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0.1 Application

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Application

0.1

0.1.1 Introduction

The Building (Scotland) Act 2003 gives Scottish Ministers the power to make building regulations to:

- secure the health, safety, welfare and convenience of persons in or about *buildings* and of others who may be affected by *buildings* or matters connected with *buildings*;
- further the conservation of fuel and power; and
- further the achievement of sustainable development.

This document gives guidance on how to comply with these regulations.

This is one of two Technical Handbooks, one covering *domestic buildings* and the other non-domestic *buildings*. These Technical Handbooks have been issued by Scottish Ministers for the purpose of providing practical guidance with respect to the requirements of the provisions of the building regulations under a notice given in accordance with Section 4(2) of the Building (Scotland) Act 2003. Each Handbook has seven sections. Section 0, this section, is identical in both Handbooks. It covers general issues and sets out how and when the regulations apply to *buildings* and *works*.

Both Handbooks are published in three forms, as printed loose leaf sheets with an A4 binder, on a single CD-rom, and on the Building Standards Division website. The 2010 version of the Technical Handbooks will be the last hard copy printed version. However you will be able to download and print off individual parts or sections of the Handbooks and all future amendments and updates will be included on the website.

Sections 1 to 6 give guidance on how to achieve the standards set by the regulations, and there are different sets for *domestic buildings* and non-domestic *buildings*. The six sections each cover a number of related standards. They are:

Section 1	Structure
Section 2	Fire
Section 3	Environment
Section 4	Safety
Section 5	Noise
Section 6	Energy

Each of the six sections consists of an introduction and then guidance on the standards within the section. In the printed version the standard and some introduction information is given on a yellow page, while the guidance on how to comply with the standard is given in the succeeding white pages.

At the end of the Handbook, after section 6, there are the following:

Appendix A: Defined terms.

Appendix B: List of standards and other publications.

A full index (hard copy only as the electronic version has a search facility).

The Technical Handbooks are supported by a Procedural Handbook, published separately, which clarifies the intent of the Building (Scotland) Procedures Regulations 2004. A separate procedural guidance document for Crown *buildings* has also been produced.

0.1.2 The Building (Scotland) Regulations 2004

This Technical Handbook gives guidance on achieving the standards set in the Building (Scotland) Regulations. The standards themselves can be found in schedule 5 to regulation 9, and are in the form of 'expanded functional standards'. That is, the standards describe the functions a *building* should perform, such as 'providing resistance to the spread of fire'.

The Building (Scotland) Regulations made by the Scottish Ministers are subject to approval by the Scottish Parliament. The content of the regulations, so far as it relates to technical specifications, is also scrutinised by the European Commission (EC). The EC checks with all the other countries that have adopted the *Construction Products Directive* (CPD) to ensure that no barriers to trade in *construction* products are created, either directly or indirectly by the way products are described.

To meet the requirements of the CPD, materials and *construction* methods must be described by use of suitable European Standards wherever these exist. As there is a rolling programme of change to these National and European Standards, which includes conversion to, and the further provision of, ENs and harmonised ENs, the Handbooks have been designed to be readily updated. An explanation of the relevance and status of specific European and British standards referred to in the Handbooks is in the section concerned. There is also a list of the publications referred to in the Handbooks provided in Appendix B.

The arrangement of the sections within Handbooks relates directly to the Essential Requirements of the CPD (as published by the EC), which *construction works* are expected to satisfy when they have been properly designed and *built*. The arrangement is as follows:

Section 1	Structure	(EC - Mechanical resistance and stability)
Section 2	Fire	(EC - Safety in case of fire)
Section 3	Environment	(EC - Hygiene, health and the environment)
Section 4	Safety	(EC - Safety in use)
Section 5	Noise	(EC - Protection against noise)
Section 6	Energy	(EC - Energy, economy and heat retention)

0.1.3 The building standards system

The building regulations are enforced through the building standards system also established by the Building (Scotland) Act 2003. This Act sets out the enabling powers that allow the Scottish Ministers to make, not only the building regulations, but also procedural regulations, fees regulations and the other supporting legislation needed to operate the system. The system is designed to ensure that new *buildings* and *works* achieve the objectives of *the Act* in terms of health, safety, welfare, convenience, conservation of fuel and power, and sustainable development.

The roles of those operating the building standards system are explained in detail in the guidance on the procedural regulations. Briefly, the duty to comply with the building regulations lies with the owner, or in some cases the client, for the *work*. Before *work* begins a building warrant must be obtained. For some simpler *works* a warrant is not required (see regulation 5 and schedule 3), but the regulations still apply. The owner or client again has the duty to comply. The role of issuing warrants and accepting completion

certificates rests with verifiers, enforcement is by local authorities, and the system is overseen and updated by the Building Standards Division advised by the Building Standards Advisory Committee. The Building Standards Division forms part of the Directorate for the Built Environment of the Scottish Government and acts on behalf of, and is responsible to, Scottish Ministers. These bodies are further explained in the guidance to the procedural regulations.

The building standards system is pre-emptive, ensuring so far as possible that the proposed *works* will comply with the regulations. It recognises that proposals can change during *construction*, so there are requirements for amendments to the proposals to be agreed and recorded. On completion, the owner or client must certify that the *works* have been *constructed* in accordance with the building warrant and the building regulations. The verifier will make reasonable inquiry to ensure the completion certificate is accurate before accepting the certificate. Usually an inspection of the *works* will be made, and on most projects some inspection of *work* in progress will also have been carried out. However verifiers cannot inspect all materials and *work* on every *building site*. It is the client that should put in place the contractual and practical arrangements needed to assure themselves that the desired quality of *work* has been achieved.

0.1.4 Status of Technical Handbooks

The regulations are mandatory, but the choice of how to comply lies with the *building* owner. This Technical Handbook has been issued by Scottish Ministers, through the Building Standards Division, for the purpose of providing practical guidance with respect to the building regulations. If the guidance is followed in full then this should be accepted by the verifier as indicating that the building regulations have been complied with. However it is quite acceptable to use alternative methods of compliance provided they fully satisfy the regulations.

Failure to comply with the Technical Handbook does not render a person liable to civil or criminal procedures, but proof of compliance with the guidance may be relied on in any proceedings as tending to negative liability for an alleged contravention of the building regulations.

Following the advice in the Technical Handbooks is therefore likely to be the normal way of complying with the building regulations. However a designer may put forward other ways of meeting the regulations, in the form of alternative solutions.

There are a further two guidance documents that Scottish Ministers have issued under Section 4(1) of the Building (Scotland) Act 2003. These are "The guide for practitioners - Conversion of Traditional Buildings", published by Historic Scotland and "The Scottish Building Standards - Technical handbook - Conservatories" published by the Building Standards Division. Both of these documents have the same standing as the Technical Handbooks. The second editions of both of these documents have been amended to take into account recent changes.

In due course other documents may be issued by Scottish Ministers to provide further guidance. Such guidance might deal with specific *building* types, or provide alternative methods of showing compliance with those provided in the Technical Handbooks.

0.1.5 Alternative solutions

The use of expanded functional standards, backed up by detailed guidance, provides a flexible system of control. Consideration of alternative solutions is assisted by the expansion of the functional standards previously used in the building standards regulations to clarify the necessary properties of each *building*. The need for a formal relaxation of standards is reduced as meeting the full details of given solutions is no longer mandatory. The professional judgment of the verifier, assisted by guidance on questions referred to Scottish Ministers, through the Building Standards Division, decides whether a standard is met.

In considering alternative solutions, however it is necessary to have regard to the details of this guidance. Where performance standards or policy statements are given, every part of the solution is expected to meet them. As a result, alternative solutions that appear suitable may not be acceptable in detail. For example, some of the solutions offered in relation to the English and Welsh building regulations, in the 'Approved Documents' (ADs), are not suitable because the levels of thermal insulation recommended are not the same. Similarly different approaches are taken to the control of fire size and the design of *compartmentation* which means that *constructions* meeting the AD on fire safety may not be acceptable. This will vary in time as both ADs and the Scottish Technical Handbooks are updated. Solutions based on other documents, such as British or European Standards, will have to be carefully evaluated to see if the Scottish standards are being met in an appropriate manner.

0.1.6 Domestic and non-domestic buildings

Where any *building* contains both domestic uses and non-domestic uses, the appropriate parts from each Technical Handbook will need to be used to ensure the standards are complied with in full, for example a caretakers *flat* in an *office building*. However communal *rooms* or other areas in a block of *dwelling*s that are exclusively associated with the *dwelling*s should be considered using the domestic guidance. Examples of this might be a *room* used as an *office* for the operation of a *sheltered housing complex* or a lounge communal to a block of *dwelling*s. It is also a general principle that where a *building* or part of a *building* might be seen as falling into more than one category it should be designed to meet the most stringent recommendations.

0.1.7 Latest changes

The following is a summary of the changes which have been introduced since 1 May 2009. Very minor changes to text have not been included here.

0.1.4 References to guidance documents added.

0.5.2 Schedule 3. Type 2A - description amended.

0.8.4 BS EN's updated.

0.1.8 Updating

It is intended that this Technical Handbook will be updated. At that time replacement pages will be published for any guidance which has been altered. It is not expected that the standards themselves will change regularly as these are set in the building regulations and can only be changed with Parliamentary approval. Therefore it is anticipated that it is only the white pages in sections 1-6, rather than the yellow pages, which will be replaced regularly. It is expected that many users will wish to download the

replacements from the Building Standards Division website (www.scotland.gov.uk/topics/built-environment/building/building-standards) where they will be available free of charge. It is intended that this edition of the Technical Handbooks will be the last printed version available.

To facilitate such updating, the pages in this Handbook are not numbered and reference to particular parts is provided through the system of section and clause numbers. The section and standard numbers are identical for both the domestic and non-domestic Handbooks. The clause numbers differ between the two Handbooks.

Every page is provided with a header/footer which records:

- domestic/non-domestic;
- section;
- standard;
- date of issue;
- clause number.

By providing this on each page it should be possible to copy particular pages independently and still be certain of their place in the appropriate Handbook.

0.1.9 Arrangement of section 0

Section 0 is arranged to follow the actual regulations. This sub-section provides an introduction to the building standards system. Sub-section 0.2 covers regulations 1 and 2 which are the citation, commencement and interpretation. Sub-sections 0.3 to 0.15 cover the significant technical regulations with each sub-section setting out and discussing the regulation with the same number (sub-section 0.3 covering regulation 3 etc.). Regulation 16 establishes which regulations cannot ever be relaxed by Scottish Ministers. These are the regulations on citation and commencement, interpretation, exempted *buildings*, *work* not requiring a warrant and the methods of measurement. Regulation 17 was introduced in 2007 to help with the implementation of the Energy Performance of Buildings Directive.

0.1.10 Certification

Scottish Ministers can, under Section 7 of the Building (Scotland) Act 2003, approve schemes for the certification of design or *construction* for compliance with the mandatory functional standards. Such schemes are approved on the basis that the procedures adopted by the scheme will take account of the need to co-ordinate the *work* of various designers and specialist contractors. Individuals approved to provide certification services under the scheme are assessed to ensure that they have the qualifications, skills and experience required to certify compliance for the *work* covered by the scope of the scheme. Checking procedures adopted by Approved Certifiers will deliver design or installation reliability in accordance with legislation.

0.2 Citation, commencement and interpretation

- 0.2.1 Explanation of Regulation 1
- 0.2.2 Explanation of Regulation 2

regulation

2

mandatory

Regulation 2 sets out the defined terms within the regulations. It is not reproduced in section 0; instead the terms have been incorporated in the list of defined terms which form Appendix A.

0.2.1 Explanation of Regulation 1

Regulation 1 is not reproduced above but contains the citation and commencement of the building regulations. They apply to *buildings* and *works* as defined in the Building (Scotland) Act 2003, other than *works* exempted by regulation 3, schedule 1. The full text is:

Regulation 1

These regulations may be cited as the Building (Scotland) Regulations 2004 and shall come into force on 1 May 2005.

The Act defines a *building* as any structure or erection, whether temporary or permanent. This is very wide, but there are exceptions in *the Act* for:

- any *public road* (including any bridge on which the *road* is carried);
- any *private road* (bridges on *private roads* are not excluded in *the Act*);
- any sewer or water main vested in Scottish Water;
- any aerodrome runway;
- any railway line;
- any large raised reservoir within the meaning of the Reservoirs Act 1975;
- any wires and cables, their supports above ground and other apparatus used for telephonic or telegraphic communications.

The term *building* is, subject to context, taken to include a prospective *building*, a part of a *building* and, for extensions, alterations and *conversions*, it can mean the extension alone or the part subject to alteration or *conversion*. *Works* in relation to a *building* is defined in *the Act* as including *works* carried out in relation to the enclosure and preparation of the *site*. *Works* therefore includes all *construction*, demolition and *conversion work*, the provision of services fittings and equipment, and any *work* carried out in relation to the *site*.

The Building (Scotland) Regulations 2004 apply to all *buildings* and *works* where an application for warrant is made on or after 1 May 2005. In the case of a Crown *building*, the regulations apply to all *buildings* and *work* where an application for warrant is made on or after 1 May 2009. However full exemption from the *building* standards system is provided for defence and national security *buildings* in legislation under The Building (Scotland) Act 2003 (Exemptions for Defence and National Security) Order 2009, SI 2009 No.822 (S.6).

The Building (Scotland) Act 2003 (Commencement No.2 and Transitional Provisions) Order 2009 allows *work* to Crown *buildings* that has started prior to 1 May 2009 to continue with immunity from *building* regulations. In addition, *work* carried out pursuant to a contract entered into prior to 1 May 2009 will continue with immunity on the basis that *work* commenced before 1 November 2009. In both cases, *work* must be complete before 1 May 2012.

Buildings and *works* related to earlier warrant applications or exempt *works* commencing before 1 May 2005 are subject to previous building standards and procedure regulations, in particular the time by when these *works* must be completed. Previously exempt *works*, in particular any no longer exempt, must have been completed by 2 September 2005, otherwise the exemption falls and a warrant for any outstanding *work* may be required.

On completion of the *works*, before the period specified in the building warrant expires, a completion certificate must be submitted. If a completion certificate is submitted for *work* done without a warrant, the regulations that are applicable are those in force at the time of submission of the certificate, which may well be more onerous than those which would have applied when the *work* started. Fuller details of the arrangements for submitting warrant applications and completion certificates will be given in the guidance on the procedure regulations.

The building regulations also incorporate requirements previously set in separate Building Operations Regulations (regulations 13-15). These cover the provision of protective *works*, clearing of footpaths and securing of unoccupied *buildings*.

The following is a list of all amendments made to the Building (Scotland) Regulations 2004, together with the date they came into force and a summary of the major changes.

The Building (Scotland) Amendment Regulations 2006 (1 May 2007)

- New regulation 17 inserted to implement the terms of Article 9 of EPBD regarding the inspection of air conditioning systems.
- Schedule 1 - changes to *building* types 1 and 20.
- Schedule 3 - changes to *building* types 1,2,5,6 and 19.
- Schedule 5 - minor changes to functional standards. New functional standards 6.9 and 6.10.

The Building (Scotland) Amendment Regulations 2007 (28 March 2007)

- Replacement Schedule 2 for that contained in 2006 amendments.
- Schedule 5 - minor changes to functional standards 6.9 and 6.10.

The Building (Scotland) Amendment Regulations 2008 (4 January 2009)

- Minor changes to reflect requirements of energy performance certificates.

The Building (Scotland) Amendment Regulations 2009 (1 May 2009)

- Schedule 1 - change to paved areas or hardstanding exempt from regulations 8-13.
- Schedule 3 - amended to include certain Crown *buildings*.

The Building (Scotland) Amendment Regulations 2010 (1 October 2010)

- Schedule 3 - rewording of *building* type 2A.
- Schedule 5 - minor changes to several functional standards. Re-write of functional standard 5.1 and new functional standard 5.2.

0.2.2 Explanation of Regulation 2

Regulation 2 sets out the defined terms within the regulations. It is not reproduced in section 0, instead the terms have been incorporated in the list of defined terms which form Appendix A. The Appendix also includes definitions from the Building (Scotland) Act 2003 and those used in these Technical Handbooks.

All of the terms defined above, including those from the regulations, are in italics throughout the Handbooks.

In the determination of the description of a *building*, any use which is ancillary to another use or which is of a minor nature should be disregarded and the *building* taken to be that of the principal description. Minor uses within the *curtilage* of a *dwelling* may also be disregarded, for example a single-room *office* for use by up to two people. Notwithstanding the above, parts of a *building* may be considered to be of a separate description where the context requires (for example a caretakers *flat* should be taken separately from any other part of the *building* in which it is located).

A *dwelling* may include any surgeries, consulting *rooms*, *offices* or other accommodation, of a floor area not exceeding in the aggregate 50 square metres, forming part of the *dwelling* and used by an occupant of the *dwelling* in a professional or business capacity. A *dwelling* may provide bed and breakfast facilities provided this does not exceed two double bedrooms and is not in use for more than half of the year.

Where further guidance on *building* types is needed to define the proposals for particular *buildings*, it is included in the relevant section.

0.3 Exempted buildings and services, fittings and equipment

0.3.1 Explanation

0.3.2 Schedule 1

regulation

3

mandatory

- (1) **Regulations 8 to 12 shall not apply to any *building* or any services, fittings and equipment the whole of which falls into any one or more of the exempted types described in schedule 1.**
- (2) **The provision of:**
 - (a) **services, fittings and equipment to, or the demolition or removal of, exempted *buildings* is exempt; and**
 - (b) **services, fittings and equipment to, or the demolition of, exempted services, fittings and equipment is exempt.**
- (3) **For the purposes of this regulation, for the avoidance of doubt, each such exempted type does not include any of the exceptions expressed in relation to that type.**

0.3.1 Explanation

Regulation 3 and schedule 1 set out what *buildings* and *work* are exempted from the building regulations. The general principles applied to establish exemption are that the regulations do not need to apply where:

- other legislation covers the *buildings* or *work* (types 1 - 3);
- the *buildings* or *work* are covered by another regulation (type 4);
- the *buildings* or *work* are not normally frequented by people (types 5 - 8);
- the *buildings* or *work* are so separated that the regulations are largely inappropriate, and are likely in any case to be supervised by specialists including civil engineers (types 9 - 12);
- the *buildings* or *work* are sufficiently minor that they have little or no impact on the public interest and it is not in the public interest to seek to enforce the regulations (types 13 - 15 and 17 - 21);
- the *buildings* or *work* are temporary (type 16).

Particular care is necessary where exempted *work* is in the vicinity of, or attached to, an existing *building*. The level of compliance of the existing *building* with building regulations should not be adversely affected when exempt *works* are undertaken.

Where exempt *work* requires that alteration is made to an existing *building* to maintain the level of compliance with building regulations, a building warrant may be required. For example where it is intended to *construct* a *porch*, which falls within type 18, over an accessible entrance and a new accessible entrance is required.

0.3.2 Schedule 1

Exempted buildings and services, fittings and equipment

	Type	Description	Exception
Buildings etc. controlled by other legislation	1.	Any <i>building</i> in which explosives are manufactured or stored under a licence granted under the Manufacture and Storage of Explosives Regulations 2005.	
	2.	A <i>building</i> erected on a <i>site</i> which is subject to licensing under the Nuclear Installations Act 1965.	A <i>dwelling, residential building, office, canteen</i> or visitor centre.
	3.	A <i>building</i> included in the schedule of monuments maintained under section 1 of the Ancient Monuments and Archaeological Areas Act 1979.	A <i>dwelling</i> or <i>residential building</i> .
Protective works	4.	Protective <i>works</i> subject to control by regulation 13.	
Buildings or work not frequented by people	5.	A <i>building</i> into which people cannot or do not normally go.	A <i>building</i> within 6 metres or the equivalent of its height (whichever is the less) of the <i>boundary</i> . A wall or fence. A tank, cable, sewer, drain or other pipe above or below ground for which there is a requirement in these regulations.
	6.	Detached fixed plant or machinery or a detached <i>building</i> housing only fixed plant or machinery, the only normal visits to which are intermittent visits to inspect or maintain the fixed plant or machinery.	A <i>building</i> within 1 metre of a <i>boundary</i> .
Agricultural and related buildings	7.	An <i>agricultural greenhouse</i> or other <i>building</i> of mainly translucent material used mainly for commercial growing of plants.	A <i>building</i> used to any extent for retailing (including storage of goods for retailing) or exhibiting.
	8.	A single-storey detached <i>building</i> used for any other form of <i>agriculture, fish farming</i> or forestry.	A <i>building</i> used to any extent for retailing (including storage for retailing) or exhibiting. A <i>building</i> exceeding 280 square metres in area. A <i>building</i> within 6 metres or the equivalent of its height (whichever is the less) of a <i>boundary</i> . A <i>dwelling, residential building, office, canteen</i> or visitor centre. A dungstead or farm effluent tank.

	Type	Description	Exception
Works of civil engineering construction	9.	A <i>work</i> of civil engineering <i>construction</i> , including a dock, wharf, harbour, pier, quay, sea defence work, lighthouse, embankment, river work, dam, bridge, tunnel, filter station or bed, inland navigation, reservoir, water works, pipe line, sewage treatment works, gas holder or main, electricity supply line and supports, any bridge embankment or other support to railway lines and any signalling or power lines and supports, and a fire practice tower.	A bridge or tunnel forming part of an <i>escape route</i> or an access route provided to meet a requirement of these regulations. A private sewage treatment works provided to meet a requirement of these regulations.
Buildings of a specialist nature	10.	A <i>building</i> essential for the operation of a railway including a locomotive or carriage shed, or for the operation of any other <i>work</i> of civil engineering contained in type 9 of this schedule and erected within the <i>curtilage</i> of such a railway or <i>work</i> .	A signalling and control centre for a railway or dock. A <i>building</i> to which the public is admitted, not being a <i>building</i> exempted by type 11 of this schedule. A <i>dwelling</i> , <i>residential building</i> , <i>office</i> , canteen, or warehouse.
	11.	A single- <i>storey</i> detached <i>road</i> or rail passenger shelter or a telephone kiosk which in so far as it is glazed complies with the requirements of regulation 9 and paragraph 4.8 of schedule 5.	A <i>building</i> having a floor area exceeding 30 square metres. A <i>building</i> containing a fixed combustion appliance installation.
	12.	A caravan or mobile home within the meaning of the Caravan Sites and Control of Development Act 1960, or a tent van or shed within the meaning of section 73 of the Public Health (Scotland) Act 1897.	Any <i>wastewater</i> disposal system serving a <i>building</i> of this type.
Small buildings	13.	A detached single- <i>storey building</i> having an area not exceeding 8 square metres.	A <i>dwelling</i> or <i>residential building</i> . A <i>building</i> ancillary to and within the <i>curtilage</i> of a <i>dwelling</i> . A <i>building</i> within 1 metre of a <i>boundary</i> . A <i>building</i> containing a fixed combustion appliance installation or <i>sanitary facility</i> . A wall or fence.
Construction & development buildings	14.	A <i>building</i> used only by people engaged in the <i>construction</i> , demolition or repair of any <i>building</i> or structure during the course of that <i>work</i> .	A <i>building</i> containing sleeping accommodation.

	Type	Description	Exception
Temporary buildings	15.	A <i>building</i> used in connection with the letting or sale of any <i>building</i> under <i>construction</i> until such time as the letting or sale of all related <i>buildings</i> is completed.	A <i>building</i> containing sleeping accommodation.
	16.	A <i>building</i> which, during any period of 12 months, is either erected or used on a <i>site</i> – a. for a period not exceeding 28 consecutive days; or b. for a number of days not exceeding 60, and any alterations to such <i>buildings</i> .	
Buildings ancillary to houses	17.	A detached single- <i>storey building</i> ancillary to and within the <i>curtilage</i> of a <i>house</i> .	A <i>building</i> exceeding 8 square metres in area. A <i>building</i> within 1 metre of the <i>house</i> unless it is at least 1 metre from any <i>boundary</i> . A <i>building</i> containing sleeping accommodation. A <i>building</i> containing a <i>flue</i> , a fixed combustion appliance installation or <i>sanitary facility</i> . A wall or fence.
	18.	A single- <i>storey building</i> attached to an existing <i>house</i> , which is ancillary to the <i>house</i> and consists of a <i>conservatory</i> or <i>porch</i> which insofar as it is glazed complies with the requirements of regulation 9 and paragraph 4.8 of schedule 5.	A <i>building</i> exceeding 8 square metres in area. A <i>building</i> containing a <i>flue</i> , a fixed combustion appliance installation or <i>sanitary facility</i> . A <i>building</i> within 1 metre of a <i>boundary</i> .
	19.	A single- <i>storey building</i> which is detached, or is attached to an existing <i>house</i> and which is ancillary to the <i>house</i> and consists of a <i>greenhouse</i> , <i>carport</i> or <i>covered area</i> .	A <i>building</i> exceeding 30 square metres in area. A <i>building</i> containing a <i>flue</i> , a fixed combustion appliance installation or <i>sanitary facility</i> .
Buildings ancillary to flats or maisonettes	20.	A detached single- <i>storey building</i> ancillary to and within the <i>curtilage</i> of a <i>flat</i> or <i>maisonette</i> .	A <i>building</i> exceeding 8 square metres in area. A <i>building</i> within 1 metre of the <i>flat</i> or <i>maisonette</i> or within 3 metres of any other part of the <i>building</i> containing the <i>flat</i> or <i>maisonette</i> . A <i>building</i> within 1 metre of a <i>boundary</i> . A <i>building</i> containing a <i>flue</i> , a fixed combustion appliance installation or <i>sanitary facility</i> . A wall or fence. A swimming pool deeper than 1.2 metres.

	Type	Description	Exception
Paved areas	21.	A paved area or hardstanding.	A paved area or hardstanding exceeding 50 square metres in area. A paved area forming part of an access to meet a requirement of these regulations.

0.4 Changes in the occupation or use of a building that cause the regulations to apply

- 0.4.1 Explanation
- 0.4.2 Schedule 2

regulation

4

mandatory

For the purposes of section 56(1) of *the Act* and these regulations, the changes in occupation or use of *buildings* set out in schedule 2 shall be *conversions* to the extent specified by regulation 12.

0.4.1 Explanation

The building regulations always apply where *construction* occurs, unless exempted by regulation 3, and *construction* includes alterations and extensions as well as entirely new *buildings*. When there is a *conversion* it will be necessary to seek a warrant and possibly to undertake *works* to improve the standards of the *building*, or part of the *building*, concerned.

Regulation 4 and schedule 2 set out what changes of occupation or use of a *building* are defined as *conversions* and for which the owner must obtain a warrant before making the change. The warrant for a *conversion* will only be granted if the standards set out in regulation 12 are achieved and this might well require *building works*.

Those changes of use or occupation listed in schedule 2 are those which are considered critical due to the risks involved. They relate to:

- a. *domestic buildings*, for example:
 - a hotel to a *dwelling* (type 1);
 - use of an attic space as a *room* within a *dwelling* (type 1);
 - use of a garage attached to a *dwelling* as a *room* (type 2);
 - sub-division of a *house* into two *flats* (type 3);
 - use of a *house* as *shared residential accommodation* (type 4);
- b. *residential buildings*, for example:
 - use of a hotel as *office* (type 5);
 - use of a hotel as a residential care home (type 6);
 - use of *offices* as a backpackers hostel (type 7);
- c. whether a *building* falls within the exemptions of schedule 1, for example:
 - use of a railway signal box as a *house* (type 8);
- d. public access to *buildings*, for example:
 - development of a retail trade in a *storage building* (type 9);
- e. division of a *building* into different occupancies, for example:
 - use of a single *shop* to provide space for two different occupancies (type 10).

Type 6 in schedule 2 refers to the significant alterations in the type and the number of expected occupants. A significant alteration of type could be considered to occur when there was a significant change in the mobility, the familiarity with *building*, or the awareness of danger, of the occupants. For example, significantly different types would include:

- patients receiving care and/or treatment in a residential care home/*hospital*;
- children in a residential institution or residential school;
- guest in a hotel;
- people held in lawful detention.

A significant alteration in number could be considered to occur where it amounted to an increase greater than 25%.

Type 9 in schedule 2 refers to allowing access by the general public where previously there was none. Access by the general public refers to permitting members of the general public to enter a *building* during opening hours and allowing them to access all parts of the *building*, other than those parts restricted to staff only.

For *conversions* it is the intention that the standards achieved in the *converted building* should be broadly similar to those achieved by entirely new *buildings*. Schedule 6 to regulation 12 guides the verifier as to where discretion is expected to be necessary. It identifies those standards where it is not expected to be *reasonably practicable* to have existing *buildings* fully comply. However for these standards improvement of the existing *building* is expected where it is *reasonably practicable*. This means that matters such as thermal insulation now have to be improved even if meeting the full standard is not practically achievable. Guidance on what is normally *reasonably practicable* is given in schedule 6 and in the individual sections. Guidance is also given on the treatment of historic *buildings*.

It is also relevant that the requirements of other legislation, for example regulations made under Health and Safety at Work or licensing legislation, will apply to changes of use, so that risk assessments of changed circumstances will provide protection to the occupants of *buildings*.

0.4.2 Schedule 2

Conversions to which the regulations apply

Type	Conversion
1.	Changes in the occupation or use of a <i>building</i> to create a <i>dwelling</i> or <i>dwellings</i> or a part thereof.
2.	Changes in the occupation or use of a <i>building</i> ancillary to a <i>dwelling</i> to increase the area of human occupation.
3.	Changes in the occupation or use of a <i>building</i> which alters the number of <i>dwellings</i> in the <i>building</i> .
4.	Changes in the occupation or use of a <i>domestic building</i> to any other type of <i>building</i> .
5.	Changes in the occupation or use of a <i>residential building</i> to any other type of building.
6.	Changes in the occupation or use of a <i>residential building</i> which involve a significant alteration to the characteristics of the persons who occupy, or who will occupy, the <i>building</i> , or which significantly increase the number of people occupying, or expected to occupy, the <i>building</i> .
7.	Changes in the occupation or use of a <i>building</i> so that it becomes a <i>residential building</i> .
8.	Changes in the occupation or use of an exempt <i>building</i> (in terms of schedule 1) to a <i>building</i> which is not so exempt.
9.	Changes in the occupation or use of a <i>building</i> to allow access by the public where previously there was none.
10.	Changes in the occupation or use of a <i>building</i> to accommodate parts in <i>different occupation</i> where previously it was not so occupied.

0.5 Buildings, work, services, fittings and equipment not requiring a warrant

0.5.1 Explanation
0.5.2 Schedule 3

regulation

5

mandatory

For the purposes of section 8(8) of *the Act*, any *work* which consists solely of a *building* or *conversion*, including the provision of services, fittings or equipment, of a kind specified in schedule 3, shall meet the standards required by regulations 8 to 12 but shall not, subject to the exceptions and conditions, require a warrant.

0.5.1 Explanation

Regulation 5 and schedule 3 specifies what *work* can be done without the need to obtain a building warrant. However such *work* must still comply with the regulations.

Building type 1

In particular, type 1 means much more *work* to or in *houses* does not need a warrant. This could include:

- *work* external to, but immediately adjoining, the *house* (e.g. patio, decking, wall, fence, steps or ramp);
- small penetrations of the *external walls* or roof (e.g. balanced *flues*, sanitary pipework, mechanical extract *ducts* or vent pipes);
- small attachments to the *external walls* (e.g. canopies or micro-renewables);
- erection, demolition or alteration of non-loadbearing partitions;
- electrical *work*;
- an en-suite bathroom or shower *room* (including associated drainage);
- a central heating system.

The exceptions are intended to safeguard against changes that might have significant effect, such as the removal of structural walls. The following list provides some examples of the various exceptions:

- increasing the floor area of the *house* (e.g. creation of a mezzanine floor or the infill of a stair well);
- demolition or alteration of the roof (e.g. forming a dormer window or *construction* of a masonry *chimney* through the roof);
- demolition or alteration of the *external walls* (e.g. slapping a new window or door, applying insulation to the *external wall* surface);
- demolition or alteration of an *element of structure* (e.g. removal of a loadbearing wall);
- *work* adversely affecting a *separating wall* (e.g. installing recessed electrical sockets);
- *work* involving a change to *wastewater* discharge (e.g. disconnection from the mains system).

The exception about increasing the floor area applies because there will be significant implications arising from such *work*. Other changes, such as the development of a *roof space* or a garage as habitable space are *conversions* in terms of regulation 4, a warrant is required and the standards also apply. Where a *roof space* has limited boarding inserted to allow access to services or to allow attic storage, or where the removal of a non-loadbearing wall creates a marginal increase in floor area these should not be considered as increasing the floor area.

Building type 2

Buildings, other than *domestic buildings* or *residential buildings*, where the public are not normally admitted are granted a similar concession in type 2, allowing many *offices* and factories for example, to make the kind of small alterations necessary to accommodate changes in production or process. Again however the *building work* done should be to the standard of the building regulations. Exemptions have been added under type 2 to recognise security concerns relating to a prison, a *building* where a person may be legally detained or legally held in custody, the Scottish Parliament and property owned by Her Majesty in right of Her private estates.

Thus, types 1 and 2 permit virtually any *work* to be carried out to 1 or 2 *storey houses* and to non-domestic *buildings* not more than 7.5 m high, other than the exceptions listed.

Building types 3 - 23

However the broad types described above are followed by types 3 to 23 covering more specific *work* that can be carried out to a wider range of *buildings* without restricting the *work* allowed by types 1 and 2. Types 3 to 23 begin with small *buildings*, particularly those within the *curtilage* of *dwellings* (types 4 and 5). Note that some of these may now be in the *curtilage* of *flats* or *maisonettes* provided they are a sufficient distance from the *dwellings*. A *sanitary facility* should not be considered to be a wet-floor shower *room* and such *work* is not intended to be covered by type 11.

Building types 24 - 26

Types 24 to 26 are different in that they cover *work* that is closer to a repair than new *work*. These replacements are therefore required to be to a standard no worse than the existing, rather than to the standard for completely new *work*.

Doors, windows and rooflights which are a complete replacement are not considered to be a repair and have to meet the full requirements of the standards (see type 20). For historic *buildings*, where there is a specific need to match existing doors, windows or rooflights, the principle of 'like for like' may still be permitted.

0.5.2 Schedule 3

Description of building and work, including the provision of services, fitting and equipment, not requiring a warrant

Type	Description	Exception
A	On condition that types 1 – 23 in all respects and/or in the manner of their fitting meet any standards required by the regulations.	
1.	Any work to or in a <i>house</i> .	Any work which increases the floor area of the <i>house</i> . Any demolition or alteration of the roof, <i>external walls</i> or <i>elements of structure</i> . Any work involving underpinning. Any work adversely affecting a <i>separating wall</i> . Any work involving a change in the method of <i>wastewater</i> discharge. Work, not being work of types 3 to 26 below, to a <i>house</i> having a <i>storey</i> , or creating a <i>storey</i> , at a height of more than 4.5 metres.
2.	Any work to or in a <i>non-residential building</i> to which the public does not have access.	A <i>non-residential building</i> within which there is a <i>domestic</i> or <i>residential building</i> . Any work which increases the floor area of the <i>building</i> . Any demolition or alteration of the roof, <i>external walls</i> or <i>elements of structure</i> . Any work involving underpinning. Any work adversely affecting a <i>separating wall</i> . Any work involving a change in the method of <i>wastewater</i> discharge. Work, not being work of types 3 to 26 below, to a <i>building</i> having a <i>storey</i> , or creating a <i>storey</i> , at a height of more than 7.5 metres.
2A.	Any works to or in a <i>building</i> that is a <i>prison</i> or a <i>building</i> where a person may be legally detained or otherwise legally held in custody.	Any work which increases the floor area of the <i>building</i> by more than 100 square metres. Any demolition or alteration of the roof, <i>external walls</i> or <i>elements of structure</i> . Any work involving underpinning. Any work adversely affecting a <i>separating wall</i> . Any work involving a change in the method of <i>wastewater</i> discharge. Work, not being work of types 3 to 26 below, to a <i>prison</i> or a <i>building</i> where a person may be legally detained or otherwise legally held in custody having a <i>storey</i> , or creating a <i>storey</i> , at a height of more than 7.5 metres.
2B.	A <i>building</i> or any work to or in a <i>building</i> or the <i>conversion</i> of a <i>building</i> that is the Scottish Parliament.	

Type	Description	Exception
2C.	A <i>building</i> or any work to or in a <i>building</i> or the <i>conversion</i> of a <i>building</i> belonging to Her Majesty in right of Her private estates.	
and, without prejudice to the generality of types 1 to 2C above,		
3.	A detached single-storey <i>building</i> , having an area exceeding 8 square metres but not exceeding 30 square metres.	A <i>dwelling</i> or <i>residential building</i> . A <i>building</i> ancillary to, or within the <i>curtilage</i> of, a <i>dwelling</i> . A <i>building</i> within 1 metre of a <i>boundary</i> . A <i>building</i> containing a fixed combustion appliance installation or <i>sanitary facility</i> . A swimming pool deeper than 1.2 metres.
4.	A detached single-storey <i>building</i> , having an area exceeding 8 square metres but not exceeding 30 square metres, ancillary to and within the <i>curtilage</i> of a <i>house</i> .	A <i>building</i> within 1 metre of the <i>house</i> unless it is at least 1 metre from any <i>boundary</i> . A <i>building</i> containing a fixed combustion appliance installation or <i>sanitary facility</i> . A swimming pool deeper than 1.2 metres.
5.	A detached single-storey <i>building</i> , having an area exceeding 8 square metres but not exceeding 30 square metres, ancillary to and within the <i>curtilage</i> of a <i>flat</i> or <i>maisonette</i> .	A <i>building</i> within 1 metre of the <i>flat</i> or <i>maisonette</i> or within 3 metres of any other part of the <i>building</i> containing the <i>flat</i> or <i>maisonette</i> . A <i>building</i> within 1 metre of a <i>boundary</i> . A <i>building</i> containing a fixed combustion appliance installation or <i>sanitary facility</i> . A swimming pool deeper than 1.2 metres.
6.	Any <i>work</i> associated with a combustion appliance installation or other part of a heating installation, not being <i>work</i> of types 7 or 8 below.	Any <i>work</i> associated with a solid fuel appliance having an output rating more than 50 kW, an oil-firing appliance with an output rating more than 45 kW or a gas-fired appliance having a <i>net input rating</i> more than 70 kW. Any <i>work</i> associated with a <i>chimney</i> , <i>flue-pipe</i> or <i>constructional</i> hearth. Any <i>work</i> associated with an oil storage tank with a capacity of more than 90 litres, including any pipework connecting the tank to a combustion appliance providing space or water heating or cooking facilities. Any <i>work</i> adversely affecting a <i>separating wall</i> or <i>separating floor</i> .
7.	Any <i>work</i> associated with a balanced <i>flue</i> serving a <i>room-sealed appliance</i> .	

Type	Description	Exception
8.	Any <i>work</i> associated with pipework, radiators, convector heaters and thermostatic controls for, or associated with, type 6 above.	
9.	Any <i>work</i> associated with installing a <i>flue liner</i> .	
10.	Any <i>work</i> associated with refillable liquefied petroleum gas storage cylinders supplying, via a fixed pipework installation, combustion appliances used principally for providing space heating, water heating, or cooking facilities.	
11.	Any <i>work</i> associated with the provision of a single <i>sanitary facility</i> , together with any relevant branch soil or waste pipe.	Any <i>work</i> associated with a water closet, waterless closet or urinal.
12.	Any <i>work</i> associated with the relocation within the same <i>room</i> or space of any <i>sanitary facility</i> , together with any relevant branch soil or waste pipe.	
13.	Any <i>work</i> associated with the provision of an extractor fan.	
14.	Any <i>work</i> associated with a stairlift within a <i>dwelling</i> .	
15.	Any <i>work</i> associated with the provision of a notice or other fixture for which there is no requirement provided in these regulations.	
15A.	Any <i>work</i> associated with affixing of an <i>energy performance certificate</i> to a <i>building</i> .	
16.	Any <i>work</i> associated with an outdoor sign that is the subject to the Town and Country Planning (Control of Advertisements)(Scotland) Regulations 1984.	
17.	Any <i>work</i> associated with thermal insulating material to or within a wall, ceiling, roof or floor.	Any <i>work</i> associated with the application of thermal insulating material to the outer surface of an <i>external wall</i> .

Type	Description	Exception
18.	A wall not exceeding 1.2 metres in height, or a fence not exceeding 2 metres in height.	
19.	Any <i>work</i> associated with open raised external decking.	Any decking at a height of more than 1.2 metres. Decking that forms part of any access provided to comply with the requirements in regulation 9 and paragraph 4.1 of schedule 5. Decking that forms any <i>escape route</i> other than from a <i>flat</i> or <i>maisonette</i> , provided to comply with the requirements in regulation 9 and paragraph 2.9 of schedule 5.
20.	A door, window or rooflight when the <i>work</i> includes replacing the frame.	
21.	A paved area or hardstanding exceeding 50 square metres in area but not exceeding 200 square metres in area. A paved area forming part of an access to meet a requirement of these regulations.	
22.	An electrical installation, including a circuit for telecommunication, alarm purposes or for the transmission of sound, vision or data, which operates at extra-low voltage (not exceeding 50 volts alternating current or 120 volts direct current, measured between conductors or to earth) and which is not connected directly or indirectly to an electricity supply which operates at a voltage higher than either of those specified above.	
23.	The <i>construction</i> of a ramp not exceeding 5 metres in length.	

Type	Description	Exception
B	On condition that this work, service, fitting or equipment is to a standard no worse than that at present.	
24.	Any <i>work</i> associated with the replacement of a fitting or equipment, in whole or in part, by another of the same general type, including a <i>sanitary facility</i> (together with any relevant branch soil or waste pipe), rainwater gutter or downpipe, solid fuel combustion appliance, electrical fixture, ventilation fan, <i>chimney</i> or <i>flue</i> outlet fitting or terminal, fire hydrant or main, lift or escalator, solid waste chute or container, <i>kitchen</i> fitments or other fitted furniture and ironmongery.	
25.	Any <i>work</i> associated with the replacement in whole or in part, by material of the same general type, of flooring, lining, cladding, covering or rendering either internally or externally.	
26.	Any <i>work</i> to a door, window or rooflight, including <i>glazing</i> which is not a complete replacement falling within type 20 above.	

0.6 Limited life buildings

0.6.1 Explanation

regulation

6

mandatory

For the purposes of paragraph 3 of schedule 1 of *the Act* (which enables special provision to be made for *buildings* intended to have a limited life) a period of five years is hereby specified.

0.6.1 Explanation

Regulation 6 deals with *constructions* that are intended to have only a short life span on *site* and in view of this the mandatory standards and associated guidance give some concessions to such *buildings*. These concessions only apply to *buildings* which are not *dwellings*.

Standard 3.1 in schedule 5 allows a lesser standard for the treatment of the *site* of a *limited life building*, other than a *dwelling*.

Section 6 Energy, indicates that less demanding *U-values* can be adopted for the *insulation envelope* of certain types of *limited life buildings*, other than *dwellings* and *residential buildings*.

0.7 Measurements

- 0.7.1 Explanation
- 0.7.2 Schedule 4

regulation

7

mandatory

For the purpose of these regulations, measurements shall be made or calculated in accordance with schedule 4.

0.7.1 Explanation

Schedule 4 to regulation 7 specifies those methods of measurement that are necessary for the regulations themselves. In the Technical Handbooks certain additional measurements are also used, and references to additional methods of measurement specific to particular sections are included in the introductions to those sections.

0.7.2 Schedule 4

Measurements

Area

1. Measurement of area shall be taken to the innermost surfaces of enclosing walls or, on any side where there is no enclosing wall, to the outermost edge of the floor on that side.
2. A *room* excludes any built-in fixture extending from the floor to the ceiling.
3. In the case of a *dwelling*, a *room* excludes any part where the height is less than 1.5 metres.

Height and depth

4. The height of:
 - a. a *building* shall be taken to be the height from the surface of the ground to the underside of the ceiling of the topmost *storey* or, if the topmost *storey* has no ceiling, one-half of the height of the roof above its lowest part; and
 - b. a *storey* above the ground or the depth of a *storey* below the ground shall be taken to be the vertical height or depth as the case may be from the ground to the upper surface of the floor of the *storey*, and the expressions “a *storey* at a height” and “a *storey* at a depth” shall be construed accordingly.
5. In the measurement of height or depth from ground which is not level the height or depth shall be taken to be the mean height or depth, except that:
 - a. for the purpose of types 1, 2, 3, 4, 5, 18 or 19 of schedule 3; and
 - b. for any other purpose where the difference in level is more than 2.5 metres,the height or depth shall be taken to be the greatest height or depth.

General

6. Except where the context otherwise requires, measurements shall be horizontal and vertical.

0.8 Durability, workmanship and fitness of materials

- 0.8.1 Explanation
- 0.8.2 Durability
- 0.8.3 Workmanship
- 0.8.4 Fitness of materials

<p>regulation</p> <p>8</p> <p>mandatory</p>	<p>(1) Work to every <i>building</i> designed, <i>constructed</i> and provided with services, fittings and equipment to meet a requirement of regulation 9 to 12 must be carried out in a technically proper and workmanlike manner, and the materials used must be durable, and fit for their intended purpose.</p> <p>(2) All materials, services, fittings and equipment used to comply with a requirement of regulations 9 to 12 must, so far as <i>reasonably practicable</i>, be sufficiently accessible to enable any necessary maintenance or repair <i>work</i> to be carried out.</p>
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0.8.1 Explanation

Regulation 8 requires that materials, fittings and components used in the *construction of buildings* should be suitable for their purpose, correctly used or applied, and sufficiently durable, taking account of normal maintenance practices, to meet the requirements of these regulations. For example, external timber cladding for low-rise *buildings* that is readily accessible and replaceable need not be as durable as that which is to be used at a higher level on medium-rise *buildings*.

It also implements the intention of the *Construction Products Directive*, that specification of *construction* products should not be used to effectively bar the use of *construction* products or processes from other European countries. The relevant countries are those in the European Union, and those who in the European Economic Area Act of 1993 agreed to adopt the same standards.

The guidance below details a variety of published standards and specifications recognised by the States within the European Economic Area which provide an acceptable standard of suitability and fitness. Traditional *constructions*, when supported by adequate technical descriptions, may also be appropriate.

The intention is to provide adequate flexibility to accommodate new techniques as well as proven traditional practices. This guidance ensures proper acceptance of products which satisfy the essential requirements of the *Construction Products Directive* and the Fixing and Use of CE Marks Directive, to avoid barriers to trade. For example, products bearing a CE mark (European Mark of Conformity) must be accepted as meeting regulation requirements where the declared performance satisfies the requirement and the product is being correctly used. A verifier may only reject CE marked products if the declared performance on the accompanying declaration does not meet the regulation requirement or if the documentation is incomplete. If the verifier rejects a product the relevant trading standards officer must be notified (this is a requirement of the Construction Product Regulations). This will enable the UK government, where necessary, to notify the European Commission. A fuller explanation of CE marking is given in the booklet 'CE Marking under the Construction Products Directive', published by the Department of the Environment Transport and the Regions (DETR) in 2001.

The Technical Handbooks are arranged to equate with the six Essential Requirements of the *Construction Products Directive*. This should aid assessment of products against the regulation requirements. There may, however be other Directives applicable to certain products or *constructions*.

Marks showing compliance with these are for the purpose of that Directive, not to indicate compliance with the Essential Requirements, or our regulations. For example, a self contained *smoke alarm*, manufactured in accordance with the Electro Magnetic Compatibility Directive should be accepted as satisfying requirements only insofar as they relate to prevention of electromagnetic disturbances by, and prevention against disturbances to, such *smoke alarms*.

0.8.2 Durability

The EC is introducing durability requirements into European Standards (ENs) for *construction* products. Durability is not a term defined in this guidance, but it has been defined by the EC: the ability of a *building* material, fitting, component, or part thereof to perform its required function over a period of time and under influence of agents. 'Agents' are factors that may affect the durability of a product and include: exposure conditions, temperature, humidity, water, UV radiation, abrasion, chemical attack, biological attack, corrosion, weathering, frost, freeze-thaw, and fatigue.

Subject to normal maintenance, a product should enable properly designed and executed *works* to fulfill the Essential Requirements for an economically reasonable period of time (i.e. the working life of the product).

Durability is thus dependent on the intended use of the product and its service conditions. The assessment of durability can relate to the product as a whole or to its performance characteristics, insofar as these play a significant part with respect to the fulfillment of the Essential Requirements. In either case, the underlying assumption is that the performance will meet or exceed minimum acceptable values (thresholds) throughout its working life. The assessment of durability of *construction* products may use performance based methods, descriptive solutions, or a combination of both.

Levels of durability can in theory be set only by reference to criteria laid down in the harmonised test procedures. At present most harmonised ENs are prescriptive, giving for example a minimum thickness of material rather than a level of performance, e.g. that the product must last at least 'x' number of years. The EC have the issue under consideration and it is likely that there will be a move towards performance standards. Until the EC have issued definitive guidance, reference can be made to BS 7543, which covers the durability of *building* elements, products, and components.

0.8.3 Workmanship

The term workmanship has been included so that references to methods of establishing workmanship can be included in the Technical Handbooks. For example, where performance depends on the *construction* being carried out with a crucial standard of workmanship, say in the *construction* of *dwelling separating walls*, it will prove useful to consider the information provided in the British Standard. It is not the intention that verifiers check workmanship generally, (certainly not of aesthetic matters such as finishes), but that where proper workmanship is essential to meeting the building standards verifiers have criteria against which it may be assessed.

Some methods of establishing workmanship are:

- compliance with BS 8000: Workmanship on building sites;
- compliance with an equivalent technical specification which may include a national technical specification of other Member States, which are contracting parties to the European Economic Area;

- the workmanship is specified for a material, fitting, or component covered by a national or European Certificate issued by a European Technical Approvals issuing body, and the conditions of use are in accordance with certificate;
- the workmanship may be covered by an equivalent technical approval (including a technical approval of another Member State of the Organisation for Technical Approval, EOTA), that provides an equivalent level or performance and the conditions of use are in accordance with terms of the technical approval;
- the workmanship is covered by a scheme, which complies with relevant recommendations of BS EN ISO 9000: Quality Management and quality assurance standards (there are also independent schemes of accreditation and registration of installers of materials and products that provide a means of ensuring that the *work* has been carried out by knowledgeable contractors to an appropriate standard);
- by use of past experience (where it can be shown by experience, such as a *building* in use, that the method of workmanship is capable of performing the function for which it is intended);
- by use of recognised test methods.

0.8.4 Fitness of materials

Subject to the paragraph below, it is recommended that the requirement of regulation 8 is met by using materials, fittings, and components, or parts thereof which comply with any of the following standards:

- a. the standard (whether British Standard or otherwise) specified in the Technical Handbooks;
- b. a relevant code of practice of a national standards institution or equivalent body of any Member State within the European Economic Area;
- c. a relevant international standard recognised in any Member State within the European Economic Area;
- d. a relevant specification acknowledged for use as a standard by a public authority of any Member State within the European Economic Area;
- e. traditional procedures of manufacture of a Member State within the European Economic Area where these are the subject of written technical description sufficiently detailed to permit assessment of materials, fittings, and components, or parts thereof for the use specified; or
- f. for materials, fittings, and components or parts thereof, of an innovative nature subject to an innovative process of manufacture and which fulfil the purpose provided for by the specified standard, a European Technical Approval or specification sufficiently detailed to permit assessment.

The standard code of practice, specification, technical description of European Technical Approval referred to in b to f above must provide in use levels of safety, suitability and fitness for purpose equivalent to those recommended in the Technical Handbooks, referred to in paragraph a, in so far as such levels are not inconsistent with the Essential Requirements set out in the CPD.

Where materials, fittings, and components are used on the basis of a standard, code of practice, specification, technical description or European Technical Approval, testing and sampling may be carried out as specified in or applicable to such standard, code of practice, specification, technical description or European Technical Approval.

Where testing is carried out within a Member State within the European Economic Area, such test shall be carried out by an appropriate organisation offering suitable and satisfactory evidence of technical and professional competence and independence. The requirements shall be satisfied if the organisation is accredited in a State within the European Economic Area in accordance with BS 7501 and BS 7502, and/or BS ENs: 17011, 17020, 17021, 17024, 17025, 17050, 45002 and 45011.

www.wrap.org.uk

The Waste and Resources Action Programme offers guidance on the use of recycled materials and products containing recyclate. It is acceptable to use such materials as a measure to further sustainable development provided that they are durable and fit for their intended purpose.

0.9 Building standards applicable to construction

0.9.1 Explanation

0.9.2 Schedule 5

regulation

9

mandatory

Construction shall be carried out so that the work complies with the applicable requirements of schedule 5.

0.9.1 Explanation

Regulation 9 and schedule 5 are the heart of the building standards system as they set out what must be achieved in *building work*. The standards are given in full along with the associated guidance on compliance in sections 1 – 6 of the Technical Handbooks. The sections relate directly to the Essential Requirements, as published by the EC, which *buildings* and *works* are expected to satisfy when they have been properly designed and *built*.

The six sections are:

Section 1	Structure	(EC - Mechanical resistance and stability)
Section 2	Fire	(EC - Safety in case of fire)
Section 3	Environment	(EC - Hygiene, health and the environment)
Section 4	Safety	(EC - Safety in use)
Section 5	Noise	(EC - Protection against noise)
Section 6	Energy	(EC - Energy, economy and heat retention)

The Essential Requirements are also subject to overall requirements related to durability, which are covered in regulation 8.

The guidance on suitable provision to meet the building regulation standards is given without assurance that any other legislative or administrative requirement might apply more onerous standards.

In considering which standards apply, where more than one is relevant to any *building work* all the standards should be met.

0.9.2 Schedule 5

The mandatory standards in schedule 5 are given in the six sections of this Handbook (structure, fire safety, environment, safety, noise and energy) and are therefore not repeated here.

0.10 Building standards applicable to demolition

0.10.1 Explanation

regulation

10

mandatory

- (1) **Every *building* to be demolished must be demolished in such a way that all service connections to the *building* are properly closed off and any neighbouring *building* is left stable and watertight.**
- (2) **When demolition *work* has been completed and, where no further *work* is to commence immediately, the person who carried out that *work* shall ensure that the *site* is:**
- (a) **immediately graded and cleared; or**
 - (b) **provided with such fences, protective barriers or hoardings as will prevent access thereto.**

0.10.1 Explanation

Regulation 10 sets out the mandatory requirements when undertaking demolition *work*.

The building regulations do not control the method or process of demolition. This is the responsibility of the Health and Safety Executive and is covered under other legislation.

What the building regulations do seek to control is the area which is left after demolition has been completed, and the state of any surrounding *buildings* affected by the demolition. Any adjacent *buildings* must be left safe and watertight and all service connections must be properly sealed. Unless it is intended to *build* on the cleared *site* without delay, it must be left in a safe condition. This might be achieved by *site* clearance and grading, or by ensuring adequate perimeter enclosures.

**0.11 Building standards applicable to the provision of services,
fittings and equipment**

0.11.1 Explanation

regulation

11

mandatory

Every service, fitting or piece of equipment provided so as to serve a purpose of these regulations shall be so provided in such a way as to further those purposes.

0.11.1 Explanation

Regulation 11 requires that every service, fitting or piece of equipment provided so as to serve a purpose of the regulations should be designed, installed, and commissioned in such a way as to fulfill those purposes.

0.12 Building standards applicable to conversions

0.12.1 Explanation

0.12.2 Schedule 6

regulation

12

mandatory

Conversion shall be carried out so that the building as converted complies with the applicable requirements of schedule 6.

0.12.1 Explanation

Certain changes of use or occupation were defined as *conversions* in schedule 2 and are therefore subject to the building regulations. Regulation 12 requires that in these cases the *building* shall meet the requirements of schedule 6. However it is recognised that this is not *reasonably practical* in many existing *buildings*. Therefore the schedule also lists those standards where a lower level of provision may well be sufficient. It is essential to establish with the verifier where meeting the standards in full is not *reasonably practicable*, and early discussion will be necessary. The individual sections of the Handbooks give further details.

For historic *buildings*, the classification of the *building* should influence the extent to which improvement is required, depending on whether the classification is for the outside, the inside, all parts, etc.

0.12.2 Schedule 6

Every *conversion*, to which these regulations apply, shall meet the requirements of the following standards in schedule 5:

- a. standards 2.1, 2.3, 2.5, 2.9, 2.10, 2.11, 2.13, 2.14, 2.15 in section 2, fire;
- b. standards 3.5, 3.6, 3.7, 3.8, 3.9, 3.11, 3.12, 3.13, 3.14, 3.17, 3.18, 3.20, 3.21, 3.22, 3.23, 3.24, 3.25, 3.26, in section 3, environment;
- c. standards 4.5, 4.6, 4.7, 4.9, 4.11, 4.12, 4.13; in section 4, safety;
- d. standards 5.1 and 5.2, in section 5, noise; and
- e. standards 6.7, 6.8, 6.10 in section 6, energy.

Every *conversion*, to which these regulations apply, shall meet the requirements of the following standards in schedule 5 in so far as is *reasonably practicable*, and in no case be worse than before the *conversion*:

- a. the standards in section 1, structure;
- b. standards 2.2, 2.4, 2.6, 2.7, 2.8, 2.12, in section 2, fire;
- c. standards 3.1, 3.2, 3.3, 3.4, 3.10, 3.15, 3.16, 3.19, in section 3, environment;
- d. standards 4.1, 4.2, 4.3, 4.4, 4.8, 4.10; in section 4, safety; and
- e. standards 6.2, 6.3, 6.4, 6.5, 6.6, in section 6, energy.

0.13 Provision of protective works

0.13.1 Explanation

regulation

13

mandatory

- (1) No person shall carry out *work* unless the following provisions of this regulation are complied with.
- (2) Subject to paragraph (3), where *work* is to be carried out on any *building site* or *building* which is within 3.6 metres of any part of a *road* or other place to which members of the public have access (whether or not on payment of a fee or charge) there shall, prior to commencement of the *work*, be erected protective *works* so as to separate the *building site* or *building* or that part of the *building site* or *building* on which *work* is to be carried out from that *road* or other place.
- (3) Nothing in paragraph (2) shall require the provision of protective *works* in any case where the local authority is satisfied that no danger to the public is caused, or is likely to be caused, by the *work*.
- (4) The protective *works* referred to in the preceding paragraphs are all or any of:
 - (a) providing hoardings, barriers or fences;
 - (b) subject to paragraph (5), where necessary to prevent danger, providing footpaths outside such hoardings, barriers or fences with safe and convenient platforms, handrails, steps or ramps, and substantial overhead coverings;
 - (c) any other protective *works* which in the opinion of the local authority are necessary to ensure the safety of the public, all of such description, material and dimensions and in such position as the local authority may direct.
- (5) Nothing in paragraph(4)(b) shall require the provision of a platform, handrail, step or ramp:
 - (a) where no part of the existing footpath is occupied by the protective *works* or in connection with the *work*;
or
 - (b) where that part of an existing footpath remaining unoccupied affords a safe means of passage for people, and is of a width of not less than 1.2 metres or such greater width as the local authority may direct.
- (6) Any protective *works* shall be so erected as to cause no danger to the public and shall be maintained to the satisfaction of the local authority.
- (7) Subject to paragraph (8), any protective *works* shall be removed:
 - (a) in the case of a *building* which has been *constructed* by virtue of a warrant, not more than 14 days or such longer period as the local authority may direct from the date of acceptance of the certificate of

- completion; and**
- (b) in any other case, on completion of the *work*.**
- (8) Nothing in paragraphs (1) to (7) of this regulation shall prohibit the removal of the protective *works* or any part thereof prior to the completion of the *work* where the local authority is satisfied that no danger to the public is caused or is likely to be caused as a result of their removal.**
- (9) Any protective *works* shall be illuminated, and any such *works* which project on to or over that part of a *road* which is not a pavement or footpath shall be provided with such markings, as in the opinion of the local authority are necessary to secure the safety of the public.**
- (10) Where *work* has been carried out without the provision of protective *works*, or where *work* on a *building site* has stopped or a *building site* has been abandoned, a local authority may require the *site owner* to carry out protective *works*.**

0.13.1 Explanation

Regulation 13 requires that *building sites* are fenced off in such a way as to protect the public. It also provides powers to deal with *building sites* where *work* has for any reason ceased and the Health and Safety at Work etc. Act provisions are no longer applicable.

0.14 Clearing of footpaths

0.14.1 Explanation

regulation

14

mandatory

Where any *work* is being carried out on a *building site* or *building*, any neighbouring footpath (including any footpath provided so as to form part of the protective *works*) shall be regularly cleaned and kept free of *building* debris and related materials by the person carrying out the *work*, to the satisfaction of the local authority.

0.14.1 Explanation

Regulation 14 requires the keeping free from mud or dust footpaths adjacent to *building sites*.

0.15 Securing of unoccupied and partially completed buildings

0.15.1 Explanation

regulation

15

mandatory

- (1) Subject to paragraph (2) a person carrying on *work* shall ensure that any *building* which is partly *constructed* or partly demolished or which has been completed but not yet occupied is, so far as *reasonably practicable*, properly secured or closed against unauthorised entry at all times when *work* thereon is not in progress.
- (2) Nothing in paragraph (1) shall apply to any *work* where the local authority is satisfied that adequate supervision of the *building* is being or will be maintained for the purpose of securing the *building*.

0.15.1 Explanation

Regulation 15 requires that all *building sites* where there are unfinished or partially complete *works* are kept safe and secure.

0.16 Relaxations

0.16.1 Explanation

regulation

16

mandatory

No direction may be given under section 3(2) of *the Act* in relation to regulations 1 to 3, 5 and 7.

0.16.1 Explanation

Regulation 16 sets out the regulations that cannot be relaxed.

0.17 Continuing requirements

- 0.17.1 Explanation
- 0.17.2 Implementation
- 0.17.3 Procedures to be followed
- 0.17.4 Other legislative requirements

<p>regulation</p> <h1 style="font-size: 2em; margin: 0;">17</h1> <p>mandatory</p>	<p>(1) Subject to paragraph (2), the owners of <i>buildings</i> shall ensure that:</p> <p style="margin-left: 20px;">(a) every air-conditioning system within a <i>building</i> is inspected at regular intervals; and</p> <p style="margin-left: 20px;">(b) appropriate advice is given to the users of the <i>buildings</i> on reducing the energy consumption of such an air-conditioning system.</p> <p>(2) This regulation shall not apply to:</p> <p style="margin-left: 20px;">(a) air-conditioning systems with a total effective output rating of less than 12 kW; or</p> <p style="margin-left: 20px;">(b) air-conditioning systems solely for processes within a <i>building</i>.</p> <p>(3) In terms of section 2 of the Building (Scotland) Act 2003 the provisions of paragraph (1) are a designated provision in respect of which there is a continuing requirement imposed on the owners of <i>buildings</i>.</p>
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0.17.1 Explanation

Regulation 17 requires the owners of an air-conditioned *building* to have such plant regularly inspected and to provide advice to the users of the *building* on related energy efficiency improvement *work* and how to operate the system efficiently. This regulation implements the terms of Article 9 of Directive 2002/91/EC on the energy performance of *buildings* (EPBD).

Scope

The regulation relates only to larger, fixed air-conditioning systems and does not cover portable systems. It also relates to comfort cooling of people in a *building* but does not cover any other system, such as cooling solely used in a manufacturing, trade or mechanical process. For example, a system only cooling computer equipment would be exempt.

The efficiency of the system should be assessed and the sizing compared to the cooling requirements of the *building* and appropriate advice given to the users of the *building* on possible improvement or replacement of the system and on alternative solutions.

0.17.2 Implementation

Continuing requirement

The regulation imposes a continuing requirement that means inspections are required not only throughout the life of a new *building*, but also for the life of an existing *building*, for as long as it has an air-conditioning system. In the early stages of implementation, a relaxation direction was used to manage introduction of inspections. This relaxation expired on 4 January 2009 and phased introduction of inspections is outlined in this guidance.

0.17.3 Procedures to be followed

CIBSE

CIBSE Technical Memorandum 44 (TM44) 'Inspection of air conditioning systems' provides guidance on the regular inspection and assessment of air-conditioning systems and on the provision of advice and alternative solutions. TM44 can be used in Scotland subject to the paragraphs that follow:

Inspection frequency

For completely new air-conditioning systems, one way of meeting paragraph 1(a) of this regulation would be to make arrangements at completion for the

first inspection. This should be carried out by an accredited expert no later than 5 years after the acceptance of the completion of commissioning of the system to standard 6.7.

For existing systems over 250 kW, one way of meeting paragraph 1(a) of this regulation would be to make arrangements for an inspection to be carried out by an accredited expert. Thereafter the owner should ensure that the inspection is carried out before 4 January 2011.

For existing systems of 250 kW or less, one way of meeting paragraph 1(a) of this regulation would be to make arrangements for an inspection to be carried out by an accredited expert. Thereafter the owner should ensure that the inspection is carried out between 4 January 2011 and 4 January 2013.

In all cases, the accredited expert doing the inspection has the discretion to set the frequency of inspections ranging from three years for poorly maintained and inefficient systems up to five years for those systems that are well maintained and demonstrate excellent levels of efficiency. In order to ensure compliance with the continuing requirement, the subsequent inspection should be carried out within the intervening time period.

The following issues should be considered in setting an inspection of systems more frequently than five years:

- a. inefficiency of system
- b. significantly oversized in relation to the cooling requirements
- c. evidence that the design is not fit for purpose
- d. evidence of poor installation
- e. evidence of lack of maintenance
- f. control system out of adjustment
- g. age of system.

Size of systems

A number of individual systems each 12 kW or less, but taken together totalling more than 12 kW, within one *building* or fire-separated part of a *building*, would only qualify for inspection if they are linked by way of a central control.

New buildings

For new *buildings*, commissioning of *building* services including air-conditioning systems and the provision of written information shall be in accordance with standards 6.7 and 6.8 respectively and guidance to these standards is provided in the Domestic and Non-domestic Technical Handbooks.

Accredited experts

Inspections of existing air-conditioning systems should be carried out by accredited experts who are members of protocol organisations who are approved by Scottish Government to carry out such inspections.

0.17.4 Other legislative requirements

This guidance relates purely to Article 9 of the EPBD. There are other separate legislative requirements for the inspection of air conditioning systems such as the F-Gas Regulations which are not dealt within *building* regulations. However from an operational point of view, consideration could be given to combining inspections where appropriate.

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- 1.0 Introduction**
- 1.1 Structure**
- 1.2 Disproportionate collapse**

1.0 Introduction

- 1.0.1 Background
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- 1.0.4 Relevant Legislation
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- 1.0.6 Annex
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Introduction

1.0

1.0.1 Background

The structure of a *building* is fundamental to ensuring the safety of people in or around new and existing *buildings* and can be affected by a number of factors inside and outside the *building* including environmental factors. These factors should be considered to prevent the collapse, excessive deformation or the disproportionate collapse of *buildings*.

Climatic conditions

The climatic conditions in Scotland including temperature, snow, wind, driving rain and flooding and the impact of climate change should be carefully considered in the assessment of loading (actions) and in the structural design of *buildings*.

Standing Committee on Structural Safety (SCOSS)

www.scoss.org.uk

The Standing Committee on Structural Safety (SCOSS) is an independent body supported by the Institution of Civil Engineers, the Institution of Structural Engineers and the Health and Safety Executive to maintain a continuing review of *building* and civil engineering matters affecting the safety of structures. The prime function of SCOSS is to identify in advance those trends and developments that might contribute to an increasing risk to structural safety. The collation and dissemination of information relating to matters of structural concern is a vital element of achieving safe structures. SCOSS has established a UK wide confidential reporting system (CROSS) to gather data on structural problems.

Appraisal of existing *buildings*

Conversions to existing *buildings* present particular problems and an appraisal of the existing structure for its new occupation or use should be undertaken to ensure that appropriate measures are taken to meet the requirements of regulation 12. Guidance on how a structural appraisal may be undertaken is given in 'Appraisal of Existing Structures', 1996 published by the Institution of Structural Engineers.

Procurement

The contractual arrangements used by clients to procure a *building* can have important consequences for the reliability of the design and the adequacy of the *construction*. Frequently, *building* design procurement will involve the appointment of a number of designers who may be employed by more than one organisation. Detailed design of individual structural details and components can be passed to specialist contractors. In these circumstances the client should appoint a lead designer or other appropriately experienced and qualified person to oversee the design process.

1.0.2 Aims

The intention of this section is to ensure that the structure of a *building* shall be designed and executed in such a way that, during its intended life, it will not pose a threat to the safety of people in and around the *building* with an appropriate degree of reliability. To achieve a structure with adequate structural resistance, serviceability and durability the following should be taken into account:

- a. the loadings (actions) on the *building*;
- b. nature of the ground;
- c. collapse or deformations;
- d. stability of the *building* and other *buildings*;
- e. climatic conditions;
- f. materials;
- g. structural analysis; and
- h. details of *construction*.

The actions on the *building* will comprise a set of loads applied directly to the structure that will include dynamic, concentrated and peak load effects, together with a set of imposed deformations caused for example by temperature changes or uneven settlement.

1.0.3 Latest changes

The following is a summary of the changes made to this section since 1 May 2009.

- 1.0.1 reference to SCOSS updated;
- 1.0.1 guidance for clients on procurement added;
- 1.0.2 aims re-written to reflect Structural Eurocodes;
- 1.0.4 guidance on relevant legislation added for CDM regulations;
- 1.0.5 guidance on alternative approaches added including the use of withdrawn British Standards;
- 1.0.7 clause on certification introduced;
- 1.1.1 reference to guidance on fixings and stone masonry added;
- 1.1.2 reference to Structural Eurocodes added for loadings;
- 1.1.3 reference to Structural Eurocodes added for design and *construction*;
- 1.1.4 reference to BS EN 1997-2:2007 added for geotechnical investigation of the *site*;
- 1.1.5 reference to BS EN 1997-1:2004 added for design of *foundations* adjacent to existing *buildings*; and
- 1.2.1 guidance in relation to disproportionate collapse updated to align with Structural Eurocodes.
- 1.A. Annex A - list of structural Eurocodes and corresponding British Standards to be withdrawn added.

The previous annexes forming the Small Buildings Structural Guidance (SBSG) have been removed from the Technical Handbook and are now referenced in clause 1.0.5.

Minor alterations and corrections have also been made. A full list of changes to this edition of the Technical Handbooks is available on the Building Standards website.

1.0.4 Relevant Legislation

The Construction (Design and Management) Regulations 2007 are intended to protect people working in *construction* and others who may be affected by their activities. The regulations require the systematic management of projects from concept to completion and throughout the life cycle of the structure, including eventual demolition. Clients have a duty to ensure that competent people are employed to do the *work*, that sufficient time is allocated for the *work* to be undertaken and that the various members of the design and *construction* teams co-operate and exchange information.

The Construction
(Design and
Management)
Regulations 2007

1.0.5 Alternative approaches

Where alternative approaches to the structural design are proposed other than using the guidance contained in this section, the structural design should take account of all of the factors identified in clause 1.0.2 above. For example, care should be taken where alternative numerical values are placed on factors of safety as this may have a detrimental effect on the overall stability of the structure.

The British Standards Institution (BSI) agreement with the European Committee for Standardisation (CEN) obliges it to withdraw UK national standards after a harmonised European Standard with the same scope and field of application has been produced. Withdrawal of a standard implies that while documents will still be available there will be no support or five-year review by a BSI committee to consider the currency of the standard and to decide whether it should be confirmed, revised or withdrawn. BSI, in line with this commitment, will by 31 March 2010 replace the British Standards relating to loading and structural design with the European Standards and associated National Annexes listed in sections 1.1.2 and 1.1.3 of this guidance.

Whilst other guidance documents or international standards, including withdrawn national standards might be used in alternative approaches to satisfy building regulations, designers, verifiers, or in the case of certified projects, the approved certifiers of design (*building* structures) will need to satisfy themselves that the use of such guidance is appropriate for a specific project. Care should be exercised, particularly with withdrawn standards, in relation to wind and snow loadings (actions) where the effects of climate change may render these unsafe.

Where alternative approaches use design methods or codes other than those listed in this guidance then these must be used within the context of the assumptions set out in section 1.1.3. Designs must be checked in order to deliver similar levels of design reliability.

Small *Buildings*
Structural Guidance

The Small Buildings Structural Guidance (SBSG) provides structural guidance to designers of small *domestic buildings* on how to comply with standard 1.1. The guidance was published in section 1 (annexes 1.A to 1.F) of the Technical Handbooks in May 2005 (updated in 2007) and based on British Standards which have now been withdrawn. The SBSG, together with research on the impact of the Structural Eurocodes on masonry *construction*, is available on the Building Standards Division website www.scotland.gov.uk/Topics/Built-Environment/Building/Building-standards

The SBSG has been written for those with expertise in *building* design and *construction* but not necessarily in structural engineering design. Where the conditions or parameters fall outside the scope of the guidance, then specialist advice should be sought from approved certifiers of design, chartered engineers or other appropriately qualified persons.

1.0.6 Annex

A list of structural Eurocodes and corresponding British Standards to be withdrawn is contained in Annex 1A.

1.0.7 Certification

Scottish Ministers can, under Section 7 of the Building (Scotland) Act 2003, approve schemes for the certification of design or *construction* for compliance with the mandatory functional standards. Such schemes are approved on the basis that the procedures adopted by the scheme will take account of the need to co-ordinate the *work* of various designers and specialist contractors. Individuals approved to provide certification services under the scheme are assessed to ensure that they have the qualifications, skills and experience required to certify compliance for the *work* covered by the scope of the scheme. Checking procedures adopted by Approved Certifiers will deliver design or installation reliability in accordance with legislation.

The Certification of Design (Building Structures) scheme has been approved by Scottish Ministers to confirm compliance with standards 1.1 and 1.2. Details are available on the Building Standards Division website www.scotland.gov.uk/Topics/Built-Environment/Building/Building-standards

1.1 Structure

- 1.1 Functional standard
- 1.1.0 Introduction
- 1.1.1 General
- 1.1.2 Loading
- 1.1.3 Design and construction
- 1.1.4 Nature of the ground
- 1.1.5 Stability of existing buildings

<p>standard</p> <p style="font-size: 2em; font-weight: bold; text-align: center;">1.1</p> <p>mandatory</p>	<p>Every <i>building</i> must be designed and <i>constructed</i> in such a way that the loadings that are liable to act on it, taking into account the nature of the ground, will not lead to:</p> <p>(a) the collapse of the whole or part of the <i>building</i>;</p> <p>(b) deformations which would make the <i>building</i> unfit for its intended use, unsafe, or cause damage to other parts of the <i>building</i> or to fittings or to installed equipment; or</p> <p>(c) impairment of the stability of any part of another <i>building</i>.</p>
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1.1.0 Introduction

Loadings	The loadings on the <i>building</i> will comprise actions that may be applied both separately and in various combinations.
Nature of the ground	The stability of a <i>building</i> and other existing <i>buildings</i> in the vicinity can be affected by ground conditions which should be investigated and assessed to ensure that the ground can safely support the <i>building</i> .
Collapse	The collapse of the whole or part of a <i>building</i> is clearly a matter of the highest importance with respect to public safety. The design and <i>construction</i> of <i>buildings</i> should take into account all contributing factors such as loadings, climatic conditions, partial safety factors for materials and loadings, and design methodology to ensure that there is an acceptable probability that the <i>building</i> will not collapse (ultimate limit state) during its design lifetime.
Deformations	Similarly deformations of <i>buildings</i> while not leading to an ultimate collapse can lead to public safety concerns particularly where they become unfit or unsafe for use. This can become apparent in several ways ranging from cracking, movement or springiness of floors, doors or windows not opening or closing, damage to pipes and other services within the <i>building</i> . The design and <i>construction</i> of a <i>building</i> should ensure that, by taking into account the factors set out above, the <i>building</i> does not fail in normal use (serviceability limit state).
Stability of existing <i>buildings</i>	The stability of existing <i>buildings</i> can be affected if the design and <i>construction</i> of a new <i>building</i> does not take into account any potential impacts on existing <i>buildings</i> . This could lead to a risk of collapse or damage to existing <i>buildings</i> with a consequent risk to public safety.
<i>Conversions</i>	In the case of conversions, as specified in regulation 4, the <i>building</i> as <i>converted</i> shall meet the requirements of this standard in so far as is <i>reasonably practicable</i> , and in no case be worse than before the <i>conversion</i> (regulation 12, schedule 6).

1.1.1 General

In order to be safe, a *building* should be capable of resisting all loads acting on it as a result of its intended use and geographical location. To achieve this, the structure of a *building* should be designed with margins of safety to ensure that the mandatory functional standard has been met.

In clause (b), of standard 1.1 deformations are not intended to cover aesthetic damage such as shrinkage and other minor cracking.

Specialist advice

Specialist advice from approved certifiers of design, chartered engineers or other appropriately qualified persons should be sought if the designer is in any doubt about the loads acting on a *building* or how these loads can be accommodated by the structure and safely transmitted to the ground.

Fixings

The SCOSS committee has expressed concern that safety critical fixings do not always receive the attention that they deserve. Fixings are important structural components. Designers must be satisfied that fixings receive the same consideration as other aspects of the design in terms of their selection, design, installation, inspection and testing. A SCOSS ALERT “The Selection and Installation of Construction Fixings” has been issued that can be found on the SCOSS website. www.cross-structural-safety.org

Stone Masonry

The Scottish Stone Liaison Group publication 'natural stone masonry in modern Scottish *construction*' provides guidance in the use of natural stone in new *construction*. Guidance includes information on stone and mortar selection, soiling of facades and design details for structures and moisture control.

www.scotland.gov.uk/Topics/Built-Environment/Building/Building-standards

1.1.2 Loading

Any reference to European Standards for Structure (Structural Eurocodes) in this section must be taken to include reference to the relevant UK National Annex.

The loadings to which a *building* will be subjected should be calculated in accordance with the appropriate Structural Eurocodes:

- a. for densities, self-weight and *imposed loadings*, BS EN 1991-1-1: 2002 (Eurocode 1);
- b. for snow loadings, BS EN 1991-1-3:2003 (Eurocode 1);
- c. for *wind loadings*, BS EN1991-1-4:2005 (Eurocode 1);
- d. for earth retaining structures, BS EN 1997-1:2004 (Eurocode 7);
- e. any greater loadings to which the *building* is likely to be subjected.

1.1.3 Design and construction

Any reference to European Standards for Structure (Structural Eurocodes) in this section must be taken to include reference to the relevant UK National Annex.

The structural design and *construction* of a *building* should be carried out in accordance with the following Structural Eurocodes:

- a. for *foundations*, BS EN 1997-1:2004 (Eurocode 7);
- b. for structural *work* of reinforced, prestressed or plain concrete, BS EN 1992-1-1:2004 (Eurocode 2);
- c. for structural *work* of steel, BS EN 1993-1-1:2005 (Eurocode 3);
- d. for structural *work* of cold form, thin gauge steel members and sheeting BS EN 1993-1-3:2006 (Eurocode 3);

- e. for structural *work* of composite steel and concrete *construction*, BS EN 1994-1-1:2004 (Eurocode 4);
- f. for structural *work* of aluminium, BS EN 1999-1-1:2007 (Eurocode 9);
- g. for structural *work* of masonry, BS EN 1996-1-1:2005 or BS EN 1996-3:2006 Simplified calculation rules for masonry structures (Eurocode 6);
- h. for structural *work* of timber, BS EN 1995-1-1:2004 (Eurocode 5) or in the case of floors and roofs to *domestic buildings* of not more than three *storeys* BS 8103 Part 3 - 2009;
- i. for earth retaining structures BS EN 1997-1:2004 (Eurocode 7).

The reliability of designs carried out in accordance with these codes is based on a number of assumptions set out in BS EN 1990:2002 that include:

- the choice of the structural system and the design of the structure is made by appropriately qualified and experienced personnel;
- the design and *construction* is carried out by personnel having the appropriate skill and experience;
- adequate supervision and quality control is provided during execution of the *work*;
- the *construction* materials and products are used as specified in BS EN 1990 or in BS EN 1991 to BS EN 1999 or in the relevant execution standards, or reference material or product specifications;
- the structure will be adequately maintained; and
- the structure will be used in accordance with the design assumptions.

Those responsible for procuring the design and *construction of buildings* based on Structural Eurocodes should be aware of these assumptions and should ensure that they have employed individuals with the necessary qualifications, skills and experience and that appropriate procedures for checking designs have been adopted.

1.1.4 Nature of the ground

The *foundations of buildings* should be designed to sustain and transmit the loadings to the ground in such a manner that there will be no ground movement which will impair the stability of the *building*. All aspects of the nature of the ground should be taken into consideration including ground movement caused by:

- swelling, shrinkage or freezing of the subsoil; or
- landslip; or
- subsidence such as that arising from the collapse of abandoned mineral workings or quarrying operations.

There may be known or recorded conditions of ground instability, such as that arising from landslides, disused mines or unstable strata which, if ignored, could have an adverse effect on a *building*. Such conditions should be taken into account in the design and *construction* of the *building* and its *foundations*.

www.communities.gov.uk

Attention is drawn to Planning Policy Guidance Note 14 (PPG 14) Development on unstable land. Although PPG 14 contains specific reference to England & Wales it does set out the broad planning and technical issues relating to development on unstable land.

www.bgs.ac.uk

www.coalminingreports.co.uk

Information on the scale and nature of problems arising from mining instability, natural underground cavities and adverse *foundation* conditions is available from the following:

- British Geological Survey, Murchison House, West Mains Road, Edinburgh, EH9 3LA;
- The Coal Authority, 200 Lichfield Lane, Mansfield, Nottinghamshire, NG18 4RG.

Information can also be obtained from local authorities that hold Building Standards Registers and other relevant records.

Where new *foundations* are to be *constructed* or existing *foundations* altered it will generally be necessary to undertake a geotechnical investigation of the *site*. This should be carried out using the methods described in BS EN 1997-2:2007.

1.1.5 Stability of existing *buildings*

The stability of existing *buildings* may be affected by a new *building* located in their vicinity. Care must be taken to avoid undermining the *foundations* or otherwise affect the stability of existing *buildings*. The design of *foundations* adjacent to existing *buildings* should be carried out in accordance with the recommendations of BS EN 1997-1:2004.

Factors that can also affect the stability of an existing *building* and should be taken into account include:

- additional or new loads arising from the *construction* of the new *building*;
- increased or new *wind loads* arising from the *construction* of the new *building*;
- pressure bulb extending below existing *building*;
- changes in groundwater level;
- loss of fines during pumping operations or climatic conditions.

1.2 Disproportionate collapse

- 1.2 Functional standard
- 1.2.0 Introduction
- 1.2.1 Disproportionate collapse
- 1.2.2 Determine building risk group
- 1.2.3 Assess additional measures
- 1.2.4 Design and construct additional measures
- 1.2.5 Other sources of guidance

standard

1.2

mandatory

Every *building* must be designed and *constructed* in such a way that in the event of damage occurring to any part of the structure of the *building* the extent of any resultant collapse will not be disproportionate to the original cause.

1.2.0 Introduction

All *buildings* must be designed to accommodate unforeseen or accidental actions in such a way as to prevent the extent of any resulting collapse being disproportionate to the cause of the collapse. *Buildings* should be designed so that they are robust which is defined in BS EN-1991-1-7: 2006 as the ability of a structure to withstand events like fire, explosions, impact or the consequences of human error without being damaged to an extent disproportionate to the original cause.

Explanation of terms

Nominal length of load-bearing wall construction should be taken as:

- in the case of a reinforced concrete wall, the distance between lateral supports subject to a length not more than 2.25 x *storey* height;
- in the case of an external masonry wall, or timber or steel stud wall, the length measured between vertical lateral supports;
- in the case of an internal masonry wall, or timber or steel stud wall, a length not more than 2.25 x *storey* height.

Storey height is the distance from the underside of one floor to the underside of the floor immediately above.

Key element is a structural member upon which the stability of the remainder of the structure depends and should be capable of sustaining an accidental design loading of 34 kN/m² applied in the horizontal and vertical directions (in one direction at a time) to the member and any attached components such as cladding, having regard to the ultimate strength of such components and their connections. Such accidental design loading should be assumed to act simultaneously with 1/3rd of all normal characteristic loading.

Load bearing wall construction includes masonry cross-wall *construction* and walls comprising close centred timber or lightweight steel section studs.

Fire

The protection to be afforded to the structure of a *building* when it is exposed to the action of fire is dealt with by mandatory standard 2.3. The guidance within section 2 refers to relevant codes that should be used for the design of the structure in a fire.

Conversions

In the case of conversions, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably practicable*, and in no case be worse than before the *conversion* (regulation 12, schedule 6).

1.2.1 Disproportionate collapse

A *building* which is susceptible to disproportionate collapse is one where the effects of accidents and, in particular, situations where damage to small areas of a structure or failure of single elements could lead to collapse of major parts of the structure.

Buildings should be provided with a level of robustness by adopting the principles of risk analysis, categorising *buildings*, taking into account both the risk of the hazard and its consequences and providing additional measures commensurate to the level of risk and consequences of such collapse of the *building*. The risk level and accidental actions that should be considered when undertaking the structural design of a *building for disproportionate collapse* should be in accordance with the recommendations of BS EN 1991-1-7:2006 or the method set out below.

Any reference to European Standards for Structure (Structural Eurocodes) in this section must be taken to include the relevant UK National Annex.

To ensure that *buildings* are designed and *constructed* to sustain a limited extent of damage or failure without a disproportionate level of collapse from an unspecified cause, the following procedure should be followed:

- determine *building* risk group;
- assess additional measures;
- design and *construct* additional measures.

1.2.2 Determine *building* risk group

The issues to be considered with respect to assessing the risk group of a *building* are its occupancy level, use, the number of *storeys* and floor areas.

The risk of an extreme event such as an explosion or other incident occurring would not be decreased simply by providing these measures and there is no certainty that demolition or *building* alteration would be carried out in accordance with good practice but the consequences of such an incident occurring would be considerably reduced.

Risk Group	<i>Building</i> Type
1	<i>Houses</i> not more than 4 <i>storeys</i> ; <i>Carports, Conservatories and Greenhouses</i> ; Domestic garages and other small single leaf <i>buildings</i> not more than 1 <i>storey</i> ;
2A	5 <i>storey houses</i> ; <i>Flats and maisonettes</i> not more than 4 <i>storeys</i> ;
2B	<i>Flats and maisonettes</i> more than 4 <i>storeys</i> but not more than 15 <i>storeys</i> ;
3	Every <i>domestic building</i> not covered in Risk Groups 1, 2A and 2B.

The nomenclature of the Risk Groups 1, 2A, 2B and 3 are synonymous with the consequence classes in Table A.1 – Categorisation of consequence classes of BS EN 1991-1-7:2006.

In determining the number of *storeys* in a *building*, *basement storeys* may be excluded provided such *basement storeys* fulfil the robustness of risk group 2B *buildings*.

For *buildings* intended for more than one type of use the risk group should be that pertaining to the most onerous Risk Group.

1.2.3 Assess additional measures

The additional measures which should be provided vary extensively according to *building* type and use and the actual measures should be designed in accordance with the relevant sections of the design codes. For example, high rise hotels or *flats* or *assembly buildings* or grandstands require a different level of robustness than low rise *buildings* or storage *buildings*.

The additional measures which should be applied to *buildings* of the risk groups derived from the above table are set out below:

For risk group 1
buildings

No additional measures are likely to be necessary when the *building* has been designed and *constructed* in accordance with the rules given in this Technical Handbook, or other guidance referenced under section 1, for complying with standard 1.1 in normal use.

For risk group
2A *buildings*

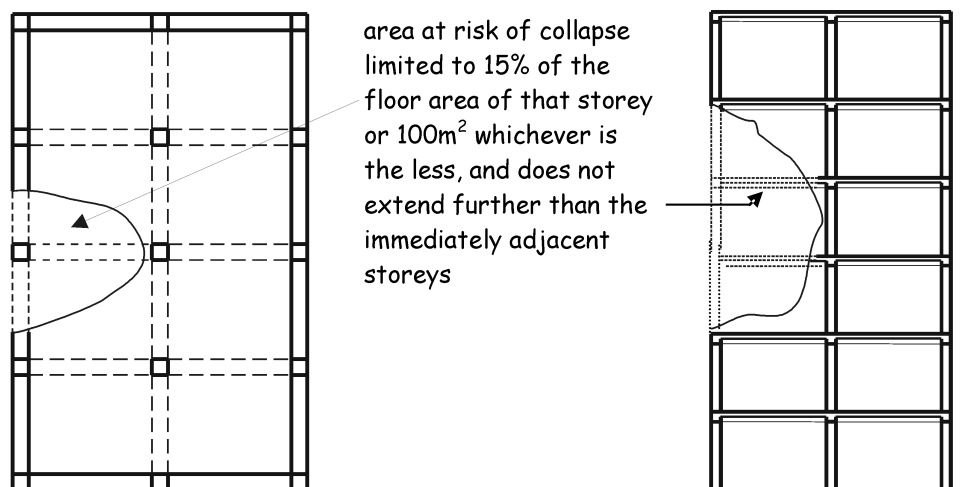
Provide effective horizontal ties, or effective anchorage of suspended floors to walls, for framed and load-bearing wall *construction*.

For risk group
2B *buildings*

Provide effective horizontal ties for framed and load-bearing wall *construction*, together with effective vertical ties, in all supporting columns and walls.

Alternatively, check that upon the notional removal of each supporting column and each beam supporting one or more columns, or any nominal length of load-bearing wall (one at a time in each *storey* of the *building*) the *building* should remain stable and that the area of floor at any *storey* at risk of collapse should be not more than 15% of the floor area of that *storey* or 100 m², whichever is the less and does not extend further than the immediate adjacent *storeys* (see diagram below).

Where the notional removal of such columns and lengths of walls would result in an extent of damage in excess of the above limit, then such elements should be designed as 'key elements'.



For risk group 3
buildings

A systematic risk assessment of the *building* should be carried out, taking into account all the normal hazards that can be foreseen as far as possible together with any abnormal hazards.

Critical situations for design should be selected that reflect the conditions that can be foreseen as far as possible during the life of the *building*.

The structural form and concept and any protective measures should then be chosen and the detailed design of the structure and its elements undertaken in accordance with the recommendations in the codes and standards in clause 1.2.4.

1.2.4 Design and *construct* additional measures

The structural design and *construction* should take account of the additional measures including horizontal and vertical ties where appropriate and checking the integrity of the *building* following the notional removal of vertical members and the design of key elements, should be carried out in accordance with the design recommendations contained in Annex A of BS EN 1991-1-7 2006.

1.2.5 Other sources of guidance

More detailed information has been produced by organisations on disproportionate collapse as follows:

- a. Technical Guidance Note – ‘The Building Regulations 2004 Edition – England and Wales Requirement A3 – Disproportionate Collapse’, National House Building Council (NHBC);
- b. Technical Bulletin Number 3 ‘Design Guidance for Disproportionate Collapse’, UK Timber Frame Association;
- c. ‘Masonry Design for Disproportionate Collapse Requirements under Regulation A3 of the Building Regulations (England & Wales)’, Brick Development Association;
- d. ‘Guidance on meeting the Robustness Requirements in Approved Document A’, Steel Construction Institute;
- e. ‘How to design concrete buildings to satisfy disproportionate collapse requirements’, [The Concrete Centre](#).

The above guidance is based on England & Wales Regulation A3 and should be interpreted in relation to standard 1.2. In particular, references to *building* classes should be risk groups and the *building* types and occupancy should be interpreted as the *building* types set out in the table to clause 1.2.2.

Annex
1.A Structural Design Standards

- 1.A.0 Introduction
- 1.A.1 Structural Design Standards [1]

annex

1.A

1.A.0 Introduction

The British Standards Institution (BSI) agreement with the European Committee for Standardization (CEN) obliges it to withdraw UK national standards after a harmonised European Standard with the same scope and field of application has been produced. BSI, in line with this commitment, will by 31 March 2010 replace the British Standards relating to loading and structural design with the European Standards and associated National Annexes listed in the tables below:

1.A.1 Structural Design Standards [1]

Eurocode: Basis of structural design	Corresponding BS to be withdrawn
BS EN 1990: 2002 Basis of structural design	
<p>Note: Some sections of EN 1990 correspond with BS 5268-2, BS 5628-1, BS 5950-1 and BS 8110-1 and 2. BS 5400-1 which is not referred to in section 1: Structure also has some content that corresponds to EN 1990.</p>	

Eurocode 1: Actions on structures	Corresponding BS to be withdrawn
BS EN 1991-1-1: 2002 Actions on structures. General actions. Densities, self-weight, <i>imposed loads</i> for buildings	BS 6399-1, BS 6399-3, BS 648
BS EN 1991-1-2: 2002 Actions on structures. General actions. Actions on structures exposed to fire	
BS EN 1991-1-3: 2003 Actions on structures. General actions. Snow loads	BS 6399-3
BS EN 1991-1-4: 2005 Actions on structures. General actions. Wind actions	BS 6399-2, BS 5400-2
BS EN 1991-1-5: 2003 Actions on structures. General actions. Thermal actions Note: Some sections of EN 1991-1-5 relating to bridges correspond to BS 5400-2	
BS EN 1991-1-6: 2005 Actions on structures. General actions. Actions during execution	

BS EN 1991-1-7: 2006 Actions on structures. General actions. Accidental actions	Minimal guidance in BS 6399-1. Some sections of EN 1991-1-7 correspond with BS 6399-1, BS 5268-1, BS 5628-1, BS 5950-1, BS 8110-1 and 2 and BS 5400-3
BS EN 1991-2: 2003 Actions on structures. Traffic loads on bridges	BS 5400-2
BS EN 1991-3: 2006 Actions on structures. Actions induced by cranes and machines	
BS EN 1991-4: 2006 Actions on structures. Silos and tanks	

Eurocode 2: Design of concrete structures	Corresponding BS to be withdrawn
BS EN 1992-1-1: 2004 Design of concrete structures. General rules and rules for buildings	BS 8110-1, BS 8110-2, BS 8110-3
BS EN 1992-1-2: 2004 Design of concrete structures. General rules. Structural fire design	BS 8110-1, BS 8110-2
BS EN 1992-2: 2005 Design of concrete structures. Concrete bridges. Design and detailing rules	BS 5400-4, BS 5400-7, BS 5400-8
BS EN 1992-3: 2006 Design of concrete structures. Liquid retaining and containing structures	BS 8007

Eurocode 3: Design of steel structures	Corresponding BS to be withdrawn
BS EN 1993-1-1: 2005 Design of Steel structures. General rules and rules for buildings	BS 5950-1, BS 5400-3
BS EN 1993-1-2: 2005 Design of steel structures. General rules. Structural fire design	BS 5950-8
BS EN 1993-1-3: 2006 Design of steel structures. General rules. Supplementary rules for cold-formed members and sheeting	BS 5950-5, BS 5950-6, BS 5950-9
BS EN 1993-1-4: 2006 Design of steel structures. General rules. Supplementary rules for stainless steels	

BS EN 1993-1-5: 2006 Design of steel structures. Plated structural elements	BS 5950-1, BS 5400-3
BS EN 1993-1-6: 2007 Design of steel structures. General. Strength and stability of shell structures	
BS EN 1993-1-7: 2007 Design of steel structures. Plated structures subject to out of plane loading	
BS EN 1993-1-8: 2005 Design of steel structures. Design of joints	BS 5950-1 BS 4604-1, BS 4604-2, BS 5400-3
BS EN 1993-1-9: 2005 Design of steel structures. Fatigue	BS 5950-1, BS 5400-10
BS EN 1993-1-10: 2005 Design of steel structures. Material toughness and through-thickness properties	BS 5950-1, BS 5400-3
BS EN 1993-1-11: 2006 Design of steel structures. Design of structures with tension components	
BS EN 1993-1-12: 2007 Design of steel structures. Additional rules for the extension of EN 1993 to steel grades S700	BS 5950-1
BS EN 1993-2: 2006 Design of steel structures. Steel bridges	BS 5400-3
BS EN 1993-3-1: 2007 Design of steel structures. Towers, masts and chimneys. Towers and masts	BS 8100-1, BS 8100-2, BS 8100-3, BS 8100-4
BS EN 1993-3-2: 2008 Design of steel structures. Towers, masts and chimneys. Chimneys	BS 4076
BS EN 1993-4-1: 2007 Design of steel structures. Silos, tanks and pipelines. Silos	
BS EN 1993-4-2: 2007 Design of steel structures. Silos, tanks and pipelines. Tanks	

BS EN 1993-4-3: 2007 Design of steel structures. Silos, tanks and pipelines. Pipelines	
BS EN 1993-5: 2007 Design of steel structures. Piling	BS 5950-1
BS EN 1993-6: 2007 Design of steel structures. Crane supporting structures	BS 5950-1, BS 2853
Eurocode 4: Design of composite steel and concrete structures	Corresponding BS to be withdrawn
BS EN 1994-1-1: 2004 Design of composite steel and concrete structures. General rules and rules for buildings	BS 5950-3.1, BS 5950-4
BS EN 1994-1-2: 2005 Design of composite steel and concrete structures. General rules. Structural fire design	BS 5950-8
BS EN 1994-2: 2005 Design of composite steel and concrete structures. General rules and rules for bridges	BS 5400-5
Eurocode 5: Design of timber structures	Corresponding BS to be withdrawn
BS EN 1995-1-1: 2004 Design of timber structures. General. Common rules and rules for buildings	BS 5268-2, BS 5268-3, BS 5268-6.1, BS 5268-6.2, BS 5268-7.1, BS 5268-7.2, BS 5268-7.3, BS 5268-7.4, BS 5268-7.5, BS 5268-7.6, BS 5268-7.7
BS EN 1995-1-2: 2004 Design of timber structures. General. Structural fire design	BS 5268-4.1, BS 5268-4.2
BS EN 1995-2: 2004 Design of timber structures. Bridges	
Eurocode 6: Design of masonry structures	Corresponding BS to be withdrawn
BS EN 1996-1-1: 2005 Design of masonry structures. General rules for reinforced and unreinforced masonry structures	BS 5628-1, BS 5628-2
BS EN 1996-1-2: 2005 Design of masonry structures. Structural fire design	BS 5628-3

BS EN 1996-2: 2006 Design of masonry structures. Design considerations, selection of materials and execution of masonry	BS 5628-3
BS EN 1996-3: 2006 Design of masonry structures. Simplified calculation methods for unreinforced masonry structures	
Eurocode 7: Geotechnical design	Corresponding BS to be withdrawn
BS EN 1997-1: 2004 Geotechnical design. General rules	BS 8002, BS 8004, BS 8006, BS 8081
BS EN 1997-2: 2007 Geotechnical design. Ground investigation and testing	
Eurocode 8: Design of structures for earthquake resistance	Corresponding BS to be withdrawn
BS EN 1998-1: 2004 Design of structures for earthquake resistance. General rules. Seismic actions for buildings	
BS EN 1998-2: 2005+Amendment 1: 2009 Design of structures for earthquake resistance. Bridges	
BS EN 1998-3: 2005 Design of structures for earthquake resistance. Assessment and retrofitting of buildings	
BS EN 1998-4: 2006 Design of structures for earthquake resistance. Silos tanks and pipelines	
BS EN 1998-5: 2004 Design of structures for earthquake resistance. Foundations, retaining structures and geotechnical aspects	
BS EN 1998-6: 2005 Design of structures for earthquake resistance. Towers masts and chimneys	

Eurocode 9: Design of aluminum structures	Corresponding BS to be withdrawn [1]
BS EN 1999-1-1: 2007 Design of aluminium structures. General rules	BS 8118-1, BS 8118-2
BS EN 1999-1-2: 2007 Design of aluminium structures. General. Structural fire design	
BS EN 1999-1-3: 2007 Design of aluminium structures. Additional rules for structures susceptible to fatigue	BS 8118-1
BS EN 1999-1-4: 2007 Design of aluminium structures. Supplementary rules for trapezoidal sheeting	
BS EN 1999-1-5: 2007 Design of aluminium structures. Supplementary rules for shell structures	BS 8118-1

Notes:

1. Many of these standards are not directly, or are not currently referenced in section 1: Structure. Some may not be applicable to section 1 Structure such as, BS 5400 for bridges, or are applicable to other parts of the technical handbooks.

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2.0 Introduction

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Introduction

2.0

2.0.1 Background

Life safety is the paramount objective of fire safety. *Domestic buildings* should be designed and *constructed* in such a way that the risk of fire is reduced and, if a fire does occur, there are measures in place to restrict the growth of fire and smoke to enable the occupants to escape safely and for fire-fighters to deal with fire safely and effectively.

There are more than 7000 reported fires in *dwellings* (e.g. *houses, flats and maisonettes*) every year in Scotland. Fires can have a devastating effect on the lives of people and results in around 60 deaths and 1700 injuries each year. The most common cause of accidental fires in *dwellings* is the careless disposal of cigarettes and matches in more than 40% of cases. Accidents involving cooking accounts for more than 20% followed by electrical, space heaters and candles at around 5%. Statistics also show that the consumption of alcohol is a contributory factor which increases the risk of an accidental fire occurring. Occupants who are alone at the time of the fire and are in the *room* of fire origin, are more likely to suffer injury (e.g. burns and smoke inhalation) or even death in some cases.

www.dontgivefireahome.co.uk

It is impossible to eliminate the risks from fire altogether and the prevention of deliberate or accidental fires caused by the actions of occupants within a *dwelling* are outside the scope of building standards. For advice on best practice relating to fire safety in the home, visit the Scottish Government website or contact the community fire safety officer at the local fire and rescue services.

Although beyond the scope of this guidance, the adoption of good fire safety practices should be encouraged to reduce the risk of fire occurring in the first place. Fire prevention will not only save lives but will protect property and reduce environmental pollution.

The standards and guidance in this section are designed to work together to provide a balanced approach to fire safety. The *building* elements, materials, components or other parts of the *building* identified in the guidance should follow the appropriate performance levels that are recommended throughout the guidance. However where a *building* element, material, component, or other part of a *building* is covered by more than one standard, the more demanding guidance should be followed.

2.0.2 Aims

The purpose of the guidance in section 2 is to achieve the following objectives in the case of an outbreak of fire within the *building*:

- to protect life;
- to assist the fire and rescue services; and
- to further the achievement of sustainable development.

Protection of life

It is important to recognise that the standards will not guarantee the life safety of all *building* occupants. Occupants in *dwellings* do not normally perceive themselves to be at risk from fire and are not usually aware of the speed that fire can spread. The risk to occupants is greater if they are asleep during the outbreak of fire as they are likely to be roused more slowly. Occupants should be warned as soon as possible following the outbreak of fire and the guidance to standard 2.11 provides recommendations for the installation of alarm and detection systems in *domestic buildings*.

