   |                      |
|---|--|---|--|---|----------------------|
| Part of building  | Minimum provisions when tested to the relevant part of BS 476 <sup>(1)</sup> (minutes) |   |  | Minimum provisions when tested to the relevant European standard (minutes) <sup>(9)</sup> | Method of exposure   |
|   | Loadbearing capacity <sup>(2)</sup>  | Integrity   | Insulation   |   |                      |
| 13. Fire-resisting construction:  |  |   |  |   |                      |
| a. enclosing places of special fire hazard  | 30   | 30  | 30   | REI 30  | Each side separately |
| b. between store rooms and sales area in shops  | 30   | 30  | 30   | REI 30  |                      |
| c. fire-resisting subdivision described in section E1.9, Diagram23                                | 30   | 30  | 30   | REI 30  |                      |
| d. enclosing bedrooms and ancillary accommodation in care homes (see E1.9.14 11) and E1.9.14 13)) | 30   | 30  | 30   | REI 30  |                      |
| 14. Enclosure in a flat to a protected entrance hall, or to a protected landing.                  | 30   | 30  | 30 <sup>(8)</sup>  | REI 30 <sup>(8)</sup>   | Each side separately |
| 15. Cavity barrier  | N/A  | 30  | 15   | E 30 and EI 15  | Each side separately |
| 16. Ceiling Diagram 41  | N/A  | 30  | 30   | EI 30   | From underside       |
| 17. Duct described in paragraph E3.5.3.4 e)   | N/A  | 30  | No provision   | E 30  | From outside         |
| 18. Casing around a drainage system described in section E3.60, Diagram 44                        | N/A  | 30  | No provision   | E 30  | From outside         |
| 19. Flue walls described in section E3.6, Diagram 45  | N/A  | Half the period specified in Table A2 for the compartment wall/floor          | Half the period specified in Table A2 for the compartment wall/floor | EI half the period specified in Table A2 for the compartment wall/floor                   | From outside         |
| 16. Fire doors  | See Table B1   |   |  | See Table B1  |                      |

### Notes for Table A1:

- (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. *BS 476-8* results are acceptable for items tested or assessed before 1 January 1988.
- (2). Applies to loadbearing elements only (see E3.2.1 1) and Appendix E).
- (3). Guidance on increasing the fire resistance of existing timber floors is given in *BRE Digest 208* Increasing the fire resistance of existing timber floors (*BRE 988*).
- (4). 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.
- (5). The guidance in section E4.3 allows such walls to contain areas which need not be fire-resisting (unprotected areas).
- (6). Unless needed as part of a wall in item 5a or 5b.
- (7). Except for any limitations on glazed elements given in Table A4.
- (8). See Table A4 for permitted extent of uninsulated glazed elements.
- (9). The National classifications do not automatically equate with the equivalent classifications in the European column, therefore products cannot typically assume a European class unless they have been tested accordingly.

'R' is the European classification of the resistance to fire performance in respect of loadbearing capacity; 'E' is the European classification of the resistance to fire performance in respect of integrity; and 'I' is the European classification of the resistance to fire performance in respect of insulation.

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| <b>Table A2 Minimum periods of fire resistance</b> |   |                  |  |                  |                  |               |
|--|---|------------------|--|------------------|------------------|---------------|
| Purpose group of building                          | Minimum period of fire resistance (minutes) in a:   |                  |  |                  |                  |               |
|  | Basement storey <sup>(5)</sup> including floor over |                  | Ground or upper storey   |                  |                  |               |
|  | Depth of a lowest basement (m)                      |                  | Height of top floor above ground in a building or separated part of a building (m) |                  |                  |               |
|  | More than 10  | Not more than 10 | Not more than 5  | Not more than 18 | Not more than 30 | More than 30  |
| <b>1. Residential</b>                              |   |                  |  |                  |                  |               |
| (a) Block of flats                                 |   |                  |  |                  |                  |               |
| Not sprinklered                                    | 90  | 60               | 30*  | 60**†            | 90**             | Not permitted |
| Sprinklered  | 90  | 60               | 30*  | 60**†            | 90**             | 120**         |
| (b) Dwelling houses                                |   |                  |  |                  |                  |               |
|  |   |                  | 30*  | 60 <sup>5</sup>  |                  |               |
| 2(a) Institutional                                 | 90  | 60               | 30*  | 60               | 90               | 120#          |
| 2(b) Other residential                             | 90  | 60               | 30*  | 60               | 90               | 120#          |
| <b>3. Office</b>                                   |   |                  |  |                  |                  |               |
| Not sprinklered                                    | 90  | 60               | 30*  | 60               | 90               | Not permitted |
| Sprinklered <sup>(2)</sup>                         | 60  | 60               | 30*  | 30*              | 60               | 120#          |
| <b>4. Shop and commercial</b>                      |   |                  |  |                  |                  |               |
| Not sprinklered                                    | 90  | 60               | 60   | 60               | 90               | Not permitted |
| Sprinklered  | 60  | 60               | 30*  | 60               | 60               | 120#          |
| <b>5. Assembly and recreation</b>                  |   |                  |  |                  |                  |               |
| Not sprinklered                                    | 90  | 60               | 60   | 60               | 90               | Not permitted |
| Sprinklered <sup>(2)</sup>                         | 60  | 60               | 30*  | 60               | 60               | 120#          |
| <b>6. Industrial</b>                               |   |                  |  |                  |                  |               |
| Not sprinklered                                    | 120   | 90               | 60   | 90               | 120              | Not permitted |
| Sprinklered <sup>(2)</sup>                         | 90  | 60               | 30*  | 60               | 90               | 120#          |

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| Table A2 Minimum periods of fire resistance  |   |                  |  |                     |                     |               |
|--|---|------------------|--|---------------------|---------------------|---------------|
| Purpose group of building  | Minimum period of fire resistance (minutes) in a:   |                  |  |                     |                     |               |
|  | Basement storey <sup>(5)</sup> including floor over   |                  | Ground or upper storey   |                     |                     |               |
|  | Depth of a lowest basement (m)  |                  | Height of top floor above ground in a building or separated part of a building (m) |                     |                     |               |
|  | More than 10  | Not more than 10 | Not more than 5  | Not more than 18    | Not more than 30    | More than 30  |
| <b>7. Storage and other non-residential</b>  |   |                  |  |                     |                     |               |
| (a) Any building or part not described elsewhere   |   |                  |  |                     |                     |               |
| Not sprinklered  | 120   | 90               | 60   | 90                  | 120                 | Not permitted |
| Sprinklered <sup>(2)</sup>   | 90  | 60               | 30*  | 60                  | 90                  | 120#          |
| (b) Car park for light vehicles  |   |                  |  |                     |                     |               |
| i. Open sided car park <sup>(3)</sup>  | N/A   | N/A              | 15*+   | 15*+ <sup>(4)</sup> | 15*+ <sup>(4)</sup> | 60            |
| ii. Any other car park   | 90  | 60               | 30*  | 60                  | 90                  | 120#          |
| <b>Notes for Table A2:</b>   |   |                  |  |                     |                     |               |
| Single storey buildings are subject to the periods under the heading “not more than 5”. If they have basements, the basement storeys are subject to the period appropriate to their depth. |   |                  |  |                     |                     |               |
| \$   | The floor over a basement (or if there is more than 1basement, the floor over the topmost basement) should meet the provisions for the ground and upper storeys if that period is higher.                             |                  |  |                     |                     |               |
| *  | Increased to a minimum of 60 minutes for compartment walls separating buildings.  |                  |  |                     |                     |               |
| **   | Reduced to 30 minutes for any floor within a flat with more than one storey, but not if the floor contributes to the support of the building.   |                  |  |                     |                     |               |
| #  | Reduced to 90 minutes for elements not forming part of the structural frame.  |                  |  |                     |                     |               |
| +  | Increased to 30 minutes for elements protecting the means of escape.  |                  |  |                     |                     |               |
| †  | Refer to paragraph E3.3.3 1) regarding the acceptability of 30 minutes in flat conversions.   |                  |  |                     |                     |               |
| 1  | Refer to Table A1 for the specific provisions of test.  |                  |  |                     |                     |               |
| 2  | “Sprinklered” means that the building is fitted throughout with an automatic sprinkler system in accordance with section E0.9.  |                  |  |                     |                     |               |
| 3  | The car park should comply with the relevant provisions in the guidance on requirement E3, section E3.7.  |                  |  |                     |                     |               |
| 4  | For the purposes of meeting the Building Regulations, the following types of steel elements are deemed to have satisfied the minimum period of fire resistance of 15 minutes when tested to the European test method: |                  |  |                     |                     |               |
|  | i) Beams supporting concrete floors maximum $H_p/A=230m^{-1}$ operating under full design load.   |                  |  |                     |                     |               |
|  | ii) Free standing columns, maximum $H_p/A=180m^{-1}$ operating under full design load.  |                  |  |                     |                     |               |
|  | iii) Wind bracing and struts, maximum $H_p/A=210m^{-1}$ operating under full design load.   |                  |  |                     |                     |               |
|  | Guidance is also available in BS 5950 Structural use of steelwork in building. Part 8 Code of practice for fire resistant design.   |                  |  |                     |                     |               |
| 5  | 30 minutes in the case of a three storey dwelling house, increased to 60 minutes for compartment walls separating buildings.  |                  |  |                     |                     |               |

### A10 Application of the fire resistance standards in Table A2:

1) 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).

2) There are circumstances where it may be reasonable to vary this principle, for example:

- i. where the supporting structure is in the open air and is not likely to be affected by the fire in the building; or
- ii. the supporting structure is in a different compartment, with a fire-separating element (which has the higher standard of fire resistance) between the supporting and the separated structure; or
- iii. where a plant room on the roof needs a higher fire resistance than the elements of structure supporting it.

3) 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.

4) 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 firefighting, it may be appropriate to adopt the standard of fire resistance applicable to above-ground structures for elements of structure in that storey.

5) Although most elements of structure in a single storey building may not need fire resistance (see the guidance on requirement E3, paragraph E3.3.1.2 a)), fire resistance will be needed if the element:

- i. is part of (or supports) an external wall and there is provision in the guidance on requirement E4 to limit the extent of openings and other unprotected areas in the wall; or
- ii. is part of (or supports) a compartment wall, including a wall common to two or more buildings; or
- iii. supports a gallery.

6) 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 a single storey building. The fire resistance of the basement storeys should be that appropriate to basements.



## E Appendix A Performance of materials, products and structures

| <b>Table A3 Limitations on fire-protecting suspended ceilings (see Table A1, Note 4)</b>   |                 |  |                                  |
|--|-----------------|--|----------------------------------|
| Height of building or separated part (m)   | Type of floor   | Provision for fire resistance or floor (minutes) | Description of suspended ceiling |
| Less than 18   | Not compartment | 60 or less                                       | Type W, X, Y or Z                |
|  | Compartment     | Less than 60                                     |                                  |
|  |                 | 60   | Type X, Y or Z                   |
| 18 or more   | Any             | 60 or less                                       | Type Y or Z                      |
| No limit   | Any             | More than 60                                     | Type Z                           |
| <p><b>Notes on Table A3:</b></p> <p>1 Ceiling type and description (the change from Types A-D to Types W-Z is to avoid confusion with Classes A-D (European)):</p> <p>W Surface of ceiling exposed to the cavity should be Class 0 or Class 1(National) or Class C-s3, d2 or better (European).</p> <p>X Surface of ceiling exposed to the cavity should be Class 0 (National) or Class B-s3, d2 or better (European).</p> <p>Y Surface of ceiling exposed to the cavity should be Class 0 (National) or Class B-s3, d2 or better (European). Ceiling should not contain easily openable access panels.</p> <p>Z Ceiling should be of a material of limited combustibility (National) or of Class A2-s3, d2 or better (European) and not contain easily openable access panels. Any insulation above the ceiling should be of a material of limited combustibility (National) or Class A2-s3, d2 or better (European).</p> <p>2 Any access panels provided in fire protecting suspended ceilings of type Y or Z should be secured in position by releasing devices or screw fixings, and they should be shown to have been tested in the ceiling assembly in which they are incorporated.</p> <p>3 The National classifications do not automatically equate with the equivalent European classifications, therefore, products cannot typically assume a European class unless they have been tested accordingly.</p> <p>4 When a classification includes 's3, d2', this means that there is no limit set for smoke production and/or flaming droplets/particles.</p> |                 |  |                                  |

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| Table A4  |  | Limitations on the use of uninsulated glazed elements on escape routes (These limitations do not apply to glazed elements which satisfy the relevant insulation criterion, see Table A1) |  |   |  |
|---|--|--|--|---|--|
| 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. Flats - Within the enclosures of a protected entrance hall or protected landing or within fire-resisting separation shown in E1.8 Diagram 11 <sup>(3)</sup>  | Fixed fanlights only   | Unlimited above 1100mm from floor  | Fixed fanlights only                             | Unlimited above 1100mm from floor               |  |
| General   |  |  |  |   |  |
| 2. Between residential/sleeping accommodation and a common escape route (corridor, lobby or stair).   | Nil  | Nil  | Nil  | Nil   |  |
| 3. Between a protected stairway <sup>(1)</sup> and:<br>a. the accommodation, or<br>b. a corridor which is not a protected corridor. Other than in item 2 above. | Nil  | 25% of door area   | Unlimited above 1100mm from floor <sup>(2)</sup> | 50% of door area                                |  |
| 4. a) Between a protected stairway <sup>(1)</sup> and a protected lobby or protected corridor <sup>(3)</sup>  | Unlimited above 1100mm from floor                                | Unlimited above 100mm from floor <sup>(4)</sup>  |  |   |  |
| 4. b) Between accommodation and a protected lobby, other than in item 1 above <sup>(3)</sup>  |  |  |  |   |  |
| 5. Between the accommodation and a protected corridor forming a dead end, other than in item 1 above  | Unlimited above 1100mm from floor                                | Unlimited above 100mm from floor <sup>(4)</sup>  | Unlimited above 1100mm from floor                | Unlimited above 100mm from floor <sup>(4)</sup> |  |
| 6. Adjacent to an external escape route described in paragraph E1.9.13 2)   |  | Unlimited above 1100mm from floor  |  | Unlimited above 1100mm from floor               |  |
| 7. Between accommodation and any other corridor or subdividing corridors, other than in item 1 above  | N/A  | N/A  | Unlimited above 100mm from floor <sup>(4)</sup>  | Unlimited above 100mm from floor <sup>(4)</sup> |  |
| 8. Adjacent to an external escape stair as described in E1.11.4.4 and Diagram 30 or a roof escape as described in paragraph E1.11.5.5                           | Unlimited  | Unlimited  | Unlimited  | Unlimited                                       |  |
| 9. On the external wall of a building where fire resistance is recommended in paragraph E3.4.7.4 5).  | Nil  | Nil  | Nil  | Nil   |  |

## E Appendix A Performance of materials, products and structures

### Notes on Table A4:

- 1 If the protected stairway is also a protected shaft (see paragraph E3.4.9) or a firefighting stair (see section E5.5) there may be further restrictions on the uses of glazed elements.
- 2 Measured vertically from the landing floor level or the stair pitch line.
- 3 Applies also to single storey buildings.
- 4 The 100mm limit is intended to reduce the risk of fire spread from a floor covering.
- 5 Fire-resisting glass should be marked with the manufacturer and product name.
- 6 Further guidance can be found in *A guide to best practice in the specification and use of fire-resistant glazed systems* published by the Glass and Glazing Federation.