Fire and rescue service In some cases, occupants will not react quickly enough before being overcome by the effects of the fire and smoke and as a result, may require to be rescued by the fire and rescue service. For facilities to assist the fire and rescue service, see standards 2.12 to 2.14.

Sustainability The building regulations are primarily concerned with the protection of people from the dangers inherent in *buildings*, rather than protecting the owners of *buildings* from any economic loss which might occur. However following the guidance in the handbook will continue to embed active and passive fire protection systems within *buildings* which should reduce the likelihood of the total destruction of the *building* following the outbreak of fire.

2.0.3 Scope

Guidance in this section may not be appropriate for the following *buildings* as they are rarely designed and *constructed* in Scotland:

- a. a *dwelling* having an individual *storey* with an area more than 200 m²;
- b. *houses* with a *storey* at a height of more than 18 m above ground level;
- c. *domestic buildings* containing a *basement storey* at a depth of more than 4.5 m below ground level;
- d. *domestic buildings* with a communal *room* with an area more than 60 m²;
- e. *domestic buildings* containing catwalks, openwork floors or escalators;
- f. *domestic buildings* containing places of special fire risk;
- g. *domestic buildings* having an *escape route* over a *flat roof*; or
- h. *domestic buildings* with a *storey* at a height of more than 60 m above ground level.

For the purposes of a above, the area of an individual *storey* includes the area of a *gallery* or sleeping deck but excludes the area of an integral domestic garage.

In the case of a mixed use *building* containing non-domestic and domestic accommodation, reference should be made to the Technical Handbook for non-*domestic buildings* as well as the guidance contained in this Handbook.

In the case of sub-clauses a to h above, the alternative approach described in clause 2.0.7 should be used.

2.0.4 Method of measurement

The rules of measurement in section 0 of the Technical Handbook may not be appropriate for the guidance in section 2 Fire. For example, to establish the height of the topmost *storey* for fire and rescue service facilities, the height should be measured from the fire and rescue service access level and not necessarily the lowest ground level. Therefore, methods of measurement unique to fire are described within the guidance under each of the relevant standards.

Plant *storeys* For the purpose of measurement, the height above ground to the top most *storey* excludes roof-top plant areas and any top *storeys* consisting exclusively of plant rooms.

2.0.5 Latest changes

The key changes that have been made to the standards and guidance from May 2009 include:

- greater choice of active and passive fire safety measures within the *dwelling* of fire origin;
- improved guidance on fire detection and fire alarm systems in *dwelling*s to better reflect risk;
- improved guidance and greater choice on the escape strategy and fire safety measures serving *flats* and *maisonettes* including *high rise domestic buildings*;
- reference to fire service amended to fire and rescue service throughout guidance;
- standard 2.13 fire and rescue service water supply amended and clarified for *domestic buildings*;
- improved guidance on facilities to assist the fire and rescue service including the performance of fire mains;
- updated guidance on fire suppression systems including water supplies and component parts;
- incorporate annex 2A *high rise domestic buildings* within the guidance to standards 2.1 to 2.15 and amend annex numbering; and
- reference to structural eurocodes in annex 2A resistance to fire.

2.0.6 Explanation of terms

Flats or maisonettes

For the purposes of the guidance in section 2 Fire, a *flat* or *maisonette* entered only from the open air at ground level and with no *storey* at a height of more than 4.5 m should be regarded as a *house* and follow the guidance accordingly.

Protected routes of escape

Throughout the document there are references to protected routes of escape these include: open access balconies, galleries wholly or partly enclosed below, protected lobbies, *protected zones*, *protected enclosures*, external *escape stairs*, basements and *alternative exits*. This list is not exhaustive and is not intended to cover all parts of a *building* providing protected routes of escape. For example, *separating walls* and *separating floors* also protect routes of escape but are covered by the guidance to standard 2.2.

External areas

A roof, an external balcony or an enclosed courtyard open to the external air, where the area is more than 8 m² and to which there is access for a purpose other than maintenance, should be regarded as a *room*. It is not intended that these external areas be treated as *apartments* which create *inner rooms* to *dwelling*s.

Circulation space

A circulation space in a *dwelling* is an area mainly used as a means of access and egress between a *room* and an *exit* (e.g. hallways and stairwells).

Sleeping decks

A sleeping deck within a *room* should be regarded as being part of that *room*. However for the purposes of the guidance to standard 2.9, sleeping decks which do not fall within the definition of a *gallery* should be regarded as a separate *room* or *storey* as the case maybe.

2.0.7 Alternative approaches

Fire safety engineering can provide an alternative approach to the fire safety measures contained in this Technical Handbook. It may be the only practical way to achieve a satisfactory level of fire safety in some large and complex *buildings*.

Fire safety engineering may also be suitable for solving a problem with any aspect of the design which otherwise follows the guidance in this Handbook. Alternative fire safety measures include for example, the use of automatic fire detection, automatic fire suppression or ventilation systems in conjunction with passive fire protection. It is reasonable to demonstrate compliance with the functional standards by alternative means and in such cases, the verifier and the fire authority should be consulted early in the design process.

[www.scotland.gov.uk/
topics/built-environment/
building/building-
standards](http://www.scotland.gov.uk/topics/built-environment/building/building-standards)

Not all cases of variance from the guidance will require the appointment of a fire engineer. Reference could be made to 'A simplified approach to alternative fire safety strategies' Scottish Government (2010).

Existing *buildings*

It may be appropriate to vary the guidance contained in this Handbook when assessing the guidance against the constraints in existing *buildings* or in *buildings* which are listed in terms of their architectural or historic interest. In such cases, it would be appropriate to take into account a range of fire safety features, some of which are dealt with in this Handbook and some of which are not addressed in any detail. For more detailed information, guidance is contained in the 'Guide for practitioners 6 - Conversion of traditional buildings' Historic Scotland (2007).

[www.historic-
scotland.gov.uk](http://www.historic-scotland.gov.uk)

BS 7974:2001 and
International Fire
Engineering Guidelines
2005

Fire engineering designs can be complex and many require extensive use of engineering judgment. The following documents are cited to ensure that the guidance given encompasses best practice worldwide:

- BS 7974: 2001 Application of fire safety engineering principles to the design of buildings; or
- International Fire Engineering Guidelines, 2005 (IFEG).

The use of either document assumes that those carrying out or assessing a fire engineering approach have sufficient technical training, knowledge and experience to understand fully the risks involved.

The objectives of any fire safety strategy should be established first and designers and verifiers should be aware of the importance of the design assumptions. For example, the strategy should include an assessment of the system reliability. This will help to ensure that the fire safety objectives have been met.

It is important that owners/responsible person understand that the fire safety measures installed in a *building* need to be maintained and tested over the life time of the *building* so that they will operate effectively. BS 7974 and IFEG assume that all aspects of the fire engineering strategy are capable of being maintained and deployed over the lifetime of the *building*. If for example, alterations are found to be necessary due to changes to the *building* layout, the original strategy may need to be re-evaluated to ensure the fire safety provisions have not been compromised. For this reason, the fire strategy should preferably support any fire safety risk assessment required under Part 3 of the Fire (Scotland) Act 2005, as amended.

Fire safety engineering involves the use of scientific based calculations and/or statistical information to demonstrate an adequate level of safety for a specific *building*, structure or installation. In this regard the fire safety strategy is based on performance rather than prescription. Therefore fire safety engineering is about the need to identify the fire hazards, assess the fire

risks, understand the consequences and to offer fire safety strategies and designs to show how the objectives have been met. The 'tools' that support fire engineering can include calculation methods which are used to demonstrate that under a worst reasonable case, tenable conditions are maintained during the evacuation period. For example, a smoke exhaust fan in a smoke reservoir within an atrium space fails to operate but the smoke layer height continues to be maintained by the activation of a stand-by fan.

It is recognised that fire engineering is still a rapidly developing field and as such does not have the standardised codes for approaching and solving problems compared to other engineering disciplines. The documents identified above aim to provide a structured framework for assessing the interaction between, *buildings*, people and fire, and to facilitate innovation in design without compromising safety. They provide information on how to undertake a detailed analysis of specific aspects of fire safety engineering in *buildings*.

In practice, both frameworks provide a flexible but formalised engineering approach to fire safety which can be applied to new or existing *buildings* to show that the functional standards have been met.

BS 7974: 2001
Application of fire safety
engineering principles
to the design
of buildings

BS 7974: 2001 Application of fire safety engineering principles to the design of buildings is supported by 8 published documents:

- Part 0: Guide to the design framework and fire safety engineering procedures;
- Part 1: Initiation and development of fire within the enclosure of origin;
- Part 2: Spread of smoke and toxic gases within and beyond the enclosure of origin;
- Part 3: Structural response and fire spread beyond the enclosure of origin;
- Part 4: Detection of fire and actuation of fire protection systems;
- Part 5: Fire service intervention;
- Part 6: Human factors: Life safety strategies – Occupant evacuation, behaviour and condition; and
- Part 7: Probabilistic risk assessment.

International Fire
Engineering Guidelines

IFEG have been developed for use in the fire engineering design and approval of *buildings*. The objectives of the guidelines are to provide:

- a. a link between the regulatory system and fire engineering;
- b. guidance for the process of engineering; and
- c. guidance on available methodologies.

The IFEG sub-systems bear a very close resemblance to the sub-systems used in BS 7974: 2001 and are set out below:

- fire initiation and development and control;
- smoke development and spread and control;
- fire spread and impact and control;
- fire detection, warning and suppression;
- occupant evacuation and control; and
- fire services intervention.

Clause 1.3.2 of IFEG states that “Typically, each *building* project is unique and similarly, each fire engineering evaluation is unique. It is not sensible, therefore, to set down detailed guidance on how the fire safety analysis should be undertaken. Instead, it is the responsibility of the fire engineer to plan the analysis for the particular project, based on the decisions taken during the preparation of the fire engineering brief as discussed in Chapter 1.2”.

2.0.8 Relevant legislation

It is important to be aware that there is other legislation, apart from building regulations, imposing requirements for means of escape in case of fire and other fire safety measures that will come into force when the *building* is occupied. It is therefore recommended that consultation with those responsible for such legislation takes place before the application for building warrant is finalised. Any necessary fire precautions requiring additional *building work* can then be included in the application.

Fire (Scotland)
Act 2005 as
amended

Part 3 of the Fire (Scotland) Act 2005, as amended introduced a fire safety regime that applies mainly to non-*domestic buildings*. The regime does not generally apply to *domestic buildings* but may apply where staff are employed or members of the general public have access e.g. a dental surgery within a *dwelling*. The regime also applies to *domestic buildings* that are licensed as Houses in Multiple Occupation and to some *domestic buildings* where certain care services are provided. Those domestic premises covered by Part 3 of the 2005 Act, as amended are defined in section 78 of the Act.

Persons with obligations under the Act are required to carry out a fire safety risk assessment which may require additional fire safety precautions to reduce the risk to life in case of fire. For example, measures to reduce the risk and spread of fire, means of escape, fire-fighting equipment, fire detection and warning, instruction and training. Other measures are prescribed by regulation. The fire safety risk assessment should be kept under continuous review.

www.info-scotland.com/firelaw

There is sector specific guidance for various *building* uses on how to comply with Part 3 of the Act, such as guides for premises providing sleeping accommodation. This guidance can be found using the link to the firelaw website.

In many premises, existing fire safety measures have been incorporated in accordance with building regulations, however it is possible for a higher standard to be applied as a consequence of a fire safety risk assessment.

Section 71 of the 2005 Act makes it clear that terms, conditions or restrictions in licences, including statutory certification or registration schemes, are to have no effect if they relate to fire safety requirements or prohibitions which are or could be imposed under Part 3 of the 2005 Act, as amended.

Fire Safety (Scotland)
Regulations 2006

The Fire Safety (Scotland) Regulations 2006 made under the Fire (Scotland) Act 2005 and contain provisions which are part of the fire safety regime. These regulations must be considered along with Part 3 of the 2005 Act, as amended. The regulations contain further requirements in respect of fire safety risk assessment and obligations of duty holders.

The Construction
(Design and
Management)
Regulations 2007

The Construction (Design and Management) Regulations 2007 are intended to protect people working in *construction* and others who may be affected by their activities. The regulations require the systematic management of projects from concept to completion and throughout the life cycle of the structure, including eventual demolition. The CDM Regulations require designers and those who control or carry out *construction work* to identify hazards associated with their designs or *work* (including risk from fire) and plan to eliminate, reduce or control the risks.

Civic Government
(Scotland) Act 1982
(Licensing of Houses in
Multiple Occupations)
Order 2000 as amended.

The domestic Technical Handbook should be used for Houses in Multiple Occupation (HMOs) that are *dwellings* and the non-domestic Technical Handbook should be used for all other HMOs. It should be noted that HMOs may also require to be licensed under the Civic Government (Scotland) Act 1982 - Order 2000. To be classified as a House in Multiple Occupation, the accommodation must be the only or principal residence of 3 or more people from different families. In relation to fire safety aspects, HMOs which require a licence are also subject to Part 3 of the Fire (Scotland) Act 2005, as amended and guidance is available on the firelaw website to assist those with responsibilities for licensed HMOs understand and comply with fire safety legislation.

Regulation of Care
(Scotland) Act 2001

The Scottish Commission for the Regulation of Care is responsible for regulating a diverse range of care services some of which are delivered in *non-domestic buildings* (e.g. care homes, nurseries, independent *hospitals*, hospices, residential schools, secure accommodation) and some in *domestic buildings* (e.g. childminding, supported accommodation, adult placement services). The services are inspected by the Commission against national care standards issued by Scottish Ministers some of which include physical standards for the premises. The Commission consults with the fire authority on fire safety matters as part of the care service registration process. Where the applicant for a warrant intends to use or provide such a service, they should consult the Commission for advice.

2.0.9 Annexes

Annex 2A - Resistance to fire

Resistance to fire is expressed in terms of fire resistance duration and reference throughout this document to a short, medium or long fire resistance duration, are explained in annex 2.A. The performance levels include properties such as loadbearing capacity, integrity and insulation.

Annex 2B - Reaction to fire

Construction products are expressed as *non-combustible* low, medium, high or very high risk and explained in annex 2.B. The performance levels include properties such as the ease of ignition and the rate at which the product gives off heat when burning. This document does not give detailed guidance on other properties such as the generation of smoke, fumes and flaming droplets/particles.

Annex 2C - Vulnerability of roof coverings

Roof coverings are expressed in terms of low, medium or high vulnerability and explained in annex 2.C. The performance levels relate to the capability of a roof to resist penetration from fire and flame spread when the external surface is exposed to radiation and flames.

2.0.10 Certification

Scottish Ministers can, under Section 7 of the Building (Scotland) Act 2003, approve schemes for the certification of design or *construction* for compliance with the mandatory functional standards. Such schemes are approved on the basis that the procedures adopted by the scheme will take account of the need to co-ordinate the *work* of various designers and specialist contractors. Individuals approved to provide certification services under the scheme are assessed to ensure that they have the qualifications, skills and experience required to certify compliance for the *work* covered by the scope of the scheme. Checking procedures adopted by Approved Certifiers will deliver design or installation reliability in accordance with legislation.

2.1 Compartmentation

- 2.1 Functional standard
- 2.1.0 Introduction

standard

2.1

mandatory

Every *building* must be designed and *constructed* in such a way that in the event of an outbreak of fire within the *building*, fire and smoke are inhibited from spreading beyond the *compartment* of origin until any occupants have had the time to leave that *compartment* and any fire containment measures have been initiated.

Limitation:

This standard does not apply to *domestic buildings*.

2.1.0 Introduction

This standard does not apply to *domestic buildings*.

2.2 Separation

- 2.2 Functional standard
- 2.2.0 Introduction
- 2.2.1 Dwellings in different occupation
- 2.2.2 Dwellings with common occupation
- 2.2.3 Separation between domestic and non-domestic buildings
- 2.2.4 Domestic garages
- 2.2.5 Lift wells
- 2.2.6 Combustibility
- 2.2.7 High rise domestic buildings
- 2.2.8 Supporting Structure
- 2.2.9 Openings and service penetrations
- 2.2.10 Junctions

standard

2.2

mandatory

Every *building*, which is divided into more than one area of *different occupation*, must be designed and *constructed* in such a way that in the event of an outbreak of fire within the *building*, fire and smoke are inhibited from spreading beyond the area of occupation where the fire originated.

2.2.0 Introduction

In order to reduce the risk of fire spreading from one *dwelling* to another, fire *separation* should be provided between *dwellings* and between *dwellings* and any common spaces. Such *separation* should form a complete barrier to the products of combustion; smoke, heat and toxic gases. In semi-detached or terraced *houses*, or between *flats* or *maisonettes*, the barrier will normally be in the form of fire resisting walls and floors where appropriate.

The guidance in clause 2.2.9 (Openings and service penetrations) and clause 2.2.10 (Junctions) is common, not only to separation, but also to the relevant guidance in standard 2.4 cavities and standard 2.9 escape. To avoid duplication, these clauses are referred to throughout the Handbook and the reader is prompted to return to these common clauses whenever it is considered appropriate.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably practicable*, and in no case be worse than before the *conversion* (regulation 12, schedule 6).

2.2.1 Dwellings in different occupation

A *separating wall* or *separating floor* with at least a medium fire resistance duration should be provided between adjoining *dwellings*.

2.2.2 Dwellings with common occupation

A *separating wall* or *separating floor* with at least a medium fire resistance duration should be provided between a *dwelling* and any other part of the *building* in common occupation. A *protected zone* and a common access corridor should be considered as being in common occupation. Any *self-closing fire door* installed in these *separating walls* should have at least a short fire resistance duration and in the case of a *high rise domestic building*, a medium fire resistance duration. For ancillary *rooms* and spaces, common external *escape stairs* or open access balconies, see the guidance to standard 2.9.

2.2.3 Separation between domestic and non-domestic buildings

A *separating wall* or *separating floor* with at least a medium fire resistance duration should be provided between a *domestic* and *non-domestic building*. Reference should also be made to the guidance for *non-domestic buildings* where appropriate.

2.2.4 Domestic garages

There is a risk posed by the storage of combustible materials and other highly flammable substances in garages which are integral or attached to a *dwelling*.

A *separating wall* or *separating floor* with a short fire resistance duration therefore should be provided between an integral or attached garage and a *dwelling* in the same occupation. It is not necessary for a *roof space* above the garage to be separated from the *dwelling* where the garage ceiling will serve as a *separating floor* with a short fire resistance duration (see annex 2.A).

2.2.5 Lift wells

Every lift well should be enclosed by *separating walls* with a medium fire resistance duration. Where the lift well does not extend the full height of the *building*, the lift well should form a junction with a *separating floor* with a medium fire resistance duration. Where a lift is installed, the landing controls and lift car controls should be of a type that do not operate on heat or pressure resulting from a fire.

A platform lift *constructed* in accordance with the guidance in BS 6440: 1999 (see section 4 Safety), need not be enclosed by *separating walls* or *separating floors*.

2.2.6 Combustibility

In a *building* with no *storey* at a height above 18 m, *separating walls* may be *constructed* from combustible materials provided the appropriate fire resistance duration is maintained.

Separating walls

To reduce the risk of a fire starting within a combustibile *separating wall* or a fire spreading rapidly on or within the wall *construction*:

- insulation material exposed in a cavity should be *constructed* from materials which are *non-combustible* or of a low risk classification; and
- the internal wall linings should be *constructed* from materials which are *non-combustible* or of a low risk classification; and
- the wall should contain no pipes, wires or other services.

Where an opening is created to allow services to pass through the wall, the opening should be *constructed* in accordance with the guidance in clause 2.2.9.

Separating floors

In a *domestic building* with no *storey* at a height above 18 m, *separating floors* may be *constructed* from combustibile material.

Where a *domestic building* also contains non-domestic accommodation, every part of a *separating floor* (other than a floor finish e.g. laminate flooring) should be *constructed* from *non-combustible* material. This is not necessary for a floor:

- between a *shop* or *office* and a *dwelling* above the *shop* or *office* in the same *occupation* where there is no other *dwelling* above the *shop* or *office*, and the area of the *shop* or *office* is not more than 1½ times the area of the *separating floor*; or
- above a *pend* where the floor has at least medium fire resistance duration and the ceiling of the *pend* is *constructed* of *non-combustible* material; or
- between a *domestic building* and a unit of *shared residential accommodation*.

2.2.7 High rise domestic buildings

Occupants in *high rise domestic buildings* may not evacuate the *building* immediately and fire-fighting and rescue operations will take longer to commence if the fire is on a floor high above the ground. Therefore in order to improve occupant and fire-fighter safety in *high rise domestic buildings* every:

- *separating wall*, *separating floor* and open access balcony should be *constructed* from *non-combustible* products;
- *separating floor* and open access balcony should have a long fire resistance duration;
- *separating wall* including any *self-closing fire door*, should have at least a medium fire resistance duration.

2.2.8 Supporting Structure

Where an *element of structure* (see clause 2.3.0) provides support to a *non-combustible separating wall* or *separating floor*, the supporting *element of structure* should also be *constructed* from materials which are *non-combustible*.

Where an *element of structure* provides support to a *separating wall* or *separating floor* which attracts a higher fire resistance duration, the supporting *element of structure* should have at least the same fire resistance duration.

2.2.9 Openings and service penetrations

General

Separating walls and *separating floors* are intended to prevent fire passing from one part of the *building* to another part under *different occupation*. Openings and service penetrations through these walls or floors can compromise their effectiveness and should be kept to a minimum. The *solum* and *roof space* should not be forgotten. Openings and service penetrations should be carefully detailed and *constructed* to resist fire. This can be achieved by following the guidance below:

A self-closing fire door with the same fire resistance duration as the *separating wall* should be installed in accordance with the recommendations in the Code of Practice, 'Hardware for Fire and Escape Doors' Issue 2, June 2006, published by the Door and Hardware Federation and the Guild of Architectural Ironmongers.

In some instances a *self-closing fire door* with a short fire resistance duration may be installed. For example in a *separating wall* between a *dwelling* and a common space (see clause 2.2.2).

A *self-closing fire door* should not be fitted in a *separating wall* between 2 *dwellings* in *different occupation*.

A lockable door to a cupboard or service *duct* with a floor area not more than 3 m² need not be self-closing.

Hold open devices to
self-closing fire doors

Self-closing fire doors can be fitted with hold open devices as specified in BS 5839: Part 3: 1988 provided the door is not an *emergency door*, a *protected door* serving the only *escape stair* in the *building* (or the only *escape stair* serving part of the *building*) or a *protected door* serving a fire-fighting shaft.

It is important that hold open devices deactivate on operation of the fire alarm therefore some *buildings* will need automatic fire detection to be installed. Electrically operated hold open devices should therefore deactivate on operation of:

- an automatic fire alarm system designed and installed in accordance with BS 5839: Part 1: 2002 (Category L5) determined on the basis of a risk assessment;
- any loss of power to the hold open device, apparatus or switch; and
- a manually operated switch fitted in a position at the door.

An example of a Category L5 fire alarm system could be a system installed in the common corridor of *flats* incorporating only 2 smoke detectors, one installed on each side of the door and positioned not less than 500 mm and not more than 3 m from the door.

Additional guidance on the siting and coverage of fire detectors is contained in BS 5839: Part 1: 2002, and for actuation of door release mechanism, see BS 7273: Part 4: 2007.

A chimney or flue-pipe should be *constructed* so that, in the event of a fire, the fire resistance duration of the *separating wall* or *separating floor* is maintained.

A service opening (other than a ventilating duct) which penetrates a *separating wall* or *separating floor* should be *fire-stopped* providing at least the appropriate fire resistance duration for the wall or floor. This may be provided by:

- a casing which has at least the appropriate fire resistance from the outside; or
- a casing which has at least half the appropriate fire resistance from each side; or
- an automatic heat activated sealing device that will maintain the appropriate fire resistance in respect of integrity for the wall or floor regardless of the opening size.

Fire stopping of the following services passing through a *separating wall* or *separating floor* need not be provided for:

- a pipe or a cable with a bore, or diameter, of not more than 40 mm; or
- not more than four 40 mm diameter pipes or cables that are at least 40 mm apart and at least 100 mm from any other pipe; or
- more than four 40 mm diameter pipes or cables that are at least 100 mm apart; or
- a pipe which has a bore of not more than 160 mm and is of iron, steel or copper, or of a material capable of withstanding 800° C without allowing flames or hot material to pass through the wall of the pipe; or
- a branch pipe of a bore of not more than 110 mm connected to a vertical drainage or water service pipe, *constructed* from aluminium, aluminium alloy, or uPVC to BS 4514: 1983 (1998).

Where a pipe connects to another pipe which attracts a more demanding fire resistance duration, and is within 1 m from the *separating wall* or *separating floor*, the pipe should be fire stopped to the more demanding guidance.

Ventilation systems

Ventilation systems

The potential for ventilation systems to allow the spread of fire and smoke should be considered. A mechanical ventilation system may contribute to the spread of fire and smoke unless it is designed to shut down automatically or operate in a fire-mode if fire is detected. Ventilation ductwork passing through a separating wall or separating floor should be provided with either:

- fire dampers;
- fire resisting enclosures; or
- fire rated ductwork.

Any damper use in the design should be activated by smoke detection. For more detailed guidance, see BS 5588: Part 9: 1999.

Fire-stopping

Fire-stopping may be necessary to close an imperfection of fit or design tolerance between *construction* elements and components, *service openings* and *ventilation ducts*. Proprietary *fire-stopping* products, including intumescent products, should be tested to demonstrate their ability to maintain the appropriate fire resistance duration under the conditions appropriate to their end use.

Minimal differential movement	Where minimal differential movement is anticipated, either in normal use or during fire exposure, proprietary <i>fire-stopping</i> products may be used. The following materials are also considered appropriate: cement mortar; gypsum based plaster; cement or gypsum based vermiculite/perlite mixes; mineral fibre; crushed rock and blast furnace slag or ceramic based products (with or without resin binders).
Greater differential movement	Where greater differential movement is anticipated, either in normal use or during fire exposure, proprietary <i>fire-stopping</i> products should be used.
Preventing displacement	To prevent displacement, materials used for <i>fire-stopping</i> should be reinforced with, or supported by, <i>non-combustible</i> materials where the unsupported span is more than 100 mm and where non-rigid materials are used. However this is not necessary where it has been shown by test that the materials are satisfactory within their field of application.

2.2.10 Junctions

General

The basic principle is that junctions between *separating walls* and *separating floors* and other parts of the *building* should be designed and *constructed* in such a way to prevent a fire in one part of the *building* flanking the *separating wall* or *separating floor* and entering another part of the *building* under *different occupation*, including any solum space or *roof space*. Therefore, the *building* elements, materials or components should not be built into, or carried through or across the ends of, or over the top of a *separating wall* in such a way as to impair the fire resistance between the relevant parts of the *building*.

Junctions with walls

Where a *separating wall* or *separating floor* forms a junction with an *external wall*, another *separating wall*, or a wall or screen used to protect routes of escape (see clause 2.0.6), the junction should maintain the fire resistance of the *separating wall* or *separating floor*.

Junctions with roofs

Where a *separating wall* forms a junction with a roof, the junction should maintain the fire resistance duration of the *separating wall* in accordance with the following:

- where the roof has a combustible substrate, the wall should project through the roof to a distance of at least 375 mm above the top surface of the roof; or
- where the wall is taken to the underside of a *non-combustible* roof substrate, the junction should be *fire-stopped* and the roof covering should be low vulnerability (see guidance to standard 2.8) for a distance of at least 1.7 m to each side of the centre-line of the wall; or
- in the case of a pitched roof covered by slates nailed directly to sarking and underlay, the junction between the sarking and wall-head should be *fire-stopped* as described in BRE Housing Defects Prevention Unit “Defect Action Sheet (Design)” February 1985 (DAS 8); or
- in the case of a pitched roof covered by slates or tiles fixed to tiling battens and any counter-battens, the junction between the tiles or slates and the underlay should be fully bedded in cement mortar (or other *fire-stopping* material) at the wall-head.

2.3 Structural protection

- 2.3 Functional standard
- 2.3.0 Introduction
- 2.3.1 Elements of Structure
- 2.3.2 Combustibility
- 2.3.3 Supporting structure
- 2.3.4 Openings and service penetrations
- 2.3.5 Junctions

standard

2.3

mandatory

Every *building* must be designed and *constructed* in such a way that in the event of an outbreak of fire within the *building*, the load-bearing capacity of the *building* will continue to function until all occupants have escaped, or been assisted to escape, from the *building* and any fire containment measures have been initiated.

2.3.0 Introduction

In order to prevent the premature collapse of the load-bearing structural elements of a *building*, appropriate levels of fire resistance duration (see annex 2.A) should be provided to all *elements of structure*. The purpose of structural fire protection is:

- to minimise the risk to the occupants, some of whom may not evacuate the *building* immediately; and
- to reduce the risk to fire-fighters who may be engaged in fire-fighting or rescue operations.

An element of structure may perform more than one function and it is important that the appropriate guidance related to the different standards is followed.

The added benefit of structural fire protection means that the risk to people in the vicinity of the *building* or in adjoining *buildings* from collapse of the structure is reduced.

Elements of structure

An *element of structure* is part of a *building* which is part of a structural frame (beams and columns), load-bearing (other than part which is only self load bearing), a floor, or supports a floor. An example of part of the structure that is only self load-bearing could be a lintel in a non load-bearing wall. A roof structure should not be considered as an *element of structure* unless the roof provides support to an *element of structure* or which performs the function of a floor.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard (regulation 12, schedule 6).

2.3.1 Elements of Structure

It is essential that during a fire the *elements of structure* should continue to function. They should remain capable of supporting and retaining the fire protection to floors, *escape routes* and fire access routes, until all occupants have escaped, been assisted to escape or rescued by the fire and rescue service. In practice, the fire and rescue service could remain in the *building* long after it has been evacuated. For this reason, an additional level of protection is built into the guidance for *domestic buildings* that varies depending on the height of the topmost *storey* of the *building*.

Height of topmost storey above ground level	Fire resistance duration
Not more than 7.5 m	short
More than 7.5 m but not more than 18 m	medium
More than 18 m but not more than 60 m	long [1]

Notes:

1. An intermediate floor or floors within a *flat* or *maisonette* need only have short fire resistance duration provided the floor or floors do not support or provide lateral restraint to any part of the structure with a medium or long fire resistance duration.

However the following *elements of structure* need not be provided with any fire resistance for structural protection:

- an *element of structure* in a single *storey building* which does not form part of, or provide support to, a *separating wall*, a wall or screen used to protect routes of escape (see clause 2.0.6) or an *external wall* which attracts a fire resistance (see guidance to standard 2.6);
- a *gallery floor*, other than a *gallery floor* which is wholly or partly enclosed below;
- the lowest floor of a *building*.

2.3.2 Combustibility

An *element of structure* may be *constructed* from combustible material i.e. material which is low, medium, high or very high risk, (see annex 2.B) provided the *element of structure* has the appropriate fire resistance duration.

Where an element of structure provides support to another element of structure (or a protected route of escape, see clause 2.0.6) which should be *constructed* from *non-combustible* material, the supporting element of structure should also be *constructed* from materials which are *non-combustible* (see annex 2.B).

2.3.3 Supporting structure

Where an element of structure provides support to another element of structure (or provides support to a protected route of escape) which attracts a higher period of fire resistance, the supporting element of structure should have at least the same period of fire resistance.

2.3.4 Openings and service penetrations

In general, openings and service penetrations in *elements of structure* need not be protected from fire unless there is the possibility of structural failure. However where a large opening or a large number of small openings are formed, careful detailing, particularly at the edge of the opening or service penetration, should be carried out in order to maintain the load-bearing capacity of the *element of structure*. If in doubt, edge protection should be provided.

2.3.5 Junctions

The detailing of junctions between relevant parts of a *building* is described in clauses 2.2.10, 2.4.7 and 2.9.19. *Fire-stopping* of all other junctions is generally not necessary. The important criteria to consider is the ability of the element of structure to maintain its load-bearing capacity in a fire in accordance with clause 2.3.1.

2.4 Cavities

- 2.4 Functional standard
- 2.4.0 Introduction
- 2.4.1 Cavity barriers
- 2.4.2 Dividing up cavities
- 2.4.3 Fire resisting ceilings as an alternative to cavity barriers
- 2.4.4 High rise domestic buildings
- 2.4.5 Supporting structure
- 2.4.6 Openings and service penetrations
- 2.4.7 Junctions

standard

2.4

mandatory

Every *building* must be designed and *constructed* in such a way that in the event of an outbreak of fire within the *building*, the unseen spread of fire and smoke within concealed spaces in its structure and fabric is inhibited.

2.4.0 Introduction

Fire and smoke spread in concealed spaces is particularly hazardous because fire can spread quickly throughout a *building* and remain undetected by the occupants of the *building* or by fire and rescue service personnel. Ventilated cavities generally promote more rapid fire spread around the *building* than unventilated cavities due to the plentiful supply of replacement air. *Buildings* containing sleeping accommodation pose an even greater risk to life safety and demand a higher level of fire precautions. For these reasons, it is important to control the size of cavities and the type of material in the cavity.

The guidance for protection to cavities should not be assessed in isolation and reference should be made to the guidance to standard 2.6 for spread to adjoining *buildings* and the guidance to standard 2.7 for fire spread on *external walls*.

Cavity

A cavity is a concealed space enclosed by elements of a *building* (including a suspended ceiling) or contained within a *building* element, but not a *room*, cupboard, circulation space, stair enclosure, lift well, *flue* or a space within a chute, *duct*, pipe or conduit. For the purposes of this guidance, a cavity includes a *roof space*, a service riser or any other space used to run services around the *building*.

Reference to surfaces in a cavity is intended to include the surface of the enclosing envelope of the cavity (including insulation material) but excludes timber roof trusses or lintols, joist ends, pipes, conduits or cables.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably practicable*, and in no case be worse than before the *conversion* (regulation 12, schedule 6).

2.4.1 Cavity barriers

A *cavity barrier* means any *construction* provided to seal a cavity against the penetration of fire and smoke or to restrict its movement within the cavity.

In order to inhibit fire spread in a cavity, every cavity within a *building* should have *cavity barriers* with at least short fire resistance duration (see annex 2.A) installed around the edges of the cavity. This includes, for example, around the head, jambs and sill of an external door or window opening. A *cavity barrier* should also be installed between a *roof space* and any other *roof space* or between a cavity and any other cavity such as at the wall-head between a wall cavity and a *roof space* cavity.

However *cavity barriers* are not necessary at a junction between two cavity walls each comprising two leaves of masonry or concrete at least 75 mm thick.

Sealing cavities can sometimes create difficulties, especially where *construction* techniques rely on through ventilation of the cavity (see section 3 Environment) or where the detailing should take into account the effect of thermal bridging (see section 6 Energy).

2.4.2 Dividing up cavities

Measurement Cavities should be measured either horizontally or vertically, as the case may be, along the centre-line of the cavity and not diagonally.

General Every cavity should be divided by *cavity barriers* so that the maximum distance between *cavity barriers* is not more than 20 m where the cavity has surfaces which are *non-combustible* or low risk materials, or 10 m where the cavity has surfaces which are medium, high or very high risk materials.

Exclusions *Cavity barriers* are not necessary to divide a cavity:

- formed by two leaves of masonry or concrete at least 75 mm thick; or
- in a ceiling void between a floor and a ceiling *constructed* in accordance with the guidance in clause 2.4.3; or
- between a roof and a ceiling *constructed* in accordance with the guidance in clause 2.4.3; or
- below a floor next to the ground where the cavity is either inaccessible or is not more than 1 m high; or
- formed by *external wall* or roof cladding, where the inner, outer or other exposed surfaces of the cladding are low risk materials or *non-combustible* attached to a masonry or concrete *external wall* or a concrete roof, and where the cavity contains only *non-combustible* material (see also the guidance to standard 2.7).

2.4.3 Fire resisting ceilings as an alternative to *cavity barriers*

Where a ceiling is provided as an alternative to *cavity barriers* as in clauses 2.4.2b and 2.4.2c, the ceiling should have a short fire resistance duration, and be *constructed* in accordance with the following recommendations:

- the ceiling should not be easily demountable;
- openings and service penetrations in the ceiling should be protected in accordance with clause 2.2.9;
- the ceiling lining should be *constructed* in accordance with the guidance to standard 2.5;
- the ceiling may contain an access hatch which, when closed, will maintain the fire resistance duration of the ceiling.

2.4.4 High rise domestic buildings

Fire-fighters may not be able to apply a water jet from a fire-fighting hose directly onto a fire that has spread within an *external wall* or onto an *external wall*. This is because the *external wall* is either inaccessible or is too high above the ground to be within the reach capability of fire-fighting equipment such as hydraulic platforms or turntable ladders. Therefore, the *construction* of *external walls* should not contribute to the development of fire or contribute to fire spread within cavities or vertical fire spread up the facade of the *building*.

In order to satisfy standards 2.4, 2.6 and 2.7, the *external wall*, including any associated *cavity barrier* or cladding system, should be designed and *constructed* from:

- a. products that achieve a *non-combustible* reaction to fire classification in accordance with annex 2.B; or
- b. achieve the performance levels in BR 135, 'Fire Performance of external thermal insulation for walls of multi-storey buildings' when read in conjunction with the test methodology in BS 8414: Part 1: 2002 or BS 8414: Part 2: 2005.

However an insulation product need not achieve a *non-combustible* classification in a above where:

- the insulation product is located between two leaves of masonry or concrete at least 75 mm thick; and
- the external wall is provided with *cavity barriers* around all openings and at the top of the wall-head.

2.4.5 Supporting structure

A *cavity barrier* should be fixed so that its performance is not affected by:

- movement of the *building* due to subsidence, shrinkage or thermal collapse in a fire of any services penetrating it;
- failure in a fire of its fixings; or
- failure in a fire of any material or *element of structure* which it abuts.

However where a *cavity barrier* is installed in a *roof space*, there is no need to protect roof members that support the *cavity barrier*.

2.4.6 Openings and service penetrations

A *cavity barrier* and a ceiling provided as an alternative to a *cavity barrier* may contain a *self-closing fire door* (or a hatch in the case of a ceiling), or a *service opening constructed* in accordance with the guidance in clause 2.2.9.

2.4.7 Junctions

All *cavity barriers* should be tightly fitted to rigid *construction*. Where this is not possible as in the case of a junction with slates, tiles, corrugated sheeting or similar materials, the junction should be *fire-stopped*. See clause 2.2.10 for additional guidance on junctions and clause 2.2.9 for additional guidance on *fire-stopping* materials.

Where a wall, floor or other part of a *building* which has a fire resistance duration abuts a structure containing a cavity, a *cavity barrier* should be installed so as to extend the line of the structure. However this is not necessary where the cavity is:

- formed by two leaves of masonry or concrete at least 75 mm thick;
- formed by *external wall* or roof cladding, where the inner, outer or other exposed surfaces of the cladding are *non-combustible* or low risk materials and attached to a masonry or concrete *external wall* or a concrete roof, and where the cavity contains only *non-combustible* or low risk material (see also the guidance to standard 2.7);
- in a wall which has a fire resistance duration for load-bearing capacity only.

2.5 Internal linings

- 2.5 Functional standard
- 2.5.0 Introduction
- 2.5.1 Internal linings
- 2.5.2 Assessment of linings
- 2.5.3 Plastic glazing
- 2.5.4 Thermoplastic material
- 2.5.5 Thermoplastic materials in ceilings
- 2.5.6 Thermoplastic materials in rooflights
- 2.5.7 Thermoplastic materials in light fittings with diffusers
- 2.5.8 Sandwich panels

standard

2.5

mandatory

Every *building* must be designed and *constructed* in such a way that in the event of an outbreak of fire within the *building*, the development of fire and smoke from the surfaces of walls and ceilings within the area of origin is inhibited.

2.5.0 Introduction

The *building* contents are likely to be the first items ignited in a fire and are beyond the scope of this guidance. Materials used in walls and ceilings can however significantly affect the spread of fire and its rate of growth. Fire spread on internal linings in *escape routes* is particularly important because rapid fire spread in *protected zones* and *unprotected zones* could prevent the occupants from escaping.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard (regulation 12, schedule 6).

2.5.1 Internal linings

Wall and ceiling surfaces means the substrate or lining material including any treatment thereof to restrict flame spread, but excludes any decorative wallpaper or paints. Whilst it is accepted that such wallpaper or paints are not controlled by the guidance, multiple layers applied to face of wall or ceiling surface can increase flame spread and hence the fire growth rate. For this reason, multiple layers are not recommended when carrying out refurbishment *work* involving the re-decoration of wall and ceiling surfaces.

A *protected zone* should have wall and ceiling surfaces which are low risk or *non-combustible* (see annex 2.B).

A *room, unprotected zone* or *protected enclosure* should have wall and ceiling surfaces with a reaction to fire no worse than medium risk.

Limitations on higher risk surfaces

A *room* (other than a *kitchen*) not more than 4 m² may have wall and ceiling linings with a high risk classification. In a *room* (other than a *kitchen*) more than 4 m² the wall surfaces may also have a high risk classification subject to a maximum of 20 m² where the total area of the high risk surfaces is not more than half the floor area of the *room*.

2.5.2 Assessment of linings

Wall and ceiling linings should be assessed for their reaction to fire characteristics.

Wall linings

The following wall surfaces should be included in the assessment:

- *glazing* except *glazing* in doors; and
- any part of a ceiling which slopes at an angle of more than 70° to the horizontal.

However the following surfaces need not be taken into account:

- doors and door frames;
- window frames and frames in which *glazing* is fitted;
- skirtings and facings, cover moulds, picture rails, and similar narrow members; or
- fireplace surrounds, mantle shelves and fitted furniture.

Ceiling linings

The following ceiling surfaces should be included in the assessment:

- the surface of *glazing*; and
- any part of a ceiling which slopes at an angle of 70° or less to the horizontal.

However the following need not be taken into account:

- ceiling hatches and their frames; and
- the frames of windows or rooflights and the frames in which *glazing* is fitted; or
- facings, cover moulds, picture rails, and similar narrow members.

2.5.3 Plastic glazing

External windows and internal *glazing* to *rooms* (but not to *protected zones* or *unprotected zones*) may be fitted with plastic *glazing* materials which are:

- rigid solid PVC (uPVC); or
- polycarbonate rigid solid sheet at least 3 mm thick; or
- multi-skin polycarbonate sheet at least 10 mm thick overall which has a low or medium risk.

2.5.4 Thermoplastic material

Thermoplastic materials in ceilings, roof lights and lighting diffusers provide a significant hazard in a fire. Burning droplets can rapidly increase the fire growth rate and the smoke produced is normally dense and toxic which combine to produce extremely hazardous conditions. For these reasons, thermoplastic material should not be used in *protected zones* or fire-fighting shafts. However thermoplastic materials may still be used with limited application for some ceilings (see clause 2.5.5), rooflights (see clause 2.5.6) or light fittings with diffusers (see clause 2.5.7).

A thermoplastic material means any synthetic material that has a softening point below 200° C when tested in accordance with BS EN ISO 306: 2004 Method A120 Plastics - Thermoplastic Materials - Determination of Vicat softening temperature.

Rigid thermoplastic

TP(a) rigid means:

- rigid solid, (solid as distinct from double or multiple-skin) polycarbonate sheet at least 3 mm thick; or
- multi-skinned rigid sheet made from unplasticised pvc or polycarbonate which has a low or medium risk for reaction to fire; or
- any other rigid thermoplastic product, a specimen of which (at the thickness of the product as put on the market), when tested in accordance with Method 508A in BS 2782: 2004 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.

Flexible thermoplastic

TP(a) flexible means:

- flexible products not more than 1 mm thick which satisfy the Type C provisions of BS 5867: Part 2: 1980 (1993) when tested in accordance with Test 2 in BS 5438: 1989 (1995) with the flame applied to the surface of the specimens for 5, 15, 20 and 30 seconds respectively, but excluding cleansing procedure.

Semi-rigid thermoplastic

TP(b) semi-rigid means:

- a rigid solid polycarbonate sheet product not more than 3 mm thick, or multiple-skin polycarbonate sheet products which do not qualify as TP(a) by test; or
- other products which, when a specimen of the material more than 1.5 mm and not more than 3 mm thick is tested in accordance with Method 508A in BS 2782: 2004, has a rate of burning which is not more than 50 mm/minute.

2.5.5 Thermoplastic materials in ceilings

A ceiling *constructed* from thermoplastic materials, either as a suspended or stretched skin membrane with a TP(a) flexible classification should be supported on all its sides and not exceed 5 m². However this does not apply to a ceiling which has been satisfactorily tested as part of a fire resisting ceiling system. A ceiling with a TP(a) flexible classification should not be installed in the ceiling of a *protected zone* or fire-fighting shaft.

Subject to the recommendations in clause 2.5.6 and clause 2.5.7, use of thermoplastic materials with a TP(a) rigid or TP(b) semi-rigid classification is unlimited.

2.5.6 Thermoplastic materials in rooflights

Thermoplastic materials (other than TP(a) flexible) may be used in rooflights subject to the recommendations in the table and diagram below.

Thermoplastic rooflights should also be *constructed* in accordance with the guidance to standard 2.8.

2.5.7 Thermoplastic materials in light fittings with diffusers

Thermoplastic materials may be used in light fittings with diffusers. Where the lighting diffuser forms an integral part of the ceiling, the size and disposition of the lighting diffusers should be installed in accordance with the table and diagram below.

However where the lighting diffusers form an integral part of a fire-resisting ceiling which has been satisfactorily tested, the amount of thermoplastic material is unlimited.

Where light fittings with thermoplastic diffusers do not form an integral part of the ceiling, the amount of thermoplastic material is unlimited provided the lighting diffuser is designed to fall out of its mounting when softened by heat.

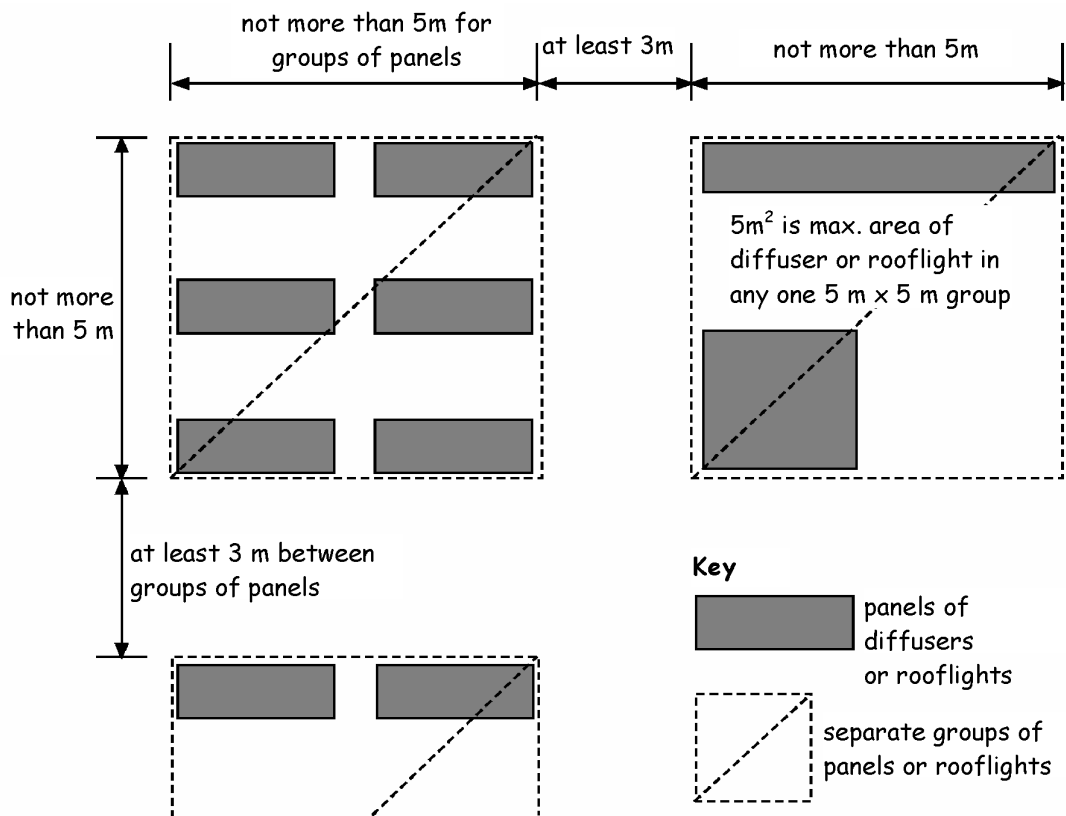
Thermoplastic rooflights and light fittings with diffusers

Classification of lower surface	Protected zone or fire-fighting shaft	Unprotected zone or protected enclosure		Room	
		TP(a) rigid	TP(a) flexible and TP(b)	TP(a) rigid	TP(a) flexible and TP(b)
Maximum area of each diffuser panel or rooflight (m ²)	Not advised	No limit	5 m ²	No limit	5 m ²
Maximum total area of diffuser panels or rooflights as a percentage of the floor area of the space in which the ceiling is located (%)	Not advised	No limit	15%	No limit	50%
Minimum separation distance between diffuser panels or rooflights (m)	Not advised	No limit	3 m	No limit	3 m

Notes:

- Smaller panels can be grouped together provided that the overall size of the group and the space between any others, satisfies the dimensions shown in the diagram below.
- The minimum 3 m separation in the diagram below should be maintained between each 5 m² panel. In some cases therefore, it may not be possible to use the maximum percentage quoted.
- TP(a) flexible is not recommended in rooflights.

Layout restrictions on thermoplastic rooflights and light fittings with diffusers



2.5.8 Sandwich panels

A sandwich panel is a factory-made non load-bearing component of a wall, ceiling or roof consisting of a panel having an insulated core filling the entire area between sheet metal outer facings, which may or may not have decorative and/or weatherproof coatings.

A sandwich panel used for internal walls or linings should have a *non-combustible* classification.

2.6 Spread to neighbouring buildings

- 2.6 Functional standard
- 2.6.0 Introduction
- 2.6.1 Fire resistance of external walls
- 2.6.2 Unprotected area
- 2.6.3 The simple geometry method
- 2.6.4 External wall cladding
- 2.6.5 Combustibility
- 2.6.6 Supporting structure

standard

2.6

mandatory

Every *building* must be designed and *constructed* in such a way that in the event of an outbreak of fire within the *building*, the spread of fire to neighbouring *buildings* is inhibited.

2.6.0 Introduction

In order to reduce the danger to the occupants of other *buildings*, one *building* should be isolated from another by either *construction* or distance. The distance between a *building* and its relevant *boundary* is dictated by the amount of heat that is likely to be generated in the event of fire. This will be influenced by the extent of openings, or other unprotected areas in the *external wall* of the *building*.

The guidance for fire spread to neighbouring *buildings* should not be assessed in isolation and reference should be made to the guidance to standard 2.4 for fire spread in cavities and the guidance to standard 2.7 for fire spread on *external walls*.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably practicable*, and in no case be worse than before the *conversion* (regulation 12, schedule 6).

2.6.1 Fire resistance of external walls

Apart from unprotected areas, as described in clause 2.6.2, *external walls* should have:

- short fire resistance duration, if more than 1 m from the *boundary*; or
- medium fire resistance duration, if not more than 1 m from the *boundary*.

However short fire resistance duration is sufficient even if not more than 1 m from the *boundary*, for the following:

- a detached *building* ancillary to a *dwelling* comprising a garden hut or store, or a *building* for keeping animals, birds or other livestock for *domestic* purposes;
- a *conservatory* or *porch* attached to a *dwelling*; or
- a garage wall.

Fire resistance duration need not be provided for a *building* ancillary to a *dwelling*, comprising a *carport*, *covered area*, *greenhouse*, summerhouse, or swimming pool enclosure unless the *building* contains oil or liquefied petroleum gas fuel storage (see section 3 and section 4).

2.6.2 Unprotected area

An unprotected area means any part of an *external wall* (including a door or window opening), which does not attain the appropriate fire resistance duration as recommended in clause 2.6.1.

An unprotected area does not include a fixed unopenable window where the frame and *glazing* has the appropriate fire resistance duration. Any wallhead fascia, soffit or barge board, or any cavity vents or solum vents may also be excluded from the unprotected area calculation.

Up to 500 mm from *boundary*

Where the *external wall* of a *building* is not more than 500 mm from the *boundary* there should be no unprotected area, other than any wallhead fascia, soffit or barge board, or any cavity vents or solum vents.

500 mm to 1 m from *boundary*

Where the *external wall* of a *building* is more than 500 mm but not more than 1 m from the *boundary*, the level of unprotected area is limited to:

- the *external wall* of a *protected zone*;
- an area of not more than 0.1 m^2 , which are at least 1.5 m from any other unprotected area in the same wall;
- an area of not more than 1 m^2 , which are at least 4 m from any other unprotected area in the same wall (this 1 m^2 unprotected area may consist of 2 or more smaller areas which when combined do not exceed an aggregate area of 1 m^2).

More than 1 m from *boundary*

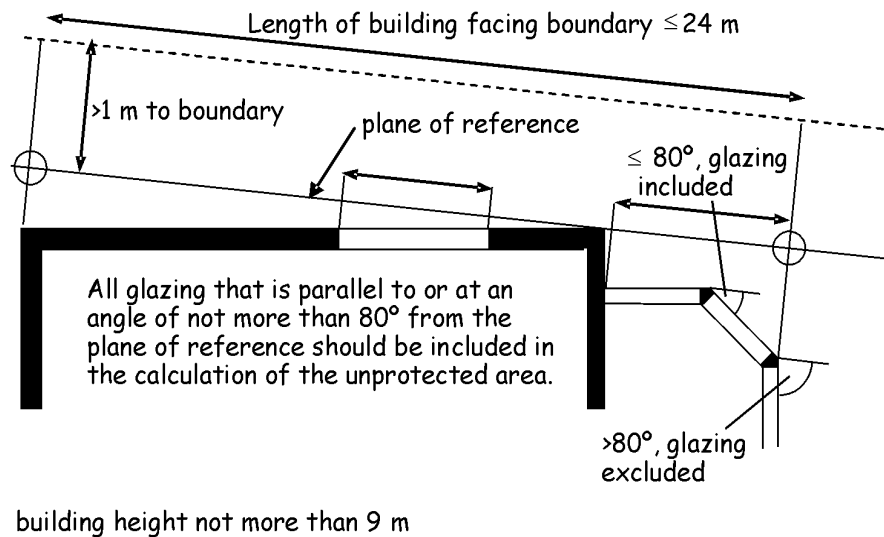
2.6.3 The simple geometry method

Where the *external wall* of a *building* is more than 1 m from the *boundary* the amount of unprotected area (in square metres) may be equivalent to six times the distance (in metres) to the *boundary*. Therefore if the distance to the *boundary* is at least 1 m, the unprotected area should not exceed 6 m^2 , if the distance to the *boundary* is at least 2 m, the unprotected area is 12 m^2 , and so on.

Where the *external wall* of a *building* is more than 6 m from the *boundary*, the amount of unprotected area is unlimited.

The use of the simple geometry method described above is limited to *buildings* which are more than 1 m from the *boundary*, not more than 9 m in height, and the length of the side of the *building* facing the *boundary* is not

more than 24 m. Any external side of a *building* which makes an angle of more than 80° with the plane of reference can be ignored in the calculation of unprotected area. The diagram below provides a typical example of a *conservatory* attached to a *house*.



Where a *domestic building* exceeds these limits, reference could be made to the Enclosing Rectangle Method (Table B) contained in the non-domestic guidance document or the Building Research Establishment Report 'External fire spread: *building separation and boundary distances*' (BR 187, 1991). In these cases, for the purpose of calculating the enclosing rectangle, a *separating wall* or *separating floor* should be regarded as a *compartment wall* or *compartment floor*.

2.6.4 External wall cladding

External wall cladding includes all non load-bearing *external wall* cladding systems attached to the structure, for example, clay or concrete tiles, slates, pre-cast concrete panels, stone panels, masonry, profiled metal sheeting including sandwich panels, weather boarding, thermally insulated *external wall* rendered systems, *glazing* systems and all other ventilated cladding systems.

External wall cladding not more than 1 m from a *boundary* should have a *non-combustible* classification.

Fire within the *building* may break out through a window or door opening and as a consequence, the cladding, once ignited, would contribute to the heat generated from the fire. Therefore where the cladding is more than 1 m from the *boundary* and is *constructed* from combustible material more than 1 mm thick that has a low, medium, high or very high risk, (as described in annex 2.B), the cladding should be included in the calculation of unprotected area.

However combustible cladding need not be included in the calculation of unprotected area where:

- the combustible cladding is attached to the structure of the *building* and the *external wall* contains no openings other than the small openings described in clause 2.6.2b; and
- the wall behind the cladding (or the cladding itself) has the appropriate fire resistance duration from the inside.

In addition, a cavity formed by *external wall* cladding should be protected in accordance with the guidance to standard 2.4 and fire spread on *external walls* in accordance with the guidance to standard 2.7.

2.6.5 Combustibility

Every part of an *external wall* including *external wall* cladding (see clause 2.6.4) not more than 1 m from a *boundary* or the *external wall* of a *high rise domestic building*, should be *constructed* of *non-combustible* products. This does not apply to insulation exposed in a cavity that is between 2 leaves of masonry or concrete at least 75 mm thick, and which has a *cavity barrier* around all openings in the wall and at the top of the wall-head.

However a structural frame which is low, medium, high or very high risk (see annex 2.B) may be used not more than 1 m from a *boundary* provided:

- no *storey* height is more than 18 m; and
- the recommendations in clauses 2.6.1 and 2.6.2 have been followed; and
- any *external wall* cladding is *constructed* from *non-combustible* products.

See the guidance to standard 2.7 for additional recommendations on *external wall* cladding and the alternative to the need for *non-combustibility* mentioned above.

2.6.6 Supporting structure

Where an *element of structure* provides support to an *external wall* (including *external wall* cladding) which has a fire resistance duration (as recommended in the guidance to clauses 2.6.1 and 2.6.2) the supporting *element of structure* should also have at least the same fire resistance duration.

2.7 Spread on external walls

- 2.7 Functional standard
- 2.7.0 Introduction
- 2.7.1 External wall cladding

standard

2.7

mandatory

Every *building* must be designed and *constructed* in such a way that in the event of an outbreak of fire within the *building*, or from an external source, the spread of fire on the *external walls* of the *building* is inhibited.

2.7.0 Introduction

There is a risk of fire spread on the *external walls* of a *building*. Fire could break out through a window or door opening and spread onto the *external walls*. *External walls* close to the *boundary* are also at risk as they may be exposed to radiant heat flux from a fire in an adjoining *building*.

Horizontal or lateral fire spread between *houses* or between *flats* and/or *maisonettes* will be inhibited by the *construction* of *separating walls*. Vertical fire spread between *flats* and *maisonettes* will be inhibited by the *construction* of *separating floors* (see standard 2.2).

High rise domestic buildings

Fire-fighters may not be able to apply a water jet from a fire-fighting hose directly onto a fire that has spread onto or within an *external wall* high above the ground. This is because the *external wall* is either inaccessible or is out with the reach capability of fire-fighting equipment such as hydraulic platforms or turntable ladders. The *construction* of *external walls* in *high rise domestic buildings* should not contribute to the development of fire or contribute to vertical fire spread up the façade of the *building*.

The guidance for fire spread on *external walls* should not be assessed in isolation and reference should be made to the guidance to standard 2.4 for fire spread in cavities and the guidance to standard 2.6 for fire spread to neighbouring *buildings*.

Conversions

In the case of conversions, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably practicable*, and in no case be no worse than before the conversion (regulation 12, schedule 6).

2.7.1 External wall cladding

External wall cladding includes all non *load-bearing external wall* cladding systems attached to the structure, for example, clay or concrete tiles, slates, pre-cast concrete panels, stone panels, masonry, profiled metal sheeting including sandwich panels, weather boarding, thermally insulated *external wall* rendered systems, *glazing* systems and all other ventilated cladding systems.

External wall cladding more than 1 m to the *boundary* may be *constructed* from combustible products more than 1 mm thick which is low, medium, high or very high risk (see annex 2.B). This guidance does not apply to *high rise domestic buildings*.

External wall cladding not more than 1 m from a *boundary* should have a *non-combustible* classification.

External wall cladding not more than 1 m from a *boundary* or used on the *external wall* of a *high rise domestic building*, should be *constructed* of *non-combustible* products.

However an insulation product need not achieve a *non-combustible* classification where:

- the insulation product is located between 2 leaves of masonry or concrete at least 75 mm thick; and
- the *external wall* is provided with *cavity barriers* around all openings and at the top of the wall-head.

Alternative guidance

BR 135, 'Fire Performance of external thermal insulation for walls of multi-storey buildings' and BS 8414: Part 1: 2002 or BS 8414: Part 2: 2005 has been updated to include the most up-to-date research into fire spread on *external wall* cladding. The guidance provided in these publications may be used as an alternative to *non-combustible external wall* cladding as described above and for materials exposed in a cavity, as described in clause 2.4.7.

2.8 Spread from neighbouring buildings

2.8 Functional standard

2.8.0 Introduction

2.8.1 Roof coverings

standard

2.8

mandatory

Every *building* must be designed and *constructed* in such a way that in the event of an outbreak of fire in a neighbouring *building*, the spread of fire to the *building* is inhibited.

2.8.0 Introduction

Buildings are at risk from fires starting beyond their *boundaries*. The area of greatest vulnerability is the roof and there may be a risk of ignition or penetration by burning brands, flames or heat. The degree of protection for roof coverings is dependent upon the distance to the *boundary*.

A roof covering consists of one or more layers of material such as felt, tiles, slates, sandwich panels etc, but is not intended to include the whole of the roof structure. Solar roof panels should be regarded as forming part of the roof covering and as such should be able to resist ignition from an external source. Most solar panels are *glazed* and their ability to inhibit fire spread can be determined by the thickness of *glass* which makes up the panel (see table to annex 2.C).

A roof covering or rooflight which forms part of an internal ceiling lining should also follow the guidance to standard 2.5 Internal linings.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably practicable*, and in no case be worse than before the *conversion* (regulation 12, schedule 6).

2.8.1 Roof coverings

The possibility of direct flame impingement from neighbouring *buildings* is greater where the roof covering of the *building* is close to the *boundary*. Whilst much will depend on the fire dynamics and the velocity and direction of the wind, burning brands are also likely to be more intense. For these reasons, the vulnerability of a roof covering is determined in relation to the distance of a *building* to the *boundary*.

Not more than 6 m from *boundary*

The roof of a *building*, including any rooflights, but excluding any wallhead fascia, flashing or trim, boxed gutters, soffit or barge boards, should have a low vulnerability if not more than 6 m from the *boundary*. Common materials that normally attain the criterion include slates, tiles, *glazing*, sandwich panels and certain plastic materials as described in the table to annex 2.C.

More than 6 m but not more than 24 m from *boundary*

The roof of a *building*, including any rooflights, but excluding any wallhead fascia, flashing or trim, boxed gutters, soffit or barge boards, should have a low or a medium vulnerability if more than 6 m but not more than 24 m from the *boundary*. Common materials that normally attain the criterion include felts and certain plastic materials as described in the table to annex 2.C.

More than 24 m from *boundary*

Where a *building* is more than 24 m from the *boundary*, the roof may be of any material, including materials of high vulnerability classification.

2.9 **Escape**

- 2.9 Functional standard
- 2.9.0 Introduction
- 2.9.1 Escape within dwellings - general principles
- 2.9.2 Escape within dwellings - options
- 2.9.3 Escape within dwellings - basement storeys
- 2.9.4 Escape within dwellings - escape windows
- 2.9.5 Escape within dwellings - protected enclosures
- 2.9.6 Escape within dwellings - alternative exits
- 2.9.7 Escape within dwellings - open plan option with suppression and enhanced early warning
- 2.9.8 Escape within dwellings - ducted heating and ventilation systems
- 2.9.9 Escape routes - general principles
- 2.9.10 Escape routes - options
- 2.9.11 Escape routes - basement storeys
- 2.9.12 Escape routes - protected zones
- 2.9.13 Escape routes - protected lobbies
- 2.9.14 Escape routes - smoke ventilation
- 2.9.15 Escape routes - natural smoke ventilation
- 2.9.16 Escape routes - mechanical smoke ventilation
- 2.9.17 Escape routes - mixed use buildings
- 2.9.18 Escape routes - fire hazard rooms and services
- 2.9.19 Escape routes - construction of escape stairs
- 2.9.20 Escape routes - openings
- 2.9.21 Escape routes - junctions
- 2.9.22 Escape routes - external escape routes and escape stairs
- 2.9.23 Escape routes - open access balconies
- 2.9.24 Escape routes - refuge within building

standard

2.9

mandatory

Every *building* must be designed and *constructed* in such a way that in the event of an outbreak of fire within the *building*, the occupants, once alerted to the outbreak of the fire, are provided with the opportunity to escape from the *building*, before being affected by fire or smoke.

Escape within
*dwelling*s (houses,
flats and *maisonettes*)

2.9.0 Introduction

If a fire starts in a *dwelling*, occupants within the *dwelling* of fire origin should be provided with at least one route of escape through an *exit* door which leads to a *place of safety* outside the *building*. Occupants in *dwelling*s may not be aware of the speed that fire can spread and if they are asleep are more likely to delay their escape. Therefore, it is important that a fire alarm is installed to provide occupants with early warning of fire (see standard 2.11). In some cases, a fire alarm alone may not be sufficient and a protected route within the *dwelling* may be necessary due to the height that occupants are located above the ground. Occupants in *dwelling*s located near the ground have the added benefit of access to windows to escape in an emergency.

Flats and *maisonettes*

Once outside *flats* or *maisonettes*, occupants may still need to escape through common areas within the *building* to reach a *place of safety*. This is termed an '*escape route*'. The *building* should be designed to inhibit fire and smoke spread into the *escape route*. Where occupants have only one means of escape from the *building*, automatic smoke ventilation is normally provided to help remove any smoke and heat that may enter the *escape route*.

Following the outbreak of fire anywhere in the *building*, there may be residents located in common lounges, communal laundry *rooms* and solid waste storage *rooms*. Service engineers may also be working in service spaces, plant rooms and lift machine rooms for example. These occupants should also be provided with the opportunity to escape from the *building* following a fire. The non-domestic Technical Handbook should be used for guidance on travel distances within ancillary *rooms* and for *escape routes* serving such *rooms*.

It is common practice for the fire and rescue service to intervene and commence fire-fighting and rescue operations before all occupants have made their escape to a *place of safety*. However compliance with standard 2.9 should reduce the risk of occupants becoming trapped by fire and smoke.

If a fire has accidentally or deliberately been set in the common stair, the *escape route* may become impassable. In such cases occupants should be able to remain safely inside the *building* until the fire has burnt itself out or until the fire has been contained and it is safe to use the *escape route*.

Fire protection measures

Fire protection measures used to protect routes of escape and to provide a safe refuge include a combination of passive and active protection. Walls, floors, and doors can provide good passive fire protection. Active systems such as automatic detection, automatic smoke ventilation and automatic suppression are designed to activate in the earlier stages of fire development to provide early warning, control heat and smoke and inhibit fire growth. All escape strategies incorporate a combination of passive and active fire protection measures.

Exclusions and obstacles to escape

A lift should not be used for escape because there is a risk that the lift could malfunction during the outbreak of fire. Fire-fighters may use a fire-fighting lift to rescue injured occupants but this is matter for the fire and rescue service to decide, following a risk assessment at the incident.

Fixed ladders are considered to be too dangerous for residents to use for escape however a fixed ladder may be used from a lift machine room or a plant room provided it is not a *place of special fire risk*. These rooms will only be used intermittently by engineers who are likely to be familiar with and trained in the use of fixed ladders.

Locking devices on final *exit* doors and on escape windows should not prevent occupants escaping from the *building*. The intention is to assist escape, but not to exclude the use of locks or other safety devices (see section 4 Safety). Permanent obstructions such as fixed security grills should not be used on final *exit* doors or escape windows.

Conversions

In the case of conversions, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

2.9.1 Escape within *dwellings* - general principles

The time occupants need to escape varies enormously and is dependent on a number of risk factors including, early warning of fire, the occupant characteristics, the number of *exit* doors, the area of an individual *storey* within a *dwelling*, the height of the topmost *storey* above the ground or depth of the *storey* below ground.

Early warning

Early warning of fire is one of the key fire safety measures to provide occupants with sufficient time to escape from the *building* before being overcome from the effects of fire and smoke. Sleeping occupants will react more slowly and it is important that they receive the earliest possible warning of the outbreak of fire within the *dwelling*. Guidance to standard 2.11 provides recommendations for the installation of fire detection and alarm systems in *domestic buildings*.

Occupant characteristics

The occupant characteristics in *dwellings* are wide ranging and therefore impossible to quantify in building standards. The guidance in the Handbooks assumes that the occupants are capable of moving or being moved to a *place of safety*. For *dwellings* that require to be licensed as a house in multiple occupation, or where a care service is provided for the occupants, additional fire protection measures may be required to satisfy other legislation (see 2.0 Introduction).

Number of *exit* doors

The number of *exit* doors from a *dwelling* is important. If every floor in every *dwelling* has 2 or more *exit* doors which lead to a *place of safety*, the risk that occupants could become trapped by fire and smoke would be low and the fire protection measures would be minimal. However this is not practical to achieve in the majority of cases and as a result, the guidance recommends that every *dwelling* should be provided with at least 1 *exit* door.

Area of an individual *storey* The area of an individual *storey* within a *dwelling* has an impact on the time occupants have available for escape from a fire originating in the *dwelling*. A *dwelling* with an individual *storey* more than 200 m² is outside the scope of the guidance (see 2.0 Introduction). In such cases, an alternative approach (see clause 2.0.8) based on the guidance contained in this handbook may be appropriate but the need for additional *exits* and additional fire protection measures would need to be considered on a case by case basis.

Height of *storey* above ground Increased height brings extra risk, both in the time needed for escape and the difficulties posed to the fire and rescue service in attempting to assist evacuation, effect rescue or fight fires. Therefore, the fire protection measures increase with the *storey* height of the *building*.

Dwellings on sloping *sites* may have certain *rooms* located deeper below or higher above the adjacent ground level than other *rooms*. In such cases, the *storey* depth below the adjacent ground or *storey* height above the adjacent ground from each *room* may be assessed individually and the guidance followed accordingly.

The scope of the guidance is limited to those *storeys* at a depth of not more than 4.5 m below the adjacent ground level and to those *buildings* with no *storey* at a height of more than 60 m (approximately 20 *storeys*) above the adjacent ground (see 2.0 Introduction).

2.9.2 Escape within *dwellings* - options

In the event of an outbreak of fire, every *dwelling* should be provided with at least one route of escape through an *exit* door which leads ultimately to a *place of safety*. The route within a *dwelling* will normally comprise a combination of *rooms* and circulation spaces. Where the *dwelling* has more than one *storey* such as *houses* and *maisonettes*, the occupants may be located on a *storey* where their only means of escape is by way of a *private stair* towards the floor of fire origin. The occupants would then need to negotiate the fire floor before reaching the *exit* door from the *dwelling* and therefore the guidance recognises the increased risk in multi-*storey dwellings*.

The following table summarises the recommendations for escape within *dwellings*. For example, a typical 2 *storey house* would normally have a topmost *storey* not more than 4.5 m and from the following table should be provided with at least one route of escape through an *exit* door, early warning (smoke and heat alarms) and escape windows.

Escape within dwellings (*houses, flats and maisonettes*)

Height of topmost storey of dwelling above, or basement depth below adjacent ground	Summary of recommendations [1] [2]
<i>Basement storey</i> at a depth of not more than 4.5 m (see clause 2.9.3)	1 route of escape, early warning [3] and: <ul style="list-style-type: none"> • escape windows (see clause 2.9.4); or • <i>alternative exit</i> (see clause 2.9.6)
Topmost <i>storey</i> not more than 4.5 m	1 route of escape, early warning [3] and: <ul style="list-style-type: none"> • escape windows (see clause 2.9.4)
Topmost <i>storey</i> more than 4.5 m but not more than 7.5 m [4]	1 route of escape, early warning [3] and: <ul style="list-style-type: none"> • escape windows (see clause 2.9.4) and; • <i>protected enclosure</i> (see clause 2.9.5); or • suppression and enhanced early warning (see clause 2.9.7)
Topmost <i>storey</i> more than 7.5 m [4] but not more than 18 m [4]	1 route of escape, early warning [3] and: <ol style="list-style-type: none"> a. for <i>houses</i> and <i>maisonettes</i>: <ul style="list-style-type: none"> • escape windows (see clause 2.9.4) and; • <i>protected enclosure</i> (see clause 2.9.5) and <i>alternative exit</i> (see clause 2.9.6); or • <i>protected enclosure</i> (see clause 2.9.5) and suppression [5] b. for <i>flats</i>: <ul style="list-style-type: none"> • escape windows (see clause 2.9.4) and; • <i>protected enclosure</i> (see clause 2.9.5); or • suppression and enhanced early warning (see clause 2.9.7)
Topmost <i>storey</i> more than 18 m [4] but not more than 60 m (see clause 2.9.1)	1 route of escape, early warning [3] and: <ol style="list-style-type: none"> a. for <i>maisonettes</i>: <ul style="list-style-type: none"> • escape windows (see clause 2.9.4); • <i>protected enclosure</i> (see clause 2.9.5) and suppression [5] b. for <i>flats</i>: <ul style="list-style-type: none"> • escape windows (see clause 2.9.4); • suppression and enhanced early warning (see clause 2.9.7)

Notes:

1. No *storey* height more than 60 m (see clause 2.0.3).
2. No *dwelling* with a *storey* area more than 200 m² (see clause 2.0.3).
3. See guidance to standard 2.11 for early warning systems.
4. See guidance to standard 2.14 for explanation of 7.5 m and 18 m trigger heights and additional fire fighting facilities.
5. See guidance to standard 2.15 for suppression systems.

2.9.3 Escape within dwellings - basement storeys

A *basement storey* may have no windows or a limited number of *ventilators* which can cause a significant build up of heat and smoke. The fire may become suppressed as the oxygen is depleted however if the door to the *basement storey* (or *room* of fire origin) is opened, the sudden intake of air together with the release of hot fire gases can cause an explosive event known as a backdraught. This rapid fire spread places occupants on the ground or *upper storeys* at greater risk. Therefore, the *private stair* serving the *basement storey* should be separated at the *ground storey* by *construction* having a short fire resistance duration.

There is a risk that occupants in a *basement storey* could become trapped following the outbreak of fire. This is because windows are often positioned too high above the floor level to access with ease or they may lead to an enclosed space below the adjoining ground level from which there is no escape. Therefore, an *alternative exit* (see clause 2.9.6) should be provided from the *basement storey* unless escape windows are provided from every *basement apartment*.

2.9.4 Escape within dwellings - escape windows

Occupants in a *basement storey* or in an *upper storey* at a height of not more than 4.5 m may have access to escape windows. The use of windows for escape should only ever be considered in an emergency situation as a last resort and should not form part of the principal route of escape. Where occupants are trapped on *upper storeys*, they can use the window to call for assistance or to supply fresh air whilst awaiting rescue. If conditions within the *room* become untenable, the occupant can use the window to escape and lower themselves to the adjoining ground. This inevitably involves some degree of risk and windows in a *storey* at a height of more than 4.5 m are considered to be too high above the adjacent ground from which to escape. Therefore, an escape window should be provided in every *apartment* on an *upper storey* at a height of not more than 4.5 m above the adjacent ground. However this is not necessary where there is an alternative route of escape from the *apartment* to other circulation spaces or to other *rooms*.

Occupants within an *inner room* can become trapped where there is an outbreak of fire in the adjoining access *room*. Therefore, every *inner room* on a *storey* at a height of not more than 4.5 m above the adjacent ground level should be provided with an escape window unless the *inner room* has an alternative route of escape.

Escape windows should be large enough to escape through and should be situated in an *external wall* or roof. The windows should have an unobstructed openable area that is at least 0.33 m² and at least 450 mm high and 450 mm wide. The route through the window may be at an angle rather than straight through and the bottom of the openable area should be not more than 1100 mm above the floor.

Conservatories

The location of *conservatories* also presents some difficulties in relation to escape windows. Where a *conservatory* is located below an escape window consideration should be given to the design of the *conservatory* roof to withstand the loads exerted from occupants lowering themselves onto the roof in the event of a fire. However the choice to *construct* a more robust roof and frame is a matter of preference and the decision to do this should remain with the owner.

2.9.5 Escape within dwellings - protected enclosures

Occupants in *apartments* (e.g. lounges, bedrooms etc) may be asleep during the outbreak of fire. Where they are located on a *storey* at a height of more than 4.5 m above the adjacent ground there is a greater risk of becoming trapped by fire and smoke. For this option (see table to clause 2.9.2), every *apartment* on a *storey* at a height of more than 4.5 m above the adjacent ground should provide direct access to a *protected enclosure* which leads to an *exit* door.

Protected enclosures should be designed and *constructed* to withstand fire in an adjoining *room* or space. The *protected enclosure* should form a complete enclosure having a short fire resistance duration. Every door in the wall of a *protected enclosure* (other than a door serving *sanitary accommodation*) should be a *self-closing fire door* with a short fire resistance duration. A cupboard door need not be self-closing unless there is an ignition source within the cupboard such as an electrical distribution board or a boiler.

2.9.6 Escape within dwellings - alternative exits

For this option (see table to clause 2.9.2), every *upper storey* in a *house* or *maisonette* at a height of more than 7.5 m above the adjacent ground should be provided with an *alternative exit*. The intention is to reduce the risk that occupants could become trapped within their own *dwelling* and provide them with the opportunity to turn away from the fire on the floor of fire origin and make their escape in the other direction. Where the second route of escape is by way of another *private stair*, the stair should be enclosed in a *protected enclosure* which leads to an *alternative exit*.

2.9.7 Escape within dwellings - open plan option with suppression and enhanced early warning

Open plan layouts are becoming more popular with modern living styles. For this option (see table to clause 2.9.2), the following guidance should be followed for open plan layouts provided the *kitchen* is remote from the *exit* door.

Where the topmost *storey* height is more than 4.5 m above the adjoining ground an automatic life safety fire suppression system and an enhanced early warning system should be installed to protect the occupants. In a slower developing fire, the early warning system should provide the occupants with sufficient time to escape and in those cases where the fire develops quickly, the suppression system should control the fire giving the occupants the opportunity to escape.

The automatic life safety fire suppression system should be designed and installed in accordance with BS 9251: 2005. For the purposes of satisfying standard 2.9, the limit in the scope of BS 9251: 2005 to *buildings* below 20 m in height can be ignored.

The enhanced early warning system should follow the guidance in BS 5839: Part 6: 2004 for a grade D, category LD1 system. Where this option is adopted in *sheltered housing complexes*, a grade C system should be installed (see standard 2.11).

2.9.8 Escape within *dwellings* - *ducted* heating and ventilation systems

Ducted heating or ventilation systems should not transfer fire and smoke from the *room* of fire origin to the remainder of the *dwelling*. Therefore, where a *dwelling* has a *basement storey* or a *storey* at a height of more than 4.5 m and is provided with a system of *ducts* that connect *rooms* and circulation spaces:

- transfer grilles should not be fitted between any *room* and the *protected enclosure*; and
- supply and return grilles should be not more than 450 mm above floor level; and
- where warm air is *ducted* to a *protected enclosure*, the return air should be *ducted* back to the heater; and
- where a *duct* passes through any wall, floor, or ceiling of a *protected enclosure*, all joints between the *duct* and the surrounding *construction* should be *fire stopped*; and
- there should be a *room* thermostat in the living *room*, at a height more than 1370 mm and not more than 1830 mm, with an automatic control which will turn off the heater, and actuate any circulation fan should the ambient temperature rise to more than 35°C; and
- where the system recirculates air, smoke detectors should be installed within the *duct* to cause the recirculation of air to stop and direct all extract air to the outside of the *building* in the event of fire.

Fire dampers should be installed where the *ducts* pass through fire resisting *construction* or alternatively fire resisting ductwork should be provided. In either case, the fire resistance duration of the *construction* should be maintained.

2.9.9 Escape routes - general principles

Once occupants have left the *flat*, *maisonette* or any other ancillary *room* or space, they should be protected from fire and smoke to allow them sufficient time to escape from the *building* in relative safety. Those occupants who are remote from the fire are more likely to be unaware of the outbreak and may delay their evacuation. People also move more slowly on stairs than they do on the level and will take longer to evacuate tall *buildings* with many *flights* of stairs.

The fire dynamics can be significantly different in *high rise domestic buildings*. The effect of the wind may be greater which could accelerate the speed, direction and intensity of the fire. For example, if a window is open or breaks under fire conditions or the door to the *dwelling* of fire origin is opened, the wind could accelerate fire growth to such an extent that the entire *flat* or *maisonette* becomes fully involved in the fire. The wind direction might also induce cross flows of fire and smoke that could endanger fire-fighters entering the *dwelling* and any occupants attempting to escape from adjoining *dwellings*. A further risk in *high rise domestic buildings* is the loss of smoke buoyancy in tall shafts such as stairs which may cause stratification of smoke before it reaches the smoke *ventilator* at the top of the stairwell.

2.9.10 Escape routes - options

The guidance assumes that in most cases, a fire will start inside a *dwelling* or other ancillary *room* or space within the *building*. Therefore, at least one *escape route* should be provided from every *flat*, *maisonette* and from the following ancillary *rooms* or spaces serving a *domestic building*:

- communal *room* e.g. a communal lounge or laundry in a *sheltered housing complex*;
- plant room;
- solid waste storage room;
- store room;
- lift machine room; and
- accessible service *duct* or cupboard.

The above list is not intended to be comprehensive and any other *room* or space should be provided with at least one *escape route*. The non-domestic Technical Handbook should be used for guidance on travel distances within ancillary *rooms* and *escape routes* serving such *rooms*.

There are many options available to designers when considering *escape routes* in *buildings* containing *flats* and *maisonettes*. These options can be subdivided into 2 broad categories:

- internal *escape routes* e.g. protected corridors and protected stairs; and
- external *escape routes* e.g. protected balconies or protected external *escape stairs*.

Where *protected enclosures* (see clause 2.9.5) or an automatic fire suppression system (see clause 2.9.7) are installed within a *domestic building*, there is no need to provide protected lobbies (see clause 2.9.13) between the *dwellings* and the *escape stair*. However there is a risk that the fire protection measures may not be maintained by the occupants of the *building* and as a result, the number of *dwellings* should be limited to 4 *dwellings* per *storey* and no *storey* is at a height of more than 7.5 m above the adjacent ground level. The intention is to limit the size and height of a *domestic building* where some reliance is placed on fire precautions within a *dwelling* that also protects the common *escape route*.

The limitation on travel distance within protected lobbies is intended to reduce the time it takes occupants to escape and to reduce their potential exposure to fire and smoke. Automatic smoke ventilation should be provided within every *protected lobby* to improve tenability conditions within the *escape route*.

The following table summarises the recommendations when designing *buildings* containing *flats* and *maisonettes*.

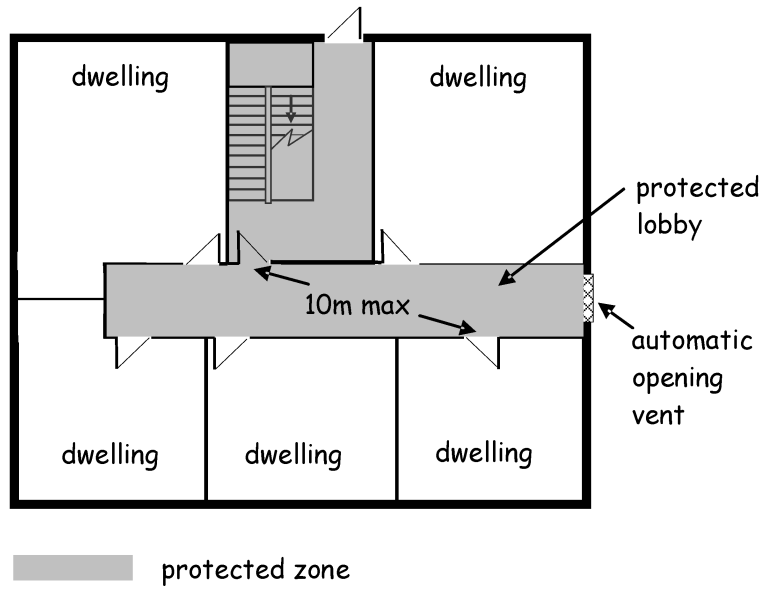
Escape routes (flats, maisonettes and ancillary rooms and spaces)

Height of topmost storey of dwelling above, or basement depth below adjacent ground	Summary of recommendations [1]
<i>Basement storey</i> (see clause 2.9.11) at a depth not more than 4.5 m (if applicable) and topmost storey not more than 7.5 m [2]	<p>at least 1 <i>escape route</i>:</p> <ul style="list-style-type: none"> • <i>protected enclosures</i> in <i>dwellings</i> (see clause 2.9.5); and • not more than 4 <i>dwellings</i> per storey; or <p>at least 1 <i>escape route</i> and:</p> <ul style="list-style-type: none"> • suppression in <i>dwellings</i> [3]; • not more than 4 <i>dwellings</i> per storey; or <p>at least 1 <i>escape route</i> and:</p> <ul style="list-style-type: none"> • protected lobbies (see clause 2.9.13); • smoke ventilation (see clauses 2.9.14 – 2.9.16); • not more than 10 m travel distance inside <i>protected lobby</i>; or <p>at least 2 <i>escape routes</i> and:</p> <ul style="list-style-type: none"> • not more than 30 m travel distance in protected corridor
Topmost storey more than 7.5 m but not more than 18 m [2]	<p>at least 1 <i>escape route</i> and:</p> <ul style="list-style-type: none"> • protected lobbies (see clause 2.9.13); • smoke ventilation (see clauses 2.9.14 – 2.9.16); • not more than 10 m travel distance inside <i>protected lobby</i>; or <p>at least 2 <i>escape routes</i> and:</p> <ul style="list-style-type: none"> • not more than 30 m travel distance in protected corridor
Topmost storey more than 18 m [2] but not more than 60 m	<p>at least 1 <i>escape route</i> and:</p> <ul style="list-style-type: none"> • protected lobbies (see clause 2.9.13); • smoke ventilation (see clauses 2.9.14 – 2.9.16); • suppression [3]; • not more than 10 m travel distance inside <i>protected lobby</i>; or <p>at least 2 <i>escape routes</i> and:</p> <ul style="list-style-type: none"> • suppression [3]; • not more than 30 m travel distance in protected corridor

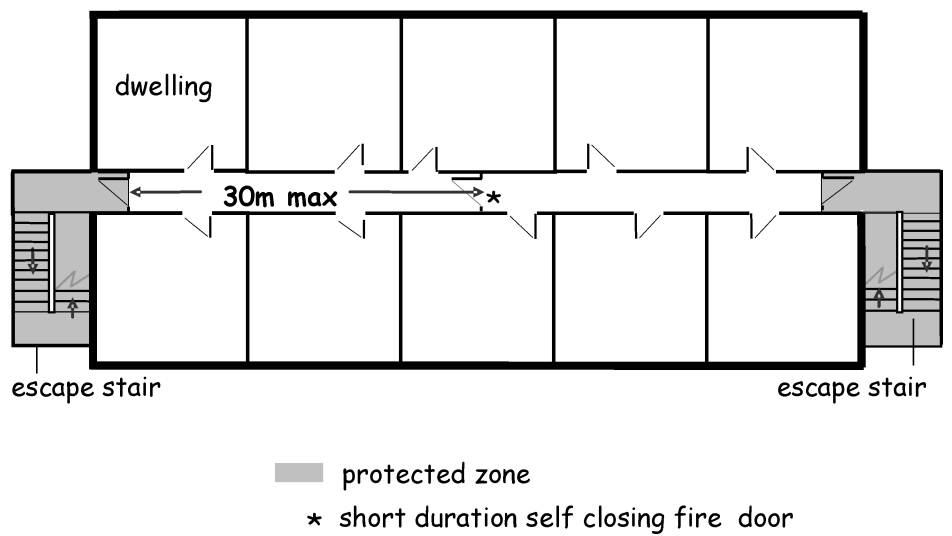
Notes:

1. See diagrams for guidance on measurement of travel distance.
2. See guidance to standard 2.14 for explanation of 7.5 m and 18 m trigger heights and additional fire fighting facilities.
3. See guidance to standard 2.15 for suppression systems.

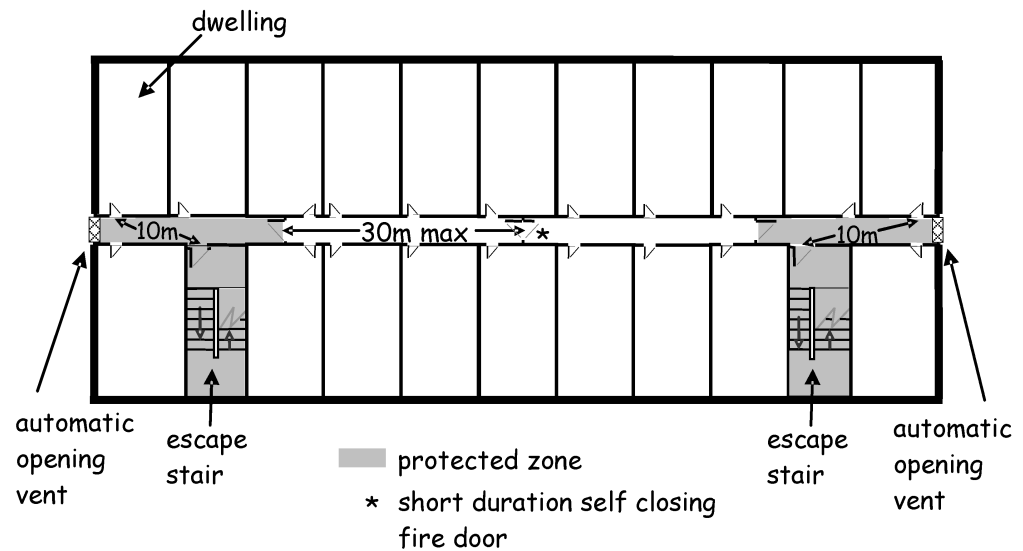
Typical ground floor - one escape route - storey height more than 7.5m but not more than 18m



Typical upper floor - two escape routes - corridor access without dead ends - storey height not more than 60m



Typical upper floor - two escape routes - corridor access with dead ends - storey height not more than 60m



2.9.11 Escape routes - basement storeys

A *basement storey* with insufficient ventilation can cause a significant build up of heat and smoke. If the door to the *basement storey* is opened, the sudden intake of air together with the release of hot fire gases can cause an explosive event known as a backdraught which can create significant flaming through the door opening. There is also a risk that disoriented occupants could continue their escape to the *basement storey* instead of escaping through the *ground storey*. In order to minimise these risks, a medium duration fire resisting wall or screen (including a *self-closing fire door*) should be provided in the *protected zone* at the *ground storey* to separate the *basement storey* from the remainder of the *protected zone*.

2.9.12 Escape routes - protected zones

Protected zones are intended to provide a place of relative safety inside the *building*. Occupants using the *escape stair* should be safe from the effects of fire and smoke during their evacuation to a *place of safety*. The enclosing structure of a *protected zone* should have at least a medium fire resistance duration. In the case of a *high rise domestic building* the *protected zone* should have a long fire resistance duration. *Self-closing fire doors* in the enclosing structure of a *protected zone* need only achieve a short fire resistance duration and in the case of a *high rise domestic building*, a medium fire resistance duration.

External walls adjacent to protected zones

If a *protected zone* has an *external wall* that projects beyond the face of a *building* or is set back in a recess, the *protected zone* may be vulnerable if fire breaks out through an adjacent window, door or other opening. Radiated heat or flames from the fire may impede occupants using the *protected zone* to escape.

Therefore, where any part of an *external wall* of a *protected zone* is not more than 2 m from, and makes an angle of not more than 135 degrees with any part of an *external wall* in another part of the *building*, the *protected zone* should be protected against fire for a distance of 2 m by *construction* which provides a medium fire resistance duration. The designer can choose which wall should be fire resisting and may include fire resisting facades or other

fixed *glazing* or any other opening protected against fire. However it is not sufficient to use the final *exit* door as a barrier between the occupants escaping and the fire. In such cases, the *external wall* adjoining the *protected zone* at the final *exit* should be protected against fire as described above.

2.9.13 **Escape routes - protected lobbies**

A *protected lobby* is located within a *protected zone* and is designed to inhibit the movement of fire and smoke from an adjoining *room*, *storey* or space into the *escape stair* or fire-fighting lobby. This is normally achieved by fire resisting *construction* together with at least 2 sets of *self-closing fire doors* between the fire and the *escape stair* or fire-fighting lobby. The wall between the *protected lobby* or fire-fighting lobby and the *escape stair* should have a short fire resistance duration and any door in the wall should be a *self closing fire door* with short fire resistance duration. For *high rise domestic buildings* the wall between the *escape stair* and the *protected lobby* should have a medium fire resistance duration and any *self-closing fire door* should have a short fire resistance duration. See guidance to standard 2.14 for fire-fighting facilities.

Protected lobbies in *domestic buildings* are used:

- to inhibit fire and smoke spread to *escape stairs*;
- to help evacuees escape from the floor of fire origin;
- to provide protection and space for the fire and rescue service to set up a forward control point (see standard 2.14); and
- to provide a bridgehead from which to commence fire fighting and rescue operations (see standard 2.14).

In order to inhibit fire and smoke spread to the *escape stair* and to help evacuees on the floor of fire origin reach the *escape stair*, automatic smoke ventilation should be provided and travel distance within the lobby is limited to 10 m. Where *flats* or *maisonettes* are accessed from an open access balcony, there is no need to provide a *protected lobby*.

Protected lobbies should be designed that smoke entering one *protected lobby* should not spread to other protected lobbies. There should be no inter-connection between protected lobbies other than:

- the *escape stair*;
- a smoke ventilation shaft;
- protected services;
- fire mains; or
- passenger lift or fire-fighting lift.

Any gaps or imperfections of fit should be *fire-stopped*.

2.9.14 **Escape routes - smoke ventilation**

Although there are physical barriers to fire such as walls, floors and doors, there is still a risk of smoke spread into *escape routes*. Therefore, smoke ventilation should be provided in protected lobbies, fire-fighting lobbies and protected corridors to help maintain tenable conditions within *escape routes*.

The fire and rescue service will normally be in attendance before all *flats* or *maisonettes* have been evacuated. Therefore, it is important that the smoke *ventilators* (including powered systems) are capable of being opened, closed or shut off by fire and rescue personnel to assist them with their fire-fighting and rescue operations (see standard 2.14).

Smoke ventilation of *escape routes* can be provided by:

- natural smoke ventilation; or
- mechanical smoke ventilation.

The merits and limitations of each system should be assessed by the designer before deciding which system to choose.

2.9.15 *Escape routes - natural smoke ventilation*

Natural ventilation uses external openings in the roof or walls of the *building* to remove smoke using its own buoyancy. The efficiency of a natural smoke ventilation system depends upon the location of the *ventilator* and the direction and velocity of the prevailing wind. Under certain conditions, the smoke flow through *ventilators* may be enhanced whilst under other conditions, it may be impaired. Ideally the location of *ventilators* should be positioned on the *building* in negative pressure zones and inlets in positive pressure zones however this is difficult to achieve for all wind directions. Natural smoke ventilation can be provided by either:

- automatic opening *external wall ventilators*; or
- smoke shafts.

Automatic opening
external wall
ventilators

Every *protected lobby* should be provided with natural smoke *vents* on an *external wall* which have an area of at least 1.5 m² that discharges smoke direct to the external air. The *ventilators* should be actuated automatically by means of smoke detectors in the common space.

Smoke Shafts
www.bre.co.uk

A natural smoke shaft uses the natural buoyancy of the smoke together with the effect of the wind passing over the top of the shaft to help draw the smoke through the shaft to the outside air. The design of natural smoke shafts is based on a fire providing a heat output of not more than 2.5 megawatts through an open door of 780 mm wide. This scenario simulates a fully developed (flashover) fire condition in a *room* within the *flat* or *maisonette*. Where the fire produces cooler smoke (e.g. a smouldering fire), the smoke might not escape so readily when subject to adverse wind or stack effects. The inlet/outlet configuration will vary depending wind direction and designers should take this into account. For example, a vent cowl could be installed on the top of the smoke shaft to help draw the smoke out of the shaft for all wind directions. The full research report 'Smoke ventilation of common access areas of *flats* and *maisonettes* (BD 2410) – Final Factual Report (BRE, 2005)' can be accessed on the BRE website.

The shaft should be closed at the base and replacement air is provided from the automatic opening *ventilator* in the adjacent stairwell to help the efficiency of the shaft system. The smoke shaft should have:

- a minimum cross-sectional area 1.5 m² (minimum dimension 0.85 m in any direction), opening at roof level at least 0.5 m above any surrounding structures within a horizontal distance of 2.0 m; and
- the minimum area of the *ventilator* from the *protected 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 m²; and
- the smoke shaft should have at least a medium fire resistance duration

- and all *ventilators* should have a short fire resistance duration; and
- the shaft should be vertical from base to head but may have not more than 4 m at an inclined angle not more than 30° from the vertical plane; and
- on detection of smoke in the *protected lobby*, the *ventilator* on the fire floor, the *ventilator* at the top of the smoke shaft and the 1 m² *ventilator* at the head of the stairway should all open simultaneously. The *ventilators* from the *protected lobbies* on all other *storeys* should remain closed.

2.9.16 *Escape routes - mechanical smoke ventilation*

Mechanical smoke ventilation using pressure differentials may be used to inhibit smoke spread into *escape routes* by means of:

- depressurisation systems; or
- pressurisation systems; or
- heating and ventilation systems.

For more detailed guidance on the design of smoke control systems using pressure differentials is available in BS EN 12101: Part 6: 2005.

Depressurisation systems	A depressurisation system is based on the principle of extracting smoke to the outside air. This creates a negative pressure in the space relative to the adjacent spaces. Where a smoke ventilation depressurisation system is used, replacement air should be provided for the system to operate effectively. The volume of air and smoke removed should be replaced with the equivalent volume of replacement air at a sufficient rate in order to ensure a smoke flow out of the <i>building</i> . Reducing the rate of replacement air can result in the smoke ventilation system becoming less efficient whereas increasing replacement air and extraction at high velocities can produce air pressure conditions which make doors difficult to open. The system should be balanced to ensure that the forces required to open doors are not greater than those specified in section 4 Safety.
Pressurisation systems	A pressurisation system is based on the principle of forcing air into the <i>escape route</i> which helps to keep smoke out. Forced air can be used to maintain a positive pressure in the <i>escape route</i> which produces an air flow through gaps around doors preventing the smoke from entering. The system design should take account of likely pressure reduction when occupants open doors to escape or when fire-fighters open doors to access the fire. The system should be balanced to ensure that the forces required to open doors are not greater than those specified in section 4 Safety.
Heating and ventilation systems	<i>Ducted</i> heating and/or <i>ventilation</i> systems, including air conditioning systems, that serve all <i>dwellings</i> in the <i>building</i> should not transfer fire and smoke to or from any <i>dwelling</i> to any other <i>dwelling</i> , common space, <i>roof space</i> or concealed space. Fire dampers should be installed where <i>ducts</i> pass through fire resisting <i>construction</i> unless the <i>ducts</i> have a medium fire resistance duration or in the case of a <i>high rise domestic building</i> , the <i>ducts</i> have a long fire resistance duration.

The system installed to maintain interior environment conditions in a *building* should not compromise the function of the mechanical smoke ventilation system. Therefore, in the event of an outbreak of fire, the system should automatically either shut off or its function integrated with any smoke ventilation system that serves the *escape routes*. For more detailed guidance refer to BS 5588: Part 9: 1999.

2.9.17 Escape routes - mixed use buildings

In a mixed use *building* the fire in the non-domestic part of the *buildings* could remain undetected for some time and reach a severe intensity (due to fire load) before the occupants in the *flats* or *maisonettes* get warning. Therefore, where a *protected zone* is shared with a non-domestic building, a *protected lobby* should be provided between the non-domestic building and the escape stair to provide additional time for the residential occupants to escape. For additional protected lobbies, see clause 2.9.24.

Where *flats* or *maisonettes* share a *protected zone* with a non-domestic building, the height of the topmost storey of the domestic building should be limited to 7.5 m to reduce the number of occupants who might be affected by a fire originating in the non-domestic building.

2.9.18 Escape routes - fire hazard rooms and services

Fire hazard rooms and services can present a potential source of fire ignition and fire spread into common *escape routes*.

The following fire hazard rooms and service spaces adjacent to *escape routes* should be separated from the *escape route* by a *construction* that provides a medium fire resistance duration:

- communal room e.g. a communal lounge or laundry in a *sheltered housing complex*;
- plant room;
- solid waste storage room;
- store room;
- lift machine room; and
- service *duct* or cupboard.

Even if the room does not contain an ignition source, the potential for a fire to be set accidentally or deliberately should be assessed. For example, the door to a solid waste storage room might be left unlocked. For this reason, any door accessing a fire hazard room should be a *self-closing fire door* with a short fire resistance duration. A *fire door* to a service *duct* or service cupboard should be locked to prevent unauthorised entry therefore does not need be fitted with a self-closing device.

Fuel pipes

Pipes conveying fuel inside *protected zones* and protected lobbies could accelerate fire growth and under certain conditions, create an explosive atmosphere within the *building*. Oil and liquefied petroleum gas can produce pool fires (i.e. a turbulent fire burning above a horizontal pool of vaporising hydrocarbon fuel). The pool fire can either be static, where the pool is contained, or a 'running' pool.

Fuel pipes carrying oil (other than a pipe conveying oil supplying a hydraulic lift) should be located outside *protected zones* and protected lobbies.

Fuel pipes carrying natural gas or liquefied petroleum gas (including associated meters) may be located inside *protected zones* or protected lobbies provided:

- the installation is in accordance with the requirements of the Pipelines Safety Regulations 1996, SI 1996 No 825 and the Gas Safety (Installation and Use) Regulations 1998 SI 1998 No 2451; and
- any pipe in a *protected zone* is *constructed* of screwed steel or welded steel *construction*; and
- the pipe or pipes are contained within a service shaft having a medium fire

- resistance duration; and
- the service shaft is ventilated at high and low level in accordance with BS 8313: 1997.

2.9.19 Escape routes - construction of escape stairs

Escape stairs should be protected from the outbreak of fire to allow occupants to escape and fire-fighters to access the fire. Therefore, every part of an *escape stair* (including landings) and the floor of a *protected zone* (including the floor of *protected* lobbies), should be *constructed* of *non-combustible* products.

However this does not apply to:

- the floor of the lowest *storey* of the *building*;
- any handrail, balustrade or protective barrier on an *escape stair*, or
- a floor finish (e.g. laminate flooring) applied to the *escape stair* (including landings) or to the floor of a *protected zone* or *protected lobby*.

2.9.20 Escape routes - openings

Fire and smoke can easily pass through openings in *escape routes* which could prevent the occupants from escaping in the event of an outbreak of fire within the *building*. For this reason, the openings should be designed to inhibit the spread of fire and smoke into the *escape route*. Where fire shutters or dampers are installed as part of a *ducted* system, they should be activated by localised smoke detectors.

In order to inhibit the spread of fire and smoke, openings in *separating walls* and floors and openings in protected routes of escape should be protected and *fire-stopped* in accordance with the guidance to standard 2.2.

2.9.21 Escape routes - junctions

The junctions between *escape routes* and other parts of the *building* are vulnerable to fire and smoke. This is because fire and smoke can penetrate weaknesses at junctions which could compromise the *escape route*. The designer should consider detailing at junctions to inhibit fire and smoke spread into *escape routes*.

In order to inhibit the spread of fire and smoke, junctions in *separating walls* and floors and junctions in protected routes of escape should be protected and *fire-stopped* in accordance with the guidance to standard 2.2.

2.9.22 Escape routes - external escape routes and escape stairs

Escape routes will normally lead to the final *exit* door of the *building*, which leads to a safe place in the outside air from which occupants can freely disperse. An *exit* can also lead to an external *escape stair* giving access to a *place of safety*.

In some cases it may not be possible to freely disperse away from the *building* (e.g. where the final *exit* door discharges to an enclosed outdoor space). In such cases, where there is only 1 route of escape, the *external wall* of the *building* within 2 m of the route of escape should have a short fire resistance duration for integrity up to 1.1 m above the adjoining ground. This does not apply to sub-floor vents.

Protection of external route of escape

External *escape stair*

An external *escape stair* is an unenclosed *escape stair* which is open to the external air and provides occupants with an *escape route* which leads to a *place of safety*. External *escape stairs* present additional hazards to people escaping from *buildings* in the case of fire. This is because the *escape stair* may be exposed to inclement weather during the evacuation. For this reason, an external *escape stair* should not serve a *building* where the topmost *storey* height is more than 7.5 m above the adjacent ground.

In order to protect the occupants from fire and smoke during evacuation, the external *escape stair* should be protected against the outbreak of fire from within the *building*. Where the *escape stair* has a total rise of more than 1.6 m, every part of the *external wall* including fixed windows or *glazing*, *self-closing fire doors* (other than a door opening from the top *storey*) or any other opening not more than 2 m from the *escape stair*, should have a short fire resistance duration. Fire protection below an *escape stair* should be extended to the lowest ground level.

An external *escape stair* with a total rise of not more than 1.6 m from which occupants can freely disperse, is considered to be low enough above the ground to present minimal risk to occupants leaving the *building* and as a result, fire protection need not be provided.

2.9.23 *Escape routes - open access balconies*

An open access balcony can be used as an *escape route* from *flats* or *maisonettes*. Fire and smoke should ventilate more freely than an enclosed *escape route*. The balcony should be open to the external air and have an opening that extends over at least four-fifths of its length and at least one third of its height.

Where only one direction of escape is available, the travel distance along an open access balcony should be not more than 40 m. However where the balcony provides 2 directions of escape, the travel distance can be unlimited.

Flames and smoke from a fire may emanate from a window or other opening in the *external wall* of a *flat* or *maisonette*. Therefore, where an open access balcony provides escape in 1 direction only, the *external wall* up to a height of at least 1.1 m above the level of the balcony should be provided with a short fire resistance duration to allow evacuees to pass below the level of windows in relative safety. Any door in the *external wall* should be a *self closing fire door* with a short fire resistance duration.

In order to protect occupants escaping from *flats* or *maisonettes* on *storeys* above the fire floor, every open access balcony should have a medium fire resistance duration from the underside. Openings in the floor of the balcony should be *fire-stopped* in accordance with the guidance to standard 2.2.

Wide balconies above the floor of fire origin could present a risk to occupants escaping on the fire floor. This is because lateral fire and smoke spread along the underside of the balcony may compromise the *escape route*. Therefore, in order to inhibit lateral fire and smoke spread, every balcony more than 2 m wide should be provided with smoke channels or down-stands at 90 degrees to the face of the *building* on the same line as the *separating wall* between each *dwelling*. The depth of the smoke channel or down-stand should be at least 300 mm below the soffit of the balcony.

2.9.24 *Escape routes - refuge within building*

Research and fire investigation reports from fire and rescue services show that the incidence of multiple fire deaths and injuries beyond the *dwelling* of fire origin is uncommon. This is because:

- fire and smoke spread is contained mainly to the *dwelling* of fire origin by the *construction* of *separating walls* and *separating floors* (see standard 2.2);
- occupants in *flats* and *maisonettes* (other than the *flat* or *maisonette* of fire origin) are protected from fire and smoke by the *construction* of *separating walls* and *separating floors*; and
- fire and rescue service intervene and control fire spread.

However there are occasions where the common *escape routes* serving *flats* and *maisonettes* may be compromised by fire and smoke. For example, where a fire has accidentally or deliberately been set in the *protected zone* or *protected lobby*.

Where a *domestic building* and a *non-domestic building* share a *protected zone* (see clause 2.9.17), the occupants in the *domestic building* should be provided with additional protection. A *protected lobby* is necessary between an *escape stair* and every:

- *flat*;
- *maisonette*; and
- ancillary *room* or space.

Occupants who are confronted by fire and smoke in the common space may retreat back into their *flat* or *maisonette* and contact the emergency services. Control room personnel will provide helpful advice and attempt to keep callers calm whilst awaiting arrival of the fire and rescue service.

Occupants should be able to remain safely inside the *building* until the fire has burnt itself out or until the fire has been contained and it is safe to use the *escape route*. In most cases, the fire and rescue service will intervene and commence fire-fighting and rescue operations before all occupants have made their escape to a *place of safety* (see standard 2.14).

Although a rare event, if the spread of fire and smoke is significant, it may be necessary to evacuate the entire *building* as a precaution. This will normally be co-ordinated by the fire and rescue service with assistance from the other emergency services such as the police and ambulance services.

2.10 Escape lighting

- 2.10 Functional standard
- 2.10.0 Introduction
- 2.10.1 Escape route lighting
- 2.10.2 Protected circuits
- 2.10.3 Emergency lighting

standard

2.10

mandatory

Every *building* must be designed and *constructed* in such a way that in the event of an outbreak of fire within the *building*, illumination is provided to assist in escape.

2.10.0 Introduction

In seeking to escape from a *building* the occupants will find it easier if the *escape routes* are illuminated. Specifically dedicated escape lighting is not necessary within *dwellings* as it is assumed the occupants will have a degree of familiarity with the layout, and *escape routes* only begin at the door to the *dwelling*. However in *buildings* containing *flats* and *maisonettes*, the common *escape routes* should be illuminated to assist the occupants of the *building* to make their way to a *place of safety*.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard (regulation 12, schedule 6).

2.10.1 Escape route lighting

Escape route lighting utilises the artificial lighting within the *building*, but should be supplied by a fire protected circuit.

Every part of an *escape route* should have artificial lighting supplied by a protected circuit that provides a level of illumination not less than that recommended for emergency lighting. Where artificial lighting serves a *protected zone*, it should be via a protected circuit separate from that supplying any other part of the *escape route*.

Artificial lighting supplied by a protected circuit need not be provided if a system of emergency lighting is installed.

2.10.2 Protected circuits

A protected circuit is a circuit originating at the main incoming switch or distribution board, the conductors of which are protected against fire. Regardless of what system is employed, *escape routes* should be capable of being illuminated when the *building* is in use. In *conversions* for example, it may be easier to install self-contained emergency luminaires than to install a protected circuit to the existing lighting system.

2.10.3 Emergency lighting

Emergency lighting is lighting designed to come into, or remain in, operation automatically in the event of a local and general power failure.

Emergency lighting should be installed in *buildings* considered to be at higher risk. In a *building* containing *flats* or *maisonettes* emergency lighting should be provided in the following areas:

- an underground car park including any *protected zone* serving it, where less than 30% of the perimeter of the car park is open to the external air;
- a *protected zone* or *unprotected zone* serving a *basement storey* or a *protected zone* or *unprotected zone* in a high rise domestic.

The emergency lighting should be installed in accordance with BS 5266: Part 1: 2005 as read in association with BS 5266: Part 7: 1999 (BS EN: 1838: 1999).

High rise domestic buildings

In order to assist the evacuation of occupants in *high rise domestic buildings*, every *protected lobby*, *protected zone* (including *escape stairs*) and any other associated *escape route* should be provided with emergency lighting designed and installed in accordance with BS 5266: Part 1: 2005 as read in association with BS 5266: Part 7: 1999 (BS EN: 1838: 1999).

2.11 Communication

- 2.11 Functional standard
- 2.11.0 Introduction
- 2.11.1 Fire detection and fire alarm systems
- 2.11.2 Choice of fire detector
- 2.11.3 Optical smoke alarms
- 2.11.4 Ionisation smoke alarms
- 2.11.5 Multi sensor alarms
- 2.11.6 Heat alarms
- 2.11.7 Siting of fire detectors
- 2.11.8 Grade of fire detection and fire alarm system
- 2.11.9 Wiring and power
- 2.11.10 Radio linked systems

standard

2.11

mandatory

Every *building* must be designed and *constructed* in such a way that in the event of an outbreak of fire within the *building*, the occupants are alerted to the outbreak of fire.

2.11.0 Introduction

Over 90% of Scottish fire deaths occur in *dwellings* and asphyxiation caused by smoke inhalation is the primary cause of death. If there is an outbreak of fire within a *dwelling*, early detection and warning to the occupants can play a vital role in increasing their chances of escape. This is particularly important as the occupants may well be asleep and are more likely to react slower.

Most fires in *dwellings* are accidental and statistics show that the main sources of ignition are:

- smoking materials e.g. the careless disposal of cigarettes, used tobacco and matches; and
- cooking.

Occupant characteristics

In the 4 years 2003-04 to 2006-07 where fatalities were recorded, 38% of fires started in living *rooms*, 24% started in *kitchens*, 21% in bedrooms and 17% of fires started in the remaining *rooms* and spaces. This means that a significant number of fire related deaths (62%), occur from fires started in living *rooms* and *kitchens*. It is therefore important that the outbreak of fire in living *rooms* and *kitchens* is detected quickly and the alarm raised as early as possible during the early stages of fire growth.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard (regulation 12, schedule 6).

2.11.1 Fire detection and fire alarm systems

Living *rooms* and *kitchens* should be fitted with fire detectors because they are the most likely sources of fire in *dwellings* and result in the greatest number of fatalities and injuries in Scotland each year. Statistics also show that bedrooms and other *rooms* or spaces within a *dwelling* also contribute to the overall number of casualties in Scotland and as a result the circulation spaces outside these *rooms* or spaces should be protected to give early warning of fire.

Therefore, in order to provide a fire detection and fire alarm system that should alert occupants to the outbreak of fire a Grade D system should be installed in all *dwellings*, comprising of:

- at least 1 *smoke alarm* installed in every principal habitable *room*;
- at least 1 *smoke alarm* in every circulation space such as hallways and landings; and
- at least one heat alarm installed in every *kitchen*.

A principal habitable *room* is a frequently used *room* by the occupants of a *dwelling* for general daytime living purposes.

inner room

Every *inner room* and adjoining access *room* on a storey at a height of not more than 4.5 m should be provided with an additional *smoke alarm* to give the occupants early warning. Where the access *room* is a *kitchen*, the type of detector should be carefully considered to reduce the likelihood of false alarms.

common systems

In a *building* containing *flats* or *maisonettes*, a common fire alarm and detection system that interlinks all *dwellings* and common spaces is not recommended due to the risk of unwanted false alarms. However in a *sheltered housing complex*, monitoring equipment is recommended due to the vulnerability of the occupants.

Detailed guidance on fire detection and fire alarm systems in *dwellings* can be obtained from BS 5839: Part 6: 2004.

2.11.2 Choice of fire detector

False alarms are common in *dwellings* and may result in the occupants disabling the fire detection and fire alarm system. The most common causes of a false alarm are:

- fumes from cooking (including toasting of bread);
- steam from bathrooms, shower rooms and *kitchens*;
- tobacco smoke;
- dust;
- aerosol spray and incense;
- candles;
- high humidity; and
- water ingress.

Consideration should therefore be given to the type of fire detector in order to reduce the amount of unwanted false alarms. There are 4 main types of fire detector used in *dwellings*:

- optical *smoke alarms*;
- ionisation *smoke alarms*;
- multi sensor alarms; and
- heat alarms.

2.11.3 Optical smoke alarms

Optical *smoke alarms* should conform to BS EN 14604: 2005 and operate on the principle of detecting the scattering or absorption of light within the detector chamber. Optical *smoke alarms* are more sensitive to slow smouldering fires such as fires involving soft furnishings and bedding.

Principal habitable *room* The most likely source of fire in a principal habitable *room* is the careless disposal of smoking materials. Polyurethane foam found in some furnishings may ignite and begin to smoulder producing large particles of smoke. Optical *smoke alarms* are therefore recommended in principal habitable *rooms* however if the *room* is used by a heavy smoker, this could give rise to some false alarms from tobacco smoke.

Open plan In cases where a principal habitable *room* is open plan with a *kitchen*, an optical *smoke alarm* is recommended to reduce the amount of unwanted alarms from cooking fumes.

Circulation spaces Most unwanted alarms occur during cooking. Optical *smoke alarms* are less sensitive from fumes caused by toasting bread or frying or grilling food. Therefore, optical *smoke alarms* are recommended in hallways and stairwells adjacent to *kitchens*.

2.11.4 Ionisation smoke alarms

Ionisation *smoke alarms* should conform to BS EN 14604: 2005 and operate on the principle that the electrical current flowing between electrodes in an ionisation chamber is reduced when smoke particles enter the chamber. Ionisation *smoke alarms* are more sensitive to smoke containing small particles such as rapidly burning flaming fires but are less sensitive to steam. Therefore, ionisation *smoke alarms* are recommended in hallways and stairwells adjacent to bathrooms or shower rooms to reduce the amount of unwanted false alarms.

Circulation spaces Multi sensor alarms are recommended in hallways and stairwells adjacent to bathrooms or shower rooms to reduce the amount of unwanted false alarms.

2.11.5 Multi sensor alarms

A multi-sensor alarm provides the early warning of fire and can significantly reduce the amount of unwanted false alarms in certain circumstances. See BS 5839: Part 6: 2004 for more detailed information.

2.11.6 Heat alarms

Heat alarms conforming to BS 5446: Part 2: 2003 have fixed-temperature elements and operate on the principle of responding to the temperature of the fire gases in the immediate vicinity of the heat alarm. Heat alarms are used where ambient temperatures are likely to fluctuate rapidly over a short period such as in *kitchens* and are less likely to produce false alarms. Elsewhere, heat alarms should not be used instead of *smoke alarms* to reduce unwanted false alarms.

2.11.7 Siting of fire detectors

The guidance in this clause takes account of the audibility levels in adjoining *rooms* and the effect of smoke travelling along a ceiling.

Smoke alarms and heat alarms by their definition, include an integral sounder. *Smoke alarms* are designed to produce a sound output of 85 dB(A) at 3 m. Therefore, allowing for a sound attenuation through a domestic door,

a sound level of between 55 – 65 dB(A) can be expected at the bed-head in each bedroom which should rouse the occupants. There is no evidence to suggest that lives are being lost in *dwelling*s due to audibility levels other than when people are incapacitated to such a degree e.g. by alcohol or drugs, that even higher sound levels would not waken them.

Smoke from a fire in a *dwelling* is normally hot enough that it rises and forms a layer below the ceiling. As the smoke rises and travels horizontally it mixes with air which increases the size of the smoke particles. This means that ionisation *smoke alarms* may be less sensitive to the smoke. Where a hallway is very long, the smoke might cool to such an extent that it loses buoyancy and spreads along the floor.

Audibility

Therefore, *smoke alarms* should be located in circulation spaces:

- not more than 7 m from the door to a living *room* or *kitchen*;
- not more than 3 m from every bedroom door; and
- in circulation spaces more than 7.5 m long, no point within the circulation space should be more than 7.5 m from the nearest *smoke alarm*.

Smoke travel

A *smoke alarm* in the principal habitable *room* should be sited such that no point in the *room* is more than 7.5 m from the nearest *smoke alarm* and in the case of a heat alarm, no point in the *kitchen* should be more than 5.3 m from the nearest heat detector.

All dimensions should be measured horizontally.

Smoke might not reach a *smoke alarm* where it is located on or close to a wall or other obstruction. Therefore, *smoke alarms* should be ceiling mounted and positioned away from any wall or light fitting. In order to reduce unwanted false alarms, *smoke alarms* should not be sited directly above heaters, air conditioning *ventilators* or other *ventilators* that might draw dust and fine particles into the *smoke alarm*.

Smoke alarms and heat alarms should be ceiling mounted and located such that their sensitive elements are:

- in the case of a *smoke alarm*, between 25 mm and 600 mm below the ceiling, and at least 300 mm away from any wall or light fittings; and
- in the case of a heat alarm, between 25 mm and 150 mm below the ceiling.

2.11.8 Grade of fire detection and fire alarm system

Monitoring of wiring or faults reduces the amount of time which a system is likely to be disabled before a fault in the system is discovered. A visual indicator or warning signal should be provided to alert the occupant that there is a fault with the system.

Therefore, at least a Grade D fire detection and fire alarm system should be installed in every *dwelling* which comprises 1 or more mains powered *smoke alarm* and 1 or more mains powered heat alarm with an integral standby supply in accordance with BS 5839: Part 6: 2004.

However a *sheltered housing complex* normally provides accommodation for vulnerable occupants with a diverse range of support needs. Therefore, a fire alarm signal should be transmitted to a remote monitoring service or to a warden who can assist with any evacuation if necessary, or call for assistance.

In order to achieve this principle, a Grade C system should be installed in every *dwelling* in a *sheltered housing complex* which comprises central control equipment in accordance with BS 5839: Part 6: 2004 and:

- 1 or more mains powered *smoke alarm* and 1 or more mains powered heat alarm with an integral standby supply; or
- point fire detectors and separate sounders.

2.11.9 Wiring and power

Research shows that significant proportion of battery operated *smoke alarms* fail to operate during the outbreak of a fire. The main reason for this is that the battery is either faulty or has been removed from the alarm. Therefore, *smoke alarms* and heat alarms should be mains operated and permanently wired to a circuit which should take the form of either:

- an independent circuit at the main distribution board, in which case no other electrical equipment should be connected to this circuit (other than a dedicated monitoring device installed to indicate failure of the mains supply to the alarms); or
- a separately electrically protected regularly used local lighting circuit.

The standby supply for *smoke alarms* and heat alarms may take the form of a primary battery, a secondary battery or a capacitor.

The capacity of the standby supply should be sufficient to power the *smoke alarms* and heat alarms in the quiescent mode for at least 72 hours whilst giving an audible or visual warning of power supply failure, after which there should remain sufficient capacity to provide a warning for a further 4 minutes or, in the absence of a fire, a fault warning for at least 24 hours.

Standby supply

All *smoke alarms* and heat alarms in a *dwelling* should be interconnected so that detection of a fire in any alarm, operates the alarm signal in all of them. *Smoke alarms* and heat alarms should be interconnected in accordance with BS 5839: Part 6: 2004.

The system should be installed in accordance with the manufacturers written instructions. This should include a limitation on the number of *smoke alarms* and heat alarms which may be interconnected.

Interconnection

2.11.10 Radio linked systems

Radio linked interconnection between hard wired *smoke alarms* and/or heat alarms may be used for a Grade D system. More detailed guidance on the use of radio linked technology can be obtained from, BS 5839: Part 6: 2004.

2.12 Fire and rescue service access

- 2.12 Functional standard
- 2.12.0 Introduction
- 2.12.1 Vehicle access provision
- 2.12.2 Vehicle access routes
- 2.12.3 Operating spaces for high reach appliances
- 2.12.4 Access for fire and rescue service personnel

standard

Every *building* must be accessible to the fire and rescue service.

2.12

mandatory

2.12.0 Introduction

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 fire-fighting and rescue activities. The access arrangements increase with *building* size and height.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably practicable*, and in no case be worse than before the *conversion* (regulation 12, schedule 6).

2.12.1 Vehicle access provision

Access from a *public road* should be provided to assist fire and rescue personnel in their rescue and fire-fighting operations. Whilst the access will depend to some extent on the vehicles and equipment used, assistance may be provided from adjoining fire and rescue services when the need arises. For this reason, the more demanding guidance for high reach appliances may be recommended by the fire and rescue service. This may have a significant impact on planning and a feasibility study may be appropriate. Consultation with the fire and rescue service at the earliest opportunity is strongly recommended.

Vehicle access should be provided to at least one elevation of all *domestic buildings* to assist in fire-fighting and rescue operations.

Flats or maisonettes

In the case of *flats* or *maisonettes* with a common entrance, a vehicle access route for fire-fighting vehicles from a *public road* should be provided not more than 45 m from the common entrance.

In addition, where dry or wet fire mains are installed in a *building*, parking spaces should be provided for fire and rescue service vehicles a distance not more than 18 m from riser inlets. The intention is to assist fire and rescue service personnel connect a short length of hose between the pumping appliance and the inlets to the fire mains quickly and efficiently therefore saving operational time.

However vehicle access routes to more than one elevation may not always be possible due to the constraints of the *site*, and pedestrian access for fire and rescue service personnel as described in clause 2.12.4 may be sufficient. In such cases, advice from the fire and rescue service should be sought.

Houses

Every *house* should be provided with a vehicle access route for fire-fighting vehicles from a *public road* to not more than 45 m from any door giving direct access to the interior of the *dwelling*.

2.12.2 Vehicle access routes

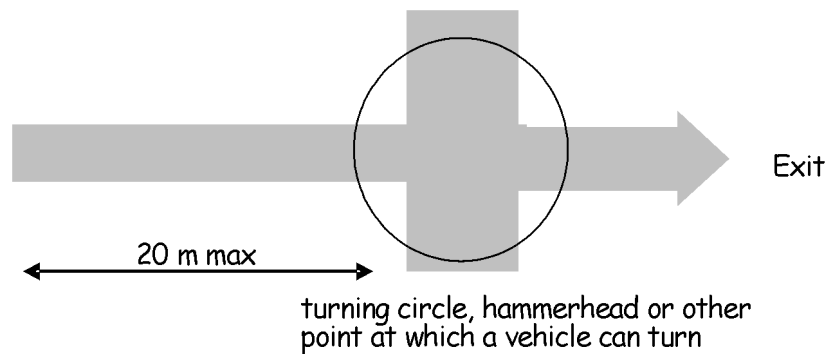
Access routes to *buildings* for fire and rescue service vehicles or personnel should not be assessed in isolation and the proposed access routes in effect will be dictated by need for water hydrants and other fire-fighting facilities such as fire mains (see clause 2.14.7).

Dead end route

Fire and rescue service vehicles should not have to reverse more than 20 m from the end of an access *road*. Where any dead-end route is more than 20 m long turning facilities should be provided. This can be a turning circle or a hammerhead designed on the basis of the diagram and table below.

In rural areas, access from a *public road* may not be possible to within 45 m of an entrance to the *building*, and access from a *private road* will suffice provided the guidance in the table below has been followed. The vehicle access route assumes that access for pumping appliances will be sufficient for *houses*, but that provision for high reach appliances should be made to *buildings* containing *flats* or *maisonettes*. Where, in consultation with the fire and rescue service access is only needed for pumping appliances, the smaller dimensions for a *house* may be used.

Turning Facilities



Access route for fire and rescue service vehicles

	Flats and maisonettes	Houses
Minimum width of <i>road</i> between kerbs	3.7 m	3.7 m
Minimum width of gateways etc	3.5 m	3.5 m
Minimum clearance height	4.0 m	3.7 m
Minimum turning circle between kerbs	26.0 m	16.8 m
Minimum turning circle between walls	29.0 m	19.2 m
Minimum axle loading	14 tonnes	14 tonnes

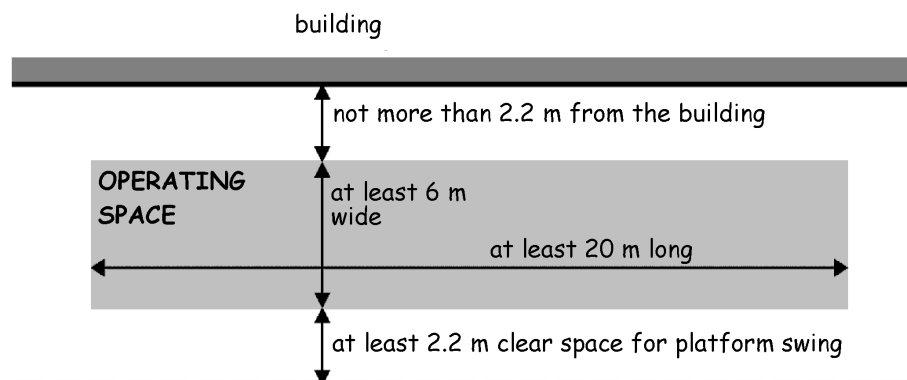
2.12.3 Operating spaces for high reach appliances

Following consultation with the fire and rescue service if it is recommended that an operating space, or spaces, for a high reach appliance should be provided, the operating spaces(s) should:

- have a ground loading capacity of not less than 8.3kg/cm²; and
- be level or have a gradient not more than 1 in 12.

The operating space shown in the diagram below is suitable for either a hydraulic platform or a turntable ladder. Where the *building* has obstructions such as balconies or other projections, the *building* line should be taken to be the outer edge of the balconies or other projections.

Minimum dimensions for operating space for high reach appliances



2.12.4 Access for fire and rescue service personnel

It is common practice for fire and rescue service personnel to enter a *building* through the normal entrance and fight the fire head on. This is termed 'offensive fire-fighting'.

In order to allow unobstructed access to a *domestic building* for fire and rescue service personnel, a paved (or equivalent) footpath at least 900 mm wide (see also section 4 Safety) should be provided to the normal entrances of the *building*.

In addition, where vehicle access is not possible to within 18 m of the dry riser inlets (see clause 2.12.1), a footpath should also be provided to the riser inlets. This will allow the fire and rescue service to deploy portable pumps to relay water supplies to where the water is needed. Whilst this method of water distribution is quite common, it should be avoided for new developments because of the time delay in supplying water to the fire-fighters.

Every elevation which is provided with vehicle or pedestrian access for fire and rescue service personnel should have a door giving access to the interior of the *building*. Inward opening doors are preferable because this allows easier forced entry by fire and rescue service personnel should the need arise. However an outward opening final *exit door* or *emergency door* should also be considered as providing suitable access.

2.13 Fire and rescue service water supply

- 2.13 Functional standard
- 2.13.0 Introduction
- 2.13.1 Fire and rescue service water supply
- 2.13.2 Public water supply
- 2.13.3 Alternative water supply

standard

2.13

mandatory

Every *building* must be provided with a water supply for use by the fire and rescue service.

2.13.0 Introduction

The fire and rescue service should be provided with a water supply to assist with their fire-fighting and rescue operations. This is normally provided from public water mains through fire hydrants or alternative water supplies such as tanks or reservoirs may be provided.

In some cases, the existing water supply may be sufficient and there is no need to provide additional water supplies. Therefore, it is important to consult the fire and rescue service and the water authority early in the design process to establish what water supply, if any, should be provided in order to carry out their statutory duties under the Fire (Scotland) Act 2005, as amended.

Conversions

In the case of conversions, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

2.13.1 Fire and rescue service water supply

Fires in *domestic buildings* are generally smaller than fires in *non-domestic buildings*. *Domestic building* fires are usually contained within the *dwelling* or other ancillary room or space of fire origin. There may be sufficient water stored in the pumping appliance to fight the fire and carry out rescue operations without the need to connect to a fire hydrant. However there are occasions where the fire has spread or is difficult to contain such as fires in concealed spaces, and additional water supplies will be necessary to replenish the water storage tank on the appliance.

Every *domestic building* should, where agreed with the fire and rescue service, be provided with a water supply to assist fire-fighting and rescue operations from:

- a public water supply; or
- an alternative water supply.

2.13.2 Public water supply

A *domestic building* should be erected no more than 100 m from a fire hydrant. An existing hydrant may be used in agreement with the fire and rescue service. Additional hydrants may be required in those cases where the *building* has fire mains (see standard 2.14).

Where a *domestic building* is being erected more than 100 m from an existing fire hydrant, the fire and rescue service should be consulted to establish whether additional fire hydrants are necessary to assist fire-fighting and rescue operations.

Where a new fire hydrant is required, it should be connected to a water service pipe capable of delivering water at a flow rate of 1500 litres per minute, provided by a water main vested in a public water authority or a water supply provided under the Fire (Scotland) Act 2005, as amended.

A fire hydrant should be clearly indicated by a plate, affixed nearby in a conspicuous position, in accordance with BS 3251:1976.

2.13.3 Alternative water supply

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 charged static water tank of at least 45,000 litre capacity; or
- a spring, river, canal, loch or pond 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
- any other means of providing a water supply for fire-fighting operations considered appropriate by the fire and rescue service.

2.14 Fire service facilities

- 2.14 Functional standard
- 2.14.0 Introduction
- 2.14.1 Fire and rescue service facilities
- 2.14.2 Number and type of facilities
- 2.14.3 Fire-fighting stairs
- 2.14.4 Fire-fighting lifts
- 2.14.5 Fire-fighting lobbies
- 2.14.6 Heat and smoke control
- 2.14.7 Fire mains

standard

2.14

mandatory

Every *building* must be designed and *constructed* in such a way that facilities are provided to assist fire-fighting or rescue operations.

2.14.0 Introduction

Facilities within a *building* are provided to assist the fire and rescue service carry out their statutory duties as efficiently and safely as possible. Fire and rescue service personnel are trained to enter *buildings* following the outbreak of fire to assist with any evacuation of the *building* occupants, effect rescues of any casualties and to fight fires. Fire-fighters operational duties are made on a statutory basis in the Fire (Scotland) Act 2005 as amended, which states:

“Each relevant authority shall make provision for the purpose of –

- a. extinguishing fires in its area;
- b. protecting life and property in the event of fires in its area.”

The extent of fire development will vary with each incident and in any situation, the fire and rescue service will assess the need to evacuate the entire *building* whilst the fire is brought under control. Sometimes, the fire can develop to such an extent that additional fire-fighting teams may need to be summoned from other fire stations or fire authorities.

Fire-fighters will normally enter a *building* through the main entrance and attempt to attack the fire. This is termed ‘offensive fire-fighting’ and is normal practice regardless of whether people are in the *building* or not. When conditions within the *building* become too hazardous for fire-fighters to remain, they will normally retreat a safe distance away from the *building* and implement ‘defensive’ fire-fighting tactics to control the spread of fire. In cases where a large fire develops, numerous fire-fighting teams may be involved using a combination of offensive and defensive tactics until the fire is brought under control and extinguished. Due to the high level of fire separation and containment within a *building* containing *flats* and *maisonettes*, it would be unusual to implement defensive fire-fighting tactics.

Whilst fire-fighters are professionally trained to deal with all types of fire condition, the fire and rescue service facilities within a *building* are important to reduce fire attack time which in turn, could save lives, limit the fire damage to property and improve fire-fighter safety.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard (regulation 12, schedule 6).

2.14.1 Fire and rescue service facilities

Fire and rescue service facilities may need to be provided in a *building* to assist with any evacuation of the *building* occupants, effect rescues of any casualties and to fight fires. The time taken for fire and rescue service intervention is dependent on a number of variables. The time to contact the emergency services, the location of the *building* in relation to the fire station and the height of the floor of fire origin above or below the fire and rescue service access level.

Fires in tall *buildings* or in *basement storeys* may present additional risks to fire and rescue service personnel. Fire and smoke can suddenly change direction and intensity due to a number of factors which might induce reverse air flows. For example, the wind direction and velocity (which increases with height) could have a significant impact when fire-fighters open the door to the *dwelling* of fire origin. Similarly, limited ventilation available in a *basement storey* can lead to heat and smoke build up that is released through the opening the fire-fighters are using as an entry point.

It is important that the facilities to assist the fire and rescue service take account of the *building* design. The Building Disaster Assessment Group carried out extensive research on behalf of the UK Government to assess the interaction between *building* design and the operational response of fire and rescue service. The subjects covered by the research included:

- physiological performance criteria for fire-fighting;
- fire-fighting in under-ventilated *compartments*; and
- fire-fighting media in high-rise *buildings*.

www.communities.gov.uk

The research is available on the UK Government website.

2.14.2 Number and type of facilities

houses

Facilities to assist the fire and rescue service need not be provided in a *house*. This is because the forward control point will be set up outside the *building* and the operations will commence from that point.

flats and maisonettes

The further fire-fighters need to travel to reach the seat of the fire above or below ground, the greater the risk. Therefore, the number and type of facilities should be provided based on the height of the topmost *storey* above the fire and rescue service access level, the depth of any *basement storeys* below the access level and the distance from any fire mains outlets (see clause 2.14.7).

Facilities that may be necessary include:

- fire-fighting stairs (see clause 2.14.3);
- fire-fighting lifts (see clause 2.14.4);
- fire-fighting lobbies (see clause 2.14.5);
- heat and smoke control e.g. natural or mechanical ventilation (see clause 2.14.6); and
- fire mains i.e. wet or dry risers (see clause 2.14.7).

Height of topmost storey

Building design should complement fire fighting and rescue capability. The 7.5 m *storey* height above the ground is historically linked to the height at which fire and rescue service personnel can rescue occupants using the standard 13.5 m portable ladder. Whilst this practice is no longer common, for health and safety reasons, fire fighters continue to carry out external rescues as a last resort and *building* design should recognise this.

The 18 m *storey* height above the ground is also historically linked with the reach capability of fire and rescue service equipment such as wheeled escape ladders (now obsolete). The general intent is that *buildings* with a *storey* at a height of more than 18 m above the access level, cannot be easily reached by fire and rescue service equipment and personnel. Therefore, at least 1 fire-fighting shaft (fire-fighting stair, fire-fighting lobby, fire mains and in some cases a fire-fighting lift) is provided within the *building* to allow equipment and personnel to be deployed as quickly as possible.

In addition, fire-fighters cannot apply water jets from fire hoses onto *external walls* high above the ground because of the limited reach capability. The guidance throughout this handbook including standard 2.7, fire spread on *external walls*, recognises this limitation.

The fire and rescue service facilities recommended in the table should be applied on every *storey* however the lowest *basement storey* sets the level of facilities recommended throughout the *basement storeys* only. The depth of the lowest *basement storey* is measured from the fire and rescue service access level to the upper surface of the lowest *basement storey*. The height of the topmost *storey* of a *building* is measured from the fire and rescue service access level to the upper surface of the topmost *storey*.

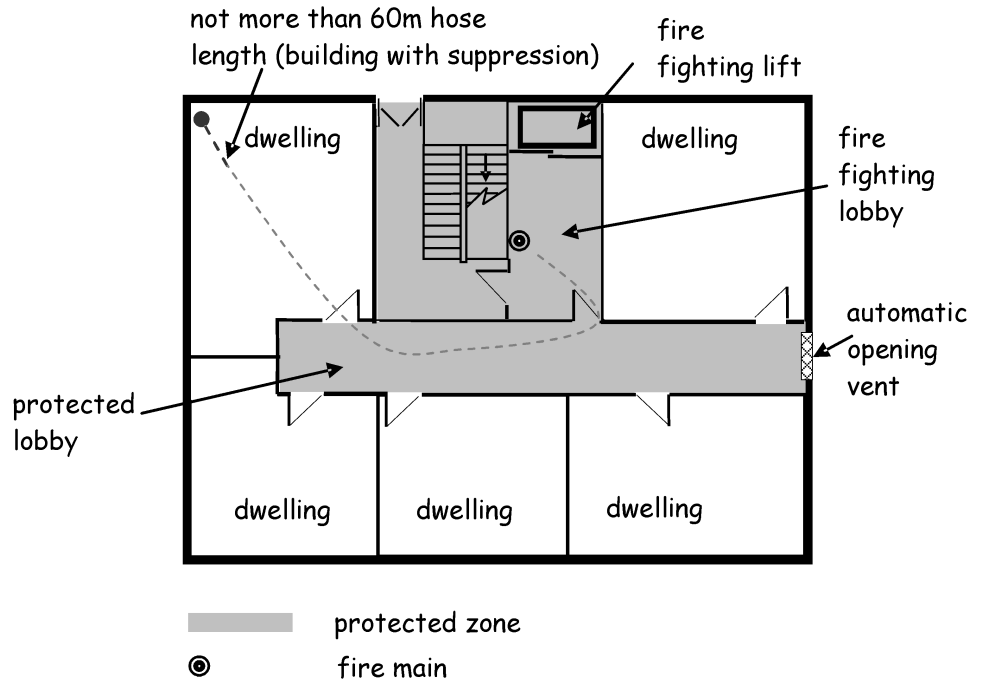
Fire and rescue service facilities

Height and depth of storey above or below fire and rescue service access level [1]	Type of facilities [2]
<i>Basements</i> at a depth not more than 4.5 m below access level	Fire-fighting stair (see clause 2.14.3), ventilation to stair (see clause 2.14.6)
Topmost <i>storey</i> not more than 7.5 m above access level	Fire-fighting stair (see clause 2.14.3), ventilation to stair (see clause 2.14.6)
Topmost <i>storey</i> more than 7.5 m but not more than 18 m above access level	Fire-fighting stair (see clause 2.14.3), fire-fighting lobby (see clause 2.14.5), ventilation to stair and fire-fighting lobby (see clause 2.14.6), dry fire main located in fire-fighting lobby (see clause 2.14.7)
Topmost <i>storey</i> more than 18 m but not more than 50 m above access level	Fire-fighting stair (see clause 2.14.3), fire-fighting lift (see clause 2.14.5), fire-fighting lobby (see clause 2.14.6), ventilation to stair, and fire-fighting lobby (see clause 2.14.6), dry fire main located in fire-fighting lobby (see clause 2.14.7)
Topmost <i>storey</i> more than 50 m but not more than 60 m above access level	Fire-fighting stair (see clause 2.14.3), fire-fighting lift (see clause 2.14.4), fire-fighting lobby (see clause 2.14.5), ventilation to stair, and fire-fighting lobby (see clause 2.14.6), wet fire main located in fire-fighting lobby (see clause 2.14.7)

Notes:

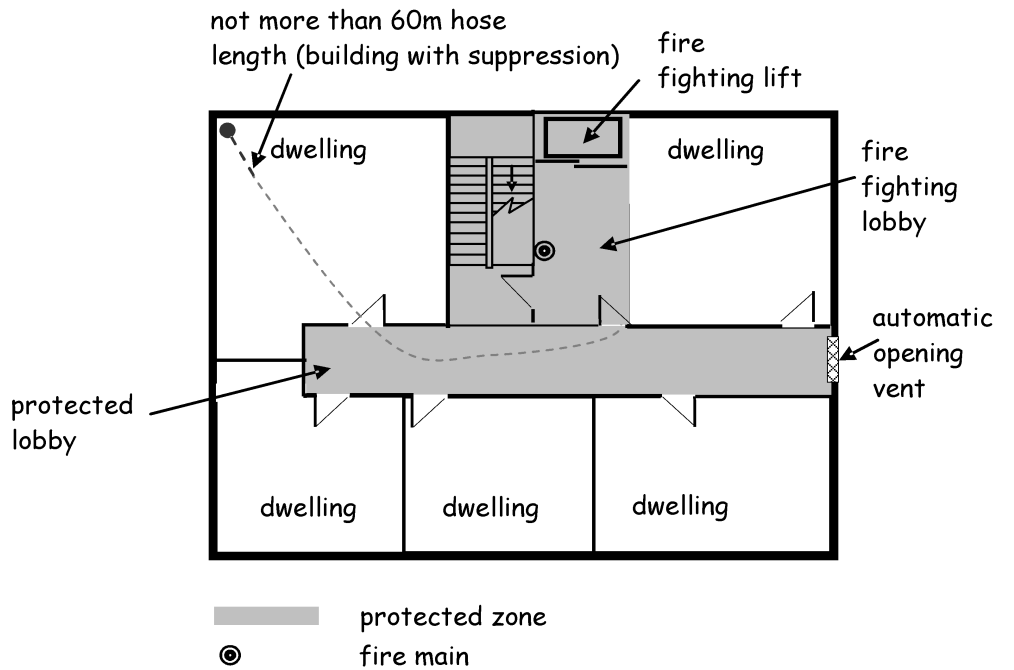
1. The access level is the level at which the fire and rescue service enter the *building* to commence fire-fighting and rescue operations.
2. Ventilation to stairs includes both *escape stairs* and fire-fighting stairs (see clause 2.14.6).

Typical ground floor - one escape route - storey height more than 18m but not more than 60m



Note: For heat and smoke control see clause 2.14.6

Typical upper floor - one escape route - storey height more than 18m but not more than 60m



Note: For heat and smoke control see clause 2.14.6

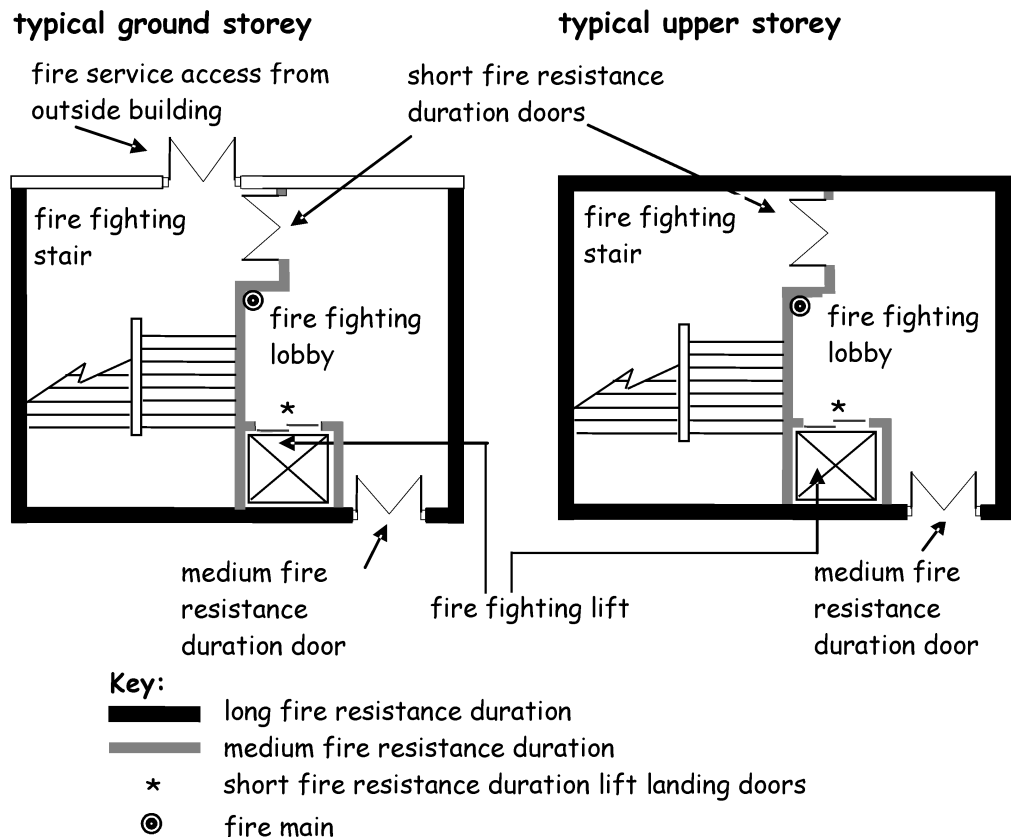
2.14.3 Fire-fighting stairs

At least 1 fire-fighting stair should be provided to assist fire-fighters to access the fire and if necessary escape from the fire in relative safety. The fire fighting stair should be at least 1.0 m wide measured between handrails to provide fire and rescue service personnel sufficient room to carry fire-fighting and rescue equipment.

A fire-fighting stair and where required a fire fighting lobby and fire fighting lift should be contained within a *protected zone*. The enclosing structure of the *protected zone* should have at least a medium fire resistance duration. The *protected zone* should have a long fire resistance duration where it serves a *building* where the topmost *storey* is more than 18 m above the fire and rescue service access level. A *self-closing fire door* in the enclosing structure of a *protected zone* should have a short fire resistance duration and in the case of a *high rise domestic building*, a medium fire resistance duration. A fire-fighting stair can also be used as an *escape stair*.

The wall separating the fire-fighting stair from the fire-fighting lobby (where necessary, see table to clause 2.14.2) should have at least a medium fire resistance duration and the *self-closing fire door* should have at least a short fire resistance duration. The wall separating the fire-fighting lobby from the remainder of the *building* should have a long fire resistance duration and the door should be a *self-closing fire door* with a medium fire resistance duration.

Fire and rescue service facilities - buildings with storey height of more than 18m



Note: For heat and smoke control see clause 2.14.6

2.14.4 Fire-fighting lifts

In *high rise domestic buildings*, a fire-fighting lift should be provided to assist fire-fighters to transport equipment to a floor of their choice as quickly as possible. The lift also allows fire-fighters to access several floors quickly to assess the situation and to rescue any casualties.

The fire-fighting lift installation includes the lift car itself, the lift well and the lift machinery space, together with the lift control system and the lift communication system. The lift control and communication system should be capable of being used under the direct control of the fire and rescue service. The lift installation should conform to BS EN 81: Part 72: 2003 and BS EN 81: Part 1: 1998 or BS EN 81: Part 2: 1998 depending on the type of lift.

A fire-fighting lift should be located within a *protected zone* and *constructed* within its own *compartment* having at least a medium fire resistance duration. The lift landing doors need only achieve a short fire resistance duration.

The fire-fighting lift should only be entered from:

- a fire-fighting lobby with not more than 1 door to the *room* or *storey* it serves; or
- an open access balcony.

A fire-fighting lift need not serve the top *storey* of a *building* where:

- the top *storey* is for service plant use only; and
- access to the plant *room* is from the fire-fighting stair from the *storey* below; and
- the foot of the fire-fighting stair is not more than 4.5 m from the fire-fighting lift.

2.14.5 Fire-fighting lobbies

A fire-fighting lobby serves a fire-fighting stair and a fire-fighting lift where appropriate. Where a fire-fighting lobby is required (see table to clause 2.14.2), it should be located within a *protected zone* and should be provided on every *storey*. The purpose of a fire-fighting lobby is:

- to allow fire-fighters to set up a forward control point at least 1 floor below the fire floor where fire-fighters and fire-fighting equipment can safely be assembled before commitment to fire-fighting and rescue operations;
- to protect fire-fighters when making their final approach to the fire floor;
- to protect any evacuees or fire-fighters who might be using the stair from a fire in the lift well or lift machine room;
- to provide fire-fighters with a safe route of egress from the fire, or if the lift should fail or its reliability becomes uncertain;
- to protect fire-fighters who might accidentally arrive at the fire floor;
- to reduce the potential for fire-fighters to become disoriented due to poor visibility; and
- to protect the lift from the effects of fire and smoke in adjoining accommodation.

Therefore a fire fighting lobby should be provided on every *storey* and have an area of at least 5 m² with all principal dimensions at least 1.5 m. This allows fire-fighters sufficient room to lay out hose and connect to the outlet from a fire main.

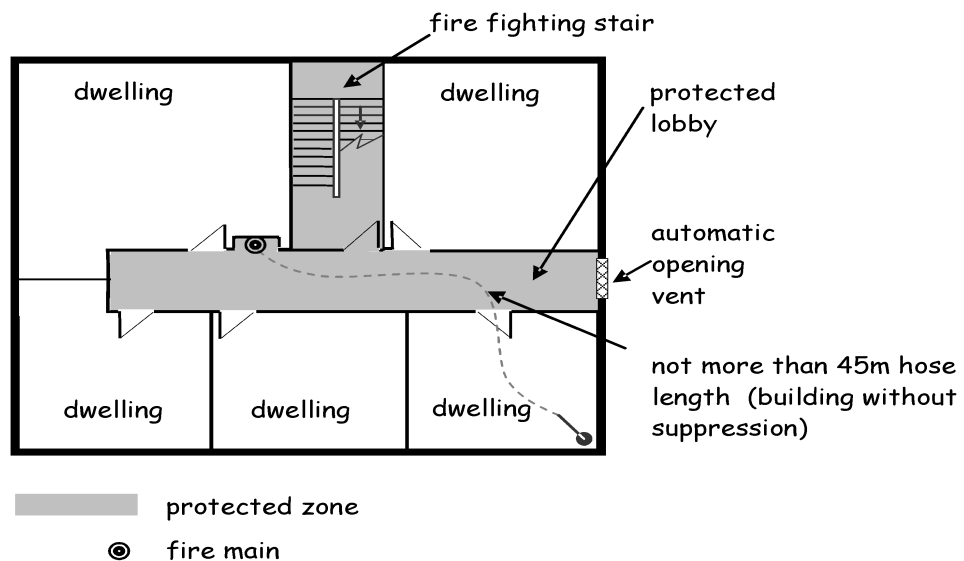
In *buildings* where the topmost *storey* height is more than 18 m above fire and rescue service access level a fire-fighting lobby should have not more than 1 door to the *room* or *storey* it serves.

However a fire-fighting lobby need not be provided where:

- the topmost *storey* of the *building* is no more than 18 m above fire and rescue service access level; or
- access to the *flats* or *maisonettes* is from an open access balcony serving a *storey* in a *building* with a *storey* height of not more than 60 m.

In these cases, the fire main may be located in the protected corridor, *protected lobby* or open access balcony provided an area of at least 5 m² with all principal dimensions of at least 1.5 m is available at the fire main outlet which is located adjacent to the *protected door* leading to the fire-fighting stair.

Typical upper floor – one escape route – storey height more than 7.5m but not more than 18m



Note: For heat and smoke control see clause 2.14.6

2.14.6 Heat and smoke control

The fire and rescue service should be provided with the facility to release smoke and heat from a fire during their fire-fighting and rescue operations. Ventilation should be provided to every *escape stair*, fire-fighting stair, fire-fighting lobby and to every *protected lobby* or protected corridor where appropriate (see table to clause 2.14.2). The efficiency of the *ventilators* depends upon the prevailing wind and it is important that fire-fighters can control the opening and closing of the *ventilators* on arrival at the *building*.

Ventilators should be fitted with a simple handle or lock that can be operated by fire-fighters. If *ventilators* are not easily accessible they should be operated by a mechanism positioned within the *building* at the fire and rescue service access point. In the case of an *escape stair* and a fire-fighting stair, a local control should also be provided at the topmost *storey*. This will allow fire-fighters flexibility in their operations.

Escape stairs and fire-fighting stairs

Ventilation should be provided to every *escape stair* and every fire-fighting stair by:

- a *ventilator* of at least 1 m² at the top of the stair; or
- an *ventilator* of at least 0.5 m² at each *storey* on an *external wall*; or

- ‘Smoke shafts protecting fire-fighting shafts; their performance and design’ (BRE, 2002).

Protected lobbies, protected corridors and fire-fighting lobbies

Ventilation should also be provided in protected lobbies, protected corridors and fire-fighting lobbies by:

- a *ventilator* of at least 1 m² at each *storey* on an *external wall*; or
- smoke shafts as described in the guidance to standard 2.9; or
- ‘Smoke shafts protecting fire-fighting shafts: their performance and design’ (BRE, 2002).

A natural or mechanical smoke ventilation system used to satisfy standard 2.9 may also be used to satisfy standard 2.14 with the agreement of the fire and rescue service.

2.14.7 Fire mains

Where there is an outbreak of fire high above the fire and rescue service access level, the time taken to set up a forward control point, assess the situation and carry hoses up several *flights* of stairs can be considerable. Therefore, in a *building* where the topmost *storey* is more than 7.5 m, a fire main should be installed in the fire-fighting lobby, to help reduce fire attack time. Fire mains may be located in a *protected lobby*, protected corridor or open access balcony (see clause 2.14.5).

Dry fire main

A dry fire main is a pipe installed in a *building* for fire-fighting purposes, which is normally dry but is capable of being charged with water by pumping from a fire and rescue service appliance. A dry fire main is commonly referred to as a ‘dry riser’.

Dry fire mains should be designed and *constructed* in accordance with BS 9990: 2006 and boxes for fire mains outlets valves should conform to BS 5041: Part 4: 1975 (1987).

The inlets to the risers should be located externally to the *building* and not more than 18 m from a parking space suitable for a pumping appliance. There should be a clear hose route between the appliance and the inlet.

Wet fire mains

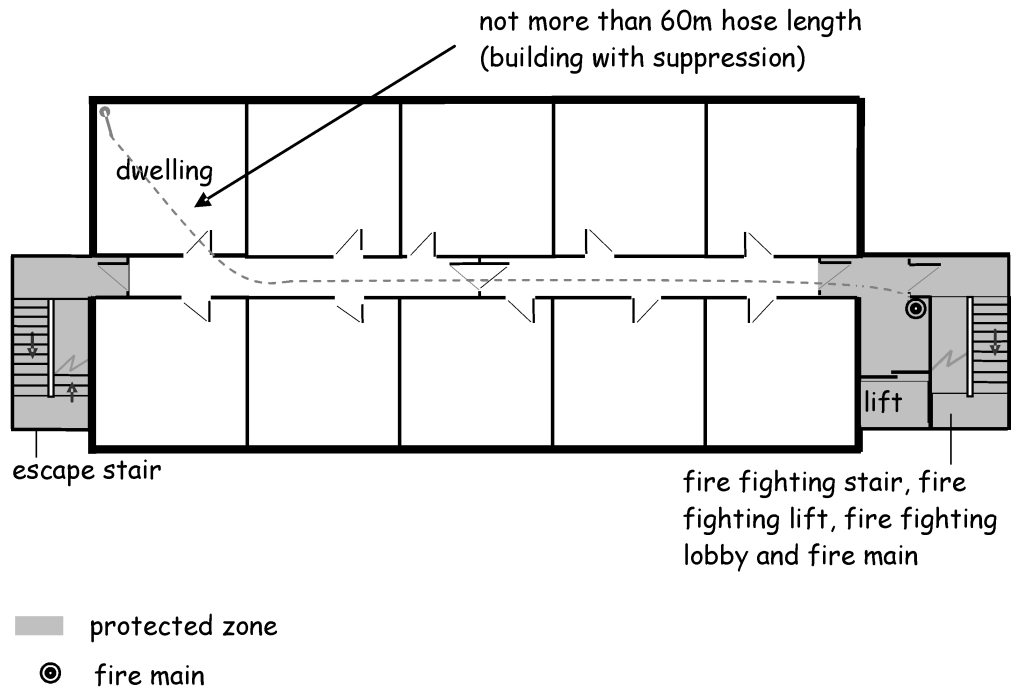
The pressure and flow rates delivered from fire mains reduce with height above the ground and may not provide an effective water jet from fire-fighting hoses. Therefore, where the height of the topmost *storey* is more than 50 m above the fire and rescue service access level, wet rising mains should be installed. A wet fire main is a pipe which is constantly charged with water supplied from a suction tank and pump. The suction tank should have an inlet for the emergency replenishment of water and is clearly visible to the fire and rescue services. A wet fire main is commonly referred to as a ‘wet riser’.

Fire mains outlets

Fire mains outlets should be provided on every *storey* of a *building* and the *basement storey* to permit firefighting operations to be conducted at any floor level when it is safe for fire and rescue service personnel to do so.

If an automatic fire suppression system is installed in the *building*, no point on the *storey* should be more than 60 m from the fire main outlet, measured along an unobstructed route for laying a fire hose. If the *building* is not fitted with an automatic fire suppression system, no point on the *storey* should be more than 45 m from the outlet.

Typical upper floor - two escape routes - storey height more than 18m but not more than 60m



Note: For heat and smoke control see clause 2.14.6

2.15 Automatic fire suppression systems

- 2.15 Functional standard
- 2.15.0 Introduction
- 2.15.1 Automatic fire suppression systems
- 2.15.2 Sheltered housing complexes
- 2.15.3 High rise domestic buildings
- 2.15.4 Water supply

standard
2.15
mandatory

Every *building* must be designed and *constructed* in such a way that, in the event of an outbreak of fire within the *building*, fire growth will be inhibited by the operation of an automatic fire suppression system.

Limitation:

This standard applies only to a *building* which:

- (a) is an enclosed shopping centre;
- (b) is a *residential care building*;
- (c) is a *high rise domestic building*;
- (d) forms the whole or part of a *sheltered housing complex*; or
- (e) is a school *building*.

2.15.0 Introduction

Automatic fire suppression systems installed in domestic premises are primarily designed for life safety purposes. Successful activation can provide occupants, including vulnerable occupants, with additional time to escape following the outbreak of fire. The added benefit of automatic fire suppression in *domestic buildings* means that the damage and disruption caused by fire is greatly reduced.

Automatic suppression systems react to heat therefore, the greatest protection is afforded to those occupants out-with the *room* of fire origin. Automatic suppression may provide some benefit to occupants in the *room* of fire origin where for example the fire growth is fast and the temperatures allow the sprinkler system (normally 1 or 2 heads) to open early in the development phase of the fire. The spray pattern delivered from the sprinkler heads should control fire spread. Whilst the effect of sprinkler spray will increase the smoke volume and could obscure *exits*, smoke temperatures and toxicity will be greatly reduced. In some cases, the fire might be extinguished if the fire is not shielded from the sprinkler spray.

Automatic life safety fire suppression systems are required in 2 categories of *domestic building*:

- *dwellings* which form part of a *sheltered housing complex*; and
- *high rise domestic buildings*.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

2.15.1 Automatic fire suppression systems

The term automatic life safety fire suppression system includes sprinkler systems but provides the opportunity for designers to propose other systems which may be just as effective. The key characteristics of the system are:

- it must be automatic and not require people to initiate its activation;
- it must be designed primarily to protect lives, rather than property, which means it should be fitted with faster responding sprinkler heads; and
- it must be a fire suppression system, one designed specifically to deal with fires rather than other hazards.

Concealed or recessed pattern sprinkler heads

Concealed or recessed pattern sprinkler heads may be used in the system design. However there is a risk that the heads are rendered ineffective or operate less efficiently by the application of any decorative ceiling finish. Therefore, consideration should be given to labelling of the heads with words to the effect of 'DO NOT PAINT'.

Alternative suppression systems

There are many alternative or innovative fire suppression systems available including systems utilising domestic plumbing and water-mist systems. Verifiers should satisfy themselves that such systems have been designed and tested for use in *domestic buildings* and are fit for their intended purpose (see section 0).

Alternative approaches in a particular case may or may not be compensated by an automatic fire suppression system.

2.15.2 Sheltered housing complexes

A *sheltered housing complex* is a purpose built complex comprising of 2 or more *dwelling*s e.g. *houses*, *flats* and *maisonettes*, where the occupants are likely to receive a support service due to the nature of their vulnerability or need e.g. age, infirmity, disability, illness, mental disorder or are dependant on alcohol or drugs. Such occupants are likely to react slowly to the fire alarm (see standard 2.11) and the suppression system may provide the additional time necessary to make a safe escape.

Therefore, a *sheltered housing complex* should have an automatic life safety fire suppression system designed and installed in accordance with BS 9251: 2005. For the purposes of satisfying standard 2.15, a *sheltered housing complex* should be regarded as a 'residential occupancy' as defined in BS 9251: 2005 and the limit on the scope of BS 9251: 2005 to *buildings* below 20 m in height can be ignored.

Where the *sheltered housing complex* is designed as individual *dwelling*s (for example, terraced *houses*) served by individual sprinkler systems, the *sheltered housing complex* may be regarded as a 'domestic occupancy' as defined in BS 9251: 2005.

2.15.3 High rise domestic buildings

Occupants are at greater risk from fire if they are located on a floor high above the ground. Wind effects might also have an influence on the speed, intensity and direction of fire development within the *dwelling* or other ancillary *room* or space of fire origin.

Therefore, in order to help contain the fire and to protect occupants in *high rise domestic buildings*, every *flat* or *maisonette* including all ancillary rooms and spaces throughout the *building* should be provided with an automatic life safety fire suppression system designed and installed in accordance with BS 9251: 2005. For the purposes of satisfying standard 2.15, a *high rise domestic building* should be regarded as a 'residential occupancy' as defined in BS 9251: 2005 and the limit on the scope of BS 9251: 2005 to *buildings* below 20 m in height can be ignored.

2.15.4 Water supply

For a suppression system to be effective it is essential that there is an appropriate water supply. Therefore, designers need to discuss with Scottish Water what supply is likely to be available and what pressure can be expected. It is recognised that pressures will vary during the day, over the year and perhaps in future years. Therefore it is imperative that the system is designed on the basis of what the minimum pressure and flow is likely to be. If there is any doubt, a tank and pump arrangement should be used.

Annex

2.A Resistance to fire

- 2.A.0 Introduction
- 2.A.1 Fire resistance duration
- 2.A.2 British Standards and associated specifications
- 2.A.3 Harmonised European Standards

annex

2.A

2.A.0 Introduction

This annex provides guidance on how to establish the resistance to fire of a *building* element or component. Whilst it could be argued that occupants of a *building* only need minutes to reach relative safety such as a *protected zone*, it should be remembered that the fire tests used to establish fire resistance in terms of time, do not replicate a real fire. In order to ensure the safe evacuation of the *building* occupants and to ensure that fire-fighters are not placed at undue risk, it is necessary to apply certain factors of safety to the fire resistance for structural and non-structural fire protection.

2.A.1 Fire resistance duration

Fire resistance durations are established from the guidance to standards 2.1 to 2.15. Reference throughout this document to a short, medium or long fire resistance duration, will be satisfied by following the guidance in the table to this annex titled 'Fire resistance duration for common *building* elements or components'. The designer is free to choose materials or products which satisfy either the British Standard Tests or the Harmonised European Tests.

Any test evidence or assessment used to substantiate the fire resistance rating of a wall, floor, ceiling, door or shutter should be carefully checked to ensure that it demonstrates compliance with appropriate fire tests and performance criteria contained in this handbook and is applicable to the complete installed assembly. For example, in the case of floors or ceilings small differences in details such as openings for lighting or ventilation can significantly affect the rating. Similarly, *fire doors* may also have small differences in detail such as *glazing* apertures, intumescent strips, door frames and ironmongery etc may significantly affect the rating.

Transitional period

British and European fire tests will co-exist in use until the British Standard classifications are withdrawn.

2.A.2 British Standards and associated specifications

The recommended fire resistance duration can be attained where the *construction* follows the guidance in columns 3, 4 and 5 of the table below. The tests and specifications in either:

- a. Clause 10 of BS 476: Part 20: 1987, when read in conjunction with - for load-bearing elements, BS 476: Part 21: 1987 for non load-bearing elements, BS 476: Part 22: 1987, for components, BS 476: Part 23: 1987, for ventilation *ducts*, BS 476: Part 24: 1987;
- b. for *fire door* assemblies with non-metallic leaves, BS 8214: 1990: Sections 1 and 2;
- c. for structural steelwork, BS 5950: Part 8: 2003 or 'Fire Safe Design: A new approach to multi- *storey* steel framed buildings' published by The Steel Construction Institute (within the limitations described in the SCI Publication P288);
- d. for the structural use of timber, BS 5268: Part 4: Sections 4.1 and 4.2: 1990;
- e. for the structural use of concrete, BS 8110: Part 2: 1985: Section 4.3 Tabulated data (method 1);
- f. an appropriate specification given in the Building Research Establishment Report BR 128 "Guidelines for the Construction of Fire Resisting Structural Elements" (BRE 1988).

2.A.3 Harmonised European Standards

The recommended fire resistance duration can be attained where the *construction* follows the guidance in Column 6 of the table below as specified in Commission Decision 2000/367/EC of 3/5/2000 implementing Council Directive 89/106/EEC as regards the classification of the resistance to fire of *construction products*, *construction works* and parts thereof.

BS EN 13501-2: 2007, Fire classification of *construction products* and building elements, Part 2-Classification using data from fire resistance tests (excluding products for use in ventilation systems).

BS EN 13501-3: 2005, Fire classification of *construction products* and building elements. Classification using data from fire resistance tests on

products and elements used in building service installations: fire resisting ducts and fire dampers (other than smoke control systems).

BS EN 13501-4: 2007, Fire classification of construction products and building elements, Part 4 - Classification using data from fire resistance tests on smoke control systems.

The tests and specifications are:

BS EN 1363-1: 1999, Fire resistance tests, Part 1-General requirements.

BS EN 1363-2: 1999, Fire resistance tests, Part 2-Alternative and additional procedures.

BS EN 1363-3: 2000, Fire resistance tests, Part 3-Verification of furnace performance.

BS EN 1364-1: 1999, Fire resistance tests for non load-bearing elements-Part 1: Walls.

BS EN 1364-2: 1999, Fire resistance tests for non load-bearing elements-Part 2: Ceilings.

BS EN 1365-1: 1999, Fire resistance tests for load-bearing elements-Part 1: Walls.

BS EN 1365-2: 2000, Fire resistance tests for load-bearing elements-Part 2: Floors and roofs.

BS EN 1365-3: 2000, Fire resistance tests for load-bearing elements-Part 3: Beams.

BS EN 1365-4: 1999, Fire resistance tests for load-bearing elements-Part 4: Columns.

BS EN 1366-1: 1999, Fire resistance tests for service installations-Part 1: Ducts.

BS EN 1366-2: 1999, Fire resistance tests for service installations-Part 2: Fire dampers.

BS EN 1634-1: 2008, Fire resistance and smoke control test for door and shutter assemblies, openable windows and elements of building hardware, Part 1 - Fire resistance tests for doors, shutters and openable windows.

BS EN 1634-2: 2008, Fire resistance and smoke control test for door and shutter assemblies, openable windows and elements of building hardware, Part 2 - Fire resistance characterisation test for elements of building hardware.

BS EN 1634-3: 2004, Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware, Part 3 - Smoke control test for door and shutter assemblies.

BS EN 81-58: 2003, Safety rules for the construction and installation of lifts - Examination and tests - Part 58: landing doors fire resistance test may be used in accordance with Council Directive 95/16/EC of 29/6/1995 implementing the Lifts Regulations 1997 (SI 1997/831).

Any reference to European Standards for Structure (Structural Eurocodes) must be taken to include the relevant UK National Annex:

BS EN 1991-1-2: 2002, Eurocode 1: Actions on structures – Part 1-2: General actions – Actions on structures exposed to fire.

BS EN 1992-1-2: 2004, Eurocode 2: Design of concrete structures – Part 1-2: General rules – Structural fire design.

BS EN 1993-1-2: 2005, Eurocode 3: Design of steel structures – Part 1-2: General rules – Structural fire design.

BS EN 1994-1-2: 2005, Eurocode 4: Design of composite steel and concrete structures – Part 1-2: General rules – Structural fire design.

BS EN 1995-1-2: 2004, Eurocode 5: Design of timber structures – Part 1-2: General rules – Structural fire design.

BS EN 1996-1-2: 2005, Eurocode 6: Design of masonry structures – Part 1-2: General rules – Structural fire design.

BS EN 1999-1-2: 2007, Eurocode 9: Design of aluminium structures – Part 1-2: General rules – Structural fire design.

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
Construction	Fire resistance duration	British Standards			European Standards	Test exposure
		Load bearing capacity (mins)	Integrity (mins)	Insulation (mins)		
1. Structural frame, column or beam	Short	30	None	None	R 30	Faces exposed on the inside
	Medium	60	None	None	R 60	
	Long	120	None	None	R 120	
2. <i>Separating floor</i> , or any other floor, <i>flat roof</i> or <i>access deck</i> used as a protected route of escape (2.0.6)	Short	30	30	30	REI 30	From the underside
	Medium	60	60	60	REI 60	
	Long	120	120	120	REI 120	
3. Other than a floor in 2 or an intermediate floor within a <i>flat</i> or <i>maisonette</i>	Short	30	None	None	R 30	From the underside
	Medium	60	None	None	R 60	
	Long	120	None	None	R 120	
4. <i>Separating wall</i> or an internal wall or screen used as a protected route of escape (2.0.6) [1, 2]	Short	30 [4]	30	30	REI 30 [4]	Each side separately
	Medium	60 [4]	60	60	REI 60 [4]	
	Long	120 [4]	120	120	REI 120 [4]	
5. Load-bearing wall, other than a wall in 4	Short	30	None	None	R 30	Each side separately
	Medium	60	None	None	R 60	
	Long	120	None	None	R 120	
6. <i>Fire door</i> in a wall in 4	Short	None	30 [6]	None	E 30 Sa [6]	Each side separately, when fitted in frame [7]
	Medium	None	60 [6]	None	E 60 Sa [6]	
	Long	None	120 [5, 6]	None	E 120 Sa [5, 6]	
7. <i>External wall</i> more than 1m from a <i>boundary</i> [1, 2]	Short	30 [4]	30	None	RE 30 [4]	From the inside only
	Medium	60 [4]	60	30	RE 60 and I 30 [4]	
8. <i>External wall</i> not more than 1m from a <i>boundary</i> [1, 2]	Short	30 [4]	30	30	REI 30 [4]	From the inside only
	Medium	60 [4]	60	60	REI 60 [4]	
9. Horizontal <i>cavity barrier</i> [3]	Short	None	30	None	E 30	From the underside
10. Vertical <i>cavity barrier</i> [3]	Short	None	30	None	E 30	Each side separately
11. Ceiling in place of a <i>cavity barrier</i> (see 2.4.2b, 2.4.2c, 2.4.3)	Short	None	30	30	EI 30	From the underside

Notes:

1. An *external wall* includes any *external wall* used to protect routes of escape (see clause 2.0.6) but excludes an unprotected area calculated in accordance with clauses 2.6.1 to 2.6.4.
2. Any door in an *external wall*, which is not included in the calculation of unprotected area, should have the same fire resistance and the same test exposure as the *external wall*.

3. In a timber stud wall or partition the following will also be deemed to have a short fire resistance duration:
 - a. polythene sleeved mineral wool, or mineral wool slab, in either case under compression when installed; or
 - b. calcium silicate, cement based or gypsum based board at least 12 mm thick; or
 - c. steel at least 0.5 mm thick; or
 - d. timber at least 38 mm thick.
4. If the *construction* is non load-bearing, none in the case of column 3, and no load-bearing (R) in the case of column 6.
5. Medium fire resistance duration is sufficient for a *fire door* in the enclosing structure of a fire-fighting shaft.
6. Unless the *fire door* is in an *external wall* or a lift door or pressurisation techniques following the guidance in BS EN 12101: Part 6: 2005 are used, the *fire door* should also either:
 - a. in the case of column 4, have smoke seals fitted unless the leakage rate does not exceed 3 m³/m/hour, head and jambs only, when tested at 25 Pa according to BS476: Part 31: 1983 (Section 31.1) with AMD 8366/ November 1994; or
 - b. in the case of column 6, attain the additional classification of Sa when tested to BS EN1634-3: 2001.

Annex

2.B Reaction to fire

- 2.B.0 Introduction
- 2.B.1 Reaction to fire classification
- 2.B.2 British Standards and associated specifications
- 2.B.3 Harmonised European Standards

annex

2.B

2.B.0 Introduction

The performance criteria in terms of reaction to fire can be satisfied by either the fire test specified in British Standards terms or the European harmonised fire tests. The reaction to fire properties of *elements of structure, separating walls, separating floors, cavity barriers, linings, external walls, ceilings, external claddings and escape stairs* is provided throughout the handbook. Some materials are deemed intrinsically to be *non-combustible* and therefore do not need to be tested.

2.B.1 Reaction to fire classification

The level of risk is established from the guidance to standard 2.1 to 2.15. The guidance in the following table will be sufficient to attain the appropriate levels of performance (in terms of risk) identified throughout this handbook. The British Standard classifications do not automatically equate with the equivalent classifications in the European Standards column, therefore products cannot typically assume a European class, unless they have been tested accordingly. The designer is free to choose materials or products which satisfy either the British Standard Tests or the Harmonised European Tests.

Transitional period

British and European fire tests will co-exist in use until the British Standard classifications are withdrawn.

2.B.2 British Standards and associated specifications

Column 2 of the table sets out the performance criteria for 'reaction to fire'. The materials or components should be tested to the BS 476 series of test standards which are deemed to satisfy the level of risk set throughout this Technical Handbook.

2.B.3 Harmonised European Standards

In accordance with Commission Decision 2000/147/EC of 8/2/2000 implementing Council Directive 89/106/EEC as regards the classification of the reaction to fire of materials and components, column 3 of the table sets out the European performance criteria. Materials or components should be tested to the European Harmonised Tests listed in column 3 of the table which are deemed to satisfy the level of risk set throughout this guidance document. BS EN 13501-1: 2007 provides the reaction to fire classification procedure for all *construction* products within the scope of the *Construction Products Directive*.

Reaction to Fire

Column 1	Column 2	Column 3
Risk	British Standards	European Standards (1)
<i>Non-combustible</i>	<p>The material is certified <i>non-combustible</i> according to the test specified in BS 476: Part 4: 1970 (1984) throughout; or</p> <p>The material does not flame or cause any rise in temperature on either the centre (specimen) or furnace thermocouples according to the test specified in BS 476: Part 11: 1982 (1988).</p>	<p>The material has achieved a classification of A1 when tested in accordance with BS EN ISO: 1182: 2002 and BS EN ISO: 1716:2002; or</p> <p>The material has achieved a classification of A2-s3, d2 when tested in accordance with BS EN: 13823:2002 and BS EN ISO: 1182:2002 or BS EN ISO: 1716:2002; or</p> <p>Products made from only 1 or more of the materials considered as Class A1 without the need for testing, as defined in Commission Decision 96/603/EC 4th October 1996 establishing the list of products belonging to Class A1 “No contribution to fire” provided for in the Decision 94/611/EC implementing Article 20 of the Council Directive 89/106/EEC on the <i>construction</i> products. None of the materials contain more than 1.0% by weight or volume (whichever is the lower) of homogeneously distributed organic material.</p>
Low risk	The surface material (or where it is bonded throughout to a substrate, the surface material combined with the substrate) has a surface of Class 1 and, when tested in accordance with BS 476: Part 6: 1981 or BS 476: Part 6: 1989 has an index of performance (I) not more than 12 and a sub-index (i ¹) not more than 6.	The material has achieved a classification of B-s3, d2 or better when tested in accordance with BS EN: 13823:2002 and BS EN ISO: 11925-2:2002.
Medium risk	The material of the wall or ceiling when tested to BS 476: Part 7: 1987 (1993), attains a Class 1 surface spread of flame.	The material has achieved a classification of C-s3, d2 or better when tested in accordance with BS EN: 13823:2002 and BS EN ISO: 11925-2:2002.
High risk	The material of the wall or ceiling when tested to BS 476: Part 7: 1987 (1993), attains a Class 2 or Class 3 surface spread of flame.	The material has achieved a classification of D-s3, d2 or better when tested in accordance with BS EN: 13823:2002 and BS EN ISO: 11925-2:2002.
Very high risk	A material which does not attain the recommended performance for high risk.	

Notes:

1. When a classification includes “s3, d2” this means that there is no limit set for smoke production and/or flaming droplets/particles.

Annex

2.C Vulnerability of roof coverings

- 2.C.0 Introduction
- 2.C.1 Vulnerability of roof coverings
- 2.C.2 British Standards and associated specifications
- 2.C.3 Harmonised European Standards

annex

2.C

2.C.0 Introduction

This annex provides guidance on the vulnerability of roof coverings and is concerned with the performance of roofs when exposed to fire from neighbouring *buildings*.

Commission Decision 2005/823/EC amending Decision 2001/671/EC establishing a classification system for the external fire performance of roofs and roof coverings allows the classification of performance by either:

- a. BS 476: Part 3: 2004 (National Test), External fire exposure roof tests; or
- b. BS EN 13501-5: 2005 (European Test), Fire classification of construction products and building elements, Part 5-Classification using test data from external fire exposure to roof tests.

2.C.1 Vulnerability of roof coverings

The level of vulnerability is established from the guidance to standard 2.1 to 2.15. Reference throughout this document to a low, medium or high vulnerability, will be satisfied by following the guidance in the tables. The British Standard classification does not automatically equate with the equivalent classifications in the European standards column therefore, products cannot typically assume a European class, unless they have been tested accordingly. The designer is free to choose materials or products, which satisfy either the British Standard Tests or the Harmonised European Tests.

Transitional period

British and European fire tests will co-exist in use until the British Standard classifications are withdrawn.

2.C.2 British Standards and associated specifications

The national test for roof coverings is BS 476: Part 3: 2004 which measures the capability of a roof to resist penetration from fire and flame spread when the external surface is exposed to radiation and flames.

BS 476: Part 3: 2004 sets out a classification system based on external penetration and flame spread as set out in the following table. The first letter of the designation indicates fire penetration performance i.e. the time at which any glowing or flaming [other than that from the gas pilot flame] appears on the underside of the specimen. The second letter of the designation indicates flame spread performance. The addition of the suffix 'X' indicates dripping from the underside of the specimen, any mechanical failure or development of holes in the specimen. The angle of the specimen in the test is designated by the prefix 'S' [slope] or 'F' [flat].

Penetration		Flame spread	
A	Those specimens which have not been penetrated within 60 minutes	A	Those specimens on which there is no spread of flame
B	Those specimens which are penetrated in not less than 30 minutes	B	Those specimens on which there is not more than 525 mm spread of flame
C	Those specimens which are penetrated in less than 30 minutes	C	Those specimens on which there is more than 525 mm spread of flame
D	Those specimens which are penetrated in the preliminary test	D	Those specimens which continue to burn for more than 5 minutes after the withdrawal of the test flame or spread of flame more than 375 mm across the region of burning in the preliminary test

2.C.3 Harmonised European Standards

The European test method has been published as DD ENV 1187: 2002, 'Test methods for external fire exposure to roofs', which specifies four methods for determining the performance of roofs to external fire exposure:

- Test 1 : with burning brands;
- Test 2 : with burning brands and wind;
- Test 3 : with burning brands, wind and supplementary radiant heat;
- Test 4 : two stage test method incorporating burning brands, wind and supplementary radiant heat.

Only test method 4 evaluates penetrability in a satisfactory way to satisfy the fire performance requirements in the United Kingdom. For this reason, (t4) has been added to the European test designations to add clarity.

The performance criteria in terms of vulnerability to external fire exposure can be satisfied where the roof covering follows the guidance in the following table. The classification methodology is contained in BS EN 13501-5: 2005.

Classification for roofs / roof coverings exposed to external fire	
Roof (t4)	<ul style="list-style-type: none"> a. No penetration of roof system within 60 minutes b. In preliminary test, after withdrawal of the test flame, specimens burn for less than 5 minutes c. In preliminary test, flame spread less than 0.38 m across region of burning
Croof (t4)	<ul style="list-style-type: none"> a. No penetration of roof system within 30 minutes b. In preliminary test, after withdrawal of the test flame, specimens burn for less than 5 minutes c. In preliminary test, flame spread less than 0.38 m across region of burning
Droof (t4)	<ul style="list-style-type: none"> a. Roof system is penetrated within 30 minutes but is not penetrated in the preliminary test b. In preliminary test, after withdrawal of the test flame, specimens burn for less than 5 minutes c. In preliminary test, flame spread less than 0.38 m across region of burning
Eroof (t4)	<ul style="list-style-type: none"> a. Roof system is penetrated within 30 minutes but is not penetrated in the preliminary test b. Flame spread is not controlled
Froof (t4)	<ul style="list-style-type: none"> c. No performance determined

Vulnerability of roof coverings

Column 1	Column 2	Column 3
Vulnerability	British Standards	European Standards
Low	<p>a) designation AA, AB or AC when tested along with the substrate in accordance with BS 476: Part 3: 2004; or</p> <p>b) glass at least 4 mm thick; or</p> <p>c) a roof covering or rooflight of plastics materials which is in an open canopy or over a substantially open area such as a loading bay which is a single-skin polycarbonate sheet not more than 3 mm thick or multi-skin polycarbonate sheet, or a thermoplastic material (see clause 2.5.4): a specimen of which when tested in accordance with Method 508A in BS 2782: 1970 (1974), performs so that the test flame does not reach the second mark within 2 minutes, the specimen thickness to be more than 1.5 mm and not more than 3 mm; or</p> <p>d) a thermoplastic sheet with a low or medium risk (see table to annex 2.C) or a rigid solid PVC (uPVC), or a polycarbonate rigid solid sheet at least 3 mm thick, or a multiskin polycarbonate sheet at least 10 mm thick overall.</p>	<p>The material has achieved a classification of Broof(t4) in accordance with BS EN 13501-5: 2005 when tested to DD ENV 1187: 2002 + A1: 2005, test4.</p>
Medium	<p>a) designation BA, BB, BC, CA, CB or CC when tested along with the substrate in accordance with BS 476: Part 3: 2004; or</p> <p>b) a roof covering or rooflight of plastics materials which is a single-skin polycarbonate sheet not more than 3 mm thick or multi-skin polycarbonate sheet, or thermoplastic material, a specimen of which when tested in accordance with Method 508A in BS 2782: 1970 (1974), performs so that the test flame does not reach the second mark within 2 minutes, the specimen thickness to more than 1.5 mm and not more than 3 mm.</p>	<p>The material has achieved a classification of Croof(t4) and Droof(t4) in accordance with BS EN 13501-5: 2005 when tested to DD ENV 1187: 2002 + A1: 2005, test4.</p>
High	<p>Any designation other than low or medium vulnerability, including for example, timber shingles or thatch.</p>	<p>The material has achieved a classification of Eroof(t4) and Froof(t4) in accordance with BS EN 13501-5: 2005 when tested to DD ENV 1187: 2002 + A1: 2005, test4.</p>

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3.0 Introduction

- 3.0.1 Background
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Introduction

3.0

3.0.1 Background

Water, air and soil are intricately linked and all can be affected by various forms of pollution that affect our environment. Other issues such as condensation have been a constant threat to people and *buildings* for many years.

Industrial change and demographic shift during the 19th and 20th centuries resulted in large-scale re-organisation of our villages, towns and cities. Industries moved out or disappeared altogether leaving large, 'brownfield', gaps in our landscape. At the same time, changes in heating methods and the advent of the consumer society, have had a significant effect on the type and volume of refuse it has been necessary to dispose of to landfill. Inevitably, these changes have left behind a legacy of land contamination that in some cases, may be harmful. The Scottish Government encourages the use of previously developed land (brownfield) and local authorities may wish to promote brownfield land in preference to greenfield land. Some of this land will be contaminated and will need to be made safe.

Climate is controlled by the long-term balance of energy of the Earth and its atmosphere. Natural events cause changes in climate but human activities can also change the climate. The accumulation of greenhouse gases in the atmosphere due to human activities will change the climate by enhancing the natural greenhouse effect, leading to an increase in the Earth's average surface temperature resulting in heavier rainfall.

Indoor air quality complaints are frequently precipitated by comfort issues: high or low temperatures, draughts, high or low humidity or poor lighting. However the incidence of real indoor pollution should not be ignored, it is surprisingly common. The *construction* quality of *dwellings* is improving with a resulting reduction of adventitious air infiltration producing fewer air changes. Inadequate ventilation, inefficient filtration and poor hygiene all contribute to poor indoor air quality.

Carbon monoxide (CO) gas has no smell, taste or colour and it kills dozens of people in their homes every year. Many more suffer debilitating illnesses often without anybody realising that they are being poisoned. CO gas is produced by combustion appliances such as fires, boilers and water heaters. Any appliance that burns solid fuel, gas or oil and that does not have a *room-sealed* balanced *flue* so that it is sealed off from the *room*, is capable of poisoning you if it is not properly installed, maintained and serviced. The highest incidence of CO poisoning occurs in *domestic buildings*.

Oil accounts for about a third of all reported pollution incidents in Scotland that are investigated by the Scottish Environment Protection Agency (SEPA). That means around 500 to 600 pollution incidents a year with about 10 to 12% being serious. It is an offence to cause pollution and courts now impose heavy fines. Although domestic pollution is low compared with commercial and industrial *buildings*, it is important to ensure standards are not lowered.

Disposal of *wastewater* and *surface water* needs to be carefully considered to prevent environmental pollution and uncontrollable runoff during periods of heavy rainfall leading to flooding. The incorporation of water conservation measures in *buildings* can reduce pressure on precious water resources by recycling water from certain types of appliance. Recycling can also reduce the reliance on mains water and limit the amount of water discharged thus alleviating the risk of flooding. The inclusion of 'green roofs' into *building*

design can also provide benefits to the environment and *building* owners alike. Although viewed as mainly a vernacular *building* practice renewed interest is being shown in this technique due to the diverse benefits that can be achieved, such as:

- run-off attenuation helping to reduce sewer surcharging;
- absorption of greenhouse gases;
- absorption of air pollution;
- protecting the roof finish from mechanical damage and ultra-violet radiation; and
- providing additional insulation.

Solid waste has increased enormously in the last couple of decades and disposal to landfill sites is creating severe problems. Recycling is now a priority.

3.0.2 Aims

The intention of this section is to ensure that, as far as is *reasonably practicable*, *buildings* do not pose a threat to the environment and *dwellings* and people in and around *dwellings* are not placed at risk as a result of:

- a. *site* conditions;
- b. hazardous and dangerous substances;
- c. the effects of moisture in various forms;
- d. an inadequate supply of air for human occupation of a *dwelling*;
- e. inadequate drainage from a *building* and from paved surfaces around a *dwelling*;
- f. inadequate and unsuitable *sanitary facilities*;
- g. inadequate accommodation and facilities in a *dwelling*;
- h. inadequately *constructed* and installed combustion appliances;
- i. inadequately *constructed* and installed oil storage tanks;
- j. inadequate facilities for the storage and removal of solid waste from a *dwelling*.

3.0.3 Latest changes

The following is a summary of changes made to this section since 1 May 2009.

Standard 3.1	Additional guidance introduced on contaminants and their risk to construction materials and services.
Standard 3.3	Improved guidance for flooding and groundwater.
Standard 3.14	Change to standard emphasising ventilation and improved guidance highlighting the issue of ventilation in relation to energy consumption, natural ventilation and air-tightness of <i> buildings</i> .
Standard 3.15	Removal of limitation allowing application of this standard to non-domestic <i> buildings</i> . Provision of supporting guidance to this standard.
Standard 3.17	Guidance to inform on the issues of biomass as a solid fuel.
Standard 3.21	Guidance on flueless gas appliance installations and ventilation.

Minor alterations and corrections have also been made. A full list of changes to this edition of the Technical Handbooks is available on the Building Standards website.

3.0.4 Relevant legislation

Listed below are some pieces of legislation that may be relevant and/or helpful to those using the guidance in this particular section.

Gas Safety (Installation and Use) Regulations 1998	The Gas Safety (Installations and Use) Regulations 1998 require that any person who installs, services, maintains, removes, or repairs gas fittings must be competent. It covers not only materials, workmanship, safety precautions and testing of gas fittings but also the safe installation of all aspects of gas fired appliance installations.
Gas Appliance (Safety) Regulations 1995	The Gas Appliance (Safety) Regulations 1995 cover all aspects of gas appliances and fittings and sets safe standards to satisfy the essential requirements set by the EU. It sets procedures and duties for demonstrating attestation of conformity.
The Control of Pollution Act 1974	The Control of Pollution Act 1974 covers, among others, duties and powers of SEPA to control and dispose of solid waste.
The Environment Act 1995	The Environment Act 1995 covers, among others, duties and powers of the Scottish Environment Protection Agency.
The Environmental Protection Act 1990	The Environmental Protection Act 1990 covers, among others, management and enforcement of the collection, disposal and treatment of waste, control of hazardous substances, oil pollution and nature conservation. Part IIA covers contaminated land.
The Groundwater Regulations 1998	The Groundwater Regulations 1998 were introduced to prevent ground water pollution and to manage groundwater resources in a sustainable way.
The Water Environment and Water Services (Scotland) Act 2003	The Water Environment and Water Services (Scotland) Act 2003 sets up an integrated regime for water quality and quantity management.
The Water Byelaws 2004	The Water Byelaws apply to any water fitting installed or used in <i>buildings</i> where water is supplied by Scottish Water other than where specifically exempted.
The Sewerage (Scotland) Act 1968	The Sewerage (Scotland) Act 1968 covers, among others, duties and powers of the local authority to provide, construct and maintain public sewers and rights of connection and discharge.
CAR Regulations 2005	The Water Environment (Controlled Activities)(Scotland) Regulations 2005 gives Ministers the power to introduce controls over a range of activities that have an adverse impact upon the water environment.
Oil Storage Regulations 2006	The Water Environment (Oil Storage)(Scotland) Regulations 2006 were introduced to help reduce the incidence of oil pollution particularly from inadequate storage.

3.0.5 Certification

Scottish Ministers can, under Section 7 of the Building (Scotland) Act 2003, approve schemes for the certification of design or *construction* for compliance with the mandatory functional standards. Such schemes are approved on the basis that the procedures adopted by the scheme will take account of the need to co-ordinate the *work* of various designers and specialist contractors. Individuals approved to provide certification services under the scheme are assessed to ensure that they have the qualifications, skills and experience required to certify compliance for the *work* covered by the scope of the scheme. Checking procedures adopted by Approved Certifiers will deliver design or installation reliability in accordance with legislation.

3.1 Site preparation – harmful and dangerous substances

- 3.1 Functional standard
- 3.1.0 Introduction
- 3.1.1 Preparation of a site
- 3.1.2 Harmful or dangerous substances
- 3.1.3 Hazard identification and assessment
- 3.1.4 Development on land that may be contaminated
- 3.1.5 Land not initially identified as being contaminated
- 3.1.6 Risk management techniques
- 3.1.7 Housing on land affected by contamination
- 3.1.8 Re-development of industrial land
- 3.1.9 Risks to construction materials and services

standard

3.1

mandatory

Every *building* must be designed and *constructed* in such a way that there will not be a threat to the *building* or the health of people in or around the *building* due to the presence of harmful or dangerous substances.

Limitation:

This standard does not apply to the removal of unsuitable material, including turf, vegetable matter, wood, roots and topsoil on the *site* of a *building* (other than a *dwelling*) intended to have a life not exceeding the period specified in regulation 6.

Environmental Protection Act 1990

3.1.0 Introduction

Land contamination is an unwanted legacy of Britain’s long industrial history. Part IIA of the Environmental Protection Act 1990 (inserted by section 57 of the Environment Act 1995) was introduced to enable the identification and remediation of contaminated land from which contamination currently represents an unacceptable risk. Risks associated with the land’s future use will continue to be dealt with under the planning and building standards system. Some functions of Part IIA, planning and building standards regimes may, at times, overlap.

Public registers

Part IIA adopts a ‘suitable for use approach’ that requires the current risks to be assessed and remediated as required, for a *site*’s existing use. The primary regulatory role for this rests with the local authorities. Local authorities and SEPA must establish public registers to record all prescribed regulatory action taken under Part IIA. The register will contain particulars relating to the remediation, as well as notifications of the identification, of contaminated land. The registers will expand as new information is identified.

Section 78A(2) of the Act (as amended) provides a specific definition of ‘contaminated land’ for the purpose of the Act. Land that is not ‘contaminated land’ as defined under the Act may still contain harmful or dangerous substances and the following guidance should be useful to the local authority in carrying out its other functions.

PAN 33

Land confirmed, or suspected of being contaminated is a material consideration when local authorities determine planning applications. The key role of the planning system is to ensure that all the ground included within the planning application is suitable for the proposed future use. Conditions may be added to any permission given to ensure the required remediation takes place. Planning Advice Note (PAN) 33 ‘Development of Contaminated Land’ explains further the role of planning and includes useful cross-references to other relevant publications and regimes.

Harmful or dangerous substances

Harmful or dangerous substances include deposits of faecal or animal matter and any substance, or mixture of substances, which is, or could become, corrosive, explosive, flammable, radioactive or toxic or which produces, or could produce, any gas likely to have any such characteristic.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably practicable*, and in no case be worse than before the *conversion* (regulation 12, schedule 6).

3.1.1 Preparation of a site

'ground immediately adjoining'

Surface soil and vegetable matter can be detrimental to a *building's* structure if left undisturbed within the *building* footprint. Therefore, before any *work* can commence, unsuitable material including turf, vegetable matter, wood, roots and topsoil should be removed from the ground to be covered by the *building*, and the ground immediately adjoining the *building*, to a depth of at least that which will prevent later growth that could damage the *building*. The term 'ground immediately adjoining' is intended to cover ground that is disturbed as a direct result of the *works*.

The solum (prepared area within the containing walls of a *building*) should be treated to prevent vegetable growth and reduce the evaporation of moisture from the ground to the inner surface of any part of a *dwelling* that it could damage.

The solum should be brought to an even surface and any up filling should be of hard, inert material. See guidance to standard 3.4 relating to *building* elements adjacent to the ground.

To prevent water collecting under the *building*, the solum should be not lower than the highest level of the adjoining ground. However where this may not be possible, such as on sloping ground, the solum should be laid to fall to an outlet in the under *building* above the lowest level of the adjoining ground to prevent any water build up below the *building*. Any part of the under *building* that is in contact with the ground, such as on sloping ground, should be tanked see clause 3.4.7.

Made ground

Where the *site* contains fill or made ground, consideration should be given to its compressibility and its collapse potential. Thought should be given to *foundation* design to prevent the damaging effect of differential settlement.

3.1.2 Harmful or dangerous substances

For the purposes of this Technical Handbook, clause 3.1.0 provides guidance on what harmful or dangerous substances may consist of. Because of their hazardous qualities, any ground below and immediately adjoining (see clause 3.1.1) a *building* should have them removed or made safe. Guidance on remedial action to deal with such substances is given in clause 3.1.5.

3.1.3 Hazard identification and assessment

A preliminary desk-top study should be carried out to provide information on the past and present uses of the proposed *building site* and surrounding area that may give rise to contamination. Examples of land likely to contain contaminants can include, but are not limited to:

- asbestos works;
- chemical works;
- gas works, coal carbonisation plants and ancillary by-products works;
- industries making or using wood preservatives;
- landfill and other waste disposal sites;
- metal mines, smelters, foundries, steel works and metal finishing works;
- munitions production and testing sites;
- nuclear installations;
- oil storage and distribution sites;
- paper and printing works;
- railway land, especially the larger sidings and depots;
- scrap yards;

- sewage works, sewage farms and sludge disposal sites;
- tanneries; and
- petrol filling stations.

During a walk-over of the area there may be signs of possible contaminants. The preliminary investigation can assist in the design of the exploratory and detailed ground investigation. A detailed ground investigation may be necessary and should provide sufficient information for the risk assessment and the design and specification of any remedial *work*.

Risk assessment should be specific to each *building site* and take into account the presence of source, pathways and receptors at a particular *building site*. Generic assessment criteria may provide an indication of where further consideration of risk to receptors is required. The selection of assessment criteria should take into account the specific circumstances of the *building site* and the receptors that may be exposed. Assessment criteria should be authoritative and scientifically based. Should a risk be indicated then further consideration would be warranted. This may involve collection and assessment of further information. Useful tools for undertaking detailed assessment of risk are available e.g. CONSIM and CLEA. Reference should be made to SEPA and DEFRA web sites which contain details of published and forthcoming guidance.

www.sepa.org.uk

www.defra.gov.uk/

www.environment-

agency.gov.uk

The Environment Agency manages an extensive research programme related to land contamination. This programme is ongoing and a check should be made to ensure that the most up-to-date guidance is used. The following are just some of the publications that may be of interest:

- assessment of risks to human health from land contamination, an overview of the development of soil guideline values: CLR 7;
- priority contaminants report: CLR 8;
- contaminants in soils, collation of toxicological data and intake values for humans: CLR 9;
- contaminated land exposure assessment (CLEA) model, technical basis and algorithms: CLR 10;
- land contamination risk assessment tools: an evaluation of some of the commonly used methods: Technical Report P260;
- secondary model procedure for the development of appropriate soil sampling strategies for land contamination - R&D Technical Report P5;
- technical aspects of site investigation - R&D Technical report P5.

3.1.4 Development on land that may be contaminated

Where the desk study, records or local knowledge of previous use identifies land that may contain, or give rise to, harmful or dangerous substances, planning permission will normally be subject to conditions. These conditions may be imposed to ensure that the development proposed for the land will not expose future users or *occupiers*, or any *building* or services, to hazards associated with the contaminants.

3.1.5 Land not initially identified as being contaminated

There may be occasions when land containing harmful or dangerous substances has not been identified at the planning stage, and the presence of contaminants is only suspected later. Some signs of the possible presence of contaminants are given in the table below together with the possible contaminant and the probable remedial action recommended.

Possible contaminants and actions

Signs of possible contamination	Possible contaminant	Probable remedial action recommended
Vegetation (absence, poor or unnatural growth)	metals, metal compounds	none
	organic compounds, gases	removal or treatment
Surface materials (unusual colours and contours may indicate)	metals, metal compounds	none
	oil and tarry wastes	removal, filling, sealing or treatment
	asbestos (loose)	removal, filling, sealing or treatment
	other fibres	none
	organic compounds including phenols	removal, filling or treatment
	potentially combustible material including coal and coke dust	removal, inert filling or treatment
	refuse and waste	removal or treatment
Fumes and odours (may indicate organic chemicals at very low concentrations)	flammable, explosive, toxic and asphyxiating gases including methane and carbon dioxide	removal or treatment the <i>construction</i> is to be free from unventilated voids
	corrosive liquids	removal, filling, sealing or treatment
	faecal, animal and vegetable matter (biologically active)	removal, filling or treatment
Drums and containers (whether full or empty)	various	removal with all contaminated ground

The verifier may require the removal or treatment of any of the contaminants in the table to clause 3.1.5, to be carried out by specialists.

If any signs of possible contaminants are present, the verifier should be told at once. If the presence of any of the contaminants listed in the table to clause 3.1.5 is confirmed, it is likely that some form of remedial action will be required. For guidance, the normal course of remedial action is listed against each contaminant. In all cases these courses of action assume that the ground to be covered by the *building* will have at least 100 mm of in-situ concrete cover. Expert advice may be required to provide an economical and safe solution to the hazards encountered especially where contaminants are present in large amounts or where there is imminent danger to health or safety.

3.1.6 Risk management techniques

The Construction Industry Research and Information Association (CIRIA) produces many useful guidance documents on the application of different risk management techniques.

There are a range of options for managing the risk of land that is contaminated. This can include removal or treatment of the contaminant source or breaking the pathway by which contaminants can present a risk to receptors:

Removal means that the contaminant itself and any contaminated ground to be covered by the *building* should be taken out to a depth of 1 m (or less if the verifier agrees) below the level of the lowest floor. The contaminant should then be taken away to a place to be named by the local authority;

Filling means that the ground to be covered by the *building* should be determined on a *site* specific basis but is normally to a depth of 1 m (or less if the verifier agrees) with a material which will not react adversely with any contaminant remaining and may be used for making up levels. The type of filling and the design of the ground floor should be considered together;

Inert filling means that the filling is wholly non-combustible and not easily changed by chemical reactions;

Sealing means that an impermeable barrier is laid between the contaminant and the *building* and sealed at the joints, around the edges and at the service entries. Note that polyethylene may not be suitable if the contaminant is a liquid such as a tarry waste or organic solvent;

Ground treatment may provide a more cost effective and environmentally sustainable solution. Treatment may be the only option where the presence of structures or services prevents excavation. Treatment processes can be biological, chemical or physical and be undertaken either in-situ (contaminants are treated in the ground) or ex-situ (contaminated material is excavated and then treated before being returned). The processes convert the contaminant into a neutral form or render it harmless. There are also solidification and stabilisation processes that can 'fix' contaminants in the soil so as to reduce the harm, and thermal processes that alter the contaminant by incineration or by volatilisation. The exact process to use will depend on the contaminant present and the soil type. Expert advice should be sought.

www.ciria.org
www.environment-agency.gov.uk

The CIRIA and the EA websites also contain useful data sheets on remedial treatment options.

www.nhbc.co.uk

3.1.7 Housing on land affected by contamination

The National House Building Council (NHBC), together with the Environment Agency, has produced a guidance document 'Guidance for the Safe Development of Housing on Land Affected by Contamination'. The document aims to promote the adoption of good practice in the identification, investigation, assessment and remedial treatment of land affected by contamination, so that the development of *housing* on such land can be undertaken safely and with confidence that no unacceptable risks remain.

3.1.8 Re-development of industrial land

With the increasing re-development of former industrial land, attention is also drawn to BS 10175: 2001; 'Investigation of potentially contaminated sites, Code of Practice'. The British Standard provides guidance on, and recommendations for, the investigation of land that may be contaminated or land with naturally enhanced concentrations of potentially harmful materials, to determine or manage the ensuing risk. BS 5930: 1999, 'Code of Practice for Site Investigations' is also relevant. This CoP deals with the investigation of ground for the purpose of assessing their suitability for the *construction* of

the *work*. It provides recommendations on certain constraints or problems that can affect a *site*, such as geotechnical aspects and the legal aspects including the need for licences or permits.

3.1.9 Risks to *construction* materials and services

Buildings, and the materials they are *constructed* from, are classed as receptors and therefore may be subject to damage if they come into contact with contaminated land. A principal concern is that any attack or damage from ground contaminants may affect the structural integrity or serviceability of the *building* and present a health and safety threat.

Both natural and human generated ground conditions can be aggressive to structures and services, in view of this the *construction* design should take account of any ground contaminants that could affect or damage *buildings*, materials and services. In practice it may be more difficult to assess and manage contamination risks when dealing with new *work* to existing *buildings*.

Site analysis and hazard identification are necessary to allow assessment of any contamination risks posed to the *construction*. The susceptibility of *construction* to aggressive contaminant attack generally depends on four conditions:

- presence of water;
- contaminant concentrations;
- contact between materials and contaminants;
- material sensitivity.

The BRE publication BR 255:1994 'Performance of Building Materials in Contaminated Land' provides detailed guidance on the vulnerability of *building* materials to the hazards arising from contamination.

The following table identifies some common aggressive substances, their possible effects on *building* materials and possible mitigation options.