**Table A5 Notional designations of roof coverings**

#### Part i: Pitched roofs covered with slates or tiles

| Covering material                 | Supporting structure   | Designation  |
|-----------------------------------|--|--|
| 1. Natural slates                 | Timber rafters with or without underfelt, sarking, boarding, wood-wool slabs, compressed straw slabs, plywood, wood chipboard, or fibre insulating board | AA (National class) or B <sub>ROOF</sub> (t4) (European class) |
| 2. Fibre reinforced cement slates |  |  |
| 3. Clay tiles                     |  |  |
| 4. Concrete tiles                 |  |  |

**Note:** Although the Table does not include guidance for roofs covered with bitumen felt, it should be noted that there is a wide range of materials on the market and information on specific products is readily available from manufacturers.

#### Part ii: Pitched roofs covered with self-supporting sheet

| Roof covering material  | Construction  | Supporting structure                   | Designation  |
|---|---|--|--|
| 1. Profiled sheet of galvanised steel, aluminium, fibre reinforced cement, or pre-painted (coil coated) steel or aluminium with a pvc or pvf2 coating | Single skin without underlay, or with underlay or plasterboard, fibre insulating board, or wood-wool slab                       | Structure of timber, steel or concrete | AA (National class) or B <sub>ROOF</sub> (t4) (European class) |
| 2. Profiled sheet of galvanised steel, aluminium, fibre reinforced cement, or pre-painted (coil coated) steel or aluminium with a pvc or pvf2 coating | Double skin without interlayer, or with interlayer of resin bonded glass fibre, mineral wool slab, polystyrene, or polyurethane | Structure of timber, steel or concrete | AA (National class) or B <sub>ROOF</sub> (t4) (European class) |

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| Table A5 continued... Notional designations of roof coverings  |   |   |
|--|---|---|
| Part iii. Flat roofs covered with bitumen felt   |   |   |
| <p>A flat roof comprising bitumen felt should (irrespective of the felt specification) be deemed to be of designation AA (National class) or B<sub>ROOF</sub>(t4) (European class) if the felt is laid on a deck constructed of 6mm plywood, 12.5mm wood chipboard, 16mm (finished) plain edged timber boarding, compressed straw slab, screeded wood wool slab, profiled fibre reinforced cement or steel deck (single or double skin) with or without fibre insulating board overlay, profiled aluminium deck (single or double skin) with or without fibre insulating board overlay, or concrete or clay pot slab (in situ or pre cast), and has a surface finish of:</p> <p>a. bitumen-bedded stone chippings covering the whole surface to a depth of at least 12.5mm;</p> <p>b. bitumen-bedded tiles of a non-combustible material;</p> <p>c. sand and cement screed; or</p> <p>d. macadam</p> |   |   |
| Part iv. Pitched or flat roofs covered with fully supported material   |   |   |
| Covering material  | Supporting structure  | Designation   |
| 1. Aluminium sheet   | timber joists, and  | AA* (National class) or B <sub>ROOF</sub> (t4) (European class) |
| 2. Copper sheet  | tongued and grooved boarding, or  |   |
| 3. Zinc sheet  | plain edged boarding  |   |
| 4. Lead sheet  |   |   |
| 5. Mastic asphalt  |   |   |
| 6. Vitreous enamelled steel  | steel or timber joists with deck of   |   |
| 7. Lead/tin alloy coated steel sheet   | wood-wool slabs, compressed straw   |   |
| 8. Zinc/aluminium alloy coated steel sheet   | slab, wood chipboard, fibre insulating board, or 9.5mm plywood  |   |
| 9. Pre-painted (coil coated) steel sheet including liquid applied pvc coatings   | concrete or clay pot slab (in-situ or pre-cast) or non-combustible deck of steel, aluminium, or fibre cement (with or without insulation) |   |
| <b>Notes for Table A5:</b>   |   |   |
| <p>* Lead sheet supported by timber joists and plain edged boarding should be regarded as having a BA designation and is deemed to be designated class C<sub>ROOF</sub>(t4) (European class).</p>  |   |   |
| <p>The National classifications do not automatically equate with the equivalent classifications in the European column; therefore, products cannot typically assume a European class unless they have been tested accordingly.</p>   |   |   |

## E Appendix A Performance of materials, products and structures

| <b>Table A6 Use and definitions of non-combustible materials</b>   |   |  |
|--|---|--|
| References in this Part to situations where such materials should be used  | Definitions of non-combustible materials  |  |
|  | National class  | European class   |
| 1. refuse chutes meeting the provisions in the guidance to E3, paragraph E3.4.8.3 c).  | a. Any material which when tested to <i>BS 476-11:1982</i> does not flame nor cause any rise in temperature on either the centre (specimen) or furnace thermocouples  | a. Any material classified as class A1 in accordance with <i>BS EN 13501-1:2007 Fire classification of construction products and building elements, Part 1 – Classification using data from reaction to fire tests.</i>  |
| 2. suspended ceilings and their supports where there is provision in the guidance to E3, paragraph E3.5.4.1 6) to 7), for them to be constructed of non-combustible materials.   | b. Totally inorganic materials such as concrete, fired clay, ceramics, metals, plaster and masonry containing not more than 1% by weight or volume of organic material. (Use in buildings of combustible metals such as magnesium/aluminium alloys should be assessed in each individual case). | b. Products made from one or more of the materials considered as Class A1 without the need for testing as defined in <i>Commission Decision 2003/424/EC of 6th June 2003</i> amending <i>Decision 96/603/EC</i> establishing the list of products belonging to Classes A1 “No contribution to fire” provided for in the <i>Decision 94/611/EC</i> implementing Article 20 of the <i>Council Directive 89/106/EEC</i> on construction products. None of the materials shall contain more than 1% by weight or volume (whichever is the more onerous) of homogeneously distributed organic material. |
| 3. pipes meeting the provisions in the guidance to E3, Table 14.   |   |  |
| 4. flue walls meeting the provisions in the guidance to E3, Diagram 45.  |   |  |
| 5. construction forming car parks referred to in the guidance to E3, paragraph E3.7.1.   | c. Concrete bricks or blocks meeting <i>BS EN 771-1:2011</i><br><br>d. Products classified as non-combustible under <i>BS 476-4:1970</i>  |  |
| <p><b>Note for Table A6:</b></p> <p>The National classifications do not automatically equate with the equivalent classifications in the European column, therefore products cannot typically assume a European class unless they have been tested accordingly.</p> |   |  |

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| Table A7 Use and definitions of materials of limited combustibility  |   |  |
|--|---|--|
| References in this Part to sections where such materials should be used  | Definitions of materials of limited combustibility  |  |
|  | National class  | European class   |
| 1. stairs where there is provision in the guidance to E1 for them to be constructed of materials of limited combustibility.  | a. Any non-combustible material listed in Table A6.   | <p>a. Any material listed in Table A6.</p> <p>b. Any material/product classified as Class A2-s3, d2 or better in accordance with <i>BS EN 13501-1:2007 Fire classification of construction products and building elements, Part 1—Classification using data from reaction to fire tests.</i></p> |
| 2. materials above a suspended ceiling meeting the provisions in the guidance to E3, paragraphs E3.5.4.1 6) to 7).   | b. Any material of density 300/kg/m <sup>3</sup> or more, which when tested to <i>BS 476-11:1982</i> , does not flame and the rise in temperature on the furnace thermocouple is not more than 20°C.  |  |
| 3. reinforcement/support for fire stopping referred to in the guidance to E3, see E3.6.4 2).   | c. Any material with a non-combustible core at least 8mm thick having combustible facings (on one or both sides) not more than 0.5mm thick. (Where a flame spread rating is specified, these materials must also meet the appropriate test requirements).   |  |
| 4. roof coverings meeting provisions:<br>a. in the guidance to E3, paragraph E3.4.7.5 2) to 4); or<br>b. in the guidance to E4, Table 16 or<br>c. in the guidance to E4, Diagram 53.<br>5. roof deck meeting the provisions of the guidance to E3, Diagram 36a.<br>6. class 0 materials meeting the provisions in Appendix A, paragraph A7 5) a).<br>7. ceiling tiles or panels of any fire protecting suspended ceiling (Type Z) in Table A3. |   |  |
| 8. insulation material in external wall construction referred to in section E4.3.5.1   | <p>Any of the materials (a), (b) or (c) above, or:</p> <p>d. Any material of density less than 300kg/m<sup>3</sup> which when tested to <i>BS 476-11:1982</i>, 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.</p> | Any of the materials/products (a) or (b) above.  |
| 9. insulation above any fire-protecting suspended ceiling (Type Z) in Table A3.  |   |  |

## E Appendix A Performance of materials, products and structures

### Notes for Table A7:

1. The National classifications do not automatically equate with the equivalent classifications in the European column; therefore, products cannot typically assume a European class unless they have been tested accordingly.
2. When a classification includes “s3, d2”, this means that there is no limit set for smoke production and/or flaming droplets/particles.



## E Appendix A Performance of materials, products and structures

| <b>Table A8</b>  |  |
|--|--|
| <b>Typical performance ratings of some generic materials and products</b>  |  |
| <b>Rating</b>  | <b>Material or product</b>   |
| Class 0 (National)   | Any non-combustible material or material of limited combustibility. (Composite products listed in Table A7 must meet test requirements given in Appendix A, paragraph A7 5) b)).<br>Brickwork, blockwork, concrete and ceramic tiles.<br>Plasterboard (painted or not with a PVC facing not more than 0.5mm thick) with or without an air gap or fibrous or cellular insulating material behind.<br>Wood-wool cement slabs.<br>Mineral fibre tiles or sheets with cement or resin binding. |
| Class 3 (National)   | Timber or plywood with a density greater than 400kg/m <sup>3</sup> , painted or unpainted.<br>Wood particle board or hardboard, either untreated or painted.<br>Standard glass reinforced polyesters.  |
| Class A1 (European)<br>Class A2-s3, d2 (European)<br>Class B-s3, d2 (European)<br>Class C-s3, d2 (European)<br>Class D-s3, d2 (European)   | Any material that achieves this class or is defined as 'classified without further test' in a published Commission Decision.   |
| <b>Notes for Table A8 (National):</b> <ol style="list-style-type: none"> <li>1. Materials and products listed under Class 0 also meet Class 1.</li> <li>2. Timber products listed under Class 3 can be brought up to Class 1 with appropriate proprietary treatments.</li> <li>3. The following materials and products may achieve the ratings listed below. However, as the properties of different products with the same generic description vary, the ratings of these materials/products should be substantiated by test evidence.</li> </ol> <p>Class 0 – aluminium faced fibre insulating board, flame retardant decorative laminates on a calcium silicate board, thick polycarbonate sheet, phenolic sheet and UPVC.<br/>Class 1 – phenolic or melamine laminates on a calcium silicate substrate and flame-retardant decorative laminates on a combustible substrate.</p> <b>Notes for Table A8 (European):</b><br>For the purposes of the Building Regulations: <ol style="list-style-type: none"> <li>1. Materials and products listed under Class A1 also meet Classes A2-s3, d2, B-s3, d2, C-s3, d2 and D-s3, d2.</li> <li>2. Materials and products listed under Class A2-s3, d2 also meet Classes B-s3, d2, C-s3, d2 and D-s3, d2.</li> <li>3. Materials and products listed under Class B-s3, d2 also meet Classes C-s3, d2 and D-s3, d2.</li> <li>4. Materials and products listed under Class C-s3, d2 also meet Class D-s3, d2.</li> <li>5. The performance of timber products listed under Class D-s3, d2 can be improved with appropriate proprietary treatments.</li> <li>6. Materials covered by the CWFT process (classification without further testing) can be found by accessing the European Commission's website via the link on the CLG website <a href="http://www.communities.gov.uk">www.communities.gov.uk</a></li> <li>7. The national classifications do not automatically equate with the equivalent classifications in the European column, therefore products cannot typically assume a European class unless they have been tested accordingly.</li> <li>8. When a classification includes 's3, d2', this means that there is no limit set for smoke production and/or flaming droplets/particles.</li> </ol> |  |

### Appendix B Fire doors

#### B1 Guidance

1) All fire doors should have the appropriate performance given in Table B1 either:

- a) by their performance under test to BS 476 Fire tests on building materials and structures, Part 22 Methods for determination of the fire resistance of non-loadbearing elements of construction, in terms of integrity for a period of minutes, e.g. FD30. A suffix (S) is added for doors where restricted smoke leakage at ambient temperatures is needed; or
- b) as determined with reference to *Commission Decision 2000/367/EC of 3rd May 2000 implementing Council Directive 89/106/EEC* as regards the classification of the resistance to fire performance of construction products, construction works and parts thereof. All fire doors should be classified in accordance with *BS EN 13501-2:2007, Fire classification of construction products and building elements. Classification using data from fire resistance tests (excluding products for use in ventilation systems)*. They are tested to the relevant European method from the following:

- *BS EN 1634-1:2008, Fire resistance tests for door and shutter assemblies. Fire doors and shutters;*
- *BS EN 1634-2:2008 Fire resistance tests for door and shutter assemblies. Fire door hardware;*
- *BS EN 1634-3:2004 Fire resistance tests for door and shutter assemblies. Smoke control doors.*

2) The performance requirement is in terms of integrity (E) for a period of minutes. An additional classification of Sa is used for all doors where restricted smoke leakage at ambient temperatures is needed.

3) The requirement (in either case) is for test exposure from each side of the door separately, except in the case of lift doors which are tested from the landing side only.

4) Any test evidence used to substantiate the fire resistance rating of a door or shutter should be carefully checked to ensure that it adequately demonstrates compliance and is applicable to the complete installed assembly. Small differences in detail (such as glazing apertures, intumescent strips, door frames and ironmongery etc.) may significantly affect the rating.

5) Until such time that the relevant harmonised product standards are published, for the purposes of meeting the Building Regulations, products tested in accordance with *BS EN 1634-1* (with or without pre-fire test mechanical conditioning) will be deemed to have satisfied the provisions provided that they achieve the minimum fire resistance in terms of integrity, as detailed in Table B1.

6) All fire doors should be fitted with a self-closing device except for fire doors to cupboards and to service ducts which are normally kept locked shut and fire doors within flats (self-closing devices are still necessary on flat entrance doors).

7) All rolling shutters should be capable of being opened and closed manually for firefighting purposes (see sections E5.5 and E5.5.5).

## E Appendix B Fire doors

8) Where a self-closing device would be considered a hindrance to the normal approved use of the building, self-closing 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 9 below); or
- b) an automatic release mechanism actuated by an automatic fire detection and alarm system; or
- c) a door closer delay device.

9) Two fire doors may be fitted in the same opening so that the total fire resistance is the sum of their individual fire resistances, provided that each door is capable of closing the opening. In such a case, if the opening is provided as a means of escape, both doors should be self-closing, but one of them 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.

10) Because fire doors often do not provide any significant insulation, there should be some limitation on the proportion of doorway openings in compartment walls. Therefore no more than 25% of the length of a compartment wall should consist of door openings, unless the doors provide both integrity and insulation to the appropriate level (see Appendix A, Table A2).

11) Where it is practicable to maintain a clear space on both sides of the doorway, then the above percentage may be greater.

12) Roller shutters across a means of escape should only be released by a heat sensor, such as a fusible link or electric heat detector, in the immediate vicinity of the door. Closure of shutters in such locations should not be initiated by smoke detectors or a fire alarm system, unless the shutter is also intended to partially descend to form part of a boundary to a smoke reservoir.

13) Unless shown to be satisfactory when tested as part of a fire door assembly, the essential components of any hinge on which a fire door is hung should be made entirely from materials having a melting point of at least 800°C.

14) Except for doors identified in paragraph 16 below, all fire doors should be marked with the appropriate fire safety sign complying with *BS 5499-5:2002* according to whether the door is:

- a) to be kept closed when not in use (Fire door keep shut);
- b) to be kept locked when not in use (Fire door keep locked shut); or
- c) held open by an automatic release mechanism or free swing device (Automatic fire door keep clear).

15) Fire doors to cupboards and to service ducts should be marked on the outside; all other fire doors on both sides.

16) The following fire doors are not required to comply with paragraph 14) above:

- a) doors to and within flats;
- b) bedroom doors in 'Other-residential' premises; and
- c) lift entrance/landing doors.

17) Tables A1 and A2 set out the minimum periods of fire resistance for the elements of structure to which performance of some doors is linked. Table A4 sets out limitations on the use of uninsulated glazing in fire doors.

18) *BS 8214:2008* gives recommendations for the specification, design, construction, installation and maintenance of fire doors constructed with non-metallic door leaves.

19) Guidance on timber fire-resisting door-sets, in relation to the new European test standard, may be found in *Timber Fire Resisting Doorsets: maintaining performance under the new European test standard* published by TRADA.

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20) Guidance for metal doors is given in *Code of practice for fire-resisting metal door-sets* published by the DSMA (Door and Shutter Manufacturers' Association) in 1999.

21) Hardware used on fire doors can significantly affect performance in fire. Notwithstanding the guidance in this Document, guidance is available in *Hardware For fire and escape doors* published by the Builders Hardware Industry Federation.

## E Appendix B Fire doors

| <b>Table B1</b>   |  | <b>Provisions for fire doors</b>  |  |
|---|--|---|--|
| Position of door  | Minimum fire resistance of door in terms of integrity (minutes) when tested to <i>BS 476-22</i> <sup>(1)</sup>                               | Minimum fire resistance of door in terms of integrity (minutes) when tested to the relevant European standard <sup>(3)</sup>                  |  |
| 1. In a <b>compartment wall separating buildings</b>  | As for the wall in which the door is fitted, but a minimum of 60   | As for the wall in which the door is fitted, but a minimum of 60  |  |
| 2. In a <b>compartment wall</b> :   |  |   |  |
| a. If it separates a flat from a space in common use  | FD 30S <sup>(2)</sup>  | E30 Sa <sup>(2)</sup>   |  |
| 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 <sup>(2)</sup>  | E30 Sa <sup>(2)</sup>   |  |
| c. enclosing a protected shaft forming a stairway not described in (b) above  | Half the period of fire resistance of the wall in which it is fitted, but 30 minimum and with suffix S <sup>(2)</sup>                        | Half the period of fire resistance of the wall in which it is fitted, but 30 minimum and with suffix Sa <sup>(2)</sup>                        |  |
| d. enclosing a protected shaft forming a lift or service shaft  | Half the period of fire resistance of the wall in which it is fitted, but 30 minimum   | Half the period of fire resistance of the wall in which it is fitted, but 30 minimum  |  |
| e. not described in a, b, c or d above  | As for the wall it is fitted in, but add S <sup>(2)</sup> if the door is used for progressive horizontal evacuation under the guidance to E1 | As for the wall it is fitted in, but add Sa <sup>(2)</sup> if the door is used for progressive horizontal evacuation under the guidance to E1 |  |
| 3. In a <b>compartment floor</b>  | As for the floor in which it is fitted   | As for the floor in which it is fitted  |  |
| 4. Forming part of the <b>enclosures</b> of:  |  |   |  |
| a. a protected stairway (except as described in item 9) ; or  | FD 30S <sup>(2)</sup>  | E30 Sa <sup>(2)</sup>   |  |
| b. a lift shaft which does not form a protected shaft in 2b, c or d above.  | FD 30  | E30   |  |
| 5. Forming part of the <b>enclosures</b> of:  |  |   |  |
| a. a protected lobby approach (or protected corridor) to a stairway   | FD 30S <sup>(2)</sup>  | E30 Sa <sup>(2)</sup>   |  |
| b. any other protected corridor   | FD 30S <sup>(2)</sup>  | E30 Sa <sup>(2)</sup>   |  |
| c. a protected lobby approach to a lift shaft   | FD 30S <sup>(2)</sup>  | E30 Sa <sup>(2)</sup>   |  |
| 6. Affording access to an <b>external escape route</b>  | FD 30  | E30   |  |

## E Appendix B Fire doors

| Table B1 continued  |   | Provisions for fire doors  |  |
|---|---|--|--|
| Position of door  | Minimum fire resistance of door in terms of integrity (minutes) when tested to BS 476-22 <sup>(1)</sup> | Minimum fire resistance of door in terms of integrity (minutes) when tested to the relevant European standard <sup>(3)</sup> |  |
| 7. Sub-dividing:  |   |  |  |
| a. corridors connecting alternative exits   | FD 30S <sup>(2)</sup>   | E30 Sa <sup>(2)</sup>  |  |
| b. dead-end portions of corridors from the remainder of the corridor  | FD 30S <sup>(2)</sup>   | E30 Sa <sup>(2)</sup>  |  |
| 8. Any door within a cavity barrier   | FD 30   | E30  |  |
| 9. Any door forming part of the enclosure to a protected entrance hall or protected landing in a flat   | FD 30   | E30  |  |
| 10. Any door forming part of the enclosure  |   |  |  |
| a. to a place of special fire risk  | FD 30   | E30  |  |
| b. to ancillary accommodation in care homes (see paragraph E1.9.14 13))   | FD 30   | E30  |  |
| 11. In dwelling houses:   |   |  |  |
| a. within a cavity barrier  | FD 30   | E30  |  |
| b. between a dwelling houses and a garage   | FD30S   | E30 Sa   |  |
| c. forming part of the enclosures to a protected stairway in a single family dwelling house   | FD20  | E20  |  |
| d. within any other fire resisting construction in a dwelling house not described elsewhere in this table   | FD20  | E20  |  |
| Notes for Table B1:   |   |  |  |
| 1. To BS 476-22 (or BS 476-8 subject to paragraph A2 5) in Appendix A).   |   |  |  |
| 2. Unless pressurization techniques complying with BS EN 12101-6:2005 Smoke and heat control systems – Part 6: Specification for pressure differential systems – Kits are used, these doors should also either:<br>(a) have a leakage rate not exceeding 3m <sup>3</sup> /m/hour (head and jambs only) when tested at 25 Pa under BS 476 Fire tests on building materials and structures, section 31.1 Methods for measuring smoke penetration through door-sets and shutter assemblies, Method of measurement under ambient temperature conditions; or<br>(b) meet the additional classification requirement of Sa when tested to BS EN 1634-3:2004 Fire resistance tests for door and shutter assemblies, Part 3 – Smoke control doors. |   |  |  |
| 3. The National classifications do not automatically equate with the equivalent classifications in the European column, therefore products cannot typically assume a European class unless they have been tested accordingly.   |   |  |  |

### Appendix C Methods of measurement

#### C1 Introduction

1) Some form of measurement is an integral part of many of the provisions in this Document. The paragraphs in this appendix and Diagrams C1 to C7 show how the various forms of measurement should be made.

#### C2 Occupant capacity

1) The occupant capacity of a room, storey, building or part of a building is:

- a) the maximum number of people it is designed to hold; or
- b) the number calculated by dividing the area of room or storey(s) ( $\text{m}^2$ ) by a floor space factor ( $\text{m}^2$  per person) such as those given in Table C1 for guidance.

2) The 'area' that should be used when referring to Table C1 excludes stair enclosures, lifts, sanitary accommodation and any other fixed part of the building structure (but counters and display units, etc. should not be excluded).

3) The floor space factors given in Table C1 are typical figures representing what might be expected in such a building or room. They do not represent the maximum allowable density of people in a building or room.

4) As an alternative to using the values in the table, the floor space factor may be determined by reference to actual data taken from similar premises. Where appropriate, the data should reflect the average occupant density at a peak trading time of year.

5) Where accommodation is not directly covered by the descriptions given, a reasonable value based on a similar use may be selected.

6) Where any part of the building is to be used for more than one type of accommodation, the most onerous factor(s) should be applied. Where the building contains different types of accommodation, the occupancy of each different area should be calculated using the relevant space factor.

7) Refer to *BS 9999* Annex E for detailed guidance on the calculation of occupancy in common public areas in shopping complexes.

8) For detailed guidance on appropriate floor space factors for concourses in sports grounds refer to "*Concourses*" published by the Football Licensing Authority (ISBN: 0 95462 932 9). Alternatively the occupant capacity may be taken as the number of fixed seats provided, if the occupants will normally be seated.

#### C3 Travel distance

1) Travel distance is measured by way of the shortest route which if:

- a) there is fixed seating or other fixed obstructions, is along the centre line of the seatways and gangways;
- b) it includes a stair, is along the pitch line on the centre line of travel.

#### C4 Width

1) The width of:

- a) a door (or doorway) is the clear width when the door is open (see Diagram C1);
- b) an escape route is the width at 1500mm above floor level when defined by walls or, elsewhere, the minimum width of passage available between any fixed obstructions;
- c) a stair is the clear width between the walls or balustrades.

2) In the case of escape routes and stairs, handrails and strings which do not intrude more than 100mm into these widths may be ignored (see Diagram C1).