SUBSTANCE AFFECTING MATERIALS

Material	Substance	Possible effect	Mitigation Options
concrete, mortar, masonry	sulphates (acid & water soluble in soil) pyrites heavy metals	expansion, disintegration deterioration	<ul style="list-style-type: none"> • specify resistant materials • provide protective coatings, isolation or sacrificial layers excavate and remove affected material • excavate and remove affected material • contain contamination • design and construct <i>site</i> drainage to reduce or eliminate contact between contaminants and <i>building</i> structure or services
	chloride (acid & water soluble in soil)	reduced strength increased permeability reinforcement corrosion	
	inorganic and organic acids (depending on type and concentration)	expansion degradation and corrosion of reinforcement	
	magnesium salts	disintegration	
	ammonium salts	increased porosity	
structural steel, metal pipes and services	sulphate, sulphur and sulphide	corrosion	<ul style="list-style-type: none"> • design and construct <i>site</i> drainage to reduce or eliminate contact between contaminants and <i>building</i> structure or services
	inorganic and organic acids	corrosion	
plastics, rubbers	alkalis, ammonia, chlorine, hydrocarbons, oils	swelling deterioration	
polythenes	benzene, toluene, phenol	permeation	

Notes:

1. The potential for chemical attack often depends on the presence of water as a substance carrier.
2. Concrete, being an alkaline material is potentially vulnerable to attack from acids.

3.2 Site preparation – protection from radon gas

- 3.2 Functional standard
- 3.2.0 Introduction
- 3.2.1 Radon affected areas
- 3.2.2 Protection from radon gas

standard

3.2

mandatory

Every *building* must be designed and *constructed* in such a way that there will not be a threat to the health of people in or around the *building* due to the emission and containment of radon gas.

3.2.0 Introduction

Radon is a naturally occurring, radioactive, colourless and odourless gas that is formed where uranium and radium are present. It can move through cracks and fissures in the subsoil, and so into *buildings*. The amount, or activity, of radon is measured in becquerels (Bq). Where this gas occurs under a *dwelling*, the *external walls* contain it and the containment of radon can build up inside the *dwelling* over the long term posing a risk to health.

Breathing in radon gas for long periods increases the risk of developing lung cancer and since people spend a high proportion of their time at home, concentration levels in *dwellings* are very important. Although the risk is relatively insignificant for people visiting or living for short periods in a *dwelling* with high levels of radon, long-term exposure can increase the risk to the point where preventative action is necessary. To reduce the risk, all new *dwellings*, extensions and alterations, built in areas where there might be radon concentration, may need to incorporate protective measures.

Health Protection Agency

The Health Protection Agency (HPA) recommends that radon levels in homes should be reduced if the average is more than 200 becquerels per cubic metre (Bq/m³). Further information relating to radon levels, testing, sources and effects can be accessed on the HPA website at www.hpa.org.uk/radiation.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably practicable*, and in no case be worse than before the *conversion* (regulation 12, schedule 6).

3.2.1 Radon affected areas

Action level	“Radon affected areas” have been designated by testing <i> dwellings</i> . Where tests on existing <i> dwellings</i> show that 1% of the <i> dwellings</i> in that area are likely to have a radon concentration above 200 Bq/m ³ (the action level) the area is designated as a ‘radon affected area’.
Radon maps	The Scottish Government commissioned the HPA to review and update the National Radiological Protection Board (NRPB) 1993 advice and mapping on ‘radon affected areas’ in Scotland. The HPA have now produced ‘Radon in <i> Dwellings</i> in Scotland: 2008 Review and Atlas’ which contains revised radon probability maps. The full report is available from the HPA website. The new maps provide a more accurate picture of the areas of the country where radon levels are likely to be higher and also indicate a greater number of local authority geographical regions that are now shown to have ‘radon affected areas’.
non-identified areas	The HPA 2008 maps provide a good indication of the radon potential for an area. However protection measures should also be provided to any further areas where they are identified. Further advice may be obtained from the verifier, HPA or the Building Research Establishment (BRE).
radon risk report	A radon risk report giving an estimate of the probability of an individual address exceeding the action level can be obtained from www.UKradon.org .

3.2.2 Protection from radon gas

If a *dwelling* is located on ground designated as a ‘radon affected area’ protective *work* should be undertaken to prevent excessive radon gas from entering the *dwelling*.

Radon protective measures should be provided in accordance with the guidance contained in BRE publication BR 376 – ‘Radon: guidance on protective measures for new *dwellings* in Scotland’. Note that the maps shown in the BRE document are now superseded. Instead, the HPA updated radon probability maps identified in clause 3.2.1 should now be used.

3.3 Flooding and groundwater

- 3.3 Functional standard
- 3.3.0 Introduction
- 3.3.1 Groundwater
- 3.3.2 Flood risk assessment
- 3.3.3 Resilient construction in flood risk areas

standard

3.3

mandatory

Every *building* must be designed and *constructed* in such a way that there will not be a threat to the *building* or the health of the occupants as a result of flooding and the accumulation of groundwater.

3.3.0 Introduction

Flooding can be diverse, often *site* specific and brought about by a range of factors including heavy rain, raised groundwater levels, increased rain water run-off and blocked or surcharged drainage systems. It is also generally recognised that climate change may play a major role in increasing the risk of flooding in the future, for example, local pluvial (rainfall) flooding from more frequent short intense rain storms.

The effects of flooding on a *building* can include significant damage to materials, services and structure. Contamination could result where waste water drainage is present in the floodwater. Where there is a risk that flooding can affect a *building* it is important that any *construction* is designed to be more resistant or resilient.

SPP 7

Pressure for land development may mean that development may be given planning approval on land subject to some risk of flooding. Where development is to take place on land assessed by the planning authority as having a flood risk, advice should be sought from sources such as the local planning authority, the Scottish Environment Protection Agency (SEPA) and those responsible for coastal defences. Further guidance may be obtained from the 'Scottish Planning Policy 7: Planning and Flooding, 2003' (SPP 7).

www.sepa.org.uk

The Scottish Environment Protection Agency (SEPA) provides flood risk information on their indicative river and coastal interactive flood maps on their website.

When near surface level groundwater is present on a *building site* there is the potential for *construction* activity to affect it or for the groundwater to pose a hazard to any new *buildings*. To reduce the risk to *buildings* from groundwater, subsoil drainage of a *site* may be necessary to protect against penetration of groundwater through a *building* and damage to the *building* fabric. Any existing drains that will be affected by the *construction* of a *building* should also continue to function properly and guidance is provided under standard 3.5.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably practicable*, and in no case be worse than before the *conversion* (regulation 12, schedule 6).

3.3.1 Groundwater

New *building sites* should be initially assessed to establish the existing groundwater level and any fluctuation to the established level brought about by seasonal effect, new *construction*, excavations or other related activities.

Ground below and immediately adjoining a *dwelling* that is liable to accumulate groundwater, at a level that could affect the structure or penetrate the *building*, requires subsoil drainage or other dewatering treatment to be provided to mitigate against the harmful effects of such water.

The drainage of groundwater may also be necessary for the following reasons:

- to increase the stability of the ground;
- to avoid surface flooding;
- to alleviate subsoil water pressures likely to cause dampness to below-ground accommodation;
- to assist in preventing damage to *foundations* of *buildings*;
- to prevent frost heave of subsoil that could cause fractures to structures such as concrete slabs.

The selection of an appropriate drainage layout will depend on the nature of the subsoil and the topography of the ground. Field drains, where provided, should be laid in accordance with the recommendations in clause 10 of BS 8301: 1985.

Surface water run-off to adjacent *sites*

With the removal of topsoil from a development *site*, developers should be aware of the dangers from possible *surface water* run-off from their *building site* to other properties. It is good practice to have procedures in place to overcome this occurrence. Depending on conditions, the formation of channels or small dams to divert the run-off or, where conditions are particularly serious, the installation of field drains or rubble drains may overcome the problem.

3.3.2 Flood risk assessment

Any identified *site* specific risk of flooding to a *building* or its occupants should be assessed to allow sustainable design mitigation. *Building site* flood risk assessments should be an integral part of the design and *construction* process with the appraisal also considering the effects that the development may have on adjoining ground.

PAN 69
CIRIA guidance (C624)

'Planning and Building Standards Advice on Flooding' (PAN 69) sets out flood risk and probability assessment procedures including the need for drainage assessments to demonstrate a neutral or better effect on *sites* where flooding is an issue. For *site* specific flood risk assessments the CIRIA document 'Development and Flood Risk – guidance for the *construction* industry' (C624) 2004 provides detailed guidance on carrying out flood risk assessment and suggests design considerations for developers.

3.3.3 Resilient *construction* in flood risk areas

Flood Resilient
Construction

Where it is intended to develop in areas that may be at some identified risk of flooding, *buildings* should be designed and *constructed* to offer a level of flood resistance and resilience that can reduce the flood impact on structure and materials.

The May 2007 CIRIA document 'Improving the Flood Performance of New

Buildings – Flood Resilient Construction' is a national document that provides design guidance on suitable materials and *construction* details for use in low or residual flood risk developments.

Design Guidance
on Flood
Damage to
Dwellings 1996

'The Design Guidance on Flood Damage to Dwellings, 1996'. This document describes the likely effects of flooding on materials and elements of the *building* and assesses various forms of *construction* and measures to reduce the risk of flood damage in *dwellings*.

3.4 Moisture from the ground

- 3.4 Functional standard
- 3.4.0 Introduction
- 3.4.1 Treatment of building elements adjacent to the ground
- 3.4.2 Ground supported concrete floors
- 3.4.3 Suspended concrete floors
- 3.4.4 Suspended timber floors
- 3.4.5 Walls at or near ground level
- 3.4.6 Floors at or near ground level
- 3.4.7 Structures below ground, including basements

standard

3.4

mandatory

Every *building* must be designed and *constructed* in such a way that there will not be a threat to the *building* or the health of the occupants as a result of moisture penetration from the ground.

3.4.0 Introduction

Water is the prime cause of deterioration in *building* materials and *constructions* and the presence of moisture encourages growth of mould that is injurious to health. Ground water can penetrate *building* fabric from below, rising vertically by capillary action. The effects of this rising damp are immediately recognisable. There may be horizontal ‘tidemarks’ sometimes several feet above the floor; below it the wall is discoloured with general darkening and patchiness. There may also be loose wallpaper, signs of mould growth and deterioration of plaster. Hygroscopic salts brought up from the ground tend to concentrate in the ‘tidemark’.

Dwellings therefore, need to be *constructed* in such a way that rising damp neither damages the *building* fabric nor penetrates to the interior where it may constitute a health risk to occupants.

Climate change

Designers should be aware of the impact that climate change could have on the fabric of *buildings* through increased rainfall and temperatures. Higher wind speeds and driving rain should focus attention to improved design and quality of *construction* and to the protection of the *building* fabric from long term dampness.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably practicable*, and in no case be worse than before the *conversion* (regulation 12, schedule 6).

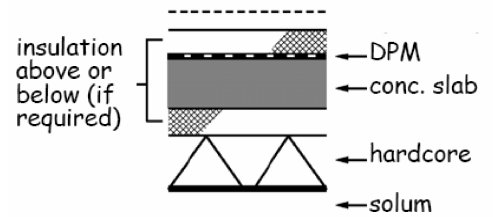
3.4.1 Treatment of building elements adjacent to the ground

A floor, wall or other *building* element adjacent the ground should prevent moisture from the ground reaching the inner surface of any part of a *dwelling* that it could damage.

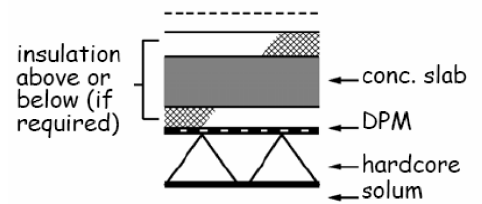
Floors, walls or other *building* elements adjoining the ground should be *constructed* in accordance with the following recommendations. The dimensions specified are the minimum recommended; greater dimensions may therefore be used.

3.4.2 Ground supported concrete floors

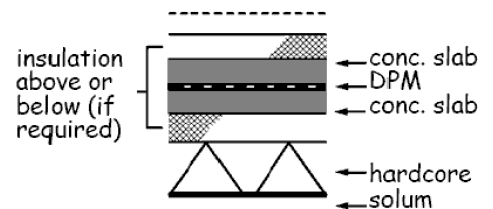
The solum is brought to a level surface. Hardcore bed 100 mm thick of clean broken brick or similar inert material free from fine material and water soluble sulphates in quantities which would damage the concrete; blinded with suitable fine material and *constructed* to form a level, crack-free surface.



Concrete slab 100 mm thick with insulation, if any, laid above or below the slab; with or without a screed or floor finish.

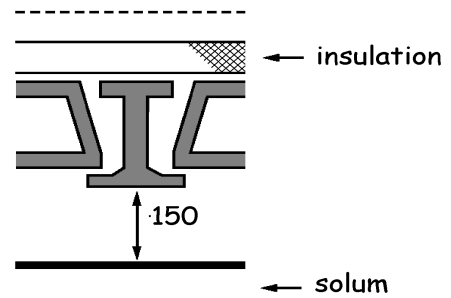


Damp-proof membrane above or below the slab or as a sandwich; jointed and sealed to the damp proof course or damp-proof structure in walls, columns and other adjacent elements in accordance with the relevant clauses in section 3 of CP 102: 1973.



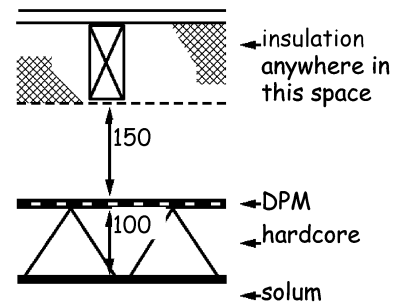
3.4.3 Suspended concrete floors

The solum is brought to an even surface; any up filling to be of hard, inert material. Suspended concrete floor of in-situ or precast concrete slabs or beams with concrete or clay infill units; with insulation, if any; with or without a screed or floor finish, or with boards. *Permanent ventilation* of the under floor space direct to the outside air by *ventilators* in 2 *external walls* on opposite sides of the *building* to provide an open area in each wall of 1500 mm² for at least every metre run of the wall, or 500 mm² for at least every square metre of floor area, this open area also being provided in internal sleeper walls or similar obstructions to maintain the under floor ventilation; the ventilated space to be 150 mm to the underside of the floor slab or beams.

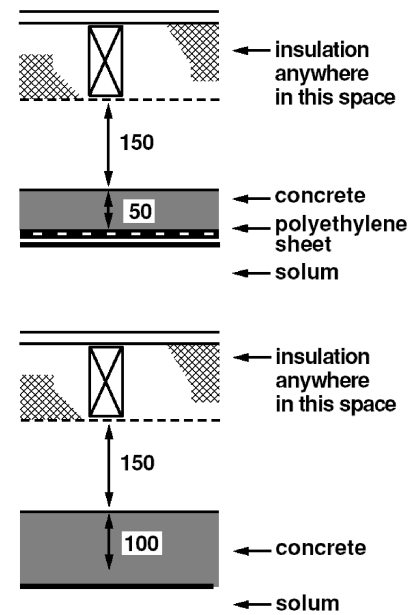


3.4.4 Suspended timber floors

The solum is brought to an even surface; any up filling to be of hard, inert material. Hardcore bed as for clause 3.4.2; with either a dpm in accordance with section 3 of CP 102: 1973; or concrete 50 mm thick laid on 0.25 mm (1000 gauge) polyethylene sheet; or concrete 100 mm thick; so that in any case the top surface is not below that of the adjacent ground.



Suspended timber floor with or without insulation as required. Floor joists carried on wall-plates supported as necessary by sleeper walls with a dpc under the wall-plates. *Permanent ventilation* of the under floor space direct to the outside air by *ventilators* in 2 *external walls* on opposite sides of the *building* to provide an open area in each wall of either 1500 mm² for at least every metre run of the wall, or 500 mm² for at least every square metre of floor area, this open area also being provided in internal sleeper walls or similar obstructions to maintain the under floor ventilation; the ventilated space to be 75 mm in height from the *site* covering to the underside of any wall-plates and 150 mm to the underside of the floor joists.



3.4.5 Walls at or near ground level

Walls at or near ground level should be *constructed* in accordance with the recommendations of BS 8102: 1990.

3.4.6 Floors at or near ground level

Floors at or near ground level should be *constructed* in accordance with the recommendations in Clause 11 of CP 102: 1973. However the ventilation of the sub-floor as described in Clause 11.8.4 of CP 102: 1973 is not recommended but should be provided as described in clause 3.4.4 for suspended timber floors.

3.4.7 Structures below ground, including basements

Structures below ground, including basements, should be *constructed* in accordance with the recommendation of BS 8102: 1990.

3.5 Existing drains

- 3.5 Functional standard
- 3.5.0 Introduction
- 3.5.1 Existing drains
- 3.5.2 Re-routing of drains
- 3.5.3 Re-construction of drains
- 3.5.4 Drains passing through structures
- 3.5.5 Sealing disused drains

standard
3.5
mandatory

Every *building* must not be *constructed* over an existing drain (including a field drain) that is to remain active.

Limitation:

This standard does not apply where it is not *reasonably practicable* to reroute an existing drain.

3.5.0 Introduction

The purpose of this standard is to ensure that existing drains continue to function properly without causing harm to the *building* or to the health of the occupants.

Public sewers

Generally, public sewers are not permitted beneath *buildings*. Where it is proposed to *construct* a *building* over the line of an existing sewer, the sewer should be re-routed around the *building*. Permission will be required from the Water Authority for any *work* that is to be carried out to a public sewer.

Permission of Scottish Water

In exceptional circumstances, if it not possible to re-route an existing drain or sewer away from the *dwelling*, for instance if a gap *building site* in a terrace is being developed, the Water Authority may permit a *building* to be *constructed* over an existing public sewer. Where it is necessary to *build* over a public sewer, approval of the Water Authority will be required.

Disused drains and sewers offer ideal harbourage to rats and frequently offer a route for them to move between the drains and the surface. They can also collapse causing subsidence.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

3.5.1 Existing drains

A survey should be carried out to establish the geography and topography of the *building site* and ascertain whether there are any existing field drains. Where a *building site* requires that an existing drain (including a field drain) must remain active and be re-routed or retained, particular methods of *construction* and protection should be carefully considered. The guidance contained in clauses 3.5.2, 3.5.3 and 3.5.4 should be taken into account and any new drain should be *constructed* in accordance with the guidance to standards 3.6 and/or 3.7.

3.5.2 Re-routing of drains

Where a *building* is erected over a private drain, including a field drain that is to remain active, the drain should be re-routed if *reasonably practicable* or *re-constructed* in a manner appropriate to the conditions of the *site*.

3.5.3 Re-construction of drains

The condition of any private drain or sewer that is to be *built* over should be determined. If in poor condition and/or relatively shallow, then consideration should be given to *re-construction* if re-routing is not *reasonably practicable*.

The strength of a pipeline should be determined, decided or specified before *construction work* is undertaken. Drains should be designed and *constructed* in accordance with the recommendations described in BS EN 752-3: 1997 and BS EN 1295-1: 1998. During *construction*, it should be ensured that the assumptions made in the design are safeguarded or adapted to changed conditions.

Protection of drains

Every drain or sewer should be protected from damage by *construction* traffic and heavy machinery. Providing barriers to keep such traffic away from the line of the drain or sewer may be appropriate. Heavy materials should not be stored over drains or sewers.

It is recommended that manholes are not located within a *dwelling*.

3.5.4 Drains passing through structures

Where a drain or sewer passes through a structure, including a manhole or inspection chamber, a detail should be devised to allow sufficient flexibility to avoid damage of the pipe due to movement. A rigid connection however maybe appropriate if the drain or sewer and the structure are an integral *construction* on a rigid *foundation*. Where drains or sewers pass under or close to structures, similar precautions should be considered. Drains or sewers should be *constructed* and laid in accordance with the recommendations of BS EN 1610: 1998.

3.5.5 Sealing disused drains

Disused sewers or drains provide ideal nesting sites for rats. In order to prevent this, they should be disconnected from the drainage system as near as possible to the point of connection. This should be done in a manner that does not damage any pipe that is still in use and ensures that the sewer system is watertight. This may be carried out, for example, by removing the pipe from a junction and placing a stopper in the branch of the junction fitting. Where the connection is to a public sewer, the Water Authority should be consulted.

Sewers and drains less than 1.5 m from the surface and in open ground should be, as far as *reasonably practicable*, removed. Other pipes should be capped at both ends and at any point of connection, to ensure rats cannot gain entry.

3.6 Surface water drainage

- 3.6 Functional standard
- 3.6.0 Introduction
- 3.6.1 Surface water drainage from dwellings
- 3.6.2 Surface water drainage of paved surfaces
- 3.6.3 Surface water discharge
- 3.6.4 Sustainable Urban Drainage Systems
- 3.6.5 Soakaways serving single dwellings and extensions
- 3.6.6 Surface water run-off from small paved areas
- 3.6.7 Rainwater harvesting
- 3.6.8 Traditional drainage systems
- 3.6.9 Discharges into a drainage system
- 3.6.10 Testing

<p>standard</p> <h1 style="margin: 0;">3.6</h1> <p>mandatory</p>	<p>Every <i>building</i>, and hard surface within the <i>curtilage</i> of a <i>building</i>, must be designed and <i>constructed</i> with a <i>surface water</i> drainage system that will:</p> <p>(a) ensure the disposal of <i>surface water</i> without threatening the <i>building</i> and the health and safety of the people in and around the <i>building</i>; and</p> <p>(b) have facilities for the separation and removal of silt, grit and pollutants.</p>
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3.6.0 Introduction

Climate change is expected to result in more rain in the future and it is essential that this is taken into account in *buildings*. It is essential that the *surface water* from *buildings* is removed safely without damage to the *building*, danger to people around the *building* and without posing a risk to the environment by flooding or pollution.

PAN 61

Development of *building sites* generally leads to increased impermeable areas that can significantly increase the amount of *surface water* run-off to be dealt with. The approach to the disposal of *surface water* from *buildings* and hard surfaces clearly needs to be considered at the earliest stage in the design and development process (see also the Scottish Executive Development Department's Planning Advice Note No. PAN 61 - Planning and Sustainable Urban Drainage Systems).

For safety reasons it is essential that *surface water* is not permitted to collect or remain on all access routes to *buildings*, particularly with elderly and *disabled people* in mind. Ponding in winter can cause slippery surfaces that can be a hazard to pedestrians.

Controlled Activities

The discharge of *surface water* is a controlled activity under The Water Environment (Controlled Activities) (Scotland) Regulations 2005. Under these regulations *surface water* discharges to ground or water (wetlands, *surface waters* or groundwater) must be by means of a sustainable urban drainage system authorised by The Scottish Environment Protection Agency (SEPA). *Surface water* discharge from a single *dwelling* or its curtilage is permitted to be by other means.

SEPA authorisation

Water conservation

In some localities there is growing pressure on water resources due to changes in the climate and increasing expectations of personal hygiene. The introduction of conservation measures, such as the collection of *surface water* for its reuse is strongly encouraged to reduce the reliance on mains water.

Explanation of Terms

Paved surface – means any constructed hard surface more than 50 m².

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* must meet the requirement of this standard (regulation 12 schedule 6).

3.6.1 Surface water drainage from dwellings

Every *building* should be provided with a drainage system to remove rainwater from the roof, or other areas where rainwater might accumulate, without causing damage to the structure or endangering the health and safety of people in and around the *building*. Where gutters and rainwater pipes are used, they should be *constructed* and installed in accordance with the recommendations described in BS EN 12056-3: 2000.

Eaves drop systems

Methods other than gutters and rainwater pipes may be utilised to remove rainwater from roofs. An eaves drop system will allow rainwater to drop freely to the ground. Where these are used, they should be designed taking into account the following:

- the existing groundwater level and ground infiltration capacity;
- the protection of the fabric of the *dwelling* from ingress of water caused by water splashing on the wall;
- the need to prevent water from entering doorways and windows;
- the need to protect persons from falling water when around the *dwelling*;
- the need to protect persons and the *building* fabric from rainwater splashing on the ground or forming ice on access routes. The provision of a gravel layer or angled concrete apron or such like may be acceptable;
- the protection of the *building foundations* from concentrated discharges from gutters.

Gutters and rainwater pipes may be omitted from a roof at any height provided it has an area of not more than 8 m² and no other area drains onto it.

3.6.2 Surface water drainage of paved surfaces

Every *domestic building* should be provided with a drainage system to remove *surface water* run-off from paved surfaces, such as an access route that is suitable for *disabled people*, without endangering the *building* or the health and safety of people in and around the *building*. The paved surface should be so laid as to ensure rainwater run-off is not close to the *building*. Paved surface drainage systems should be designed, *constructed* and installed, either:

- a. incorporating SUD system techniques as in clause 3.6.4; or
- b. using a traditional piped drainage system as in clause 3.6.8.

3.6.3 Surface water discharge

Surface water discharged from a *domestic building* and a hard surface within the curtilage of a *domestic building* should be carried to a point of disposal that will not endanger the *building*, environment or the health and safety of people around the *building*.

Surface water discharge should be to:

- a. a SUD system designed and *constructed* in accordance with clause 3.6.4; or
- b. a soakaway *constructed* in accordance with:
 - clause 3.6.5; or
 - the guidance in BRE Digest 365, 'Soakaway Design'; or
 - National Annex NA 4 of BS EN 752: 2008; or
- c. a public sewer provided under the Sewerage (Scotland) Act 1968; or
- d. an outfall to a watercourse, such as a river, stream or loch or coastal waters, that complies with any notice and/or consent by SEPA; or
- e. to a storage container with an overflow discharging to either of the 4 options above.

Discharge from a soakaway should not endanger the stability of the *building*. Damage to the *foundations* is likely to occur where discharge is too close to the *building* and it is sensible to ensure that any water bearing strata directs water away from the *building*.

Location of soakaway

To prevent such damage therefore, every part of a soakaway should be located at least 5 m from a building and from a *boundary* in order that an adjoining plot is not inhibited from its full development potential. However the volume of *surface water* run-off, ground strata or permeability of the soil may influence this dimension and it may be reduced, or indeed may need to be increased, to preserve the structural integrity of the *building*.

3.6.4 Sustainable Urban Drainage Systems

Sustainable urban drainage (SUD) is a concept that focuses decisions about drainage on the environment and people. The concept takes account of the quantity and quality of *surface water* run-off and the amenity value of *surface water* in the urban environment.

The variety of design options available allows designers and planners to consider local land use, land take, future management and the needs of local people. SUD systems often stretch beyond the confines of the curtilage of individual *buildings* but need to be considered as a whole.

Fundamental to a successful SUD system is a management train that allows for a range of components to be incorporated for control or management of *surface water*, such as:

- **Source Control** – control of run-off at or very near its source by components including soakaways, other infiltration methods, green roofs or permeable surfaces.
- **Site Control** – management of *surface water* within a *building site* by components including large soakaways, infiltration systems or detention basins.
- **Regional Control** – management of *surface water* from *building sites* by components including balancing ponds or wetlands.

SUD systems range from the use of basic components such as permeable materials that allow *surface water* to infiltrate to ground in a way that can mimic natural drainage, to more complex engineered components including filter strips, swales, or wet ponds that will convey or store *surface water*. The CIRIA document C697 'The SUDS Manual' 2007 provides comprehensive advice on initial drainage design assessments and best practice guidance on the planning, design, *construction*, operation and maintenance of SUD systems.

CIRIA C697

www.environment-agency.gov.uk

Brownfield sites

www.sepa.org.uk

Careful consideration should be given to the design of *surface water* drainage from brownfield land, particularly where contamination might be expected. SEPA provides guidance in their SUDS Advice Note – 'Brownfield Sites'. Generally SUD systems are designed to utilise natural processes and regular monitoring and maintenance will be needed to ensure the system as conceived is operating as intended.

3.6.5 Soakaways serving single dwellings and extensions

Soakaways have been the traditional method of disposal of *surface water* from *buildings* and paved areas where no mains drainage exists. A soakaway serving a single *dwelling* or an extension should be designed and *constructed* in accordance with the following guidance:

- a. test the suitability of the ground in accordance with the percolation test method in clause 3.9.1. The trial holes and the finished soakaways should be a minimum of 5 m from the *dwelling* and the *boundary*. However this dimension may be reduced slightly on small *sites* where ground conditions allow, such as very well draining soil;
- b. there should be individual soakaways for each *dwelling*.

The soakaways may be sized using the following simplified formulae derived from BRE Digest 365:

$$(A \times 0.0145) - (a \times f \times 900) = S$$

Where - A is the area to be drained in m².

- a is the internal surface area of the soakaway to 50% effective depth, excluding the base in m². This has to be assumed for initial calculation purposes.
- f is the soil infiltration rate, in m/s, determined in accordance with clause 3.9.1. This calculation produces Vp in secs/mm [conversion = (1/Vp) /1000].
- S is the required storage in m³.

3.6.6 Surface water run-off from small paved areas

Free draining *surface water* run-off may be appropriate for small hard surface areas, such as access paths. Free draining run-off can be achieved by laying the surface to a fall, sufficient to avoid ponding, that allows the water to drain to a pervious area, such as grassland, provided the infiltration capacity of the ground is not overloaded. Also the discharge should not be adjacent to the *building* where it could damage the *foundations*.

3.6.7 Rainwater harvesting

Rainwater harvesting systems allow *surface water* run-off from *dwellings* or hardstanding areas to be collected, stored and distributed thereby reducing the demand for potable water, the load on drainage systems and *surface water* run-off that can lead to incidents of flooding. The reuse of *surface water* can produce benefits to the home owner and the environment and therefore is recommended.

Rain, as it falls on *buildings*, is soft, clear and largely free of contaminants. During collection and storage however there is potential for contamination. For this reason it is recommended that recycled *surface water* is used only for flushing water closets, car washing and garden taps as it is not possible to guarantee the necessary maintenance of complex filters that would be essential if it were used for consumption or personal hygiene.

CIRIA C539
www.environment-agency.gov.uk

Manufacturers of proprietary systems or guidance documents such as CIRIA C539 or 'Harvesting Rainwater for domestic use: an information guide' published by the Environment Agency provides helpful guidance on design considerations.

Water Byelaws 2004

WRAS 9-02004

Where a rainwater harvesting system is to be installed it should be designed, *constructed* and installed in accordance with the Water Byelaws 2004, the recommendations of the Water Regulations Advisory Scheme (WRAS) Information and Guidance Notes No. 9-02-04 and 9-02-05, 1999. BS 8515: 2009 'Rainwater harvesting systems - Code of Practice' and the CIRIA publication CIRIA C539; 'Rainwater and greywater use in *buildings*', provide good practice installation, design and maintenance advice. The approval of

Scottish Water is needed before any such scheme is installed.

Filtration

Prior to the storage of water in a tank the rainwater should be filtered to remove leaves and other organic matter and dust or grit. Disinfection may be required if the catchment area is likely to be contaminated with animal faeces, extensive bird droppings, oils or soil.

Water storage tanks should be *constructed* of materials such as GRP, high-density polyethylene, steel or concrete and sealed and protected against the corrosive effects of the stored water and to prevent the ingress of ground water if located underground.

Pipework identification

Water for use in the *dwelling* should be extracted from just below the water surface in the tank to provide optimum water quality. All pipework carrying rainwater for use in the *dwelling* should be identified as such in accordance with the WRAS guidance notes and great care should be taken to avoid cross-connecting reclaimed water and mains water. Tanks should be accessible to allow for internal cleaning and the maintenance of inlet valves, sensors, filters or submersible pumps. An overflow should discharge to a soakaway (see guidance to standard 3.6) or to mains drainage where it is not reasonably practicable to discharge to a soakaway. Backflow prevention devices should be incorporated to prevent contaminated water from entering the system.

3.6.8 Traditional drainage systems

There can be substantial advantages from the use of SUD systems, but where a traditional piped system is required it should be designed and *constructed* in accordance with the guidance in National Annex of BS EN 752: 2008.

3.6.9 Discharges into a drainage system

Where a discharge into a traditional drainage system contains silt or grit, for example from a hard standing with car wash facilities, there should be facilities for the separation of such substances. Removable grit interceptors should be incorporated into the *surface water* gully pots to trap the silt or grit.

3.6.10 Testing

A *surface water* drainage system should be tested to ensure the system is laid and is functioning correctly. Testing should be carried out in accordance with the guidance in BS EN 1610: 1998.

3.7 Wastewater drainage

- 3.7 Functional standard
- 3.7.0 Introduction
- 3.7.1 Sanitary pipework
- 3.7.2 Sanitary appliances below flood level
- 3.7.3 Drainage system outside a building
- 3.7.4 Connection to a public sewer
- 3.7.5 Combined sewers
- 3.7.6 Conversions and extensions
- 3.7.7 Sewers intended for vesting
- 3.7.8 Ventilation of a drainage system
- 3.7.9 Testing
- 3.7.10 Wastewater discharge

standard
3.7
mandatory

Every *wastewater* drainage system serving a *building* must be designed and *constructed* in such a way as to ensure the removal of *wastewater* from the *building* without threatening the health and safety of the people in and around the *building*, and:

- (a) that facilities for the separation and removal of oil, fat, grease and volatile substances from the system are provided;
- (b) that discharge is to a public sewer or public *wastewater* treatment plant, where it is *reasonably practicable* to do so; and
- (c) where discharge to a public sewer or public *wastewater* treatment plant is not *reasonably practicable* that discharge is to a private *wastewater* treatment plant or septic tank.

Limitation:

Standard 3.7(a) does not apply to a *dwelling*.

3.7.0 Introduction

This guidance applies to *wastewater* systems that operate essentially under gravity. The guidance to this standard provides recommendations for the design, *construction* and installation of drains and sewers from a *building* to the point of connection to a public sewer or public sewage treatment works.

The guidance should also be used for all pipe work connecting to a private *wastewater* treatment plant or septic tank.

Treatment plants, septic tanks

Guidance on private *wastewater* treatment plants, septic tanks and infiltration fields is provided under standards 3.8 and 3.9.

Combined sewers

Some sewers, called combined sewers, carry *wastewater* and *surface water* in the same pipe. It may be appropriate to install a drainage system within the *curtilage* of a *building* as a separate system even when the final connection is to a combined sewer. This will facilitate the upgrading of the combined sewer at a later date.

Incorrect connections

The connection of *wastewater* drains to *surface water* drains is a common occurrence during *conversions* and extensions in urban areas served by separate drainage systems. Incorrect connections can cause chronic and severe pollution of watercourses and a careful check should be made before final connection is made to the appropriate drain.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

3.7.1 Sanitary pipework

Differences in plumbing within Europe have led to a variety of systems being developed. These have happened as a result of differences in the type and use of sanitary appliances in Member States. The European Standards describe the 4 main systems in use but it is expected that traditional practices will continue in the various countries. However care will need to be taken if different systems are used to ensure that the entire system operates satisfactorily and that the system designed and installed is compatible with, and suitable for, connection to existing *wastewater* systems.

Sanitary pipe work should be *constructed* and installed in accordance with the recommendations in BS EN 12056-2: 2000. The BS EN describes 4 different systems as follows:

Traditional UK system

- System III (single discharge stack system with full bore branch discharge pipes) as described in Clause 4.2 of BS EN 12056-2: 2000 is the traditional system in use in the UK.

Low-flush system

- However low water and energy consumption is now a major consideration in any design solution. With this in mind, System II (single discharge stack system with small bore discharge branch pipes) may be appropriate. Careful consideration should be given to the design of the system where a low flush cistern is connected to an existing drain to ensure that blockages do not occur as a result of reduced flow rates.

European systems

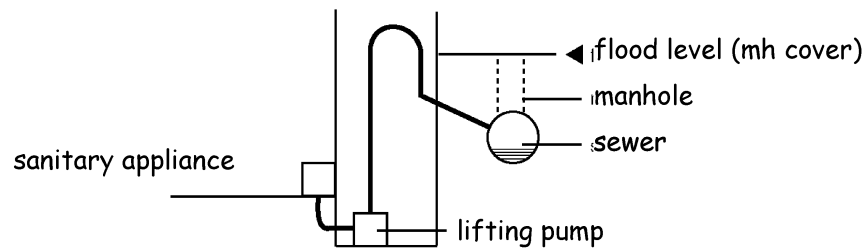
- Systems I (single discharge stack system with partially filled branch discharge pipes) and IV (separate discharge stack system) have developed as a result of different types of sanitary appliances and technical traditions in the various European countries. These system types are unlikely to be appropriate for use in this country.

Reducing the bore of a pipe in the direction of flow can lead to blockages and should not be considered as an acceptable method of *construction*. However sanitary pipework may be reduced where it is connected to a pump installed in compliance with the conditions of certification by a *notified body*. These pumped systems are generally in use where the appliances are located in basement levels below the flood level of the drain (see clause 3.7.2).

3.7.2 Sanitary appliances below flood level

The basements of approximately 500 *buildings* in Scotland are flooded each year when the sewers surcharge (the effluent runs back up the pipes because they are too small to take the required flow). *Wastewater* from sanitary appliances and floor gullies below flood level should be drained by *wastewater* lifting plants or, where there is unlikely to be a risk to persons such as in a car park, via an anti-flooding device. *Wastewater* lifting plants should be *constructed* in accordance with the requirements of BS EN 12056-4: 2000. *Wastewater* from sanitary appliances above flood level should not be drained through anti-flooding devices and only in special case, e.g. refurbishment, by a *wastewater* lifting plant.

Diagrammatic section through a pumped system in a basement



3.7.3 Drainage system outside a building

A drainage system outside a *dwelling*, should be *constructed* and installed in accordance with the recommendations in BS EN 12056-1: 2000, BS EN 752: 2008 and BS EN 1610: 1998.

Reducing the bore of a drain in the direction of flow may lead to blockages and is not recommended.

Health and safety legislation requires that manual entry to a drain or sewer system is only undertaken where no alternative exists. Therefore use of remotely operated equipment will become the normal method of access. As well as the traditional inspection chambers used for depths of up to 1 m, remotely operated equipment is available for inspection, cleaning and removal of debris from deeper drains and sewers, without the need for personal entry.

3.7.4 Connection to a public sewer

Where a private drain discharges into a public sewer, normally at the *curtilage* of a *building*, some form of access should be provided for maintenance and to allow a satisfactory connection. The preferred method is by a disconnecting inspecting chamber for each *house* immediately inside the *curtilage*, although other methods and locations may be acceptable. Although access for maintenance purposes may be required by Scottish Water, design and *construction* of the chamber should be in accordance with the recommendations of BS EN 752: 2008. It is preferable that a chamber is provided for individual *houses* but where this is not practicable, a shared disconnecting chamber (or manhole where the depth is more than 1.2 m) should be provided in accordance with the requirements of Scottish Water in whom it is likely to be vested.

Disconnecting chambers

Disconnecting manholes

The disconnecting chamber, or manhole, for a block of individually owned *flats* or *maisonettes* should be located as close to the *building* as is *reasonably practicable* as the drain will become a public sewer once it passes out with the footprint of the *building*.

3.7.5 Combined sewers

Some sewers, called combined sewers, carry *wastewater* and *surface water* in the same pipe. These systems are not recommended today as they are more likely to surcharge during heavy rains. A separate drainage system carrying *wastewater* and *surface water* therefore should be *constructed* within the *curtilage* of a *building* even if it connects to a combined sewer to facilitate the upgrading of the combined sewer at a later date.

3.7.6 Conversions and extensions

Incorrect drainage connections, mostly related to *conversions* and extensions, whether *wastewater* to *surface water* or vice versa, is a common occurrence and can cause severe pollution of watercourses or surcharging of drains also leading to pollution. A careful check should be made before breaking into an existing drain to ensure it is the correct one and a further test carried out after connection, such as a dye test, to confirm correct connection.

3.7.7 Sewers intended for vesting

Sewers for Scotland

Where it is intended that a private sewer (a sewer connecting 2 or more *buildings* that are privately owned and maintained) will be vested in the Water Authority, *construction* and installation should be in accordance with requirements in 'Sewers for Scotland'.

3.7.8 Ventilation of a drainage system

A *wastewater* drainage system serving a *dwelling* should be ventilated to limit the pressure fluctuations within the system and minimise the possibility of foul air entering the *building*. A system should be installed in accordance with the guidance in Sections 4, 5, 6 and National Annex ND of BS EN 12056-2: 2000.

Air admittance valves

Air admittance valves are another method of ventilating a drainage system as they allow air to enter the drainage system, but not to escape, thus limiting pressure fluctuations within the system. Care should be taken when installing these valves that they are located where they will operate effectively. Air admittance valves should be installed:

- a. accordance with the recommendations in BS EN 12380: 2002; or
- b. in compliance with the conditions of certification of a *notified body*.

3.7.9 Testing

A *wastewater* drainage system should be tested to ensure the system is laid and is functioning correctly. Testing should be carried out in accordance with the guidance in:

- a. National Annex NG of BS EN 12056-2: 2000, for sanitary pipework;
- b. BS EN 1610: 1998, for a drainage system under and around a *building*.

3.7.10 Wastewater discharge

A *wastewater* drainage system should discharge to a public sewer or public *wastewater* treatment plant provided under the Sewerage (Scotland) Act 1968, where it is *reasonably practicable* to do so. Where it is not possible to discharge to a public system, for example in the countryside where there is no public sewer, other options are available, as described in the guidance to standards 3.8 and 3.9: Private *wastewater* treatment systems.

3.8 Private wastewater treatment systems – treatment plants

- 3.8 Functional standard
- 3.8.0 Introduction
- 3.8.1 Treatment plants
- 3.8.2 Treatment plant covers
- 3.8.3 Inspection and sampling
- 3.8.4 Location of a treatment plant
- 3.8.5 Discharges from septic tanks and treatment plants
- 3.8.6 Access for desludging
- 3.8.7 Labelling

standard

3.8

mandatory

Every private *wastewater* treatment plant or septic tank serving a *building* must be designed and *constructed* in such a way that it will ensure the safe temporary storage and treatment of wastewater prior to discharge.

3.8.0 Introduction

A *wastewater* treatment system is an effective, economical way of treating *wastewater* from *buildings*. It consists of 2 main components, a watertight underground tank into which raw sewage is fed and a system designed to discharge the *wastewater* safely to the environment without pollution. This is normally an infiltration field through which *wastewater* is released to the ground, but when ground conditions are not suitable, a discharge to a watercourse or coastal waters may be permitted. The infiltration field provides secondary treatment and is often critical for protecting the environment from pollution. Not all treatment plants treat to the same standard, for example, biological treatment plants treat the *wastewater* to a much higher standard than septic tanks prior to release of the *wastewater* thus reducing pollution and permitting a smaller infiltration field. As there are many different types of treatment plants with varying degrees of efficiency, then the type chosen should be selected for the effluent standard required to protect the environment.

Although a septic tank is a basic form of treatment plant, it has been specifically mentioned in the guidance to clarify the recommendations.

Package treatment plant is the term applied to a range of systems engineered to treat a given hydraulic and organic load using prefabricated components that can be installed with minimal *site work*.

Guidance on the *construction* and installation of drains discharging into private *wastewater* treatment plants or septic tanks is covered in standard 3.7.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

3.8.1 Treatment plants

Where it is not *reasonably practicable* to connect to a public sewer or a public *wastewater* treatment plant then discharge should be to a private *wastewater* treatment plant or septic tank.

Treatment plants provide suitable conditions for the settlement, storage and partial decomposition of solids that need to be removed at regular intervals. The discharge can however still be harmful and will require great care when discharging to ground to ensure a suitable level of protection of the environment is achieved. A large number of small sewage treatment works in a limited area is undesirable. The guidance to standard 3.9 deals with the infiltration system that should be *constructed* as an integral part of the treatment plant or septic tank.

When sizing and selecting the *wastewater* treatment plant the designer should take full account of all population loadings, effluent treatment standard, and also where appropriate, any unusual pollution loads such as waste disposal units.

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Domestic use of detergents and disinfectants is not detrimental but excessive use may have a harmful effect on the performance of the sewage treatment works. The British Water Code of Practice, Flows and Loads – 2, provides guidance on sizing criteria and treatment capacity for small (maximum 1000 population equivalent) *wastewater* treatment systems.

A private *wastewater* treatment plant and septic tank should be designed, *constructed* and installed in accordance with:

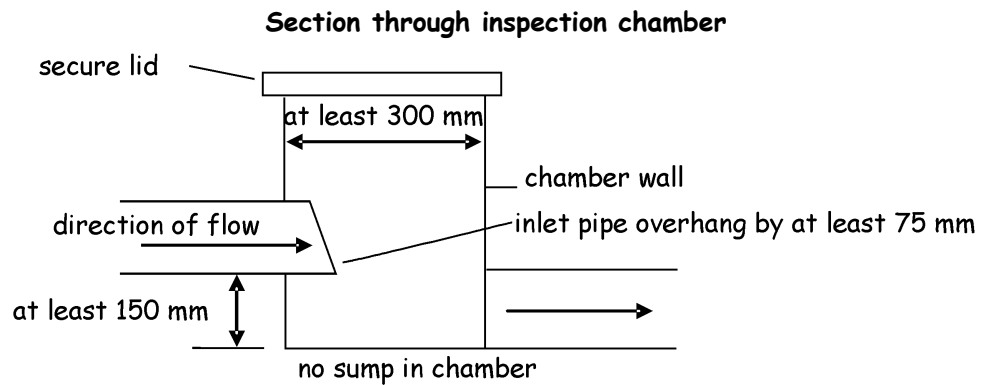
- a. the recommendations of BS EN 12566-1: 2000, for a prefabricated septic tank; or
- b. the recommendations of BS 6297: 1983; or
- c. the conditions of certification by a *notified body*.

3.8.2 Treatment plant covers

The settlement tank of a private *wastewater* plant and a septic tank should have a securely sealed, solid cover that is capable of being opened by 1 person using standard operating keys.

3.8.3 Inspection and sampling

A private *wastewater* plant and septic tank should be provided with a chamber for the inspection and sampling of the *wastewater* discharged from the tank. The owner should carry out inspection at regular intervals and SEPA may sample the effluent to ensure compliance with any discharge consent. A chamber should be provided in accordance with the following diagram:



3.8.4 Location of a treatment plant

Research has shown that there are no health issues that dictate a safe location of a treatment plant or septic tank relative to a *dwelling*. However damage to the *foundations* of a *dwelling* has been shown to occur where leakage from the tank has occurred. In the unlikely event of there being leakage, it is sensible to ensure that any water bearing strata directs any effluent away from the *dwelling*. To prevent any such damage therefore, every part of a private *wastewater* plant and septic tank should be located at least 5 m from a *dwelling*.

Every part of a private *wastewater* plant and septic tank should be located at least 5 m from a *boundary* in order that an adjoining plot is not inhibited from its full development potential.

3.8.5 Discharges from septic tanks and treatment plants

Where mains drainage is not available, it may be possible to discharge treated *wastewater* to ground via an infiltration system, as described in clause 3.9.2, or to a water course, loch or coastal waters.

SEPA consents

SEPA will require an authorisation, under the terms of the Water Environment (Controlled Activities)(Scotland) Regulations 2005 to be applied for all discharges of sewage effluent whether to ground via an infiltration system or to a watercourse.

3.8.6 Access for desludging

Wastewater treatment plants should be inspected monthly to check they are working correctly. The effluent in the outlet from the tank should be free flowing. The frequency of desludging will depend upon the capacity of the tank and the amount of waste draining to it from the *dwelling* but further advice on desludging frequencies should be obtained from the tank manufacturer or the desludging contractor.

A private *wastewater* treatment plant and septic tank should be provided with an access for desludging. The desludging tanker should be provided with access to a working area that:

- will provide a clear route for the suction hose from the tanker to the tank; and
- is not more than 25 m from the tank where it is not more than 4 m higher than the invert level of the tank; and
- is sufficient to support a vehicle axle load of 14 tonnes.

3.8.7 Labelling

Every *dwelling* with a drainage system discharging to a private *wastewater* treatment plant or septic tank should be provided with a label to alert the *occupiers* to such an arrangement. The label should describe the recommended maintenance necessary for the system and should include the following:

‘The drainage system from this property discharges to a wastewater treatment plant (or septic tank, as appropriate). The owner is legally responsible for routine maintenance and to ensure that the system complies with any discharge consent issued by SEPA and that it does not present a health hazard or a nuisance’.

The label should be located adjacent to the gas or electricity consumer unit or the water stopcock.

3.9 Private wastewater treatment systems – infiltration systems

- 3.9 Functional standard
- 3.9.0 Introduction
- 3.9.1 Assessing the suitability of the ground
- 3.9.2 Design of infiltration fields
- 3.9.3 Greywater disposal
- 3.9.4 Location of infiltration fields – pollution
- 3.9.5 Location of infiltration fields – damage to buildings

standard

3.9

mandatory

Every private *wastewater* treatment system serving a *building* must be designed and *constructed* in such a way that the disposal of the *wastewater* to ground is safe and is not a threat to the health of the people in or around the *building*.

SEPA authorisation

3.9.0 Introduction

The intention of this standard is to ensure that non-mains drainage systems are designed and *constructed* to a standard so that the discharges from them do not contribute to environmental pollution and will achieve statutory environmental standards. Subject to discharge authorisation from SEPA, (see clause 3.8.5) *wastewater* from treatment systems can either discharge to land via an infiltration system or to watercourses, lochs or coastal waters. The guidance to this standard deals with discharges to land via infiltration systems. The infiltration method will form a critical part of the treatment system and care must be taken in the type, design and location chosen to avoid environmental pollution. The guidance to this standard should be used in conjunction with the guidance to standard 3.8 when designing *wastewater* treatment systems.

Several hundreds of *wastewater* treatment systems are thought to cause pollution problems every year. These problems occur mainly because of poor location, poor drainage field design or lack of maintenance.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

3.9.1 Assessing the suitability of the ground

An infiltration system serving a private *wastewater* treatment plant, septic tank or for *greywater* should be *constructed* in ground suitable for the treatment and dispersion of the *wastewater* discharged. This can be achieved by following the guidance below.

A ground assessment and soil percolation test should be carried out to determine the suitability of the ground. The following three step procedure should be followed:

Ground assessment

First, carry out a preliminary ground assessment. The following check list indicates the actions that should be taken and the type of information that should be collected:

- consult SEPA, verifier and the Environmental Health Officer as required;
- consult SEPAs latest groundwater protection policy;
- identification of the underlying geology and aquifers;
- whether the ground is liable to flooding;
- nature of the sub-soil and groundwater vulnerability;
- implication of plot size;
- proximity of underground services;
- ground topography and local drainage patterns;
- whether water is abstracted for drinking, used in food processing or farm dairies;
- implication for, and of, trees and other vegetation;
- location of *surface waters* and terrestrial ecosystems.

The preliminary assessment may indicate that the ground is unsuitable for the installation of an infiltration system, in which case an alternative disposal method should be considered.

Trial holes

Second, a trial hole should be dug to determine the position of the water table and soil conditions. This trial hole will enable the sub-soil type to be determined. The trial hole should be a minimum of 2 m deep, or a minimum of 1.5 m below the invert of the proposed distribution pipes. The trial hole should be left covered for a period of 48 hours before measuring any water table level. Subsoils that overlay bedrock allow water to move through the pore spaces between the grains of material of which they are composed. They are the first line of defence against pollution and act as a protecting filtering layer. Where these materials are unsaturated, pollution attenuation processes are often enhanced. Water flows through much of Scotland's bedrock via fissures. Attenuation of contaminants is limited in these cases. For safe and effective dispersal of the *wastewater*, the groundwater and bedrock should be at least 1 m below the bottom of the distribution pipes. It should also be noted that it is the seasonally highest level of the water table that should be determined for the infiltration area.

Percolation tests

Third, to determine the type of infiltration system and the area of ground required, percolation tests should be carried out. These percolation tests should be carried out using either of the following methods:

- a. expert examination of the soil distribution analysis, using the method described in BS 1377: Part 2: 1990; or
- b. expert in-situ testing using either the Constant Head or Tube Permeameter as described in CEN /TR 12566–2–2005; or
- c. excavate a minimum of two percolation holes, not less than 5 m apart along the line of and below the proposed invert level of the effluent distribution pipe. Each hole should be 300 mm square to a depth of

300 mm. Where deep drains are necessary, the holes should conform to this shape at the bottom but may be enlarged above the 300 mm level to facilitate safe excavation. Fill the 300 mm square section of the holes to a depth of at least 300 mm with water and allow them to seep away overnight. It is important to saturate the soil surrounding the test holes to simulate day to day conditions in an operational drainage field. Next day, refill the test sections of the percolation holes with water to a depth of at least 300 mm and observe the time (t) in seconds, for the water to seep away from 75% to 25% full level. Divide this time by 150 mm. The answer gives the average time in seconds (Vp) required for the water to drop 1 mm. Take care when making the tests to avoid unusual weather conditions such as heavy rain, severe frost or drought. To obtain consistent results carry out the test at least 3 times for each percolation hole and take the average figure.

The floor area of a sub-surface drainage trench required to disperse effluent from treatment plants or septic tanks may be calculated from the following formula:

$$A = P \times V_p \times 0.25$$

A is the area of the sub-surface drainage trench, in m²;

p is the number of persons served by the tank; and

Vp is the percolation value obtained, as described above, in secs/mm.

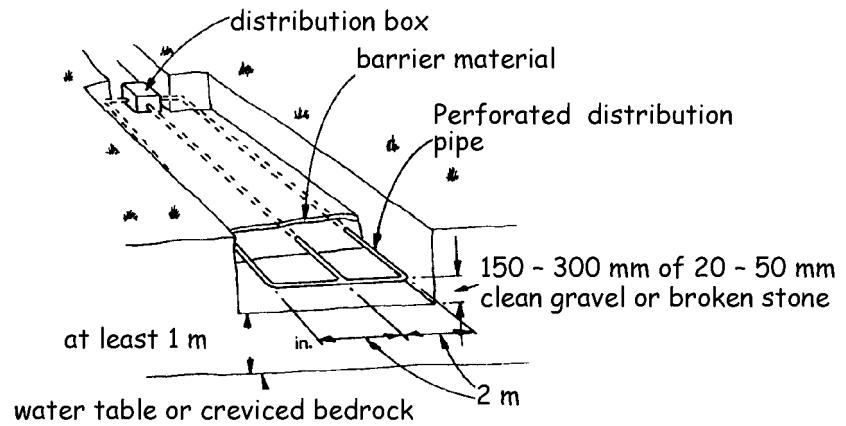
For *wastewater* that has received the benefit of secondary treatment followed by settlement, this area may be reduced by 20%, i.e.

$$A = P \times V_p \times 0.2$$

3.9.2 Design of infiltration fields

An infiltration system serving a private *wastewater* treatment plant or septic tank should be designed and *constructed* to suit the conditions as determined by the ground into which the treated *wastewater* is discharged. An infiltration system should be designed and *constructed* in accordance with the following guidance:

- | | |
|--------------------------|--|
| Fast percolation rates | Where the percolation value (as demonstrated by the percolation test) is not more than 15 secs/mm, in accordance with the requirements of SEPA; |
| Normal percolation rates | Where the percolation value (as demonstrated by the percolation test) is more than 15 secs/mm and not more than 100 secs/mm, as: <ol style="list-style-type: none"> a. a piped infiltration trench system in accordance with national annex NA of BS EN 752: 2008, using perforated, rigid pipes with a smooth internal surface; or b. a piped infiltration bed system in accordance with the diagram below; or c. any system described under 'slow and very slow percolation rates'. |

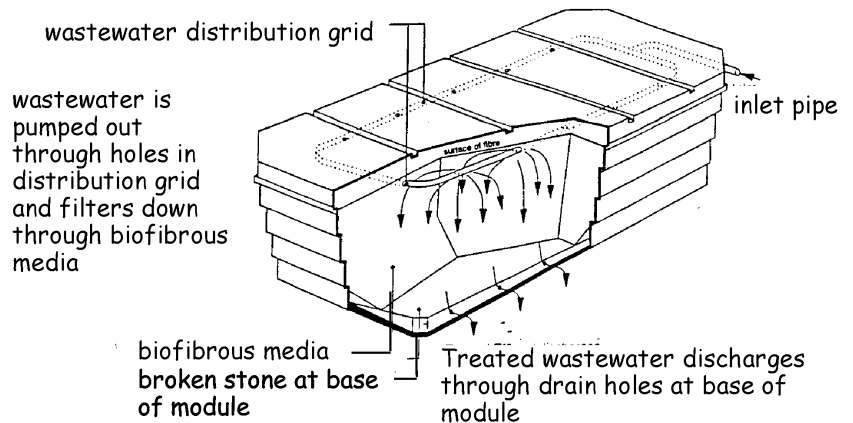


Slow percolation rates

Where the percolation value (as demonstrated by the percolation test) is more than 100 secs/mm and not more than 140 secs/mm, as:

- a. a reed bed complying with the requirements of the BRE, Good Building Guide, GBG 42, Parts 1 and 2 together with a piped infiltration system described in Sub-clauses a and b with a normal percolation rate, or a suitable outfall; or
- b. a *constructed* wetland, other than a reed bed, to a professionally prepared design and *constructed* by specialist contractor(s); or
- c. a proprietary filtration system designed, *constructed* and installed in accordance with the conditions of a *notified body*; or
- d. any other equivalent filtration system designed by a specialist in this subject and *constructed* by specialist contractor(s).

Typical proprietary filtration system



Very slow percolation rates

Where the percolation value (as demonstrated by the percolation test) is more than 140 secs/mm:

- a. as a system described under 'slow percolation rate' that does not use an infiltration system for the final treated *wastewater*; or
- b. for domestic sized *buildings*, by designing and *constructing* a mound filter system in accordance with BR 478, 'Mound Filter Systems for the treatment of domestic wastewater'.

3.9.3 Greywater disposal

The disposal of *greywater* (from baths, showers, washbasins, sinks and washing machines) may be accomplished by an infiltration field the area of which can be calculated from the following:

$$A = P \times V_p \times 0.2$$

A is the area of the sub-surface drainage trench, in m²;

p is the number of persons served; and

V_p is the percolation value obtained, as described above, in secs /mm.

3.9.4 Location of infiltration fields – pollution

An infiltration system serving a private *wastewater* treatment plant or septic tank should be located to minimise the risk of pollution. An infiltration field should be located in accordance with the following guidance:

- a. at least 50 m from any spring, well or borehole used as a drinking water supply; and
- b. at least 10 m horizontally from any watercourse (including any inland or coastal waters), permeable drain, road or railway.

3.9.5 Location of infiltration fields – damage to buildings

Research has shown that there are no health issues that dictate a safe location of an infiltration field relative to a *building*. However damage to the *foundations* of a *building* is likely to occur where discharge is too close to the *building*. It is sensible to ensure that any water bearing strata directs any effluent away from the *building*.

To prevent any such damage therefore, every part of an infiltration system serving a private *wastewater* treatment plant or septic tank should be located at least 5 m from a *building*. An infiltration system should also be located at least 5 m from a *boundary* in order that an adjoining plot is not inhibited from its full development potential.

However the ground strata or permeability of the soil may influence this dimension and it may be reduced slightly where the strata directs any groundwater away from the *foundations* or if the soil is free draining. Indeed, to preserve the structural integrity of the *building*, it may be prudent to increase the dimension where ground conditions would allow *wastewater* to collect around the *building's foundations*.

3.10 Precipitation

- 3.10 Functional standard
- 3.10.0 Introduction
- 3.10.1 General provisions
- 3.10.2 Wall constructions (solid, masonry)
- 3.10.3 Wall constructions (cavity, masonry)
- 3.10.4 Conservatories and extensions
- 3.10.5 Wall constructions (framed)
- 3.10.6 Ventilation of wall cavities
- 3.10.7 Roof constructions (flat)
- 3.10.8 Roof constructions (pitched)

<p style="text-align: center;">standard</p> <p style="font-size: 2em; text-align: center;">3.10</p> <p style="text-align: center;">mandatory</p>	<p>Every <i>building</i> must be designed and <i>constructed</i> in such a way that there will not be a threat to the <i>building</i> or the health of the occupants as a result of moisture from precipitation penetrating to the inner face of the <i>building</i>.</p> <p>Limitation: This standard does not apply to a <i>building</i> where penetration of moisture from the outside will result in effects no more harmful than those likely to arise from use of the <i>building</i>.</p>
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3.10.0 Introduction

Rain penetration shows up as damp patches, usually after heavy rain, on the inside of *external walls*, around door or window openings or on ceilings. It can be difficult to pinpoint the exact route the rainwater is taking. For example, a damp patch on a ceiling could be the result of a faulty flashing or damaged felt on a *flat roof* some distance away from the damp patch. Similarly, unless they have adequate damp proof courses and flashings, materials in parapets and *chimneys* can collect rainwater and deliver it to other parts of the *dwelling* below roof level. Penetration occurs most often through walls exposed to the prevailing wet winds, usually south-westerly or southerly.

BR 302

There are numerous publications providing good practice guidance on methods of preventing rain penetration to internal surfaces of *buildings*. BRE book 'Roofs and Roofing – performance, diagnosis, maintenance, repair and the avoidance of defects' provides helpful guidance for *building* professionals to address these problematic issues.

Explanation of terms

The following terms are included to provide clarity to their meaning in the guidance to this standard.

A **vented cavity** means a cavity with openings to the outside air placed so as to allow some limited, but not necessarily through air movement. The openings are normally located at low level where they can also act as weep holes to drain water from the cavity.

A **ventilated cavity** means a cavity with openings to the outside air placed so as to promote through movement of air. The openings should be located at high and low level.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably practicable*, and in no case be worse than before the *conversion* (regulation 12, schedule 6).

3.10.1 General provisions

A floor, wall, roof or other *building* element exposed to precipitation, or wind driven moisture, should prevent penetration of moisture to the inner surface of any part of a *dwelling* so as to protect the occupants and to ensure that the *building* is not damaged.

Some types of *buildings*, such as *carports* or storage of outdoor equipment, can be unaffected by damp penetration and the following guidance therefore may not be relevant.

When using any of the *constructions* below, the following general recommendations should be followed for walls or roofs, as appropriate:

- masonry walls of bricks and/or blocks incorporating damp-proof courses, flashings and other materials and components *constructed* in accordance with the relevant recommendations of BS 5628: Part 3: 2005. The *construction* used should suit the degree of exposure to wind and rain in accordance with Clause 21 and as described in BS 8104: 1992;
- masonry walls incorporating external rendering which conforms to the relevant recommendations of BS 5262: 1991, to suit the degree of exposure and the type of masonry;
- masonry walls of natural stone or cast stone blocks *constructed* in accordance with the relevant recommendations of Section 3 of BS 5390: 1976 (1984) and to suit the degree of exposure to wind and rain as described in BS 8104: 1992;
- masonry cavity walls incorporating insulation material, either as a complete or partial cavity fill, where the insulating material is the subject of a current certificate issued under the relevant conditions of an independent testing body. The walls should be *constructed* in accordance with the terms of the certificate and to suit the degree of exposure to wind and rain as described in BS 8104: 1992 and the relevant recommendations of the following British Standards:

Cavity wall insulation

Materials or conditions	British Standards
Urea formaldehyde (UF) foam	BS 5617: 1985 and BS 5618: 1985
Man-made mineral fibre (slabs)	BS 6676: Parts 1: 1986
Assessment of walls for filling	BS 8208: Part 1: 1985

- roofs with copper, lead, zinc and other sheet metal roof coverings require provision for expansion and contraction of the sheet material. In 'warm deck' roofs, in order to reduce the risk of condensation and corrosion, it may be necessary to provide a ventilated air space on the cold side of the insulation and a high performance vapour control layer between the insulation and the roof structure. It may also be helpful to consult the relevant trade association.

- walls or roofs incorporating cladding materials *constructed* in accordance with the recommendations of the following British Standards or Codes of Practice:

Wall and roof cladding materials

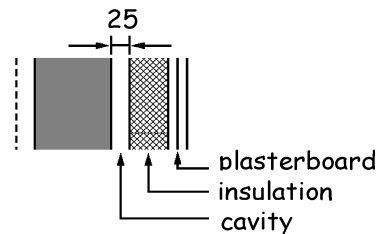
Materials and conditions	Element	British Standards and Codes of Practice
Aluminium	wall or roof	CP 143: Part 15: 1973 (1986)
Galv. corrugated steel	wall or roof	CP 143: Part 10: 1973
Lead	wall or roof	BS 6915: 2001
Copper	wall or roof	CP 143: Part 12: 1970 (1988)
Slates and tiles	wall or roof	BS 5534: Part 1: 2003
Zinc	wall or roof	CP 143: Part 5: 1964
Non-loadbearing walls	wall or steep roof	BS 8200: 1985
PC concrete cladding	wall	BS 8297: 2000
Natural stone cladding	wall	BS 8298: 1994
<i>Flat roofs</i>	roof	BS 6229: 2003
Bitumen felt	roof	BS 8217: 2005
Mastic asphalt	roof	BS 8218: 1998

3.10.2 Wall constructions (solid, masonry)

The following sketches provide guidance on recommended methods of *construction* to prevent rain penetration to the inner surfaces of the *building*. The thickness and other dimensions quoted are the minimum recommended unless otherwise stated. Greater figures are therefore possible.

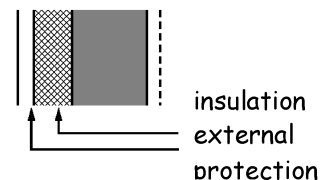
Wall type A
(solid wall with internal insulation)

Solid wall, 200 mm thick of bricks, blocks or slabs of clay, calcium silicate, concrete or cast stone. Wall rendered or unrendered externally. Insulation and plasterboard internally, with a cavity 25 mm wide.



Wall type B
(solid wall with external insulation)

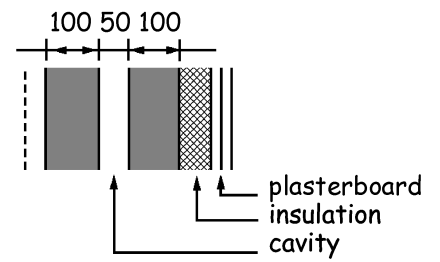
Solid wall as A above. Insulation applied to the external surface of the wall; protected externally either by cladding (of sheets, tiles or boarding) with *permanent ventilation*, or by rendering. Wall with or without an internal surface finish of plaster or plasterboard.



3.10.3 Wall constructions (cavity, masonry)

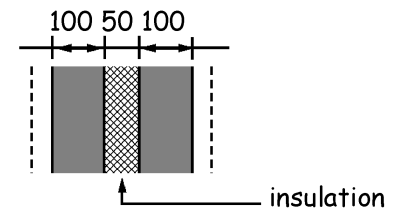
Wall type A
(cavity wall with internal insulation)

Cavity wall of 2 leaves of masonry separated by a 50 mm cavity; each leaf, 100 mm thick, of either bricks or blocks of clay, calcium silicate or concrete. Wall rendered or unrendered externally. Insulation applied as a lining to the internal surface of the wall and plasterboard.



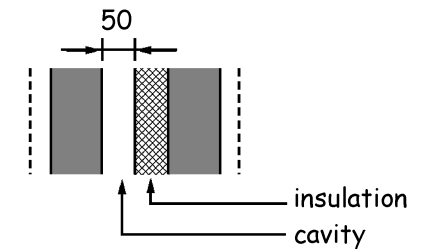
Wall type B
(cavity wall with cavity fill insulation)

Cavity wall as A above. Wall rendered or unrendered externally. Insulation applied as a cavity fill. Wall with or without an internal surface finish of plaster or plasterboard. This construction is only recommended for sheltered conditions.



Wall type C
(cavity wall with partial fill insulation)

Cavity wall as A above. Wall rendered or unrendered externally. Insulation applied to either leaf as a partial cavity fill so as to preserve a residual space of 50 mm wide. Wall with or without an internal surface finish of plaster or plasterboard.



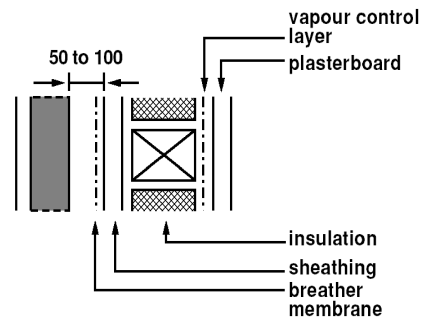
3.10.4 Conservatories and extensions

Careful consideration should be given to the detailing of an existing wall of a *building* when a *conservatory* or extension is added. The outer leaf of a previously *external wall* will become an internal wall and any moisture that enters the cavity could collect and cause serious damage to the *building*. Where the *dwelling* is located in an exposed location or where the existing *construction* might allow the passage of rain either through facing brick or a poorly rendered masonry wall, the use of a cavity tray along the line of the roof of the *conservatory* or extension may be appropriate. However in sheltered situations or where the detailing can prevent damage to the *building* as a result of rain penetration a ragged flashing (chased into the wall) may be sufficient.

3.10.5 Wall constructions (framed)

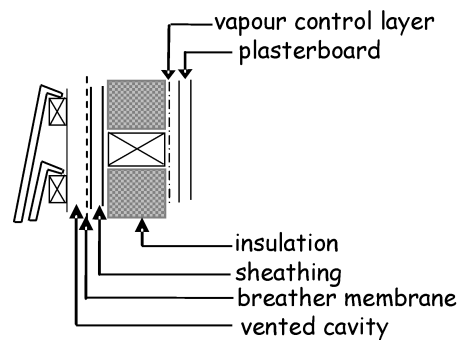
Wall type A
(masonry cladding)

Framed wall of timber studs and dwangs, with a vapour permeable sheathing to the framing covered with a breather membrane. Masonry external cladding of 100 mm thick clay brick or block, concrete or calcium silicate brick or block, dense in-situ concrete, lightweight concrete or autoclaved aerated concrete, with an externally ventilated cavity in accordance with the guidance in clause 3.10.6. Masonry cladding rendered or unrendered externally. Insulation applied as an infill to the framing. The framing lined internally with a vapour control layer and plasterboard.



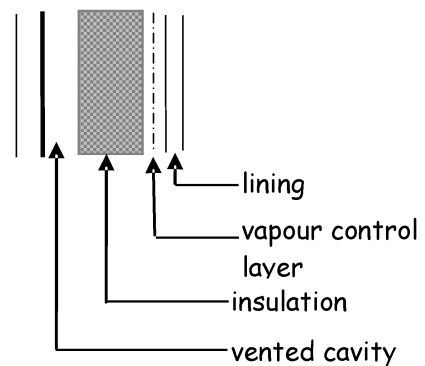
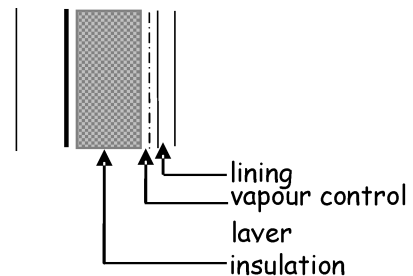
Wall type B
(weatherboarding, tile or slate cladding)

Framed wall of timber studs and dwangs with a breather membrane. Cladding material, on battens and counter battens as required, of timber weather boarding, tile or slate. Insulation and internal lining as A above.



Wall type C
(sheet or panel cladding with/without ventilated cavity)

Framed wall of timber or metal studs and dwangs. Sheet or panel cladding material of fibre cement, plastic, metal, GRP or GRC. Insulation applied either to the internal face of the framing with *permanent ventilation* behind any impervious cladding, or as an infill to the framing; in either case the wall lined internally with a vapour control layer and a lining.



3.10.6 Ventilation of wall cavities

Ventilation of *external wall* cavities is necessary to prevent the build-up of excessive moisture that could damage the fabric of a *building*. Ventilation holes can also be used to drain excess water from the cavity that has entered through the outer leaf.

Timber frame

Interstitial condensation is one of the major problems that need to be addressed in timber framed *buildings*. To reduce the amount of interstitial condensation to a level that will not harm the timber frame or sheathing, a cavity of at least 50 mm wide should be provided between the sheathing and the cladding. Where timber, slate or tile cladding is used, the width of the cavity should be measured between the sheathing and the inner face of the cladding, ignoring the battens and counter battens.

Where the outer leaf is of timber, slate or tile clad *construction*, a vented cavity should be provided. A ventilated cavity should be provided for extra protection in severely exposed areas. Where necessary refer to BS 8104: 1992. Due to the air gaps inherent between the components of a timber, slate or tile clad wall, no proprietary *ventilators* should be necessary and a 10 mm free air space should be sufficient.

Cavity barriers

Where the wall cavity is sub-divided into sections by the use of *cavity barriers* e.g. at mid-floor level in a 2 storey house, the *ventilators* should be provided to the top and bottom of each section of the cavity. Care should be taken with rendered walls to prevent blockage of the *ventilators*.

Masonry outer leaf

Where the outer leaf is of masonry *construction*, venting of the cavity is normally sufficient. Cavities should be vented to the outside air by installing *ventilators* with at least 300 mm² free opening area at 1.2 m maximum centres. Precipitation can penetrate the outer leaf of an external wall and cavities are normally drained through weep holes. These weep holes can also provide the necessary venting.

3.10.7 Roof constructions (flat)

The following sketches provide guidance on recommended methods of *construction* to prevent rain penetration to the inner surfaces of a *building*.

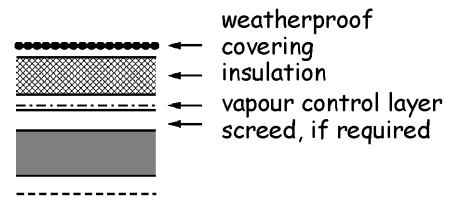
There is evidence to suggest that condensation in cold deck *flat roofs* is a problem and should be avoided. Both the warm deck and warm deck inverted roof *constructions*, where the insulation is placed above the roof deck, are considered preferable. Further guidance is given to standard 3.15, Condensation.

The following British Standards give recommendations on the design and *construction of flat roofs*:

- BS 6229: 2003 – CoP for *flat roofs* with continuously supported coverings
- BS 6915: 2001 – CoP Design and construction of fully supported lead sheet roof and wall cladding
- BS 8217: 2005 – CoP for reinforced bitumen membranes
- BS 8218: 1998 – CoP for mastic asphalt roofing
- CP 143 - 12: 1970 – CoP for sheet and wall coverings

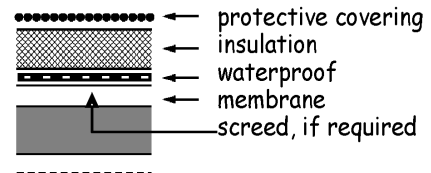
Roof type A
(concrete – warm roof)

Flat roof structure of in-situ or precast concrete with or without a screed; with or without a ceiling or soffit. External weatherproof covering; with insulation laid on a vapour control layer between the roof structure and the weatherproof covering. [Note 1]



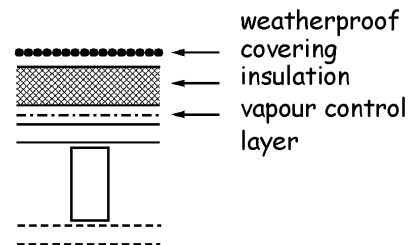
Roof type B
(concrete – inverted roof)

Flat roof structure as A above. External protective covering; with low permeability insulation laid on a waterproof membrane between the roof structure and the external covering.



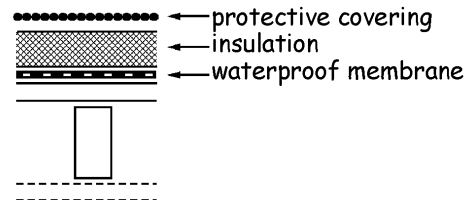
Roof type C
(timber or metal frame – warm roof)

Flat roof structure of timber or metal-framed construction with a board decking 19 mm thick; with or without a ceiling or soffit. External weatherproof covering, insulation and vapour control layer as A above. [Note 1]



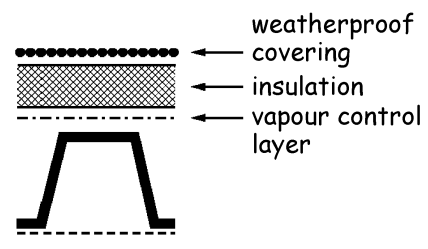
Roof type D
(timber or metal frame – inverted roof)

Flat roof structure as C above. External protective covering, insulation and waterproof membrane as B above.



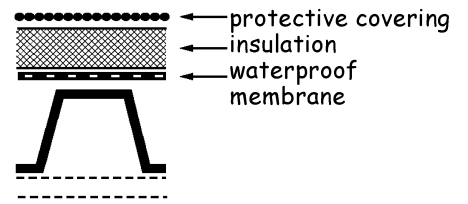
Roof type E
(troughed metal decking – warm roof)

Flat roof structure of timber or metal framed construction with a troughed metal decking; with or without a ceiling or soffit. External weatherproof covering and insulation and vapour control layer as A above. [Note 1]



Roof type F
(troughed metal decking – inverted roof)

Flat roof structure as E above. External protective covering, insulation and waterproof membrane as B above.



Note 1

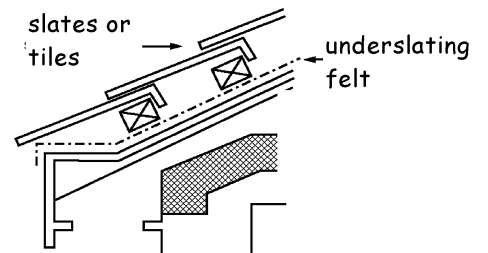
Roof types A, C and E are not suitable for sheet metal coverings that require joints to allow for thermal movement. See also sub-clause f of clause 3.10.1.

3.10.8 Roof constructions (pitched)

BS 5534: 2003 gives recommendations on the design, materials, installation and performance of slates, tiles and shingles including, amongst others, information on rain and wind resistance. The British Standard also provides a comprehensive list of other British Standards covering other less common pitched roof coverings.

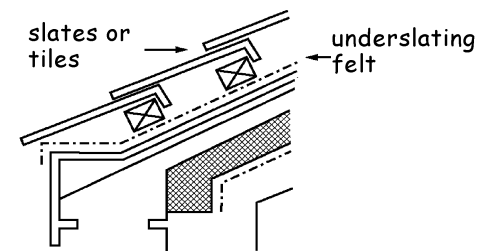
Roof type A
(slates or tiles – insulation on a level ceiling)

Pitched roof structure of timber or metal framed *construction*. External weatherproof covering of slates or tiles on under slating felt with or without boards or battens.



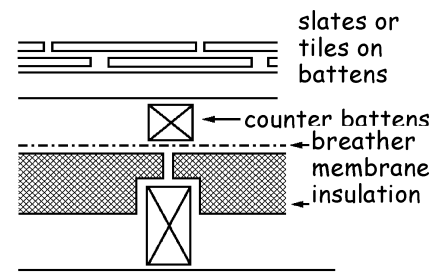
Roof type B
(slates or tiles – insulation on a sloping ceiling)

Pitched roof structure as A above. External weatherproof covering as A.



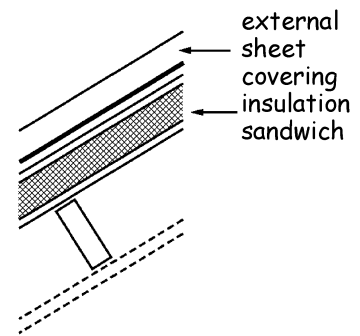
Roof type C
(slates or tiles – insulation as decking)

Pitched roof structure as A above with a decking of low permeability insulation fitted to and between the roof framing. External weatherproof covering of slates or tiles, with tiling battens and counter battens (located over roof framing), and a breather membrane laid on the insulation decking; with a sloping ceiling.



Roof type D
(metal or fibre cement
sheet – sandwich
insulation)

Pitched roof structure as A above.
External weatherproof covering of
metal or fibre cement sheet
sandwich *construction* laid on
purlins; with insulation sandwiched
between the external and soffit
sheeting; and with or without a
ceiling. [Note 2]



Note 2

Roof type D is not suitable for sheet metal coverings that require joints to allow for thermal movement. See also sub-clause f of clause 3.10.1.

3.11 Facilities in dwellings

- 3.11 Functional standard
- 3.11.0 Introduction
- 3.11.1 Apartments
- 3.11.2 Enhanced apartment
- 3.11.3 Kitchens
- 3.11.4 Height of activity spaces
- 3.11.5 Alterations and extensions
- 3.11.6 Drying of washing

<p style="text-align: center;">standard</p> <p style="font-size: 2em; font-weight: bold; text-align: center;">3.11</p> <p style="text-align: center;">mandatory</p>	<p>Every <i>building</i> must be designed and <i>constructed</i> in such a way that:</p> <p>(a) the size of any <i>apartment</i> or <i>kitchen</i> will ensure the welfare and convenience of all occupants and visitors; and</p> <p>(b) an accessible space is provided to allow for the safe, convenient and sustainable drying of washing.</p> <p>Limitation: This standard applies only to a <i>dwelling</i>.</p>
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3.11.0 Introduction

Guidance on design of *dwellings* recommends that the size of individual *rooms* should be dictated by the way a *room* should function and the activities that are to be accommodated rather than by arbitrary rule of thumb areas. This design philosophy was included in a report by Sir Parker Morris in the 1960s and is still relevant today.

Liveability

Extending standards to address 'liveability' and the needs of occupants supports the Scottish Executive's aim of promoting a more inclusive *built* environment and will better address the changing needs of occupants over time. This approach to the design of *dwellings* ensures that Scotland's *housing* stock can respond to the needs of our population, now and in the future.

The provision, on one level, of an enhanced *apartment*, and *kitchen* under this standard, together with accessible *sanitary accommodation* (standard 3.12) and improvement to circulation spaces (standard 4.2) will assist in creating more sustainable homes.

The guidance in this standard and standard 3.12, together with the guidance in section 4, Safety relating to accessibility, has been based around, and developed from, issues that are included in 'Housing for Varying Needs' and the Lifetime Homes concept developed by the Joseph Rowntree Foundation.

Drying of washing

From 1963 to 1986 the *building* regulations included a requirement for the provision of drying facilities. This was removed in response to increased ownership of specialised appliances and the vandalism of common drying areas in blocks of flats. The re-introduction of space to allow washing to be dried other than by a tumble drier is intended to encourage the use of more sustainable methods and thereby reduce carbon dioxide emissions.

Recycling

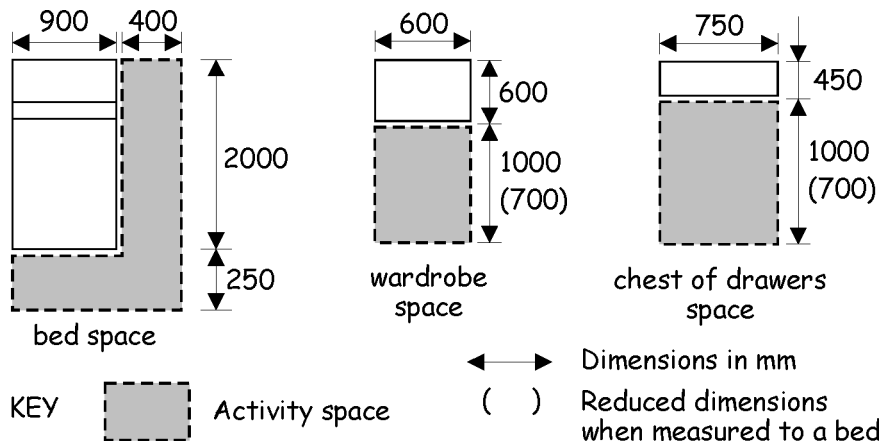
Designers should be aware of local authority initiatives on the recycling of solid waste and useful cross-references are provided in the guidance to standard 3.25, Solid waste storage. Such initiatives may affect storage provision in a *dwelling*.

Conversions

In the case of conversions, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

3.11.1 Apartments

Every *apartment* should be of a size that will accommodate at least a bed, a wardrobe and a chest of drawers, this being the minimum furniture provision that may be expected in such a *room*. Associated activity spaces for each item of furniture should be shown as in the diagram below. A door swing may open across an activity space.



Notes:

1. Activity spaces for furniture may overlap
2. A built-in wardrobe space of equal size may be provided as an option to a wardrobe.

3.11.2 Enhanced apartment

Smaller *apartments* or those with an unusual shape may limit how space within can be used. Where all *apartments* within a *dwelling* are designed in this way, this will present problems for occupants, particularly if affecting the main living spaces.

Therefore, at least one *apartment* on the principal living level of a *dwelling* should be of a size and form that allows greater flexibility of use. This enhanced *apartment* should:

- have a floor area of at least 12 m² and a length and width at least 3.0 m. This area should exclude any space less than 1.8 m in height and any portion of the *room* designated as a kitchen; and
- contain a unobstructed manoeuvring space of at least a 1.5 m by 1.5 m square or an ellipse of at least 1.4 m by 1.8 m, which may overlap with activity spaces recommended in clause 3.11.1. A door may open over this space; and
- have unobstructed access, at least 800 mm wide, to the controls of any openable window or any heating appliance and between doors within the *apartment*.

3.11.3 Kitchens

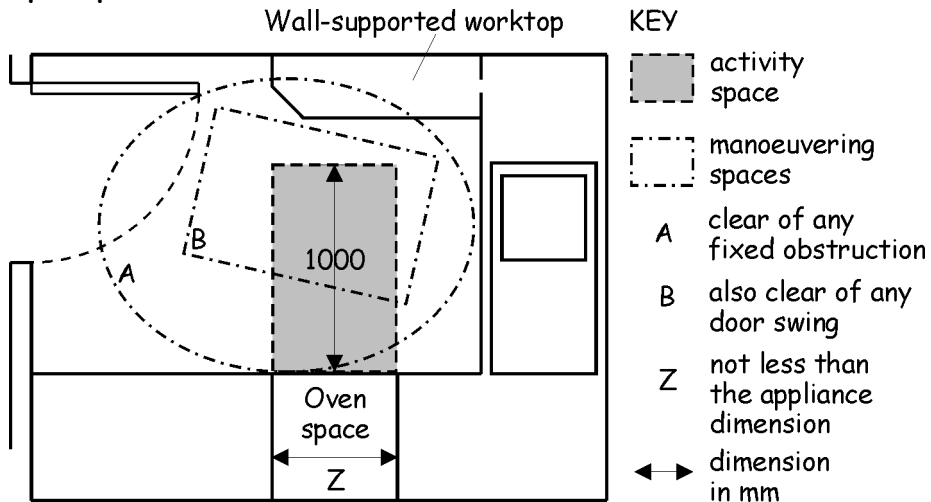
A *dwelling* should have a *kitchen* and, to be accessible, this should be on the principal living level. Space should be provided within the *kitchen* to both assist in use by a person with mobility impairment and offer flexibility in future alteration.

The layout should include an unobstructed manoeuvring space of at least a 1.5 m by 1.5 m square or an ellipse of 1.4 m by 1.8 m. A door may open across this manoeuvring space but a clear space of at least 1.1 m long by

800 mm wide, oriented in the direction of entry into the *room*, should remain unobstructed, to allow an occupant to enter and close the door.

A wall-supported worktop or similar obstruction, the underside of which is at least 750 mm above floor level, may overlap the manoeuvring space by not more than 300 mm.

Space provision within a kitchen



Where a *kitchen* is within the same *room* as an *apartment*, the area of the *kitchen* should be defined by a rectangle enclosing any floor-standing units, appliances and worktops. In such cases, manoeuvring space for the *kitchen* may project into the *apartment* but should not overlap with the separate manoeuvring space of an enhanced *apartment*.

A *kitchen* should be provided with space for a gas, electric or oil cooker or with a solid fuel cooker designed for continuous burning. The space should accommodate such piping, cables or other apparatus as will allow the appliance to operate. A cooker should have an activity space to allow access to, and safe use of, an oven, as shown in the diagram above. An activity space need not be provided in front of a hob or microwave oven.

Kitchen storage of at least 1 m³ should be provided either within or adjacent to the *kitchen*. Additional storage may be required depending on the local authority's recycling policy.

3.11.4 Height of activity spaces

Reduced headroom, such as beneath a sloping ceiling, can cause problems in use of both facilities and furniture, particularly if a person has difficulty in bending or has a visual impairment.

Activity spaces within the enhanced *apartment* or *kitchen* should therefore have an unobstructed height of at least 1.8 m.

3.11.5 Alterations and extensions

Where *works* to alter or extend are proposed, physical constraints in the size of an extension or the form of an existing *building* may mean that meeting recommendations in guidance is not always possible. Accordingly:

- where alteration or extension of a *building* includes *work* to, or provision of a new, *apartment* on the principal living level of the dwelling, and there is not already an enhanced *apartment* on that level, guidance in clause 3.11.2 should be met as far as is *reasonably* practicable;

- where altering an existing kitchen, guidance on manoeuvring space given in clause 3.11.3 should be met as far as is *reasonably* practicable.

3.11.6 Drying of washing

Drying washing indoors can produce large amounts of water vapour that needs to be removed before it can damage the *building* fabric or generate mould growth that can be a risk to the health of occupants. The tendency to build 'tighter' *buildings* could increase these risks by trapping the moisture in the building. Providing dedicated drying areas either outside or inside the *dwelling* should discourage householders from using non-sustainable methods of drying washing and should encourage the adoption of alternative practices that limit the production of greenhouse gases and the depletion of material resources.

Outdoor drying space

Drying washing outside will avoid the problems of high relative humidity in the home and where it is reasonably practicable, an accessible space for the drying of washing should be provided for every *house* on ground immediately adjacent to, and in the same occupation as, the *house*. The area provided should allow space for at least 1.7 m of clothes line per *apartment*.

Indoor drying space

Since weather is unreliable in Scotland, a designated space for the drying of washing should be provided in every dwelling, in addition to the external space.

The designated space may be either:

- capable of allowing a wall mounted appliance which may, for example be fixed over a bath; or
- capable of allowing a ceiling-mounted pulley arrangement; or
- a floor space in the *dwelling* on which to set out a clothes horse.

The designated space should have a volume of at least 1 m³ and should have no dimension less than 700 mm. The designated space should allow space for at least 1.7 m of clothes line per *apartment*.

The location of the designated space should not restrict access to any other area or appliance within the *dwelling* nor obstruct the swing of any door.

Guidance to standard 3.14 provides information on the ventilation of indoor spaces designated for the drying of washing.

3.12 Sanitary facilities

- 3.12 Functional standard
- 3.12.0 Introduction
- 3.12.1 Sanitary provision
- 3.12.2 Waterless closets
- 3.12.3 Accessible sanitary accommodation
- 3.12.4 Access to sanitary accommodation
- 3.12.5 Alteration and extensions

standard

3.12

mandatory

Every *building* must be designed and *constructed* in such a way that *sanitary facilities* are provided for all occupants of, and visitors to, the *building* in a form that allows convenience of use and that there is no threat to the health and safety of occupants or visitors.

3.12.0 Introduction

Sanitary accommodation that is more immediately accessible and offers both adaptability and flexibility of layout gives a more sustainable solution that will simplify modifications to the design and layout of *dwellings*, helping to reduce cost and disruption and better enabling people to remain in their home as their circumstances change.

Although not recommending that *sanitary facilities* on the principal living level of a *dwelling* be designed to an optimum standard for wheelchair users, it should be possible for most people to use these facilities unassisted and in privacy.

Extending standards to address 'liveability' and the needs of occupants supports the Scottish Executive's aim of promoting a more inclusive built environment and will better address the changing needs of occupants over time. This approach to the design of *dwellings* ensures that Scotland's *housing* stock can respond to the needs of our population, now and in the future.

The guidance in this standard and standard 3.11, together with the guidance in section 4, Safety relating to accessibility, has been based around, and developed from, issues that are included in 'Housing for Varying Needs' and the Lifetime Homes concept developed by the Joseph Rowntree Foundation.

The provision, on one level, of accessible *sanitary accommodation* under this standard, together with an enhanced *apartment*, and *kitchen* (standard 3.11) and improvement to circulation spaces (standard 4.2) will assist in creating more sustainable homes.

Lead in water

www.scottishwater.co.uk
www.snipef.co.uk

The human body absorbs lead easily from drinking water and this can have a negative effect on the intellectual development of young children. Although mains water supplies do not contain significant levels of lead, recent research studies have shown that leaded solder plumbing fittings, normally used for heating systems, have been used on drinking water pipework in contravention of the Scottish Water Byelaws 2004. Further guidance can be obtained from Scotland and Northern Ireland Plumbing Employers Federation (SNIPEF) and Scottish Water.

Conversions

In the case of conversions, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

3.12.1 Sanitary provision

Every *dwelling* should have *sanitary facilities* comprising at least 1 watercloset (WC), or waterless closet, together with 1 wash hand basin per WC, or waterless closet, 1 bath or shower and 1 sink. It is normal for the sink to be located in a kitchen.

To allow for basic hygiene, a wash hand basin should always be close to a WC or waterless closet, either within a *toilet*, or located in an adjacent space providing the sole means of access to the *toilet*.

There should be a door separating a space containing a WC, or waterless closet, from a *room* or space used for the preparation or consumption of food, such as a *kitchen* or dining *room*.

3.12.2 Waterless closets

If a waterless closet is installed it should be to a safe and hygienic design such as:

- a. National Sanitation Foundation Certification to Standard NSF 41: 'wastewater recycling/reuse and water conservation devices'; or
- b. NFS International Standard NSF/ANSI 41-1999: 'non-liquid saturated treatment systems'; or
- c. to the conditions of a certification by a *notified* body.

Although some European countries manufacture waterless closets, they have not as yet been tested to any recognised standard. This does not mean that they are unacceptable, just that care should be taken in their choice to ensure they are both safe and hygienic in use.

3.12.3 Accessible sanitary accommodation

Bathrooms and *toilets* designed to minimum space standards can often create difficulties in use. As the ability of occupants can vary significantly, *sanitary accommodation* should be both immediately accessible and offer potential for simple alteration in the future.

A *dwelling* should have at least 1 accessible WC, or waterless closet, and wash hand basin and at least 1 accessible shower or bath.

These *sanitary facilities* should be located on the principal living level of a *dwelling* and be of a size and form that allows unassisted use, in privacy, by almost any occupant. This should include use by a person with mobility impairment or who uses a wheelchair, albeit with limited manoeuvring space within the *sanitary* accommodation.

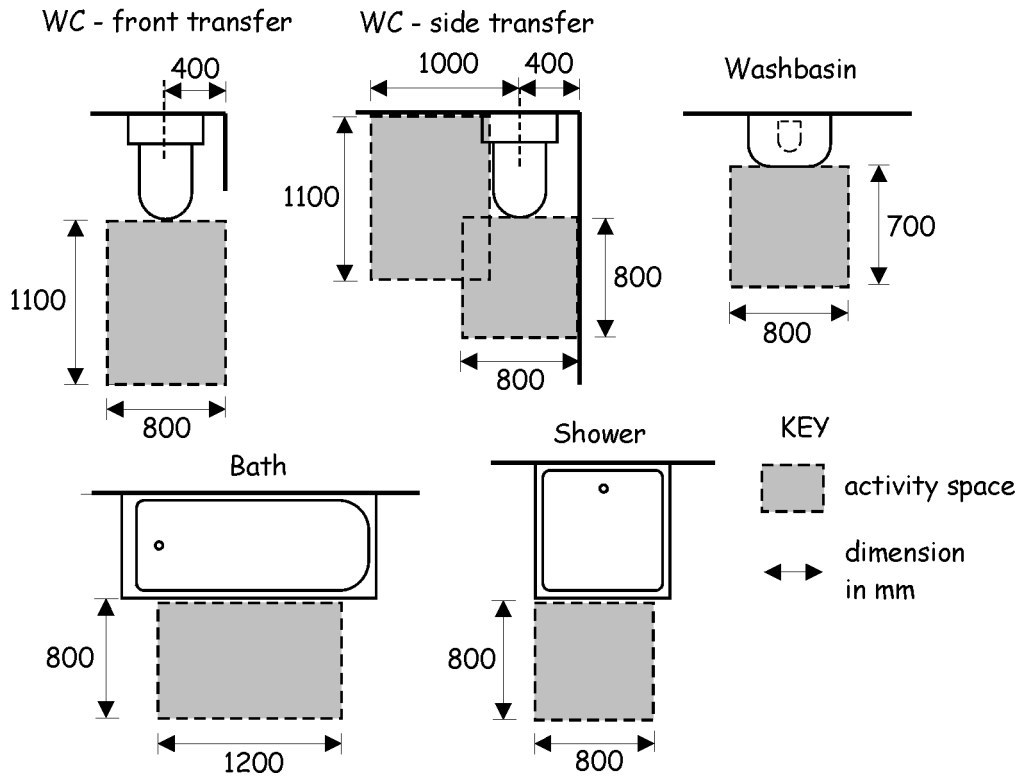
An additional accessible *toilet* may be needed on the entrance level of a *dwelling* where this is not also the principal living level (see clause 4.2.10).

Accessible *sanitary accommodation* should have:

- a manoeuvring space that will allow a person to enter and close the door behind them. This should be at least 1.1 m long by 800 mm wide, oriented in the direction of entry, and clear of any door swing or other obstruction; and
- except where reduced by projection of a wash hand basin, unobstructed access at least 800 mm wide to each *sanitary* facility; and
- an activity space for each *sanitary* facility, as noted in the diagram below. These may overlap with each other and with the manoeuvring space noted above. A door may open over an activity space; and

- an unobstructed height above each activity space and above any bath or shower of at least 1.8 m above floor level; and
- walls adjacent to any *sanitary facility* that are of robust *construction* that will permit secure fixing of grab rails or other aids; and
- where incorporating a WC, space for at least one recognised form of unassisted transfer from a wheelchair to the WC.

Activity spaces for accessible sanitary facilities



Notes:

1. Though commonly as shown, the activity space in front of a WC need not be parallel with the axis of the WC.
2. Where allowing side transfer, a small wall-hung wash hand basin may project up to 300 mm into the activity space in front of the WC.
3. The projecting rim of a wash hand basin may reduce the width of a route to another sanitary facility to not less than 700 mm.
4. A hand-rinse basin should only be installed within a *toilet* and only if there is a full-size wash hand basin elsewhere in the *dwelling*.

Accessible bathroom

An accessible bathroom should be of a size that will accommodate a 1.7 m x 700 mm bath (or equivalent). The activity space in front of a bath may be at any position along its length. Within an accessible bathroom, it should be possible to replace the bath with an accessible shower without adversely affecting access to other *sanitary facilities*.

Accessible shower room

An accessible shower room should be of a size that will accommodate either a level-access floor shower with a drained area of not less than 1.0 m x 1.0 m (or equivalent) or a 900 mm x 900 mm shower tray (or equivalent). The drained area of a level-access floor shower may overlap with activity or manoeuvring spaces where access to other *sanitary facilities* is not across the drained area.

Alternative - space for future shower

Where a *dwelling* has a bathroom or shower *room* on another level, which is not en suite to a bedroom, some occupants may not require the immediate provision for bathing on the principal living level. Where this is the case, the principal living level may instead have a separate, enclosed space of a size that, alone or by incorporation with the accessible *toilet*, will permit formation of an accessible shower *room* (as described above) at a future date. This space can, instead, offer useful storage space.

This space should have a drainage connection, positioned to allow installation of either a floor shower or raised shower tray, sealed and terminated either immediately beneath floor level under a removable access panel or at floor level in a visible position. The structure and insulation of the floor in the area identified for a future floor shower should allow for the depth of an inset tray installation (all floors) and a 'laid to fall' installation (solid floors only). If not adjacent to an accessible *toilet* and separated by an easily demountable partition, a *duct* to the external air should be provided to allow for later installation of mechanical ventilation.

3.12.4 Access to sanitary accommodation

Where an *apartment* is intended for use solely as a bedroom, it is considered a private space. To ensure that privacy can be maintained, the only accessible *sanitary accommodation* in a *dwelling* should not be en suite, reached through such an *apartment*.

3.12.5 Alteration and extensions

Additional *sanitary facilities*

Additional *sanitary facilities* need not be provided as part of an extension to, or alteration of, a *dwelling*. However an additional accessible *toilet* may be needed under the circumstances set out in clause 4.2.10, if one does not exist on the entrance level of a *dwelling*.

New *sanitary facilities*

If it is intended to install a new *sanitary facility* on the principal living level or entrance *storey* of a *dwelling* and there is not already an accessible *sanitary facility* of that type within the *dwelling*, the first new facility should be in accordance with the guidance given in clauses 3.12.3 and 3.12.4.

In the case of alterations within an existing *dwelling*, the new *sanitary facility* should be in accordance with guidance given in clause 3.12.3 as far as is *reasonably practicable*. This recognises that it may not always be possible, within the confines of an existing *building*, for accessible *sanitary facility* to be in accordance with guidance and that the provision of a facility that is usable by most occupants will still improve amenity.

Alteration of existing facilities

If altering existing *sanitary accommodation* on the principal living level or entrance *storey* of a *dwelling* which meets the guidance in clause 3.12.3 or the previous guidance for an accessible *toilet* (see below), any changes should at least maintain the level of compliance present before alterations.

Existing *sanitary accommodation* which meets the guidance in clause 3.12.3 or the previous guidance for an accessible *toilet* (see below) should only be removed or relocated where facilities at least equivalent to those removed will still be present within the *dwelling*.

Removal of existing facilities

A *sanitary facility* that is not an accessible facility may be altered or removed where the minimum provision for a *dwelling*, set out in clause 3.12.1, is maintained.

Accessibility of existing facilities

However where activity spaces for existing *sanitary facilities* come close to meeting either the current recommendations in clause 3.12.3 or the previous guidance for an accessible *toilet*, they will still offer greater amenity to a wide range of people and should be treated in the same way as accessible *sanitary facilities* when considering altering or relocating as noted above.

The previous guidance for an accessible *toilet* sought an activity space, clear of any door swing, of 800 mm wide x 750 mm deep in front of, but not necessarily centred on, the WC. A small wall-hung wash hand basin could project into this activity space.

3.13 Heating

- 3.13 Functional standard
- 3.13.0 Introduction
- 3.13.1 Heating recommendations
- 3.13.2 Alternative heating systems

standard

3.13

mandatory

Every *building* must be designed and *constructed* in such a way that it can be heated and maintain temperatures at a level that will not endanger the health of the occupants.

Limitation:

This standard applies only to a *dwelling*.

3.13.0 Introduction

Heating in a *building* is necessary to provide suitable conditions in which to live. Heating, ventilation and thermal insulation should be considered as part of a total design that takes into account all heat gains and losses. Failure to do so can lead to inadequate internal conditions, e.g. condensation and mould and the inefficient use of energy due to overheating.

Whole *house* 'central heating' is now almost universal, particularly in new *buildings* and is regarded as almost essential in combating problems such as condensation and mould growth.

Normal activities within a *dwelling* add both heat and water vapour to the air. If the heating maintains comfort levels in the whole at all times, condensation problems will be minimised, but costs will be high. A reasonable compromise needs to be given to heating and ventilation to reduce the possibility of such problems and guidance is provided for both these issues in this sub-section. Section 6, Energy, provides guidance on the third issue, thermal insulation.