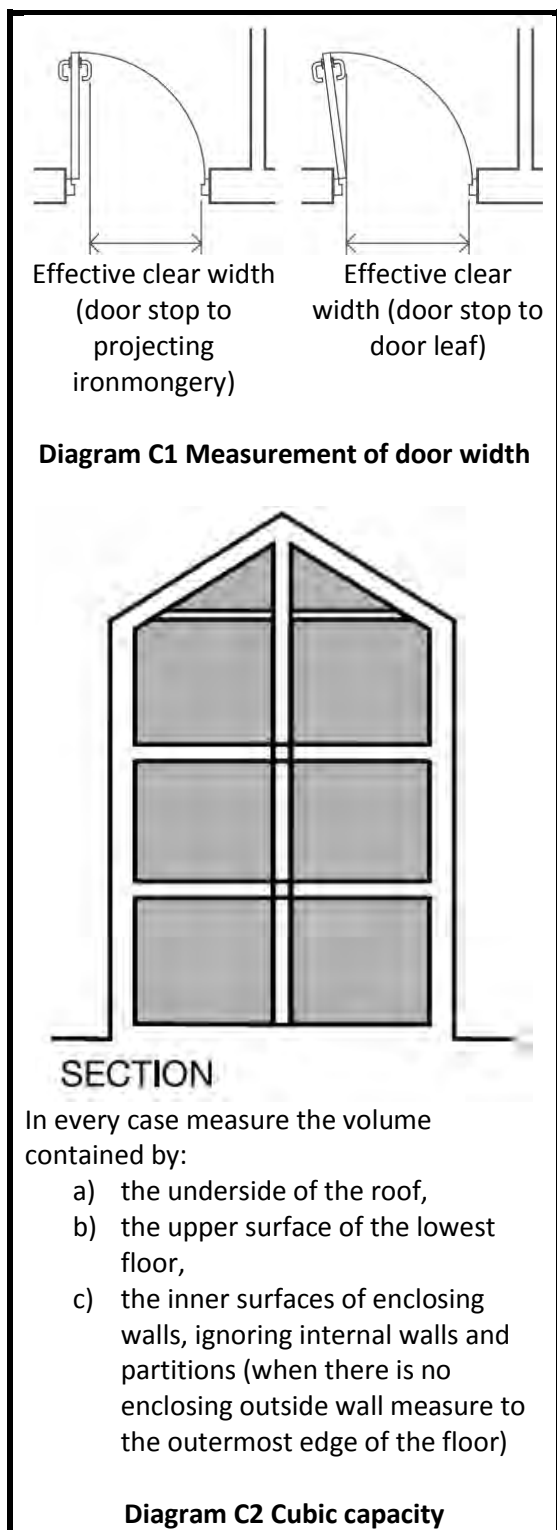


## E Appendix C Methods of measurement

| <b>Table C1 Floor space factors</b>   |  |  |
|---|--|--|
| Type of accommodation   |  | Floor space factor<br>m <sup>2</sup> /person |
| 1   | Standing spectator areas, bar areas (within 2m of serving point) similar refreshment areas   | 0.3  |
| 2   | Amusement arcade, assembly hall (including a general purpose place of assembly), bingo hall, club, crush hall, dance floor or hall, venue for pop concert and similar events and bar areas without fixed seating           | 0.5  |
| 3   | Concourse, queuing area or shopping mall <sup>(1)(2)</sup>   | 0.7  |
| 4   | Committee room, common room, conference room, dining room, licensed betting office (public area), lounge or bar (other than in 1 above), meeting room, reading room, restaurant, staff room or waiting room <sup>(3)</sup> | 1.0  |
| 5   | Exhibition hall or studio (film, radio, television, recording)   | 1.5  |
| 6   | Skating rink   | 2.0  |
| 7   | Shop sales area <sup>(4)</sup>   | 2.0  |
| 8   | Art gallery, dormitory, factory production area, museum or workshop  | 5.0  |
| 9   | Office   | 6.0  |
| 10  | Shop sales area <sup>(5)</sup>   | 7.0  |
| 11  | Kitchen or library   | 7.0  |
| 12  | Bedroom or study-bedroom   | 8.0  |
| 13  | Bed-sitting room, billiards or snooker room or hall  | 10.0   |
| 14  | Storage and warehousing  | 30.0   |
| 15  | Car park   | 2 people per parking space                   |
| <p><b>Notes for Table C1:</b></p> <p>(1) See paragraph C2 7) above.</p> <p>(2) See paragraph C2 8) above.</p> <p>(3) Alternatively the occupant capacity may be taken as the number of fixed seats provided, if the occupants will normally be seated.</p> <p>(4) Shops excluding those under item 10, but including - supermarkets and department stores (main 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.</p> <p>(5) Shops (excluding those in covered shopping complexes but including department stores) trading predominantly in furniture, floor coverings, cycles, prams, large domestic appliances or other bulky goods, or trading on a wholesale self-selection basis (cash and carry).</p> |  |  |

## E Appendix C Methods of measurement

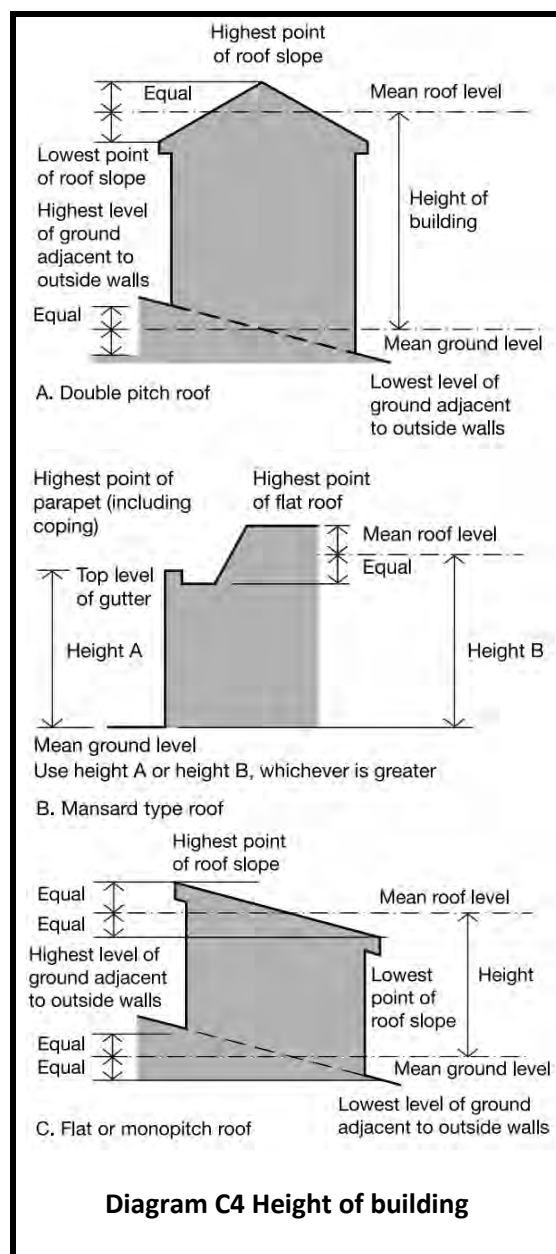
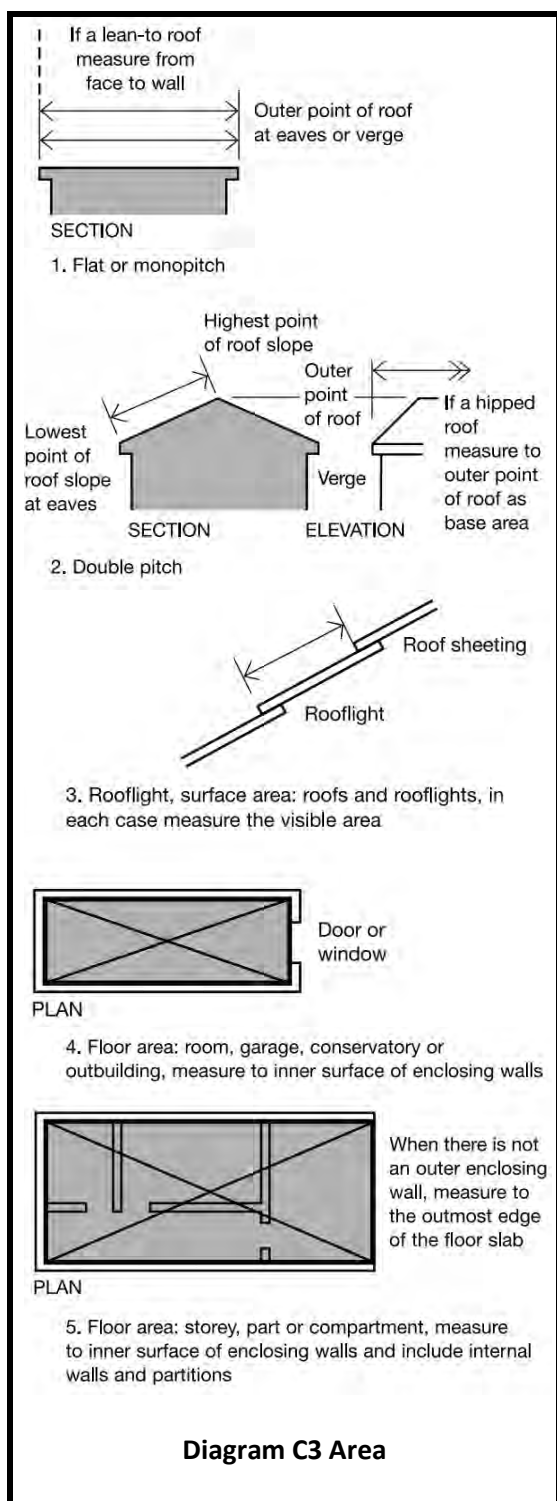
- 3) The rails used for guiding a stair-lift may be ignored when considering the width of a stair. However, it is important that the chair or carriage is able to be parked in a position that does not cause an obstruction to either the stair or landing.



### C5 Free Area of Smoke Ventilators

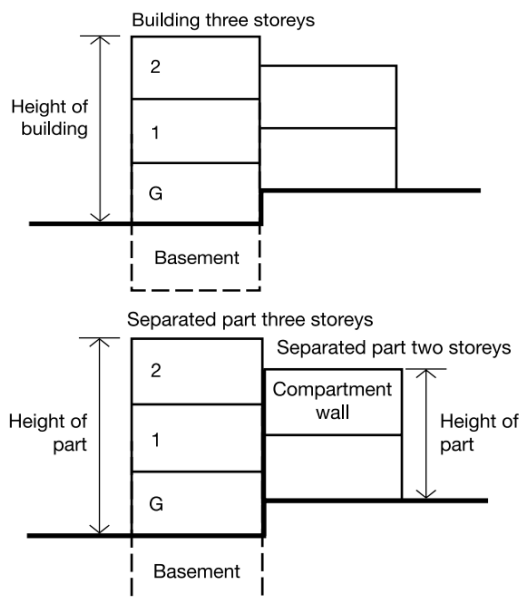
- 1) The free area of a smoke ventilator, specified in this document, may be measured by either:
- a) the declared aerodynamic free area in accordance with *BS EN 12101-2:2003 Smoke and heat control systems. Specification for natural smoke and heat exhaust ventilators*; or,
  - b) The total unobstructed cross sectional area, measured in the plane where the area is at a minimum and at right angles to the direction of air flow (see diagram C7).

## E Appendix C Methods of measurement



## E Appendix C Methods of measurement

To count the number of storeys in a building, or in a separated part of a building, count only at the position which gives the greatest number and exclude any basement storeys.

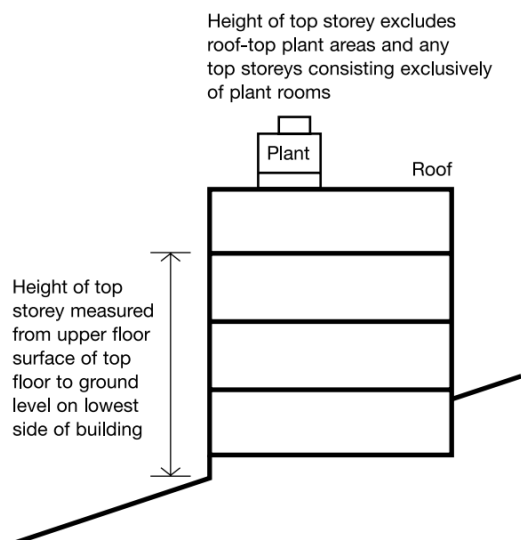


### Notes:

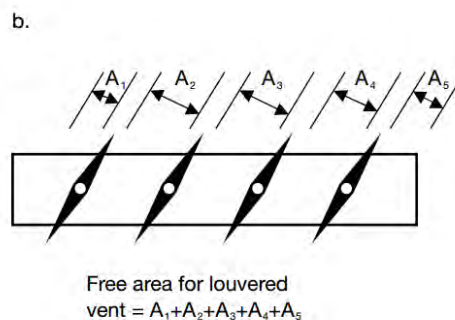
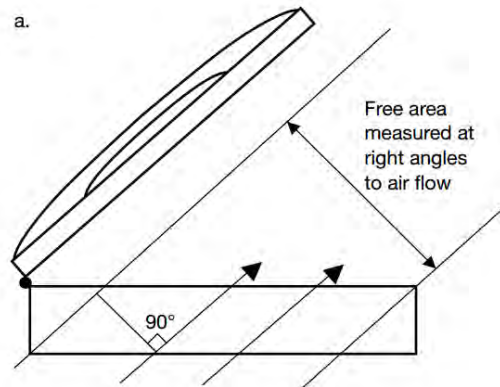
In assembly buildings, a gallery is included as a storey, but not if it is a loading gallery, fly gallery, stage grid, lighting bridge, or any gallery provided for similar purposes, or for maintenance and repair.

In other purpose group buildings, galleries are not counted as a storey.

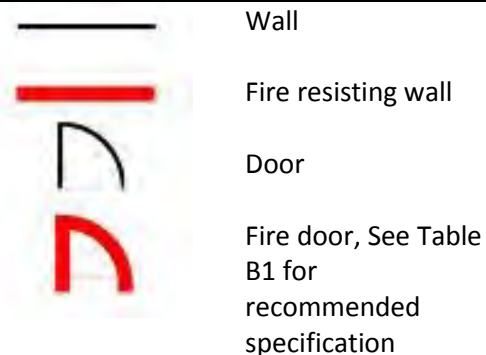
**Diagram C5 Number of storeys**



**Diagram C6 Height of top storey in building**



**Diagram C7 Free area of smoke ventilators**



**Diagram C8 Key for plan diagrams this Document**

### Appendix D Purpose groups

#### D1 Introduction

1) Many of the provisions in this Part are related to the use of the building. The use classifications are termed purpose groups and represent different levels of hazard. They 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.

2) Table D1 sets out the purpose group classification.

3) This is only of relevance in this Document.

#### D2 Ancillary and main uses

1) 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 use as belonging to a purpose group in its own right. These situations are:

- a) where the ancillary use is a flat; or
- b) where the building or compartment is more than 280m<sup>2</sup> in area and the ancillary use is of an area that is more than a fifth of the total floor area of the building or compartment; or
- c) storage in a building or compartment of Purpose Group 4 (shop or commercial), where the storage amounts to more than one third of the total floor area of the building or compartment and the building or compartment is more than 280m<sup>2</sup> in area.

2) 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.

3) 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.

## E Appendix D Purpose groups

| <b>Table D1 Classification of purpose groups</b>  |              |   |
|---|--------------|---|
| <b>Title</b>  | <b>Group</b> | <b>Purpose for the building or part of building</b>   |
| Residential (dwellings)   | 1(a)*        | Flat  |
|   | 1(b)†        | Dwelling house which contains a habitable storey with a floor level which is more than 3.5m above ground level.   |
|   | 1(c)†+       | Dwelling house which does not contain a habitable storey with a floor level which is more than 3.5m above ground level.   |
| Residential (Institutional) (other)   | 2(a)         | Hospital, home, school or other similar establishment used as living accommodation for, or for the treatment, care or maintenance of people suffering from disabilities due to illness or old age or other physical or mental incapacity, or under the age of 5 years, or place of lawful detention, where such people sleep on the premises.   |
|   | 2(b)         | Hotel, boarding house, residential college, hall of residence, hostel and any other residential purpose not described above.  |
| Office  | 3            | Offices or 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, police and fire and rescue service work), handling money (including banking and building society work), and communications (including postal, telegraph and radio communications) or radio, television, film, audio or video recording, or performance (not open to the public) and their control.   |
| Shop and commercial   | 4            | Shops or premises used for a retail trade or business (including the sale to members of the public of food or drink for immediate consumption and retail 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 the rental of storage space to the public) and premises to which the public is invited to deliver or collect goods in connection with their hire repair or other treatment, or (except in the case of repair of motor vehicles) where they themselves may carry out such repairs or other treatments.   |
| Assembly and recreation   | 5            | Place of assembly, entertainment or recreation; including bingo halls, broadcasting, recording and film studios open to the public, casinos, dance halls; entertainment, conference, exhibition and leisure centres; funfairs and amusement arcades; museums and art galleries; non-residential clubs, theatres, cinemas and concert halls; educational establishments, dancing schools, gymnasia, swimming pool buildings, riding schools, skating rinks, sports pavilions, sports stadia; law courts; churches and other buildings of worship, crematoria; libraries open to the public, non-residential day centres, clinics, health centres and surgeries; passenger stations and termini for air, rail, road or sea travel; public toilets; zoos and menageries. |
| 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 the storage or deposit of goods or materials (other than described under 7(b)) and any building not within any of the 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 2500kg gross.  |
| <b>Notes for Table D1:</b><br>This table only applies within the context of this Part.<br>* includes live/work units that meet the provisions of section E1.8.9.<br>† includes any surgeries, consulting rooms, offices or other accommodation, not exceeding 50m <sup>2</sup> in total, forming part of a dwelling house and used by an occupant of the dwelling house in a professional or business capacity.<br>+ A detached garage not more than 40m <sup>2</sup> in area is included in purpose group 1(c); as is a detached open carport of not more than 40m <sup>2</sup> , or a detached building which consists of a garage and open carport where neither the garage nor the open carport exceeds 40m <sup>2</sup> in area. |              |   |



## E Appendix E Definitions

### Appendix E Definitions

These definitions apply consistently within the context of this Document.

**Access room** A room through which passes the only escape route from an inner room.

**Accommodation stair** A stair, 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, each of which is separate from the other.

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

**Atrium** A space within a building, not necessarily vertically aligned, passing through one or more structural floors. Enclosed lift wells, enclosed escalator wells, building services' ducts and stairways are not classified as atria.

**Atria** Plural of atrium.

**Automatic release mechanism** 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;
- b) operation of a hand-operated switch fitted in a suitable position;
- c) failure of electricity supply to the device, apparatus or switch;
- d) operation of the fire alarm system if any.

**Basement storey** A storey which is below the ground storey; or, if there is no ground storey, means a storey 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.

**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 47.)

**Building** Any permanent or temporary building but not any other kind of structure or erection. A reference to a building includes a reference to part of a building.

**Building Control** The enforcing authority for building works in Gibraltar.

**Cavity barrier** A construction, other than a smoke curtain, 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.

**Ceiling** A part of a building which encloses and is exposed overhead in a room, protected shaft or circulation space. (The soffit of a roof-light is included as part of the surface of the ceiling, but not the frame. An up-stand below a roof-light would be considered as a wall).

**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** A product performance classification for wall and ceiling linings. The relevant test criteria are set out in Appendix A, paragraph A7 5).

**Common balcony** A walkway, open to the air on one or more sides, forming part of the escape route from more than one flat.

**Common stair** An escape stair serving more than one flat.

**Compartment (fire)** Any part of a building which is separated from all other parts by one



## E Appendix E Definitions

or more compartment walls or compartment floors or by both such walls and floors; and, if any part of the top storey of a building is within a compartment, that compartment shall also include any roof space above such part of the top storey. (See also “Separated part”.)

**Compartment exit** An exit leading from one compartment to a second compartment where this exit is not the only exit route from the first compartment.

**Compartment wall or floor** A fire-resisting wall/floor used in the separation of one fire compartment from another. (Constructional provisions are given in section E3.4).

**Concealed space or 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.

**Corridor access** A design of a building containing flats in which each flat is approached via a common horizontal internal access or circulation space which may include a common entrance hall.

**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 enclosures of the building, to the nearest final exit, storey exit or compartment exit (where such an exit is acceptable) ignoring furniture and fittings.

**Dwelling** A unit of residential accommodation occupied (whether or not as a sole or main residence):

- a) by a single person or by people living together as a family; or
- b) by not more than 6 residents living together as a single household, including a household where care is provided for residents.

### Element of structure

- a) a member forming part of the structural frame of a building or any other beam or column;
- b) a loadbearing wall or loadbearing part of a wall;
- c) a floor;
- d) a gallery (but not a loading gallery, fly gallery, stage grid, lighting bridge, or any gallery provided for similar purposes or for maintenance and repair);
- e) an external wall; and
- f) a compartment wall (including a wall common to two or more buildings). (However, see the guidance to E3, paragraph E3.3.1.2, for exclusions from the provisions for elements of structure.)

**Emergency lighting** Lighting provided for use when the 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.

**Escape route** Route forming that part of the means of escape from any point in a building to a final exit.

**European Technical Approval** A favourable technical assessment of the fitness for use of a construction product for an intended use, issued for the purposes of the Construction Products Directive by a body authorised by a member State to issue European Technical Approvals for those purposes and notified by that member State to the European Commission.

**European Technical Approvals Issuing body** A body notified under Article 10 of the Construction Products Directive. The details of these institutions are published in the “C” series of the Official Journal of the European Communities.

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

## E Appendix E Definitions

**Exit passageway** A protected passageway connecting a protected stairway to a final exit (exit passageways should be protected to the same standard as the stairway they serve).

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

**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 people from the vicinity of a building so that they are no longer in danger from fire and/or smoke. Windows are not acceptable as final exits.

**Fire damper** Mechanical or intumescent device within a duct or ventilation opening which is operated automatically and is designed to prevent the passage of fire and which is capable of achieving an integrity E classification and/or an ES classification to *BS EN13501-3:2005 +A1:2009* when tested to *BS EN1366-2:1999*. Intumescent fire dampers may be tested to *ISO 10294-5*.

**Fire and smoke damper** Fire damper which when tested in accordance with *BS EN 1366-2:1999* meets the ES classification requirements defined in *BS EN 13501-3:2005 +A1:2009* and achieves the same fire resistance in relation to integrity, as the element of the building construction through which the duct passes. Intumescent fire dampers may be tested to *ISO 10294-2*.

**Fire door** A door or shutter, provided for the passage of people, 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 the term includes a cover or other form of protection to an opening in a

fire-resisting wall or floor, or in a structure surrounding a protected shaft.)

**Firefighting lift** A lift designed to have additional protection, with controls that enable it to be used under the direct control of the fire and rescue service in fighting a fire. (See sections E5.3 to E5.5)

**Firefighting lobby** A protected lobby providing access from a firefighting stair to the accommodation area and to any associated firefighting lift.

**Firefighting shaft** A protected enclosure containing a firefighting stair, firefighting lobbies and, if provided, a firefighting lift, together with its machine room.

**Firefighting stair** A protected stairway communicating with the accommodation area only through a firefighting lobby.

**Fire-resisting (fire resistance)** The ability of a component or construction of a building to satisfy for a stated period of time, some or all of the appropriate criteria specified in the relevant standard test.

**Fire-separating element** Compartment wall, compartment floor, cavity barrier or construction enclosing a protected escape route or a place of special fire hazard.

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

**Flat** A separate and self-contained premises constructed or adapted for use for residential purposes and forming part of a building from some other part of which it is divided horizontally.

**Gallery** A floor or balcony which does not extend across the full extent of a building's footprint and is open to the floor below.

**Glazing** Light transmitting material whether glass or not. The term Glazed shall be construed accordingly.

## E Appendix E Definitions

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

**Habitable room** A room used, or intended to be used, for dwelling purposes (including for the purposes of Part E, a kitchen, but not a bathroom).

**Height (of a building or storey for the purposes of Part E)** Height of a building is measured as shown in Appendix C, Diagram C4 and height of the floor of the top storey above ground is measured as shown in Appendix C, Diagram C6.

**Inner room** Room from which escape is possible only by passing through another room (the access room).

**Live/Work Unit** A flat which is intended to serve as a workplace for its occupants and for people who do not live on the premises.

**Material of limited combustibility** A material performance specification that includes non-combustible materials and for which the relevant test criteria are set out in Appendix A, paragraph A6.

**Means of escape** Structural means whereby [in the event of fire] a safe route or routes is or are provided for people to travel from any point in a building to a place of safety.

**Measurement** Width of a doorway, area, cubic capacity, height of a building and number of storeys, see Appendix C, Diagrams C1 to C7; occupant capacity, travel distance and, escape route and a stair, see Appendix C.

**Non-combustible material** The highest level of reaction to fire performance. The relevant test criteria are set out in Appendix A, section A5.

**Notional boundary** A boundary presumed to exist between buildings on the same site (see section E4.4, Diagram 48).

**Occupancy type** A purpose group identified in Appendix D.

**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. For the purposes of this Document there is a distinction between open spatial planning and an atrium space.

**Perimeter (of a building)** The maximum aggregate plan perimeter, found by vertical projection onto a horizontal plane (see section E5.4, Diagram 54).

**Pipe** (for the purposes of section E3.6) – includes pipe fittings and accessories and excludes a flue pipe and a pipe used for ventilating purposes (other than a ventilating pipe for an above ground drainage system).

**Places of special fire hazard** Oil-filled transformer and switch gear rooms, boiler rooms, storage space for fuel or other highly flammable substances and rooms housing a fixed internal combustion engine.

**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.

**Protected circuit** An electrical circuit protected against fire.

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

**Protected entrance hall/landing** A circulation area consisting of a hall or space in a flat, enclosed with fire-resisting construction (other than any part which is an external wall of a building).

## E Appendix E Definitions

**Protected shaft** A shaft which enables people, air or objects to pass from one compartment to another and which is enclosed with fire-resisting construction.

**Protected stairway (Protected stair)** A stair discharging through a final exit to a place of safety (including any exit passageway between the foot of the stair and the final exit) that is adequately enclosed with fire-resisting construction.

**Purpose group** A classification of a building according to the purpose to which it is intended to be put. See Appendix D, Table D1.

**Relevant boundary** The boundary which the side of the building faces, (and/or coincides with) and which is parallel, or at an angle of not more than 80°, to the side of the building (see section E4.4, Diagram 47). A notional boundary can be a relevant boundary.

**Roof-light** A dome light, lantern light, skylight, ridge light, glazed barrel vault or other element intended to admit daylight through a roof.

**Room** (for the purposes of E2) An enclosed space within a building that is not used solely as a circulation space. (The term includes not only conventional rooms, but also cupboards that are not fittings and large spaces such as warehouses and auditoria. The term does not include voids such as ducts, ceiling voids and roof spaces.)

**School** A place of education for children older than 2 and younger than 19 years. Includes nursery schools, primary schools and secondary schools.

**Self-closing device** A device which is capable of closing the door from any angle and against any latch fitted to the door. Rising butt hinges which do not meet the above criteria are acceptable where the door is in a cavity barrier.

**Separated part** (of a building) A form of compartmentation in which a part of a building is separated from another part of the same building by a compartment wall. The wall runs the full height of the part and is in one vertical plane. (See paragraph E3.4.7.2 and Appendix C, Diagram C5.)

**Separating wall** A wall or a part of a wall which is common to two or more adjoining buildings

**Sheltered housing** includes:

- a) two or more dwellings in the same building;
- b) two or more dwellings on adjacent sites where those dwellings are, in each case, designed and constructed for the purpose of providing residential accommodation for vulnerable or elderly people who receive, or who are to receive, a support service.

**Single storey building** A building consisting of a ground storey only. (A separated part which consists of a ground storey only, with a roof to which access is only provided for repair or maintenance, may be treated as a single storey building). Basements are not included in counting the number of storeys in a building (see Appendix C).

**Site** (of a building) The land occupied by the building, up to the boundaries with land in other ownership.

**Smoke alarm** A device containing, within one housing, all the components, except possibly the energy source, necessary for detecting smoke and giving an audible alarm.

## E Appendix E Definitions

**Storey** includes:

- a) any gallery in an assembly building (Purpose Group 5); and
- b) any gallery in any other type of building if its area is more than half that of the space into which it projects (where there is more than one gallery and the total aggregate area of all the galleries in any one space is more than half of the area of that space then the building should be regarded as being a multi storey building);
- c) a roof, unless it is accessible only for maintenance and repair.

**Storey exit** A final exit, or a doorway giving direct access into a protected stairway, firefighting lobby, or external escape route. A door in a compartment wall in an institutional building is considered as a storey exit for the purposes of E1 if the building is planned for progressive horizontal evacuation.

**Suspended ceiling (fire-protecting)** A ceiling suspended below a floor, which contributes to the fire resistance of the floor. Appendix A, Table A3, classifies different types of suspended ceiling.

**Technical specification** A standard or a European Technical Approval Guide. It is the document against which compliance can be shown in the case of a standard and against which an assessment is made to deliver the European Technical Approval.