This guidance covers *dwellings* only as the heating of *buildings* other than *dwellings* is covered by the Workplace (Health, Safety and Welfare) Regulations.

Conversions

In the case of conversions, as specified in regulation 4, the *building* as converted shall meet the requirement of this standard (regulation 12, schedule 6).

3.13.1 Heating recommendations

The layout of a *dwelling*, the size and orientation of the windows, the thermal mass, level of insulation, airtightness, and ventilation can have a significant affect on the demand for heat. The performance of a heating system will also have a major affect on energy efficiency. Section 6, Energy provides guidance on these issues.

Heating a *dwelling* will normally be tailored to personal comfort taking cost into consideration. However in addition to comfort, the heating should reflect the combined effects of occupancy pattern, ventilation provision, *building* mass and insulation to reduce the possibility of producing excess condensation that might damage the *building* fabric.

Every *dwelling* should have some form of fixed heating system, or alternative that is capable of maintaining a temperature of 21° C in at least 1 *apartment* and 18° C elsewhere, when the outside temperature is minus 1° C.

There is no need to maintain these temperatures in storage *rooms* with a floor area of not more than 4 m².

3.13.2 Alternative heating systems

Alternative heating systems may involve a holistic design approach to the *dwelling* and can include the use of natural sources of available energy such as the sun, wind and the geothermal capacity of the earth. Passive design, such as use of the orientation of *glazing* for solar gain and of the *building* mass to store heat with controlled heat release may only need minor supplementation from a lower output fixed heating system. Active heating systems, such as heat pumps that extract heat from ground, air, water or geo-thermal sources, can limit emissions of carbon dioxide and reduce the use of fossil fuels. Complementary systems can also be used, to heat water using solar energy or generate electricity using solar or wind power.

Elderly and infirm

Where there are elderly or infirm occupants in a *dwelling* the capability of the heating system to maintain an *apartment* at a temperature higher than 21° C is a sensible precaution. Since it is not possible to determine the occupants at design stage the heating system should be designed with the capability of being easily upgraded at a later date.

Upgrade

If an existing heating system is to be upgraded to provide higher temperatures the boiler size may not need to be replaced, provided it was correctly sized originally. The upgrading may necessitate the replacement of some pipes and radiator in one or two *rooms* and accessibility will need to be considered. Such modification could result in a small increase in the recovery time of the hot water supply for bathing and washing.

3.14 Ventilation

- 3.14 Functional standard
- 3.14.0 Introduction
- 3.14.1 Ventilation generally
- 3.14.2 Ventilation of dwellings
- 3.14.3 Ventilation of conservatories
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standard
3.14
mandatory

Every *building* must be designed and *constructed* in such a way that ventilation is provided so that the air quality inside the *building* is not a threat to the *building* or the health of the occupants.

3.14.0 Introduction

Ventilation of a *dwelling* is required to maintain air quality and so contribute to the health and comfort of the occupants. Without ventilation it is possible that carbon dioxide, water vapour, organic impurities, smoking, fumes and gases could reduce the air quality by humidity, dust and odours and also reduce the percentage of oxygen in the air to make the *building* less comfortable to *work* or live in.

Well designed natural ventilation has many benefits, not least financial and environmental, although it is also recognised that inside air quality can only be as good as outside air quality and in some cases filtration may be necessary. In other cases mechanical systems or systems that combine natural with mechanical (hybrid) may provide the ventilation solution for the *building*.

Ventilation can also have a significant affect on energy consumption and performance and so thorough assessment of natural, as against mechanical ventilation, should be made, as the decision could significantly affect the energy efficiency of the *building* (see section 6, Energy).

Ventilation should not adversely affect comfort and, where necessary, designers might wish to consider security issues and protection against rain penetration prevalent in naturally ventilated *buildings* when windows are partially open to provide background ventilation.

Reducing air infiltration

Improved insulation and ‘tighter’ *construction* of *buildings* will reduce the number of natural air changes but can increase the risk of condensation. However leaky *buildings* are draughty and uncomfortable. Sealing up air leaks improves comfort and saves energy whilst proper ventilation keeps the indoor air pleasant and healthy. If poor attention to detail occurs air leakage can account for a substantial part of the heating costs. Energy savings from *building* ‘tighter’ could make significant savings on energy bills. There is a common perception that ‘tight’ *construction* promotes indoor air pollution. However both ‘tight’ and ‘leaky’ *buildings* can have air quality problems. Though air leaks can dilute indoor pollutants, there is no control over how much leakage occurs, when it occurs or where it comes from. BRE GBG 67, ‘Achieving air tightness: General principles’ provides useful guidance on how to *build* new *buildings* tighter.

BR GBG 67

Occupants should have the opportunity to dry washing other than by a tumble dryer which uses a considerable amount of energy. Drying of washing internally can generate large quantities of moisture that should be removed before it damages the *building*.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

3.14.1 Ventilation generally

A *dwelling* should have provision for ventilation by either:

- a. natural means; or
- b. mechanical means; or
- c. a combination of natural and mechanical means (mixed-mode).

Ventilation is the process of supplying outdoor air to an enclosed space and removing stale air from the space. It can manage the indoor air quality by both diluting the indoor air with less contaminated outdoor air and removing the indoor contaminants with the exhaust air. Ventilation should have the capacity to:

- provide outside air to maintain indoor air quality sufficient for human respiration;
- remove excess water vapour from areas where it is produced in sufficient quantities in order to reduce the likelihood of creating conditions that support the germination and growth of mould, harmful bacteria, pathogens and allergies;
- remove pollutants that are a hazard to health from areas where they are produced in significant quantities;
- rapidly dilute pollutant odours, where necessary.

Additional ventilation provision

This guidance relates to the provision of air for human respiration and is in addition to, and should be kept separate from, any air supply needed for the smoke ventilation of *escape routes* in the case of fire (section 2, Fire) and for the safe operation of combustion appliances (see standards 3.21 and 3.22).

Small *rooms*

There is no need to ventilate a *room* with a floor area of not more than 4 m². This is not intended to include a kitchen or utility *room* where ventilation should be in accordance with the recommendations in table to clause 3.14.2.

Ventilation should be to the outside air. However clauses 3.14.5 and 3.14.7 explain where *ventilators* and *trickle ventilators* may be installed other than to the external air.

Calculation of volume

For ventilation purposes, a *storey* should be taken as the total floor area of all floors within that *storey*, including the floor area of any *gallery* or openwork floor. Where an air change rate is recommended, the volume of the space to be ventilated may be required. The volume of any space is the internal cubic capacity of the space. Any volume more than 3 m above any floor level in that space may be disregarded.

3.14.2 Ventilation of dwellings

All *buildings* leak air to a greater or lesser extent. However the movement of uncontrolled infiltrating air through the fabric of a *building* can cause draughts and can have a significant adverse effect on the energy efficiency of the *building* as a whole. By improving *building* techniques, it is possible to reduce this infiltrating air to lower levels that can improve energy efficiency (see section 6, Energy).

Some *building* techniques may have little effect on air leakage and so allow the uncontrolled infiltrating air to be taken into account in the *building's* ventilation provision. By *building* with techniques designed to reduce air leakage there will need to be a reciprocal increase in the designed ventilation provision to make up for the lower levels of infiltrating air.

Recommendations for trickle ventilation in the table below are made on the basis that infiltrating air rates of 5 to 10 m³/h/m² @ 50 Pa will be achieved as a matter of course in modern *dwelling*s. However where the designer intends to use low fabric infiltration air rates of less than 5 m³/h/m² @ 50 Pa in the SAP calculations (see section 6 Energy) the areas of trickle ventilation shown may not suffice to maintain air quality and therefore an alternative ventilation solution should be adopted (see clause 3.14.10).

Recommended ventilation of a dwelling

	Ventilation recommendations	Trickle ventilation [1]
<i>Apartment</i>	A <i>ventilator</i> with an opening area of at least 1/30 th of the floor area it serves.	12,000 mm ²
<i>Kitchen</i>	either: a. mechanical extraction capable of at least 30 l/sec (intermittent) above a hob [3]; or b. mechanical extraction capable of at least 60 l/sec (intermittent) if elsewhere [3]; or c. a passive stack ventilation system [4].	10,000 mm ²
<i>Utility room</i>	either: a. mechanical extraction capable of at least 30 l/sec (intermittent) [3]; or b. a passive stack ventilation system [4].	10,000 mm ²
<i>Bathroom or shower-room (with or without a WC)</i>	either: a. mechanical extraction capable of at least 15 l/sec (intermittent); or b. a passive stack ventilation system [4].	10,000 mm ²
<i>Toilet</i>	either: a. a <i>ventilator</i> with an opening area of at least 1/30 th of the floor area it serves; or b. mechanical extraction capable of at least 3 air changes per hour.	10,000 mm ²

Notes:

1. Where the *trickle ventilator* is *ducted*, the recommended areas in the table should be doubled (see clause 3.14.5).
2. The overall provision of trickle ventilation in a *dwelling* may be provided at an average of 11,000 mm² per *room* with a minimum of 11,000 mm² for each *apartment*.
3. Refer to guidance to standard 3.17 and OFTEC Technical Book 3 where an extract fan is fitted in a *building* containing an *open-flued* combustion appliance. Extract rates should be reduced.
4. Refer to section 2: Fire where a passive stack ventilation system is

installed in a *building* containing *flats and maisonettes*.

5. Long *duct* runs, flexible *ducting* and bends can reduce fan performance and should be carefully considered during design.

Work on existing *buildings*

Where infiltration rates in a *dwelling* exceed $10 \text{ m}^3/\text{h}/\text{m}^2$ @ 50 Pa, which may often be the case in existing *buildings*, the size of *trickle ventilation* may be reduced to 8000 mm^2 for *apartments* and 4000 mm^2 for all other *rooms*. Alternatively, the overall provision of *trickle ventilation* in a *dwelling* may be provided at an average of 6000 mm^2 per *room*, with a minimum provision of 4000 mm^2 in each *apartment*.

Height of *ventilator*

To reduce the effects of stratification of the air in a *room*, some part of the opening *ventilator* should be at least 1.75 m above floor level.

3.14.3 Ventilation of conservatories

With large areas of *glazing*, *conservatories* attract large amounts of the sun's radiation that can create unacceptable heat build-up. Efficient ventilation therefore is very important to ensure a comfortable environment. A *conservatory* should have a *ventilator* or *ventilators* with an opening area of at least $1/5^{\text{th}}$ of the floor area it serves. Although this is the minimum recommended area, a greater area can provide more comfortable conditions particularly in sunny weather. Notwithstanding the recommended opening height of 1.75 m for *ventilators*, high level or roof vents are best placed to minimise the effects of heat build-up and reduce stratification.

3.14.4 Ventilation of areas designated for drying of washing

Where clothes are dried naturally indoors large quantities of moisture can be released and this will need to be removed before it can damage the *building*. Normally a utility *room* or bathroom is used and mechanical extract is the usual method of removing moisture. Where a space other than a utility *room* or bathroom is designated, that space should be provided with either:

- mechanical extraction capable of at least 15 l/s intermittent operation. The fan should be connected through a humidistat set to activate when the relative humidity is between 50 and 65%; or
- a passive stack ventilation system provided in accordance with the recommendations in clause 3.14.6.

Guidance to standard 3.11 gives information on the space recommended for the drying of washing.

3.14.5 Trickle ventilators

A *trickle ventilator*, sometimes called 'background ventilation', is a small ventilation opening, mostly provided in the head of a window frame, but not always, and is normally provided with a controllable shutter. They should be provided in naturally ventilated areas to allow fine control of air movement. The area recommendations in the table to clause 3.14.2 may, in some situations, be difficult to achieve in the window frame and other options may need to be considered. A *permanent ventilator* is not recommended since occupants like control over their environment and uncontrollable *ventilators* are usually permanently sealed up to prevent draughts.

Because *dwelling*s produce so many variables and differing life styles, ventilation of such *buildings* is not an exact science. The recommended areas in the table to clause 3.14.2 therefore are based on the geometric method (actual size of the opening formed in the window frame, in the case of a slot vent) as being a simple method that will satisfy most conditions.

Where the *trickle ventilator* has to be *ducted*, e.g. to an internal *room*, the geometric area of the *trickle ventilator* should be increased to double that shown in the table to clause 3.14.2, to compensate for the reduced air flow caused by friction. This may over-provide ventilation in some cases but can be regulated by the fine control.

Non-proprietary *trickle ventilators*

Fitting proprietary *trickle ventilators* is the preferred method of fine tuning *room* ventilation. However in some cases it may be acceptable for background ventilation to be provided through small windows, such as top hoppers, but other issues need to be considered if this method is to be adopted:

- a partially open window on a night latch is a possible point of forced entry to a *dwelling* even when the window is locked in position and because of this it is less likely to be left open at night or when the *dwelling* is empty, even for short periods. Small, upper floor windows in a well lit, open location that are difficult to access may be appropriate;
- it tends to be windier where *flats* and *maisonettes* are at high level and windows on night latches do not have fine adjustment to reduce draughts. They are therefore more likely to be kept closed;
- manufacturers will need to show that the opening area when on the night latch is to the recommended sizes in the table to clause 3.14.2;
- some windows might be too small to incorporate the recommended size of *trickle ventilator* in the frame and careful thought will need to be given to the design and location of *trickle ventilators* in the window itself or additional *trickle ventilators* through the *external wall*;
- *trickle ventilators* supply replacement air for mechanical extract and passive stack ventilation systems and routes for extracting air provided by mechanical input air systems. It is recommended that proprietary *trickle ventilators* are used in *rooms* where such systems are installed since it is more likely that they, rather than windows, will be left open.

Height of *trickle ventilators*

A *trickle ventilator* should be so positioned that a part of it is at least 1.75 m above floor level. This will allow at least some movement of air within the *dwelling* and reduce stratification.

Although ventilation should normally be to the external air, a *trickle ventilator* serving a bathroom or shower *room* may open into an area that does not generate moisture, such as a bedroom or hallway, provided the area is fitted with a *trickle ventilator* in accordance with the guidance in clause 3.14.2. In these cases, noise transmission may need to be limited, see section 5.

A *trickle ventilator* should be provided in an area fitted with mechanical extraction to provide replacement air and ensure efficient operation when doors are closed. This will prevent moist air being pulled from other 'wet areas'. The *trickle ventilator* should be independent of the mechanical extract so that replacement air can be provided when the extract fan is operating. Consideration should be given to the location of the *ventilator* and the fan so as to prevent short-circuiting of the air.

3.14.6 Passive stack ventilation systems

A passive stack ventilation system uses a *duct* running from a ceiling (normally in a *kitchen* or shower *room*) to a terminal on the roof to remove any moisture-laden air. It operates by a combination of natural stack effect, i.e. the movement of air due to the difference in temperature between inside and outside temperatures and the effect of wind passing over the roof of the *building*.

A passive stack ventilation system should be installed in full compliance with BRE Information Paper BRE IP 13/94. These systems are most suited for use in a *building* with a height of not more than 4 *storeys* (about 8 m maximum length of stack) as the stack effect will diminish as the air cools.

Every passive stack ventilation system should:

- a. incorporate a ceiling mounted automatic humidity sensitive extract grille that will operate when the relative humidity is between 50 and 65%; and
- b. be insulated with at least 25 mm thick material having a thermal conductivity of 0.04 W/mK where it passes through a *roof space* or other unheated space or where it extends above the roof level. This will prevent the walls of the *duct* from becoming too cold thus inhibiting the stack effect and reducing the likelihood of condensation forming inside the *duct*.

The *flue* of an open-*flued* combustion appliance may serve as a passive stack ventilation system provided that either:

- a. the appliance is a solid fuel appliance and is the primary source of heating, cooking or hot water production; or
- b. the *flue* has an unobstructed area equivalent to a 125 mm diameter *duct* and the appliance's combustion air inlet and dilution air inlet are permanently open, i.e. there is a path with no control dampers which could block the flow, or the ventilation path can be left open when the appliance is not in use; or
- c. the appliance is an oil firing appliance which is a continually burning vapourising appliance (only) such as a cooker or *room* heater and the *room* is fitted with a *ventilator* with a minimum free area of 10,000 mm².

Non-combustibility

A *duct* or casing forming a passive stack ventilation system serving a *kitchen* should be *non-combustible*. However this is not necessary where it passes through a *roof space*.

3.14.7 Conservatories and extensions built over existing windows

Constructing a *conservatory* or extension over an existing window, or *ventilator*, will effectively result in an internal *room*, restrict air movement and could significantly reduce natural ventilation to that *room*. Reference should be made to clause 3.16.2 relating to natural lighting, and to the guidance to standards 3.21 and 3.22 on the ventilation of combustion appliances, as this also may be relevant. There are other recommendations in section 2: Fire relating to escape from *inner rooms*.

Conservatories

A *conservatory* may be *constructed* over a *ventilator* serving a *room* in a *dwelling* provided that the ventilation of the *conservatory* is to the outside air and has an opening area of at least 1/30th of the total combined floor area of the internal *room* so formed and the *conservatory*. The *ventilator* to the internal *room* should have an opening area of at least 1/30th of the floor area of the *room*. *Trickle ventilators* should also be provided relevant to the overall areas created.

Extensions

An extension may also be built over a *ventilator* but a new *ventilator* should be provided to the *room*. Where this is not practicable, e.g. where there is no *external wall*, the new extension should be treated as part of the existing *room* rather than the creation of a separate internal *room* because the extension will be more airtight than a *conservatory* and therefore the rate of air change will be compromised. The opening area between the 2 parts of the *room* should be not less than 1/15th of the total combined area of the existing *room* and the extension.

Moisture-producing areas

If the *conservatory* or extension is *constructed* over an area that generates moisture, such as a *kitchen*, bathroom, shower *room* or utility *room*, mechanical extract, via a *duct* if necessary, or a passive stack ventilation system should be provided direct to the outside air. Any existing system disadvantaged by the *work* may require to be altered to ensure supply and extracted air is still to the outside air.

3.14.8 Mechanical ventilation

Where a *dwelling* is mechanically ventilated it should be provided in accordance with the recommendations of Section 3, Requirements of CIBSE Guide B2: 2001, Ventilation and air conditioning.

Mechanical ventilation provided in line with this guidance should be to the outside air but it may be via a *duct* or heat exchanger.

Where a mechanical ventilation system serves more than 1 *dwelling* it should have a duplicate motor and be separate from any other ventilation system installed for any other purpose. Where the mechanical ventilation system gathers extracts into a common *duct* for discharge to an outlet, no connections to the system should be made between any exhaust fan and the outlet. The use of non-return valves is not recommended.

Open-flued appliances

Care should be taken when installing mechanical extract systems where there is an open-flued combustion appliance in the *dwelling*. Further guidance is provided in clause 3.17.8.

3.14.9 Control of legionellosis

An inlet to, and an outlet from, a mechanical ventilation system should be installed such that their positioning avoids the contamination of the air supply to the system. The system should be *constructed* and installed in accordance with the recommendations in Legionnaires' Disease: The control of legionella bacteria in water systems – approved code of practice and guidance - HSE L8, in order to ensure, as far as is *reasonably practicable*, the avoidance of contamination by legionella.

3.14.10 Mechanical ventilation and systems

A mechanical ventilation system should be designed, installed and commissioned to perform in a way that is not detrimental to the health of the occupants of the *building* and when necessary, is easily accessible for regular maintenance. Very few *dwellings* are air-conditioned but the use of continuously operated balanced supply and extract mechanical ventilation systems and of heat recovery units are becoming more popular as a result of the need to conserve energy and reduce greenhouse gas emissions. As *buildings* are *constructed* to lower infiltration rates, mechanical ventilation may be necessary to deliver the effective ventilation needed to provide a healthy living environment.

Simpler and more efficient systems are steadily being introduced that augment, complement and/or improve the natural ventilation of *dwellings*. Where infiltration rates of less than $5 \text{ m}^3/\text{h}/\text{m}^2$ @50 Pa are intended, such a system should be used. The following are examples of mechanical systems that will aid ventilation in a *dwelling*:

MVHR

- a. continuously operating balanced supply and extract mechanical ventilation systems. When combined with heat recovery these installations are known as Mechanical Ventilation and Heat Recovery (MVHR) systems. Installations should be in accordance with the guidance in BRE Digest

398. In hot weather windows can be opened to cool the *dwelling* while the system is operating. Openable windows may also be needed for fire escape purposes;

- b. continuously operating mechanical extract ventilation installed in accordance with the guidance in BRE Digest 398;
- c. mechanical extract ventilation units (extract fans), either window or wall mounted, in *rooms* where there is likely to be high humidity such as *kitchens*, bathrooms and shower *rooms* installed in accordance with the recommendations in clause 3.14.2. Fans can be switched manually or automatically via a humidistat control. Humidistat control is not recommended for *rooms* containing a watercloset as odours may not be removed.

Positive input systems

Mechanical input air ventilation systems have been successfully installed in existing *dwellings* with the objective of overcoming problems of surface condensation and mould growth. They can also improve air quality and remove musty odours. The general principle of *building* tighter to reduce the amount of uncontrolled air movement through the *building* fabric may have a detrimental effect on the operation of input air ventilation systems and therefore they may not be appropriate for installation in new *dwellings*. Further information should be obtained from the product manufacturer.

- In *houses* air is supplied to the hall via a low speed fan unit located in the *roof space* where it is allowed to circulate throughout the *house* before being extracted to the outside normally through the *building* fabric or *trickle ventilators*.
- In *flats* and *maisonettes* the air is drawn direct from the outside through the fan unit before being discharged into the *dwelling*. The air supplied will normally have a lower relative humidity than the air in the *dwelling* thus removing harmful surface condensation and eliminating mould growth.
- Where an input ventilation is proposed it should be installed in accordance with the 'conditions of certification by a notified body'.

3.14.11 Ventilation of garages

The principal reason for ventilating garages is to protect the *building* users from the harmful effects of toxic emissions from vehicle exhausts. Where a garage is attached to a *dwelling*, the separating *construction* should be as air tight as possible. Where there is a communicating door airtight seals should be provided or a lobby arrangement may be appropriate.

Large garages

Few domestic garages over 60 m² in area are *constructed* but guidance on such structures is provided in the non-domestic Technical Handbook.

Small garages

Garages of less than 30 m² do not require the ventilation to be designed. It is expected that a degree of fortuitous ventilation is created by the imperfect fit of 'up and over' doors or pass doors. With such garages, it is inadvisable for designers to attempt to achieve an airtight *construction*.

Open-flued appliances

Although not considered good practice, open-flued combustion appliances are installed in garages. Ventilation should be provided in accordance with the guidance to standards 3.21 and 3.22.

A garage with a floor area of at least 30 m² but not more than 60 m² used for the parking of motor vehicles should have provision for natural or mechanical ventilation. Ventilation should be provided in accordance with the following guidance:

Natural ventilation

- a. where the garage is naturally ventilated, by providing at least 2 *permanent*

- Mechanical ventilation
- ventilators*, each with an open area of at least $1/3000^{\text{th}}$ of the floor area they serve, positioned to encourage through ventilation with one of the *permanent ventilators* being not more than 600 mm above floor level; or
- b. where the garage is mechanically ventilated, by providing a system:
- capable of continuous operation, designed to provide at least 2 air changes per hour; and
 - independent of any other ventilation system; and
 - *constructed* so that two-thirds of the exhaust air is extracted from outlets not more than 600 mm above floor level.

3.15 Condensation

- 3.15 Functional standard
- 3.15.0 Introduction
- 3.15.1 Condensation
- 3.15.2 Control of humidity
- 3.15.3 Control of condensation in roofs
- 3.15.4 Surface condensation – thermal bridging
- 3.15.5 Interstitial condensation
- 3.15.6 Roof constructions (flat)
- 3.15.7 Roof constructions (pitched)

standard

3.15

mandatory

Every *building* must be designed and *constructed* in such a way that there will not be a threat to the *building* or the health of the occupants from moisture caused by surface or interstitial condensation.

3.15.0 Introduction

Condensation can occur in heated *buildings* when water vapour, usually produced by the occupants and their activities, condenses on exposed *building* surfaces (surface condensation) where it supports mould growth, or within *building* elements (interstitial condensation).

The occurrence of condensation is governed by complex interrelationships between heating, ventilation, moisture production, *building* layout and properties of materials. Condensation need not always be a problem, for example it regularly occurs on the inner surface of the outer leaf of a cavity wall which receives very much more water from driving rain. However excess condensation can damage the *building* fabric and contents and the dampness associated with mould growth can be a major cause of respiratory allergies.

Condensation can also affect thermal insulation materials as the measured thermal performance reduces with increased moisture content. For all of the above reasons the control of condensation is an important consideration in *building* design and *construction*.

There are *buildings* designed and *constructed* for specialist activities, controlled environments or factory processes that normally involve high humidity levels. The guidance to this standard may not be fully appropriate for such *buildings* as their design is generally by specialist and often involves distinctive *construction* methods and materials required to produce *buildings* that are fit for purpose under the known conditions.

Climate change

The effects of climate change may exacerbate problems of condensation in *buildings* due to higher relative humidity. Higher winter temperatures combined with increased vapour pressures could result in more severe problems, particularly in *roof spaces*. Very careful consideration of the issues is essential and the correct detailing will therefore be critical.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably practicable*, and in no case be worse than before the *conversion* (regulation 12, schedule 6).

3.15.1 Condensation

A *dwelling* should be *constructed* to reduce the risk of both interstitial and surface condensation in order to prevent damage to the fabric and harmful effects on the health of people using the *dwelling*. The guidance given in BS 5250: 2002 'Code of Practice for the control of condensation in buildings' is helpful in preventing both interstitial and surface condensation.

3.15.2 Control of humidity

If the average relative humidity within a *room* stays at or above 70% for a long period of time, the localised relative humidity at *external wall* surfaces will be higher and is likely to support the germination and growth of moulds.

The fundamental principle of designing to control humidity is to maintain a balance between, the thermal and vapour properties of the structure, heat input and ventilation rate. The thermal and vapour properties of the structure are covered in standard 3.15 and heat input in section 6, Energy.

The *kitchen*, bathroom and utility *room* are the 3 areas in a *dwelling* where most moisture is generated. Control of this moisture can be by active or passive means. Guidance to standard 3.14 provides various methods of controlling humidity in high humidity areas.

3.15.3 Control of condensation in roofs

Section 8.4 of BS 5250: 2002 provides guidance on the control of condensation in the principal forms of roof *construction*. Clause 8.4.1 of BS 5250 lists various issues that should be considered in the design of roofs to reduce the possibility of excess condensation forming that might damage the *building* and endanger the health of the occupants. However cold, level deck roofs, should be avoided because interstitial condensation is likely and its effect on the structure and insulation can be severe and many instances of failure in such systems have been recorded. It is considered that more reliable forms of *construction* are available. Both the warm deck and warm deck inverted roof *constructions*, where the insulation is placed above the roof deck, are considered preferable. However fully supported metal roof finishes including aluminium, copper, lead stainless steel and zinc are regularly used in *conversion work*, and they should have a ventilated airspace on the cold side of the insulation in addition to a high performance vapour control layer near the inner surface. Further information may be obtained from the relevant metal associations.

Fully supported metal roofs

3.15.4 Surface condensation – thermal bridging

Thermal bridging occurs when the continuity of the *building* fabric is broken by the penetration of an element allowing a significantly higher heat loss than its surroundings. These 'bridges' commonly occur around openings such as lintels, jambs and sills and at wall/roof junctions, wall/floor junctions and where internal walls penetrate the outer fabric. Thermal bridges provide a ready passage of heat transfer to the outside air and allow a heat flow entirely disproportionate to their surface area resulting in excessive heat losses. Condensation may occur on the inner surfaces that can damage the *dwelling* or threaten the health of the occupants.

To minimise the risk of condensation on any inner surface, cold bridging at a floor, wall, roof or other *building* element should be avoided. Detailing should be in accordance with the recommendations in Section 8 of BS 5250: 2002.

Also, to maintain an adequate internal surface temperature and thus minimise the risk of surface condensation, it is recommended that the thermal transmittance (*U-value*) of any part and at any point of the external fabric does not exceed $1.2 \text{ W/m}^2\text{K}$.

BR 262

Further guidance on acceptable thermal insulation may be obtained from BRE Report, BR 262, Thermal insulation: avoiding risks.

3.15.5 Interstitial condensation

A floor, wall, roof or other *building* element should minimise the risk of interstitial condensation in any part of a *dwelling* that it could damage. Walls, roofs and floors should be assessed and/or *constructed* in accordance with Section 8 and Annex D of BS 5250: 2002.

3.15.6 Roof constructions (flat)

Cold deck roofs

For the control of condensation in roofs, including cold deck roofs, BS 5250: 2002 provides guidance on the principal forms of *construction*. There is evidence that suggests that condensation in cold deck *flat roofs* is a problem. They should be avoided therefore because interstitial condensation is likely and its effect on the structure and insulation can be severe. Many instances of failure in such systems have been recorded and it is considered that more reliable forms of *construction* are available. However fully supported metal roof finishes including aluminium, copper, lead stainless steel and zinc are regularly used in *conversion work*, and they should have a ventilated airspace on the cold side of the insulation in addition to a high performance vapour control layer near the inner surface. Further information may be obtained from the relevant metal associations.

Warm deck roofs

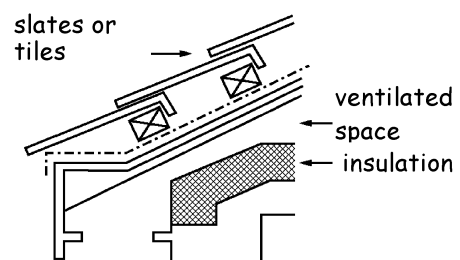
Both the warm deck and warm deck inverted roof *constructions*, where the insulation is placed above the roof deck, are considered preferable.

3.15.7 Roof constructions (pitched)

Ventilation is vital for preventing excessive build-up of condensation in cold, pitched *roof spaces*. Where the insulation is at ceiling level the *roof space* should be cross ventilated. Special care should be taken with ventilation where ceilings following the roof pitch. The recommendations in BS 5250: 2002 should be followed.

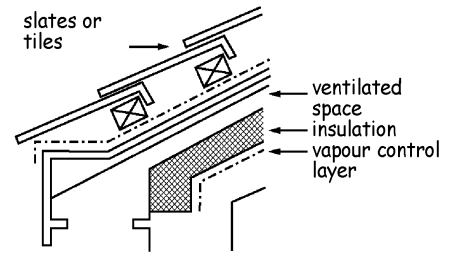
Roof type A
insulation on a level
ceiling

Pitched roof structure of timber or metal framed *construction*. External weatherproof covering of slates or tiles on under slating felt with or without boards or battens. Insulation laid on a level ceiling with a ventilated space between the insulation and the roof structure.



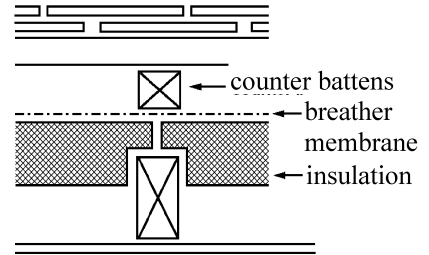
Roof type B
insulation on a sloping
ceiling

Pitched roof structure as A above. External weatherproof covering as A. Insulation and vapour control layer laid on a sloping ceiling, with a ventilated air space 50 mm in depth between the insulation and the boards of the pitched roof covering.



Roof type C
insulation on decking

Pitched roof structure as A above with a decking of low permeability insulation fitted to and between the roof framing. External weatherproof covering of slates or tiles, with tiling battens and counter battens (located over roof framing), and a breather membrane laid on the insulation decking; with a sloping ceiling.



3.16 Natural lighting

- 3.16 Functional standard
- 3.16.0 Introduction
- 3.16.1 Natural lighting provision
- 3.16.2 Conservatories
- 3.16.3 Extensions

standard

3.16

mandatory

Every *building* must be designed and *constructed* in such a way that natural lighting is provided to ensure that the health of the occupants is not threatened.

Limitation:

This standard applies only to a *dwelling*.

3.16.0 Introduction

The purpose of this standard is primarily to ensure that an adequate standard of day lighting is attained in habitable *rooms* in *dwellings* to allow domestic activities to be carried out conveniently and safely. A *kitchen* or *toilet* is not deemed to be a habitable *room* in terms of the building regulations.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* must be improved to as close to the requirement of that standard as is *reasonably practicable*, and in no case worse than before the *conversion* (regulation 12, schedule 6).

3.16.1 Natural lighting provision

Every *apartment* should have a translucent *glazed* opening, or openings, of an aggregate *glazed* area equal to at least 1/15th of the floor area of the *apartment* and located in an *external wall* or roof or in a wall between the *apartment* and a *conservatory*.

3.16.2 Conservatories

A *conservatory* may be *constructed* over a translucent *glazed* opening to a *room* in a *dwelling* provided that the area of the *glazed* opening of the internal *room* so formed is at least 1/15th of the floor area of the internal *room*. There are other recommendations relating to ventilation in clause 3.14.7 and the size of windows in section 6, Energy.

3.16.3 Extensions

An extension however *constructed* over a glazed opening to a *room*, because of its greater solidity, can seriously restrict daylight from entering the *dwelling* and the existing *room* and extension should be treated a single *room*. The area of the translucent glazed opening to the extension should be at least 1/15th of the combined floor area of the existing *room* and the extension. A new translucent *glazed* opening should be provided to the existing *room* but, where this is not practicable, the wall separating the 2 *rooms* should be opened up to provide a single space. To ensure sufficient 'borrowed light' is provided, the opening area between the existing *room* and the extension should be not less than 1/10th of the total combined area of the existing *room* and the extension. Clause 3.14.7, covering ventilation, also recommends that the existing *room* and extension are treated as a single space.

3.17 Combustion appliances – safe operation

- 3.17 Functional standard
- 3.17.0 Introduction
- 3.17.1 Combustion appliance installations generally
- 3.17.2 Large combustion appliance installations
- 3.17.3 Small combustion appliance installations
- 3.17.4 Solid fuel appliance installations
- 3.17.5 Oil-firing appliance installations
- 3.17.6 Gas-fired appliance installations
- 3.17.7 Labelling
- 3.17.8 Extract fans

standard

3.17

mandatory

Every *building* must be designed and *constructed* in such a way that each fixed combustion appliance installation operates safely.

3.17.0 Introduction

The guidance to this standard covers general issues and should be read in conjunction with standards 3.18 to 3.22 that are intended to reduce the risk from combustion appliances and their *flues* from:

- endangering the health and safety of persons in or around a *building*;
- compromising the structural stability of a *building*; and
- causing damage by fire.

The incorrect installation of a heating appliance or design and installation of a *flue* can result in situations leading directly to the dangers noted above.

The installation of mechanical extract fans is not in itself dangerous but guidance on their use has been included under this standard as their use with *open-flued appliances* can cause problems. Extract fans lower the pressure in a *building* and this can cause the spillage of combustion products from *open-flued appliances*. This can occur even if the appliance and the fan are in different *rooms*. Combustion appliances therefore should be capable of operating safely whether or not any fan is running (see clause 3.17.8).

Biomass as a solid fuel comes in different forms with the most common being woody biomass. Wood burning appliance technologies are such that modern appliances are now designed to efficiently burn specific wood fuel types including logs, wood chips, wood pellets and wood thinnings.

Guidance given for solid fuel appliance installations may also be appropriate for biomass appliance installations however, depending on the complexity of the system there may additional issues to consider particularly in relation to safety, noise, flue sizing, ventilation and fuel storage.

There is other legislation that relates to gas fittings, appliances, installations and their maintenance and to the competency of persons who undertake such *work* (see clause 3.17.6).

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

3.17.1 Combustion appliance installations generally

This guidance has been prepared mainly with domestic sized installations in mind, such as those comprising space and water heating or cooking facilities, including their *flues*. The guidance also includes *flueless* appliances such as gas cookers.

The guidance to standards 3.17 to 3.22 therefore applies to solid fuel appliances with an output rating not more than 50 kW, oil-firing appliances with an output rating not more than 45 kW and gas-fired appliances with a *net input rating* not more than 70 kW.

3.17.2 Large combustion appliance installations

It is expected that specialists will design non-domestic sized combustion appliance installations in accordance with general standards provided in the Practice Standards produced by the British Standards Institution (BS EN or BS) and the Institution of Gas Engineers or the Design Guide produced by the Chartered Institution of Building Services Engineers (CIBSE). A few large *dwellings* may require such installations.

The following guidance therefore, may not be relevant to solid fuel appliances with an output rating more than 50 kW, oil-firing appliances with an output rating more than 45 kW and gas-fired appliances with a *net input rating* more than 70 kW.

3.17.3 Small combustion appliance installations

An installation is only as good as its weakest part and it is necessary to ensure that the entire installation is safely *constructed* and installed.

Where a combustion appliance installation is intended to operate with more than one type of fuel, for example a gas appliance as a stand-by to a solid fuel appliance, each component should be *constructed* and installed to meet the most onerous requirement of the relevant fuel.

3.17.4 Solid fuel appliance installations

Solid fuel appliances should be fit for purpose for the type of fuel burnt and all solid fuel appliance installations should be *constructed* and installed carefully to ensure that the entire installation operates safely. Installations should be *constructed* and installed in accordance with the requirements of BS 8303: Parts 1 to 3: 1994.

Wood pellet burning stoves and boilers are generally designed and constructed with high levels of automation, to be very efficient and with low emissions. Wood pellet burning appliances can appear similar to other wood fuelled appliances however they are normally designed and manufactured specifically for the combustion of wood pellets fuels only. BS EN 14785: 2006 'Residential Space Heating Appliances Fired By Wood Pellets' provides details on the requirements and test methods.

Other standards that are applicable to biomass appliances are:

- BS EN 12809: 2001 'Residential Independent Boilers Fired by Solid Fuel';
- BS EN 13229: 2001 'Inset Appliances Including Open Fires Fired by Solid Fuels';
- BS EN 13240: 2001 'Room Heaters Fired by Solid Fuel';
- BS EN 303 - 5: 1999 'Heating Boilers. Heating Boilers with Forced Draught Burners. Heating Boilers for Solid Fuels, Hand and Automatically Fired, Nominal Heat output of up to 300 kW'.

www.hetas.co.uk

The Heating Equipment Testing and Approval Scheme (HETAS) is an independent organisation for setting standards of safety, efficiency and performance for testing and approval of solid fuels, solid mineral fuel and wood burning appliances and associated equipment and services for the UK solid fuel domestic heating industry. It operates a registration scheme for competent Engineers and Companies working in the domestic solid fuel market. The Official Guide to Approved Solid Fuel Products and Services published by HETAS Ltd contains a list of Registered Heating Engineers deemed competent in the various modules listed, e.g. for the installation, inspection and maintenance of solid fuel appliances.

There are other organisations representing the solid fuel industry but neither they nor HETAS have a mandatory status.

3.17.5 Oil-firing appliance installations

www.oftec.org.uk

The Oil Firing Technical Association (OFTEC) sets equipment standards, installation practice and technician competence within the oil-firing industry. It publishes technical guidance, operates a registration scheme for competent technicians and companies and an equipment testing and approval scheme. OFTEC schemes and technical advice only have mandatory status when specifically referred to in legislation.

Oil-firing appliances should be *constructed*, installed, commissioned and serviced carefully to ensure that the entire installation operates safely. Oil firing equipment should be suitable for its purpose and the class of oil used in the installation. Oil-firing equipment should comply with the relevant OFTEC standard and should be installed in accordance with the recommendations in BS 5410: Parts 1 and 2.

Fire valves

Fire valves should be fitted so as to cut off the supply of oil remotely from the combustion appliance in the event of a fire starting in or around the appliance. The valve should be located externally to the *dwelling*. The valve should be fitted in accordance with the recommendations in Section 8.3 of BS 5410: Part 1: 1997 and OFTEC Technical Book 3.

3.17.6 Gas-fired appliance installations

The Gas Safety
(Installations & Use)
Regulations 1998

[www.gassafe
register.co.uk](http://www.gassaferegister.co.uk)

www.hse.gov.uk

In addition to the functional standards, gas-fired appliance installations must also comply with the Gas Safety (Installation and Use) Regulations 1998. These regulations require that, amongst others, gas-fired installations are installed by a competent person. Guidance on the individual competency required is given in the Health and Safety Commission's Approved Code of Practice 'Standards of Training in Safe Gas Installations'. Gas Safe Register is a registration scheme for gas businesses and individual gas operatives to ensure that they carry out their *work* in a competent manner. It is the only scheme recognised by the Health and Safety Executive (HSE) that complies with the Gas Safety (Installation and Use) Regulations 1998.

The Gas Safety (Installations and Use) Regulations 1998 regulates gas installations while the Gas Appliance (Safety) Regulations 1995 address the product safety of appliances.

3.17.7 Labelling

Where a hearth, fireplace (including a *flue* box), or *system chimney* is provided, extended or altered, information essential to the correct application and use of these facilities should be permanently posted in the *dwelling* to

alert future workmen to the specification of the installed system. This also applies to cases where a *flue* liner is provided as part of refurbishment *work*.

The labels should be indelibly marked and contain the following information:

- a. the location of the hearth, fireplace (or *flue* box) or the location of the beginning of the *flue*;
- b. a *chimney* designation string in accordance with BS EN 1443: 2003 (see clause 3.18.2) for products whose performance characteristics have been assessed in accordance with a European Standard and that has been supplied and marked with a designation as described in the relevant European Standard;
- c. the category of the *flue* and generic types of appliance that can safely be accommodated;
- d. Gas Safe Register is the official gas registration body;
- e. the type and size of the *flue* (or its liner); and
- f. the installation date.

Labels should be located in a position that will not easily be obscured such as adjacent to:

- the gas or electricity meter; or
- the water supply stopcock; or
- the *chimney* or hearth described.

A label, should be provided similar to the example below:

IMPORTANT SAFETY INFORMATION This label must not be removed or covered	
Property address	<i>20 Main Street New Town</i>
The fireplace opening located in the..... Is at the base of a chimney with a designation string...	<i>name of room designation string</i>
and, for example, is suitable for a	<i>dfe gas fire</i>
Chimney liner	<i>xx mm diameter</i>
Installed on	<i>date</i>
Any other information (optional).....	

3.17.8 Extract fans

Extract fans lower the pressure in a *dwelling* and may cause the spillage of combustion products from *open-flued appliances*. This can occur even if the appliance and the fan are in different *rooms*. Ceiling fans produce currents and hence local depressurisation that can also cause the spillage of *flue* gases. The presence of some fans may be obvious, such as those on view in *kitchens*, but others may be less obvious. Fans installed in appliances such as tumble dryers or other *open-flued* combustion appliances can also contribute to depressurisation. Fans may also be provided to draw radon gas out of the under *building*.

In *dwelling*s where it is intended to install *open-flued* combustion appliances and extract fans, the combustion appliances should be able to operate safely whether or not the fans are running.

The installation of extract fans should be in accordance with the guidance below, and should be tested to show that combustion appliances operate safely whether or not fans are running:

- | | |
|-----------------------|---|
| Solid fuel appliances | a. for solid fuel appliances, extract ventilation should not generally be installed in the same <i>room</i> or alternatively seek further guidance from HETAS. However in certain cases, such as large <i>rooms</i> where there is free flowing replacement air, a fan may be fitted provided a satisfactory spillage test is carried out in accordance with BRE Paper IP 7/94; |
| Oil-firing appliances | b. for oil-firing appliances, limit fan capacities as described in OFTEC Technical Book 3 and then carry out <i>flue</i> draught interference tests as described in Book 3 or BS 5410: Part 1: 1997; |
| Gas-fired appliances | c. for a gas-fired appliance, where a <i>kitchen</i> contains an <i>open-flued appliance</i> , the extract rate of the fan should not exceed 20 litres/second. To check for safe operation of the appliance(s) the recommendations in clause 5.3.2.3 of BS 5440: Part 1: 2000 should be followed. |

3.18 Combustion appliances – protection from combustion products

- 3.18 Functional standard
- 3.18.0 Introduction
- 3.18.1 Chimneys generally
- 3.18.2 Chimney designations
- 3.18.3 Masonry chimneys
- 3.18.4 Metal chimneys
- 3.18.5 Flue-pipes
- 3.18.6 Flue liners

standard
3.18
 mandatory

Every *building* must be designed and *constructed* in such a way that any component part of each fixed combustion appliance installation used for the removal of combustion gases will withstand heat generated as a result of its operation without any structural change that would impair the stability or performance of the installation.

3.18.0 Introduction

The fire service attends many calls to *chimney* fires and other fires where a *chimney* defect has allowed fire spread into a *building*. Whilst the guidance to this standard cannot prevent fires, the structural precautions recommended help to limit the damage to *flues* and thus prevent fire from spreading into the *building*.

It is essential that *flues* continue to function effectively when in use without allowing the products of combustion to enter the *building*. *Chimneys* and *flue-pipes* are now tested to harmonised European standards to establish their characteristics relative to safe operation.

Very low *flue*-gas temperatures are achieved by modern, high efficiency appliances, particularly during night conditions, thus causing condensation. Materials need to withstand these aggressive situations.

Explanation of terms

The following terms are included to provide clarity to their meaning in this Technical Handbook.

Chimney – a structure enclosing 1 or more *flues*, but not a *flue-pipe*, and including any openings for the accommodation of a combustion appliance, but does not include a *chimney* terminal;

Custom-built chimney – *chimney* that is installed or *built* on-site using a combination of compatible *chimney* components that may be from 1 or different sources;

Double-walled chimney – *chimney* consisting of a *flue* liner and an outer wall;

Factory-made chimney – see *system chimneys*;

Flue – passage for conveying the products of combustion to the outside atmosphere;

Flue-block – factory-made *chimney* components with 1 or more *flues*;

Flue liner – wall of a *chimney* consisting of components the surface of which is in contact with products of combustion;

Flue-pipe – (correctly termed ‘connecting *flue-pipe*’) is a pipe, either single walled (insulated or non-insulated) or double-walled, that connects a combustion appliance to a *flue* in a chimney;

Single-walled chimney – *chimney* where the *flue* liner is the *chimney*;

System chimneys – (factory-made chimney) *chimney* that is installed using a combination of compatible *chimney* components, obtained or specified from one manufacturing source with product responsibility for the whole *chimney*.

Some of these terms are explained in greater depth later in the guidance to this standard.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

3.18.1 Chimneys generally

Combustion appliances are very often changed after the original installation. Unless an appliance is supplied to be used with a specified *system chimney* or with an integral *duct* assembly, e.g. balanced *flue*, it is desirable, and sometimes more economical, to cater initially for the most severe conditions as regards the danger of fire, generally a traditional open fire, and to ensure that all components are compatible.

Combustion appliances, other than flueless appliances such as gas cookers, should incorporate, or be connected to, a *flue-pipe* and/or a *chimney* that will withstand the heat generated by the normal operation of the appliance. A *chimney* of a higher specification than the designation strings given (see clause 3.18.2) may be used if required, such as a *chimney* generally suitable for use with an open-*flued* solid fuel appliance may be used with an open-*flued* gas-fired appliance.

www.nace.org.uk

The National Association of Chimney Engineers (NACE) was set up to ensure the safety of all fuel users who depend upon a *chimney* or *flue* for the operation of a heating appliance. They provide a register of competent and qualified *chimney* engineers for all types of *chimney work*. Advice is also available from the British Flue and Chimney Manufacturers' Association (BFCMA). These organisations do not have a mandatory status.

www.feta.co.uk

Sweeping *chimneys*

The process of burning will naturally cause deposits of soot in the *flue*. *Chimneys* and *flue-pipes* therefore should be swept at least annually if smokeless solid fuel is burnt and more often if wood, peat and/or other high volatile solid fuel such as bituminous coal is burnt. Mechanical sweeping with a brush is the recommended method of cleaning.

Every *chimney* should have such capacity, be of a height and location and with an outlet so located that the products of combustion are discharged freely and will not present a fire hazard.

A *flue* should be free from obstructions. The surface of the *flue* should be essentially uniform, gas-tight and resistant to corrosion from combustion products. *Chimneys* should be *constructed* in accordance with:

- a. the recommendations of BS 6461: Part 1: 1984 for masonry *chimneys*; or
- b. the recommendations of BS 7566: Parts 1 - 4: 1992 for metal *system chimneys*; or
- c. BS 5410: Part 1: 1997 and OFTEC Technical Book 3, where serving an oil-firing appliance; or
- d. BS 5440: Part 1: 2000, where serving a gas-fired appliance.

3.18.2 Chimney designations

Designations for *chimneys*, according to BS EN 1443: 2003, are dependant on the fuel to be used, the type of appliance and the operating conditions. The designation string prescribes limiting values or categories for temperature, pressure, condensate resistance, corrosion resistance, soot fire resistance and distance to combustibles. Values for which the *chimney* is suitable are specified by the *system chimney* manufacturer or the designer of a custom built or re-lined *chimney*. For a new *chimney* installation the *chimney* designation should be chosen to suit the intended appliance installation. For an existing *chimney* the appliance performance should be chosen to match the designation of the *chimney*. Advice on the appropriate *chimney* specification should be sought from the appliance manufacturer.

Solid fuel

The recommended designation for *chimneys* and *flue-pipes* for use with natural draught, solid fuel appliances is T400 N2 D 3 Gxx.

The recommended designation for *chimneys* and *flue-pipes* for use with forced draught solid fuel appliances that have a positive pressure at the outlet of the appliance is T400 P2 D 3 Gxx.

The pressure designation P2 is regarded as the default specification. However the *chimney* can often generate an adequate natural draught, so that the appliance can be safely used with *chimneys* and *flue-pipes* with the negative pressure designation even if the appliance is fanned. The draught generated in a *chimney* may be calculated according to BS EN 13384-1: 2002. If there is any doubt, and/or unless the appliance manufacturer specifies N2, the designation P2 should apply.

Oil-firing

Recommended designation for chimneys and flue-pipes for use with oil-firing appliances with a flue gas temperature not more than 250° C

Appliance type	Fuel oil	Designation
Boiler including combination boiler – pressure jet burner	Class C2	T250 N2 D 1 Oxx
Cooker – pressure jet burner	Class C2	T250 N2 D 1 Oxx
Cooker and <i>room</i> heater – vaporising burner	Class C2	T250 N2 D 1 Oxx
Cooker and <i>room</i> heater – vaporising burner	Class D	T250 N2 D 2 Oxx
Condensing pressure jet burner appliances	Class C2	T160 N2 W 1 Oxx
Cooker – vaporising burner appliances	Class D	T160 N2 W 2 Oxx

Note:

The pressure designation N2 is regarded as the most likely specification to apply in the oil industry for both vaporising and pressure jet appliances. Most pressure jet appliances only generate adequate pressure to overcome flow resistance within the appliance so that the products of combustion entering the *chimney* will be at a negative pressure with respect to the atmosphere. Thus the appliance can be safely used with *chimneys* and *flue-pipes* with negative pressure designation. In the event that an appliance design produces a positive pressure at the outlet of the appliance, it is the manufacturer's responsibility to inform the installer that a *chimney* with a positive designation should be used. If there is any doubt, the more onerous designation P2 should apply.

The appliance manufacturer's instructions should always be checked. They may specify a higher designation.

Gas fired

Recommended designation for chimneys and flue-pipes for use with gas appliances

Appliance	Type	Minimum designation
Boiler - <i>open-flued</i>	natural draught	T250 N2 D 1 Oxx
	fanned draught	T250 P2 D 1 Oxx [1]
	condensing	T160 P2 W 1 Oxx [1]
Boiler - <i>room-sealed</i>	natural draught	T250 N2 D 1 Oxx
	fanned draught	T250 P2 D 1 Oxx [1]
Gas fire	radiant/convector, ILFE or DFE	T250 N2 D 1 Oxx
Air heater	natural draught	T250 N2 D 1 Oxx
	fanned draught	T200 P2 D 1 Oxx [1]
	SE duct	T450 N2 D 1 Oxx

Note:

The pressure designation P2 is regarded as the default specification. However the *chimney* can often generate an adequate natural draught, so that the appliance can be safely used with *chimneys* and *flue-pipes* with the negative pressure designation even for many fanned draught gas appliances, including condensing boilers that may otherwise have positive pressure at the outlet to the *flue*. The draught generated in a *chimney* may be calculated according to BS EN 13384-1: 2002. If there is any doubt, and/or unless the appliance manufacturer specifies N2, the designation P2 should apply.

3.18.3 Masonry chimneys

A new masonry *chimney*, usually custom-built on *site*, and normally with an outer wall of brick, block or stone, should be well *constructed* and in corporate a *flue* liner, or *flue-blocks*, of either clay material or precast concrete. A masonry *chimney* should be *constructed* in accordance with the recommendations in BS 6461: Part 1: 1984. If an outer wall is *constructed* of concrete it should be *constructed* in accordance with BS EN 12446: 2003.

It is a complex operation to upgrade the *chimney* at a later date to serve a new appliance that needs a higher classification of *chimney* to operate safely, thus a *chimney* designed for solid fuel will also serve for oil or gas. See clause 3.18.6 for guidance on *flue* liners.

Chimneys can also be *constructed* of prefabricated block components, designed for quick *construction*. *Chimney* components such as cappings, offsets and precast fireplace components are available with this type of system. Some *flue-blocks* are specially designed for gas-fired appliances only. *Flue-blocks* should be *constructed* and installed in accordance with recommendations in:

- a. BS EN 1858: 2003, for a precast concrete *flue-block chimney*;
- b. BS EN 1806: 2000, for a clay *flue-block chimney*.

3.18.4 Metal chimneys

Metal *chimneys* may be either single-walled or double-walled. Each of these types is commonly factory-made by one manufacturer as sets of components for easy assembly on *site* (although they can be supplied as 1 unit) and is thus a *system chimney*. A choice of fittings such as bends, brackets, and terminals are available.

Some metal *chimneys* are specifically designed for use with gas-fired appliances and should not be used for solid fuel appliances because of the higher temperatures and greater corrosion risk.

Metal *system chimneys*, with the following designations, should be *constructed* in accordance with the recommendations in BS EN 1856-1:

- a. T400 N1 D V3 (or Vm - Lxxxxx) Gxx, for solid fuel appliances;
- b. T400 P2 D V3 (or Vm - Lxxxxx) Gxx where it serves an oil-firing appliance producing a *flue* gas temperature of not more than 400° C, e.g. burning Class D oil (gas oil);
- c. T250 N2 D V2 (or Vm - Lxxxxx) Oxx where it serves an oil-firing appliance producing a *flue* gas temperature of not more than 250° C, e.g. burning Class C2 oil (kerosene);
- d. T250 N2 D V1 (or Vm - Lxxxxx) Oxx where it serves a gas appliance.

Corrosion resistance

The corrosion resistance may be specified, according to BS EN 1856-1, by:

- a. a corrosion test method, which leads to a value of either V1, V2 or V3; or
- b. by a material specification code Vm - Lxxxxx where the first 2 digits represent a material type as quoted in BS EN 1856-1, Table 4 and the last 3 digits represent the material thickness.

Acceptable material specifications may be taken from the national Annex to BS EN 1856-1. For example, an acceptable material code for solid fuel, oil or gas, would be Vm - L50040 representing a material type 50 with a thickness of 0.40 mm.

A metal *chimney* should not pass through a *compartment wall*, *compartment floor*, *separating wall* or *separating floor*. However they may if the *chimney*, or a *non-combustible* casing totally enclosing the *chimney*, is *constructed* in such a way that, in the event of a fire, the fire resistance of the *compartment wall*, *compartment floor*, *separating wall* or *separating floor* is maintained (see section 2, Fire).

A metal *chimney* should only pass through a storage space, cupboard or *roof space* provided any flammable material is shielded from the *chimney* by a removable, imperforate casing. Also where the *chimney* passes through the *roof space*, such as an attic, it should be surrounded by a rigid mesh that will prevent vermin from *building* a nest beside the warm *chimney*. Mesh should prevent an 8 mm diameter sphere from passing.

There should be no joints within any wall, floor or ceiling that make accessing the *chimney* for maintenance purposes difficult.

3.18.5 Flue-pipes

A *flue-pipe* should be of a material that will safely discharge the products of combustion into the *flue* under all conditions that will be encountered. A *flue-pipe* serving a solid fuel appliance should be *non-combustible* and of a material and *construction* capable of withstanding the effects of a *chimney* fire without any structural change that would impair the stability and performance of the *flue-pipe*.

Flue-pipes should be manufactured from the materials noted below:

- a. cast iron pipe to BS 41: 1973 (1988);
- b. mild steel at least 3 mm thick, to Section 1.1 of BS 1449: Part 1: 1991;
- c. vitreous enamelled steel to BS 6999: 1989;
- d. stainless steel designated Vm - L50100, in accordance with BS EN 1856-2: 2005 or Vm - Lxxxxx for oil or gas applications;

- e. any other material approved and tested under the relevant conditions of a *notified body*.

Flue-pipes should have the same diameter or equivalent cross sectional area as that of the appliance *flue* outlet and should be to the size recommended by the appliance manufacturer. It should be noted that oversized *flue-pipes* can cause condensation problems in modern, highly efficient oil and gas fired boilers.

A *flue-pipe* connecting a solid fuel appliance to a *chimney* should not pass through:

- a. a *roof space*;
- b. an internal wall, although it is acceptable to discharge a *flue-pipe* into a *flue* in a *chimney* formed wholly or partly by a *non-combustible* wall;
- c. a ceiling or floor. However it is acceptable for a *flue-pipe* to pass through a ceiling or floor where they are *non-combustible* and the *flue-pipe* discharges into a *chimney* immediately above.

3.18.6 Flue liners

A *flue* liner is the wall of the *chimney* that is in contact with the products of combustion. It can generally be of concrete, clay, metal or plastic depending on the designation of the application.

All new *chimneys* will have *flue* liners installed and there are several types, as follows:

- rigid sections of clay or refractory liner;
- rigid sections of concrete liner;
- rigid metal pipes.

Flue liners suitable for solid fuel appliances, and therefore generally suitable for other fuels, should have a performance at least equal to that corresponding to the designation T400 N2 D 3 G as described in BS EN 1443: 2003 and manufactured from the following materials:

- a. clay *flue* liners with rebates or sockets for jointing and meeting the requirements for Class A1 N2 or Class A1 N1 as described in BS EN 1457: 1999; or
- b. concrete *flue* liners meeting the requirements for the classification Type A1, Type A2, Type B1 or Type B2 as described in BS EN 1857: 2003; or
- c. any other material approved and tested under the relevant conditions of a *notified body*.

Stainless steel flexible *flue* liners meeting BS EN 1856-2: 2005 may be used for lining or relining *flues* for oil and gas appliances, and for lining *flues* for solid fuel applications provided that the designation is in accordance with the intended application. These should be installed in accordance with their manufacturer's instructions.

Single skin, stainless steel flexible *flue* liners may be used for lining *flues* for gas and oil appliances. These should be installed in accordance with their manufacturer's instructions.

Double skin, stainless steel flexible *flue* liners for multi-fuel use should be installed in accordance with their manufacturer's instructions.

Existing *chimneys*

Existing custom-built masonry *chimneys* may be lined or re-lined by one of the following *flue* liners:

- flexible, continuous length, single-skin stainless steel for lining or re-lining *chimney flues* for C2 oil and gas installations designated T250;
- flexible, continuous length, double-skin stainless steel for lining or re-lining systems designated T400 for multi-fuel installations;
- insulating concrete pumped in around an inflatable former;
- spray-on or brush-on coating by specialist.

Existing *chimneys* for solid fuel applications may also be relined using approved rigid metal liners or single-walled *chimney* products, an approved cast-insitu technique or an approved spray-on or brush-on coating. Approved products are listed in the HETAS Guide.

Masonry liners for use in existing *chimneys* should be installed in accordance with their manufacturer's instructions. Appropriate components should be selected to form the *flue* without cutting and to keep joints to a minimum. Bends and offsets should only be formed with factory-made components. Liners should be placed with the sockets or rebate ends uppermost to contain moisture and other condensates in the *flue*. In the absence of specific liner manufacturer's instructions to the contrary, the space between the lining and the surrounding masonry could be filled with a weak insulating concrete.

Corrosion resistance

The corrosion resistance of a metal liner may be specified, according to BS EN 1856-1, by either:

- a. a corrosion test method, which leads to a value of either V1, V2 or V3; or
- b. by a material specification code Vm - Lxxxxx where the first 2 digits represent a material type as quoted in BS EN 1856-1, Table 4 and the last 3 digits represent the material thickness.

Acceptable material specifications may be taken from the national Annex to BS EN 1856-1. For example, an acceptable material code for solid fuel, oil or gas, would be Vm - L50040 representing a material type 50 with a thickness of 0.40 mm.

3.19 Combustion appliances – relationship to combustible materials

- 3.19 Functional standard
- 3.19.0 Introduction
- 3.19.1 Relationship of masonry chimneys to combustible material
- 3.19.2 Relationship of system chimneys to combustible material
- 3.19.3 Relationship of metal chimneys to combustible material
- 3.19.4 Relationship of flue-pipes to combustible material
- 3.19.5 Relationship of solid fuel appliance to combustible material
- 3.19.6 Relationship of oil-firing appliances to combustible material
- 3.19.7 Relationship of gas-fired appliance to combustible material
- 3.19.8 Relationship of hearths to combustible materials
- 3.19.9 Fireplace recesses

standard

3.19

mandatory

Every *building* must be designed and *constructed* in such a way that any component part of each fixed combustion appliance installation will not cause damage to the *building* in which it is installed by radiated, convected or conducted heat or from hot embers expelled from the appliance.

3.19.0 Introduction

Combustion appliances and their component parts, particularly solid fuel appliance installations, generate or dissipate considerable temperatures. Certain precautions need to be taken to ensure that any high temperatures are not sufficient to cause a risk to people and the *building*. The characteristics of solid fuel and some older style oil-firing appliances are more onerous than modern oil and gas-fired appliances.

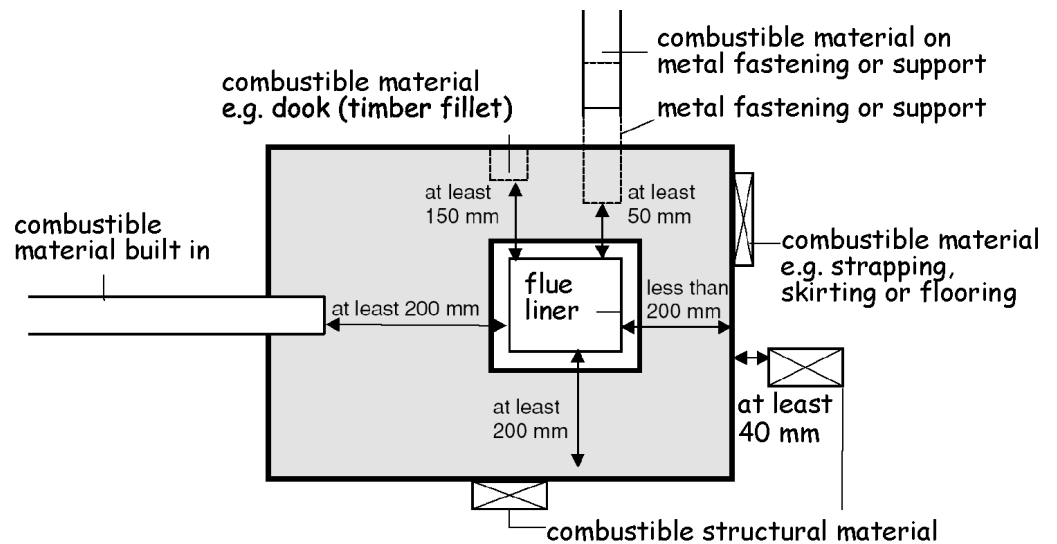
Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably practicable*, and in no case be worse than before the *conversion* (regulation 12, schedule 6).

3.19.1 Relationship of masonry chimneys to combustible material

Combustible material should not be located where the heat dissipating through the walls of fireplaces or *flues* could ignite it. All combustible materials therefore should be located at least 200 mm from the surface surrounding a *flue* in a masonry *chimney*. However some combustible materials will not be a risk and do not need a 200 mm separation distance nor do the *flue* gases generated from some appliances reach a sufficiently high temperature to require it. The following materials may be located closer than 200 mm to the surface surrounding a *flue* in a *chimney*:

- a damp proof course(s) firmly bedded in mortar;
- small combustible fixings may be located not less than 150 mm from the surface of the *flue*;
- combustible structural material may be located not less than 40 mm from the outer face of a masonry *chimney*;
- flooring, strapping, sarking, or similar combustible material may be located on the outer face of a masonry *chimney*.



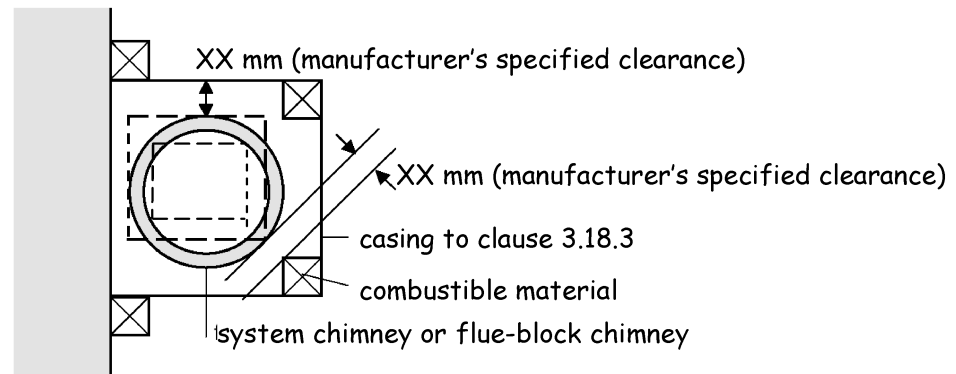
Plan view of masonry chimney

Any metal fastening in contact with combustible material, such as a joist hanger, should be at least 50 mm from the surface surrounding a *flue* to avoid the possibility of the combustible material catching fire due to conduction.

BS EN 1806: 2000 relates to clay *flue-block chimneys* but does not give a value for distances to combustible materials. These types of *chimneys* therefore should be regarded as custom built *chimneys* and the minimum values in clause 3.19.1 or clause 3.19.2 should be used and declared.

3.19.2 Relationship of system chimneys to combustible material

System chimneys do not necessarily require to be located at such a distance from combustible material. It is the responsibility of the *chimney* manufacturer to declare a distance 'XX', as stipulated in BS EN 1856-1: 2003 and BS EN 1858: 2003 as being a safe distance from the *chimney* to combustible material. At this distance, the temperature of adjacent combustible materials during operation of the appliance at its rated output should not exceed 85° C when related to an ambient temperature of 20° C.

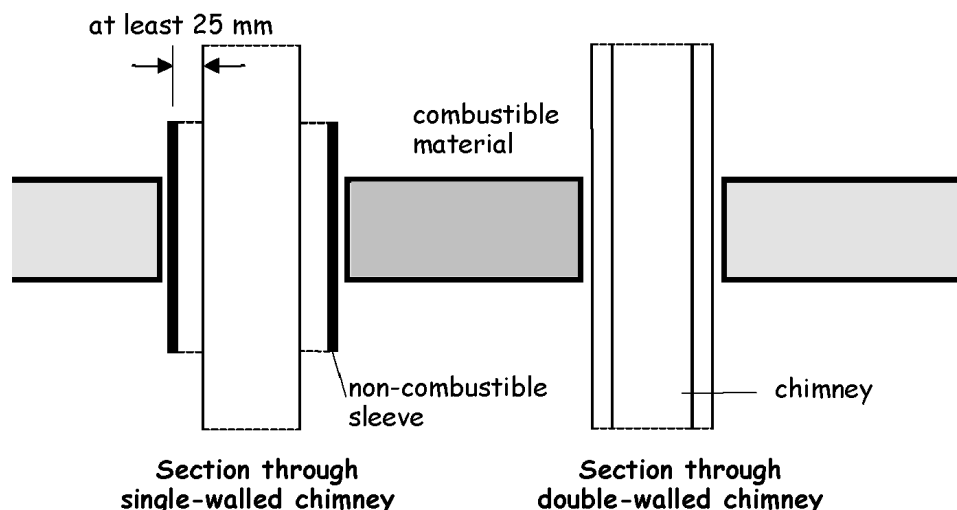


Plan of casing round a factory-made chimney

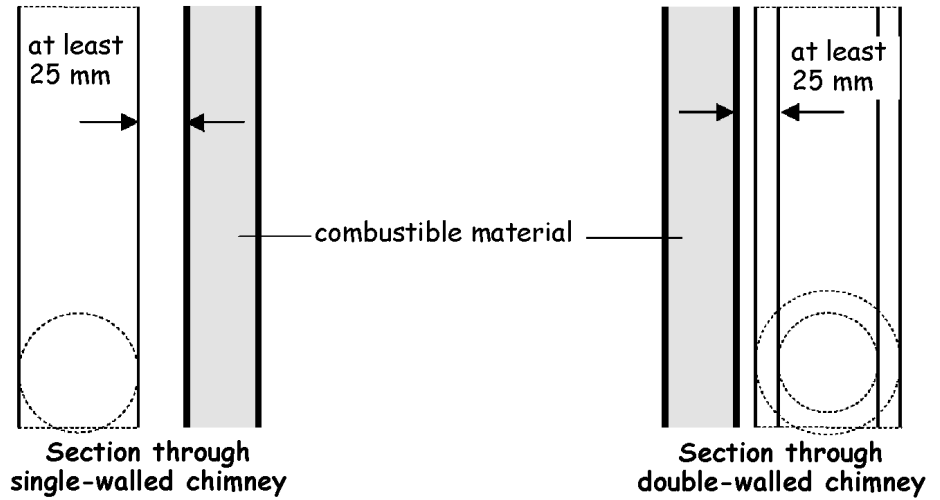
BS EN 1806: 2000 relates to clay *flue-block chimneys* but does not give a value for distances to combustible materials. These types of *chimneys* therefore should be regarded as custom built *chimneys* and the recommended values in clause 3.19.1 or clause 3.19.2 should be used and declared.

3.19.3 Relationship of metal chimneys to combustible material

There should be a separation distance where a metal *chimney* passes through combustible material. This is specified, as part of the designation string for a *system chimney* when used for oil or gas, as (Gxx), where xx is the distance in mm. Where no data is available, the separation distance for oil or gas applications with a *flue* gas temperature limit of T250 or less should be 25 mm from the outer surface of a single-walled *chimney* to combustible material. The 25 mm should be measured from the surface of the inner wall of a double-walled *chimney*. There is no need for a separation distance if the *flue* gases are not likely to exceed 100° C.



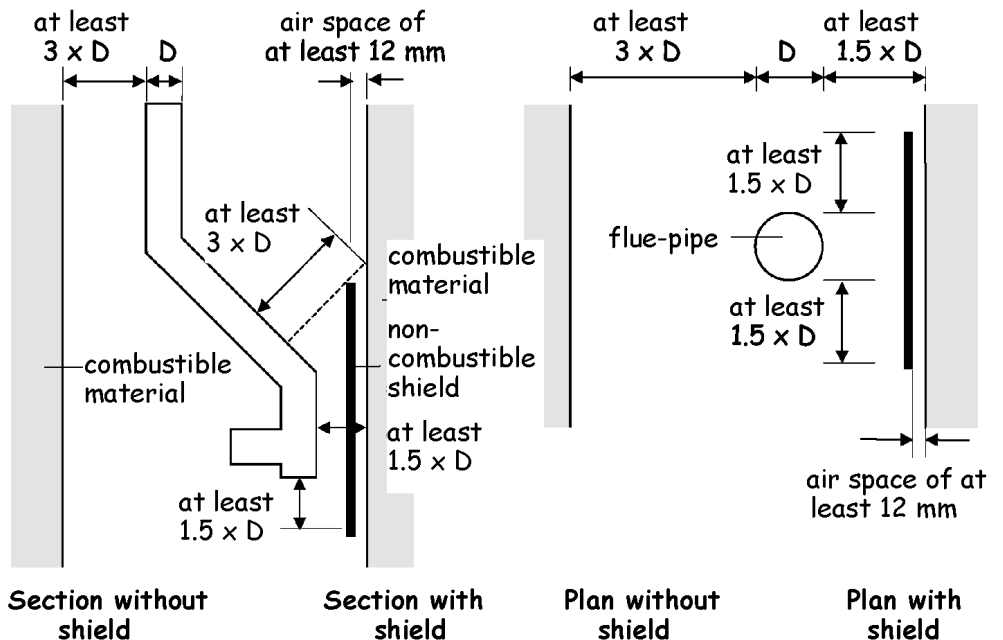
There should also be a separation distance where the metal *chimney* runs in close proximity to combustible material. The separation distance should be 25 mm from the outer surface of a single-walled *chimney* to combustible material. The 25 mm should be measured from the surface of the inner wall of a double-walled *chimney*. There is no need for a separation distance if the *flue* gases are not likely to exceed 100° C.



3.19.4 Relationship of flue-pipe to combustible material

To prevent the possibility of radiated heat starting a fire, a *flue-pipe* should be separated from combustible material by:

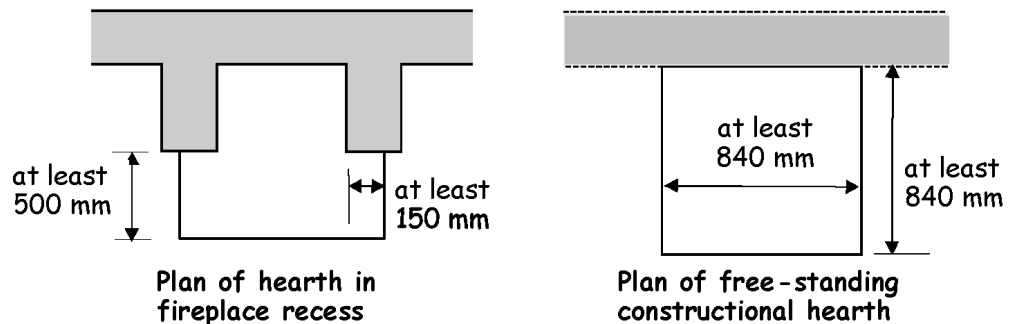
- a distance according to the designation of the connecting *flue-pipe* in accordance with BS EN 1856-2: 2005; or
- a distance equivalent to at least 3 times the diameter of the *flue-pipe*. However this distance may be reduced:
 - to 1.5 times the diameter of the *flue-pipe*, if there is a *non-combustible* shield provided in accordance with the following sketch; or
 - to 0.75 times the diameter of the *flue-pipe*, if the *flue-pipe* is totally enclosed in *non-combustible* material at least 12 mm thick with a thermal conductivity of not more than 0.065 W/mK.



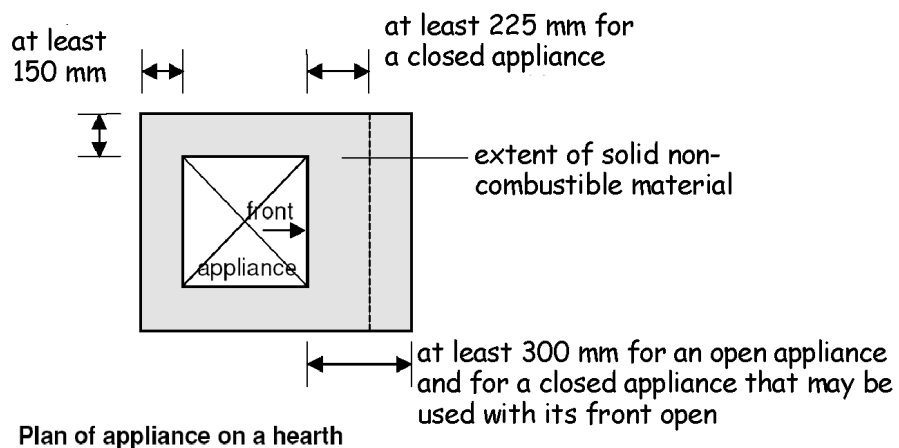
3.19.5 Relationship of solid fuel appliance to combustible material

A solid fuel appliance should be provided with a solid, *non-combustible* hearth that will prevent the heat of the appliance from igniting combustible materials. A hearth should be provided to the following dimensions:

- a. a *constructional* hearth at least 125 mm thick and with plan dimensions in accordance with the following sketches; or
- b. a free-standing, solid, *non-combustible* hearth at least 840 x 840 mm minimum plan area and at least 12 mm thick, provided the appliance will not cause the temperature of the top surface of the hearth on which it stands to be more than 100° C.

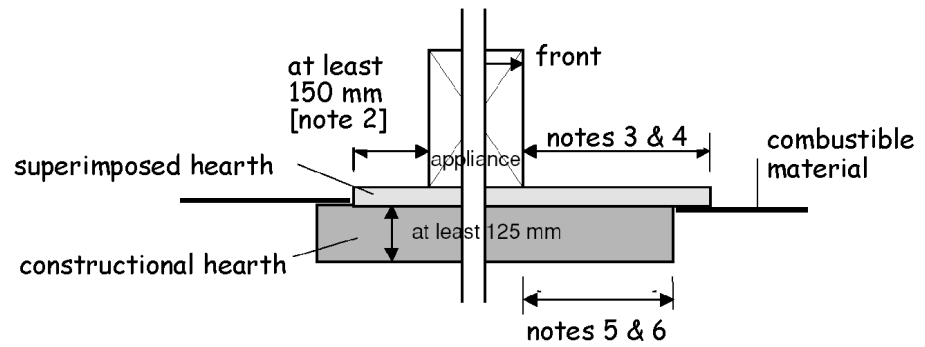


Not only should a solid fuel appliance sit on a hearth, but the appliance itself should also be located on the hearth such that protection will be offered from the risk of ignition of the floor by direct radiation, conduction or falling embers. The solid fuel appliance should be located on a hearth in accordance with the following diagram:



The 150 mm does not apply where the appliance is located in a fireplace recess, nor does it apply where the back or sides of the hearth either abut or are carried into a solid, *non-combustible* wall complying with clause 3.19.8.

A solid fuel appliance may sit on a superimposed hearth provided the hearth is positioned partly or wholly on a *constructional* hearth. The superimposed hearth should be of solid, *non-combustible* material, usually decorative, and be at least 50 mm thick in accordance with the following diagram:



Section through superimposed hearth

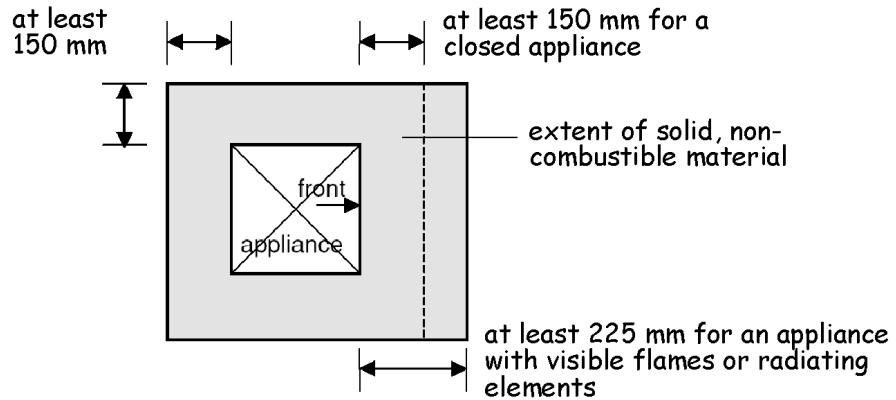
Notes:

1. SUPERIMPOSED HEARTH means a finish of solid, *non-combustible* material, usually decorative, at least 50 mm thick and positioned on a *constructional* hearth.
2. There need not be a 150 mm separation where the appliance is located in a fireplace recess, nor where the back or sides of the hearth either abut or are carried into a solid, *non-combustible* wall complying with clause 3.19.8.
3. At least 225 mm for a closed appliance.
4. At least 300 mm for an open appliance and for a closed appliance that may properly be used with its front open.
5. No part of the appliance should project over any edge of the *constructional* hearth.
6. At least 150 mm to combustible material, measured horizontally.

3.19.6 Relationship of oil-firing appliances to combustible material

A hearth is not required beneath an oil-firing appliance if it incorporates a full-sized, rigid *non-combustible* base and does not raise the temperature of the floor beneath it to more than 100° C under normal working conditions. The base may be provided separately from the appliance. In other cases the appliance should stand on a hearth *constructed* and installed in accordance with the guidance for a solid fuel appliance.

A floor-standing, oil-firing appliance should be positioned on the hearth in such away as to minimise the risk of ignition of any part of the floor by direct radiation or conduction. An oil-firing appliance should be located on a hearth in accordance with the following diagram:



Plan of appliance on a hearth

The 150 mm does not apply where the appliance is located in a fireplace recess, nor does it apply where the back or sides of the hearth either abut or are carried into a solid, *non-combustible* wall complying with clause 3.19.8.

An oil-firing appliance should be separated from any combustible material if the temperature of the back, sides or top of the appliance is more than 100°C under normal working conditions. Separation may be by:

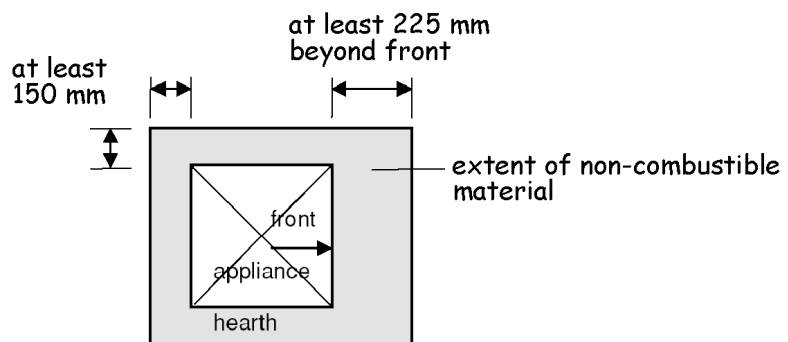
- a. a shield of *non-combustible* material at least 25 mm thick; or
- b. an air space of at least 75 mm.

OFTEC Standard OFS A100 for boilers, OFS A101 for cookers and OFS A102 for *room* heaters defines suitable tests for measuring the temperature of the back, sides and top of an oil-firing appliance.

3.19.7 Relationship of gas-fired appliance to combustible material

A gas-fired appliance should be provided with a hearth in accordance with the following recommendations:

- a. Clause 12 of BS 5871: Part 1: 2005, for a gas fire, convector heater and fire/back boiler;
- b. Clause 12 of BS 5871: Part 2: 2005, for an inset live fuel-effect gas appliance;
- c. Clause 11 of BS 5871: Part 3: 2005, for a *decorative fuel-effect gas appliance*;
- d. for any other gas-fired appliance, by a solid, heat resistant, *non-combustible*, non-friable material at least 12 mm thick and at least the plan dimension shown in the diagram to this specification:



Plan of appliance on a hearth

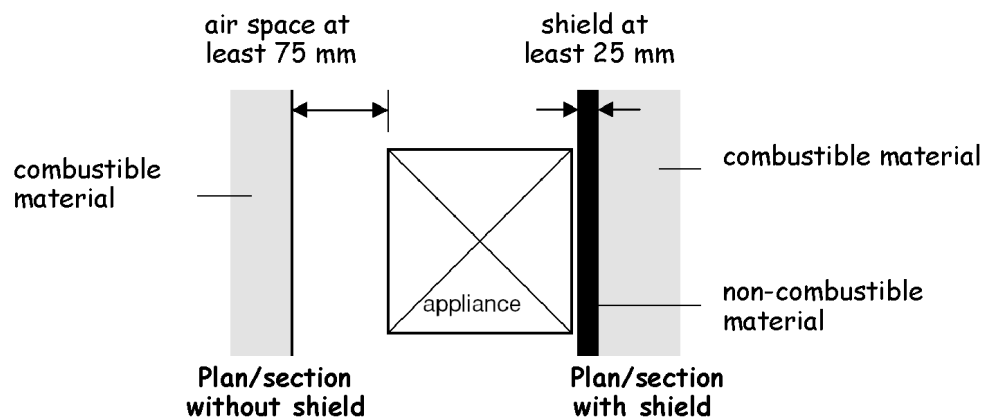
The 150 mm does not apply where the appliance is located in a fireplace recess, nor does it apply where the back or sides of the hearth either abut or are carried into a solid, *non-combustible* wall complying with clause 3.19.8.

However a hearth need not be provided:

- a. where every part of any flame or incandescent material in the appliance is at least 225 mm above the floor; or
- b. where the appliance is designed not to stand on a hearth, such as a wall mounted appliance or a gas cooker.

A gas-fired appliance should be separated from any combustible material if the temperature of the back, sides or top of the appliance is more than 100°C under normal working conditions. Separation may be by:

- a. a shield of *non-combustible* material at least 25 mm thick; or
- b. an air space of at least 75 mm.



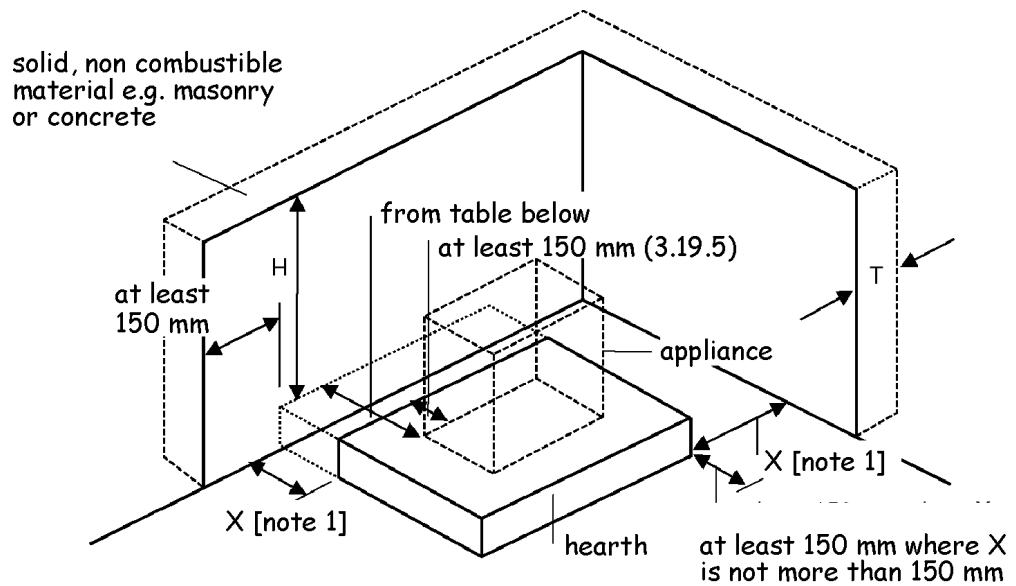
A gas-fired appliance with a CE marking and installed in accordance with the manufacturer's written instructions may not require this separation.

3.19.8 Relationship of hearths to combustible materials

Walls that are not part of a fireplace recess or a prefabricated appliance chamber but are adjacent to hearths or appliances should also protect the *dwelling* from catching fire. This is particularly relevant to timber-framed *buildings*. Any part of a *dwelling* therefore that abuts or is adjacent to a hearth, should be *constructed* in such a way as to minimise the risk of ignition by direct radiation or conduction from a solid fuel appliance located upon the hearth. This recommendation does not relate to floors, as an appliance should stand on a suitable hearth described in clauses 3.19.5, 3.19.6 and 3.19.7.

The *building* elements adjacent to combustion appliances should be *constructed* in accordance to the following recommendations:

- the hearth located in a fireplace recess in accordance with BS 8303: Part 1: 1994; or
- any part of the *dwelling*, other than the floor, not more than 150 mm from the hearth, *constructed* of solid, *non-combustible* material in accordance with the diagram and table to this specification.



Hearth and appliance adjacent to any part of a building

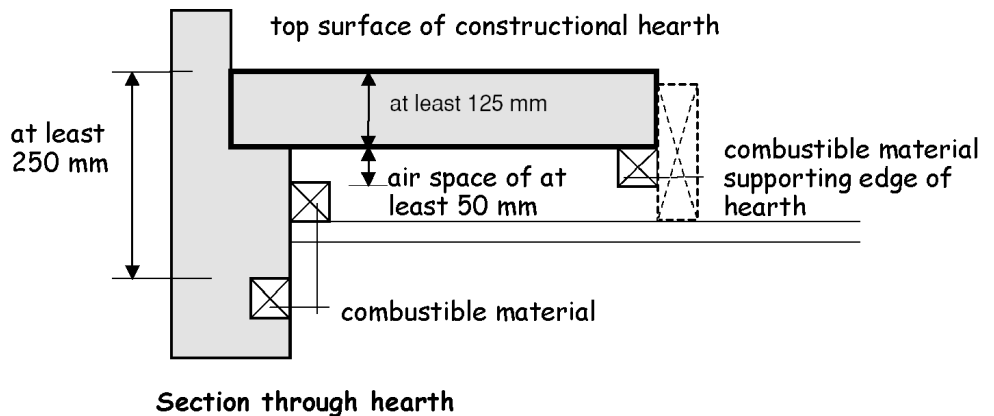
Location of hearth or appliance	Thickness (T) of solid, non-combustible material	Height (H) of solid non-combustible
where the hearth abuts a wall and the appliance is not more than 50 mm from the wall	200 mm	at least 300 mm above the appliance or 1.2 m above the hearth whichever is the greater.
where the hearth abuts a wall and the appliance is more than 50 mm but not more than 300 mm from the wall	75 mm	at least 300 mm above the appliance or 1.2 m above the hearth whichever is the greater.
where the hearth does not abut a wall and is not more than 150 mm from the wall	75 mm	at least 1.2 m above the hearth.

Notes:

1. There is no requirement for protection of the wall where X is more than 150 mm.

All combustible material under a *constructional* hearth should be separated from the hearth by an air space of at least 50 mm. However an air space is not necessary where:

- a. the combustible material is separated from the top surface of the hearth by solid, *non-combustible* material of at least 250 mm; or
- b. the combustible material supports the front and side edges of the hearth.



3.19.9 Fireplace recesses

A fireplace recess should be *constructed* of solid, *non-combustible* material in accordance with the recommendations in Clauses 7 and 8 of BS 8303:Part 1: 1994 and to the minimum thickness shown in Figure 2 to BS 8303:Part 3: 1994. The recess should incorporate a *constructional* hearth.

An alternative is to use a prefabricated appliance chamber of solid concrete components. These components should be:

- a. supplied by the same manufacturer, with pre-made jointing arrangements, assembled on *site* using a cement specified for the purpose by the manufacturer; and
- b. of insulating concrete with a density of between 1200 and 1700 kg/m³; and
- c. installed on a *constructional* hearth; and
- d. of components having a minimum thickness shown in the table below:

Thickness of solid fuel appliance chamber components

Component	Minimum thickness (mm)
Base	50
Sides	75
Back panel and top slab	100
Hood and bar lintels	100

3.20 Combustion appliances – removal of products of combustion

- 3.20 Functional standard
- 3.20.0 Introduction
- 3.20.1 Chimneys & flue-pipes serving appliances burning any fuel
- 3.20.2 Chimneys and flue-pipes serving solid fuel appliances
- 3.20.3 Chimneys and flue-pipes serving oil-firing appliances
- 3.20.4 Chimneys and flue-pipes serving gas-fired appliances
- 3.20.5 Oil-firing appliances in bathrooms and bedrooms
- 3.20.6 Gas-fired appliances in bathrooms and bedrooms
- 3.20.7 Protection of metal chimneys
- 3.20.8 Size of flues – solid fuel appliances
- 3.20.9 Size of flues - oil-firing appliances
- 3.20.10 Size of flues – gas-fired appliances
- 3.20.11 Design of flues
- 3.20.12 Openings in flues
- 3.20.13 Access to flues
- 3.20.14 Location of metal chimneys
- 3.20.15 Terminal discharges at low level
- 3.20.16 Terminal discharge from condensing boilers
- 3.20.17 Solid fuel appliance flue outlets
- 3.20.18 Oil-firing appliance flue outlets
- 3.20.19 Gas-fired appliance flue outlets

standard

3.20

mandatory

Every *building* must be designed and *constructed* in such a way that the products of combustion are carried safely to the external air without harm to the health of any person through leakage, spillage, or exhaust nor permit the re-entry of dangerous gases from the combustion process of fuels into the *building*.

3.20.0 Introduction

Fire fighters attend approximately 3400 *chimney* fires per year in Scotland.

Heating and cooking appliances fuelled by solid fuel, oil or gas all have the potential to cause carbon monoxide (CO) poisoning if they are poorly installed or commissioned, inadequately maintained or incorrectly used. Inadequate ventilation or a lack of the correct maintenance of appliances, *flues* and *chimneys* are the main causes of CO poisoning. Some incidents are also due to incorrect installation or deterioration of the structure of the *chimney*. Poisonous CO gas is produced when fuel does not burn properly. There are still a few deaths and permanent injuries in Scotland each year from CO poisoning that can be directly attributed to combustion appliance installations.

Incorrect sizing of *flues* can also have serious repercussions. If a *flue* is too small, an insufficient volume of air will pass through it and this may lead to spillage of combustion gases. Too large a *flue* will slow down the flow of combustion gases and this may also lead to spillage.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

3.20.1 Chimneys & flue-pipes serving appliances burning any fuel

A *chimney* or *flue-pipe* serving any appliance should be suitable for use with the type of appliance served. A *chimney* should be manufactured using products in accordance with the following standards:

- a. BS EN 1858: 2003, for concrete *chimney* blocks; or
- b. BS EN 1806: 2000, for clay *chimney* blocks; or
- c. BS EN 1857: 2003, for purpose made concrete *flue* linings; or
- d. BS EN 1457: 1999, for purpose made clay *flue* linings; or
- e. BS EN 1856 -1: 2003, for a factory-made metal *chimney*; or
- f. a lining accepted for the purpose after testing of the *chimney* under the relevant conditions by a *notified body*.

3.20.2 Chimneys and flue-pipes serving solid fuel appliances

A *flue* in a *chimney* should be separated from every other *flue* and extend from the appliance to the top of the *chimney*. Every *flue* should be surrounded by *non-combustible* material that is capable of withstanding the effects of a *chimney* fire, without any structural change that would impair the stability or performance of the *chimney*. However the *chimney* may include a damp proof course (or courses) of combustible material.

3.20.3 Chimneys and flue-pipes serving oil-firing appliances

A *chimney* or *flue-pipe* serving an oil-firing appliance should be *constructed* to the recommendations of BS 5410: Part 1: 1997 or OFTEC Technical Book 3 and OFTEC Standard OFS E106 as appropriate.

Satisfactory specification of *chimneys* and *flue-pipes* depends upon the gas temperature to be expected in normal service. *Flue* gas temperatures depend upon appliance types and the age of their design. Older appliances are likely to produce *flue* gas temperatures greater than 250° C while modern boilers that bear the CE mark indicating compliance with the Boiler (Efficiency) Regulations 1993 will normally have *flue* gas temperatures less than 250° C. Information for individual appliances should be sought from manufacturer's installation instructions, from the manufacturers themselves or from OFTEC. Where this is not available, *flues* should be *constructed* for an assumed *flue* gas temperature of more than 250° C.

Boiler (Efficiency)
Regulations 1993

High *flue* gas
temperatures

Where the *flue* gas temperatures are more than 250° C, under normal working conditions, custom-built *chimneys*, *system chimneys* and *flue-pipes* should be designed and *constructed* for use with a solid fuel appliance.

Low *flue* gas
temperatures

Where the *flue* gas temperatures are not more than 250° C, under normal working conditions, *chimneys* and *flue-pipes* may be of a lower specification as follows:

- a. in accordance with the guidance in clauses 3.18.3, 3.18.4, 3.18.5, relating to gas; and
- b. where the oil-firing appliance burns Class D fuel, the inner surfaces of the *chimney* or *flue-pipe* should not be manufactured from aluminium.

The *flue* gas temperatures are quoted in manufacturer's product data and can be measured in accordance with OFTEC Appliance Standard OFS A100 for boilers, OFS A101 for cookers or OFS A102 for *room* heaters.

3.20.4 Chimneys and flue-pipes serving gas-fired appliances

A *chimney* or *flue-pipe* should be *constructed* and installed in accordance with the following recommendations:

- a. BS 5440-1: 2000;
- b. 'IGE/UP/7: Edition 2, 'Gas installations in timber framed and light steel framed buildings', where the *chimney* or *flue-pipe* is in a framed *building*;
- c. the appropriate recommendations of the combustion appliance manufacturer, where the *flue-pipe* is supplied as an integral part of the combustion appliance.

3.20.5 Oil-firing appliances in bathrooms and bedrooms

There is an increased risk of carbon monoxide poisoning in bathrooms, shower *rooms* or *rooms* intended for use as sleeping accommodation, such as bed-sitters. Because of this, open-*flued* oil-firing appliances should not be installed in these *rooms* or any cupboard or *compartment* connecting directly with these *rooms*. Where locating a combustion appliance in such *rooms* cannot be avoided, the installation of a *room-sealed appliance* would be appropriate.

3.20.6 Gas-fired appliances in bathrooms and bedrooms

Regulation 30 of the Gas Safety (Installations and Use) Regulations 1998 has specific requirements for *room-sealed appliances* in these locations.

Gas Safety (Installations & Use Regulations

3.20.7 Protection of metal chimneys

Metal *chimneys* should be guarded if there could be a risk of damage or if they present a risk to people that is not immediately apparent such as when they traverse intermediate floors out of sight of the appliance.

Where the metal *chimney* passes through a *room* or accessible space such as a walk-in cupboard it should be protected in accordance with the recommendations of:

- a. BS EN 12391-1: 2003 for solid fuel appliances;
- b. BS 5410: Part 1: 1997, for oil-firing appliances;
- c. BS 5440: Part 1: 2000, for gas appliances.

It is not necessary to provide protection where a *system chimney* runs within the same space as the appliance served.

3.20.8 Size of flues – solid fuel appliances

The size of a *flue* serving a solid fuel appliance should be at least the size shown in the table below and not less than the size of the appliance *flue* outlet or that recommended by the appliance manufacturer.

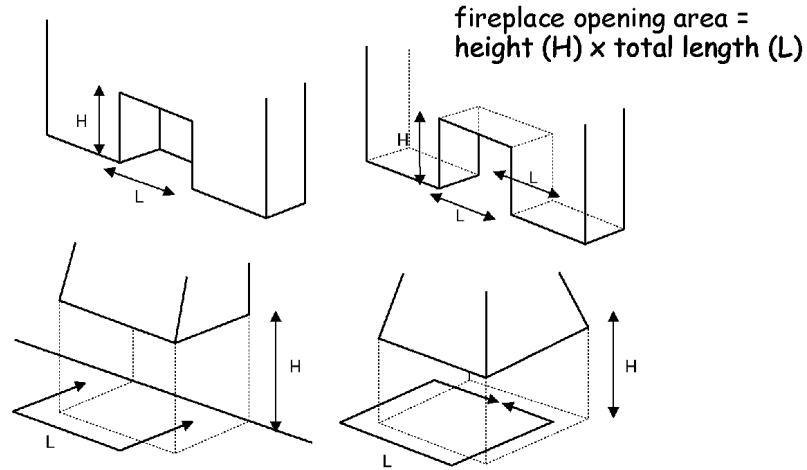
Minimum area of flues

Appliance	Minimum flue size [3]
Fireplace with an opening more than 500 mm x 550 mm, or a fireplace exposed on 2 or more sides	a. 15% of the total face area of the fireplace opening(s) [4]; or b. in accordance with the diagram to clause 3.20.7 [5]
Fireplace with an opening not more than 500 mm x 550 mm	200 mm diameter or rectangular/square <i>flues</i> having the same cross sectional area and a minimum diameter not less than 175 mm
Closed appliance with rated output more than 30 kW but not more than 50 kW, burning any fuel	175 mm diameter or rectangular/square <i>flues</i> having the same cross sectional area and a minimum diameter not less than 150 mm
Closed appliance with rated output not more than 30 kW burning any fuel	150 mm diameter or rectangular/square <i>flues</i> having the same cross sectional area and a minimum diameter not less than 125 mm
Closed appliance with rated output not more than 20 kW that burns smokeless or low volatiles fuel	125 mm diameter or rectangular/square <i>flues</i> having the same cross sectional area and a minimum diameter not less than 100 mm for straight <i>flues</i> or 125 mm for <i>flues</i> with bends or offsets

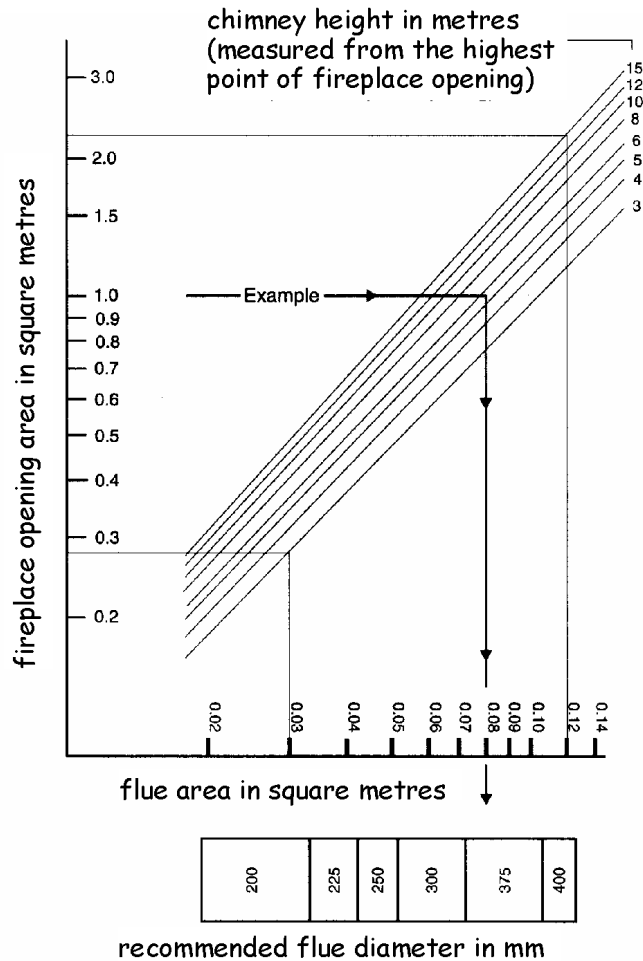
Notes:

1. CLOSED APPLIANCE includes cookers, stoves, *room* heaters and boilers.
2. SMOKELESS FUEL means solid mineral fuel that produces combustion products containing particulate matter that does not exceed a specified low amount.
3. Any *chimney* pot or open-topped terminal must maintain the same cross-sectional area as the *flue*. Any covered terminal should have side outlets with a total free area twice that of the *flue*.
4. Specialist advice should be sought when proposing to *construct flues* with an area of more than 120000 mm² or 15% of the total face area of the fireplace opening.
5. The diagram to clause 3.20.7 should only be used for the range of sizes shown within the shaded area.
6. Fire size is related to the free opening area at the front of the fireplace opening.