**Thermoplastic material** See Appendix A, paragraph A8 1).

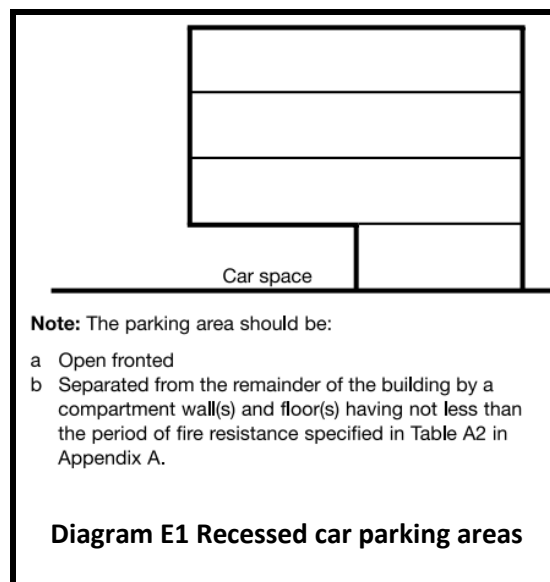
**Travel distance** (unless otherwise specified, e.g. as in the case of flats) The actual distance to be travelled by a person from any point within the floor area to the nearest storey exit, having regard to the layout of walls, partitions and fittings.

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

- a) window, door or other opening (windows that are not openable and

are designed and glazed to provide the necessary level of fire resistance and recessed car parking areas shown in Diagram E1, need not be regarded as an unprotected area);

- b) any part of the external wall which has less than the relevant fire resistance set out in section E4.3;
- c) any part of the external wall which has combustible material more than 1mm thick attached or applied to its external face, whether for cladding or any other purpose. (Combustible material in this context is any material which does not have a Class 0 rating.)



### **Appendix F        Fire behaviour of insulating core panels used for internal structures**

#### **F1        Introduction**

- 1)        Insulating core panel systems are used for external cladding as well as for internal structures. However, whilst both types of panel system have unique fire behaviour characteristics, it is those used for internal structures that can present particular problems with regard to fire spread.
- 2)        The most common use of insulating core panels, when used for internal structures, is to provide an enclosure in which a chilled or sub-zero environment can be generated for the production, preservation, storage and distribution of perishable foodstuffs. However this type of construction is also used in many other applications, particularly where the maintenance of a hygienic environment is essential.
- 3)        These panels typically consist of an inner core sandwiched between and bonded to facings of galvanised steel, often with a PVC facing for hygiene purposes. The panels are then formed into a structure by jointing systems, usually designed to provide an insulating and hygienic performance. The panel structure can be free standing, but is usually attached to the building structure by lightweight fixings or hangers in the case of ceilings.
- 4)        The most common forms of insulation in present use are:
  - polyisocyanurate,
  - mineral fibre,
  - phenolic,
  - polystyrene (cold stores),
  - extruded polystyrene,
  - composite polymers such as syntactic phenolic.

#### **F2        Fire behaviour of the core materials and fixing systems**

- 1)        The degradation of polymeric materials can be expected when exposed to radiated/conducted heat from a fire, with the resulting production of large quantities of smoke.
- 2)        It is recognised that the potential for problems in fires involving mineral fibre cores is generally less than those for polymeric core materials.
- 3)        In addition, irrespective of the type of core material, the panel, when exposed to the high temperatures of a developed fire, will tend to delaminate between the facing and core material, due to a combination of expansion of the metal facing and softening of the bond line.
- 4)        Therefore once it is involved, either directly or indirectly in a fire, the panel will have lost most of its structural integrity. Stability will then be dependent on the method of fixing to the structure.
- 5)        For systems that are not fixed through both facings the stability of the system will then depend on the residual structural strength of the non-exposed facing, the interlocking joint between panels and the fixing system.
- 6)        Most jointing or fixing systems for these systems have an extremely limited structural integrity performance in developed fire conditions. If the fire starts to heat up the support fixings or structure to which they are attached, then there is a real chance of total collapse of the panel system.
- 7)        Where panels are used as the lining to a building the insulating nature of these panels, together with their sealed joints, means that fire can spread behind the panels, hidden from the occupants of occupied rooms/spaces. With some thermoplastic

## E Appendix F Fire behaviour of insulating core panels used for internal structures

cores fire can also spread between the panel facings.

8) This can prove to be a particular problem to firefighters as, due to the insulating properties of the cores, it may not be possible to track the spread of fire, even using infra-red detection equipment. This difficulty, together with that of controlling the fire spread within and behind the panels, is likely to have a detrimental effect on the performance of the fixing systems, potentially leading to their complete and unexpected collapse, together with any associated equipment.

### F3 Firefighting

1) When compared with other types of construction techniques, these panel systems therefore provide a unique combination of problems for firefighters, including:

- hidden fire spread within panels with thermoplastic cores;
- production of large quantities of black toxic smoke;
- rapid fire spread leading to flashover;
- Hidden fire behind lining systems.

2) These characteristics are common to both polyurethane and polystyrene cored panels, although the rate of fire spread in polyurethane cores is significantly less than that of polystyrene cores, especially when any external heat source is removed.

3) In addition, irrespective of the type of panel core, all systems are susceptible to:

- delamination of the steel facing;
- collapse of the system;
- hidden fire spread behind the system.

### F4 Design recommendations

1) To identify the appropriate solution, a risk assessment approach should be adopted. This would involve identifying the potential fire risk within the enclosures formed by the panel systems and then adopting one or more of the following at the design stage:

- removing the risk;
- separating the risk from the panels by an appropriate distance;
- providing a fire suppression system for the risk;
- providing a fire suppression system for the enclosure;
- providing fire-resisting panels;
- specifying appropriate materials/fixing and jointing systems.

2) In summary the performance of the building structure, including the insulating envelope, the superstructure, the substructure etc., must be considered in relation to their performance in the event of a fire.



## E Appendix F Fire behaviour of insulating core panels used for internal structures

### F5 Specifying panel core materials

1) Where at all possible the specification of panels with core materials appropriate to the application will help ensure an acceptable level of performance for panel systems, when involved in fire conditions.

2) The following are examples in the provision of core materials which may be appropriate to the application concerned.

Mineral fibre cores:

- cooking areas,
- hot areas,
- bakeries,
- fire breaks in combustible panels,
- fire stop panels,
- general fire protection.

All cores:

- chill stores,
- cold stores,
- blast freezers,
- food factories,
- clean rooms.

3) Core materials may be used in other circumstances where a risk assessment has been made and other appropriate fire precautions have been put in place.

### F6 Specifying materials/fixing and jointing systems

1) The details of construction of the insulating envelope should, particularly in relation to combustible insulant cores, prevent the core materials from becoming exposed to the fire and contributing to the fire load.

2) The following are methods by which the stability of panel systems may be improved in the event of a fire, although they may not all be appropriate in every case:

- a) Insulating envelopes, support systems and supporting structure should be

designed to allow the envelope to remain structurally stable by alternative means such as catenary action following failure of the bond line between insulant core and facing materials. This particularly relates to ceilings and will typically require positive attachment of the lower faces of the insulant panels to supports.

- b) The building superstructure, together with any elements providing support to the insulating envelope, should be protected to prevent early collapse of the structure or the envelope. Irrespective of the type of panel provided, it will remain necessary to ensure that the supplementary support method supporting the panels remains stable for an appropriate time period under fire conditions. It is not practical to fire protect light gauge steel members such as purlins and sheeting rails which provide stability to building superstructures and these may be compromised at an early stage of a fire. Supplementary fire-protected heavier gauge steelwork members could be provided at wider intervals than purlins to provide restraint in the event of a fire.
- c) In designated high risk areas, consideration should be given to incorporating non-combustible insulant cored panels into wall and ceiling construction at intervals, or incorporating strips of non-combustible material into specified wall and ceiling panels, in order to provide a barrier to fire propagation through the insulant.
- d) Correct detailing of the insulating envelope should ensure that the combustible insulant is fully encapsulated by non-combustible facing materials which remain in place during a fire.

## **E Appendix F    Fire behaviour of insulating core panels used for internal structures**

- e) The panels should incorporate pre-finished and sealed areas for penetration of services.

### **F7    General**

- 1) Generally, panels or panel systems should not be used to support machinery or other permanent loads.
- 2) Any cavity created by the arrangement of panels, their supporting structure or other building elements should be provided with suitable cavity barriers.
- 3) Examples of possible solutions and general guidance on insulating core panels construction can be found in Design, construction, specification and fire management of insulated envelopes for temperature controlled environments published by the International Association of Cold Storage Contractors (European Division).
- 4) Of particular relevance is Chapter 8 of the document which gives guidance on the design, construction and management of insulated structures. Whilst the document is primarily intended for use in relation to cold storage environments, the guidance, particularly in Chapter 8, is considered to be appropriate for most insulating core panel applications.

### Appendix G Fire safety information

#### G1 Introduction

1) Where building work involves the erection, extension or change of use of a building to which this Document applies fire safety information should be given to the responsible person at the completion of the project or when the building or extension is first occupied.

2) Fire safety information means information relating to the design and construction of the building or extension, and the services, fittings and equipment provided in or in connection with the building or extension which will assist the responsible person to operate and maintain the building or extension with reasonable safety.

3) The responsible person means the person who has control of the building and who is responsible for fire safety in the building.

4) This Appendix is only intended as a guide as to the kind of information that should be provided. For clarity the guidance is given in terms of simple and complex buildings, however the level of detail required will vary from building to building and should be considered on a case by case basis.

#### G2 Simple buildings

1) For most buildings basic information on the location of fire protection measures may be all that is necessary. An as-built plan of the building should be provided showing:

- a) escape routes;
- b) compartmentation and separation (i.e. location of fire separating elements, including cavity barriers in walk-in spaces);
- c) fire doors, self-closing fire doors and other doors equipped with relevant hardware (e.g. panic locks);
- d) locations of fire and/or smoke detector heads, alarm call-points, detection/alarm control boxes, alarm

sounders, fire safety signage, emergency lighting, fire extinguishers, dry or wet risers and other firefighting equipment and location of hydrants outside the building;

- e) any sprinkler system(s), including isolating valves and control equipment;
- f) any smoke-control system(s) (or ventilation system with a smoke-control function), including mode of operation and control systems;
- g) any high-risk areas (e.g. heating machinery);
- h) specifications of any fire safety equipment provided, in particular any routine maintenance schedules;
- i) any assumptions in the design of the fire safety arrangements regarding the management of the building;
- j) any provision incorporated into the building to facilitate the evacuation of disabled people. This information can then be used when designing suitable Personal Emergency Escape Plans.

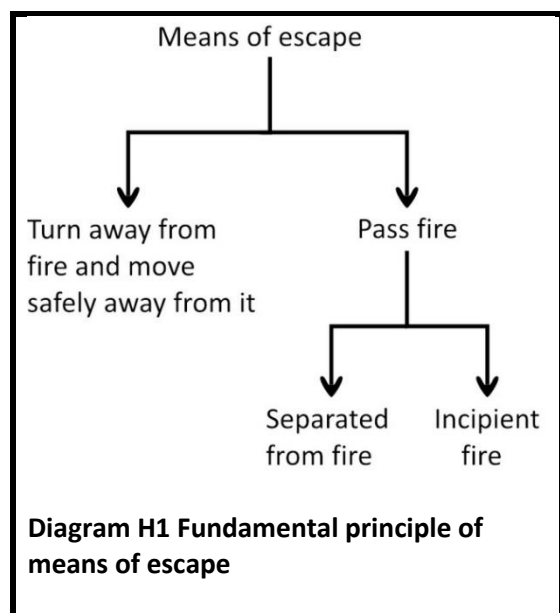
### G3 Complex buildings

- 1) For more complex buildings a more detailed record of the fire safety strategy and procedures for operating and maintaining any fire protection measures of the building will be necessary. Further guidance is available in the fire safety management sections of BS 9999
- 2) These records should include:
  - a) The fire safety strategy, including all assumptions in the design of the fire safety systems (such as fire load). Any risk assessments or risk analysis.
  - b) All assumptions in the design of the fire safety arrangements regarding the management of the building.
  - c) Escape routes, escape strategy (e.g. simultaneous or phased) and muster points.
  - d) Details of all passive fire safety measures, including compartmentation (i.e. location of fire separating elements), cavity barriers, fire doors, self-closing fire doors and other doors equipped with relevant hardware (e.g. electronic security locks), duct dampers and fire shutters.
  - e) Fire detector heads, smoke detector heads, alarm call-points, detection/alarm control boxes, alarm sounders, emergency communications systems, CCTV, fire safety signage, emergency lighting, fire extinguishers, dry or wet risers and other firefighting equipment, other interior facilities for the fire and rescue service, emergency control rooms, location of hydrants outside the building, other exterior facilities for the fire and rescue service.
  - f) Details of all active fire safety measures, including:
    - Sprinkler system(s) design, including isolating valves and control equipment; and
    - Smoke-control system(s) (or HVAC system with a smoke-control function) design, including mode of operation and control systems.
  - g) Any high-risk areas (e.g. heating machinery) and particular hazards.
  - h) As-built plans of the building showing the locations of the above.
  - i) Specifications of any fire safety equipment provided, including operational details, operators manuals, software, system zoning and routine inspection, testing and maintenance schedules. Records of any acceptance or commissioning tests.
  - j) Any provision incorporated into the building to facilitate the evacuation of disabled people.
  - k) Any other details appropriate for the specific building.

### Appendix H Commentaries on fire safety guidance

- 1) The paragraphs that follow are numbered so as to correspond with the paragraphs in the main body that they refer to.
- 2) Commentaries are only provided for certain paragraphs where clarification or background information will be useful. In the main body of the document paragraphs that have commentaries are indicated by asterisks.
- 3) If this Document is being viewed in electronic format there are hyperlinks provided between the paragraphs in the main body of the document and the commentaries in this appendix. Click on paragraph numbers.

**H1.9.1 1)** Diagram H1 illustrates, by means of a simple flow chart, the fundamental principle of means of escape. Everyone in the building should be able to achieve at least one of the three outcomes. If anyone cannot achieve one of these ends then the building cannot be considered safe.



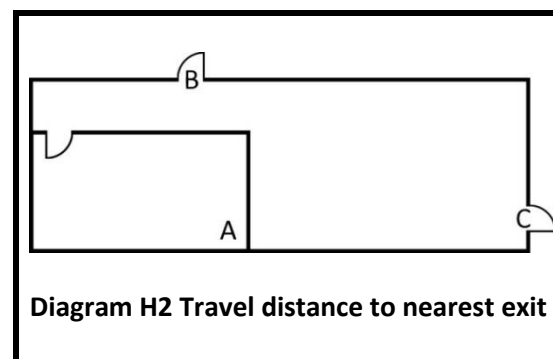
The primary aim of being able to turn away from the fire and move safely away from it can be met by providing suitable alternative exits or staircases.

The aim of being able to pass the fire by being separated from it can be met by providing protected escape routes such as a protected staircase or a protected corridor.

The aim of being able to pass the fire during its incipient phase can be met by limiting travel distances and/or by ensuring that there is good visibility over the escape route such as providing a vision panel from an inner room.

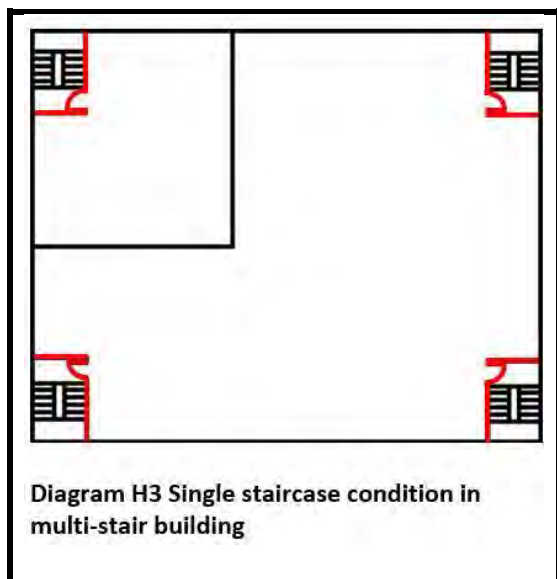
**H1.9.1 2)** Simpler buildings can include quite large buildings but the description does not cover features such as atria or large scale vertical open spatial planning and it does not cover uses such as healthcare, auditoria, shopping malls, prisons, stadia, etc.

**H1.9.2.2)** In Diagram H2 it is the distance from A to B that is of concern. The distance from A to C is of no direct relevance for people in the vicinity of location A. Therefore it is distance A-B that must be compared against the travel distance limit in Table 2 whilst distance A-C need not be checked.



## E Appendix H Fire safety commentaries

### H1.9.2 4)

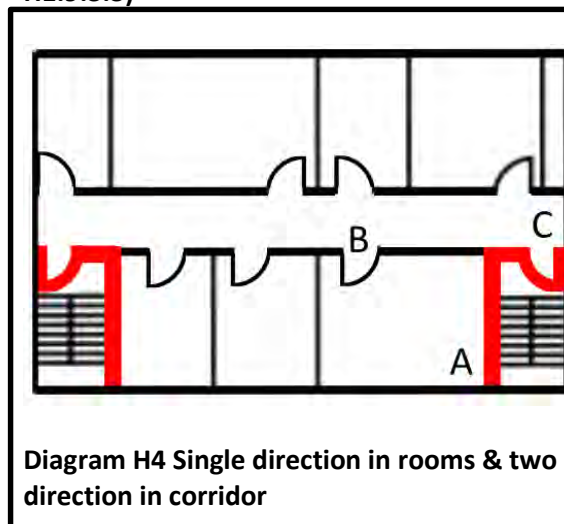


The above layout is acceptable where the applicable floors are no higher than 11m above ground, where there are no more than 60 people in the part of the floor that only has access to the single stair and where the stair has protection suitable for a single staircase.

### H1.9.3 See H1.9.1 1) above.

Note that the first option says that people should be able to turn away from the fire and 'move safely away from it'. This means that not only should there be alternative exits but those alternatives should have sufficient width to allow people to move away at a rate that is fast enough to stop them being in any danger from the fire.

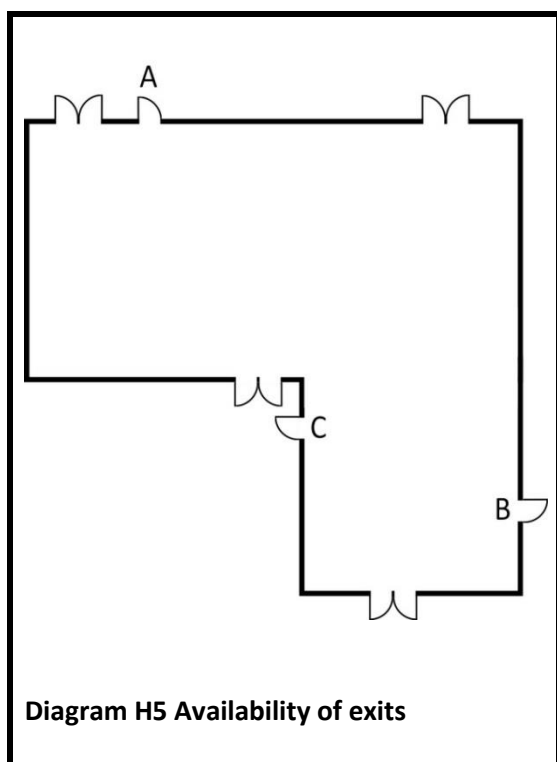
### H1.9.3.3)



In the above diagram, for each room, the distance A-B should be no more than the single direction travel distance limit appropriate for the type of building. The distance A-C should be no more than the two (or more) direction travel distance limit appropriate for the type of building. No specific limitation is set for B-C as this is limited indirectly by limiting A-B and A-C.

**H1.9.4 2)** For example, the premises represented in Diagram H5 may be a nightclub that requires all the exits to be fully available when open to the public. However, when the premises are closed to the public and there are only a small number of staff in the building it might be reasonable to only have exits A, B and C available for use. The other exits may be locked shut for security reasons. To be acceptable, exits A, B and C would have to satisfy travel distance requirements and would have to have sufficient capacity, after discounting the largest, for the number of staff in the building.

## E Appendix H Fire safety commentaries



If numbers are low enough and travel distances are satisfied, it may even be satisfactory to have only exits A and B unlocked.

**H1.9.6 1)** If the building designers state that, for example, their office building will have an occupant density of one person per 10m<sup>2</sup> (Appendix C indicates one person per 6m<sup>2</sup>) then the exits need only be sufficient for the lower density stated by the designers.

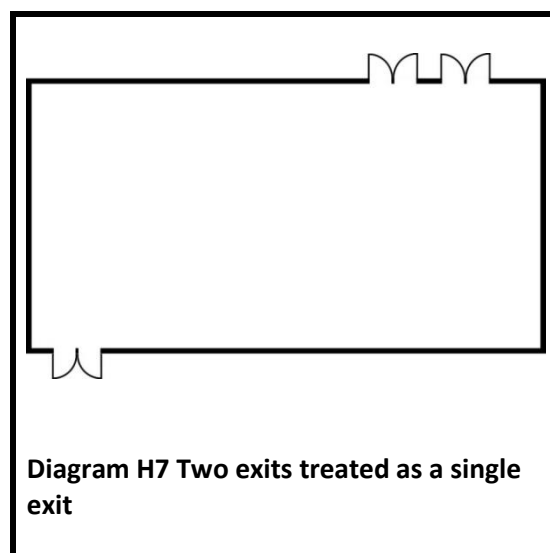
The designers should be warned, however, that in the future the number of people in the building will not be allowed to increase unless the exits have sufficient capacity for the increased number.

**H1.9.6 3)** The 45° rule should only be treated as a 'rule of thumb'. There are factors that affect its applicability. The important issue is whether or not two or more exits might be cut off by a single fire.

For example, a room with a very high ceiling may have exits within 45° of each other but the height of the ceiling might mean that, during the evacuation phase, a fire will have little lateral spread and will not be capable of cutting off both exit routes.

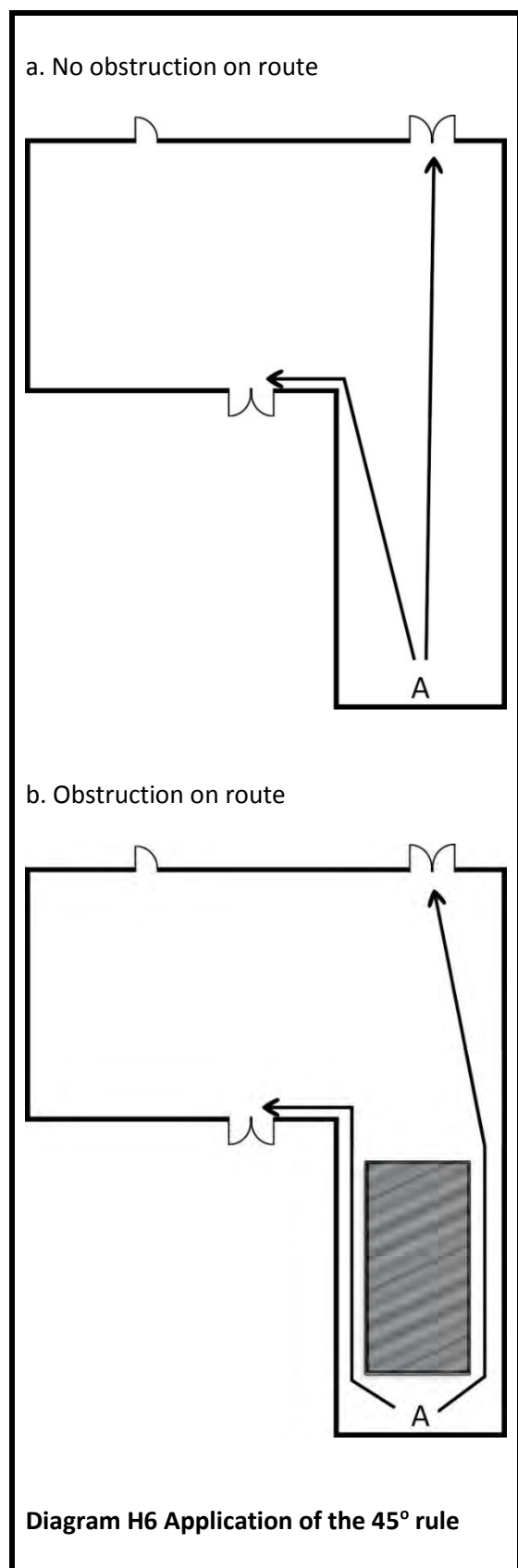
Alternatively, there might be furniture, machinery or fixtures located within the space that affect the routes to the exits and these can make the 45° rule irrelevant. In Diagram H6 it would be wrong to say that situation b. is safer than situation a. even though the directions to the exits from location A are over 45° in b. and less than 45° in situation a.

**H1.9.6 4)** In Diagram H7 the two adjacent exits are within 45° of each other for almost all of the room. Therefore, when discounting the largest exit, the two exits should be discounted together.



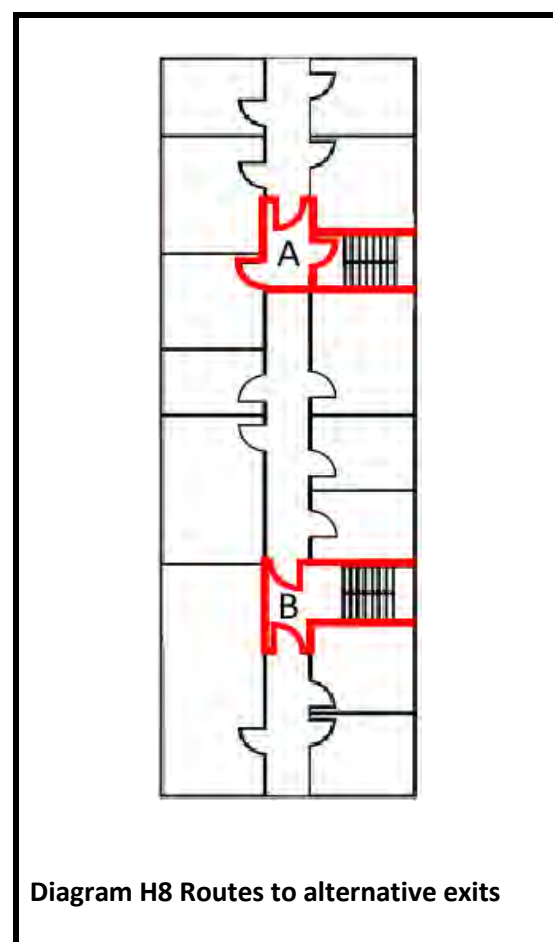
**H1.9.9 3)** The rationale behind accepting a route past a void provided that it is no longer than the single direction travel distance limit is that a void is inherently less dangerous than an actual fire and we accept that someone may have to travel up to that distance limit past a fire and that they can do so safely. There is a proviso to this and that is that there should be automatic smoke detection suitably located to detect fire where the outbreak may not be obvious to the occupants who need to pass the void.





**H1.9.10.1)** This is because the self-closing fire doors are more likely to be rendered ineffective as a result of their constant use, or because some occupants may regard them as an impediment. For example, many doors in this situation are likely to be wedged open or have their closers removed.