Fireplace opening areas



Flue sizing for solid fuel open fires



3.20.9 Size of flues - oil-firing appliances

The cross sectional area of a *flue* serving an oil-firing appliance should be in accordance with the recommendations in BS 5410: Part 1: 1997 and should be the same size as the appliance *flue* spigot.

3.20.10 Size of flues – gas-fired appliances

The area of a *flue* serving a gas-fired appliance should have a size to ensure safe operation. A *flue* should be provided in accordance with the following recommendations:

- a. Clause 9 of BS 5871: Part 3: 2005, for a *decorative fuel-effect gas* appliance;
- b. BS 5871: Part 2: 2005, for an inset live fuel-effect gas appliance;
- c. BS 5440: Part 1: 2000, for any other gas-fired appliance.

3.20.11 Design of flues

A combustion appliance should be connected to a *chimney* that discharges to the external air. However there are some combustion appliances that are designed not to discharge direct to the external air, such as *flueless* cookers. An opening window, extract fan or passive stack ventilation system may be sufficient to ventilate a *kitchen* but where other types of *flueless* appliances are installed, the manufacturer's instructions should be followed.

Solid Fuel

Every solid fuel appliance should be connected to a separate *flue*.

Oil-firing

Every oil-firing appliance should be connected to a separate *flue*. However this is not necessary where all the appliances have pressure jet burners and are connected into a shared *flue*.

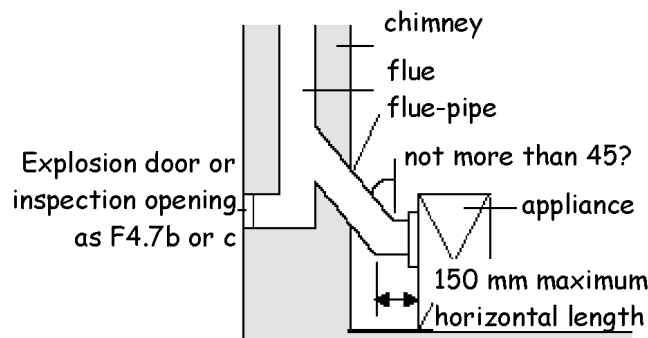
Gas-fired

Every gas-fired appliance that requires a *flue* should connect into a separate *flue*. However in certain instances, appliances can be connected to shared flues, if they are installed in accordance with the recommendations in BS 5440: Part 1: 2000.

The *flue* of a natural draught appliance, such as a traditional solid fuel appliance, should offer the least resistance to the passage of combustion gases. Resistance can be minimised by restricting the number of bends and horizontal runs should only be incorporated on back-entry appliances.

The horizontal length of the back-entry *flue-pipe* at the point of discharge from the appliance should be not more than 150 mm.

Flue-pipe connection to back-entry solid fuel appliance



Section through appliance and flue-pipe

Where bends are essential, they should be angled at not more than 45° to the vertical.

3.20.12 Openings in flues

The *flue* should have no intermediate openings. However it is acceptable to provide a draught stabiliser or draft diverter on the *chimney* provided it is in the same *room* or space as the appliance being served. An explosion door may also be provided.

3.20.13 Access to flues

Access should be provided for inspection and cleaning of the *flue* and the appliance and therefore an opening that is fitted with a *non-combustible*, rigid, gas-tight cover would be acceptable.

3.20.14 Location of metal chimneys

To minimise the possibility of condensation in a metal *chimney*, it should not be fixed externally to a *building*, but should be routed inside the *building*. However a metal *chimney* may be fixed externally if it is insulated and *constructed* of a material that can be used externally, such as stainless steel or, in the case of gas, aluminium, so long as they conform to the specifications of the National Annex to BS EN 1856-1: 2003.

3.20.15 Terminal discharges at low level

Combustion gases at the point of discharge can be at a high temperature. Therefore *flues* discharging at low level where they may be within reach of people should be protected with a terminal guard.

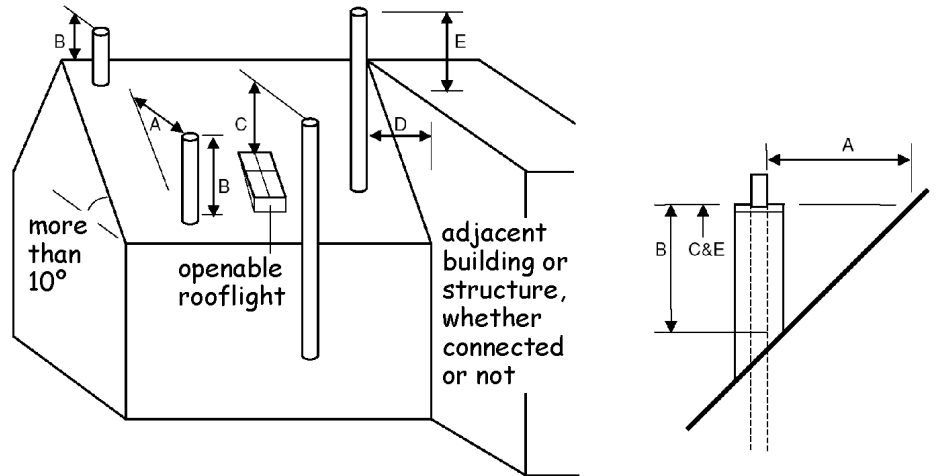
A *flue* terminal should be protected with a guard if a person could come into contact with it or if it could be damaged. If the *flue* outlet is in a vulnerable position, such as where the *flue* discharges within reach of the ground, or a balcony, veranda or window, it should be designed to prevent the entry of matter that could obstruct the flow of gases.

3.20.16 Terminal discharge from condensing boilers

The condensate plume from a condensing boiler can cause damage to external surfaces of a *building* if the terminal location is not carefully considered. The manufacturer's instructions should be followed.

3.20.17 Solid fuel appliance flue outlets

The outlet from a *flue* should be located externally at a safe distance from any opening, obstruction or flammable or vulnerable materials. The outlets should be located in accordance with the following diagram:



Minimum dimension to flue outlets

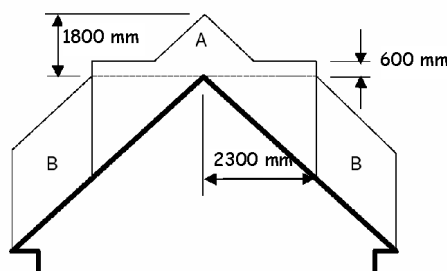
A	2.3 m horizontally clear of the weather skin.
B	1.0 m provided A is satisfied; or 600 mm where above the ridge. However where the roof is thatch or shingles, the dimensions should be as diagram 2 to clause 3.20.17.
C	1.0 m above the top of any flat roof; and 1.0 m above any openable rooflight, dormer or ventilator, etc. within 2.3 m measured horizontally.
D/E	where D is not more than 2.3 m, E must be at least 600 mm.

Notes:

1. Horizontal dimensions are to the surface surrounding the flue.
2. Vertical dimensions are to the top of the chimney terminal.

Combustible roof coverings

Flue terminals in close proximity to roof coverings that are easily ignitable, such as thatch or shingles, should be located outside Zones A and B in the following diagram:

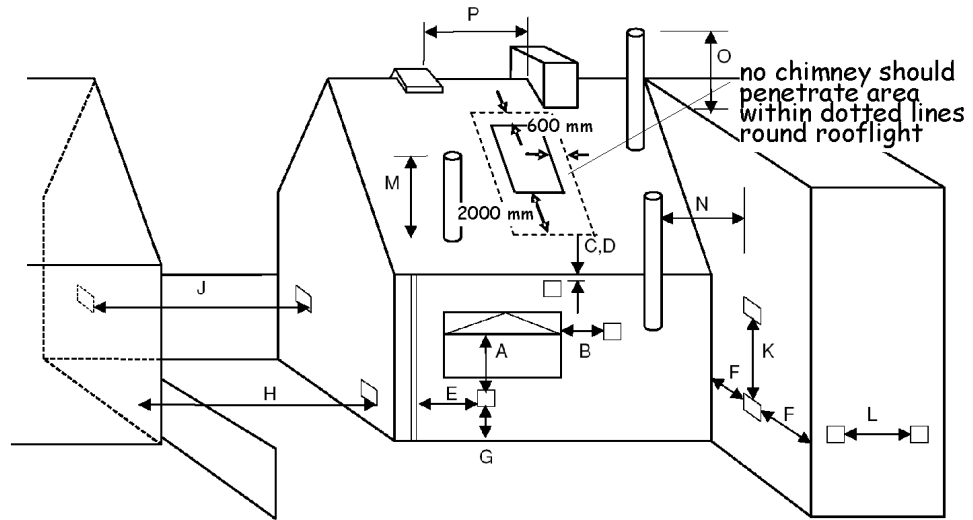


Location of flue terminals relative to easily ignitable roof coverings

Zone A	At least 1.8 m vertically above the weather skin; and at least 600 mm above the ridge.
Zone B	At least 1.8 m vertically above the weather skin; and at least 2.3 m horizontally from the weather skin.

3.20.18 Oil-firing appliance flue outlets

The outlet from a *flue* should be located externally at a safe distance from any opening, obstruction or combustible material. The outlets should be located in accordance with the following diagram:



Location	Minimum distance to terminal (mm)	
	pressure jet	vapourising
A Directly below an opening, air brick, opening window etc	600	Not allowed
B Horizontally to an opening, air brick, opening window etc	600	Not allowed
C Below a gutter, eaves or balcony with protection	75	Not allowed
D Below a gutter, eaves or balcony without protection	600	Not allowed
E From vertical sanitary pipework	300	Not allowed
F From an internal or external corner	300	Not allowed
G Above ground or balcony level	300	Not allowed
H From a surface or <i>boundary</i> facing the terminal	600 [6]	Not allowed
J From a terminal facing the terminal	1200	Not allowed
K Vertically from a terminal on the same wall	1500	Not allowed
L Horizontally from a terminal on the same wall	750	Not allowed
M Above the highest point of an intersection with the roof	600 [1]	1000 [7]
N From a vertical structure to the side of the terminal	750 [1]	2300
O Above a vertical structure not more than 750 mm from the side of the terminal	600 [1]	1000 [7]
P From a ridge terminal to a vertical structure on the roof	1500	Not allowed

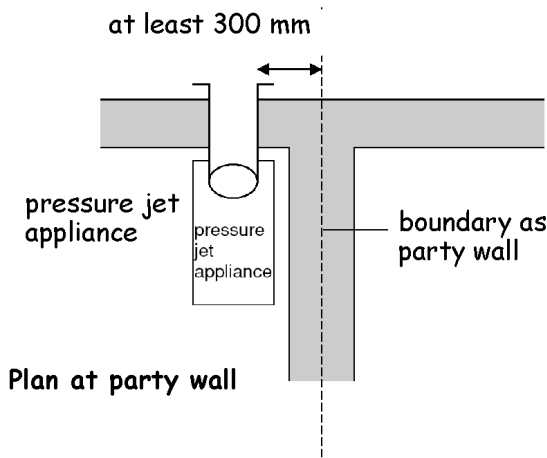
Notes:

1. Appliances burning Class D oil should discharge the *flue* gases at least 2 m above ground level.
2. Terminating positions M, N, and O for vertical balanced *flues* should be in accordance with manufacturer's instructions.
3. Vertical structure in N, O and P includes tank or lift *rooms*, parapets, dormers etc.
4. Terminating positions A to L should only be used for appliances that have been approved for low-level *flue* discharge when tested in accordance with BS EN 303-1: 1999, OFS A100 or OFS A101.
5. Terminating positions should be at least 1800 mm from an oil storage tank unless a wall with

a *non-combustible construction* type 7, short duration (see table to 2B1) and more than 300 mm higher and wider each side than the tank is provided between the tank and the terminating position.

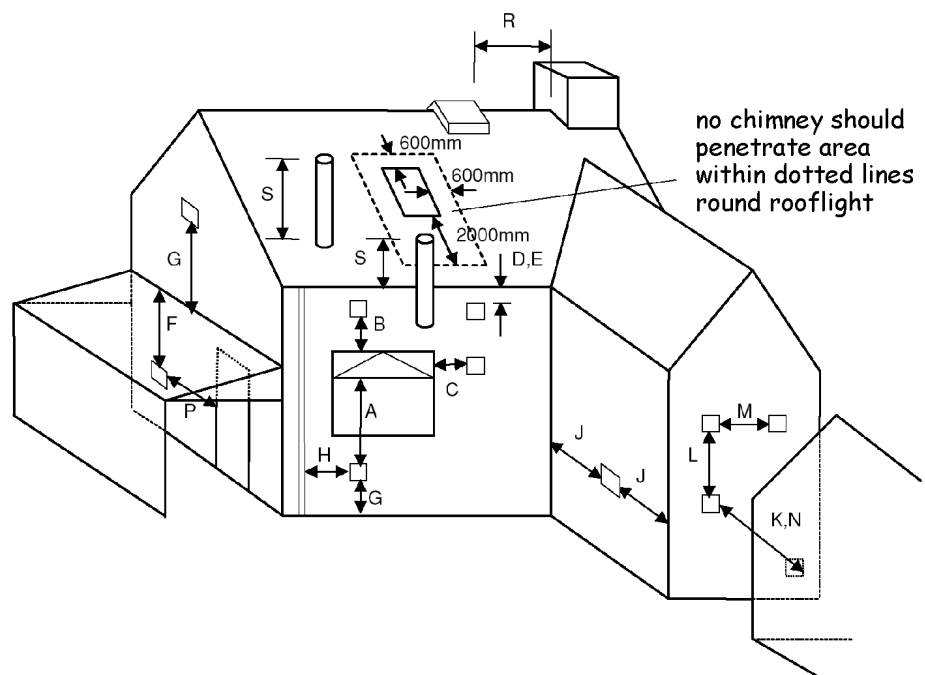
6. Where a *flue* terminates not more than 600 mm below a projection and the projection is plastic or has a combustible finish, then a heat shield of at least 750 mm wide should be fitted.
7. The distance from an appliance terminal installed at right angles to a *boundary* may be reduced to 300 mm in accordance with diagram 2 to clause 3.20.16.
8. Where a terminal is used with a vaporising burner, a horizontal distance of at least 2300 mm should be provided between the terminal and the roof line.
9. Notwithstanding the dimensions above, a terminal should be at least 300 mm from combustible material.

Separation between a boundary and terminal at right angles



3.20.19 Gas-fired appliance flue outlets

The outlet from a *flue* should be located externally at a safe distance from any opening, obstruction or combustible material. The outlets should be located in accordance with the following diagram:



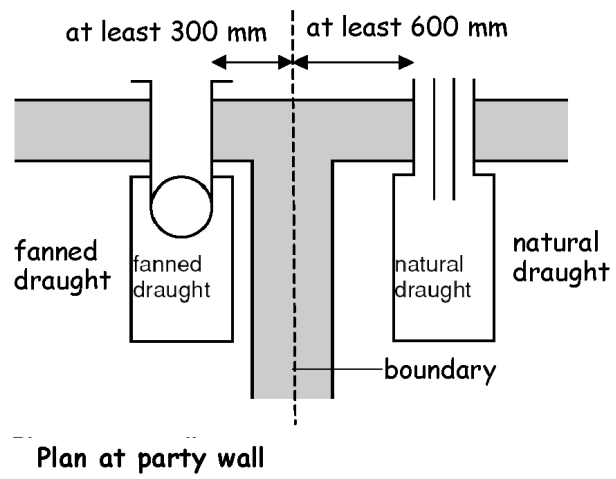
Flue terminal positions for gas-fired appliances

Location		Minimum distance to terminal in mm			
		Balanced flue, room-sealed appliance		Open flue	
		natural draught	fanned draught	natural draught	fanned draught
A	Directly below an opening, air brick, opening window, etc	(0-7 kW) 300 (>7-14 kW) 600 (>14-32 kW) 1500 (>32-70 kW) 2000	300	n/all	300
B	Above an opening, air brick, opening window, etc	(0-32 kW) 300 (>32-70 kW) 600	300	n/all	300
C	Horizontally to an opening, air brick, opening window, etc	(0-7 kW) 300 (>7-14 kW) 400 (>14-70 kW) 600	300	n/all	300
D	Below a gutter, or sanitary pipework	300 [2]	75 [1]	n/all	75 [1]
E	Below the eaves	300 [2]	200	n/all	200
F	Below a balcony or <i>carport</i> roof	600	200	n/all	200
G	Above ground, roof or balcony level	300	300	n/all	300
H	From vertical drain/soil pipework	300	150 [3]	n/all	150
J	From an internal or external corner	600	300	n/all	200
K	From a surface or <i>boundary</i> facing the terminal [4]	600	600 [5]	n/app	600
L	Vertically from terminal on same wall	1500	1500	n/app	1500
M	Horizontally from terminal on same wall	300	300	n/app	300
N	From a terminal facing the terminal	600	1200 [6]	n/app	1200
P	From an opening in a <i>carport</i> (e.g. door, window) into the <i>building</i>	1200	1200	n/app	1200
R	From a vertical structure on the roof [7]	n/app	n/app	[Note 8]	n/app
S	Above an intersection with the roof	n/app	[Note 9]	[Note 10]	150

Notes:

- Notwithstanding the dimensions in the table, a terminal serving a natural draught and fanned draught appliance of more than 3 kW heat input, should be at least 300 mm and 150 mm respectively from combustible material.
- Where a natural draught *flue* terminates not more than 1 m below a plastic projection or not more than 500 mm below a projection with a painted surface, then a heat shield at least 1 m long should be fitted.
- This dimension may be reduced to 75 mm for appliances of up to 5 kW heat input.
- The products of combustion should be directed away from discharging across a *boundary*.
- The distance from a fanned draught appliance terminal installed at right angles to a *boundary* may be reduced to 300 mm in accordance with diagram 2 to clause 3.20.17.
- The distance of a fanned *flue* terminal located directly opposite an opening in a *dwelling* should be at least 2 m.
- Vertical structure includes a *chimney-stack*, dormer window, tank *room*, lift motor *room* or parapet.
- 1500 mm if measured to a roof terminal, otherwise as Table 2 in BS 5440-1: 2000.
- To manufacturer's instructions.
- As Table 2 in BS 5440-1: 2000.
- n/all = not allowed. n/app = not applicable.

Separation between a boundary and terminal at right angles



3.21 Combustion appliances – air for combustion

- 3.21 Functional standard
- 3.21.0 Introduction
- 3.21.1 Supply of air for combustion generally
- 3.21.2 Supply of air for combustion to solid fuel appliances
- 3.21.3 Supply of air for combustion to oil-firing appliances
- 3.21.4 Supply of air for combustion to gas-fired appliances
- 3.21.5 Flueless gas heating appliances

standard

3.21

mandatory

Every *building* must be designed and *constructed* in such a way that each fixed combustion appliance installation receives air for combustion and operation of the *chimney* so that the health of persons within the *building* is not threatened by the build-up of dangerous gases as a result of incomplete combustion.

3.21.0 Introduction

All combustion appliances need ventilation to supply them with oxygen for combustion. This air, which must be replaced from outside the *dwelling*, generally comes from the *room* in which the combustion appliance is located although many appliances are now located in specially *constructed* cupboards or *appliance compartments*. Ventilation of these cupboards or *appliance compartments* is essential to ensure proper combustion. Ventilation is also needed to ensure the proper operation of *flues*, or in the case of *flueless* appliances, to ensure the products of combustion are safely dispersed to the outside air.

Failure to provide adequate replacement air to a *room* can result in the accumulation of poisonous carbon monoxide fumes.

Conservatories

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

3.21.1 Supply of air for combustion generally

A room containing an *open-flued appliance* may need permanently open air vents. An *open-flued appliance* needs to receive a certain amount of air from outside dependant upon its type and rating. Infiltration through the *building fabric* may be sufficient but above certain appliance ratings permanent openings are necessary.

Ventilators for combustion should be located so that occupants are not provoked into sealing them against draughts and noise. Discomfort from draughts can be avoided by placing vents close to appliances e.g. floor *ventilators*, by drawing air from intermediate spaces such as hallways or by ensuring good mixing of incoming air. Air vents should not be located within a fireplace recess except on the basis of specialist advice. Noise attenuated *ventilators* may be needed in certain circumstances.

Appliance compartments *Appliance compartments* that enclose *open-flued appliances* should be provided with vents large enough to admit all the air required by the appliance for combustion and proper *flue* operation, whether the *compartment* draws air from the *room* or directly from outside.

The installation of a mechanical extract system should be checked against the recommendations in clause 3.17.8.

3.21.2 Supply of air for combustion to solid fuel appliances

A solid fuel appliance installed in a *room* or space should have a supply of air for combustion by way of *permanent ventilation* either direct to the open air or to an adjoining space (including a sub-floor space) that is itself *permanently ventilated* direct to the open air. An air supply should be provided in accordance with the following table:

Supply of air for combustion

Type of appliance	Minimum ventilation opening sizes [2]
Open appliance without a throat [1]	A permanent air entry opening or openings with a total free area of 50% of the cross-sectional area of the <i>flue</i> .
Open appliance with a throat [1]	a permanent air entry opening or openings with a total free area of 50% of the throat opening area.
Any other solid fuel appliance	a permanent air entry opening or openings with a total free area of least 500 mm ² for each kW of combustion appliance rated output more than 5 kW (A combustion appliance with an output rating of not more than 5 kW has no minimum requirement, unless stated by the appliance manufacturer).

Notes:

1. THROAT means the contracted part of the *flue* lying between the fireplace opening and the main *flue*.
2. Where a draught stabiliser is fitted to a solid fuel appliance, or to a *chimney* or *flue-pipe* in the same *room* as a solid fuel appliance, additional ventilation opening should be provided with a free area of at least 300 mm²/kW of solid fuel appliance rated output.
3. Nominal fire size is related to the free opening width at the front of the fireplace opening.

3.21.3 Supply of air for combustion to oil-firing appliances

An oil-firing appliance installed in a *room* or space should have a supply of air for combustion by way of *permanent ventilation* either direct to the open air or to an adjoining space which is itself *permanently ventilated* direct to the open air. This also includes a sub-floor space. However this may not be necessary if it is a *room-sealed appliance*. An air supply should be provided in accordance with the recommendations in BS 5410: Part 1: 1997 or OFTEC Technical Book 3.

3.21.4 Supply of air for combustion to gas-fired appliances

A gas-fired appliance installed in a *room* or space should have a supply of air for combustion. An air supply should be provided in accordance with the following recommendations:

- a. BS 5871: Part 3: 2005, for a *decorative fuel-effect gas appliance*;
- b. BS 5871: Part 2: 2005, for an inset live fuel-effect gas appliance;
- c. BS 5440: Part 2: 2000, for any other gas-fired appliance.

3.21.5 Flueless gas heating appliances

Flueless gas heating appliances obtain the necessary air for combustion and disperse the products of combustion from and to the *room* or space within which they are located. As condensation could occur when *flueless* appliances are used as the only means of heating a *room* or space then notwithstanding BS 5440-2:2000, the appliance standard BS 5871-4: 2007 provides additional installation and ventilation guidance for independent *flueless* gas fires, convector heaters and heating stoves with a heat input of not more than 6kW in a *domestic building* or a *commercial building*.

3.22 Combustion appliances – air for cooling

- 3.22 Functional standard
- 3.22.0 Introduction
- 3.22.1 Appliance compartments
- 3.22.2 Supply of air for cooling to oil-firing appliances
- 3.22.3 Supply of air for cooling to gas-fired appliances

standard
3.22
mandatory

Every *building* must be designed and *constructed* in such a way that each fixed combustion appliance installation receives air for cooling so that the fixed combustion appliance installation will operate safely without threatening the health and safety of persons within the *building*.

3.22.0 Introduction

In some cases, combustion appliances may need air for cooling in addition to air for combustion. This air will keep control systems in the appliance at a safe temperature and/or ensure that casings remain safe to touch.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

3.22.1 Appliance compartments

Where appliances require cooling air, appliance *compartments* should be large enough to enable air to circulate and high and low level vents should be provided.

3.22.2 Supply of air for cooling to oil-firing appliances

An oil-firing appliance installed in an *appliance compartment* should have a supply of air for cooling by way of *permanent ventilation*, in addition to air for combustion, either direct to the open air or to an adjoining space. This also includes a sub-floor space. Air for cooling should be provided in accordance with the recommendations in BS 5410: Part 1: 1997 and in OFTEC Technical Book 3 for an oil-firing appliance located in an *appliance compartment*.

3.22.3 Supply of air for cooling to gas-fired appliances

A gas-fired appliance installed in an *appliance compartment* should have supply of air for cooling. Air for cooling should be provided in accordance with the recommendations in BS 5440: Part 2: 2000 for a gas-fired appliance located in an *appliance compartment*.

3.23 Fuel storage – protection from fire

- 3.23 Functional standard
- 3.23.0 Introduction
- 3.23.1 Separation of oil tanks from buildings and boundaries
- 3.23.2 Additional fire protection
- 3.23.3 Storage within a building
- 3.23.4 Bulk storage of woody biomass fuel

standard
3.23
mandatory

Every *building* must be designed and *constructed* in such a way that:

- (a) an oil storage installation, incorporating oil storage tanks used solely to serve a fixed combustion appliance installation providing space heating or cooking facilities in a *building*, will inhibit fire from spreading to the tank and its contents from within, or beyond, the *boundary*;
- (b) a container for the storage of woody biomass fuel will inhibit fire from spreading to its contents from within, or beyond the *boundary*.

Limitation:

This standard does not apply to portable containers.

3.23.0 Introduction

The guidance on oil relates only to its use solely where it serves a combustion appliance providing space heating or cooking facilities in a *building*. There is other legislation covering the storage of oils for other purposes. Heating oils comprise Class C2 oil (kerosene) or Class D oil (gas oil) as specified in BS 2869: 2006.

It is considered unlikely that a fire will originate from the stored oil. It is the purpose of this guidance therefore, to ensure that a fire that may originate from a *building*, or other external source, is not transferred to the tank contents, or if a fire does occur, its effects are limited.

Woody biomass

The acceptance of climate change and the environmental policies put in place to mitigate its impacts are pushing the commercial introduction of renewable energy technologies to displace the use of fossil fuels and the related combustion emissions of greenhouse gases. Woody biomass can be used as an alternative to fossil fuels and in some EU countries biomass fuel is the principal source of renewable energy for heating applications. The carbon dioxide emitted when biomass is burnt can be considered to be offset by the carbon dioxide absorbed as trees grow. Whilst this does not compensate for the energy used in processing the wood for fuel, the carbon dioxide emissions are considerably less than those of fossil fuels.

The use of woody biomass, in the form of wood chips, wood pellets, and logs may offer a viable alternative to fossil fuels, particularly in areas not served by the gas grid, although the supply and distribution of chips and pellets is, as yet, still developing with increasingly more suppliers available.

[www.scotland.gov.uk/
topics/built-environment/
building/building-standards](http://www.scotland.gov.uk/topics/built-environment/building/building-standards)

Information of the different types of woody biomass fuel can be found on the BSD website under: 'Storage of woody biomass fuel for heating equipment'

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

3.23.1 Separation of oil tanks from buildings and boundaries

Every fixed oil tank with a capacity of more than 90 litres should be located at a distance from a *building* to reduce the risk of the fuel that is being stored from being ignited if there is a fire in the *building*. Some fire protection to, or for, the *building* is required if the oil tank is located close to the *building*. Further guidance may be obtained from OFTEC Technical Information Sheet TI/136, Fire protection of oil storage tanks.

Precautions should also be taken when an oil storage tank is located close to a *boundary*. The installation of a tank should not inhibit full development of a neighbouring plot.

Large tanks

An oil tank with a capacity of more than 3500 litres should be located in accordance with the recommendations in BS 5410: Part 2: 1978.

Small tanks

An oil tank with a capacity of not more than 3500 litres should be located in accordance with the following table:

Location of oil storage tank not more than 3500 litres capacity

Location of tank	Protection recommended	
	Buildings without openings	Buildings with openings
Not more than 1.8 m from any part of any <i>building</i>	<i>non-combustible</i> base; and any part of the eaves not more than 1.8 m from the tank and extending 300 mm beyond each side of the tank must be <i>non-combustible</i> ; and, either: a. any part of a <i>building</i> not more than 1.8 m from the tank should be of <i>non-combustible construction</i> type 7, short duration [2], or b. a barrier [1].	<i>non-combustible</i> base; and any part of the eaves not more than 1.8 m from the tank and extending 300 mm beyond each side of the tank must be <i>non-combustible</i> ; and a barrier between the tank and any part of a <i>building</i> not more than 1.8 m from the tank.
More than 1.8 m from any <i>building</i>	<i>non-combustible</i> base	
Not more than 760 mm from a <i>boundary</i>	<i>non-combustible</i> base, and a barrier, or a wall with a <i>non-combustible construction</i> type 7, short duration [2].	
More than 760 mm from a <i>boundary</i>	<i>non-combustible</i> base	
Externally, wholly below ground	no protection required	

Notes:

1. BARRIER means an imperforate, *non-combustible* wall or screen at least 300 mm higher and extending 300 mm beyond either end of the tank, *constructed* so as to prevent the passage of direct radiated heat to the tank.
2. See section 2: Fire, annex 2.B.1.

3.23.2 Additional fire protection

The fuel feed system from the storage tank to the combustion appliance is also a potential hazard in the event of fire. The fire valve on the fuel feed, should be fitted in accordance with Clause 8.3 of BS 5410: Part 1: 1997 and OFTEC Technical Book 3.

Oil pipelines located inside a *building* should be run in copper or steel pipe. The recommendations of Clause 8.2 of BS 5410: Part 1: 1997 should be followed.

Fire can also spread to an oil storage tank along the ground. Provision should therefore be made to prevent the tank becoming overgrown such as a solid, *non-combustible* base in full contact with the ground. A base of concrete at least 100 mm thick or of paving slabs at least 42 mm thick that extends at least 300 mm beyond all sides of the tank would be appropriate. However where the tank is within 1 m of the *boundary* and not more than 300 mm from a barrier or a wall of *non-combustible construction* type 7, short duration (see table to section 2: Fire, annex 2.B.1), the base need only extend as far as the barrier or wall.

3.23.3 Storage within a building

Where a storage tank is located inside a *building*, additional safety provisions should be made including the following:

- a. the place where the tank is installed should be treated as a *place of special fire risk*; and
- b. the space should be ventilated to the external air; and
- c. the space should have an outward opening door that can be easily opened without a key from the side approached by people making their escape; and
- d. there should be sufficient space for access to the tank and its mountings and fittings; and
- e. a catchpit as described in standard 3.24.

Guidance on protection from spillage is provided to standard 3.24.

Further guidance may be obtained from OFTEC Technical Book 3 for garage installations.

3.23.4 Bulk storage of woody biomass fuel

By its very nature woody biomass fuel is highly combustible and precautions need to be taken to reduce the possibility of the stored fuel igniting. To ensure maximum energy from the fuel, storage should be designed to be damp free and improve or maintain the moisture content of the fuel at time of delivery. To inhibit the spread of fire to the contents, bulk storage for wood fuels should be in containers in accordance with following table:

Bulk storage of woody biomass fuel

Location of container	Protection recommended
External and not more than 1.8 m from any part of any <i>building</i>	a. any part of the <i>building</i> eaves not more than 1.8 m from the container or storage space and extending 300 mm beyond each side of the container or storage space should be <i>non-combustible</i> ; and b. a barrier [1]
External not more than 1 m from any <i>boundary</i>	the container or storage frame should be <i>constructed</i> to have short fire resistance duration to its <i>boundary</i> walls
Within a <i>building</i>	a. separated from the <i>building</i> with internal wall <i>constructions</i> providing short fire resistance duration type 4 [2]; and b. any door to be outward opening providing short fire resistance duration type 6 [2]; and c. separated from the <i>building</i> with floor <i>constructions</i> providing short fire resistance duration type 2 [2]; and d. <i>external walls constructed</i> that provide short fire resistance duration type 7 or type 8 [2] as appropriate

Notes:

1. BARRIER means an imperforate, *non-combustible* wall or screen at least 300 mm higher than and extending 300 mm beyond either end of the container or storage space *constructed* so as to prevent the passage of direct radiated heat.
2. See section 2: Fire, annex 2.B.1.

Protection for pellets

Wood pellets can be damaged during delivery thus producing dust that can cause an explosion and precautions need to be taken to reduce this risk. Once a year any dust that has collected in the store should be removed.

Storage containers for wood pellets, where they are to be pumped from a transporter to the container, should include a protective rubber mat over the wall to reduce damage to the pellets when they hit the wall. Containers should have an outward opening door incorporating containment to prevent the pellets escaping when the door is opened.

Automated supply

To maintain fire proof storage and prevent back-burning there should be an interruption to the fuel transport system normally by use of a star-feeder or chute for the fuel to fall into the boiler. The installation should be in accordance with the safety standards described in BS EN 303-5: 1999.

Small installations

Delivery of woody biomass fuel in bags would only be economical for small installations such as the suggestion in the guidance to standard 6.2 for the use of a small woody biomass stove or boiler as secondary heating providing 10% of the annual heating demand. The woody biomass fuel should be stored separately from the boiler that the fuel feeds for fire safety reasons.

3.24 Fuel storage – containment

- 3.24 Functional standard
- 3.24.0 Introduction
- 3.24.1 Construction of oil storage tanks
- 3.24.2 Installation of oil storage tanks
- 3.24.3 Secondary containment
- 3.24.4 Storage containers for solid woody biomass fuel

<p style="text-align: center;">standard</p> <h1 style="text-align: center;">3.24</h1> <p style="text-align: center;">mandatory</p>	<p>Every <i>building</i> must be designed and <i>constructed</i> in such a way that:</p> <p>(a) an oil storage installation, incorporating oil storage tanks used solely to serve a fixed combustion appliance installation providing space heating or cooking facilities in a <i>building</i> will: reduce the risk of oil escaping from the installation; contain any oil spillage likely to contaminate any water supply, ground water, watercourse, drain or sewer; and permit any spill to be disposed of safely;</p> <p>(b) the volume of woody biomass fuel storage allows the number of journeys by delivery vehicles to be minimised.</p> <p>Limitation: This standard does not apply to portable containers.</p>
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3.24.0 Introduction

Oil is a common and highly visible form of water pollution. Because of the way it spreads, even a small quantity can cause a lot of harm to the aquatic environment. Oil can pollute rivers, lochs, groundwater and coastal waters killing wildlife and removing vital oxygen from the water.

Groundwater directive	Oil is a 'List I' substance within the meaning of the EC Groundwater Directive (80/68/EEC). The UK government is required by this directive to prevent List I substances from entering groundwater and to prevent groundwater pollution by List II substances.
Storage of oil authorisation	The storage of oil is a controlled activity under the Water Environment (Controlled Activities)(Scotland) Regulations 2005 and will be deemed to be authorised if it complies with The Water Environment (Oil Storage)(Scotland) Regulations 2006. Enforcement is by SEPA.
Explanation of terms	<p>The following terms are included below to provide clarity to their meaning in this Technical Handbook.</p> <p>Catchpit means a pit, without a drain, which is capable of containing 110% of the containers storage capacity with base and walls that are impermeable to water and oil.</p> <p>Integrally banded tank means a tank together with a catchpit manufactured as a self-contained unit.</p>
Woody biomass storage	<p>Woody biomass fuel is unlikely to be locally sourced, except for chopped firewood, and for large installations is likely to be delivered in bulk. If the storage container is too small, the number of journeys by delivery vehicles will make unnecessary use of diesel fuel. Wood chips tend to be used in large boilers supplying heat to district heating systems rather than to individual <i>houses</i>. Information on woody biomass fuel can be found on the BSD website under: 'Storage of woody biomass fuel for heating equipment'.</p>
<i>Conversions</i>	In the case of <i>conversions</i> , as specified in regulation 4, the <i>building</i> as <i>converted</i> shall meet the requirement of this standard (regulation 12, schedule 6).

[www.scotland.gov.uk/
topics/built-environment/
building/building-standards](http://www.scotland.gov.uk/topics/built-environment/building/building-standards)

3.24.1 Construction of oil storage tanks

Fixed oil storage tanks between 90 and 2500 litres and the fuel feed system connecting them to a combustion appliance should be strong enough to resist physical damage and corrosion so that the risk of oil spillage is minimised. Tanks should be *constructed* in accordance with:

- a. the recommendations of BS 799: Part 5: 1987, for a steel tank; or
- b. the recommendations of OFTEC Technical Standard OFS T200, for a steel tank, with or without integral bunding; or
- c. the recommendations of OFTEC Technical Standard OFS T100, for a polyethylene tank with or without integral bunding; or
- d. a European harmonised product standard and assessed by a *notified body*.

3.24.2 Installation of oil storage tanks

Large tanks

Tanks of more than 2500 litres, and their associated pipework must be installed in accordance with the requirements of Regulation 6 of The Water Environment (Oil Storage)(Scotland) Regulations 2006. Oil storage containers up to 2500 litres serving *domestic buildings* will be deemed to be authorised if they comply with the building regulations.

Small tanks

Tanks with a capacity of more than 90 litres but not more than 2500 litres and the fuel feed system connecting them to a combustion appliance should be installed in accordance with the recommendations of BS 5410: Part 1: 1997.

Underground tanks

Reference should be made to the Scottish Executive Code of Practice, Underground Storage Tanks for Liquid Hydrocarbons (2003/27). This CoP provide guidance on underground and partially buried oil storage tanks. The CoP is currently being updated to be consistent with The Water Environment (Controlled Activities)(Scotland) Regulations 2005 and will be issued by SEPA. SEPA also provide guidance in PPG 27, (Installation, Decommissioning and Removal of Underground Storage Tanks).

Care should be taken to prevent leakage from pipework. Pipework should be run so as to provide the most direct route possible from the tank to the burner. Joints should be kept to a minimum and the use of plastic coated malleable copper pipe is recommended. Pipework should be installed in accordance with the recommendations in BS 5410: Parts 1: 1997 and Part 2: 1978 and OFTEC Technical Book 3.

3.24.3 Secondary containment

Externally located, above ground, oil tanks with a capacity of not more than 2500 litres serving a *domestic building* should be provided with a catchpit or be integrally bunded if subject to any of the hazards described below:

- tank located within 10 m of the water environment (i.e. rivers, lochs, coastal waters);
- tank located where spillage could run into an open drain or to a loose fitting manhole cover;
- tank within 50 m of a borehole or spring;
- tank over ground where conditions are such that oil spillage could run-off into a watercourse;
- tank located in a position where the vent pipe outlet is not visible from the fill point;
- any other potential hazard individual to the *site*.

OFTEC Technical Book 3 provides a simple and helpful crosscheck to the above list.

A catchpit or integrally banded tank should be provided in accordance with the recommendations of OFTEC Standard OFS T100 and OFS T200; and Clause 6.5 of BS 5410: Part 1: 1997.

Secondary containment should also be provided where a tank is within a *building* or wholly below ground.

3.24.4 Storage containers for solid woody biomass fuel

In order to best exploit the advantages achieved through the use of woody biomass as low carbon technology it is recommended that wood fuel storage provision is of a size that will ensure deliveries need not be made at intervals of less than 3 months for bulk storage and 6 months for small installations.

Deliveries of wood pellets may be less frequent than deliveries of wood chips because pellets can have three times the calorific value of dry wood chips. Alternatively, the storage volume can be smaller for the same energy capacity.

The following table provides recommended size of storage for a variety of different *dwelling* types that will permit a large enough volume to be delivered whilst minimising vehicle movements. Advice on the sizing of storage for woody biomass fuel for larger *buildings* is given in the non-domestic Technical Handbook.

Bulk woody biomass fuel storage: 100% heating (primary) and DHW

Dwelling size	Wood pellets	Wood chips	Logs - stacked
< 80 m ²	1.5 m ³	3.5 m ³	3 m ³
80 - 160 m ²	2 m ³	5 m ³	4 m ³
> 160 m ²	3 m ³	6 m ³	5 m ³

Notes:

1. The figures in the table relate to deliveries made every 3 months.

The guidance to standard 6.2 suggests that to achieve the carbon emissions target, designers and developers may use *on-site* renewable energy technologies to supply up to 10% of the annual heating demand, rather than adopting slightly more demanding insulation standards for walls. A small woody biomass stove or boiler could provide this level of heating.

Secondary heating

The following table provides recommended size of storage for secondary heating for a variety of *dwelling* types:

Woody biomass fuel storage: secondary heating

Dwelling size	Wood pellets	Wood chips	Logs - stacked
< 80 m ²	0.3 m ³ (9 bags)	1 m ³	0.5 m ³
80 - 160 m ²	0.5 m ³ (13 bags)	1.5 m ³	1 m ³
> 160 m ²	0.7 m ³ (16 bags)	2 m ³	1 m ³

Notes:

1. The figures in the table relate to deliveries made every 6 months.

3.25 Solid waste storage

- 3.25 Functional standard
- 3.25.0 Introduction
- 3.25.1 Solid waste storage point
- 3.25.2 Enclosed storage
- 3.25.3 Solid waste collection point
- 3.25.4 Provision for washing down
- 3.25.5 Security against vermin

<p style="text-align: center;">standard</p> <p style="font-size: 2em; text-align: center;">3.25</p> <p style="text-align: center;">mandatory</p>	<p>Every <i>building</i> must be designed and <i>constructed</i> in such a way that accommodation for solid waste storage is provided which:</p> <p>(a) permits access for storage and for the removal of its contents;</p> <p>(b) does not threaten the health of people in and around the <i>building</i>; and</p> <p>(c) does not contaminate any water supply, ground water or <i>surface water</i>.</p> <p>Limitation: This standard applies only to a <i>dwelling</i>.</p>
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3.25.0 Introduction

The Environmental Protection Act, 1990 gives powers to the waste collection authority to stipulate the type and number of containers to be used. The Act also empowers the waste collection authority to designate a collection point for removal of the waste and this is normally at the *curtilage* of the *dwelling*.

Since 1990, there has been a change in waste management initiatives. Huge amounts of solid waste are disposed of to landfill sites each year squandering valuable resources and contaminating the environment. The EU Landfill Directive sets ambitious targets for reducing the disposal of municipal waste to landfill and to fulfil its responsibilities, Scotland published the National Waste Plan in 1999. The aim of the Plan is to minimise the impact of waste on the environment, to improve resource use efficiency in Scotland and to remedy environmental injustices suffered by those who have to live with the consequences of a wasteful society. It sets out the basis for a fundamental shift in the way Scotland's resources are managed and establishes the direction of the Scottish Executive's policies for sustainable waste management to 2020. Some of the objectives are to:

- provide widespread segregated kerbside waste collection across Scotland;
- achieve 25% recycling and composting of municipal waste by 2006 and 55% by 2020 (35% recycling and 20% composting);
- reduce landfilling of municipal waste from around 90% to 30%.

Area Waste Plans set out the way that waste will be handled in 11 areas across Scotland. Implementation will be built around a working partnership between the Scottish Executive, SEPA, local government, industry and the community. Householders have a crucial part to play as waste producers and as consumers and they will need encouragement to allow these ambitious targets to be achieved. Several trials are already in operation and designers need to be aware of these local initiatives and make suitable provision in their designs. Two or more containers may be needed to store different types of waste and this could increase the spatial requirements for the storage area inside and outside the *dwelling*.

National Waste Plan

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

3.25.1 Solid waste storage point

Every *dwelling* should be provided with a solid, washable hard-standing large enough to accommodate a waste container (or containers) such as a wheeled bin or some other container as specified by the waste collection authority. The hard-standing and access to the contents of the container should be readily accessible to allow removal.

3.25.2 Enclosed storage

Where enclosures, compounds or storage *rooms* are provided they should allow space for filling and emptying and provide a clear space of at least 150 mm between and around the containers. Communal enclosures with a roof that are also accessible to people should be at least 2 m high while individual enclosures of wheeled bins only need to be high enough to allow the lid to open.

3.25.3 Solid waste collection point

The hard-standing may be a collection point designated by the waste collection authority where the container can be removed or emptied. If the hard-standing is not the collection point then there should be an accessible route along which the container can be transported to the collection point. Over a short distance in an urban area it would be reasonable to use the access to the *dwelling*. Over longer distances in the country, the container could be dropped off at the collection point using a vehicle as is normal for farms.

3.25.4 Provision for washing down

Where communal solid waste storage is located within a *building*, such as where a refuse chute is utilised, the storage area should have provision for washing down and draining the floor into a *wastewater* drainage system. Gullies should incorporate a trap that maintains a seal even during periods of disuse. Walls and floors should be of an impervious surface that can be washed down easily and hygienically. The enclosures should be *permanently ventilated* at the top and bottom of the wall.

3.25.5 Security against vermin

Any enclosure for the storage of waste should be so designed as to prevent access by vermin unless the waste is to be stored in secure containers with close fitting lids, such as wheeled bins. The enclosure should not permit a sphere of 15 mm diameter to pass through at any point.

3.26 Dungsteads and farm effluent tanks

- 3.26 Functional standard
- 3.26.0 Introduction
- 3.26.1 Construction of dungsteads and farm effluent tanks
- 3.26.2 Location of dungsteads and farm effluent tanks
- 3.26.3 Safety of dungsteads and farm effluent tanks

standard
3.26
mandatory

Every *building* must be designed and *constructed* in such a way that there will not be a threat to the health and safety of people from a dungstead and farm effluent tank.

3.26.0 Introduction

Silage effluent is the most prevalent cause of point source water pollution from farms in Scotland. A high portion of serious pollution incidents occur each year through failure to contain or dispose of effluent satisfactorily.

Collection, storage and disposal of farm effluent and livestock wastes are all stages when pollution can occur. These materials are generally classified by type of stock and physical form. This may be solid, semi-solid or liquid. Solids are stored in dungsteads that must be properly drained and the effluent collected in a tank while liquids are stored in tanks above or belowground. The container must be impermeable.

Prevention of
Environmental Pollution
from Agricultural
Activity

The Code of Good Practice for the Prevention of Environmental Pollution from Agricultural Activity is a practical guide for farmers, growers, contractors and others involved in agricultural activities, on whom there is a statutory obligation to avoid causing pollution to the environment. The Code provides helpful guidance on the planning, design, *construction* management and land application of slurries and silage effluent that can give rise to pollution of water, air or soil environments. SEPA is the body responsible for enforcing these regulations.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

3.26.1 Construction of dungsteads and farm effluent tanks

Every dungstead or farm effluent tank, including a slurry or silage effluent tank should be *constructed* in such a manner so as to prevent the escape of effluent through the structure that could cause ground contamination or environmental pollution.

The *construction* should also prevent seepage and overflow that might endanger any water supply or watercourse.

3.26.2 Location of dungsteads and farm effluent tanks

Every dungstead or farm effluent tank, including a slurry or silage effluent tank should be located at a distance from a *dwelling* so as not to prejudice the health of people in the *dwelling*. The dungstead or farm effluent tank should be located at least 15 m from the *dwelling*.

3.26.3 Safety of dungsteads and farm effluent tanks

Where there is the possibility of injury from falls, a dungstead or farm effluent tank should be covered or fenced to prevent people from falling in. Covers or fencing should be in accordance with the relevant recommendations of Section 8 of BS 5502: Part 50: 1993.

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4.0 Introduction

- 4.0.1 Background
- 4.0.2 Aims
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Introduction

4.0

4.0.1 Background

Safety has been defined by the International Standards Organisation as ‘a state of freedom from unacceptable risks of personal harm’. This recognises that no activity is absolutely safe or free from risk. No *building* can be absolutely safe and some risk of harm to users may exist in every *building*. Building standards seek to limit risk to an acceptable level by identifying hazards in and around *buildings* that can be addressed through the Building (Scotland) Regulations.

Deaths and serious injury to people in and around *buildings* occur in significant numbers from accidents involving falls, collisions, entrapment, scalding, electrocution or malfunction of fittings. Designers need to consider all aspects of design carefully to minimise risks inherent in any *building*.

Safety - good practice
www.rospa.co.uk

Not all issues relating to good practice are covered in this Technical Handbook. Publications by organisations including the Royal Society for Prevention of Accidents (RoSPA) may offer further information relevant to the safety of occupants of, and visitors to, *buildings*.

Accessibility

Buildings should be designed to consider safety and the welfare and convenience of *building* users. An inclusive environment is one within which everyone, regardless of age, disability or circumstance, can make use of safely, conveniently and without assistance to the best of their ability. *Buildings* that consider future flexibility of use also contribute to the creation of a more sustainable housing stock, simplifying alterations. This can allow people to remain longer in their home, through changing circumstances, with the minimum of disruption and inconvenience.

The guidance in this section, together with the guidance in section 3, Environment relating to accessibility, has been based around, and developed from, issues that are included in ‘Housing for Varying Needs’ and the Lifetime Homes concept developed by the Joseph Rowntree Foundation.

Access statements

Promoted by the implementation of the Disability Discrimination Act, which applies to most *non-domestic buildings*, many designers and developers are becoming familiar with the use of an access statement as a means of assisting in the delivery of more inclusive *buildings*. This records how access issues have been considered and developed from project inception, through all stages of development, through to the final use of a *building*.

Where design proposals vary from guidance within this Handbook or, in the case of a *conversion* where a standard is to be met as far as is *reasonably practicable*, relevant information extracted from a project access statement may assist in determining compliance.

Security

A *dwelling* that is safe and secure provides a positive contribution to the quality of life of its occupants and contributes to the delivery of a more sustainable community. Introducing basic measures to improve security can make unlawful entry into *dwellings* physically more difficult and ensure the safety and welfare of occupants.

4.0.2 Aims

The intention of this section is to give recommendations for the design of *buildings* that will ensure access and usability, reduce the risk of accident and unlawful entry. The standards within this section:

- ensure accessibility to and within *buildings* and that areas presenting risk through access are correctly guarded; and

- reduce the incidence of slips, trips and falls, particularly for those users most at risk; and
- ensure that electrical installations are safe in terms of the hazards likely to arise from defective installations, namely fire and loss of life or injury from electric shock or burns; and
- prevent the creation of dangerous obstructions, ensure that *glazing* can be cleaned and operated safely and to reduce the risk of injury caused by collision with *glazing*; and
- safely locate hot water and steam vent pipe outlets, and minimise the risk of explosion through malfunction of unvented hot water storage systems and prevent scalding by hot water from *sanitary* facilities; and
- ensure the appropriate location and *construction* of storage tanks for liquefied petroleum gas; and
- ensure that windows and doors vulnerable to unlawful entry are designed and installed to deter house breaking.

4.0.3 Latest changes

The following is a summary of the changes that have been introduced since 1 May 2009. Minor alterations and corrections have also been made. A full list of changes to the May 2010 edition of the Technical Handbooks is available on the Building Standards website.

- 4.13 Introduction of a new standard and supporting guidance on improving the physical security of *dwelling*s.

4.0.4 Relevant legislation

Listed below are some pieces of legislation that may be relevant and/or helpful to those using the guidance in this particular section.

Electricity Safety, Quality & Continuity Regulations 2002

The Electricity Safety, Quality & Continuity Regulations 2002 define the duties of any party supplying electricity to premises with regard to matters such as supply, equipment, protection and provision of earthing.

The Gas Safety (Installation and Use) Regulations 1998

The Gas Safety (Installations and Use) Regulations 1998 require that any person who installs, services, maintains, removes, or repairs gas fittings should be competent. It covers not only materials, workmanship, safety precautions and testing of gas fittings but also the safe installation of all aspects of gas-fired combustion appliance installations.

4.0.5 Certification

Scottish Ministers can, under Section 7 of the Building (Scotland) Act 2003, approve schemes for the certification of design or *construction* for compliance with the mandatory functional standards. Such schemes are approved on the basis that the procedures adopted by the scheme will take account of the need to co-ordinate the *work* of various designers and specialist contractors. Individuals approved to provide certification services under the scheme are assessed to ensure that they have the qualifications, skills and experience required to certify compliance for the *work* covered by the scope of the scheme. Checking procedures adopted by Approved Certifiers will deliver design or installation reliability in accordance with legislation.

The certification of construction (electrical installations to BS 7671) scheme has been approved by Scottish Ministers to confirm compliance with relevant standards in section 4.

www.scotland.gov.uk/topics/built-environment/building/building-standards

4.1 Access to buildings

- 4.1 Functional standard
- 4.1.0 Introduction
- 4.1.1 Accessible car parking to flats or maisonettes
- 4.1.2 Car parking within the curtilage of a dwelling
- 4.1.3 Accessible routes
- 4.1.4 Surfaces to accessible routes
- 4.1.5 Length of accessible routes
- 4.1.6 Width of accessible routes
- 4.1.7 Accessible entrances
- 4.1.8 Common entrances
- 4.1.9 Accessible thresholds
- 4.1.10 Alteration and extension

standard

4.1

mandatory

Every *building* must be designed and *constructed* in such a way that all occupants and visitors are provided with safe, convenient and unassisted means of access to the *building*.

Limitation:

There is no requirement to provide access for a wheelchair user to:

- (a) a *house*, between either the point of access to or from any car parking within the *curtilage* of a *building* and an entrance to the *house* where it is not *reasonably practicable* to do so; or
- (b) a common entrance of a *domestic building* not served by a lift, where there are no *dwellings* entered from a common area on the entrance *storey*.

4.1.0 Introduction

An inclusive approach to design should be taken to ensure that *buildings* are as accessible to as wide a range of people as possible. Solutions should be integral to a design rather than an afterthought added in order to meet duties under building standards or other legislation.

Inclusive Design

Inclusive design is not just relevant to buildings. It applies throughout any internal or external environment, where people go about everyday activities. It should be a continuous process, through all stages of the development of a *building* and involve potential users. Advice on this topic is available in the joint BSD/Scottish Executive Planning Division Planning Advice Note PAN 78: 'Inclusive Design' which promotes the merits of an inclusive approach to the design of the *built* environment.

Whilst the guidance to this standard reflects general good practice, certain issues remain outwith the scope of the building regulations. There are numerous publications offering additional guidance on accessibility and inclusive design, including those listed below:

- BS 8300: 2009 – 'Design of buildings and their approaches to meet the needs of disabled people – code of practice';
- Housing for Varying Needs, Parts 1 & 2 – Communities Scotland;
- Inclusive Mobility – Department of Transport, 2002;
- 'Guidance on the Use of Tactile Paving Surfaces', published jointly by The Scottish Office and the Department for the Environment, Transport and the Regions (DETR).

Conversions

In the case of conversions, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably practicable*, and in no case be worse than before the *conversion* (regulation 12, schedule 6).

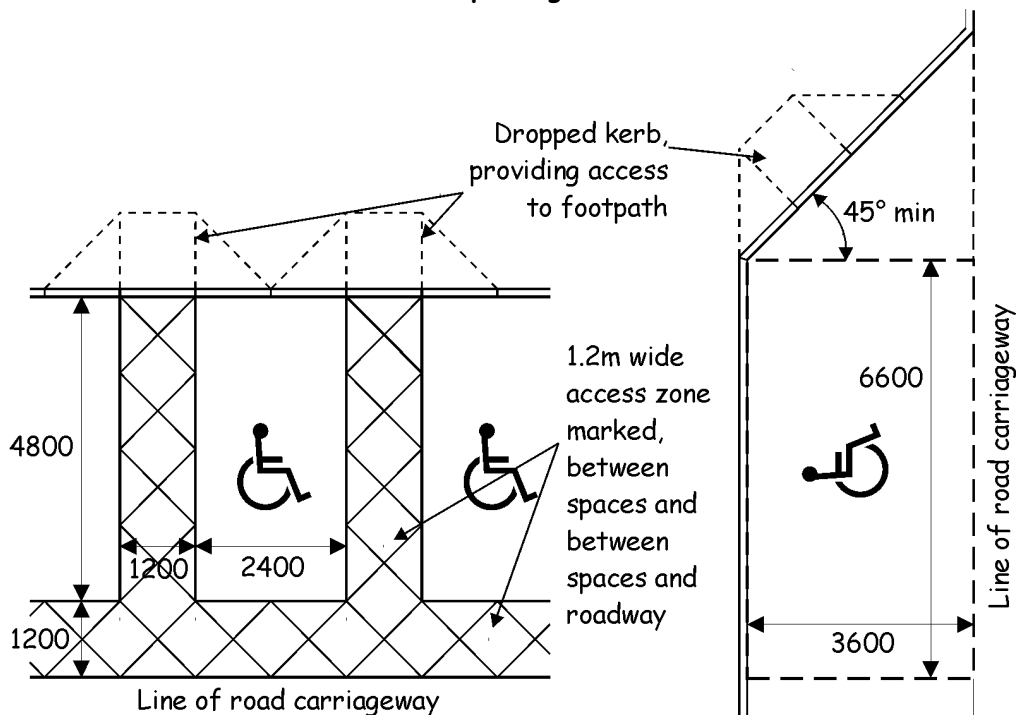
4.1.1 Accessible car parking to flats or maisonettes

The need for car parking serving a *domestic building* will commonly be determined by a developer and may also be a condition of planning permission. Where car parking is provided within the curtilage of a *building* containing *flats* or maisonettes, it should include accessible spaces.

A proportion of car parking spaces should be designed to be accessible to a person with mobility impairment, including a wheelchair user, and designated for use as such. These parking spaces should be:

- a. provided at a ratio of at least 1 per 20 parking spaces, or part thereof; and
- b. located on a *road* surface that is level (with a gradient of not more than 1 in 50); and
- c. not more than 45 m from a common entrance; and
- d. clearly marked with the international symbol of access; and
- e. provided with a dropped kerb access to an accessible route; and
- f. where perpendicular or at an angle to a *road*, at least 4.8 m long x 2.4 m wide, outwith which a delineated access zone at least 1.2 m wide to each long side and between the end of the bay and any *road* is shown; or
- g. where parallel to a *road*, at least 6.6 m long by 3.6 m wide, as shown below.

Off- and on-street accessible car parking



4.1.2 Car parking within the curtilage of a dwelling

Where car parking is provided within the *curtilage* of a dwelling, a person should be able to alight from a vehicle directly onto the firm surface of an accessible route to the dwelling.

Where a driveway or car parking space forms part of an accessible route to a dwelling, it should be at least 3.3 m wide to allow a 900 mm wide pedestrian route past a parked car. That portion of the driveway surface should be in accordance with the recommendations in clause 4.1.4.

4.1.3 Accessible routes

Regardless of how they arrive within the *curtilage* of a building, a person should then be able to travel conveniently and without assistance to an entrance of a building. Routes to a *building* that are too steep, too narrow or poorly surfaced, or that contain steps or other obstructions, will make access difficult or impossible for many people. To prevent this, a route to an entrance should be provided that is accessible to everyone.

An accessible route should contain no barriers, such as kerbs, steps or similar obstructions that may restrict access. Street furniture can present a hazard, particularly to a wheelchair user or a person with a visual impairment and should be located outwith the width of an accessible route. Use of low-level bollards or chain-linked posts, for example, can be particularly hazardous.

There should be an accessible route to the accessible entrance of a single *dwelling* from:

- a road; and
- any car parking within the *curtilage* of the dwelling.

There should be an accessible route to the common entrance of a *building* containing *flats* or *maisonettes* and to an accessible entrance of any *dwelling* not reached through a common entrance, from:

- a road; and
- any accessible car parking (see clause 4.1.1) within the *curtilage* of the building.

Gradient of accessible route

As steeper gradients are more difficult to negotiate, level or gently sloping routes should be used wherever possible, in preference to ramps. An accessible route should be:

- level, which for the purpose of this guidance is a gradient of not more than 1 in 50; or
- gently sloping, which for the purpose of this guidance is a gradient of more than 1 in 50 and not more than 1 in 20; or
- ramped, with a gradient of more than 1 in 20 and not more than 1 in 12.

The cross-fall on any part of an accessible route should not exceed 1 in 40.

Gently sloping gradients

Gently sloping gradients should be provided with level rest points of not less than 1.5 m in length, at intervals dependent on the gradient of the sloping surface. This should follow the same relationship given for ramp flights, e.g. up to 20 m apart for a slope of 1 in 30, 30 m for a slope of 1 in 40 and so on.

Recommendations for ramps are provided in the guidance to standard 4.3.

Complimentary steps

Ramps are not necessarily safe or convenient for an ambulant person with mobility impairment, and can be more difficult and dangerous to negotiate than steps. Therefore, on a route serving more than 1 *dwelling*, any ramped access having a rise of more than 300 mm should be complemented by an alternate, stepped means of access.

Stepped access to a single *house*

There may be stepped access to a route serving a single *house* where it is not *reasonably practicable* to construct an accessible route, such as on a steeply sloping site. As a guideline, if a ramp to an accessible entrance can be formed within the *curtilage* of the *dwelling* with one change in direction between the bottom of the ramp and the top landing, access should be considered *reasonably practicable*.

Where an accessible route cannot be provided from a road, it may still be practicable to *construct* an accessible route by providing a car parking space within the *curtilage* of the dwelling. It is only where it is not *reasonably practicable* to *construct* an accessible route from either a *road* or from car parking within the *curtilage* of the *dwelling* that a stepped access solution may be proposed.

4.1.4 Surfaces to accessible routes

For safety and convenience in use, the surface of an accessible route should be firm, uniform and of a material and finish that will permit ease in manoeuvring. It should provide a degree of traction that will minimise the possibility of slipping. This should take into account both anticipated use and environmental conditions.

The surface of an accessible route, whether composed of modular paving units, formless materials such as tarmac, or another durable material, should have a profile that will not offer a trip hazard or result in standing water. It should be installed in accordance with a code of practice relevant to the material, where such exists.

Surface elements such as drainage gratings and manhole covers should be of a type that will not create a trip or entrapment hazard. Uneven surfaces, such as cobbles, or loose-laid materials, such as gravel, will present difficulties to many people and should not be used.

Tactile paving

At a location where the footpath is level with a *road* surface, such as at a dropped kerb, tactile paving should be used to warn a person with a visual impairment of the presence of a vehicular route. This need not apply to a route within the *curtilage* of a single *dwelling*. Information on use of tactile paving on footpaths is given in 'Guidance on the Use of Tactile Paving Surfaces'.

4.1.5 Length of accessible routes

The longer a pedestrian route, the greater difficulty it can present to many people. Therefore, in addition to minimising gradients where possible, as recommended in clause 4.1.3, the length of an accessible route to an accessible entrance of a *building* should be limited to 45 m.

4.1.6 Width of accessible routes

The width of a pedestrian route to a *building* should reflect how it will be used. For example, most public footpaths are at least 1.8 m wide, which allows two-way traffic under most circumstances.

The clear and unobstructed surface width of an accessible route should generally be at least 1.8 m, unless:

- giving access to not more than 10 dwellings, where the minimum surface width may be not less than 1.2 m. This will accommodate any person where traffic is in a single direction of travel. To allow for passing, localised widening of any route less than 1.8 m wide to at least 1.8 m should be made at any junction and change of direction and, where the whole length of the route is not visible, also at not more than 10 m intervals along the route; or
- giving access to a single dwelling, where effective width may be not less than 900 mm, recognising reduced levels of traffic.

On an accessible route serving more than one dwelling, a level footpath of not less than 1.0 m in width should be maintained to the rear of the slope of any dropped kerb.

Any gate across an accessible route should offer a clear opening width of at least 850 mm.

4.1.7 Accessible entrances

Each common entrance to a *domestic building* and at least one entrance to a *dwelling* should be an accessible, designed to present as little restriction to passage as possible.

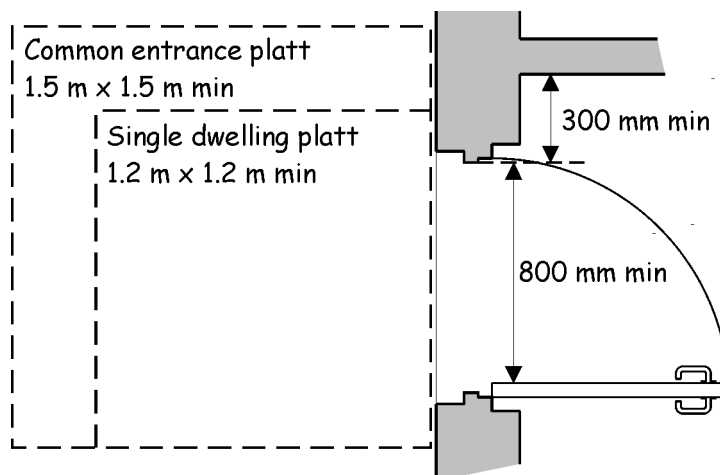
Whilst an accessible entrance to a *house* is commonly the front or main entrance, an alternate entrance may be designated as the accessible entrance where this provides a more convenient or practical route into the dwelling.

An accessible entrance to a *building* should:

- have an unobstructed entrance platt of at least 1.2 m by 1.2 m, with a crossfall of not more than 1 in 50, if required to prevent standing water; and
- have a means of automatic illumination above or adjacent to the door; and
- have an accessible threshold; and
- have a door leaf giving a clear opening width of at least 800 mm in accordance with the diagram below; and
- if fitted with a door closing device, be operable with an opening force of not more than 30 N (for first 30° of opening) and 22.5 N (for remainder of swing) when measured at the leading edge of any door leaf; and
- if not a powered door, have an unobstructed space to the opening face of the door, next to the leading edge, of at least 300 mm.

However where there is not an accessible route to a single house, the guidance in subclauses a and c above need not be followed.

Accessible entrance door



Clear opening width

The projection of ironmongery which extends across the width of a door leaf, such as an emergency push bar for escape or a horizontal grab rail, should be subtracted when calculating the clear opening width.

4.1.8 Common entrances

In addition to the recommendations in clause 4.1.7, a common entrance to a *domestic building* should have:

- an unobstructed entrance platt, measuring at least 1.5 m by 1.5 m, with a crossfall of not more than 1 in 50 if required to prevent standing water; and
- a canopy, recessed entrance or similar means of protecting people entering the *building* from exposure to the elements; and
- a *glazed* vision panel, as described below; and
- a door entry system.

Weather protection

The form that weather protection should take will vary with location and exposure of the *building*. However an example of minimum provision might be a canopy or recess, 750 mm deep, across the width of the entrance platt, with an underside not more than 2.3 m above entrance level. It is recognised that there are circumstances where provision of weather protection may not be practicable or may be constrained by other permissions.

Glazed vision panels

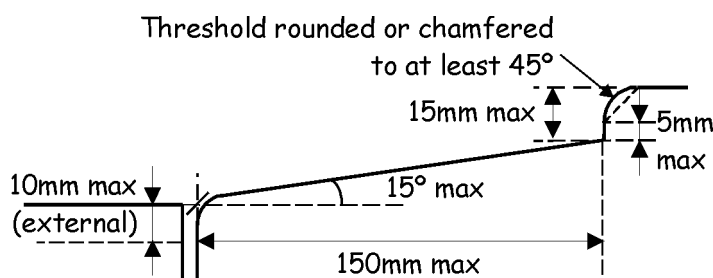
To assist in preventing collisions, a clear *glazed* vision panel or panels to a door should give a zone of visibility from a height of not more than 500 mm to at least 1.5 m above finished floor level. This may be interrupted by a solid element between 800 mm and 1.15 m above floor level. A vision panel is not needed to a powered door controlled by automatic sensors or where adjacent *glazing* offers an equivalent clear view to the other side of a door.

Guidance relevant to specific door types such as revolving doors or powered doors is given in the non-domestic Technical Handbook.

4.1.9 Accessible thresholds

To be accessible, a door should not present unnecessary barriers to use, such as a step or raised profile at a threshold that might present difficulties to a wheelchair user or be an entrapment or trip hazard to an ambulant person, whether or not using a walking aid.

Generic Threshold Profile



An accessible threshold should meet the following criteria:

- thresholds should be designed to prevent the ingress of rain. Details in the DETR publication 'Accessible Thresholds in New Housing' gives guidance on how this might be achieved;
- externally, the surface of the platt should be not more than 10 mm below the leading edge of any sill, with any exposed edge chamfered or rounded;
- an external sill or internal transition unit should be at an angle of not more than 15° from the horizontal and, if sloping, be not more than 150 mm in length;
- the threshold should either be level or of a height and form that will neither

impede unassisted access by a wheelchair user nor create a trip hazard. A threshold piece should have a height of not more than 15 mm, with any vertical element of more than 5 mm height being pencil-rounded or chamfered to an angle of not more than 45° from the horizontal;

- if the finished internal floor level is more than 15 mm below the top of the threshold, an internal transition unit, of not more than 15° to the horizontal, finishing not more than 5 mm above the internal floor surface may be used, in accordance with the guidance above. In new buildings, this should normally only be needed to allow flexibility in subsequent fitting of differing thickness of floor coverings.

4.1.10 Alteration and extension

Where a *dwelling* is altered or extended, this *work* should not adversely affect an existing accessible entrance.

Where a *dwelling* does not have an accessible entrance, one need not be provided to the existing *dwelling*, or to the extension, as this will not result in the *building* failing to meet the standard to a greater degree.

Where an accessible entrance exists, any *works* should ensure that the existing entrance remains accessible. If this is not possible, a new accessible entrance should be provided elsewhere into the dwelling. Such an entrance should also maintain accessibility within the dwelling, as set out in guidance to standard 4.2.

4.2 Access within buildings

- 4.2 Functional standard
- 4.2.0 Introduction
- 4.2.1 Horizontal circulation in common areas of domestic buildings
- 4.2.2 Floor surfaces in common areas of domestic buildings
- 4.2.3 Lobbies in common areas of domestic buildings
- 4.2.4 Doors within common areas of a domestic building
- 4.2.5 Vertical circulation in common areas of domestic buildings
- 4.2.6 Accessibility within a storey of a dwelling
- 4.2.7 Access between storeys in a dwelling
- 4.2.8 Unassisted access between storeys in a dwelling
- 4.2.9 Split level storeys
- 4.2.10 Dwellings with limited entrance storey accommodation
- 4.2.11 Alterations and extensions

standard
4.2
mandatory

Every *building* must be designed and *constructed* in such a way that:

- (a) in non-domestic *buildings*, safe, unassisted and convenient means of access is provided throughout the *building*;
- (b) in *residential buildings*, a proportion of the *rooms* intended to be used as bedrooms must be accessible to a wheelchair user;
- (c) in *domestic buildings*, safe and convenient means of access is provided within common areas and to each *dwelling*;
- (d) in *dwellings*, safe and convenient means of access is provided throughout the *dwelling*; and
- (e) in *dwellings*, unassisted means of access is provided to, and throughout, at least one level.

Limitation:

There is no requirement to provide access for a wheelchair user:

- (a) in a non-domestic *building* not served by a lift, to a *room*, intended to be used as a bedroom, that is not on an entrance *storey*; or
- (b) in a *domestic building* not served by a lift, within common areas and to each *dwelling*, other than on an entrance *storey*.

4.2.0 Introduction

Circulation areas within a *building* should allow occupants to move around freely and without difficulty, to the best of their ability. Lack of space can make movement around a *building* difficult for many people and hamper activities such as carrying or moving large items.

The design process should consider how the *building* can be used by as wide a range of people as possible, including use by a person in a wheelchair, though it is recognised that this may not be to the optimum standard that can be achieved within purpose-built dwellings.

Improvement to circulation within *dwellings* under this standard, together with the provision, on one level, of an enhanced *apartment*, and kitchen (standard 3.11) and accessible *sanitary accommodation* (standard 3.12) will assist in creating more sustainable homes.

Whilst the guidance to this standard reflects general good practice, certain issues remain outwith the scope of the building regulations. There are numerous publications offering additional guidance on accessibility and inclusive design, including those listed below:

- BS 8300: 2009 – ‘Design of buildings and their approaches to meet the needs of disabled people – code of practice’;
- Housing for Varying Needs, Parts 1 & 2 – Communities Scotland.

Conversions

In the case of conversions, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably* practicable, and in no case be worse than before the *conversion* (regulation 12, schedule 6).

4.2.1 Horizontal circulation in common areas of domestic buildings

The common areas of *domestic buildings* containing *flats* or maisonettes, though secured against unauthorised entry, remain in effect a public or shared area. As an enclosed space, it is important that provisions made on the approach to the *building* are maintained within these areas.

There should be level or ramped access within the common areas of a *domestic building*:

- *from* a common entrance to the entrance of any *dwelling* or communal facilities on the entrance *storey* and to any passenger lift; and
- where a passenger lift is installed, from the passenger lift to any *dwelling* and to any communal facilities on an upper storey.

Circulation routes within common areas should allow safe and convenient passage and provide space for manoeuvring at junctions and when passing through doorways. All corridors therefore should have a minimum width of at least 1.2 m.

To allow manoeuvring space for both people and furniture, routes should be widened locally, at changes of direction, junctions and at the landing of any lift, to accommodate, clear of any obstruction, a 1.5 m turning circle.

Obstructions

Other than on a wall opposite a doorway, or in the areas noted above, an obstruction such as a radiator may project up to 100 mm, reducing corridor width to not less than 1.1 m, over a maximum length of 900 mm.

Gently sloping surfaces

Within a building, unidentified gradients may disorient *building* users and the need for gently sloping surfaces on circulation routes should be considered carefully before use. Level rest points on gently sloping routes should be provided as recommended in clause 4.1.3. Where not extending across the full width of a *room* or corridor, guarding should be provided to any exposed edge of such an area as for a ramp *flight*, as noted in the guidance to standard 4.4.

4.2.2 Floor surfaces in common areas of domestic buildings

Floor surfaces within common areas should be uniform, permit ease in manoeuvring and be of a material and finish that, when clean and dry, will provide a level of traction that will minimise the possibility of slipping.

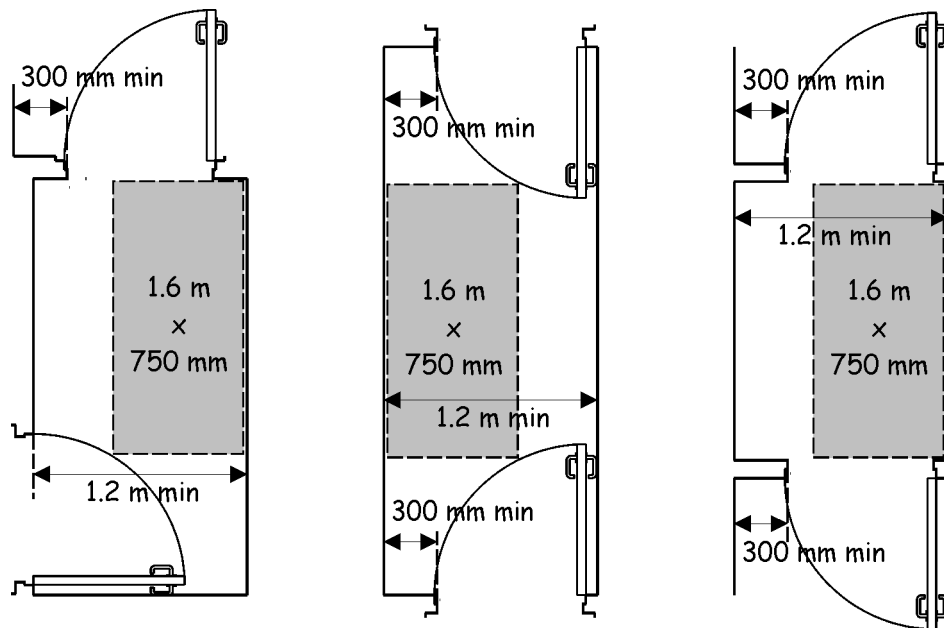
Where there is a change in the characteristics of materials on a circulation route, such as from a tile to carpet finish, transition should be level and, where *reasonably* practicable, differing surfaces should contrast visually to identify the change in material and reduce the potential for trips.

4.2.3 Lobbies in common areas of domestic buildings

Use of a lobby can reduce the effect of external conditions on the interior of a *building* and may also contribute to fire safety. However where two sets of doors are in close proximity, this can present a hazard and a potential barrier to access.

Any lobby at the entrance to or within the common areas of a *domestic building* should allow a person to pass through whilst remaining clear of the swing of doors. A rectangular area, outwith any door swing, of at least 1.6 m long by 750 mm wide will permit safe passage of, for example, a person in a wheelchair and a companion.

Accessible lobby dimensions



Where either door can be secured by a locking device, a lobby should be not less than 1.5 m wide. This will permit a wheelchair or pram to be turned around should passage be denied.

4.2.4 Doors within common areas of a domestic building

Doors within the common areas of a domestic *building* should present as little restriction to passage as practicable and be *constructed* in a manner that does not present a hazard or a potential barrier to access.

A door located within the common areas of a *domestic building* should:

- a. if fitted with a threshold, have an accessible threshold; and
- b. have a door leaf giving a clear opening width in accordance with the table below; and
- c. where across a circulation route or giving access to communal facilities, have a *glazed* vision panel in any opening leaf, as described in clause 4.1.8; and
- d. have a door leaf that, if fitted with a door closing device, be operable with an opening force of not more than 30 N (for first 30° of opening) and 22.5 N (for remainder of swing) when measured at the leading edge of the leaf; and
- e. if not a powered door, have an unobstructed space to the opening face of the door, next to the leading edge, of at least 300 mm.

Width of doors

Minimum corridor width at door (mm)	Minimum clear opening width (mm) [1]
1500	800
1200	825 [2]
900 [3]	850 [2]

Notes:

1. The projection of any ironmongery that extends across the width of a door leaf, such as an emergency push bar to a fire exit or horizontal grab rail, should be subtracted when calculating the clear opening width.
2. The clear opening width may be 800 mm where a door is approached head-on.
3. A corridor width of less than 1.2 m should not be present within new *buildings* but may be found within some existing *buildings*.

A door should not open onto a circulation route in a manner that creates an obstruction, other than a door to a cupboard or duct enclosure that is normally locked in a closed position.

4.2.5 Vertical circulation in common areas of domestic buildings

Stairs in common areas should be designed to be accessible to a person with reduced mobility, as described in guidance to standard 4.3. There should be an accessible stair between each level of a *building*.

Level access, or access by a stair or ramp device should be provided to any storey, or part of a *storey*. However it is recognised that it may not be necessary or, in some cases, *reasonably practicable* to provide full access to all parts of a *building*. Consequently, such access need not be provided to any *storey*, or part of a *storey*:

- containing only fixed plant or machinery, the only normal visits to which are intermittent, for inspection or maintenance purposes; or
- where access is restricted to suitably trained persons for health and safety reasons, such as to walkways giving access only to machinery or to catwalks and working platforms, reached by industrial ladder.

Passenger lifts

Installation of a passenger lift will allow all *dwelling*s on upper *storeys* to be reached from a common entrance level. However it is recognised that it may not always be *reasonably practicable* to provide lift access within all *domestic* buildings.

Therefore, a *building* containing *flats* or *maisonettes* may be constructed without a passenger lift where not more than 4 *storeys* in height and where there is no *dwelling* with a principal living level at more than 10 m above either a common entrance level or the level of the lowest storey.

In any *building* above this height, or where there are communal facilities on a level other than a common entrance level, there should be a means of unassisted access. This should serve each level of the *building* that contains a common entrance, an entrance to a *dwelling* or communal facilities. Unassisted access between *storeys* should be by passenger lift, with the installation meeting the recommendations of BS EN 81-70: 2003.

- Any passenger lift should be designed and installed to include the following:
- a. a clear landing at least 1.5 m x 1.5 m in front of any lift entrance door; and
 - b. automatic lift door(s), with a clear opening width of at least 800 mm, fitted with sensors that will prevent injury from contact with closing doors; and
 - c. a lift car at least 1.1 m wide by 1.4 m deep; and
 - d. within the overall dimensions of the lift car, a horizontal handrail, of a size and section that is easily gripped, 900 mm above the floor on each wall not containing a door; and
 - e. within a lift car not offering through passage, a mirror on the wall facing the doors, above handrail height, to assist a wheelchair user if reversing out; and
 - f. within the lift car, tactile *storey* selector buttons and, in a lift serving more than 2 storeys, visual and voice indicators of the *storey* reached; and
 - g. controls on each level served, between 900 mm and 1.1 m above the landing, and within the lift car on a side wall between 900 mm and 1.1 m above the car floor and at least 400 mm from any corner; and
 - h. on the landing of each level served, tactile call buttons and visual and tactile indication of the *storey* level; and
 - i. lift doors, handrails and controls that contrast visually with surrounding surfaces; and
 - j. a signalling system which gives notification that the lift is answering a landing call; and
 - k. a system which permits adjustment of the dwell time after which the lift doors close, once fully opened, to suit the level of use; and
 - l. a means of two way communication, operable by a person with a hearing impairment, that allows contact with the lift if an alarm is activated, together with visual indicators that an alarm has been sounded and received.

4.2.6 Accessibility within a storey of a dwelling

To ensure facilities within a *dwelling* can be reached and used by occupants, each *storey* within a *dwelling* should be designed to be accessible. There should be safe and convenient access to and throughout each *storey* other than to a level which comprises solely of storage and/or such accommodation as may be accessed via a 600 mm wide stair.

Each accessible level or *storey* within a *dwelling* should have:

- a. corridors with an unobstructed width of at least 900 mm wide. This may be reduced to 800 mm over a maximum length of 900 mm by permanent obstructions, such as radiators, except on a wall opposite a doorway; and
- b. corridors that are large enough to accommodate an unobstructed area of 1.1 m by 800 mm which, where a door being used opens into the corridor, is oriented in the direction of entry and is clear of the door swing; and
- c. doors with a minimum clear opening width in accordance with the following table to each room, including any apartment, *kitchen* or *sanitary* facility.

Width of doors

Minimum corridor width at door (mm)	Minimum clear opening width (mm)
1050	775
900	800 [1]

Notes:

1. The opening width may reduce to 775 mm where a door is approached head-on.

Principal living level

In addition, there should be unassisted access to the basic accommodation needed in any dwelling. The principal living level of a dwelling, normally also the entrance storey, should contain at least one enhanced *apartment* (see clause 3.11.2), a *kitchen* (see clause 3.11.3) and accessible *sanitary accommodation* (see clause 3.12.3). This accommodation should be either on one level or, if on different levels within a storey, accessible without a stepped change of level.

4.2.7 Access between storeys in a dwelling

Where a *dwelling* has accommodation on more than one level, the levels containing accommodation should be connected by a stair or ramp within the *dwelling* following the guidance given under standard 4.3.

However the guidance under standard 4.3 need not be applied to a fixed means of access leading only to a *storey* or level containing storage, though access to such a level must still meet standard 4.3 and offer safe passage.

4.2.8 Unassisted access between storeys in a dwelling

Not everyone can use stairs unassisted. This may mean that the upper levels of a *dwelling* are not accessible to some occupants. Guidance elsewhere considers situations where occupants, incapacitated for a short period of time, might live within one storey. However this is not generally appropriate for longer term illness or infirmity, where a more permanent, inclusive, solution is required.

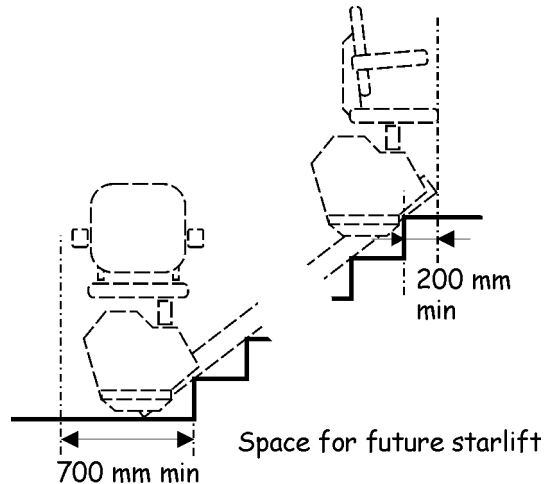
Provision should be made for future installation of a means of unassisted access, both within a *storey* and between storeys.

Future installation of a stairlift

To allow for future installation of a stair lift, any stair giving access to a principal living level or to accommodation greater than may be accessed via a 600 mm wide stair (see clause 4.3.3) should:

- have an area of wall not less than 700 mm in length, or an equivalent space, adjacent to the bottom riser of a stair and clear of any obstruction, fitting or doorway, to allow for parking of a stairlift at rest position. This space should be not less than 400 mm in depth; and
- have a similar area of not less than 200 mm in length, on the same side of the flight, at landing level adjacent to the top nosing of the stair, to assist in transfer at the upper level, allowing for projection of a stair lift track.

Future provision for unassisted access



4.2.9 Split level storeys

Any change of level within a *storey* should not compromise access to facilities within the principal living level of a dwelling.

A *storey* may be split level provided a stepped change of level does not divide the accommodation forming the principal living level of a *dwelling* (see clause 4.2.6). In addition, if a stepped change of level is proposed on an entrance *storey* containing the principal living level, the route from the accessible entrance of the *dwelling* to the accommodation forming the principal living level should be without a stepped change of level.

4.2.10 Dwellings with limited entrance storey accommodation

Where a dwelling, such as a townhouse or upper villa flat, contains no, or only limited, accommodation on the entrance storey, this can make access to the basic facilities within the *dwelling* more difficult for many people.

Where the entrance *storey* of a *dwelling* is not also the principal living level, the first *storey* above or below entrance *storey* which contains an enhanced *apartment*, *kitchen* and accessible *sanitary accommodation* is considered to be the principal living level.

Where there is not level or ramped access from the accessible entrance of a *dwelling* to the principal living level, the principal living level should be made accessible to as wide a range of occupants as possible and, accordingly:

- a. a stair, from an accessible entrance to the principal living level, should follow the guidance on rise, going and pitch for 'any other stair' given in clause 4.3.2; and
- b. provision for installation of a stairlift should be made as described in clause 4.2.8; and
- c. entrance level accommodation should contain an area of at least 800 mm wide by 1.1 m long that would permit storage of a wheelchair or pram. This should be outwith the minimum corridor width noted in clause 4.2.6 and clear of any door way, door swing, stair landing or space identified for a future stairlift installation.

Where the entrance level of such a *dwelling* contains 2 or more apartments, there should also be an accessible *toilet* on the entrance level in accordance with the guidance in clause 3.12.3. This is in addition to accessible *sanitary facilities* on the principal living level. There should be level or ramped access from the accessible entrance of the dwelling to this accessible *toilet* and at least 1 of the *apartments* on the entrance storey.

4.2.11 Alterations and extensions

Where accommodation within a *dwelling* meets the recommendations in clauses 4.2.6 to 4.2.10, any *works* to the *dwelling* should maintain compliance.

Altering an existing *dwelling*

Where alteration of a *building* includes *work* to, or provision of, a new circulation area, guidance should be followed as far as is *reasonably practicable*. This recognises that physical constraints within an existing *building* may mean compliance with space provision is not always possible.

Consequential alterations

Where existing accommodation does not meet the provisions set out in guidance, it need not be altered to comply except for consequential work, needed to ensure compliance with another standard. An example would be where an accessible entrance has been relocated and alterations are required to circulation space to maintain accessibility within the building.

4.3 Stairs and ramps

- 4.3 Functional standard
- 4.3.0 Introduction
- 4.3.1 Measurement for stairs
- 4.3.2 Rise, going, tread and pitch of stairs
- 4.3.3 Width of stair flights and landings
- 4.3.4 Number of rises in a flight
- 4.3.5 Risers and treads
- 4.3.6 Stair landings
- 4.3.7 Warning surfaces to landings of external steps
- 4.3.8 Stair landings serving outward opening fully glazed doors
- 4.3.9 Stair flights consisting of both straight and tapered treads
- 4.3.10 Stair flights consisting wholly of tapered treads
- 4.3.11 Pedestrian ramps
- 4.3.12 Width of ramps flights
- 4.3.13 Ramp landings
- 4.3.14 Handrails to stairs and ramps
- 4.3.15 Height of handrails
- 4.3.16 Headroom on stairs and ramps
- 4.3.17 Industrial stairs and fixed ladders

standard

4.3

mandatory

Every *building* must be designed and *constructed* in such a way that every level can be reached safely by stairs or ramps.

4.3.0 Introduction

Half of all accidents involving falls within and around *buildings* occur on stairways, with young children and elderly people being particularly at risk. This risk can be greatly reduced by ensuring that any change in level incorporates basic precautions to guard against accident and falls.

Stairs and ramps should be *constructed* to be within limits recognised as offering safe and convenient passage and designed so that any person who is likely to use them can do so comfortably and safely, with the minimum amount of difficulty. Design should also address the issue of appropriate guarding, where a level change is made, and seek to eliminate any possible trip hazards.

Explanation of terms

The following terms are explained to provide clarity to their meaning in the Technical Handbooks.

Private stair means a stair wholly within a *dwelling*. It may also apply to any stair within the *curtilage* of a single *dwelling*, which is not accessible to the public. This might include, for example, a stair from a *dwelling* to a private garden, or a stair providing access to or within a domestic garage. It should not, however include any external stair that forms a part of an accessible route to the *dwelling*.

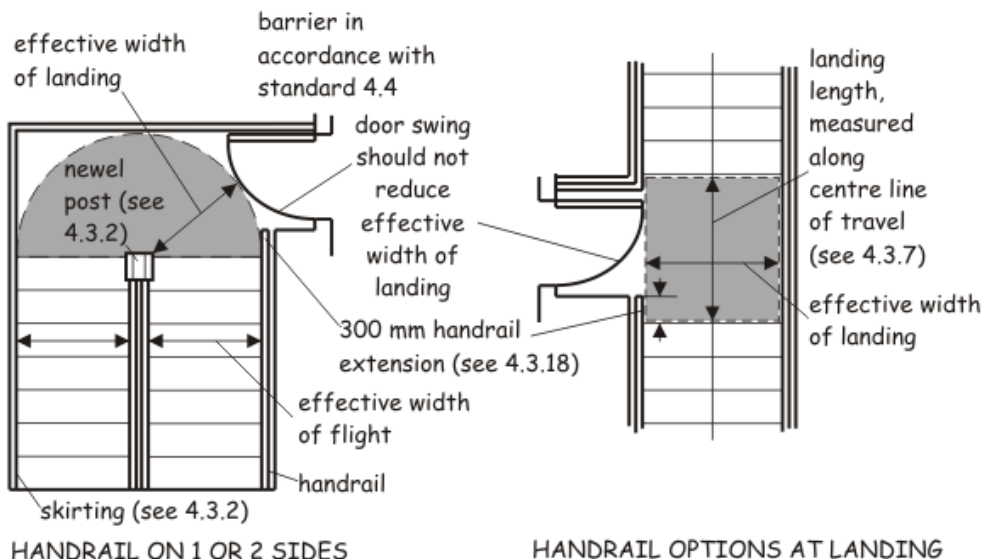
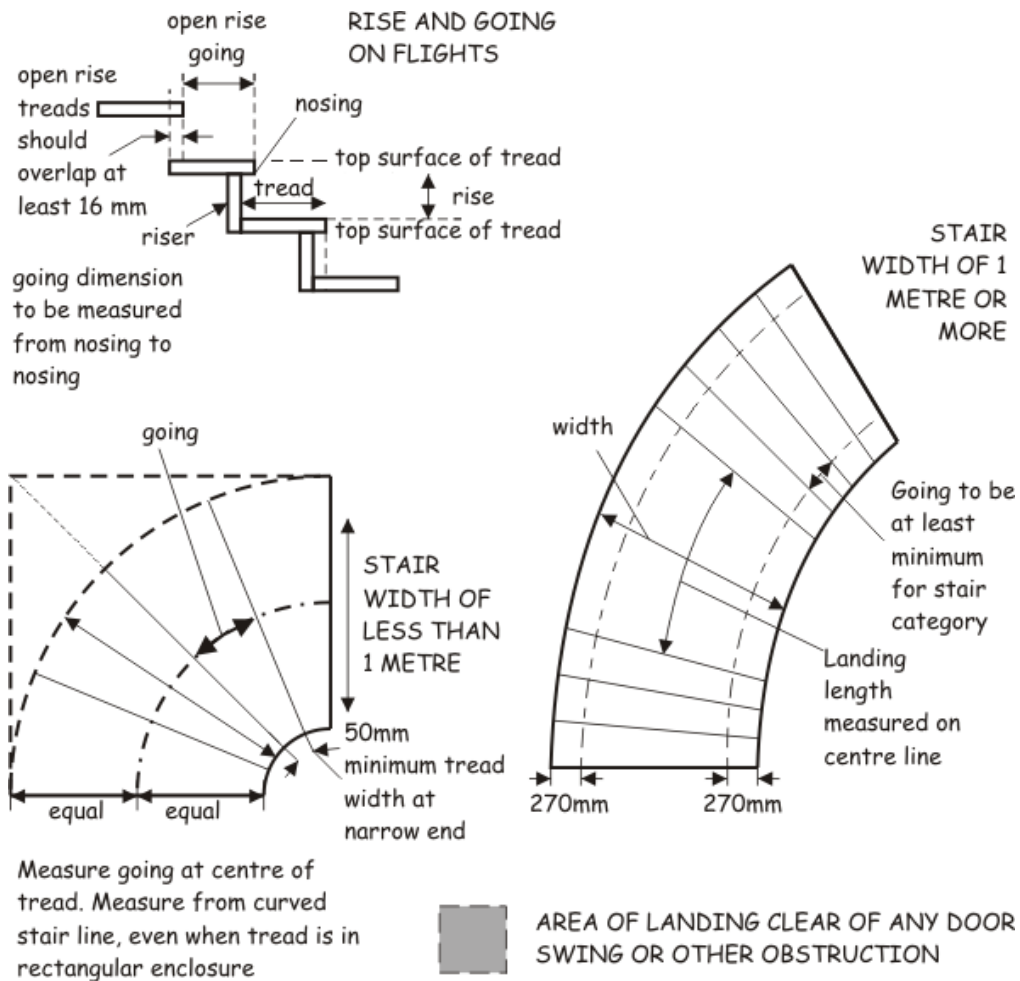
Tapered tread means a stair tread in which the nosing is not parallel to the nosing of the tread or landing next above.

Conversions

In the case of conversions, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably* practicable, and in no case be worse than before the *conversion* (regulation 12, schedule 6).

4.3.1 Measurement for stairs

Measurement for stairs



4.3.2 Rise, going, tread and pitch of stairs

The geometry of a stair *flight* can have a significant effect on the ability of people to use a stair safely and conveniently and limits should be placed on the rise and going of a stair, and steepness of pitch.

The pitch of a *private stair flight* may be steeper than that of a public *flight* (any other stair) in recognition that users, as occupants, will be more familiar with the stair through frequent use.

To provide safe and convenient access, the rise, going, tread and pitch of a *flight* in a stair should be in accordance with the following table:

Stair geometry – private stair

Minimum rise (mm)	Maximum rise (mm)	Minimum going (mm)	Tread	Maximum pitch
100	220	225	not less than going	42°

Stair geometry – Any other stair, including to a domestic building or within the common area of a building containing flats or maisonettes

Minimum rise (mm)	Maximum rise (mm)	Minimum going (mm)	Tread	Maximum pitch
100	170	250	not less than going	34°

Notes:

1. All rises in a *flight* should be of uniform height;
2. In a straight *flight*, or in a part of a *flight* that is straight, measurement should be uniform along the centreline of the *flight*;
3. Where a *flight* consists partly of straight and partly of tapered treads, the going of the tapered treads should be uniform and should not be less than the going of the straight treads;
4. The going measured at the narrow end of a tapered tread should be at least 50 mm (see diagram to clause 4.3.1);
5. The aggregate of the going and twice the rise should be at least 550 mm and not more than 700 mm. For example, stairs provided with the minimum going of 250 mm would result in rises of at least 150 mm;
6. The maximum rise and minimum going on a *private stair* should not be used together as this will result in a pitch greater than the recommended maximum;
7. Clause 4.2.10 should be referred to for exceptions where a *private stair* should meet the above recommendations for 'any other stair'.

The most comfortable combination of rise and going varies between individuals but in general, a going in excess of a minimum value, resulting in a figure in the upper end of the range in note 5, above, will increase both safety and amenity.

4.3.3 Width of stair flights and landings

The clear, or effective, width of a stair should allow users to move up and down unhindered and, on stairs giving access to a *dwelling* or *domestic* building, permit people to pass on a flight.

The effective width should be measured between handrails or, where there is no handrail present, between any walls or protective barriers. It should be clear of obstructions, as described in the diagram to clause 4.3.1. The effective width of a stair should be in accordance with the recommendations of the following table:

Effective widths of flights and landings

Private Stair	Any other stair
900 mm [1], such as from one <i>storey</i> to another or connecting levels within a <i>storey</i> ; or	1.0 m generally, such as to an external <i>flight</i> to a <i>domestic building</i> or a common access within a <i>building</i> containing <i>flats</i> or <i>maisonnettes</i> ; or
600 mm where serving only <i>sanitary accommodation</i> and/or one room, other than accessible <i>sanitary accommodation</i> , a <i>kitchen</i> or an enhanced apartment.	900 mm to an external <i>flight</i> serving a single <i>dwelling</i> , to which the public have access.

Notes:

1. The effective width of a *private stair* may be 800 mm where a continuous handrail is fitted to both sides of a *flight*.

The projection of any stringer or newel post into this width should be not more than 30 mm.

Stair lifts

A stair lift may be fitted to a *private stair* and may project into the effective width of the stair. However in such cases, at least 1 handrail should be present as described in clause 4.3.14 and, when not in use, the installation should:

- a. permit safe passage on the stair *flight* and any landing; and
- b. not obstruct the normal use of any door, doorway or circulation space.

Clause 4.2.8 gives guidance on the space to be provided adjacent to a stair *flight* to accommodate a future stair lift installation.

4.3.4 Number of rises in a flight

The act of climbing stairs can be tiring to many people. Whilst landings can provide a safe resting point, the *flight* itself is not intended to do so. The maximum number of rises between landings should therefore be limited.

Generally, a *flight* should have not more than 16 rises.

Below a minimum number of steps, it becomes difficult to signal a change of level, which can contribute significantly to a trip hazard.

Generally, a *flight* should have at least 3 rises.

However people tend to take greater care at certain locations, such as at an external door, and a single step or 2 steps may be appropriate under certain circumstances. There may be less than 3 rises:

- a. other than at an accessible entrance, between an external door of a *building* and the ground or a balcony, conservatory, *porch* or private garage; or
- b. wholly within an *apartment* other than where affecting provisions within an enhanced apartment (see clause 3.11.2); or
- c. wholly within *sanitary accommodation*, other than accessible *sanitary accommodation* (see clause 3.12.3); or
- d. between a landing and an adjoining level where the route of travel from the adjoining level to the next *flight* changes direction through 90° (i.e. on a quarter landing as the first step).

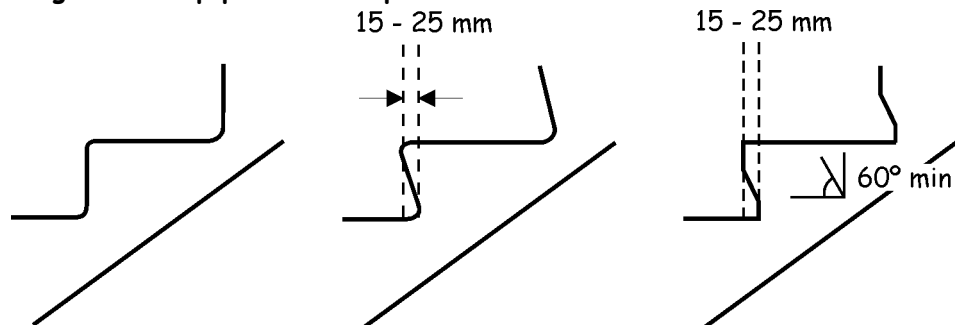
4.3.5 Risers and treads

All stairs providing access to and within *buildings* should be designed to be accessible by most persons with reduced mobility.

Open risers on a *flight* can be a hazard. When ascending a stair, people may be at risk of trapping the toes of shoes beneath projecting nosings, and of tripping as a result. In addition, many may feel a sense of insecurity when looking through spaces present between treads.

A stair should have contrasting nosings to assist in identifying the position of treads and risers should be profiled to minimise tripping as shown below. Open rises should not be used unless a stair is intended for descent only, such as in a dedicated *escape stair* on an *escape route*.

Diagram - Step profile examples



However a *private stair* may be *constructed* with open risers and without contrasting nosings as occupants will be more familiar with the stair through frequent use.

Small children can climb or fall through gaps in stair treads and the size of such gaps should be limited to prevent this. In a *flight* with open risers, the treads should overlap by at least 15 mm. Any opening between adjacent treads in a *flight* should be small enough to prevent the passage of a 100 mm sphere.

4.3.6 Stair landings

Clear space is needed to the head and foot of any stair *flight* to allow people to move between a *flight* and an adjacent level surface safely. People may also wish to pause on stairs, particularly during ascent, and any intermediate landing should provide a temporary respite and be of a size to allow this whilst still permitting others to pass safely.

A stair landing should:

- be provided at the top and bottom of every *flight*. A single landing may be common to 2 or more *flights*; and
- be level except, in external locations, for any minimal crossfall necessary to prevent standing water; and
- have an effective width of not less than the effective width of the stair *flight* it serves; and
- be clear of any door swing or other obstruction, other than to a *private stair*, as noted below.

Length of a landing

The minimum length of a stair landing, measured on the centreline of travel, should be either 1.2 m or the effective width of the stair, whichever is less. However where, on an intermediate landing, a change of direction of 90° or more occurs, the centreline length need not be measured if the

effective width of the stair is maintained across the landing.

On landings to external stair flights, where tactile paving is used, the minimum length of landing should be 1.2 m.

Flights not needing a landing

Other than at an accessible entrance, a landing need not be provided to a *flight* of steps between the external door of:

- a *dwelling* and the ground, balcony, conservatory, *porch* or private garage, where the door slides or opens in a direction away from the *flight* and the total rise is not more than 600 mm; or
- a dwelling, or *building* ancillary to a dwelling, and the ground, balcony, conservatory, or porch, where the change in level is not more than 170 mm, regardless of method of door operation.

Obstructions

On a *private* stair, other than on an intermediate landing, common to 2 flights:

- a door to a cupboard or duct may open onto a top landing if, at any angle of swing, a clear space of at least 400 mm deep is maintained across the full width of the landing;
- a door may open on to a bottom landing, if, at any angle of swing, a clear space of at least 400 mm deep is maintained across the full width of the landing and the door swing does not encroach within space designated for future installation of a stair lift (see clause 4.2.8).

4.3.7 Warning surfaces to landings of external steps

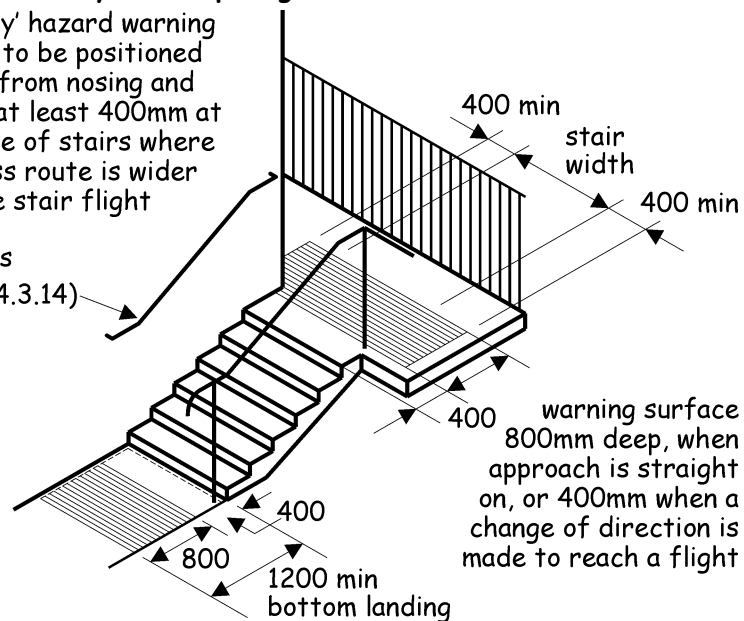
A sudden and unguarded change of level on an access route can present a hazard to a person with a visual impairment. Therefore, on external routes serving more than one dwelling, tactile paving should be used to alert people to the presence of a *flight* of steps.

The use of 'corduroy' tactile paving identifies this hazard and advises users to 'proceed with caution'. It should be provided at the head and foot of any *flight* of external steps, forming a strip 800 mm deep, positioned 400 mm from the first step edge, as noted below.

Use of corduroy tactile paving

'corduroy' hazard warning surface to be positioned 400mm from nosing and extend at least 400mm at each side of stairs where an access route is wider than the stair flight

handrails
(clause 4.3.14)



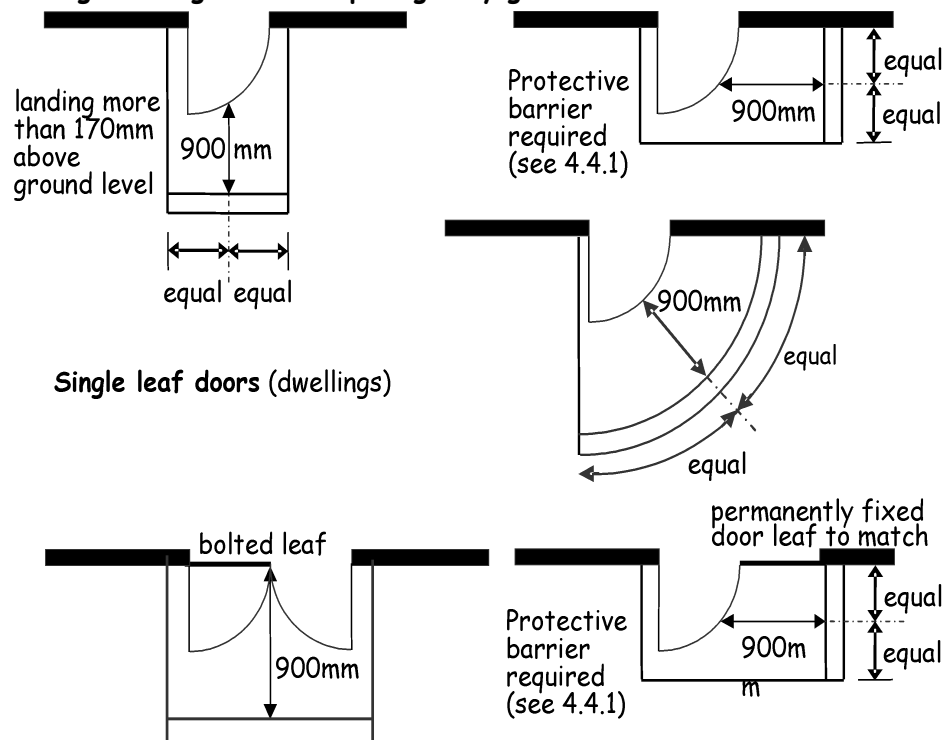
On any landing mutual to a *flight* of steps and a ramp, tactile paving should lie outwith the landing area of any ramp flight, to prevent possible confusion which might lead to injury.

General information on use of tactile paving, including options on intermediate landings, is given in 'Guidance on the Use of Tactile Paving Surfaces'.

4.3.8 Stair landings serving outward opening fully glazed doors

Conservatories and similar extensions are an increasingly prevalent addition to many *dwellings*. If the *conservatory* or extension is intended to be the accessible entrance, the guidance to standard 4.1 should be followed. If the entrance is not the accessible entrance and has an outward opening fully *glazed* door, a landing, of a length shown in the following diagram should be in accordance with the guidance in clause 4.3.6. These recommended landing lengths may also be appropriate for fully *glazed* doors leading from a *dwelling* directly into a *conservatory*.

Landings serving outward-opening fully glazed doors



Single leaf doors (dwellings)

Double leaf doors (dwellings)

4.3.9 Stair flights consisting of both straight and tapered treads

On that part of a *flight* consisting of tapered treads, the going of the tapered treads should be uniform and should not be less than the going of the straight treads. At the inner end of the tread, the going should be at least 50 mm. Tapered treads on a stair should be *constructed* in accordance with BS 585: Part 1: 1989, Appendices B1 and B3, irrespective of material or whether it contains open rises. However guarding should be in accordance with the guidance in clause 4.4.2.

In a *flight* less than 1 m wide the going should be measured at the centre line of the *flight* as described in clause 4.3.1. In a *flight* 1 m wide or more the going should be measured at 2 points, 270 mm from each end of the tread, as described in clause 4.3.1 and the minimum going should be at least the going of the straight treads.

4.3.10 Stair flights consisting wholly of tapered treads

Stairs formed from tapering treads, particularly where forming a spiral, can present greater difficulties in use for many people than straight flights. There should be an appropriate level of safety and amenity on such stairs, particularly where used as a primary means of access.

A *flight* consisting wholly of tapered treads, forming a helix or spiral, should be *constructed* to give safe passage. To achieve this, it should be *constructed* in accordance with the guidance in BS 5395: Part 2: 1984, but account should be taken of the following guidance clauses:

- minimum and maximum rise should be as recommended in clause 4.3.2; and
- the effective width should be as recommended in clause 4.3.3; and
- the maximum number of rises on a *flight* should be as recommended in clause 4.3.4; and
- other than on a *private* stair, risers and treads should be as recommended in clause 4.3.5; and
- handrails should be as recommended in clauses 4.3.14 and 4.3.15; and
- protective barriers should be as recommended in clause 4.4.2.

4.3.11 Pedestrian ramps

Surfaces with a gradient of 1 in 20 to not more than 1 in 12 are considered to be ramps and recommendations are made on such surfaces to ensure the safety and amenity of users. Gradients of more than 1 in 12 are considered too steep to negotiate safely and are not recommended.

Steep gradients require both greater effort to ascend and more care when descending. As a general principle, the steeper the gradient of a ramp, the shorter the *flight* should be. A pedestrian ramp should be *constructed* in accordance with the following table:

Gradient, length and rise of a flight in a pedestrian ramp

Maximum gradient of <i>flight</i>	Maximum length of <i>flight</i>	Maximum rise
1 in 20	10 m	500 mm
1 in 15	5 m	333 mm
1 in 12	2 m	166 mm
More than 1 in 12	Not recommended	not recommended

Notes:

1. The maximum *flight* length for a particular gradient can be interpolated as follows: 3 m long for a gradient of 1 in 13, 4 m long for a gradient of 1 in 14, and so on.

4.3.12 Width of ramps flights

The width of a ramp should relate to the intensity of use. For example, an unobstructed width of 1.8 m is the minimum that will allow two wheelchair users to pass safely. As a ramp *flight* will normally be enclosed between flanking handrails or guarding, it is important that this width still offers safe and convenient passage.

The effective width of a ramp *flight* should be at least 1.0 m. Effective width is measured between handrails, or where there are no handrails, the protective barrier or inside face of any wall or guarding kerb, and should be clear of any obstructions.

4.3.13 Ramp landings

Clear space is needed to the head and foot of any ramp *flight* to allow people to move between a *flight* and an adjacent level surface safely. This should permit manoeuvring of a wheelchair without obstructing passage or the need to encroach into circulation routes or onto a ramp flight.

A ramp landing should:

- be provided at the top and bottom of every *flight*. A single landing may be common to 2 or more *flights*; and
- be level except, in external locations, for any minimal crossfall necessary to prevent standing water; and
- have an effective width not less than the effective width of the *flight* it serves; and
- be clear of any door swing or other obstruction.

The unobstructed length of a landing should be not less than 1.5 m, to allow space for wheelchairs or prams to stop after travelling down a *flight* and to provide manoeuvring space.

Where the entire length of a series of ramp *flights* is not visible from either the top or bottom landing, intermediate landings should have an effective width of not less than 1.8 m, to provide passing places during ascent or descent.

4.3.14 Handrails to stairs and ramps

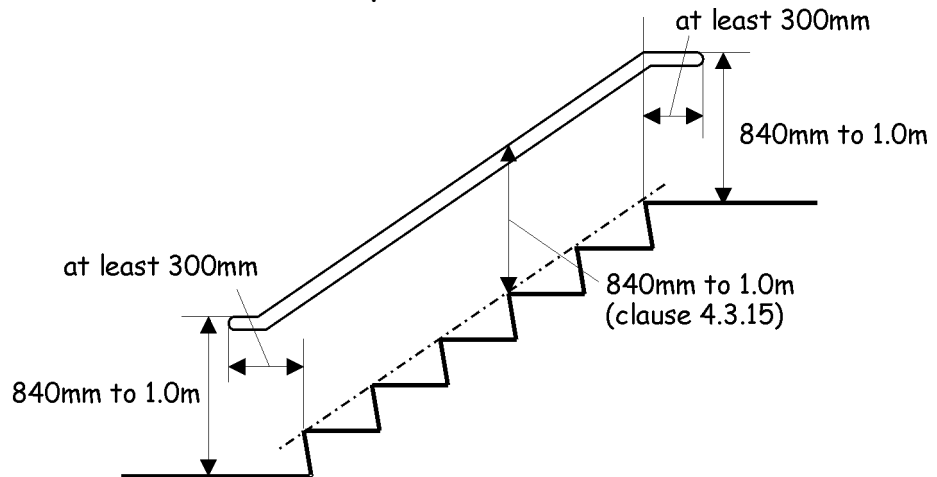
Handrails to a stair and ramp *flights* will provide support and assist safe passage. As the full width of a *flight* may be used, either by people passing or by person who favours one side, a handrail should generally be provided to both sides of a stair or ramp flight.

A handrail should be provided to both sides of any *flight* where there is a change of level of more than 600 mm, or where the *flight* on a ramp is longer than 2 m. However:

- handrails may be omitted to the *flight* of a ramp, serving a single dwelling, where the change in level is less than 600mm; and
- a handrail need only be provided to one side on a *flight* of a *private* stair.

Where a handrail is provided to only one side of a *private stair* flight, the side on which a handrail is not fixed should permit installation of a second handrail at a future date. A second handrail will provide additional support to a person using the stair and may be installed provided a clear width of 800 mm is maintained.

Handrails to stairs and ramps



The extension of a handrail at landings allows an individual to steady themselves before ascending or descending. For a person with impaired vision, the change in slope of the handrail and its return into a wall can also signal the start or finish of a flight.

A handrail on a stair or ramp *flight* should:

- extend at least 300 mm beyond the top and bottom of the *flight* as shown in the diagram above. However the 300 mm extension may be omitted where the handrail abuts a newel post; and
- have a profile and projection that will allow a firm grip; and
- end in a manner, such as a scrolled or wreathed end, that will not present a risk of entrapment to users; and
- contrast visually with any adjacent wall surface.

However only sub clause b need be provided on a *private stair* or to a ramp providing access within a single dwelling, as users are likely to be familiar with the layout and use of the flight.

A stair or ramp that is more than 2.3 m wide should be divided by a handrail, or handrails, in such a way that each section is at least 1.1 m and not more than 1.8 m wide. This does not apply to a stair between an entrance door to a *building* and ground level, where not forming part of an *escape route*.

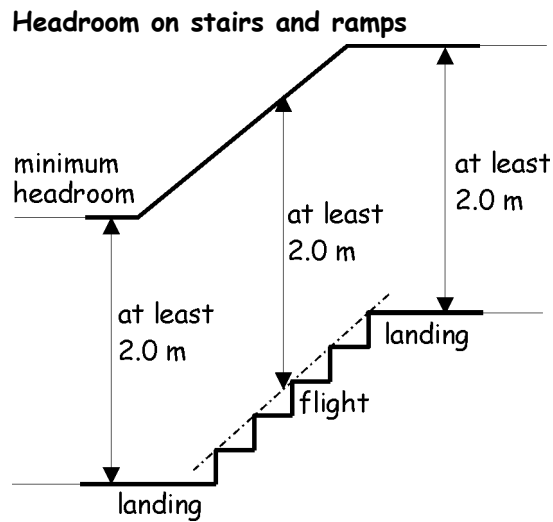
4.3.15 Height of handrails

A handrail should be fixed at a height of at least 840 mm and not more than 1.0 m, measured vertically above the pitch line of a *flight* on a stair or ramp and on a landing where a handrail is provided.

4.3.16 Headroom on stairs and ramps

A *flight* or landing on a stair or ramp should have clear headroom of at least 2.0 m extending over the whole of the effective width. Height should be measured vertically from the pitch line of the *flight* or from the surface of the landing.

In a *dwelling* where any portion of a *flight* or landing lies outwith the area needed to maintain the effective width of a *flight* or landing, a reduction in headroom may be considered, provided that no dangerous obstructions or projections are created.



4.3.17 Industrial stairs and fixed ladders

An industrial stair or fixed ladder serving an area in any *building* to which only limited access is provided should be *constructed* so as to offer safe passage. This method of access is not for public use and would only be expected to be provided in places such as plant-rooms. A stair or ladder should be *constructed* in accordance with:

- a. BS 5395: Part 3: 1985 or BS 4211: 2005, as appropriate; or
- b. BS 5395: Part 2: 1984 where the stair is a spiral or helical stair.

4.4 Pedestrian protective barriers

- 4.4 Functional standard
- 4.4.0 Introduction
- 4.4.1 Location of pedestrian protective barriers
- 4.4.2 Design of pedestrian protective barriers
- 4.4.3 Guarding to the edge of ramps

standard

4.4

mandatory

Every *building* must be designed and *constructed* in such a way that every sudden change of level that is accessible in, or around, the *building* is guarded by the provision of pedestrian protective barriers.

Limitation:

This standard does not apply where the provision of pedestrian protective barriers would obstruct the use of areas so guarded.

4.4.0 Introduction

Protective barriers are necessary to prevent people in and around *buildings* from an accidental fall at an unguarded change of level.

In assessing the type of barrier to be used, the likely hazards, the use of the *building* and the risks to the people that may be present should all be considered. Any barrier should minimise the risk of persons falling or slipping through gaps in the barrier. This is particularly important in all *domestic* buildings, where children will generally be present.

The height and form of a barrier are both important, particularly to prevent a fall resulting from an intentional act, such as climbing. Young children are often adept at climbing anything within their reach. It is important therefore that barriers are designed to minimise potential hand and footholds within dwellings, and within common areas and on access routes to *domestic* buildings.

Conversions

In the case of conversions, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably* practicable, and in no case be worse than before the *conversion* (regulation 12, schedule 6).

4.4.1 Location of pedestrian protective barriers

In the interests of safety, protective barriers should be provided where there is a sudden change in level and the possibility of severe injury from a fall.

At a change of direction on an access route, a drop of any height can be a hazard, particularly to a wheelchair user or a person with a visual impairment. A protective barrier should be provided where a significant drop occurs and in locations where a smaller change of level may increase the risk of injury.

It is not practical to provide a barrier at every change in level, but a protective barrier for pedestrians should be provided at the edge of:

- a. every floor, stair, ramp, landing, raised floor or other raised area to which people have access, where there is a difference in level of 600 mm or more; and
- b. any change in direction on an access or circulation route which is raised above the level of the surrounding surfaces.

However there is no need to provide a protective barrier in a location which would prevent intended access or be incompatible with the normal use of an area, such as to the edge of a loading bay.

A wall, partition or area of fixed glazing, *constructed* in accordance with the recommendations of clause 4.4.2, may act as a protective barrier.

To ensure a person can be aware of the presence of a protective barrier it should, unless within a *dwelling* or forming part of a wall or partition, contrast visually with surrounding surfaces. If a barrier is principally *glazed*, the recommendations for marking given in clause 4.8.2 should be followed.

4.4.2 Design of pedestrian protective barriers

In and around *domestic* buildings, gaps in any protective barrier should not be large enough to permit a child to pass through.

To ensure this, openings in a protective barrier should prevent the passage of a 100 mm diameter sphere. However the space between a rise in a stair and the lowest edge of the protective barrier may be larger than 100 mm, provided the lowest edge of the barrier is not more than 50 mm above, and parallel to, the pitch line of the stair.

A protective barrier, and any wall, partition or fixed *glazing* accepted instead of a barrier should be secure, capable of resisting loads calculated in accordance with BS 6399: Part 1: 1996 and be of a height as follows:

Height of pedestrian protective barriers

Location	Minimum height (mm) [1]
at the edge of a floor in front of walls, partitions and fixed <i>glazing</i> incapable of withstanding the loads specified in BS 6399: Part 1: 1996	800
in front of an openable window	800 [2]
on a stair or ramp <i>flight</i> wholly within a <i>dwelling</i>	840 [3]
on a stair or ramp <i>flight</i> outwith a <i>dwelling</i>	900 [3]
to a gallery, landing or raised area within a <i>dwelling</i>	900
all other locations	1100

Notes:

1. A handrail provided in accordance with clauses 4.3.14 and 4.3.15 may form the top of a protective barrier if the heights in this table are met.
2. Protective barriers should be installed where the opening window has:
 - a. a sill that is less than 800 mm above finished floor level; and
 - b. an operation that will allow the possibility of falling out; and
 - c. a difference in level between the floor level and the ground level of more than 600 mm.

At 2 storeys or more above ground level, reference should be made to clause 4.8.4. where external *glazing* is cleanable from within the *building*.
3. Where a handrail forming the top of a protective barrier to a *flight* meets a protective barrier to a landing, the height of the latter may be reduced for a distance not more than 300 mm to permit a smooth junction.

4.4.3 Guarding to the edge of ramps

Where a continuous pedestrian protective barrier is not provided to the edge of a ramp flight, a kerb upstand of at least 100 mm high should be provided to any open side of the *flight* where there is a drop of any height. However the use of an upstand kerb alone in open landscaping is not recommended as it may present a potential trip hazard.

Alternatively, an external ramp *flight* may be provided with a landscaped margin, level with the edge or the ramp for a distance of 600 mm before any grading.

4.5 Electrical safety

- 4.5 Functional standard
- 4.5.0 Introduction
- 4.5.1 Electrical installations
- 4.5.2 Extra-low voltage installations
- 4.5.3 Installations operating above low voltage

standard
4.5
mandatory

Every *building* must be designed and *constructed* in such a way that the electrical installation does not:

- (a) threaten the health and safety of the people in, and around, the *building*; and
- (b) become a source of fire.

Limitation:

This standard does not apply to an electrical installation:

- (a) serving a *building* or any part of a *building* to which the Mines and Quarries Act 1954 or the Factories Act 1961 applies; or
- (b) forming part of the works of an undertaker to which regulations for the supply and distribution of electricity made under the Electricity Act 1989.

4.5.0 Introduction

The hazards posed by unsafe electrical installation are injuries caused by contact with electricity (shocks and burns) and injuries arising from fires in *buildings* ignited through malfunctioning or incorrect installations.

Concern has been expressed that risks have been increasing in recent years due to:

- the increasing prevalence and variety of electrical systems in *buildings* and the demands being made on them;
- the reduction in subscription to voluntary industry self-regulation schemes.

The intention of this standard is to ensure that electrical installations are safe in terms of the hazards likely to arise from defective installations, namely fire, electric shock and burns or other personal injury. Installations should:

- safely accommodate any likely maximum demand; and
- incorporate appropriate automatic devices for protection against overcurrent or leakage; and
- provide means of isolating parts of the installation or equipment connected to it, as are necessary for safe working and maintenance.

The standard applies to fixed installations in *buildings*. An installation consists of the electrical wiring and associated components and fittings, including all permanently secured equipment, but excluding portable equipment and appliances.

Appendix 6 of BS 7671: 2008 (The Wiring Regulations) provides specimen certificates that may be completed by the person responsible for the installation. These can be issued to the person ordering the *works* as evidence of compliance with the recommendations of the British Standards.

Socket outlet

‘Socket outlet’ means a fixed device containing contacts for the purpose of connecting to a supply of electricity the corresponding contacts of a plug attached to any current-using appliance.

Conversions

In the case of conversions, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

4.5.1 Electrical installations

Electricity, when properly used, is a safe and convenient source of energy for heat, light and power within *buildings*. However misuse may lead to significant harm to individuals and *buildings* alike.

Risk of fire from an electrical installation should be minimised. In normal operation, taking into account the surroundings, it should not create the risk of fire, burns, shock or other injury to people.

An electrical installation should be designed, *constructed*, installed and tested such that it is in accordance with the recommendations of BS 7671: 2008.

Professional expertise

Electrical installation *work* should be inspected and tested by persons who possess sufficient technical knowledge, relevant practical skills and experience for the nature of the electrical *work* undertaken.

An approved certifier of construction who has been assessed to have the professional skills and relevant experience, can certify compliance of an electrical installation (see clause 4.0.5).

4.5.2 Extra-low voltage installations

To avoid the risk of harm, any circuit which is designed to operate at or below extra-low voltage should be protected against both direct and indirect contact with any other circuit operating at higher than extra-low voltage.

Extra-low voltage is defined as not more than 50 volts alternating current or 120 volts direct current, measured between conductors or to earth. This might include installations for alarm or detection purposes, or for transmission of sound, vision, data or power.

Any such installation should be designed, *constructed*, installed and tested such that it is in accordance with the recommendations of BS 7671: 2008.

4.5.3 Installations operating above low voltage

To avoid the risk of harm, any circuit which is designed to operate at a voltage higher than low voltage should be provided with a cut-off switch for use in emergency in accordance with the recommendations of BS 7671: 2008. Such installations are not usual in *domestic buildings*.

Low voltage is defined as not more than 1000 volts alternating current or 1500 volts direct current, measured between conductors or not more than 600 volts alternating current or 900 volts direct current between conductors and earth.

A fireman's switch, in a conspicuous position, should be provided to any circuit supplying exterior electrical installations or internal discharge lighting installations (including luminous tube signage) operating at a voltage exceeding low voltage.

4.6 Electrical fixtures

- 4.6 Functional standard
- 4.6.0 Introduction
- 4.6.1 Lighting
- 4.6.2 Lighting in common areas of domestic buildings
- 4.6.3 Door entry systems
- 4.6.4 Socket outlets

standard

4.6

mandatory

Every *building* must be designed and *constructed* in such a way that electric lighting points and socket outlets are provided to ensure the health, safety and convenience of occupants and visitors.

Limitation:

This standard applies only to *domestic buildings* where a supply of electricity is available.

4.6.0 Introduction

Visual perception increases with the level of light falling on the surface of an object. It is important to avoid hazardous situations that may be created by the nature of the lighting itself including insufficient light sources, glare, gloom and shadows.

During daylight, lighting levels within a *building* are generally much less than those outdoors. In lobby areas, transitional lighting will assist the eye in adjusting quickly between exterior and interior lighting conditions. Careful design of lighting can also play an important part in emergency situations, to ensure the safe and effective evacuation of people in an emergency.

Section 2 (Fire) includes guidance on *escape route* lighting and emergency lighting, whilst section 6 (Energy) covers energy efficient design of lighting.

Aside from the specific issues noted above and in guidance to this standard, general guidance on lighting in *buildings* remains outwith the scope of the Technical Handbook. There are, however numerous publications offering guidance on use of lighting in *buildings* for safety and amenity, including those listed below:

- Code for Lighting – CIBSE (2002);
- Building Sight - Royal National Institute for the Blind (1995).

The provision of an entryphone system to a communal entrance will enhance both the amenity and the security of occupants within a building.

Today, with ever more electrical appliances being used in homes, an adequate provision of power points reduces the possibility of both overloading of individual sockets, risking fire, and the creation of trip hazards from use of extension cabling.

Conversions

In the case of conversions, as specified in regulation 4, the *building as converted* shall meet the requirement of this standard (regulation 12, schedule 6).

4.6.1 Lighting

A *dwelling* should have an electric lighting system providing at least one lighting point to every circulation space, kitchen, bathroom, *toilet* and other space having a floor area of 2 m² or more.

Any lighting point serving a stair should have controlling switches at, or in the immediate vicinity of, the stair landing on each storey.

4.6.2 Lighting in common areas of domestic buildings

In communal areas and particularly on stairs and ramps within a building, the possibility of slips, trips and falls and of collision with obstacles should be minimised. Lighting conditions play an important part in this.

Common areas should have artificial lighting capable of providing a uniform lighting level, at floor level, of not less than 100 lux on stair *flights* and landings and 50 lux elsewhere within circulation areas. Lighting should not present sources of glare and should avoid creation of areas of strong shadow that may cause confusion or miss-step. A means of automatic control should be provided to ensure that lighting is operable during the hours of darkness.

4.6.3 Door entry systems

Entry to *buildings* containing *flats* or *maisonettes* is often controlled to maintain the security of a private space and to prevent vandalism. Similarly, the principal entrance to a *sheltered housing complex* may have an access control system for the general security and safety of residents.

Where a common entrance door, intended as a principal means of access to a building, is fitted with a locking device, a door entry system should be installed. This should comprise of a remote door release and intercom at the point of entry and a call unit within each *dwelling* served by that entrance.

Any unit at a common entrance should be positioned between 900 mm and 1.2 m above floor level. It should include an inductive coupler compatible with the 'T' setting on a personal hearing aid, together with a visual indicator that a call made has been received. Controls should contrast visually with surrounding surfaces and any numeric keypad should follow the 12-button telephone convention, with an embossed locator to the central '5' digit.

4.6.4 Socket outlets

Current lifestyle places a greater demand on electrical installations, with the increase in use of electrical appliances. Connection of multiple appliances into a socket outlet through an adapter can lead to overheating and the risk of fire. Similarly, use of extension leads can create a trip hazard.

To reduce these risks, a *dwelling* should be provided with at least the following number of 13A socket outlets:

- 4 within each apartment; and
- 6 within the kitchen, at least 3 of which should be situated above worktop level in addition to any outlets provided for floor-standing white goods or built-in appliances; and
- an additional 4 anywhere in the dwelling, including at least 1 within each circulation area on a level or storey.

Sockets may be installed as single or double outlets, to give the recommended number of outlets in each space.

4.7 Aids to communication

4.7 Functional standard

4.7.0 Introduction

standard

4.7

mandatory

Every *building* must be designed and *constructed* in such a way that it is provided with aids to assist those with a hearing impairment.

Limitation:

This standard does not apply to *domestic buildings*.

4.7.0 Introduction

This standard does not apply to *domestic buildings*.

4.8 Danger from accidents

- 4.8 Functional standard
- 4.8.0 Introduction
- 4.8.1 Collision with projections
- 4.8.2 Collision with glazing
- 4.8.3 Cleaning of windows and rooflights
- 4.8.4 Guarding of windows for cleaning
- 4.8.5 Access to manual controls

standard
4.8
mandatory

Every *building* must be designed and *constructed* in such a way that:

- (a) people in and around the *building* are protected from injury that could result from fixed glazing, projections or moving elements on the building;
- (b) fixed *glazing* in the *building* is not vulnerable to breakage where there is the possibility of impact by people in and around the building;
- (c) both faces of a window and rooflight in a *building* are capable of being cleaned such that there will not be a threat to the cleaner from a fall resulting in severe injury;
- (d) a safe and secure means of access is provided to a roof; and
- (e) manual controls for ventilation and for electrical fixtures can be operated safely.

Limitation:

Standards 4.8(d) does not apply to *domestic* buildings.

4.8.0 Introduction

This standard covers several unrelated safety issues that do not lend themselves to inclusion in other standards although glass and *glazing* do figure prominently.

Collision or entrapment accidents result in a significant numbers of deaths and injuries to people in and around *buildings* every year. The majority of these accidents occur during normal use and involve *building* features such as doors, windows and areas of fixed glazing, with the risk of injury increased where vulnerable glass is involved. Collisions with *glazing* are very common as it can, if transparent, be difficult to see and may create confusing lighting effects, presenting particular difficulties for a person with a visual or cognitive impairment.

Falls still result in deaths and serious injury to people while cleaning windows. Whether windows are cleaned professionally or by the *building* owner, provision should be made to permit *glazing* to be cleaned safely.

Natural ventilation in *dwellings* is provided by openable windows or rooflights. People may encounter difficulty and a hazard may arise in operating controls which are poorly sited. Similarly, location of electrical sockets, switches and other controls can, if not considered carefully, affect safe and convenient use.

Conversions

In the case of conversions, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably* practicable, and in no case be worse than before the *conversion* (regulation 12, schedule 6).

4.8.1 Collision with projections

Fixtures that project into, or open onto any place to which people have access can be a hazard. Any element of a *building* capable of projecting into a circulation route or space should be positioned, secured or guarded so that it does not present a risk to *building* users.

The simple way to avoid risk is to ensure that obstructions do not encroach into such spaces. However where a *building* element does project into a circulation route or space, and any part of the obstruction is less than 2.0 m above the ground, guarding should be provided to both highlight the hazard and prevent collision with the *building* element.

Guarding should be provided to:

- any moveable projection, such as a door leaf or window frame, that opens across a circulation route or into a circulation space; or
- any permanent projection of more than 100 mm into a circulation route or space that begins at a height of more than 300 mm above the ground, or the projection of which increases with height by more than 100 mm; or
- any accessible area where headroom reduces to less than 2.0 m, such as beneath a stair flight.

Guarding should comprise of a continuous horizontal rail, at a height of between 900 mm and 1.1 m above ground level and a solid element, such as kerb upstand or rail, positioned approximately 100 mm above ground level, to assist in detection by a visually impaired person using a cane.

There should be visual contrast between guarding rails and surrounding surfaces. Consideration should be given to positioning of guarding to direct a person away from the hazard, further reducing the risk of a collision.

Additional guarding may be needed to prevent collision with, or entrapment by, a powered door leaf (see clause 4.1.8).

Within a dwelling, guarding is not needed. A door swing may open into a circulation space provided no obstructions occur within the unobstructed area on a stair landing (see clause 4.3.6), on a ramp landing or that would prevent future installation of a stair lift (see clause 4.2.8).

4.8.2 Collision with glazing

Glazing in certain locations is more vulnerable to human impact. Care should be taken in the selection of *glazing* at low level in screens, walls and partitions or in areas surrounding doors, particularly where *glazed* side panels may be mistaken for doors.

To reduce the risk of injuries from accidental human impact in these locations, designers should either:

- fit *glazing* of a type, thickness and pane size that will be resistant to impact, which either does not break or breaks safely; or
- provide protection in the form of guarding to vulnerable glazing.

Glazing should be designed to resist human impact as set out in BS 6262: Part 4: 2005, where all, or part, of a pane is:

- within 800 mm of floor level; or
- part of a door leaf; or
- within 300 mm of a door leaf and within 1.5 m of floor level.

Glazing manifestation Large areas of transparent glazing, in fixed screens or partitions or where forming doors, can be difficult to identify and may be a particular hazard to a person with a visual impairment. Glazing in a building, positioned where accidental collision may be likely, should be made apparent by some form of manifestation (marking). Differences in the design of manifestation used can also assist in identifying the position of doors within a *glazed* screen.

Manifestation should be of a size and form that is immediately obvious. It should, as far as is *reasonably practicable*, contrast visually with backgrounds viewed through the *glazing* by a person approaching from either side. Forms might include broken or solid lines, patterns or logos and may be a continuous element or at appropriate horizontal intervals. Manifestation should be present within 2 height ranges, between 850 mm and 1.0 m, and between 1.4 m and 1.6 m above floor level. It should be permanent, e.g. screen printed or opaque etching or a durable applied material which is not easily removed.

Unframed *glazed* doors In addition, any unframed *glazed* door which operates on a pivot action should have any exposed vertical edge highlighted to contrast visually with surroundings, to assist in identifying the door edge when opening or in an open position. This is particularly important on powered doors.

Manifestation or highlighting of door edges need only be provided within *dwelling*s where *glazing* installations are unusual. Familiar elements such as patio doors should not usually attract marking.

4.8.3 Cleaning of windows and rooflights

Falls account for most window cleaning accidents, and generally occur from loss of balance through over-extension of reach or due to breakage of part of the *building* fabric through improper use or access. It is therefore important that transparent or translucent *glazing* should be designed so that it may be cleaned safely.

There is, however no need to provide for the safe cleaning of any *glazed* element that is opaque and does not allow the passage of light.

Any window or rooflight, all or part of which is more than 4 m above adjacent ground or internal floor level, should be *constructed* so that any external and internal *glazed* surfaces can be cleaned safely from:

- a. inside the *building* in accordance with the recommendations of Clause 8 of BS 8213: Part 1: 2004; or
- b. a loadbearing surface, such as a balcony or catwalk, large enough to prevent a person falling further; or
- c. a window access system, such as a cradle or travelling ladder, mounted on the *building*, as described in Annex C3 of BS 8213: Part 1: 2004.

Rooflights in *dwelling*s However within a dwelling, any rooflight, all of which is more than 1.8 m above both adjacent ground and internal floor level, need not be *constructed* so that it may be safely cleaned.

Glazing in common areas In addition to the above three options, any window or rooflight within a common area of a *domestic building* may be cleaned from a ladder sited on adjacent ground or from an adjacent loadbearing surface which has unobstructed space large enough to allow safe use the a ladder and which will contain a person from falling further. However a ladder should not be used to access any external or internal *glazed* surface more than 9 m above the surface on which the ladder is sited. General guidance on the safe use of

	<p>ladders may be found in HSE information sheet MISC613 'Safety in window cleaning using portable ladders'.</p>
Roof access hatches	<p><i>Glazing</i> within a roof access hatch, located within a <i>roof space</i>, need not be <i>constructed</i> so that it may be safe cleaned.</p>
Cleaning from inside	<p>When cleaning a window from inside, a person should not have to sit or stand on a window sill or use other aids to reach the external face of the window. The criterion of safety is the ability to reach all points on the surface of the external <i>glazing</i> with only the arm projecting outside the line of the window whilst remaining standing on the floor.</p>
'Safe reach'	<p>Ergonomic statistics on reach capabilities for the UK adult population are given in Annex A of BS 8213: Part 1: 2004. As reach may safely be increased to some degree by use of cleaning implements, it would still be considered reasonable to apply a safe limit to downward reach of 610 mm and a safe limit to lateral and vertical reach as an arc with a radius of 850 mm measured from a point not more than 1.3 m above floor level.</p>
Cleaning from a loadbearing surface	<p>Where the window is to be cleaned from a loadbearing surface listed in sub-clause b to this clause, there should be:</p> <ul style="list-style-type: none">• a means of safe access; and• a protective barrier not less than 1.1 m high to any edge of the surface or access to the surface which is likely to be dangerous. <p>This method of cleaning is only appropriate where no part of the <i>glazing</i> is more than 4 m above the loadbearing surface.</p>
Alternative methods	<p>Where there is a need for safe cleaning of glazing, it may be appropriate to consider alternate methods of cleaning, in addition to those listed in guidance, where an equivalent level of safety can be demonstrated.</p>

4.8.4 Guarding of windows for cleaning

For openable windows on the ground and first floor of a *building*, or where the outside face of the *glazing* will not be cleaned from inside the building, no guarding need be provided for the purpose of cleaning *glazing*. However the general guidance for provision of protective barriers given in clause 4.4.2 should be followed.

At greater heights, 2 storeys or more above ground level, where it is intended to clean the outside face of the *glazing* from inside the building, the increased risk from a fall should be recognised and guarding provided to a height of at least 1.1 m above floor level.

Where guarding is provided, it should be designed to conform to BS 6180: 1999. All guarding should be permanently fixed, should not be detachable to permit windows to open and should be designed so that it is not easily climbable by children.

Guarding to a window is not needed where the open window gives access to a fully guarded balcony.

4.8.5 Access to manual controls

The location of a manual control device can have a significant effect on both the ease of operation of the device and safety in use. Positions that are inaccessible present a greater risk of accident when bending or reaching. Any control that is intended for operation by the occupants of a *building* should be installed in position that allows safe and convenient use.

This guidance is applicable to manual controls to openable ventilators, including windows and rooflights and to controls and outlets of electrical fixtures located on a wall or other vertical surface. Unless incorporating a restrictor or other protective device for safety reasons, controls should be operable with one hand.

Windows, rooflights
and *ventilators*

An openable window or rooflight, that provides natural ventilation to meet standard 3.14, should have controls for opening, positioned at least 350 mm from any internal corner, projecting wall or similar obstruction and at a height of:

- not more than 1.7 m above floor level, where access to controls is unobstructed; or
- not more than 1.5 m above floor level, where access to controls is limited by a fixed obstruction of not more than 900 mm high which projects not more than 600 mm in front of the position of the controls, such as a *kitchen* base unit. Where obstruction is greater, a remote means of opening, in an unobstructed location, should be provided; or
- not more than 1.2 m above floor level, in an unobstructed location, within an enhanced *apartment* (see clause 3.11.2) or within accessible *sanitary accommodation* (see clause 3.12.3) not provided with mechanical ventilation.

The above guidance does not apply to windows or rooflights openable only for cleaning or maintenance purposes or that are controlled by an automatic system, or to *trickle* ventilators.

Electrical Fixtures

Outlets and controls of electrical fixtures and systems should be positioned at least 350 mm from any internal corner, projecting wall or similar obstruction and, unless the need for a higher location can be demonstrated, not more than 1.2 m above floor level. This would include fixtures such as sockets, switches, fire alarm call points and timer controls or programmers. Within this height range:

- light switches should be positioned at a height of between 900 mm and 1.1 m above floor level;
- standard switched or unswitched socket outlets and outlets for other services such as telephone or television should be positioned at least 400 mm above floor level. Above an obstruction, such as a worktop, fixtures should be at least 150 mm above the projecting surface.

Where socket outlets are concealed, such as to the rear of white goods in a kitchen, separate switching should be provided in an accessible position, to allow appliances to be isolated.

4.9 Danger from heat

- 4.9 Functional standard
- 4.9.0 Introduction
- 4.9.1 Installation of unvented hot water storage systems
- 4.9.2 Specification of small unvented hot water storage systems
- 4.9.3 Discharge from unvented hot water storage systems
- 4.9.4 Discharge of steam or hot water
- 4.9.5 Hot water discharge from sanitary fittings

standard

4.9

mandatory

Every *building* must be designed and *constructed* in such a way that protection is provided for people in, and around, the *building* from the danger of severe burns or scalds from the discharge of steam or hot water.

4.9.0 Introduction

Guidance is given under this standard on a number of issues relating to hot water safety.

Unvented hot water storage systems

Guidance is given to minimise the risk of explosion due to malfunction of an unvented hot water vessel by:

- ensuring that such installations are carried out by appropriately qualified personnel; and
- requiring a minimum range of safety devices be fitted to any such installation to prevent the temperature of the stored water exceeding 100° C.

It is not intended that this guidance should be applied to storage systems with a capacity of less than 15 litres, to systems used solely for space heating or to any system used for an industrial or commercial process.

Guidance is given on systems of up to 500 litres storage capacity, where power input does not exceed 45kW. Installations above this size are not usual in *domestic* buildings. It is unlikely that many larger installations will be installed in *dwelling*s but if required, additional guidance on such installations is provided to standard 4.9 of the non-domestic Technical Handbook.

Hot water overflows

Guidance is given on provision for the safe removal of the discharge created by the normal operation of safety devices in such an installation and on ensuring discharge of hot water and steam from any installation, unvented or otherwise, to a safe and visible location.

Sanitary facilities

Measures to prevent scalding from hot water are now addressed for certain *sanitary facilities* used for personal hygiene.

Maintaining safety devices

Safety devices installed to protect from hazards such as scalding or the risk of explosion of unvented systems should be maintained to ensure correct operation. Guidance on maintenance can be provided by both manufacturers and installers of such devices.

Conversions

In the case of conversions, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

4.9.1 Installation of unvented hot water storage systems

Installation of an unvented hot water storage system should be carried out by a person with appropriate training and practical experience.

Competence of installers

This might include current membership of a registration scheme operated by a recognised professional body. This could include those administered by the Scottish and Northern Ireland Plumbing Employers Federation (SNIPEF) and the Construction Industry Training Board (CITB) or an equivalent body.

The following points should be noted in relation to installation of an unvented hot water storage system:

- the installer should be a competent person and, on completion, the labelling of the installation should identify the installer;
- the installed system should meet the recommendations of BS 7206: 1990 or be the subject of an approval by a *notified body* and incorporate the safety devices outlined in clause 4.9.2;
- certification of the unit or package should be recorded by permanent marking and a warning label which should be visible after installation. A comprehensive installation/user manual should be supplied;
- the tundish and discharge pipework should be correctly located and fitted by the installer and the final discharge point should be visible and safely positioned where there is no risk from hot water discharge.

The operation of the system under discharge conditions should be tested to ensure provision is adequate.

4.9.2 Specification of small unvented hot water storage systems

An unvented hot water storage system should be designed and installed to prevent the temperature of the stored water at any time exceeding 100° C and to provide protection from malfunctions of the system.

An unvented hot water storage system should be in the form of a proprietary unit or package which is in accordance with the recommendations of BS 7206: 1990 or the subject of approval by a *notified body* to an equivalent level of safety and performance.

Pressure safety devices

A unit or package should have fitted:

- a check valve to prevent backflow; and
- a pressure control valve to suit the operating pressure of the system; and
- an expansion valve to relieve excess pressure; and
- an external expansion vessel or other means of accommodating expanded heated water.

These devices are factory-fitted (unit) or supplied for fitting by the installer (package).

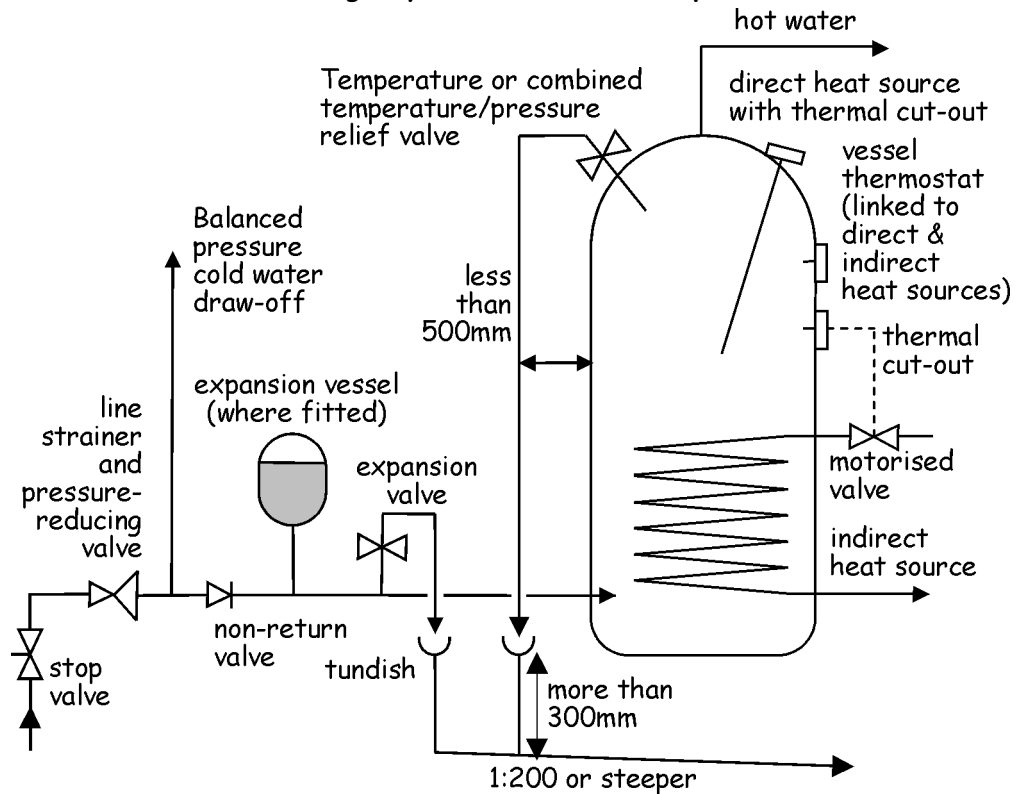
Temperature activated safety devices

A unit or package should have a minimum of 2 temperature-activated devices operating in sequence comprising:

- a non self-resetting thermal cut-out; and
- a temperature relief valve.

These devices should be in addition to any thermostatic control that is fitted to maintain the temperature of the stored water at around 60° C.

Unvented hot water storage System - indirect example



Thermal cut-out

A temperature-operated, non self-resetting, energy cut-out complying with BS 3955: 1986 should be fitted to the vessel. In the event of thermostat failure, heating to the water in the vessel should stop before the temperature rises to the critical level required for operation of the temperature relief valve.

In indirectly heated vessels, the non self-resetting thermal cut-out should operate a motorised valve, or other similar device, to shut off the flow from the heat source.

On directly heated vessels or where an indirectly heated vessel has an alternative direct method of water heating fitted, a non self-resetting thermal cut-out device should be provided for each direct source.

Temperature relief valve

The temperature relief valve should be located directly on the storage vessel. Generally, a combined temperature and pressure valve is fitted. The relief valve should comply with BS 6283 Part 2: 1991 for temperature relief valves or BS EN 1490: 2000 for combined temperature and pressure relief valves which are set to open at temperatures not normally exceeding 90° C.

The relief valve should have a discharge capacity rating at least equal to the rate of energy (power in kilowatts) input to the heat source. In the case of an indirectly heated unit or package, the valve should be tested to discharge water at a rate not less than 500 kg/h for systems up to 45 kW. The discharge pipework should accommodate this flow rate.

4.9.3 Discharge from unvented hot water storage systems

The removal of discharges of water from the system can be considered in three parts:

Relief valve to tundish

Each valve should discharge into a metal pipe not less than the nominal outlet size of the valve. The discharge pipe should have an air-break, such as a tundish, not more than 500 mm from the vessel relief valve and located in an easily visible location within the same enclosure. Discharge pipes from more than one relief valve may be taken through the same tundish.

Pipework should be installed so that any discharge will be directed away from electrical components should the discharge outlet become blocked.

Tundish to final discharge point

The presence of this air break results in the pressure of the final discharge being no higher than that of a vented system.

The discharge pipe from the tundish to final discharge point should be of a material, usually copper, capable of withstanding water temperatures of up to 95° C and be at least one pipe size larger than the outlet pipe to the relief valve. A vertical section of pipe, at least 300 mm long, should be provided beneath the tundish before any bends to the discharge pipe; thereafter the pipe should be appropriately supported to maintain a continuous fall of at least 1 in 200 to the discharge point.

The pipework should have a resistance to the flow of water no greater than that of a straight pipe 9 m long unless the pipe bore is increased accordingly. Guidance on sizing of pipework from the tundish to the final discharge point is shown in the following table:

Size of discharge pipework

Valve outlet size	Minimum size of discharge pipe to tundish	Minimum size of discharge pipe from tundish	Maximum resistance allowed, expressed as a length of straight pipe i.e. no elbows or bends	Equivalent resistance created by the addition of each elbow or bend
G ½	15 mm	22 mm	Up to 9 m	0.8 m
		28 mm	Up to 18 m	1.0 m
		35 mm	Up to 27 m	1.4 m
G ¾	22 mm	28 mm	Up to 9 m	1.0 m
		35 mm	Up to 18 m	1.4 m
		42 mm	Up to 27 m	1.7 m
G 1	28 mm	35 mm	Up to 9 m	1.4 m
		42 mm	Up to 18 m	1.7 m
		54 mm	Up to 27 m	2.3 m

Annex D to BS 6700: 1997 'Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages' also gives guidance on pipe sizing for water distribution systems.

Discharge pipe termination

The pipe termination should be in a visible location and installed so that discharge will not endanger anyone inside or outside the building.

Ideally, the final discharge point should be above the water seal to an external gully and below a fixed grating. Other methods for terminating the final discharge point would include:

- a. up to 100 mm above external surfaces such as car parks, grassed areas, or hard standings; a wire cage or similar guard should be provided to both prevent contact with discharge and protect the outlet from damage, whilst maintaining visibility;
- b. at high level into a hopper and downpipe of a material, such as cast iron, appropriate for a hot water discharge with the end of the discharge pipe clearly visible;
- c. onto a *flat roof* or pitched roof clad in a material capable of withstanding high temperature discharges of water, such as slate/clay/concrete tiles or metal sheet, with the discharge point a minimum of 3 m from any plastic guttering system that would collect such discharges.

Discharge at high level may be possible if the discharge outlet is terminated in such a way as to direct the flow of water against the external face of a wall. However evidence of the minimum height of the outlet above any surface to which people have access and the distance needed to reduce the discharge to a non-scalding level should be established by test or otherwise.

4.9.4 Discharge of steam or hot water

Any vent or overflow pipe of a hot water system should be positioned so that any discharge will not endanger anyone inside or outside the *building*.

The discharge point of such pipework should be provided in accordance with the guidance given for termination in clause 4.9.3.

4.9.5 Hot water discharge from sanitary fittings

Guidance to the Water Byelaws recommends that, to prevent the development of Legionella or similar pathogens, hot water within a storage vessel should be stored at a temperature of not less than 60°C and distributed at a temperature of not less than 55° C.

If water is supplied at high temperature, from any source, there is a danger of scalding to *building* users. Risk of severe injury increases proportionally with increase in temperature and with extent of contact.

To prevent scalding, the temperature of hot water, at point of delivery to a bath or bidet, should not exceed 48° C.

A device or system limiting water temperature should not compromise the principal means of providing protection from the risk of Legionella. It should allow flexibility in setting of a delivery temperature, up to a maximum of 48° C, in a form that is not easily altered by *building* users. This will allow reduction of temperature where, for example, facilities are used by those more at risk from injury, such as elderly people or unsupervised children.

Guidance to the Water Byelaws

Facilities used for personal hygiene

www.tmva.org.uk

Where both hot and cold water are supplied to a facility, the above may be achieved by use of a thermostatic mixing valve (TMV) or fitting complying with BS EN 1111: 1999 or BS EN 1287: 1999, fitted as close to the point of delivery as practicable. Guidance on the installation, use and maintenance of thermostatic mixing valves and fittings can be found in BRE information Paper IP 14/03 and from the Thermostatic Mixing Valve Association (TMVA).

Provision within an existing *building*

Where a *dwelling* is altered or extended, but not *converted*, and new *sanitary facilities* are provided, some primary heat sources, such as older combination boilers, may not be suited to temperature control in the manner given above. In such cases, advice should be sought from equipment manufacturers on compatible means of limiting hot water temperature to controlled facilities.

Health & Safety legislation

The non-domestic Handbook should be referred to for duties under Health & Safety legislation relevant to any part of a *dwelling* used as a place of work.

4.10 Fixed seating

- 4.10 Functional standard
- 4.10.0 Introduction

standard

4.10

mandatory

Every *building*, which contains fixed seating accommodation for an audience or spectators, must be designed and *constructed* in such a way that a number of level spaces for wheelchairs are provided proportionate to the potential audience or spectators.

Limitation:

This standard does not apply to *domestic buildings*.

4.10.0 Introduction

This standard does not apply to *domestic buildings*.

4.11 Liquefied petroleum gas storage

- 4.11 Functional standard
- 4.11.0 Introduction
- 4.11.1 LPG storage installations
- 4.11.2 LPG storage – fixed tanks
- 4.11.3 LPG storage - cylinders

standard

4.11

mandatory

Every *building* must be designed and *constructed* in such a way that each liquefied petroleum gas storage installation, used solely to serve a combustion appliance providing space heating, water heating, or cooking facilities, will:

- (a) be protected from fire spreading to any liquefied petroleum gas container; and
- (b) not permit the contents of any such container to form explosive gas pockets in the vicinity of any container.

Limitation:

This standard does not apply to a liquefied petroleum gas storage container, or containers, for use with portable appliances.

4.11.0 Introduction

This guidance deals with domestic supply installations where liquefied petroleum gas (LPG) is stored under pressure at ambient temperatures in fixed vessels larger than 75 kg LPG capacity.

Guidance is also given on the storage of LPG within grouped cylinders, when connected to a supply installation.

The intention of the guidance to this standard is to minimise both the risk of fire spreading to the tank and of the contents of the tank forming explosive gas pockets in the vicinity of any LPG storage container.

All persons concerned with the storage and use of LPG should be aware of the following characteristics and potential hazards:

- the two forms of liquefied petroleum gases that are generally available in the UK are commercial butane and commercial propane;
- LPG is stored as a liquid under pressure. It is colourless and its weight as a liquid is approximately half that of the equivalent volume of water;
- LPG vapour is denser than air, commercial butane being about twice as heavy as air. Therefore the vapour may flow along the ground and into drains, sinking to the lowest level of the surroundings and may therefore be ignited at a considerable distance from the source of the leakage. In still air, vapour will disperse slowly;
- when mixed with air, LPG can form a flammable mixture;
- leakage of small quantities of the liquefied gas can give rise to large volumes of vapour/air mixture and thus cause considerable hazard;
- owing to its rapid vaporisation and consequent lowering of temperature, LPG, particularly in liquid form, can cause severe frost burns if brought into contact with the skin;
- a container that has held LPG and is 'empty' may still contain LPG in vapour form and is thus potentially dangerous.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

4.11.1 LPG storage installations

The type, size and location of an LPG storage installation will determine the factors that should be addressed in the *construction* of the facility, to comply with health and safety requirements.

www.hse.gov.uk

The Liquefied Petroleum Gas Association (LPGA) produces and maintains Codes of Practice which give guidance on achieving levels of risk appropriate to compliance with health and safety legislation for the design, *construction* and operation of LPG installations. These Codes have been produced in consultation with the Health and Safety Executive (HSE).

The operation of properties where LPG is stored or is in use are subject to legislation enforced by both the HSE and by the Local Authority.

4.11.2 LPG storage – fixed tanks

A liquefied petroleum gas storage tank, together with any associated pipework connecting the system to a combustion appliance providing space or water heating, or cooking facilities, should be designed, *constructed* and installed in accordance with the requirements set out in the LPGA Code of Practice 1: 'Bulk LPG Storage at Fixed Installations'.

Above-ground tanks should be in accordance with Part 1 – 'Design, Installation and Operation of Vessels Located Above Ground', as amended.

Below-ground tanks should be in accordance with Part 4 – 'Buried/ Mounded LPG Storage Vessels', as amended.

For propane installations, above or below-ground, of not more than 2 tonnes (4500 litres) overall capacity, reference may be made to the simplified guidance given in the LPGA Code of Practice 1: 'Bulk LPG Storage at Fixed Installations': Part 2 – 'Small Bulk Propane Installations for Domestic and Similar Purposes', as amended.

Guidance given in this clause is relevant for all tanks, though specific criteria are noted for tanks below 4 tonnes (9000 litres) LPG capacity. LPG storage tanks in excess of 4 tonnes LPG capacity are uncommon in domestic applications. Guidance for larger installations is contained within the relevant Part of the Code of Practice.

Every tank should be separated from a building, *boundary*, or fixed source of ignition, to:

- a. in the event of fire, reduce the risk of fire spreading to the tank; and
- b. enable safe dispersal in the event of venting or leaks.

Tanks should be situated outdoors, in a position that will not allow accumulation of vapour at ground level. Ground features such as open drains, manholes, gullies and cellar hatches, within the separation distances given in column A of the table overleaf should be sealed or trapped to prevent the passage of LPG vapour.

Tanks should be separated from buildings, *boundaries* or fixed sources of ignition in accordance with the table overleaf:

Separation distances for liquefied petroleum gas storage tanks

Maximum capacity (in tonnes)		Minimum separation distance for above ground tanks (in metres)		
of any single tank	of any group of tanks	From a building, boundary or fixed source of ignition to the tank		between tanks
		A no fire wall [1]	B with fire wall [1]	
0.25	0.8	2.5	0.3 [2]	1.0
1.1	3.5	3.0	1.5 [2]	1.0
4.0	12.5	7.5	4.0	1.0

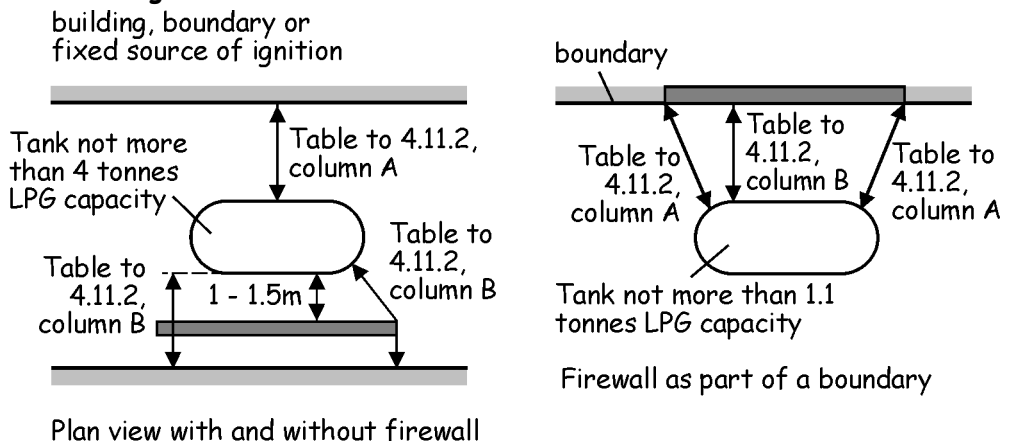
Notes:

1. Fire wall means a wall or screen meeting the guidance for an *external wall* with a fire resistance of short duration (section 2, Fire) within 1 m of the boundary, and located between 1 m and 1.5 m from the tank and extending:
 - a. longitudinally: so that the distance specified above without the fire wall is maintained when measured around the ends of the fire wall; and
 - b. vertically: 2 m or the height to the top of the pressure relief valve, whichever is greater.
2. For vessels up to 1.1 tonnes capacity, the fire wall need be no higher than the top of the pressure relief valve and may form part of the *site* boundary.

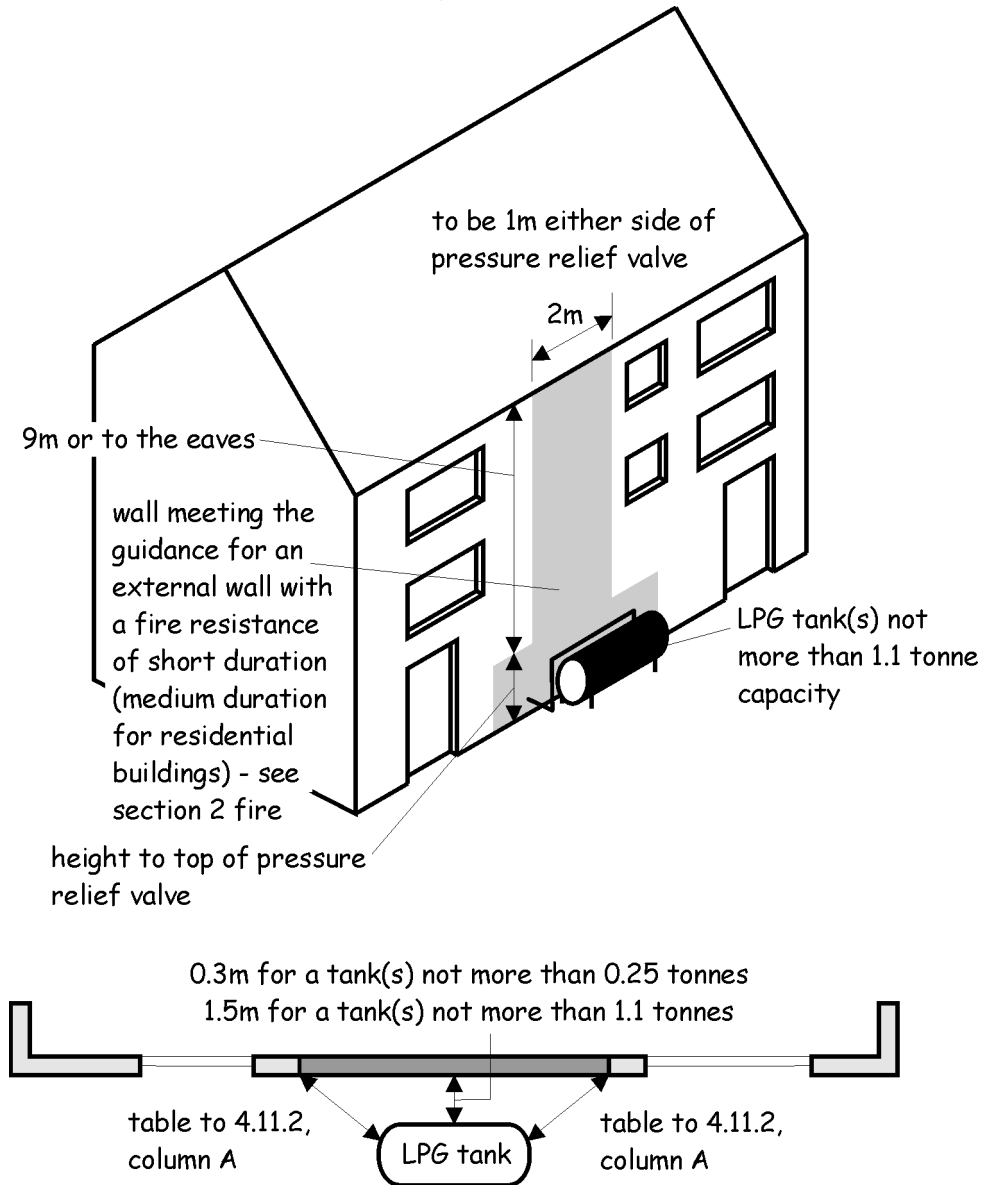
For vessels up to 1.1 tonnes capacity located closer to a *building* than the separation distance in column A of the above table, the fire wall should form part of the wall of the *building* in accordance with the diagram below. Where part of the *building* is used as a *dwelling* (or for residential accommodation), such a fire wall should meet the guidance for an *external wall* with a fire resistance of medium duration (section 2, Fire).

Where a group of tanks are sited together, the number of tanks in a group should not exceed 6 and the total storage capacity of the group should not exceed that given for any group of tanks in the table above.

Separation or shielding of a LPG tank from a building, boundary or fixed source of ignition



Small LPG tank close to a building



Vehicular parking areas

Motor vehicles under the control of a *site occupier* should be parked at least 6 m from LPG tanks or the separation distance in column A of the table to this clause, whichever is the smaller. This does not apply to the loading/unloading of vehicles. Motor vehicles not under *site* control (e.g. those belonging to members of the public) should be parked no closer than the separation distance in column A of the table to this clause.

4.11.3 LPG storage - cylinders

Where an LPG storage installation consists of a set of cylinders, the installation should be in accordance with the LPGA Code of Practice 24: 'Use of LPG cylinders': Part 1 - 'The Use of Propane in Cylinders at Residential Premises'.

Use of cylinders in a domestic installation commonly takes the form of 2 sets of paired cylinders connected to a manifold, with supply provided from one pair of cylinders at any one time. This allows continuous supply to be maintained when changing empty cylinders.

Any installation should enable cylinders to stand upright, secured by straps or chains against a wall outside the *building*.

Cylinders should be positioned on a firm, level base such as concrete at least 50 mm thick or paving slabs bedded on mortar, and located in a well-ventilated position at ground level, so that the cylinder valves will be:

- a. at least 1 m horizontally and 300 mm vertically from openings in the *buildings* or from heat source such as *flue* terminals or tumble dryer vents;
- b. at least 2 m horizontally from untrapped drains, unsealed gullies or cellar hatches unless an intervening wall not less than 250 mm high is present.

Cylinders should be readily accessible, reasonably protected from physical damage and located where they do not obstruct *exit* routes from the building.

4.12 Vehicle protective barriers

- 4.12 Functional standard
- 4.12.0 Introduction
- 4.12.1 Vehicle protective barriers

standard

4.12

mandatory

Every *building* accessible to vehicular traffic must be designed and *constructed* in such a way that every change in level is guarded.

4.12.0 Introduction

Where vehicles are introduced into a building, measures should be taken to protect people from any additional risks presented. Where areas subject to vehicular traffic are at a level higher than adjacent areas, such as on ramps or platforms, precautions should be taken to ensure that vehicles can not fall to a lower level.

In the assessment of the type of barrier to be provided, the designer should give consideration to the likely hazards, the *building* use and the risks to *building* users.

Conversions

In the case of conversions, as specified in regulation 4, the building as converted shall meet the requirement of this standard (regulation 12, schedule 6).

4.12.1 Vehicle protective barriers

If vehicles have access to a floor, roof or ramp that forms part of a building, a vehicle protective barrier should be provided to the edge of any such area that is above the level of any adjoining floor, ground or any other route for vehicles.

When designing barriers to resist vehicular impact, an estimate of the characteristic mass of the vehicle should be made. Ideally, this should be determined statistically. If this is not possible, the characteristic mass should be taken to be equal to the maximum mass anticipated. Further information on estimation of equivalent static forces for a given characteristic mass and displacement can be obtained in Annex A to BS 6180: 1999.

The designer should, wherever possible, avoid introducing projections on the vehicular face of the barrier and should also consider methods of redirecting vehicles in such a way as to cause minimum damage after impact.

A vehicle protective barrier should be:

- a. capable of resisting loads calculated in accordance with BS 6399: Part 1: 1996; and
- b. of a height at least that given in the table below:

Height of vehicle protective barriers

Location	Minimum height in mm
Floor or roof edge	400
Ramp edge	600

The minimum height for these barriers relates to the height at which imposed load is applied as described in BS 6399, Part 1: 1996.

In locations used by both vehicles and pedestrians, such as parking areas, additional barrier criteria may apply to edges and changes in level as described in clauses 4.4.1 and 4.4.2.

4.13 Security

- 4.13 Functional standard
- 4.13.0 Introduction
- 4.13.1 Physical security of doors and windows
- 4.13.2 Doors and windows – ‘Secured by Design’
- 4.13.3 Doors and windows – product accreditation
- 4.13.4 Doors and windows – product standards and component performance
- 4.13.5 Installation and fixing of doors and windows

<p>standard</p> <h1 style="margin: 0;">4.13</h1> <p>mandatory</p>	<p>Every <i>building</i> must be designed and <i>constructed</i> in such a way that doors and windows vulnerable to unlawful entry can be secured to deter housebreaking and ensure the safety and welfare of occupants.</p> <p>Limitation: This standard applies only to <i>domestic buildings</i>.</p>
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4.13.0 Introduction

Whilst police statistics show signs of housebreaking decreasing since 1999, people’s perception of their likelihood of falling victim to this type of crime continues to increase. The 2003 Scottish Crime Survey identified that one in ten people consider it ‘very’ or ‘fairly’ likely that their home would be broken into within the next twelve months. This is an increase on the same response in 2000 and is double the proportion of households who were actually victims of housebreaking in preceding years.

As almost half of the recorded incidents of housebreaking occur when a property is occupied, it is not surprising that housebreaking is rated amongst the crimes that cause people most concern and worry. However basic measures to improve the physical security of dwellings, including robust specification of doors, windows, glazing and locks, can act deter the opportunist thief.

Guidance to other standards is also relevant to promoting a more secure environment, as follows:

- lighting of common entrances and *dwelling* entrances (standard 4.1);
- lighting within the common areas of *domestic* buildings and access control systems to common entrances (standard 4.6);
- ensuring security measures do not adversely affect means of escape (standard 2.9).

Further advice

‘Secured by Design’ is the established police initiative to design out elements within development that may contribute to housebreaking and other crimes. ‘Secured by Design’ accreditation considers *site* design and layout as well as physical security measures and offers a more comprehensive solution than those physical provisions set out within this standard. As ‘Secured by Design’ is assessed on a *site*-specific basis, the police can also offer recommendations on appropriate additional measures in areas where the risk of crimes, such as housebreaking, are considered greater. Information on the scheme can be found online at www.securedbydesign.com

Conversions

In the case of conversions, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

4.13.1 Physical security of doors and windows

The two most common means of unlawful entry into a *dwelling* are through doors or windows, where these are either left open or can be easily forced open. The level of security of any *dwelling* can be significantly enhanced by ensuring that all external doors and any windows or glazing in vulnerable locations are manufactured and installed to resist forced entry and also that unauthorised entry into common areas is prevented.

Doors should be designed and installed to resist forced entry at:

- an external door to a *dwelling* or common area of a *domestic building*; and
- an entrance or egress door to a *flat* or *maisonette*; and
- a door between a *dwelling* and a *conservatory* or garage.

Windows

Windows and glazing should be designed and installed to resist forced entry where:

- located at ground floor level and easily accessible; or
- where otherwise easily accessible from outside, such as by climbing on *building* projections.

There are a number of ways in which this can be achieved:

- a. by meeting the recommendations for physical security in Section 2 of '[Secured by Design](#)' (ACPO, 2009); or
- b. by use of doorsets and windows which are tested and certified by a *notified body* as meeting a recognised standard for security; or
- c. by use of doorsets and windows manufactured to meet recognised product standards and defined component performance.

The baseline recommendations in (c) are relevant to all such doors and windows.

4.13.2 Doors and windows – 'Secured by Design'

'Secured by Design' (ACPO, 2009) offers a comprehensive solution to the security of dwellings, addressing *site* design and layout as well as detailed physical security measures. It is particularly relevant to new build or building conversions involving multiple units.

A door or window in the locations described in clause 4.13.1 should meet the recommendations for physical security in Section 2 of '[Secured by Design](#)'. Information on Secured by Design and its application can be found online at www.securedbydesign.com

4.13.3 Doors and windows – product accreditation

A door or window in the locations described in clause 4.13.1 should be tested and certified by a *notified body* as meeting a recognised standard for security such as BS PAS 24: 2007 for doorsets or BS 7950: 1997 for windows.

4.13.4 Doors and windows – product standards and component performance

To ensure a robust, basic standard of security, a doorset or window in the locations described in clause 4.13.1 should be designed and constructed in accordance with the general recommendations of the product standard appropriate for the material used, such as:

- BS 7412: 2007, for PVCu units;
- BS 644: 2009, for timber window units;
- BS 4873: 2009, for aluminium alloy units;
- BS 6510: 2005, for steel-framed units.

Vulnerable windows should be constructed to resist attempts to force frames and, if openable, ironmongery. Windows which can be opened should be fitted with either:

- a keyed locking system that uses a removable key; or
- a keyless locking system, together with glazing which incorporates laminated glass or a similarly robust glazing material.

Where a material standard for a doorset is not available, it should be designed and constructed in accordance with the recommendations in Annex A of BS 8220-1: 2000, together with the following recommendations, to ensure a robust basic standard of security.

Hinges

If single swing the doorset should be fitted with at least one and a half pairs of hinges meeting the recommendations of BS EN 1935: 2002 for hinge grade 11 or above. Hinges fitted to an outward-opening door should be of a type that does not permit the hinge pin to be removed unless the door is open. Otherwise, hinge bolts should be fitted to ensure the door leaf will remain secure when closed.

Locking

A doorset should include a single-point locking device to BS 3621: 2007 (for keyed egress) or to BS 8621: 2007 (for keyless egress) or a multipoint locking system. A deadlocking facility should be provided. Any lock cylinder should be in accordance with BS EN 1303: 2005, grade 5 key security and grade 2 attack resistance as a minimum.

To limit unauthorised access, a communal entrance door fitted with an access control system (see clause 4.63) should be self-closing and self-locking, with keyless operation of any lock from within the common area. To accommodate access control systems, a doorset may incorporate electronic or magnetic remote release and a means of access which includes keyless electronic solutions (keypad, proximity swipe, etc).

Glazing

Access to door locks from outside by breaking of glazing, in or adjacent to a door leaf should be prevented by use of laminated glass or a similarly robust glazing material.

Sliding doors

A sliding door should have a multi-point deadlocking system with 3 or more hook or similar bolts. To prevent removal of the door, an anti-lift device should be fitted. Shoot bolts, if used, should locate into the head of the frame.

Double doors

A doorset with more than one door leaf should include a means of securing

any secondary leaf at head and foot to allow the primary leaf to be securely locked.

4.13.5 Installation and fixing of doors and windows

Inadequate fixing into the surrounding structure will significantly affect the security performance of a doorset or window. In most cases, fixings designed to resist normal anticipated loads, such as from wind and accidental impact, will also ensure that a doorset or window is secure against the more common basic methods of forced entry.

To ensure a robust installation, fixing of a doorset or window should be in accordance with:

- the recommendations given in section 8 of BS 8213-4: 2007; or
- manufacturer's written instructions where these meet or exceed the recommendation within this British Standard.

Contents

- 5.0 Introduction**
- 5.1 Noise separation**
- 5.2 Noise reduction between rooms**

5.0 Introduction

- 5.0.1 Background
- 5.0.2 Aims
- 5.0.3 Latest changes
- 5.0.4 Explanation of terms
- 5.0.5 Reduction of sound transmission
- 5.0.6 Principles of airborne sound transmission
- 5.0.7 Principles of impact sound transmission
- 5.0.8 Principles of flanking transmission
- 5.0.9 Relevant legislation
- 5.0.10 Certification

Introduction

5.0

5.0.1 Background

Noise is unwanted sound. In order to limit the effects of unwanted sound the standards intend to improve the resistance of *building* elements to sound transmission. Research has presented clear evidence that noise can indirectly contribute to a range of health issues such as stress and anxiety.

Inadequate sound insulation can impair health by allowing noise from neighbours to disrupt normal life. A number of people in attached homes complain of neighbour noise. The World Health Organisation has established a relationship between noise exposure and sleep disturbance. However the short or long-term effects are still not clear. Over the years, several pieces of legislation relating to noise (see clause 5.0.9) have been introduced which provide some degree of control of 'noisy neighbours'.

Noise generated within a *dwelling*, to some extent, is under the control of the occupants but can still create tension within a family. The provision of sound absorption between *rooms* should allow people a degree of privacy as they go about their everyday activities.

5.0.2 Aims

The purpose of the standards in section 5 is to limit the transmission of sound to a level that will not threaten the health of occupants from sound transmission emanating from attached *buildings* and a differently occupied part of the same *building*. They also cover sound from within the same *dwelling* if occupants are in *rooms* where they would expect to have some degree of peace and quiet.

It is important to recognise that the standards will not guarantee freedom from unwanted sound transmission. The standards aim to limit the effects from sound levels created from normal domestic activities, but not from excessive noise from other sources such as power tools, audio systems inconsiderately played at high volume or even raised voices. The standards do not address environmental noise through the *building* facade from sources such as aircraft, trains, road traffic or industry. Other legislation covers these areas and further information may be obtained from Planning Advice Note (PAN) 56 'Planning and Noise, 1999'.

PAN 56

Home improvement
leaflet

Home improvements were previously not considered an issue, whereas some can now create a noise nuisance. For example, lifting carpets and replacing them with laminate flooring can have an adverse affect on sound transference in *buildings*, and particularly on occupants of *flats*. A leaflet giving further information on home improvements is available at www.scotland.gov.uk/topics/built-environment/building/building-standards

5.0.3 Latest changes

The 2010 edition of section 5 has been completely rewritten to include:

- an increase in the sound insulation performance of *separating walls* and *separating floors*;
- a robust post-completion testing regime;
- guidance for carrying out *work* to existing *buildings*; and
- guidance to reduce sound passing between *rooms* in *dwellings*.

5.0.4 Explanation of terms

There are a number of terms used in this section some are included below, these and other useful terms are included in annex A of the Example Constructions.

Airborne sound is sound which is propagated from a noise source through the medium of air. Examples of these are speech and sound from a television.

Airborne sound transmission is direct transmission of airborne sound through walls or floors. When sound energy is created in a *room*, for instance by conversation, some of the energy is reflected or absorbed by *room* surfaces but some may set up vibrations in the walls and floor. Depending on both the amount of energy and the type of *construction*, this can result in sound being transmitted to adjacent parts of the *building*.

Direct transmission refers to the path of either airborne or impact sound through elements of *construction*.

$D_{nT,w}$ is the weighted standardized level difference. A single-number quantity (weighted) which characterises the airborne sound insulation between two *rooms*, in accordance with BS EN ISO 717-1: 1997.

Flanking transmission is airborne or impact transmission between *rooms* that is transmitted via flanking elements and/or in flanking elements in conjunction with the main separating elements. An example of a flanking element is the inner leaf of an *external wall* that connects to the separating 'core' of a wall or floor.

Impact sound is sound which is propagated from a noise source through a direct medium. An example of this is footfall on a floor.

Impact sound transmission is sound which is spread from an impact noise source in direct contact with a *building* element.

$L'_{nT,w}$ is the weighted standardized impact sound pressure level. A single-number quantity (weighted) to characterise the impact sound insulation of floors, in accordance with BS EN ISO 717-2: 1997.

R_w is a single number quantity (weighted) which characterises the airborne sound insulation of a *building* element from measurements undertaken in a laboratory, in accordance with BS EN ISO 717-1: 1997.

5.0.5 Reduction of sound transmission

The reduction of sound transmission from attached *buildings*, or part of the same *building*, and sound from within the same *dwelling* can be provided through different mechanisms which involve; mass, isolation, absorption, resilience and stiffness (see annex A of the Example Constructions). Wall and floor *constructions* that provide a combination of such mechanisms generally provide better sound insulation.

Good design incorporates at least 2 or more of the above mechanisms and can reduce a range of sound frequencies typically found in attached *dwellings*.

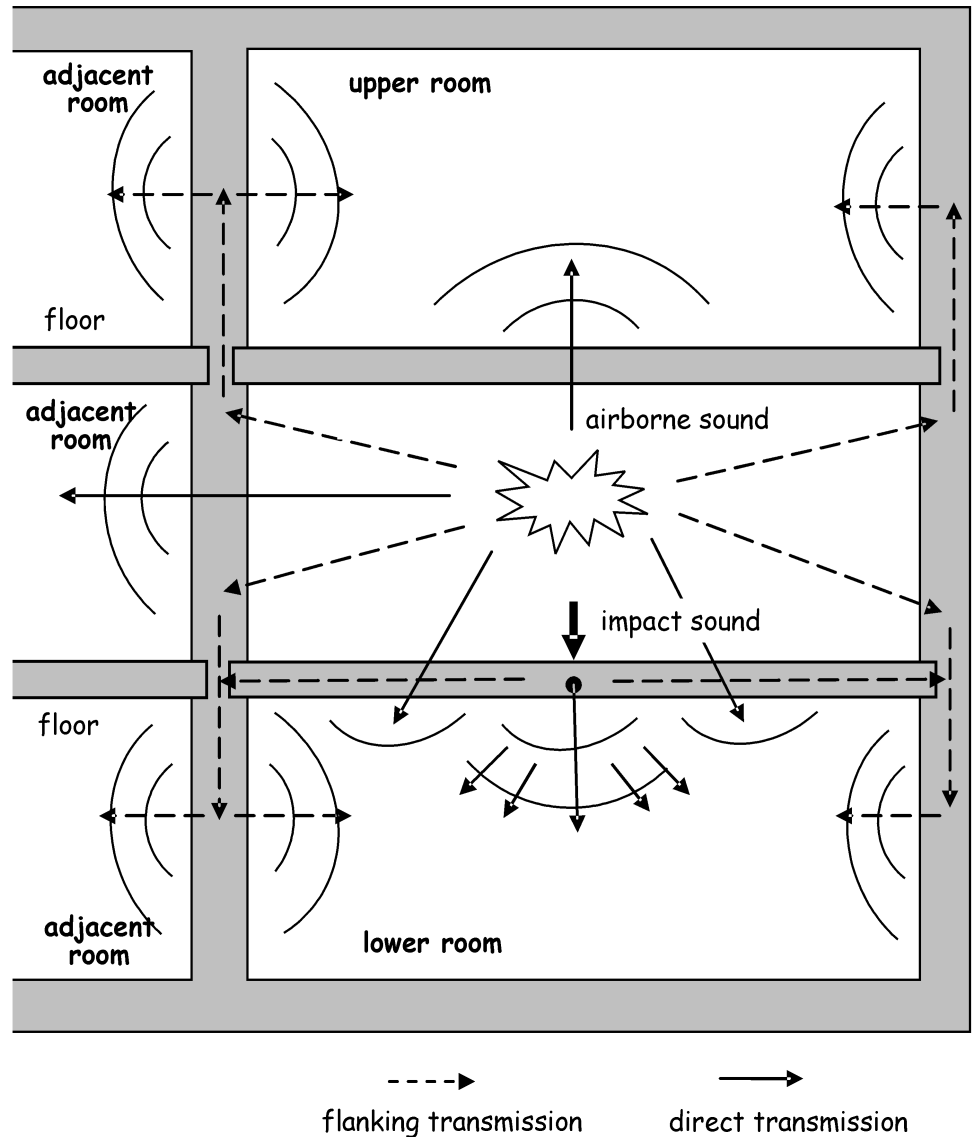
The effects these variables can have in predicting both sound transmission and insulation are as follows:

- through a heavyweight wall or floor it is its mass per unit area. A reduction in sound transmission and increase in sound insulation are expected with increasing mass, as the heavier the wall or floor, the less it vibrates in response to sound waves and hence the less sound energy is radiated. For example, heavyweight *constructions* such as masonry cavity walls provide mass and isolation;
- through a lightweight wall or floor it is the use of cavities, isolation and absorption. A reduction in sound transmission and an increase in sound insulation are expected by the use of cavities with fewer and less stiff connections, while absorptive material hung in the wall cavity will absorb mid to high frequency sound energy. The formation of narrow cavities, such as dry linings on dabs, can also create an unwelcome 'drum' effect at low frequencies and filling or lining them with absorbing material can help to reduce this. For example, in lightweight *constructions* such as timber frame walls, the twin stud of the timber frame provides isolation, stiffness and absorption;
- resilience is needed for *separating floors* in *flats* where there is direct vibration impact such as footfall noise. Resilience reduces the impact vibration by dynamic movement and also converts the energy into heat. Examples of resilient elements for floors include floating floor treatments such as battens and cradles, resilient bars and resilient floor coverings, other than carpet;
- mass and stiffness help to reduce significantly low frequency sound transmission whereas absorption and resilience predominantly reduce mid and high frequency sound transmission;
- isolation has the most influence over all frequencies of sound but can be limited by structural connections such as wall ties, straps and fixings that may bridge isolated leafs or elements.

Heavyweight
construction

Lightweight
construction

Principle of sound transmission paths, refer to clause 5.0.6 - 5.0.8



5.0.6 Principles of airborne sound transmission

When sound waves strike a wall or floor, the pressure variations cause the *construction* to vibrate. A portion of the vibrational energy on the sound source side will be transferred through the wall or floor where it is radiated as airborne sound on the other side. There is a loss in sound transmission as the frequency of the incident sound (sound waves produced from striking against a wall or floor for example) increases. This also varies with the direction of the sound waves, and is usually assumed to be the average for all possible angles of incidence.

5.0.7 Principles of impact sound transmission

Impact sound is sound that is spread from an impact or vibrational source in direct contact with a *building* element such as a floor. A structural vibration is transmitted from the point of impact through the structure causing vibration leading to the radiation of the sound into an adjacent *room* below. In a *building* this is commonly caused by an object hitting the floor from where the vibration is transferred into the structure. Usually the vibration path will lead to the ceiling and perimeter walls below. The amount of impact sound heard below will depend upon many factors including the force of the impact, the

vibration transmission characteristics of the floor *construction* and the floor covering.

5.0.8 Principles of flanking transmission

Flanking transmission occurs when there is an indirect path for sound to travel along elements adjacent to walls and floors. If the flanking *construction* and its connections with the separating structure are not correctly detailed, flanking transmission can equal, or even exceed, sound levels perceived as a result of direct transmission. Flanking transmission can occur, for instance, when a wall abuts the face of the inner leaf of an external cavity wall, and the walls are insufficiently tied or bonded together, thus allowing the noise to travel along the inner leaf.

5.0.9 Relevant legislation

Listed below are some pieces of legislation and guidance that may be relevant and/or helpful to those using the guidance in this particular section.

Common Law of Nuisance	The Common Law of Nuisance recognises that an occupant has the right to the free and absolute use of the property, but only to the extent that such use does not discomfort or annoy a neighbour.
Civic Government (Scotland) Act 1982	Part IV of the Civic Government (Scotland) Act 1982 sets out a range of public nuisance offences.
Environmental Protection Act 1990	The Environmental Protection Act 1990 as it relates to noise, states that 'any premises in such a state as to be prejudicial to health or a nuisance ranks as a statutory nuisance'.
Human Rights Act 1998	The Human Rights Act 1998 (as it relates to noise) Article 8 guarantees the right to respect for private and family life.
Antisocial Behaviour etc. (Scotland) Act 2004	The Antisocial Behaviour etc. (Scotland) Act 2004 empowers the local authority to serve a warning notice in relation to noise which exceeds the permitted level.
PAN 56	The Planning Advice Note PAN 56 'Planning and Noise', 1999 demonstrates the role of the planning system in preventing and limiting the adverse effects of noise.

5.0.10 Certification

Scottish Ministers can, under Section 7 of the Building (Scotland) Act 2003, approve schemes for the certification of design or *construction* for compliance with the mandatory functional standards. Such schemes are approved on the basis that the procedures adopted by the scheme will take account of the need to co-ordinate the *work* of various designers and specialist contractors. Individuals approved to provide certification services under the scheme are assessed to ensure that they have the qualifications, skills and experience required to certify compliance for the *work* covered by the scope of the scheme. Checking procedures adopted by Approved Certifiers will deliver design or installation reliability in accordance with legislation.

5.1 Noise separation

- 5.1 Functional standard
- 5.1.0 Introduction
- 5.1.1 Scope of standard
- 5.1.2 Design performance levels
- 5.1.3 Example Constructions
- 5.1.4 Other constructions
- 5.1.5 Conversions
- 5.1.6 Doors in a separating wall
- 5.1.7 Noise from services
- 5.1.8 Post-completion performance test levels
- 5.1.9 Post-completion testing
- 5.1.10 Remedial action following a test failure

standard
5.1
mandatory

Every *building*, which is divided into more than one area of *different occupation*, must be designed and *constructed* in such a way to limit the transmission of source noise from normal domestic type activities, between such areas, to a level that will not threaten the health of, or cause inconvenience to the *building* occupants.

Limitation:

This standard only applies to a *building* in *different occupation* incorporating:

- (a) attached *dwellings*;
- (b) attached *residential buildings*; or
- (c) a roof, walkway or *access deck* located directly above an area that is either a *dwelling* or a *residential building*.

5.1.0 Introduction

Noise nuisance outwith the control of *dwelling* occupants has increased substantially over the last decade. This is mainly as a result of people's changing lifestyles, greater numbers and use of sound-producing equipment and household appliances.

There has been a dramatic increase in the use of electrical goods, particularly sound producing equipment such as audio and TV. Music can be more bass orientated and played at higher volumes, whilst speakers mounted on walls may improve the quality to the listener, they can create a disturbance to others. The intention is not to prevent all sound from being heard, but to limit noise nuisance by achieving levels of sound insulation that will help to reduce the effects of sound on people in their home.

Complaints regarding noisy services do occur. Dealing with the varying levels of sound produced by service equipment, such as lifts, heat pumps or air conditioning units in *buildings* is a complex task. Guidance is given on the care that should be taken at the design stage in the choice of service equipment, installation and location within the *building*.

Designers should be aware that some Local Authorities may also set noise reduction targets. This is usually enforced through environmental health and planning legislation for noise emanating from commercial premises to *dwellings*, and more information on this is contained in PAN 56.

PAN 56

Conversions

In the case of *conversions* as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

5.1.1 Scope of standard

Airborne sound insulation should be provided where any *separating wall* or *separating floor* is formed between areas in *different occupation*. For example:

- between *dwellings*;
- between a *dwelling* and a *non-domestic building*;
- between a *dwelling* and other parts of the same *building*, e.g. common stair or corridor, communal lounge, or car parking garage.

Airborne sound insulation need not be provided for:

- a. a *separating wall* dividing any 2 *buildings*, such as garages, *conservatories* or porches, or a combination of these, where each *building* is attached and ancillary to a *dwelling*;
- b. an *external wall* such as a *wall* dividing a *dwelling* from an *access deck*, since it is not a *separating wall*;
- c. a wall or floor between a *dwelling* and any accommodation that is ancillary to the same *dwelling*, such as a garage.

Impact sound insulation should be provided where any *separating floor* is formed between areas in *different occupation*. For example:

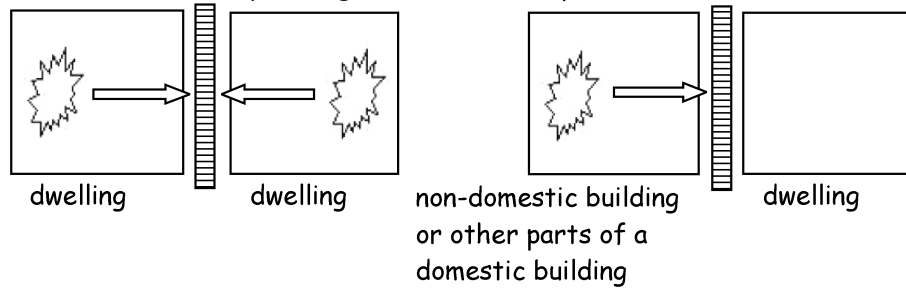
- between *dwellings*;
- between a *dwelling* and a *non-domestic building* with *rooms* intended to be used for sleeping;
- between a *dwelling*, and other parts of the same *building* directly above e.g. common stair or corridor, communal lounge, or car parking garage;
- between a *dwelling* and a *non-domestic building* other than where it meets the conditions of c below;
- a roof, walkway or *access deck* located directly above a *dwelling* and to which there is access, other than where it meets the conditions of d and e below.

Impact sound insulation need not be provided for:

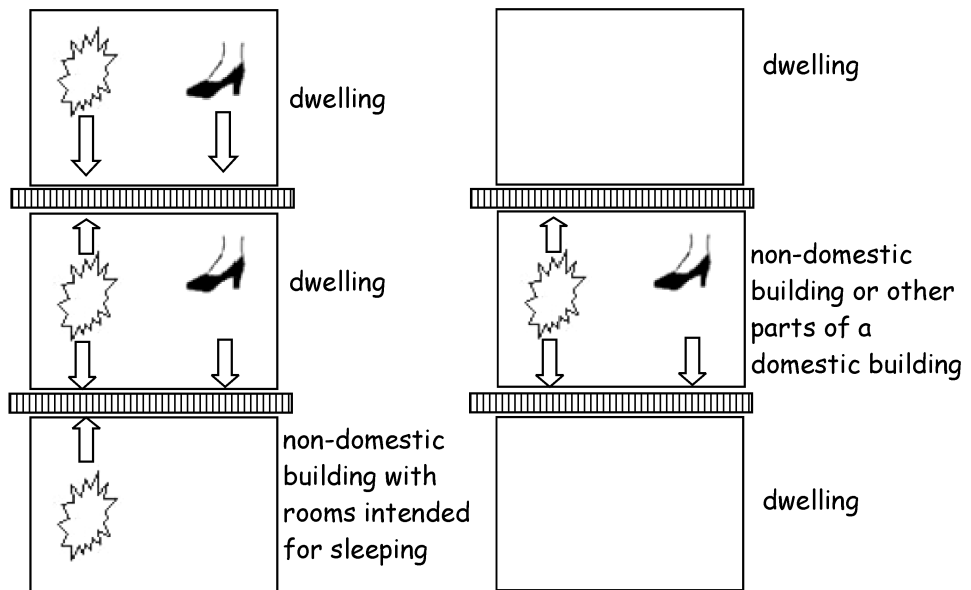
- a. a roof above a non-habitable space, such as a *roof space*;
- b. a floor between a *dwelling* and any accommodation that is ancillary to the *dwellings* such as a garage;
- c. a *separating floor* between a *dwelling* and a non-residential *non-domestic building* directly below;
- d. a roof, walkway or *access deck* located directly above a *dwelling* and to which there is access for maintenance purposes only;
- e. a roof, walkway or *access deck* located directly above a *dwelling* and to which there is access, where it is for the sole use of the residents of the *dwelling*.

The following diagrams show only direct transmission paths. Flanking transmission is also an important consideration. (see clause 5.0.8)

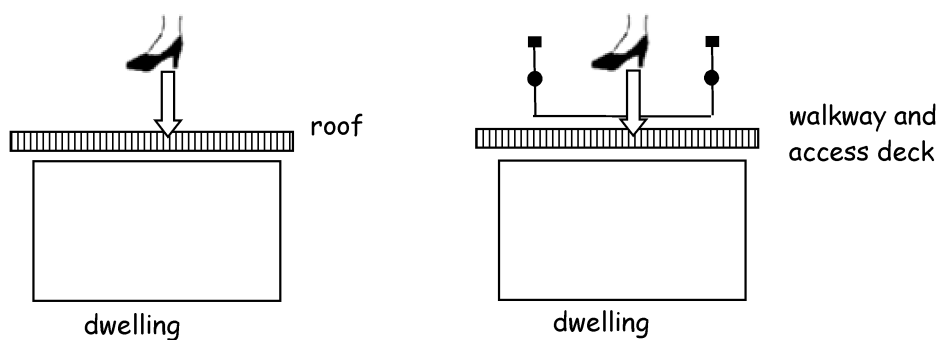
Airborne sound: separating walls (viewed in plan or section)






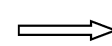
Airborne and impact sound: separating floors (viewed in section)



Impact sound: roofs, walkways and access decks (viewed in section)



Legend

-  noise source: airborne sound
-  noise source: airborne sound
-  separating wall or separating floor
-  noise source: airborne sound

5.1.2 Design performance levels

The following design performance levels are given for the control of sound through *separating walls* and *separating floors*. The levels have been developed from research covering sound and perceived sound in *dwellings*. They have been identified as levels, based on normal domestic activities that have been shown to produce few noise complaints.

However experience shows that the performance of a *construction* is dependent upon:

- achieving a high quality of workmanship on *site*;
- supervision throughout the *construction* process;
- the relationship between separating and adjoining elements (e.g. *external walls*, roofs and windows) to combat flanking transmission

and these factors should be carefully considered at the design stage.

All *work* should be designed to the levels in the following table:

Design performance levels in dB [1]

	New build and conversions not including traditional buildings	Conversions of traditional buildings [2]
Minimum airborne sound insulation [3]	56 $D_{nT,w}$	53 $D_{nT,w}$
Maximum impact sound transmission [3]	56 $L'_{nT,w}$	58 $L'_{nT,w}$

Notes:

1. For the definition of $D_{nT,w}$ and $L'_{nT,w}$ see 5.0.4.
2. Notice should be taken of the guidance on *conversions* in clause 5.1.5.
3. See clause 5.1.1 for application of these performance levels to *separating walls* and *separating floors*.

Two methods are provided on ways to achieve these levels which can lead to meeting the standard. They are by the use of:

- a. Example Constructions (see clause 5.1.3); or
- b. other *constructions* (see clause 5.1.4).

These methods are to be used in conjunction with the testing arrangements (see clause 5.1.8 to 5.1.10).

5.1.3 Example Constructions

Example Constructions have been developed that will repeatedly achieve the design performance levels in the table to clause 5.1.2. They have also been developed from *constructions* that are in general use in the UK, and that are known to reduce the range of sound frequencies that can generate complaints.

Example Constructions

The Example Constructions are available on the BSD website www.scotland.gov.uk/topics/built-environment/building/building-standards

5.1.4 Other constructions

Clause 5.1.3 provides guidance on *constructions* that have been designed and tested to repeatedly achieve the performance levels in the table to clause 5.1.2. However it may be necessary, preferable or desirable, to include new or innovative *constructions* into a proposed design.

Where *constructions* that have not been tested previously are used, the services of an acoustic specialist may be obtained, who should be able to offer design guidance on *constructions* that are capable of achieving the performance levels in the table to clause 5.1.2.

5.1.5 Conversions

Achieving the design performance levels for *conversions* can present challenges to a designer. The presence of hidden voids within *constructions*, back to back fireplaces, cupboards and gaps between *construction* elements in walls and floors, mean that it may not be possible to use 'pattern book' type *constructions* to achieve the design performance levels. When *conversions* are undertaken, the adaption of the existing *building* should be considered at the design stage. Conversions and conversions of traditional *buildings* should achieve the performance levels in the table to clause 5.1.2.

Traditional buildings

With older *buildings* achieving the performance levels in clause 5.1.2 becomes more difficult, therefore the levels for *traditional buildings* are less demanding than for new build and conversions.

The design proposals for the *conversion* of a *traditional building* should be considered carefully so that any measures taken will improve the sound insulation. The performance levels in the table to clause 5.1.2 should be considered as a benchmark, but it may not be possible to achieve these levels in all circumstances. Consultation on such matters at an early stage with both the verifier and the planning officer of the relevant authority is advisable.

Historic and Listed *buildings*

Historic and Listed *buildings* will prior to *conversion* display unique characteristics as far as sound insulation is concerned. The original *building* design and *construction* will influence the level of sound insulation achievable for the *separating walls* and *separating floors*. For this reason, specific prescriptive guidance on such *buildings* is not appropriate. The relevant authority may, at their discretion, agree measures that respect the character of the *building*.

www.napier.ac.uk

Advice on the general principles of sound insulation in Historic and Listed *buildings* can be obtained from the Building Performance Centre, Napier University booklet 'Housing and Sound Insulation – Improving existing attached *dwelling*s and designing for conversions'.

Work in a roof space

The *conversion* of a *roof space* into habitable area, although very common, can present problems as it is unlikely that access to the *roof space* in the adjoining *dwelling* can be assured. Where an existing *separating wall* in a *roof space* is *constructed* of a single leaf of masonry only, it would be appropriate to provide one leaf of a free-standing framed *construction* next to the existing wall as each attic is developed. Example Constructions - detail 3: timber frame twin stud wall; gives a typical arrangement.

Pre-conversion sound test

The *building* owner may wish to carry out a pre-conversion sound test prior to the start of any conversion, ideally during the *building* survey process. The acoustic performance of the existing *construction* can then be established

and problems identified that will allow the design of a tailored acoustic solution to be determined at an early stage.

For larger or more complex *work*, advice on *conversions* may be sought from an acoustic specialist who should be able to offer appropriate design guidance.

5.1.6 Doors in a separating wall

A door in a *separating wall* dividing a *dwelling* from a common area of a *building* can create an acoustic weak point in the wall allowing unwelcome noise into the *dwelling*. As entrance doors to *dwellings* from common areas must comply with the relevant standards in section 2: Fire, section 4: Safety and section 6: Energy the doorset will be relatively robust, and the weakest point for noise to enter the *dwelling* will be through the gap between the door frame and the door.

Entrance doors to *flats* and *maisonettes* located in a *separating wall* should be fitted with a perimeter seal, including the threshold, to minimise noise transmittance through the doorset.

A compressible type of seal may be used such as a rubber strip. Where the seal is of a type that combines a smoke and noise seal, the product literature should be consulted to confirm the seal will achieve the desired effect. The seal should not interfere with the closing mechanisms of a *fire door* and provide a positive seal between the door frame and the door.

5.1.7 Noise from services

Building service installations serving common areas in *domestic buildings* have the potential to cause noise nuisance. For example, common plant such as lifts, air conditioning units, ventilation systems, and drainage pipes running the height of a block of *flats* have all been known to be a source of complaint.

Therefore, it is important that the design of *building* services, their position in the *building* and the *building* structure should be considered at an early stage in the design process.

Service pipes

Services passing through *separating walls* or *separating floors* must comply with the relevant standards in section 2: Fire.

Service pipes or *ducts* should not pass through a *separating wall*, unless they are of small diameter, such as lateral pipework from network risers such as gas, electricity, water and telecom. These pipes or *ducts* may pass through a *separating wall* from a common area into a single *dwelling* only.

Custom-built or *system chimneys* should not be *built* into timber-framed *separating walls*. Only masonry *chimneys* (including precast concrete *flue-blocks*) may be included as an integral part of a *separating wall*. However some thickening of the *construction* may be necessary to achieve the performance levels in clause 5.1.2.

Only *service openings* for *ducts*, service pipework or *chimneys* may be formed in *separating* floors. These services should be enclosed above and below the floor with a *construction* that will maintain the levels of sound performance recommended for a *separating floor* in the table to clause 5.1.2.

Mechanical services Service equipment *rooms* should not be located next to quiet areas such as *rooms* intended for sleeping. Locating plant in a larger space can help dissipate sound. Also, plant machinery and equipment such as lift rails should be isolated from the walls and floor to reduce vibrations and the resulting sound transmission to *rooms* intended for sleeping. Vibration from mechanical equipment can be reduced with the use of inertia blocks and resilient mounts.

Structure borne noise Structure borne noise is the most common cause of complaints and the most effective approach is to structurally de-couple service installations and mechanical equipment from *separating walls and separating floors*. Lightweight structures need special consideration and it may be necessary to support noisy plant on a separate, rigid structure. The installation of an independent wall or ceiling lining may help achieve the performance levels in clause 5.1.2.

Further guidance A report '[Service noise affecting dwellings](#)' includes several useful design guide annexes. Annex H of BS EN 12354-5: 2009 provides more detailed guidance on the reduction of service sound transmittance through *separating walls* and *separating floors*.

Low carbon equipment Design guides covering low carbon equipment, such as air source heat pumps, contain advice on sound reduction measures and are available at www.scotland.gov.uk/topics/built-environment/building/building-standards

5.1.8 Post-completion performance test levels

The effectiveness of a *construction* to reduce sound transmission depends on several factors; the design, the *buildings* within which it is formed and the quality of the workmanship.

The use of either of the methods listed in clause 5.1.2 alone will not guarantee the performance levels will be achieved. Good workmanship is essential to their performance, and post-completion testing will confirm these levels have been achieved.

Tests levels for Example and other constructions in dB [1]

	New build and conversions not including traditional buildings	Conversions of traditional buildings [2]
Minimum airborne sound insulation [3]	56 $D_{nT,w}$	53 $D_{nT,w}$
Maximum impact sound transmission [3]	56 $L'_{nT,w}$	58 $L'_{nT,w}$

Notes:

1. For the definition of $D_{nT,w}$ and $L'_{nT,w}$ see 5.0.4.
2. Notice should be taken of the guidance on *conversions* in clause 5.1.5.
3. See clause 5.1.1 for application of these performance levels to *separating walls* and *separating floors*.