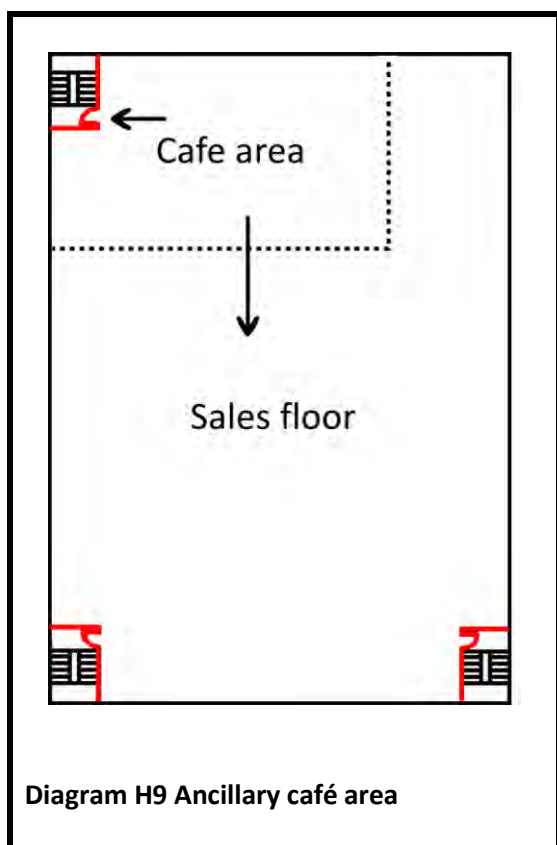
In Diagram H8 the arrangement at location A is acceptable whilst the arrangement at location B is not.



**H1.9.10 2)** This situation is unavoidable in many single staircase buildings and in such cases it is acceptable.

**H1.9.10 3)** Diagram H9 illustrates a typical satisfactory layout with one exit to a protected route and the other across the sales floor. Note that the exit door width to the protected route should be at least large enough to accommodate all occupants of the café area

## E Appendix H Fire safety commentaries



**H1.9.10 9)** Where a room or storey has only one exit it is not possible to discount an exit and this is acceptable because of the limitations that are placed on rooms with a single exit such as travel distance limitations and the restriction to a maximum of 60 people.

**H1.9.11.1)** All protected corridors should be kept free from combustible items.

**H1.9.11 1) b)** When recesses are wide it may be more accurate to treat the corridor as an access room. Either the guidance in BS 9999 can be followed or a judgement can be made about how the space should be treated.

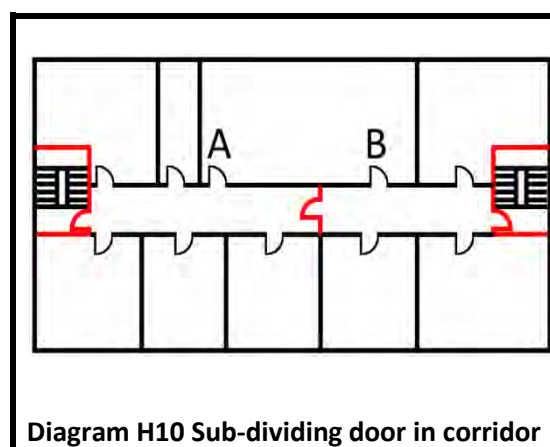
**H1.9.11.2)** Corridors that are not protected need not be kept free of combustibles but if they are used for means of escape then they should not contain obstructions that take their clear width below that width required for escape purposes.

If a corridor either contains combustible items or has a room that has no door then it should

be treated as an access room and the rooms off it as inner rooms.

**H1.9.11 4)** This has a number of effects which benefit people on the fire floor and elsewhere in the building. It roughly halves the probability that any person on the fire floor may be exposed to smoke during their evacuation, it reduces the distance that anyone who is exposed to smoke has to travel through that smoke and it protects the staircase on the side of the corridor away from the fire.

**H1.9.11 5)** In Diagram H10 either door A or door B should be self-closing. It is not necessary for both to be.



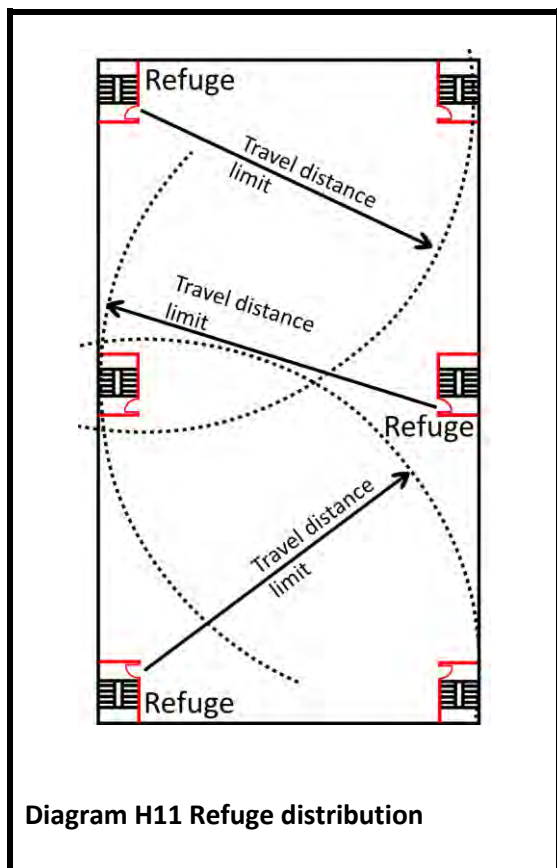
**H1.10.5 2)** If there are more than two staircases then there may not be a need for all of them to have refuges in. For example, in Diagram H11 there are six storey exits but the travel distances are such that the minimum requirement for storey exits is three, as shown (ignoring occupancy numbers).

If the option of having less refuges than storey exits is adopted then there will be a corresponding need for certain fire safety management procedures to be put in place. Personal emergency evacuation plans will have to be designed to cater for the distribution of refuges.

Also, with a reduced number of refuges it will be necessary to ensure that there are

## E Appendix H Fire safety commentaries

sufficient refuges for all the disabled people who may need to use them.



**H1.10.6.3)** As the minimum width for a staircase is 1000mm, if a staircase has a central handrail each side of the handrail has to be at least this wide.

**H1.10.6.4)** As the minimum width for a staircase is 1000mm, if a staircase has a central handrail each side of the handrail has to be at least this wide.

**H1.10.6.3.1)** The guidance on sizing stairs has the primary objective of providing enough room within the staircase enclosure to allow all the occupants of all the floors to evacuate into the staircase within two and a half minutes.

They are not designed with the objective of getting everyone out of the building within any specific timescale.

**H1.10.6.3.3)** No stair should be less than 1000mm wide or more than 1800mm wide. If a stair has to be wider than 1800mm then it needs a central handrail and automatically becomes two stairs. Each of the stairs has to be at least 1000mm wide so the overall width has to be at least 2000mm.

When using Table 6, if a row does not have a figure that is high enough for the proposed number of people (i.e. 1800mm is not large enough to cater for the proposed numbers) this indicates that another stair is required. This extra stair can either be provided elsewhere in the building or it can be provided by widening one of the proposed stairs, installing a central handrail and counting it as two stairs.

If two stairs share a single enclosure and if the staircase enclosure is not lobbied or protected by a pressure differential system then it will be necessary to discount the two stairs together at the stair discounting stage.

**H1.10.6.4.10)** If it is known that different numbers of people will be on different floors then the highest populated floors should be the ones to be taken into account in order to determine stair widths.

If the two highest populated adjacent floors have different populations then it is acceptable to use a storey exit figure that is averaged over the two floors.

For example, if the two highest populated floors have populations of 300 and 200 and if there are two stairs serving these floors then the storey exit figures for each floor are 150 and 100 respectively. These can be averaged to produce the figure of 125 which can then be taken to Table 7 or inserted into the formula to determine the minimum size for the stairs.

Note that there is no need to consider that the location of the fire might stop people being able to use one of the storey exits because when two floors evacuate together

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the fire must be on another floor. This is because the fire floor is evacuated alone.

If the fire is located next to one of the storey exits and none of the people on the fire floor can use that storey exit then this does not require any special consideration as the available stair(s) will have sufficient capacity for the whole population due to the fact that the floor is being evacuated alone.

**H1.9.5 Note 1** Strictly, the 2/3 rule is only true if the door is in the corner of the room and the room is approximately square.

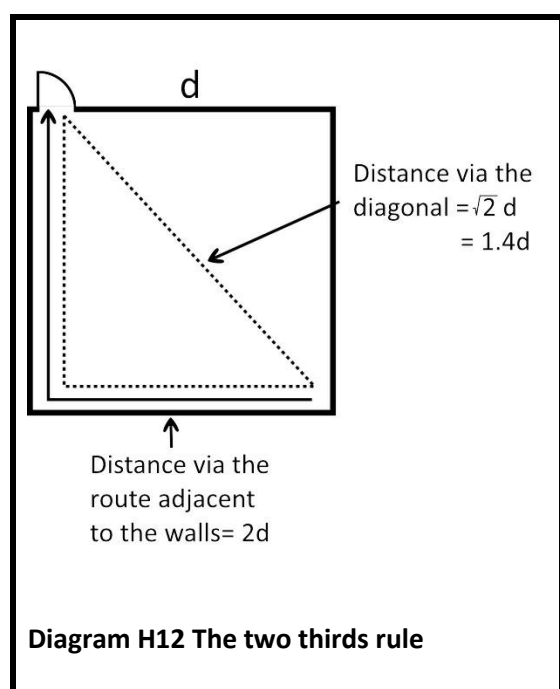


Diagram H12 shows such a room. The length of the side of the room is  $d$ . The actual travel distance from the most remote location is likely to be the length of two sides ( $2 \times d$ ) (assuming obstacles in the centre part of the room that require occupants to walk around them). The direct distance is  $\sqrt{2} \times d$  which is approximately  $1.4 \times d$ .

The ratio of the direct distance to the actual travel distance is  $1.4d/2d = 1.4/2$  and this approximately equals  $2/3$ .

If the room is not square or if the door is not in the corner then this ratio changes.

It is therefore often better to measure the actual travel distance around the walls rather than measuring the direct distance across the diagonal and then dividing it by  $2/3$ . Not only is measuring around the walls more accurate than dividing the direct distance by  $2/3$  but it is often simpler to undertake.

In measuring around the walls realistic assumptions should be made about how far people will be from the walls when walking those routes.

**H1.12** There may be premises that have an area that is smaller than  $280\text{m}^2$  for which this small premises section offers no advantages and it is acceptable in these cases to apply standard conditions (as described elsewhere in this Document).

**H1.12 5)** Note that bars and restaurants with a first floor or a basement may only be included within the definition of small premises if they have a protected escape route from the floor which is not at ground level.

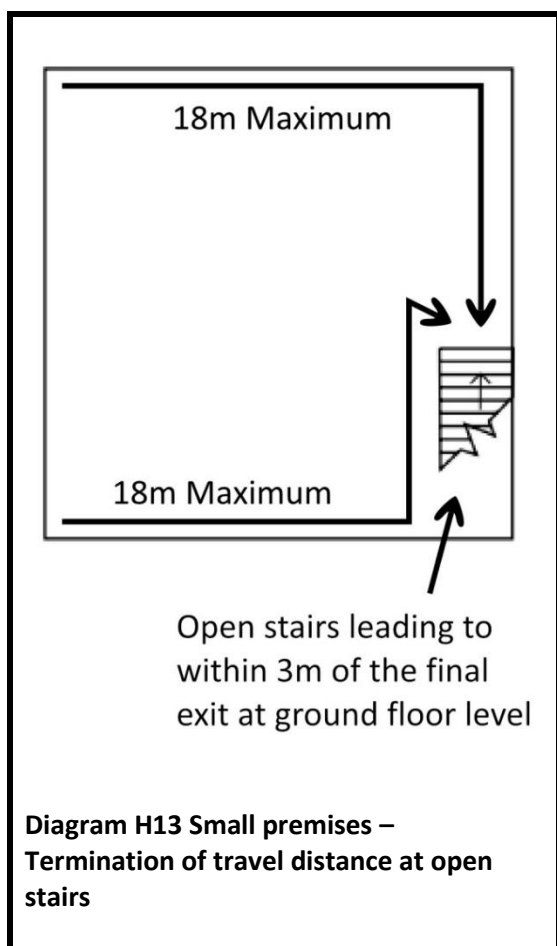
Also see H1.12 above.

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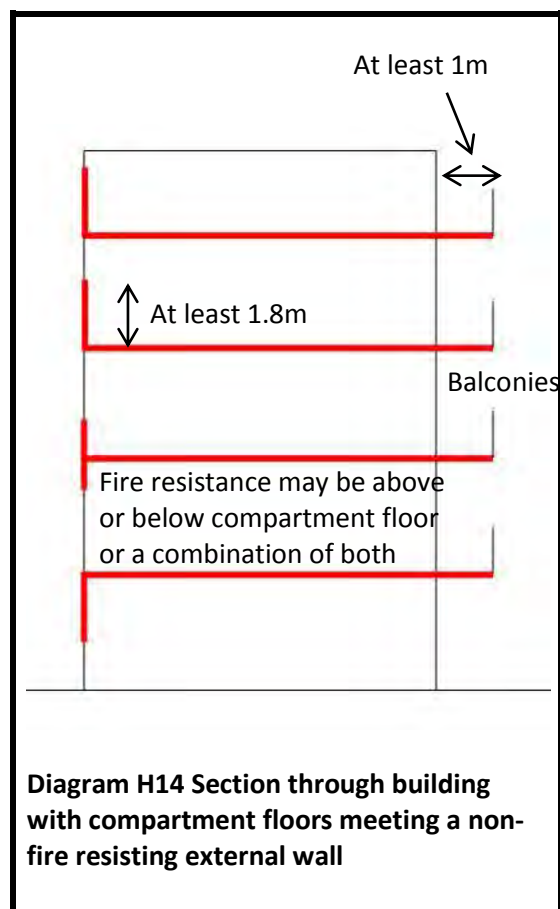
**H1.12 10)** Diagram H13 is applicable to either the first floor or the basement. The travel distance ends at the first step of the open staircase. This should be deemed to be a storey exit for these premises.

Single open staircases are not acceptable for bars or restaurants. These premises, if they qualify as small premises, can have the extended travel distance given in Table 5 at ground floor level but have nothing to gain over standard recommendations at other levels.

Single open stairs are only acceptable where the area of each storey is no more than 90m<sup>2</sup>.



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