5.1.9 Post-completion testing

On completion, new *buildings* and *conversions* should be tested in accordance with the table in this clause. In order to allow the capacity of the testing industry to grow in Scotland the guidance in the tables is being phased in on the following dates. For building warrant applications made on or after:

- 1 May 2011 - *flats* and *maisonettes*; and
- 1 October 2011 - *houses* and *conversions*;

in accordance with the table below:

Recommended minimum number of tests for new build [1, 2]

	No. of attached dwellings	No. of tests for separating walls [houses]	No. of tests for separating walls [flats or maisonettes]	No. of tests for separating floors [flats or maisonettes]
New build using Example Constructions	2 - 20	2	2	2
	21 - 40	3	3	3
	Over 40	1 extra for every 20 <i>houses</i> , or part thereof	1 extra for every 20 <i>flats</i> or <i>maisonettes</i> , or part thereof	1 extra for every 20 <i>flats</i> or <i>maisonettes</i> , or part thereof
New build using other constructions	2 - 10	2	2	2
	11 - 20	3	3	3
	21 - 30	4	4	4
	Over 30	1 extra for every 10 <i>houses</i> , or part thereof	1 extra for every 10 <i>flats</i> or <i>maisonettes</i> , or part thereof	1 extra for every 10 <i>flats</i> or <i>maisonettes</i> , or part thereof

Recommended minimum number of tests for conversions [1,2]				
	No. of attached dwellings formed by conversion	No. of tests for separating walls [houses]	No. of tests for separating walls [flats or maisonettes]	No. of tests for separating floors [flats or maisonettes]
Conversions	1 - 5	2	2	2
	6 - 10	3	3	3
	Over 10	1 extra for every 5 dwellings, or part thereof	1 extra for every 5 dwellings, or part thereof	1 extra for every 5 dwellings, or part thereof

Notes:

1. Where a *separating wall* forms a junction with a ground floor or roof a weak point in the *construction* is created affecting the sound performance. For this reason 1 test should be carried out on a *separating wall* at ground and first floor level for attached *houses*.
2. Each different *construction* in a development should be tested.

Conversions

When a *conversion* of an attached *building* occurs, for example to a mid terrace *dwelling*, it may not be possible to gain access to the adjacent *dwelling* or part of the same *building*, to carry out tests to the *separating wall*. In this case, it may not be appropriate to request testing to be carried out.

Work in a roof space

The *conversion* of a *roof space* into habitable space, although very common, can also present problems. Since it is unlikely that access to the *roof space* in the adjoining *dwelling* can be assured, it may not be appropriate to test.

Method of testing

Sound tests should only be carried out on a *building* that is complete and when doors, access hatches and windows are fitted. Carpet, should not be used as bonded resilient floor covering or laid before an impact test for separating floors. Sound testing should be carried out in accordance with:

- a. BS EN ISO 140-4: 1998 and BS EN ISO 717-1: 1997, for airborne sound transmission; and
- b. BS EN ISO 140-7: 1998 and BS EN ISO 717-2: 1997, for impact sound transmission.

Airborne sound insulation testing

At least two different loudspeaker positions should be used for the source noise, in accordance with BS EN ISO 140-4: 1998.

Methods using a single source

For each source position, the average sound pressure level in the source and receiving *rooms* is measured in one-third-octave bands using either fixed microphone positions (and averaging these values on an energy basis), or using a moving microphone.

For the source *room* measurements, the difference between the average sound pressure levels in adjacent one-third-octave bands should be not more than 6dB. If this condition is not met, the source spectrum should be adjusted and the source *room* measurement repeated. If the condition is met, the average sound pressure level in the receiving *room*, and hence a level difference, should be determined.

It is essential that all measurements made in the source and receiving *rooms* to determine a level difference should be made without moving the sound source or changing the output level of the sound source, once its spectrum has been correctly adjusted (where necessary).

The sound source should now be moved to the next position in the source *room* and the above procedure repeated to determine another level difference. At least two positions should be used for the source. The level differences obtained from each source position should be arithmetically averaged, D as defined in BS EN ISO 140-4: 1998.

Airborne and
sound impact
insulation testing

For both types of testing it is possible to use fixed microphone positions, rotating booms or manual moving microphones (mmm), in accordance with BS EN ISO 140-4: 1998 and BS EN ISO 140-7: 1998.

Doors

It is not normal practise to undertake sound insulation tests where there is a door in a *separating wall*, such as an entrance door to a *flat* from a common stair. Allowance should be made if a test is needed for such a *separating wall* as the door will not achieve the same 'design performance level' as a *separating wall*, as the door will allow sound transmission through the gaps and affect the sound test results.

Professional expertise

Testing should be carried out by persons who can demonstrate relevant, recognised expertise in acoustics for sound insulation testing. This should include membership of a professional organisation which accredits its members as competent to both test and confirm the results.

5.1.10 Remedial action following a test failure

Noise transmission in *buildings* is a complex subject and it is difficult to provide definitive guidance on resolving specific problems that have occurred in individual *buildings*. It may be prudent to seek advice from a specialist who, through experience of sound testing, may be able to identify and resolve any problems.

If the failure is attributed to the *construction* of the separating and/or associated flanking elements, other *rooms* that have not been tested may also fail to meet the test performance levels. Additional tests may be needed, over and above the number recommended in clause 5.1.9 to check that the *work* achieves the test performance levels.

5.2 Noise reduction between rooms

- 5.2 Functional standard
- 5.2.0 Introduction
- 5.2.1 Design performance levels
- 5.2.2 Internal walls
- 5.2.3 Intermediate floors
- 5.2.4 Conversions

standard
5.2
mandatory

Every *building*, must be designed and *constructed* in such a way to limit the transmission of source noise from normal domestic type activities, through a wall or floor, between a *room* and internal space where noise is likely to occur, to a level that will not cause inconvenience to the *building* occupants.

Limitation:

This standard only applies to a wall or floor forming an *apartment* in a *dwelling* and a *room* in a *residential building* which is capable of being used for sleeping; other than:

- (a) a wall between an en-suite bathroom and the *apartment* or *room* it serves;
- (b) a *hospital*; or
- (c) a place of lawful detention.

5.2.0 Introduction

Changing lifestyles has altered the way *rooms* are used in *dwellings*. Bedrooms are more often used as areas where people spend time watching television, playing computer games and listening to music. Shouting from *room* to *room*, running up and down stairs, using noisy appliances and banging doors, can all be heard throughout a *dwelling* and can create unwanted noise. At night, any noise made when generally there is little background noise, is often perceived as excessive.

Although noise within a *dwelling*, can be more easily controlled than noise from outwith the *dwelling* itself, this can still be a nuisance. The increase in noise level from speech and music within *dwellings* may indirectly lead to anxiety and stress.

Conversions

In the case of *conversions* as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard (regulation 12, schedule 6).

5.2.1 Design performance levels

Internal walls are often *built* off the structural floor. A door located in such a wall provides a path for sound to bypass a wall under test. On-site sound testing of internal walls and intermediate floors cannot be relied upon due to excessive flanking sound transmission through doors. For this reason it is appropriate to use a laboratory test. A laboratory test result is termed R_w (see 5.0.4).

As disturbance to occupants can occur from other areas within the *dwelling*, the level of sound heard should be reduced in the *rooms* in which people may sleep. Therefore, it is the internal walls between *apartments*, an *apartment* and an internal space where noise is likely to occur, that should achieve the sound performance level below. An internal wall between an en-suite bathroom and the *apartment* it serves need not have sound insulation.

Design performance level

The design performance level for internal walls and intermediate floors covered by this standard should achieve a minimum airborne sound insulation level of 43 R_w .

5.2.2 Internal walls

Generic Internal Constructions

The design performance levels in clause 5.2.1 can be achieved by using the Generic Internal Constructions available on the BSD website www.scotland.gov.uk/topics/built-environment/building/building-standards. Alternatively, product manufacturers may have solutions that will achieve the design performance level.

5.2.3 Intermediate floors

Improving the sound insulation over parts of an intermediate floor only above or below *apartments* is not *reasonably practicable* and could lead to expensive remedial measures if an area is missed or if future alteration *work* is carried out. It is therefore recommended that sound insulation should be provided across the entire area of each intermediate floor in a *dwelling* if there is an *apartment* located directly or below the floor.

Generic Internal Constructions

The design performance levels in clause 5.2.1 can be achieved by using the Generic Internal Constructions available on the BSD website www.scotland.gov.uk/topics/built-environment/building/building-standards. Alternatively, product manufacturers may have solutions that will achieve the design performance level.

Although setting impact sound insulation design levels for intermediate floors is not *reasonably practicable*, insulation against impact noise can be improved by adding a soft covering such as a carpet or foam-backed vinyl. However a carpet or foam-backed vinyl is a floor covering and should not be included as part of the *construction* used to achieve the design levels in clause 5.2.1.

5.2.4 Conversions

Traditional building

Many of the existing wall and floor *constructions* within a *traditional building*, will be *constructed* from materials generally not still in use, for example lathe and plaster. In such cases the sound insulation level will not be known, therefore it is *reasonably practicable* for the existing walls or floors to meet the performance levels in clause 5.2.1.

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6.0 Introduction

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Introduction

6.0

The Sullivan Report

6.0.1 Background

Within Scottish building regulations, improvements in energy standards have been made over many years, culminating in 2007 with the move to a carbon dioxide emissions based methodology for assessing carbon and energy performance in new *buildings*.

In 2007, Scottish Ministers convened an expert panel to advise on the development of a low carbon building standards strategy to increase energy efficiency and reduce carbon emissions. This resulted in [The Sullivan Report](#) – ‘A Low Carbon Building Standards Strategy for Scotland’. A key recommendation of this Report is staged improvements in energy standards in 2010 and 2013, with the aim of net zero carbon *buildings* (emissions for space heating, hot water, lighting and ventilation) in 2016/17, if practical.

Climate Change (Scotland) Act 2009

The [Climate Change \(Scotland\) Act 2009](#) creates a statutory framework for delivery of greenhouse gas emissions reductions in Scotland. The Act sets an interim target of a 42% reduction in emissions (compared to 1990) by 2020, and an 80% reduction target for 2050. Annual targets for each year from 2010 to 2022 will be set in secondary legislation by 1 June 2010. The high level measures required in each sector to meet Scotland’s statutory climate change targets, for 2022 and in the long term, are set out in the Scottish Government’s [Climate Change Delivery Plan](#). This includes recommendations for the delivery of low carbon new *buildings*.

The *construction* sector has a major role to play in this respect. Emissions from the burning of fossil fuels are contributing to climate change, with energy use in *buildings* a significant source of emissions. Increased energy efficiency and promotion of renewable energy are therefore an important element of Scotland’s strategy to tackle climate change.

To deliver *buildings* that are more energy efficient and have fewer carbon dioxide emissions, a greater emphasis is needed on the overall effect that design and specification choices, *construction* and commissioning of new *work* can have on *building* performance.

6.0.2 Aims

The intention of section 6 is to ensure that effective measures for the conservation of fuel and power are incorporated in *dwellings* and *buildings* consisting of *dwellings*. In addition to limiting energy demand, by addressing the performance of the *building* fabric and fixed *building* services, a carbon dioxide emissions standard obliges a designer of new *dwellings* to consider *building* design in a holistic way.

Improvements set out within this section will result in a greater need to consider the benefits which localised or *building*-integrated low carbon equipment (LCE) (e.g. photovoltaics, solar water heating, combined heat and power and heat pumps) can make towards meeting standards. Although the focus is primarily on lowering carbon dioxide emissions from *dwellings* in use, the measures within this section also reduce energy demand and continue to ensure that, for new homes and new *building work*, use of energy and fuel costs arising from this are both minimised.

Guidance also recognises issues relevant to requirements within Article 5 of the EU Directive [2002/91/EC](#) on the Energy Performance of Buildings (EPBD) and Article 13 of the EU Directive [2009/28/EC](#) on the promotion of the use of energy from renewable sources.

The standards and guidance given in this section are intended to achieve an improvement, reducing emissions by approximately 30% compared to the 2007 standards. However nothing here prevents a *domestic building* from being designed and *constructed* to be even more energy efficient and make greater use of low carbon equipment (LCE).

6.0.3 General guidance

This section addresses the carbon dioxide emissions and energy performance of all *domestic buildings* (*houses, flats and maisonettes*) and ancillary *buildings*. In respect of *dwellings*, all parts of a *building* intended to form part of the *dwelling* should be within an *insulation envelope*.

This section should be read in conjunction with all the guidance to the Building (Scotland) Regulations 2004 but in particular section 3 Environment has a close affiliation with energy efficiency, regarding:

- a. heating of *dwellings*;
- b. ventilation of *domestic buildings*;
- c. condensation;
- d. natural lighting;
- e. combustion air and cooling air for combustion appliances;
- f. drying facilities; and
- g. storage of woody biomass.

Other than where qualified in the limitations to individual functional standards, the standards and guidance within this section apply, irrespective of the intended lifespan or the potential to relocate a *building*:

- to *dwellings*;
- to ancillary and subsidiary accommodation to *dwellings* (some of which may be *stand-alone buildings*), that are to be heated (excepting heating rated at a maximum of 25 W/m² floor area, installed solely for the purpose of frost protection);
- to *stand-alone buildings* that are heated (see paragraph below); and
- to *work* on existing *buildings* (see paragraph below).

Heated *stand-alone buildings*

In 2007, the EU Directive [2002/91/EC](#) on the energy performance of *buildings* led to the introduction of the category of '*stand-alone building*', a definition of which is available in appendix A of the Technical Handbooks. The Directive exempts such *buildings*, where less than 50 m² in floor area, from both the need to use a methodology to calculate energy performance (standard 6.1) and also the production of an Energy Performance Certificate (standard 6.9). The defined term includes not only detached *buildings*, but also thermally divided parts of a *building* with separate heating shut-down control.

Stand-alone domestic buildings that are less than 50 m² in floor area must still comply with standards 6.2 to 6.8 (6.10 not being applicable to *domestic buildings*). The guidance to standard 6.2 recommends that the *insulation envelope* of such a *building* should achieve the level of performance applicable to an extension.

Examples Common examples of *stand-alone buildings* that could be less than 50 m² include: a heated stair enclosure associated with a block of *flats*; a heated summerhouse ancillary to a *dwelling*; and a *conservatory* attached to a new or existing *dwelling*.

Work on existing buildings As for other standards within Scottish building regulations, the energy standards apply to *conversions* and also *work on existing buildings*, such as extensions, *conservatories*, alterations and replacement *work*. However in some situations, individual standards may not apply or guidance on compliance with the standards may differ for such *work*. The latter is usually to recognise constraints that arise when working with existing *buildings*.

It is advisable, in the first instance, to check the functional standard as sometimes a limitation removes certain classes of this type of *work*. Where not excepted by a limitation to a standard, the provisions of the standard will apply in full to the new *work* on the existing *building*, other than where proposed *works* are wholly categorised as a conversion, where the standard in question may be met as far as is *reasonably practicable*. This is identified in the introduction to the guidance supporting each standard.

6.0.4 *U-values*

Thermal transmittance (*U-value*) is a measure of how much heat will pass through one square metre of a structure when the temperature on either side differs by one degree Celcius. It is expressed in units of watts per square metre per degree of temperature difference (W/m²K).

Measurements of *U-values* should be made in accordance with BS EN ISO 8990: 1996 - 'Thermal insulation. Determination of steady-state thermal transmission properties. Calibrated and guarded hot box'. In calculation, thermal bridging may be disregarded where the difference in thermal resistance between bridging and bridged material is less than 0.1 m² K/W. For example, normal mortar joints need not be taken into account in calculations for brickwork, but should be taken into account for lightweight insulating blockwork.

Taking into account guidance from BRE publication BR 443: 2006 '[Conventions for U-value calculations](#)' individual *U-values* of *building* elements forming the *insulation envelope* can be established by a number of methods, including:

- a. by using insulation to a thickness derived from manufacturers' data relating to thermal conductivities (W/m.K) and thermal transmittances (U-values: W/m²K) certified by a *notified body*;
- b. by calculation, taking into account thermal bridging effects of, e.g. timber joists, structural and other framing and normal bedding mortar, by using the Combined Method set out in BS EN ISO 6946: 2007 or [CIBSE Guide Section A3](#) 2006 Edition;
- c. for floors adjacent to the ground and basements, by using the method set out in BS EN ISO 13370: 2007 or [CIBSE Guide Section A3](#) 2006 Edition; or
- d. for windows, doors and rooflights, by using BS EN ISO 10077-1: 2006 or BS EN ISO 10077-2: 2003 and, for rooflights, BS EN ISO 12567-2: 2005.

6.0.5 Thermal conductivity

The thermal conductivity (the λ -value) of a material is a measure of the rate at which that material will transmit heat and is expressed in units of watts per metre per degree of temperature difference (W/m.K). Establishing the thermal conductivity of materials in a *building* element forming part of the *insulation envelope* will enable the thermal transmittance of the element to be calculated.

Measurements of thermal conductivity should be made in accordance with BS EN 12664: 2001, BS EN 12667: 2001 or BS EN 12939: 2001. There are a wide range of technical publications which give the thermal conductivity of common *construction* materials but, where available, preference should be given to values that are certified by a *notified body*. Additional guidance given in BRE publication [BR 443: 2006](#) should also be followed.

6.0.6 Thermal transmittance through separating elements

Previously, thermal transmittance through *separating walls* or *separating floors* between 2 *dwellings* or between a *dwelling* and other heated parts of the same *building* (e.g. between a *flat* and a *protected zone* with space heating) was not assessed. Accommodation on both sides of the separating element was expected to be at a similar temperature when the *dwellings* or *buildings* are occupied.

This is no longer always the case. Whilst ‘no loss’ may still be assumed for solid walls, research has identified previously unanticipated heat losses from air movement in cavity *separating walls*. This ‘thermal bypass’ is now identified in both calculation methodology and guidance to standard 6.1, guidance to standard 6.2 and within the revised [‘Accredited Construction Details \(Scotland\) 2010’](#)

6.0.7 Buffering effects on the insulation envelope

If a *dwelling* or part of a *building* consisting of *dwellings* is separated from an unheated enclosed area, (for example, solid waste storage accommodation, a *porch*, *garage*, *protected zone* or underground car park) the *U-values* of the walls/floors (including doors and translucent *glazing*) may be calculated by:

- a. disregarding the buffering effects and treating the element as if it is directly exposed to the outside;
- b. using the relevant formulae within SAP 2009;
- c. following the procedure in BS EN ISO 6946: 2007; or
- d. following the procedure in BS EN ISO 13789: 2007.

www.bre.co.uk/sap2009

6.0.8 Roofs that perform the function of a floor

A roof of a *dwelling* or *building* consisting of *dwellings* that also performs the function of a floor or similar loadbearing surface (e.g. an *access deck*, *escape route*, roof garden or car park), should be considered as a roof for the purpose of assessment within this section.

6.0.9 Conservatories and atria

A *conservatory* allows natural light and natural ventilation to be ‘borrowed’ through *glazing* and *ventilators* into adjacent *rooms* of a *dwelling*. In view of this, a large area of translucent material is required in the *conservatory* fabric to ensure that such *rooms* are not adversely affected. The definition of *conservatory* in appendix A of the Technical Handbooks should be read in conjunction with the SAP 2009 document. Further guidance is given on how the standards apply to *conservatories* in clauses 6.1.7, 6.2.12, and 6.3.14.

In a *dwelling* with an atrium, it should be assumed that the atrium is to gain heat transfer from the surrounding *building*. The continuity of the *insulation envelope* occurs at the roof level (usually predominantly *glazed* with translucent material) and the atrium is considered to be a heated part of the *dwelling*.

6.0.10 Performance of fixed building services

Unless otherwise identified in text, guidance given in support of standards 6.3 to 6.6 continues to follow the recommendations developed for the [Domestic Building Services Compliance Guide](#) produced by the Department for Communities and Local Government. This is intended to allow standardisation of the specification and expected performance of fixed *building* services throughout the UK. The Guide also provides helpful supplementary information that may assist designers in the installation and commissioning of services to delivering optimum operating efficiency.

Additional information on the use of a range of low carbon equipment (LCE), such as solar thermal systems, photovoltaic panels and heat pumps, and application within building regulations can be found on the [Technical Pages](#) of the Building Standards Division website.

6.0.11 Calculation of areas

When calculating areas for the purposes of this section and in addition to regulation 7, schedule 4, the following should be observed:

- a. all areas should be measured in square metres (m²), unless stated otherwise in this guidance;
- b. the area of a floor, wall or roof is to be measured between finished internal faces of the *insulation* envelope, including any projecting bays and in the case of a roof, in the plane of the insulation;
- c. floor areas are to include stairwells within the *insulation envelope* and also non-useable space (for example service *ducts*);
- d. the area of an opening (e.g. window or door) should be measured internally from ingo to ingo and from head to sill or threshold.

6.0.12 Latest changes

The 2010 edition of section 6 incorporates a large number of changes whilst retaining the existing methodology introduced in 2007. The majority of these changes relate to improvement in specified performance to deliver the intended 30% reduction in carbon dioxide emissions. A full summary of changes can be found on the [Technical Handbooks](#) page of the Building Standards Division section of the Scottish Government website.

The key changes that have been made to the standards and guidance since 1 May 2009.

- Standard 6.1 – standard updated to reflect previous changes to standard 6.9. No effect on guidance.
- SAP 2009 now used to calculate carbon dioxide emissions.
- Clause 6.1.2 – comprehensive revisions of fuel package table and associated notes to deliver 30% aggregate improvement on Target Emissions Rates.
- Clause 6.2.1 - improved fabric backstops for new *buildings*; proposal to address performance of cavity *separating walls*.
- Clause 6.2.3 - revised guidance on limiting non-repeating thermal bridging & revision of current Accredited Construction Details document.
- Clause 6.2.4 - expanded guidance on limiting uncontrolled air infiltration, including reference to standard 3.14 where very low infiltration rates proposed.
- Clause 6.2.5 - introduction of airtightness testing regime.
- Clause 6.2.7 - improved *U-values* for conversion of heated *buildings* (aligned with non-domestic guidance).
- Clause 6.2.8 - expanded guidance on how to address energy performance in conversion of older and *traditional buildings*.
- Clause 6.2.9 - improved fabric backstops for extensions; alternative approach for highly-*glazed* extensions; improving existing *buildings* - guidance on *constructing* extensions to better *U-values* where existing *building* fabric values are poor.
- Clause 6.2.12 - improved *U-value* for *glazing* in *conservatories*, irrespective of area.
- Standard 6.3 – 6.6 - comprehensive revision of guidance on heating lighting, cooling and ventilation systems, efficiencies and controls. Guidance remains based upon UK recommendations (developed by the Department of Communities and Local Government).
- Standard 6.4 - limitation within standard on cooled pipes or *ducts* in *domestic buildings* removed.
- Standard 6.5 - standard extended to include lighting in common areas of *domestic buildings*.
- Clause 6.5.1 - increased percentage of energy efficient lighting; revised minimum efficacy; new clause on common areas.
- Clause 6.5.2 - new clause on efficiency of external lighting.
- Standard 6.6 - standard extended to include ventilation and cooling systems in *domestic buildings*.
- Clause 6.6.2 - new clause on efficiency of air conditioning systems.
- Clause 6.6.3 - new clause on efficiency of mechanical ventilation systems.
- Standard 6.8 - standard extended to cover ventilation and cooling systems in *domestic buildings*.

6.0.13 Relevant legislation

Reference should be made to UK legal requirements enforcing Article 13 of the Energy End-Use Efficiency and Energy Services Directive [2006/32/EC](#). When *building work* is carried out to an existing *building* with a floor area of more than 1000 m² or a new *building* is *constructed*, the energy supply companies providing services to such *buildings* should be notified.

EU Directive
2006/32/EC

EU Directive
2009/28/EC

Directive [2009/28/EC](#) promotes the use of energy from renewable sources, including promotion within national legislation. It establishes a common framework for the use of energy from renewable sources in order to limit greenhouse gas emissions, including establishment of national action plans and targets which set the share of energy from renewable sources for 2020.

6.0.14 Certification

Scottish Ministers can, under Section 7 of the Building (Scotland) Act 2003, approve schemes for the certification of design or *construction* for compliance with the mandatory functional standards. Such schemes are approved on the basis that the procedures adopted by the scheme will take account of the need to co-ordinate the *work* of various designers and specialist contractors. Individuals approved to provide certification services under the scheme are assessed to ensure that they have the qualifications, skills and experience required to certify compliance for the *work* covered by the scope of the scheme. Checking procedures adopted by Approved Certifiers will deliver design or installation reliability in accordance with legislation.

The Certification of Design (section 6 – Energy) for domestic Buildings scheme has been approved by Scottish Ministers to confirm compliance with section 6. Details are available on the [certification pages](#) of the Building Standards Division website.

6.1 Carbon dioxide emissions

- 6.1 Functional standard
- 6.1.0 Introduction
- 6.1.1 Dwellings
- 6.1.2 Setting the target carbon dioxide emissions level
- 6.1.3 Calculating carbon dioxide emissions for the proposed dwelling
- 6.1.4 Buildings with multiple dwellings
- 6.1.5 Common areas in buildings with multiple dwellings
- 6.1.6 A simplified approach
- 6.1.7 Conservatories and stand-alone buildings

standard
6.1
mandatory

- Every *building* must be designed and *constructed* in such a way that:**
- (a) **the energy performance is estimated in accordance with a methodology of calculation approved under regulation 7(a) of the Energy Performance of Buildings (Scotland) Regulations 2008; and**
 - (b) **the energy performance of the *building* is capable of reducing carbon dioxide emissions.**

Limitation:

This standard does not apply to:

- (a) alterations and extensions to *buildings*, other than alterations and extensions to *stand-alone buildings* having an area less than 50 square metres that would increase the area to 50 square metres or more, or alterations to *buildings* involving the fit-out of the *building* shell which is the subject of a continuing requirement;
- (b) *conversions* of *buildings*;
- (c) *non-domestic buildings* and *buildings* that are ancillary to a *dwelling* that are *stand-alone* having an area less than 50 square metres;
- (d) *buildings*, which will not be heated or cooled other than by heating provided solely for the purpose of frost protection; or
- (e) *limited life buildings* which have an intended life of less than 2 years.

6.1.0 Introduction

Standard 6.1 focuses on the reduction of carbon dioxide emissions arising from the use of heating, hot water and lighting in a new *dwelling*. The guidance sets an overall level for maximum carbon dioxide emissions in *buildings* by use of a methodology which incorporates a range of parameters that influence energy use. This means that, for new *dwellings*, a designer is obliged to consider energy performance as a complete package rather than looking only at individual elements such as insulation or boiler efficiency - a 'whole *dwelling* approach' to energy which offers a significant degree of design flexibility.

For the majority of new *buildings*, standard 6.1 has the greatest influence on design for energy performance. Standards 6.2 to 6.10, in the main, recommend benchmark and backstop levels to be achieved for individual elements or systems. To achieve compliance with standard 6.1 it will be necessary to improve on these backstop levels or incorporate additional energy efficiency measures, such as low carbon equipment (LCE).

EU Directive
2009/28/EC
Article 13

Directive [2009/28/EC](#) promotes the use of energy from renewable sources. Where the *dwelling* design will include use of renewable energy for heating, Article 13 of the Directive recommends, amongst other measures, consideration of use of the following:

- for biomass equipment, conversion efficiencies of 85%;
- for heat pumps, those that fulfil the minimum requirements of eco-labelling established in Commission Decision 2007/742/EC of 9 November 2007 establishing the ecological criteria for the award of the Community

- eco-label to electrically driven, gas driven or gas absorption heat pumps; and
- for solar thermal systems, those that are subject to EU standards, including eco-labels and other technical reference systems established by the European standardisation bodies.

Conversions In the case of conversions, as specified in regulation 4, this standard does not apply.

6.1.1 Dwellings

Objective The calculated carbon dioxide emissions (measured in kilograms per square metre of floor area per annum) for the proposed *dwelling*, the *dwelling* emissions rate (DER), should be less than or equal to the target carbon dioxide emissions for a 'notional *dwelling*', the target emissions rate (TER).

Summary of procedure In order to establish the target carbon dioxide emissions rate (TER) for the 'notional *dwelling*' (i.e. a *dwelling* of the same size, shape and 'living area fraction' as the proposed *dwelling*), the dimensions and 'living area fraction' of the proposed *dwelling* and a set of standard values are input into the methodology. To calculate the emissions for the proposed *dwelling* (DER) a second calculation is carried out where the proposed values are input into the methodology. An alternative way of meeting standard 6.1 which avoids the use of the calculation methodology is to design to the set of values used for the 'notional *dwelling*'. This elemental approach is described in clause 6.1.6.

www.bre.co.uk/sap2009

The Government's Standard Assessment Procedure for Energy Rating of Dwellings (SAP 2009) is the calculation tool used with the methodology which conforms with the European Directive [2002/91/EC](#) and is approved to calculate the energy performance and the carbon dioxide emissions of an individual *dwelling*. At all stages, the conventions in the SAP document should be read in conjunction with the specific guidance given in the clauses to this section.

Non-domestic use within *dwellings*

Some new *dwellings* may incorporate surgeries, consulting *rooms*, *offices* or other accommodation of a floor area not exceeding 50 m² in aggregate, used by an occupant of the *dwelling* in a professional or business capacity. Where this occurs, the accommodation should be considered as a part of the *dwelling*.

6.1.2 Setting the target carbon dioxide emissions level

To set the target carbon dioxide emissions level, (i.e. the level that should not be exceeded, the TER), refer to the table to this clause. The package of measures for the fuel type for the main space heating of the proposed *dwelling* is selected. This package of measures is used in the methodology and no improvement factors are applied. In addition, this 'notional *dwelling*' is to have the same size, shape (including floor, roof, exposed wall areas and *storey* heights) and 'living area fraction' as the proposed *dwelling*. These terms are explained in SAP 2009.

www.bre.co.uk

Software vendors providing BRE - approved SAP 2009 software will incorporate a function that, with 'Scotland' selected, automatically generates the target CO₂ emissions level once the fuel type is selected and the 'notional *dwelling*' dimensions and 'living area fraction' have been input into the programme.

Measures to calculate target carbon dioxide emissions for the 'notional dwelling'

The measures identified in this table are set to deliver on aggregate, 30% fewer carbon dioxide emissions than the 2007 standards. Whilst it is possible to *construct* a *dwelling* using one of the packages of measures (see clause 6.1.6), this table is provided for the purpose of setting the target emission rate (TER) for the 'notional' *dwelling*.

Element or system	Main space heating system fuel [1] [2]				
	Gas (Package 1)	LPG (Package 2)	Oil (Package 3)	Electricity (Package 4)	Biomass [3] (Package 5)
Walls	U = 0.19	U = 0.19	U = 0.19	U = 0.19	U = 0.19
Floors	U = 0.15	U = 0.15	U = 0.15	U = 0.15	U = 0.15
Roofs	U = 0.13	U = 0.13	U = 0.13	U = 0.13	U = 0.13
Openings [4]	U = 1.5	U = 1.5	U = 1.5	U = 1.5	U = 1.5
Allowance for thermal bridging [5]	0.08 x total exposed surface area	0.08 x total exposed surface	0.08 x total exposed surface	0.08 x total exposed surface	0.08 x total exposed surface
Open flues	None	One	One	None	One
Heating system (pump in heated space)	Gas boiler <i>room sealed fan flued</i> , 90.2% efficiency	LPG boiler <i>room sealed fan flued</i> , 90.2% efficiency	Oil boiler <i>room sealed fan flued</i> , 93% efficiency	Air to water heat pump [6]	Wood pellet boiler HETAS approved
Heating system controls	Programmer + <i>room</i> thermostat + TRVs + Boiler interlock + weather compensation + delayed start	Programmer + <i>room</i> thermostat + TRVs + Boiler interlock + weather compensation + delayed start	Programmer + <i>room</i> thermostat + TRVs + Boiler interlock + weather compensation + delayed start	Programmer + <i>room</i> thermostat	Programmer + <i>room</i> thermostat + TRVs + weather compensation + delayed start
Hot water (HW) system (not applicable if combi-boiler)	Stored HW (from boiler) separate time control for space and water heating	Stored HW (from boiler) separate time control for space and water heating	Stored HW (from boiler) separate time control for space and water heating	Stored HW by electric immersion	Stored HW (from boiler) separate time control for space and water heating
Secondary space heating	none	10% closed wood log-burning <i>room</i> heater [7]	10% closed wood log-burning <i>room</i> heater [7]	10% electric	none
Solar thermal system	Yes [8]	Yes [8]	Yes [8]	Yes [8]	Yes [8]

For the 'notional *dwelling*' in addition all of the following applies in every fuel type:

Windows, doors, and rooflights	area 25% of total floor area [9]
Orientation	all <i>glazing</i> orientated east/west
Shading	average overshadowing
Number of sheltered sides	2
<i>Chimneys</i>	none
Ventilation system	natural ventilation with intermittent extract fans. 4 for <i>dwelling</i> s with floor area more than 80 m ² 3 for smaller <i>dwelling</i> s
Air infiltration through <i>building</i> fabric	7 m ³ /m ² h at 50 Pa
Hot water cylinder (combined cylinder with 75 litre solar store)	150 litre cylinder insulated with 50 mm of factory applied foam (cylinder in heated space); cylinder temperature controlled by thermostat
Primary water heating losses (where applicable)	primary pipework insulated
Low energy light fittings	100% of fixed outlets
Thermal mass parameter	The value identified for the proposed <i>building</i> should be used
Party wall heat loss (applicable to cavity <i>separating walls</i>)	0.2 W/m ² K

Notes:

- Where dual fuel solutions or a multi fuel appliance are proposed, assessment of both TER and DER should be based upon the fuel option with the highest carbon factor.
- Where solid mineral fuel is proposed for the main space heating system, the TER should be calculated using the values identified for oil as a fuel (package 3). This will require improvements in performance within the DER specification for compliance.
- The biomass column should be used not only where biomass fuel is to be used but also for biogas, large scale waste combustion from boilers and waste heat from power stations.
- U is the average *U-value* of all openings (windows, doors, rooflights) based on one opaque door 1.85 m² of U=1.5, any other doors fully *glazed*. For windows, doors etc a frame factor of 0.7, light transmittance of 0.80 and solar energy transmittance of 0.63 are assumed.
- For the purposes of setting the TER, a Y-value of 0.08 is identified, which assumes using the principles set out in the BSD document '[Accredited Construction Details \(Scotland\) 2010](#)'. In determining the DER, guidance on designing to limit heat loss from non-repeating thermal bridges is given in clause 6.2.3.
- For calculation of the TER, radiators should be identified as the distribution system.
- The closed wood log-burning *room* heater should be capable of burning wood only, not multi-fuel.
- Evacuated tube (collector efficiency $\eta_0 = 0.6$, heat loss coefficient $a_1 = 3$), oriented between SE and SW, pitch not more than 45° from horizontal, solar powered circulation pump. Panel size for TER calculation, rounded to the nearest 0.1 m², determined as follows:
Dwelling area ≤ 100m² : 0.75 + (0.0375 x total floor area)
Dwelling area > 100m² : 4.3 + (0.002 x total floor area)
 For *dwelling*s smaller than 35 m², a panel size of 2 m² should be used in the TER calculation.
- If total exposed façade area is less than 25% of the floor area, the area of windows, doors and roofs should be taken as the area of the total exposed facade area.

6.1.3 Calculating carbon dioxide emissions for the proposed *dwelling*

The second calculation involves establishing the carbon dioxide emissions for the proposed *dwelling* (DER). To do this the values proposed for the *dwelling* should be used in the methodology i.e. the *U-values*, air infiltration, heating system, etc.

The exceptions to entering the *dwelling* specific values are:

- a. it may be assumed that all *glazing* is orientated east/west;
- b. average overshadowing may be assumed if not known. 'Very little' shading should not be entered;
- c. 2 sheltered sides should be assumed if not known. More than 2 sheltered sides should not be entered;
- d. where secondary heating is proposed, if a *chimney* or *flue* is present but no appliance installed the worst case should be assumed i.e. a *decorative fuel-effect gas appliance* with 20% efficiency. If there is no gas point, an open fire with 37% efficiency should be assumed, burning solid mineral fuel for *dwellings* outwith a smokeless zone and smokeless solid mineral fuel for those that are within such a zone.

All other values can be varied, but before entering values into the methodology, reference should be made to:

- the back-stop *U-values* identified in guidance to standard 6.2; and
- guidance on systems and equipment within standards 6.3 to 6.6.

6.1.4 Buildings with multiple *dwellings*

Where a *building* contains more than one *dwelling* (such as a block of *flats* or terrace of *houses*) the average carbon dioxide emissions for the proposed block or terrace (DER) may be compared to the average target CO₂ emissions (TER) for the 'notional block or terrace'.

The average emissions for the block or terrace is the floor-area-weighted average for all the individual *dwelling* emissions, i.e:

$$\{(emissions_1 \times floor\ area_1) + (emissions_2 \times floor\ area_2) + (emissions_3 \times floor\ area_3) + \dots\} \div \{(floor\ area_1 + floor\ area_2 + floor\ area_3) + \dots\}.$$

The degree of flexibility which is provided by averaging out *building* emissions should be used carefully. It is not intended that one or more *dwellings* are super-insulated (in a *building* consisting of *dwellings*) so that another may be *constructed* with a high percentage of *glazing*.

6.1.5 Common areas in *buildings* with multiple *dwellings*

Communal *rooms* or other areas in blocks of *dwellings* (which are exclusively associated with the *dwellings*) should be assessed either by:

- a. using the guidance to standard 6.1 for non-*domestic buildings*; or
- b. ensuring that the *glazing* does not exceed 25% of the total communal floor area of the *building*; and the *U-values*, thermal bridging, air infiltration values equal or better those given for the gas 'notional *dwelling*' (package 1 in the table to clause 6.1.2).

However where the common areas are less than 50 m² in total these *rooms* or areas may be treated as a *stand-alone building* and are not therefore subject to standard 6.1.

6.1.6 A simplified approach

Where a *dwelling* is designed to one of the packages of measures in the table to clause 6.1.2, it can be considered to reduce carbon dioxide emissions to the same level as by use of the methodology, calculating and comparing DER with TER.

In using a package of measures east/west orientation, average overshadowing and 2 sheltered sides may be assumed for the proposed *dwelling*.

The simplified approach may still be used where there are minor deviations of input values that will clearly achieve the same or a better level of emissions. For example:

- a boiler with a higher SEDBUK efficiency;
- a ground source heat pump instead of an air source heat pump;
- where secondary heating forms part of the TER calculation, a secondary space heating system of equal or better performance (e.g. a closed, biomass-burning *room* heater);
- area of openings between 20% and 25% of total floor area (windows, doors, rooflights, and roof windows);
- a declared air infiltration of 7 m³/m².h at 50 Pa or lower;
- a hot water cylinder with a declared heat loss figure (BS 1566-1: 2002) not exceeding 2.11 kWh/day.

This simplified approach should not be used where there is any deviation from values in the table which will result in higher CO₂ emissions. An example is if the *dwelling* has more than 4 extract fans or windows of a poorer *U-value*. Likewise, if some elements offer poorer performance and others offer higher performance, the simplified approach should not be used.

This approach should also not be used where there is a likelihood of high internal temperature in hot weather or where air-conditioning is proposed. Reference should be made to the guidance to standard 6.6.

Note that an Energy Performance Certificate (EPC) will still be required, on completion of the *dwelling*, to meet standard 6.9.

6.1.7 Conservatories and stand-alone buildings

Conservatories of less than 50 m² in area are *stand-alone buildings*, thermally separated from the *dwelling*. A *dwelling* to which one is attached should be assessed as if there was no *conservatory* proposed.

For *conservatories* and other ancillary *stand-alone buildings* of 50 m² or more the guidance and methodology for non-*domestic buildings* should be followed.

6.2 Building insulation envelope

- 6.2 Functional standard
- 6.2.0 Introduction
- 6.2.1 Maximum U-values
- 6.2.2 Areas of windows, doors and rooflights
- 6.2.3 Limiting heat loss through thermal bridging
- 6.2.4 Limiting uncontrolled air infiltration
- 6.2.5 Air-tightness testing
- 6.2.6 Conversion of unheated buildings
- 6.2.7 Conversion of heated buildings
- 6.2.8 Conversion of historic, listed or traditional buildings
- 6.2.9 Extensions to the insulation envelope
- 6.2.10 Thermal bridging and air infiltration for existing buildings
- 6.2.11 Alterations to the insulation envelope
- 6.2.12 Conservatories
- 6.2.13 Stand-alone buildings

standard

6.2

mandatory

Every *building* must be designed and *constructed* in such a way that an *insulation envelope* is provided which reduces heat loss.

Limitation:

This standard does not apply to:

- (a) non-domestic *buildings* which will not be heated, other than heating provided solely for the purpose of frost protection;
- (b) communal parts of *domestic buildings* which will not be heated, other than heating provided solely for the purposes of frost protection; or
- (c) *buildings* which are ancillary to *dwellings*, other than *conservatories*, which are either unheated or provided with heating which is solely for the purpose of frost protection.

6.2.0 Introduction

The levels set out in the guidance to this standard are robust back-stops and these are necessary for the following reasons:

- to help reduce energy demand (particularly where use of low carbon equipment (LCE) may reduce carbon dioxide emissions but not energy consumption); and
- to ensure that a good level of fabric insulation is incorporated, especially to *construction* elements that would be difficult and costly to upgrade in the future.

Non-repeating thermal bridging at the junctions of *building* elements and around openings in the *building* envelope form part of the calculation of energy performance in the Standard Assessment Procedure (SAP 2009, see clause 6.1.1). Heat loss through such junctions, if poorly designed and *constructed*, can contribute significantly to the overall heat loss through the *insulation envelope*.

Limiting infiltration

As fabric insulation levels improve, heat lost through uncontrolled infiltration of air through the *building* envelope (air permeability) becomes proportionally greater. For example, in a typical 1960s *house* with non-draughtstripped windows 20% of the total heat could be lost through air infiltration and ventilation. If the same *house* was upgraded to 2002 levels of fabric insulation but no attempt made to reduce air infiltration then the losses from infiltration could represent up to 40% of total heat losses. Limiting infiltration, whilst providing controllable ventilation, is therefore essential if both energy efficiency and good indoor air quality are to be achieved.

Conversions

In the case of conversions, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably practicable*, and in no case be worse than before the conversion (regulation 12, schedule 6).

6.2.1 Maximum *U-values*

Area-weighted average *U-values*

Column a of the table below sets out robust backstop measures. In most cases, meeting standard 6.1 will result in even better levels of thermal insulation unless the design of a *dwelling* involves extensive use of *building-integrated* or localised low carbon equipment (LCE).

Individual element *U-values*

Localised areas of the same *building* element may be designed to give a poorer performance, providing the average *U-value* for all elements of the same type is maintained by designing the rest of the element to a more demanding level. An example of this would be a meter box set into an *external wall*. These localised areas should have a *U-value* no worse than the figures given in column b of the table below. This is particularly important with regard to the control of condensation (see section 3 Environment). Repeating thermal bridges (e.g. timber studs in a timber frame wall) should not be considered as an individual element in this respect, as these are already taken into account within a BS EN ISO 6946: 2007 *U-value* calculation.

Common areas

For communal areas refer to clause 6.2.13.

Maximum *U-values* for building elements of the insulation envelope

Type of element	(a) Area-weighted average <i>U-value</i> (W/m ² K) for all elements of the same type	(b) Individual element <i>U-value</i> (W/m ² K)
Wall [1]	0.25	0.70
Floor [1]	0.20	0.70
Roof	0.18	0.35
Windows, doors, rooflights	1.8	3.3

Notes:

1. Excluding *separating walls* and *separating floors* between heated areas where thermal transmittance need not be assessed, provided measures to limit heat loss arising from air movement within the cavity *separating wall* are made (see below).

Cavity *separating walls*

Recent research has established that previously unanticipated heat loss can arise via air movement, within a cavity *separating wall*, from heated areas to points outwith the insulation envelope. To limit heat loss, a *separating wall* cavity should have effective perimeter sealing around all exposed edges and in line with insulation layers in abutting elements which separate the *dwelling* from another *building* or from an unheated space. Further reduction in heat loss can be achieved where the cavity *separating wall* is also fully filled with a material that limits air movement.

In addressing this issue, regard should be paid to the need to limit noise transmission (see section 5 Noise).

Information on reducing heat loss from air movement in a cavity *separating wall* can be found in the Building Standards Division document [‘Accredited Construction Details \(Scotland\) 2010’](#)

6.2.2 Areas of windows, doors and rooflights

Due to the target method set by carbon dioxide emissions standard 6.1, there is no need for guidance on minimum or maximum area for windows, doors, rooflights and roof windows in new *dwellings*.

The methodology for establishing compliance with standard 6.1 considers conflicting energy issues of heat loss versus solar gain and natural lighting versus artificial lighting. In certain cases, where there is a desire to have a large proportion of glass it may be difficult to demonstrate compliance with standard 6.2. In such cases, innovative solutions will need to be considered. All relevant standards and guidance should be considered, including standard 6.6, on avoiding high internal summer temperatures.

Guidance on alterations, extensions and conversions is provided in clauses 6.2.6 to 6.2.13.

Common areas

For communal areas refer to clause 6.2.13.

6.2.3 Limiting heat loss through thermal bridging

As insulation values of new *buildings* improve, the need to limit heat loss through thermal bridging becomes increasingly important. Incorrect detailing at design stage or poor *construction work* can have a significant adverse effect on *building* performance.

The *insulation envelope* of any heated *building* should be designed and *constructed* to limit heat loss through thermal bridging. The key areas of concern are:

- repeating thermal bridging within *building* elements; and
- non-repeating thermal bridging at the junction between *building* elements and at the edges of *building* elements where openings in the envelope are formed.

Whilst repeating thermal bridges are taken into account in the BS EN ISO 6946: 2007 *U-Value* calculation, a separate assessment of non-repeating thermal bridging should be carried out for new *buildings* which are subject to standard 6.1. Advice and further information on assessment of the effects of thermal bridging can be found in BRE Information paper IP 1/06 – [‘Assessing the effects of thermal bridging at junctions and around openings’](#)

A value for non-repeating thermal bridging, which should be input into SAP 2009, can be determined in one of the following ways:

- a. a conservative default ψ -value of 0.15 may be assumed; or
- b. where *construction* is in accordance with the BSD document [‘Accredited Construction Details \(Scotland\) 2010’](#) an assessed value can be calculated simply, using the Ψ (ψ) value of each junction (provided in the document) and the lengths of the thermal bridging element of each junction; or
- c. a Ψ -value derived from numerical modelling of individual Ψ (ψ) values calculated in accordance with BS EN ISO 10211: 2007 ‘Thermal bridges in building construction - heat flows and surface temperatures - detailed calculations’. Guidance on this process is given in BR 497, [‘Conventions For Calculating Linear Thermal Transmittance and Temperature Factors’](#)

Further commentary on this process and use of other published documents providing sources of pre-calculated values can be found within [‘Accredited Construction Details \(Scotland\) 2010’](#)

6.2.4 Limiting uncontrolled air infiltration

To limit heat loss, any heated *building* should be designed to limit uncontrolled air infiltration through the *building* fabric. This is done by providing a continuous barrier that resists air movement through the *insulation envelope* and limits external air paths into each of the following:

- the inside of the *dwelling* or *building* consisting of *dwellings*;
- the 'warm' side of insulation layers;
- spaces between the component parts of exposed *building* elements, where such parts contribute to the thermal performance of the element.

Using a target-based methodology for new *buildings* in standard 6.1 (carbon dioxide emissions), a reduction in uncontrolled infiltration will allow greater design flexibility in the application of other energy performance measures. The infiltration rate used for the TER calculation is $7 \text{ m}^3/\text{m}^2.\text{h} @ 50 \text{ Pa}$ (see clause 6.1.2). Whilst no backstop value is set for uncontrolled infiltration, it is recommended that *buildings* are designed to achieve a value of $10 \text{ m}^3/\text{m}^2.\text{h} @ 50 \text{ Pa}$ or better to allow a balanced approach to managing *building* heat loss.

Designing and *constructing* a *building* in accordance with the principles set out in BSD's document '[Accredited Construction Details \(Scotland\) 2010](#)' will assist in limiting air infiltration. Due to the contribution of both detailing and workmanship, it remains difficult to achieve a specified air infiltration rate with any degree of accuracy. To ensure the *dwelling* will deliver the intended thermal performance without adversely affecting air quality, air tightness testing should be undertaken to verify as-built air infiltration rates (see clause 6.2.5).

Limiting air infiltration to improve energy performance should not compromise ventilation required for:

- the health of the occupants of the *building* (section 3);
- the removal of moisture from *building* fabric (section 3);
- the safe operation of combustion appliances (section 3); and
- any smoke control system (section 2).

Lower air infiltration rates, of less than $5 \text{ m}^3/\text{m}^2.\text{h} @ 50 \text{ Pa}$, may give rise to problems with internal air quality and condensation. Accordingly, where design infiltration rates are proposed below this rate, reference should be made to additional measures needed to ensure air quality under standard 3.14, on provision of ventilation within *dwellings*.

Common areas

In *buildings* consisting of *dwellings*, common areas which need particular consideration to limit air infiltration include common stair entrances and shafts which extend through most of the floors (e.g. lift and common stair enclosures).

6.2.5 Air-tightness testing

Low air infiltration rates will contribute to energy performance but should not be so low as to adversely affect the health of occupants or the *building* fabric. There is, therefore, a need to establish *building* performance by test, to demonstrate compliance in both these respects.

Evidence from testing of *dwellings*, *constructed* to the 2007 Accredited Construction Details (Scotland), and of similar *constructions* elsewhere in the UK, indicates that air-tightness levels of 5 to $7 \text{ m}^3/\text{m}^2.\text{h} @ 50 \text{ Pa}$ are readily achievable and can be exceeded unintentionally. Air-tightness testing should

be carried out on new *buildings* to ensure that air infiltration rates deliver both the stated design level under this guidance and minimum levels of ventilation needed (see section 3 Environment).

In order to allow the capacity of the testing industry to grow in Scotland, the need to carry out infiltration testing is being phased in as follows:

- For building warrant applications made on or after 1 May 2011 - testing of *flats* and *maisonettes* only; and
- For building warrant applications made on or after 1 October 2011 – testing of all *dwelling* types.

Frequency of testing *dwelling*s

As a baseline, testing of completed *dwelling*s should be carried out on 1 in 20 *dwelling*s or part thereof. The verifier may, however, request that the frequency of testing be varied, as considered appropriate to reasonable enquiry and in response to previous test results within a development.

In larger developments, it is advisable to test more than one example of the same *dwelling* type, completed at different stages in the overall development, to help establish consistency in quality of *construction*.

In smaller developments, the proportion of *dwelling*s tested may need to increase, dependant on the range of type and form of *dwelling*s present, to ensure a representative sample is taken.

Normally for a development of one *dwelling*, an air-tightness test should be carried out as it will not be possible to obtain comparative data on the quality of construction from similar *dwelling*s. Alternatively, where a default design value of 15 m³/m².h @ 50 Pa is stated in demonstrating compliance under standard 6.1, testing need not be carried out.

Test methods

Testing should be in accordance with BS EN 13829: 2001 – ‘Thermal performance of buildings - determination of air permeability of buildings - fan pressurization method’. Practical advice on procedure for pressure testing is given in the ATTMA publication [‘Measuring Air Permeability of Building Envelopes’](#)

Testing should be carried out by persons who can demonstrate relevant, recognised expertise in measuring the air permeability of *buildings*. This should include membership of a professional organisation which accredits its members as competent to test and confirm the results of testing.

6.2.6 Conversion of unheated *buildings*

A *building* that was originally designed to be unheated has, in most instances, the greatest void to fill in terms of energy efficiency. Heating such *buildings* will adversely affect energy efficiency and because of this, the most demanding of measures are recommended when *conversion* occurs.

Where *conversion* of an unheated *building* (e.g. a barn) or part of a *dwelling* is to be carried out, the *building* should achieve the same standards to those for an extension to the *insulation* envelope by following the guidance in clauses 6.2.9 and 6.2.10. This same approach should be taken for the *conversion* of *buildings* with heating rated at a maximum of 25 W/m² floor area and installed solely for the purposes of frost protection.

Conversion of part of a *dwelling*

Examples of *work* which involve *conversion* of part of a *dwelling* are: changing a *roof space*, an unheated garage or a deep solum space into an *apartment*.

- in the case of a *roof space*, this will usually involve extending the *insulation envelope* to include, the gables, the collars, a part of the rafters and the oxters, as well as any new or existing dormer *construction*. The opportunity should be taken at this time to upgrade any remaining poorly performing parts of the roof which are immediately adjacent to the conversion, for example, insulation to parts of the ceiling ties at the eaves;
- in the case of an unheated garage, this will usually involve extending the *insulation envelope* to include, the existing floor, perimeter walls and the roof/ceiling to the new habitable part; and
- in the case of a deep solum space, this will usually involve extending the *insulation envelope* to include, the solum/existing floor and perimeter walls to the new habitable part.

6.2.7 Conversion of heated buildings

In the case of a *building* that was previously designed to be heated, the impact on energy efficiency as a result of the conversion, may be either negligible, none whatsoever or in some circumstances even an improvement.

A less demanding approach than identified in clause 6.2.6 is recommended which at the same time still ensures that some overall improvements are being made to the existing *building* stock.

Where an extension or *conservatory* is formed and/or alterations are being made to the *building* fabric at the same time as the conversion, the guidance given in clauses 6.2.9 to 6.2.12 should also be followed.

U-values

Where conversion of a heated *building* is to be carried out, the existing *insulation envelope* should be examined and upgraded following the table below:

Maximum *U-values* for *building* elements of the insulation envelope

Type of element	(a) Area-weighted average <i>U-value</i> (W/m ² K) for all elements of the same type	(b) Individual element <i>U-value</i> (W/m ² K)
Wall [1][2]	0.30	0.70
Floor [1][2]	0.25	0.70
Roof [1]	0.25	0.35
Where new and replacement windows, doors, rooflights are installed [3][4]	1.6	3.3

Notes:

1. Where upgrading *work* is necessary to achieve the recommended *U-values*, reference should be made to ‘Reconstruction of elements’ in clause 6.2.11 and more demanding *U-values* achieved, where *reasonably practicable*.
2. Excluding *separating walls* and *separating floors* between heated areas where thermal transmittance need not be assessed, provided measures to limit heat loss arising from air movement within a cavity *separating wall* are made (see clause 6.2.1).
3. The total area of windows, doors and rooflights, should not exceed 25% of the floor area of the *dwelling* created by conversion. Alternatively, a compensatory approach should be taken.
4. Windows with a window Energy rating of Band C or better may also be used (www.bfrc.org)

6.2.8 Conversion of historic, listed or *traditional buildings*

With historic, listed or *traditional buildings*, the energy efficiency improvement measures that should be invoked by *conversion* can be more complex.

Whilst achieving the values recommended in clause 6.2.7 should remain the aim for previously heated *buildings*, a flexible approach to improvement should be taken, based upon investigation of the *traditional construction*, form and character of the *building* in question and the applicability of improvement methods to that *construction*. Provisions under other legislation (e.g. planning consent for listed *buildings* or those within conservation areas, where there is a need to maintain character, form or features) are also relevant.

For previously unheated *buildings*, now to be heated, it would be advisable to consider the feasibility of upgrading fabric to at least the *U-values* given in column b in clause 6.2.9 (individual element *U-values*). In many cases, specialist advice will be helpful in making an assessment to ensure that, in improving energy efficiency, there is no other, adverse effect to the *building* fabric.

Accordingly, each *building* will have to be dealt with on its own merits. Improvements to the fabric insulation of the *building* will often depend on factors such as whether or not improvement *work* can be carried out in a non-disruptive manner without damaging existing fabric (for example, insulating the ceiling of an accessible *roof space*) or whether potential solutions are compatible with the existing *construction*.

In certain cases, *buildings* are given historic or listed status because of specific features present in certain parts of the *building*. In these circumstances, it may be possible to make greater improvements to other less sensitive areas.

In all cases the 'do nothing' approach should not be considered initially. Innovative but sympathetic and practical solutions to energy efficiency, which are beyond the scope of this guidance, can often result in an alternative package of measures being developed for a *building*. For example, carbon dioxide emissions can be reduced without affecting *building* fabric through improvements to the heating system (refer to standards 6.3 and 6.4), the lighting system (standard 6.5) or incorporation of low carbon equipment (such as a biomass boiler or heat pump). Consultation on such matters at an early stage with both the verifier and the planning officer of the relevant authority is advised.

6.2.9 Extensions to the insulation envelope

Extension of a *building* is not subject to standard 6.1. In view of this, measures to limit energy demand and carbon dioxide emissions rely primarily upon the performance of the new *building* fabric.

As the majority of *construction work* for an extension will be new, there will seldom be the need to consider *construction* to a lesser specification as is sometimes the case for conversions and alterations. The exception to this is at the junction between existing and new, for example the need for proprietary metal 'wall starter' ties where the existing brickwork stops and new cavity blockwork begins. However other *building* standards should still be met with regard to such transitional *construction* elements.

U-values

Unlike a new *building*, an extension to an existing *building* will not commonly benefit from the provision of an efficient heating system or low carbon equipment (LCE). Therefore, fabric *U-values* should improve on the new build backstops identified in clause 6.2.1 to limit CO₂ emissions and energy demand to an equivalent level.

Accordingly, where the *insulation envelope* of a *dwelling* or a *building* consisting of *dwellings* is extended, the new *building* fabric should be designed in accordance with one of two levels of elemental *U-values* for walls, floors, roof, windows, doors and rooflights, as shown in the table below.

The applicability of particular maximum *U-values* for new *works* is determined by the energy performance of the existing *building*, assessing *external wall* and roof elements. Where a *building* has *external walls* with a *U-value* poorer than 0.7 and a roof with a *U-value* poorer than 0.25, then the more demanding *U-values* in column a should be applied to the extension. Where, existing wall and roof elements already meet or, as part of the *works*, will be upgraded to meet *U-values* of 0.7 and 0.25 respectively, the *U-values* in column b can be applied to the extension.

Maximum *U-values* for *building* elements of the insulation envelope

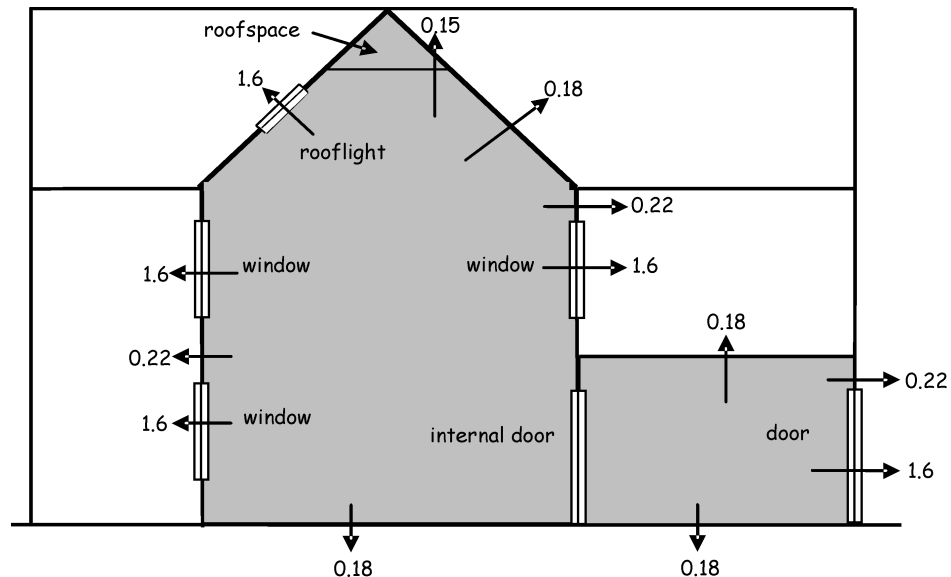
Type of element	Area-weighted average <i>U-value</i> (W/m ² K) for all elements of the same type		(c) Individual element <i>U-value</i> (W/m ² K)
	(a) where <i>U-values</i> for wall and roof of the existing <i>dwelling</i> are poorer than 0.7 [1] and 0.25 respectively	(b) where parameters for column (a) do not apply	
Wall [2]	0.19	0.22	0.70
Floor [2]	0.15	0.18	0.70
Pitched roof (insulation between ceiling ties or collars)	0.13	0.15	0.35
Flat roof or pitched roof (insulation between rafters or roof with integral insulation)	0.15	0.18	0.35
Windows, doors, rooflights	1.4 [3]	1.6 [4]	3.3

Notes:

1. The Building Standards (Scotland) Amendment Regulations 1982, came into force on 28 March 1983, introduced thermal insulation for an exposed wall broadly equivalent to 0.7 W/m²K.
2. Excluding *separating walls* and *separating floors* between heated areas where thermal transmittance need not be assessed, provided measures to limit heat loss arising from air movement within a cavity *separating wall* are made (see clause 6.2.1).

3. Windows with a Window Energy Rating of Band A may also be used www.bfrc.org
4. Windows with a Window Energy Rating of Band C or better may also be used www.bfrc.org

The *U-values* (area weighted average *U-values*) for column b of the table to this clause are summarised in the diagram below. The extension is the shaded portion, the existing *dwelling* is in elevation behind.



Area of windows, doors, rooflights

Where the *insulation envelope* of a *domestic building* is extended, the area of windows, doors, rooflights and roof windows should be limited to 25% of the floor area of the extension plus the area of any openings built over and removed as a result of the extension *work*. This figure may be exceeded if the compensatory approach, below, is adopted.

Varying *U-values* - 'Compensatory approach'

The *U-values* for the elements involved in the *work* may be varied provided that the area-weighted overall *U-value* of all the elements in the extension is no greater than that of a 'notional' extension. The 'notional' extension should be the same size and shape as one designed to the elemental *U-values* in the table above with the area of windows, doors and rooflights taken as 25% of the total extension floor area (plus equivalent area of 'built over openings'). An example of this approach is given in annex 6B.

Alternative approaches for highly-glazed extensions

Where SAP data is available for the existing *dwelling*, it may be practical to provide a revised SAP calculation to demonstrate compliance of a *dwelling*, as proposed, including extension, as part of the enlarged *dwelling*, using the target-based methodology (DER not more than TER) set out in guidance to standard 6.1 (carbon dioxide emissions). This option will generally only be viable where both extension and *dwelling* are built to the same, current edition of the standards.

6.2.10 Thermal bridging and air infiltration for existing *buildings*

Where *works* are to alter, extend or *convert* a *building*, the elements of the *work* should follow the guidance in clauses 6.2.3 and 6.2.4 and reference should be made to the principles set out in BSD's document '[Accredited Construction Details \(Scotland\) 2010](#)'. It should be noted that standard 6.1 does not apply to this type of *work* unless the designer chooses to use the methodology identified in guidance to standard 6.1, as noted in clause 6.2.9. In such cases, a default value of 10m³/m².hr @50 pa can be assumed or the testing of the extension carried out as identified in clause 6.2.5.

In addition, the recommendations within Building Research Establishment (BRE) Report 262 '[Thermal insulation, avoiding risks](#)' 2002 edition can be followed.

6.2.11 Alterations to the insulation envelope

For alterations it is more than likely that the existing *construction* will be from a different era, in *building* regulation terms. In many instances each *building* will need to be considered on its own merits. Some of the guidance given in this clause is written in specific terms, but in certain cases (e.g. historic, listed or *traditional buildings*), it may be necessary to adopt alternative energy efficiency measures which relate to the amount of alteration *work* being undertaken.

Extending the <i>insulation envelope</i>	Alterations that involve increasing the floor area and/or bringing parts of the existing <i>building</i> that were previously outwith the <i>insulation envelope</i> into the heated part of the <i>dwelling</i> are considered as extensions and/or <i>conversions</i> (regulation 4, schedule 2) and reference should be made to the relevant guidance clause for such <i>work</i> .
Infill of small openings	The infill of an existing opening of approximately 4 m ² or less in the <i>building</i> fabric should have a <i>U-value</i> which matches at least that of the remainder of the surrounding element. In the case of a wall or floor however it should not be worse than 0.70 W/m ² K, and for a roof, not worse than 0.35 W/m ² K.
Infill of large openings	The infill of an existing opening of greater area (than approximately 4 m ²) in the <i>building</i> fabric should have a <i>U-value</i> which achieves those in column b of the table to clause 6.2.9. Another way would be to follow the guidance in the paragraph above, but compensate for the energy efficiency deficit by improving the overall <i>U-value</i> of other parts of the <i>insulation envelope</i> .
<i>Insulation envelope</i> formed from internal elements	Where the alteration causes an existing internal part or other element of a <i>building</i> to form the <i>insulation envelope</i> , that part of the <i>building</i> (including any infill <i>construction</i>) should have <i>U-values</i> which achieve those in column b of the table to clause 6.2.9. This will most likely occur where a part of a <i>building</i> is permanently removed as a phase of the alteration <i>work</i> . Another approach would be to follow the guidance given for 'infill of small openings' above, but compensate for the energy efficiency deficit by improving the overall <i>U-value</i> of other parts of the <i>insulation envelope</i> . Where this occurs at a <i>boundary</i> , no upgrading need be carried out if the element is a wall that is exclusively the property of the adjoining <i>building</i> .
Windows, doors, rooflights	Where windows, doors and rooflights are being created or replaced, they should achieve the <i>U-value</i> recommended in column b of the table to clause 6.2.9. A compensating approach may be used and an example of this is given in annex 6A. For secondary <i>glazing</i> , an existing window, after alteration should achieve a <i>U-value</i> of about 3.5 W/m ² K. Where the <i>work</i> relates only to

1 or 2 replacement windows or doors, to allow matching windows or doors be installed, the frame may be disregarded for assessment purposes, provided that the centre pane *U-value* for each glazed unit is 1.2 W/m²K or less.

Area of windows, doors, rooflights

Where additional windows, doors and rooflights are being created, the total area (including existing) of these elements should not exceed 25% of the total *dwelling* floor area.

In the case of a heated communal *room* or other area (exclusively associated with the *dwelling*s), it should not exceed 25% of the total floor area of these *rooms/areas*.

Reconstruction of elements

Where the build-up of an element forming part of the *insulation envelope* is to be altered or dismantled and rebuilt, the opportunity should be taken to improve the level of thermal insulation. Column b of the table to clause 6.2.9 gives benchmark *U-values* and in many cases these can be achieved without technical risk, within the constraints of the existing *construction*. It is recognised however that certain *constructions* are easier to upgrade than others. A *building* that was in a ruinous state should, after renovation, be able to achieve almost the level expected of new *construction*. It may not however be *reasonably practicable* for a *dwelling*, which is in a habitable condition, to have its internal space significantly reduced in area or height in order to accommodate insulation; or for excessive enabling alterations to be caused by the fitting of external thermal insulation, unless the owner/*occupier* of the *dwelling* intends that these changes are to be made. Other *building* standards and the impact that they will have when upgrading thermal insulation should be taken into account. In the majority of cases however after an alteration of this nature to the *insulation envelope*, a roof should be able to achieve at least an average *U-value* of 0.35 and in the case of a wall or floor, 0.70 W/m²K.

www.energysavingtrust.org.uk

Further guidance on this subject can be found on the Energy Saving Trust website.

Thermal bridging and air infiltration

When alterations are carried out, attention should still be paid to limiting thermal bridging at junctions and around windows, doors and rooflights and limiting air infiltration (clause 6.2.10). As far as alterations are concerned, only the *work* that forms the alteration and the impact of that *work* on the existing *building* need be considered.

6.2.12 Conservatories

Conservatories are a common addition to many *dwelling*s. Traditionally used as an ancillary space, occupied for part of the year, *conservatories* are now often used year-round leading to an increased heating demand. Accordingly, such *buildings* should, like other heated *stand alone buildings*, be *constructed* to limit energy demand and reduce CO₂ emissions.

Some smaller *conservatories* can be exempt from both *building* warrant and *building* standards (see section 0). *Conservatories* of 50 m² or more are subject to standard 6.1 of the non-domestic guidance.

Thermal division

A *conservatory* should be thermally divided from a *dwelling*, being outwith the *insulation envelope* of the *dwelling*. The dividing elements (e.g. wall, door, window) should have *U-values* equal or better than the corresponding exposed elements in the rest of the *dwelling*.

U-values Although *conservatories* are attached to *dwellings*, they are *stand-alone buildings*. Where not exempt, a *conservatory* (heated or unheated) should be built to the same maximum *U-values* as any other new work, as listed in columns b and c of the table in clause 6.2.9, with the exception that *glazing* and framing elements forming the walls or roof of a *conservatory* are unlimited in area and should have a maximum area weighted average *U-value* of 2.0 W/m²K and a maximum individual element *U-value* of 3.3 W/m²K.

Varying *U-values* - 'Compensating *U-values* for windows, doors and rooflights' Individual *U-values* for the *glazed* and framing elements may exceed 2.0 W/m²K provided that the average *U-value* for all the *glazed* and framing elements is no greater than 2.0 W/m²K. An example of this approach is given in annex 6A.

Thermal bridging and air infiltration In order to limit air infiltration and thermal bridging at junctions and around windows, doors and rooflights, guidance in clause 6.2.10 should be followed.

If using the BSD document: '[Conservatories](#)' these issues will be considered to have been taken into account. Draught stripping for windows and doors which are part of the thermal division between the *conservatory* and the *dwelling* should be of a similar standard as the exposed windows and doors elsewhere in the *dwelling*.

6.2.13 Stand-alone buildings

Thermal division of a *stand-alone building* from the remainder of a *dwelling* or *domestic building* is explained in the clause 6.2.12.

For heated *stand-alone buildings* of less than 50 m², the fabric values identified in columns b and c of the table to clause 6.2.9 and clause 6.2.10 should be followed. *U-value* recommendations should be met, though it should be noted that the area of *glazing* is not limited. This allows, for example, a *dwelling* to be extended to create a highly-*glazed stand-alone building* such as a sunroom, with *glazing* in excess of the limits identified in clause 6.2.9.

Stand-alone buildings of 50 m² or more are subject to standard 6.1. Reference should be made to clause 6.1.7 and use of the non-domestic calculation methodology to assess carbon dioxide emissions.

Common areas Where the total area of a communal *room* or other heated accommodation associated with a block of *dwellings* is less than 50 m², these *rooms* or accommodation should also be treated as a *stand-alone building*. Elements (including dividing elements) should have *U-values* equal to or better than those chosen for the rest of the *building*, as determined in conjunction with the methodology in standard 6.1. As part of a new *building*, the area of windows, doors, rooflights and roof windows in these *rooms* or accommodation should be limited to 25% of the total floor area of these common areas.

6.3 Heating system

- 6.3 Functional standard
- 6.3.0 Introduction
- 6.3.1 Gas and oil wet central heating efficiency
- 6.3.2 Solid fuel wet central heating efficiency
- 6.3.3 Electric wet central heating efficiency
- 6.3.4 Heat pump systems efficiency (warm and hot water)
- 6.3.5 Dry central heating systems efficiency
- 6.3.6 Solar water heating efficiency
- 6.3.7 Micro combined heat and power efficiency
- 6.3.8 Efficiency of heating system circulators
- 6.3.9 Controls for wet space heating and hot water systems
- 6.3.10 Controls for dry space heating and hot water systems
- 6.3.11 Controls for combined warm air and hot water systems
- 6.3.12 Controls for solar water heating
- 6.3.13 Work on existing buildings
- 6.3.14 Conservatories

standard

6.3

mandatory

Every *building* must be designed and *constructed* in such a way that the heating and hot water service systems installed are energy efficient and are capable of being controlled to achieve optimum energy efficiency.

Limitation:

This standard does not apply to:

- (a) *buildings* which do not use fuel or power for controlling the temperature of the internal environment;
- (b) heating provided solely for the purpose of frost protection; or
- (c) individual solid-fuel or oil-firing stoves or open-fires, gas or electric fires or *room* heaters (excluding electric storage and panel heaters) provided as secondary heating in *domestic buildings*.

6.3.0 Introduction

In the design of *domestic buildings*, the energy efficiency of the heating plant is an important part of the package of measures which contributes to the overall *dwelling* carbon dioxide emissions. In practice the backstop levels given in this guidance for appliance efficiencies and controls will normally be exceeded to achieve compliance with standard 6.1 for new *buildings*.

This guidance refers to main heating systems for *dwellings*. Both the primary heating and secondary heating systems are taken account of in SAP 2009.

When the guidance in section 3 Environment on heating requirements for *dwellings* is considered along with standard 6.1, central heating (rather than using several individual appliances as primary heating) will usually be the most practical way to satisfy the standards.

EU Directive
2009/28/EC
Article 13

Directive [2009/28/EC](#) promotes the use of energy from renewable sources. Where the *dwelling* design will include use of renewable energy for heating, Article 13 of the directive recommends, amongst other measures, consideration of use of the following:

- For biomass equipment, conversion efficiencies of 85%.
- For heat pumps, those that fulfil the minimum requirements of eco-labelling established in Commission Decision 2007/742/EC of 9 November 2007 establishing the ecological criteria for the award of the Community eco-label to electrically driven, gas driven or gas absorption heat pumps.
- For solar thermal systems, those that are subject to EU standards, including eco-labels and other technical reference systems established by the European standardisation bodies.

Conversions

In the case of conversions, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably practicable*, and in no case be worse than before the conversion (regulation 12, schedule 6).

6.3.1 Gas and oil wet central heating efficiency

Boilers and appliances installed in a *dwelling* or *building* consisting of *dwelling*s should have minimum appliance efficiencies as set out below:

Heating system	Efficiency
Gas central heating boilers (natural gas or LPG)	SEDBUK [1] 90%
Oil central heating boilers	
Conventional boilers	SEDBUK [1] 90%
Combination boilers	SEDBUK [1] 86%
Gas or oil (twin burner) range cooker central heating boilers	75% [2] (gas) 80% [2] (oil)
Gas fired fixed independent space heating appliances used as primary space heating	63% gross
Oil fired fixed independent space heating appliances used as primary space heating	60% gross

Notes:

1. Seasonal Efficiency of Domestic Boilers in the UK (www.sedbuk.com www.boilers.org.uk)
2. Information on seasonal efficiency of range cookers is declared at www.rangeefficiency.org.uk

Vented copper hot water storage vessels associated with the system should meet the heat loss and heat exchanger requirements in BS 1566-1: 2002.

6.3.2 Solid fuel wet central heating efficiency

www.hetas.co.uk

The appliance efficiency should be at least that required for its category as designated by the Heating Equipment Testing Approval Scheme (HETAS) as given in the table below:

Category	Appliance type	Efficiency (gross calorific value)
D	Open fires with high output boilers	63%
F	Room heaters and stoves with boilers	67% (mineral fuels and logs) 70% (wood pellets – part load) 75% (wood pellets – nominal load)
G	Cookers with boilers	65% (mineral fuels) 55-60% (wood fuels)
J	Independent boilers (batch-fed) wood logs	75%
	Independent boilers (batch-fed) multi-fuel	65% (mineral fuels) 75% (wood logs)
	Independent boilers (automatic feed) anthracite	70% up to 20.5kW 75% above 20.5kW
	Independent boilers (automatic feed) wood/pellets/chips	75% nominal load 70% part load

Vented copper hot water storage vessels associated with the system should meet heat loss and heat exchanger requirements in BS 1566-1: 2002 or BS 3198: 1981.

6.3.3 Electric wet central heating efficiency

Electric flow boilers should be *constructed* to meet the requirements of the Low Voltage Directive and Electromagnetic Compatibility Directive, preferably shown by a third party electrical approval e.g. British Electrotechnical Approvals Board (BEAB) or similar. Vented copper hot water storage vessels associated with the system should meet BS 1566: 2002 or BS 3198: 1981.

For the most efficient use of electrical supplies it is recommended that an electric flow boiler is used to provide space heating alone, with the bulk of the hot water demand of the *dwelling* being supplied by a directly heated water heater utilising 'off-peak' electricity tariffs.

6.3.4 Heat pump systems efficiency (warm and hot water)

All heat pumps are at their most efficient when the source temperature is as high as possible, the heat distribution temperature is as low as practicable and pressure losses are kept to a minimum.

When designing a heating system, the following operational provisions should be applied:

System	Supply temperatures
Underfloor heating	30 °C - 40 °C (new systems) 30 °C - 55 °C (existing systems)
Radiators – high efficiency radiators with high water volume should be utilised	40 °C - 55 °C
Fan coil units	35 °C - 45 °C
Domestic hot water	60 °C - 65 °C

Notes:

1. A supplementary method of water heating should be provided if the heat pump is not capable of supplying water at these temperatures during normal operation.

Electrically driven heat pumps should have a coefficient of performance, calculated using the procedures identified in BS EN 14511 series of standards, of not less than:

- 2.2 when used for space heating; or
- 2.0 when used for heating domestic hot water.

Electrically driven heat pump systems should also have a notional Seasonal Performance Factor (SPF) not less than the relevant value identified under clause C.3 of BS EN 15450: 2007.

Reference can be made to the DECC/Carbon Trust [Energy Technology List](#) for assistance in identifying equipment with this recommended performance.

A water distribution system should be arranged for reverse return operation or arranged with a low loss manifold system to maximise efficiency.

6.3.5 Dry central heating systems efficiency

Gas fired warm air systems

For a new gas-fired warm air system, the appliance should meet the recommendations of BS EN 778: 2009 or BS EN 1319: 1999, depending on the design of the appliance. The system should be installed in accordance with the recommendations in BS 5864: 2004. Where a gas-fired circulator is incorporated in the warm-air unit to provide domestic hot water, it should be of a type that is able to deliver full and part load efficiency at least equal to that recommended by BS EN 483: 2000.

Heat pump warm air systems

Refer to guidance in clause 6.3.4 on warm water systems. Minimum clearances adjacent to all airflow paths, as recommended by the manufacturer should be maintained. For ground to air and water to air systems constant water flow should be maintained through the heat pump.

6.3.6 Solar water heating efficiency

Solar water heating has low or zero carbon dioxide emissions and low or no associated running costs and is inherently energy efficient. Reference may be made to BS EN 12975: 2006 for information on collector performance for systems. Location and orientation for optimum energy efficiency and to avoid overshadowing should be considered and SAP 2009 takes account of these issues in order to meet standard 6.1.

The effective solar storage volume of a system should be:

- at least 25 litres (or equivalent heat capacity) per net m² of the solar collector absorber area; or
- a volume (or heat equivalent heat capacity) which is equivalent to at least 80% of the daily hot water demand (V_d) as defined by SAP 2009.

A heat exchanger between a solar primary and secondary system should provide not less than 0.1 m² or equivalent of heat exchanger area per net m² of solar collector absorber area.

The electrical input power of a primary pump in a solar system should be rated at not more than 50 W or 2% of the peak thermal power of the collector, whichever is the higher.

6.3.7 Micro combined heat and power efficiency

This guidance covers micro-combined heat and power (micro-CHP) systems with an electrical output less than 5kWe. It is recommended that the system should be heat-led and capable of exporting electricity to the grid, and controlled in such a way as to avoid heat dumping.

The maximum Heating Plant Emission Rate (HPER) of a micro-CHP system (measured in kgCO₂/kWh) can be determined by dividing the carbon factor of the fuel used by the minimum efficiency, given in clause 6.3.1, for an appliance using that fuel. For example, for a gas CHP system, this would be 0.23 kgCO₂/kWh.

The system HPER should be calculated using the Annual Performance Method for micro-CHP systems that have been tested according to PAS 67 - 'Laboratory test to determine heating and electrical performance of heat led micro-generation packages primarily intended for heating *dwellings*'. Appendix N of [SAP 2009](#) provides further information on assessment of micro-CHP.

6.3.8 Efficiency of heating system circulators

Stand-alone, glandless heating system circulators and water pumps should be rated at a minimum of Band C in respect of energy efficiency, in accordance with the Europump Labelling Scheme. Further information is available at www.bpma.org.uk

6.3.9 Controls for wet space heating and hot water systems

Independent time and temperature control of heating and hot water circuits should be provided along with a boiler interlock (refer to table below) to ensure that the boiler and pump only operate when there is a demand for heat.

Small dwellings *Dwellings* with a total floor area of 150 m² or less should be divided into a minimum of 2 space heating zones, with independent temperature control, one of which is assigned to the living area.

Large dwellings Zone controls are not considered necessary for single *apartment dwellings*. For large *dwellings* with a floor area over 150 m² independent time and temperature control of multiple space heating zones is recommended. Each zone (not exceeding 150 m²) should have a *room* thermostat, and a single multi-channel programmer or multiple heating zone programmers. For hot water systems in large *dwellings*, more than one hot water system should be considered e.g. a separately controlled second hot water cylinder or heat source or a separate distribution system from the same cylinder.

Hot water systems A hot water system (other than for combi boilers with storage capacity 15 litres or less) should have controls that will switch off the heat when the water temperature required by the occupants has been achieved and during periods when there is no demand for hot water. For hot water central heating systems this thermostat should be interconnected with the other controls which are needed to form a boiler interlock.

Wet gas, oil, electric and solid fuel systems The following tables summarise minimum recommendations for controls for space and hot water gas, oil, electric and solid fuel 'wet' central heating systems (radiators, convectors):

Controls for combis, CPSU boilers, electric boilers

Type of control	Means to achieve
Boiler control	Boiler interlock Automatic bypass valve [1][2]
Time control	Time switch (7 day for space heating) Full programmer for electric
<i>Room</i> temperature control	TRVs (all radiators except in <i>rooms</i> with <i>room</i> thermostats or where 'heat bleed' required), <i>Room</i> thermostat(s)

Notes:

- As advised by boiler manufacturer in conjunction with any requirements for a minimum pipe length.
- An electric flow boiler should be fitted with a flow temperature control and be capable of modulating the power input to the primary water depending on space heating conditions.

Controls for other boilers

Type of control	Means to achieve
Boiler control	Boiler interlock (for solid fuel as advised by manufacturer) Automatic bypass valve [1]
Time control	Full programmer (7 day for space and hot water) [2]
Room temperature control	as above table
Cylinder control	Cylinder thermostat plus 2 port valves or a 3 port valve [3] Separately controlled circuits to cylinder and radiators with pumped circulation
Pump control	Pump overrun timing device as required by manufacturer

Notes:

1. As note 1 to first table.
2. For solid fuel the level of sophistication of time controls should be selected to be compatible with the appliance. The highest levels should only be used for appliances with automatic ignition.
3. A zone valve is not recommended for a thermal store.

Boiler management systems

An alternative to the controls shown in the tables above would be a boiler management control system.

Information and explanations of the various controls and heating types can be found on the Energy Saving Trust website and in SAP 2009.

Hot water systems

Solid fuel boilers

These should be thermostatically controlled to reduce the burning rate of the fuel, by varying the amount of combustion air to the fire. For safety reasons, a suitable heat bleed (slumber circuit) from the system should be formed - for example, a gravity fed radiator without a TRV or a hot water cylinder that is connected independent of any controls. For hot water systems, unless the cylinder is forming the slumber circuit, a thermostatically controlled valve should be fitted, provided that the appliance manufacturer's requirements for dealing with excess heat created during a pump over-run are met.

Gas or oil (twin burner) range cooker central heating boilers

An appliance with 2 independently controlled burners (one for cooking and one for the boiler) is recommended.

Gas and oil fired fixed independent space heating appliances

Each appliance should be capable of providing independent temperature control in areas with different heating needs. This could be independent or in conjunction with *room* thermostats or other appropriate temperature sensing devices.

Hot water underfloor heating

System temperature controls The controls described below should be fitted to ensure safe system operating temperatures:

- separate flow temperature high limit thermostat should be used for warm water systems connected to any high water temperature heat supply; and
- mixed systems containing both radiators and underfloor heating, connected to a common high water temperature supply operating at more than 60 °C should be provided with a separate means of reducing the water temperature to the underfloor heating system.

Minimum recommendations for *room* temperature, time and boiler controls are:

Controls for underfloor heating

Type of control	Means to achieve
Room temperature control	Thermostats for each <i>room</i> (adjacent <i>rooms</i> with similar functions may share [1]) Weather compensating controller
Time control	Automatic setback of <i>room</i> temperature during unoccupied periods/at night time
Boiler control	Boiler interlock

Notes:

- Bathrooms or en-suites which share a heating circuit with an adjacent bedroom provide heat only when the bedroom thermostat is activated. In such cases, the bathroom or ensuite areas should be fitted with an independent towel rail or radiator.

Unit controls **Heat pumps hot water systems**
Heat pump unit controls should include:

- control of water temperature for the distribution system;
- control of water pumps (integral or otherwise);
- defrost control of external airside heat exchanger (for air to water units);
- control of outdoor fan operation (for air to water units);
- protection for water flow failure;
- protection for high water temperature;
- protection for high refrigerant pressure; and
- protection for external air flow failure (on air to water units).

External controls Controls which are not integral to the unit should include:

- room* thermostat to regulate the space temperature and interlocked with the heat pump unit operation; and
- timer to optimise operation of the heat pump.

6.3.10 Controls for dry space heating and hot water systems

Small *dwellings* / Large *dwellings* Zone controls are not considered necessary for single *apartment dwellings*. For large *dwellings* with a floor area over 150 m², independent time and temperature control of multiple space heating zones is recommended. Each zone (not exceeding 150 m²) should have a *room* thermostat, and a single multi-channel programmer or multiple heating zone programmers.

Electric storage heaters

Electric storage heater controls should include:

- a. charge control: there should be automatic control of input charge, able to detect the internal or external temperature and adjust the charging of the heater accordingly; and
- b. temperature control: heaters should have manual controls for adjusting the rate of heat release from the appliance. This may take the form of an adjustable damper or some other thermostatically controlled means.

Panel heaters

Time and temperature control should be provided using:

- a programmable time switch and thermostat integral to the appliance; or
- a separate time switch and separate *room* thermostats.

Electric warm air systems

Time and temperature control should be provided either integral to the heater or external, using either:

- a time switch/programmer and *room* thermostat; or
- a programmable *room* thermostat.

Gas fired warm air systems (without water heating)

Time and temperature control should be provided using:

- controls outwith the heater: time switch/programmer and *room* thermostat, or programmable *room* thermostat; or
- controls integrated with heater: time-switch/programmer and *room* temperature sensor linked to heater firing and fan speed control.

Electric underfloor heating

The guidance relating to hot water underfloor heating should be followed (disregarding the boiler interlock). For electric storage, direct acting systems and under-tile systems programmable *room* timer/thermostats with manual over-ride feature *room* controls are recommended for all heating zones, with air and floor (or floor void) temperature sensing capabilities to be used individually or combined. A storage system should have anticipatory controllers installed controlling low tariff input charge with external temperature sensing and floor temperature sensing. A manual override facility should be available for better user control. Controls for storage systems with *room* timer/thermostats should take advantage of low tariff electricity except where the system has anticipatory controllers controlling low tariff input charge with external temperature and floor temperature sensing.

Heat pumps warm air systems

In addition to the controls that are not integral to the unit for heat pump hot water systems (refer to clause 6.3.9) and the controls b to h for such systems, warm air system controls should include:

- control of *room* air temperature (integral or otherwise); and
- control for secondary heating (if fitted) (on air to air systems).

6.3.11 Controls for combined warm air and hot water systems

The first paragraph of the above clause provides guidance on zones for small and large *dwelling*s. However the following controls should be provided in all cases:

- a. independent time control of both the heating and hot water circuits (achieved by means of a cylinder thermostat and a timing device, wired such that when there is no demand for hot water both the pump and circulator are switched off);
- b. pumped primary circulation to the hot water cylinder;
- c. a hot water circulator interlock (achieved by means of a cylinder thermostat and a timing device, wired such that when there is no demand from the hot water both the pump and circulator are switched off); and
- d. time control by the use of either:
 - a full programmer with separate timing to each circuit;
 - two or more separate timers providing timing control to each circuit;
 - a programmable *room* thermostat(s) to the heating circuit(s); or
 - a time switch/programmer (two channel) and room thermostat.

6.3.12 Controls for solar water heating

To ensure the safe and efficient operation of a system, controls should be provided to:

- a. optimise the useful energy gain from the solar collectors into the system's storage vessel(s);
- b. minimise the accidental loss of stored energy by the solar hot water system, whether originating from solar collectors, cold intake or auxiliary heat sources;
- c. ensure that hot water produced by auxiliary heat sources is not used when adequate grade solar pre-heated water is available;
- d. provide a means of control consistent with the solar system being inherently secure against the adverse affects of excessive primary temperatures and pressures;
- e. ensure where possible that, where a separate DHW heating appliance is pre-heated by a solar system, no extra heat is added if the target temperature is already satisfied from the solar pre-heat; and
- f. inform the end user of the system's correct function and performance at all times.

6.3.13 Work on existing buildings

The guidance in the above clauses also relates to:

Conversions, extensions
and complete systems

- space heating/hot water system alterations or installations (including new or replacement appliances) for *conversions* and extensions to the *insulation* envelope; and
- where alterations are being made to an existing heating/hot water system or a new or replacement heating/hot water system is being installed in an existing *dwelling* (or *building* consisting of *dwelling*s). For example thermostatic radiator valves should be installed to all new radiators in an extension even when the heating is from an existing boiler.

For example, thermostatic radiator valves should be installed to all new radiators in an extension even when the heating is from an existing boiler.

Part systems	If a heating and/or hot water system is being replaced in part, the guidance in the above clauses should be followed but only as it affects the new or replaced components of the system. Such alterations should not allow the heating system as a whole to be downgraded in terms of energy efficiency or compromised from a safety point of view.
Condensing boilers	There may be exceptional circumstances which make it impractical or uneconomic to install a condensing boiler as recommended in the guidance to clause 6.3.1. This can be shown by following the criteria set out in the 'Guide to Condensing Boiler Installation Assessment Procedure for Dwellings (Scotland)' Where this occurs the minimum SEDBUK efficiencies are: mains natural gas 78%, LPG 80%, oil combi 82%. Alternatively a replacement back boiler with a SEDBUK of 3 percentage points less than the above recommended figures may be installed. In addition existing gas and oil systems with semi-gravity circulation should be <i>converted</i> to fully pumped systems.
Historic, listed or traditional <i>buildings</i>	For historic, listed or traditional <i>buildings</i> the guidance in the above clauses should be referred to taking into account circumstances. In many cases heating system improvements will be more feasible than any other energy efficiency measures such as improving wall insulation. Therefore systems which go beyond these minimum backstop levels may help offset the deficiency in other areas of energy efficiency and in carbon dioxide emissions terms.

6.3.14 Conservatories

As a *conservatory* which is heated will be inefficient in energy terms, the general guidance to *occupiers* is that they should be heated as little as possible. In view of the fact that heating is often desired particularly at the start and end of the heating season, any *conservatory* with heating installed should have controls that regulate it from the rest of the *dwelling* e.g. a thermostatic radiator valve (TRV) to each radiator.

6.4 Insulation of pipes, ducts and vessels

- 6.4 Functional standard
- 6.4.0 Introduction
- 6.4.1 Insulation of pipes and ducts
- 6.4.2 Insulation of vessels
- 6.4.3 Work on existing buildings

standard

6.4

mandatory

Every *building* must be designed and *constructed* in such a way that temperature loss from heated pipes, *ducts* and vessels, and temperature gain to cooled pipes and *ducts*, is resisted.

Limitation:

This standard does not apply to:

- (a) *buildings* which do not use fuel or power for heating or cooling either the internal environment or water services;
- (b) *buildings*, or parts of a *building*, which will not be heated, other than heating provided solely for the purpose of frost protection; or
- (c) pipes, *ducts* or vessels that form part of an isolated industrial or commercial process.

6.4.0 Introduction

Thermal insulation to heating pipes and *ducts* and hot water storage vessels will improve energy efficiency by preventing:

- uncontrolled heat loss from such equipment; and
- an uncontrolled rise in the temperature of the parts of the *building* where such equipment is situated.

Conversions

In the case of conversions, as specified in regulation 4, the *building as converted* shall meet the requirements of this standard in so far as is *reasonably practicable*, and in no case be worse than before the conversion (regulation 12, schedule 6).

6.4.1 Insulation of pipes and ducts

Warm air *ducts* and hot water pipes serving a space heating system should be thermally insulated against uncontrolled heat loss unless the use of such pipes or *ducts* always contribute to the heating demands of the *room* or space. In some cases this will not be necessary where pipe and *duct* runs occur just behind the internal wall or ceiling linings of the *insulation envelope*. This will not only address energy conservation issues but will also assist with frost protection. Further information on this subject is contained in BR 262, [Thermal Insulation Avoiding Risks](#)

Hot water pipes to appliances

Pipes that are used to supply hot water to appliances within a *domestic building* should be insulated against heat loss. This is to conserve heat in the hot water pipes between frequent successive draw-offs. All pipes of a solar water heating primary system should be insulated.

Insulation for such pipes and *ducts* may be provided by following the guidance on insulation thickness given in BS 5422: 2009. The selection of insulation thickness should be representative of both environmental conditions and fluid temperatures within the pipe or *duct* in question. For example, reference can be made to the 2001 edition of BS 5422 for insulation to pipework within unheated areas.

The *building* design should be considered at an early stage to ensure complete insulation of pipes and *ducts*, where such services pass through or around structural *building* components.

6.4.2 Insulation of vessels

A hot water storage vessel should be insulated against heat loss. Vented copper hot water storage cylinders should comply with the heat loss recommendations within BS 1566-1: 2002. Vessels themselves should be identified as having a standing heat loss (kWh/day) of not more than $1.15 \times (0.2 + 0.051 V^{2/3})$ where V is the declared volume of the vessel.

In addition to guidance within clause 6.4.1, other pipework that connects to the vessel, including any vent pipe or primary flow and return should also be insulated from their point of connection to the vessel to a distance of about 1 m or to where they pass into the *building* fabric.

Insulation should not compromise the safe operation of the system and of any safety devices fitted including, on unvented cylinders, the visibility of warning discharges.

6.4.3 Work on existing buildings

Where a new or replacement boiler or hot water storage vessel is installed, or where existing systems are extended, new or existing pipes that are accessible or exposed as part of the *work* should be insulated as for new systems. Replacement hot water storage vessels should be insulated as for a new vessel and should be identified as having a standing heat loss (kWh/day) of not more than $1.28 \times (0.2 + 0.051 V^{2/3})$, where V is the declared volume of the vessel.

It is recognised that complete insulation will sometimes not be possible, where such services pass through or around structural *building* components, floor joists, for example or where existing systems are wholly or partially retained as part of *conversion works*. In such cases, insulation should be fitted as for new systems as far as is *reasonably practicable*.

6.5 Artificial and display lighting

- 6.5 Functional standard
- 6.5.0 Introduction
- 6.5.1 Fixed internal lighting
- 6.5.2 Fixed external lighting

standard

6.5

mandatory

Every *building* must be designed and *constructed* in such a way that the artificial or display lighting installed is energy efficient and is capable of being controlled to achieve optimum energy efficiency.

Limitation:

This standard does not apply to:

- (a) process and emergency lighting components in a *building*;
- (b) alterations in *dwellings*.

6.5.0 Introduction

Artificial lighting can account for a substantial proportion of the electricity used within a *building*. Appropriate lighting design (including use of natural daylight) can reduce carbon dioxide emissions and running costs, and can also reduce internal heat gains.

Advice on use and specification of low-energy lighting is available from the [Energy Saving Trust](#). This includes documents such as GIL 20 – ‘Low energy domestic lighting’ and CE61 – ‘Energy efficient lighting - guidance for installers and specifiers’.

In respect of this standard:

- fixed light fittings include only the main light sources to a *room* and not display or feature lighting such as picture lights, *kitchen* wall cupboard lights, over mirror lights. A light fitting may contain one or more lamps and a group of lamps operated by the same switch could be counted as one fitting, e.g. A pair of wall lights;
- low energy light fittings should include the provision of lamps/bulbs.

Conversions

In the case of conversions, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably practicable*, and in no case be worse than before the *conversion* (regulation 12, schedule 6).

6.5.1 Fixed internal lighting

Whilst lighting generally represents a relatively small proportion of energy use in the home, this aspect of domestic energy demand can be limited simply and effectively, at very little cost, through the use of energy efficient light fittings and lamps.

Accordingly, a minimum of 75% of the fixed light fittings and lamps installed within a *dwelling* should be low energy type, with a luminous efficacy at least 45 lumens/circuit watt, for example tubular fluorescent and compact fluorescent fittings (CFL's).

These fittings may be either:

- dedicated fittings which will have a separate control gear and will only take low energy lamps (e.g. pin based lamps); or
- standard fittings supplied with low energy lamps with integrated control gear (e.g. bayonet or Edison screw base lamps).

Common areas

Lighting to common areas of *domestic buildings* should follow the guidance above for *dwellings* with the following exception:

- all fixed light fittings and lamps provided to corridors, stairs and other circulation areas should be low energy type. Controls to such lighting, to enable safe use of the areas in question, are identified in guidance to standard 4.6.

6.5.2 Fixed external lighting

Where fixed external lighting is installed, such as to enable safe use of external areas when natural light levels are not sufficient or for security during the hours of darkness, measures should be taken to prevent wasteful use of energy by such fittings.

Fixed external lighting should either:

- be rated at not more than 100 lamp-watts per light fitting with automatic control by both movement detection (e.g. PIR) and photocell to ensure operation only when needed; or
- have fittings with an efficacy of at least 45 lumens per circuit-watt, with automatically control by photocell to ensure operation only when needed.

In addition to the above, manual switching may be provided to override operation of automatic controls.

6.6 Mechanical ventilation and air conditioning

- 6.6 Functional standard
- 6.6.0 Introduction
- 6.6.1 Form and fabric of the building
- 6.6.2 Efficiency of air conditioning systems
- 6.6.3 Efficiency of mechanical ventilation systems

standard

6.6

mandatory

Every *building* must be designed and *constructed* in such a way that:

- (a) the form and fabric of the *building* minimises the use of mechanical ventilating or cooling systems for cooling purposes; and
- (b) ventilating and cooling systems installed are energy efficient and are capable of being controlled to achieve optimum energy efficiency.

Limitation:

This standard does not apply to *buildings* which do not use fuel or power for ventilating or cooling the internal environment.

6.6.0 Introduction

It is not desirable that *dwellings* or *buildings* consisting of *dwellings* have air-conditioning systems or use mechanical ventilation systems for cooling purposes, as this leads to increased energy use and higher carbon dioxide emissions. In view of this, guidance is intended to promote designs that avoid the need for such systems in *dwellings*. However where such systems are installed, which should generally only be a consideration when working with existing *buildings*, a performance specification to limit energy use is set out.

With the drive to reduce carbon dioxide emissions and limit energy demand in *buildings*, the need arises to consider efficient use of mechanical systems, including ventilation. Accordingly, guidance is now offered on power consumption and controls of such systems and on the efficiency of systems that incorporate heat recovery.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirements of this standard in so far as is *reasonably practicable*, and in no case be worse than before the conversion (regulation 12, schedule 6).

Reducing overheating CE 129 EST	<p>6.6.1 Form and fabric of the building</p> <p>In order to minimise any need for mechanical ventilation for cooling or air-conditioning due to high internal temperatures in hot weather the following issues should be considered with regard to the form and the fabric of the <i>dwelling</i>:</p> <ol style="list-style-type: none">a. proportion of translucent <i>glazing</i> taking into account the need for daylighting and artificial lighting (section 3 Environment and standard 6.5);b. orientation of translucently <i>glazed</i> areas;c. solar shading or other solar control measures where areas of the external <i>building</i> fabric are susceptible to solar gain;d. natural ventilation (including night cooling); ande. thermal mass. <p>Further information is available in the Energy Saving Trust publication CE129 - 'Reducing Overheating - A Designer's Guide'.</p>
Poor cross ventilation/ high proportion of translucent <i>glazing</i>	<p>Where a <i>dwelling</i> has little or no cross ventilation (e.g. <i>flats</i> with all external windows/rooflights on one southerly elevation which is orientated between due east and due west) or a high proportion of translucent <i>glazing</i>:</p> <ol style="list-style-type: none">a. the <i>dwelling</i> should be designed to avoid high internal temperature (refer to advice above); andb. it should be shown by calculation that the 'likelihood of high internal temperature in hot weather' in the <i>dwelling</i> is 'not significant, slight or medium'. The recommended method to assess this is Appendix P to SAP 2009. The intention is to avoid the situation where a <i>dwelling occupier</i> installs mechanical cooling or air-conditioning at a later date.
www.bre.co.uk/sap2009	
Cooling system	<p>Where a mechanical cooling system is to be considered for a <i>dwelling</i>:</p> <ol style="list-style-type: none">a. the <i>dwelling</i> should first be designed to avoid any need for a cooling system (refer to advice above);b. then the 'likelihood of high internal temperature in hot weather' should be assessed using Appendix P of SAP 2009. <p>If the 'likelihood of high internal temperature' is 'not significant, slight or medium' an air-conditioning system should not be installed.</p>
	<p>6.6.2 Efficiency of air conditioning systems</p> <p>Where a need for cooling is identified which cannot be addressed by the measures identified in clause 6.6.1 and installation of air conditioning or similar non-passive cooling is proposed, controls and system efficiency should minimise additional energy demand, as follows:</p> <ul style="list-style-type: none">• air-cooled air conditioners working in cooling mode should have an Energy Efficiency Rating greater than 2.4;• water-cooled air conditioners working in cooling mode should have an Energy Efficiency Rating greater than 2.5;• fixed air conditioners should have an energy efficiency classification equal to or better than Class C in Schedule 3 of the labelling scheme adopted under The Energy Information (Household Air Conditioners) (No. 2) Regulations, SI 2005/1726; and• controls should prevent the operation of simultaneous heating and cooling within any area of the <i>building</i>.

6.6.3 Efficiency of mechanical ventilation systems

Energy demand arising from the use of mechanical ventilation should be limited to ensure efficient operation. Specific fan power (SFP) for domestic extract systems should be no greater than the values noted below:

Extract type	SFP
intermittent extract ventilation; continuous supply ventilation	0.5 W/l/s
continuous extract ventilation	0.7 W/l/s
continuous supply and extract with heat recovery ventilation[1]	1.5 W/l/s

Notes:

1. The heat recovery efficiency of a mechanical ventilation and heat recovery (MVHR) system should be 70% or more.

The design and installation of ductwork design can have a significant effect on the effectiveness of a ventilation system. Further guidance on basic good practice in installation and commissioning of ventilation systems can be found on the [Technical Guidance](#) page of the Building Standard Divisions website.

Reference should also be made to section 3 Environment for the provision of ventilation to *buildings*.

Advice on the selection of systems can be found in the Energy Saving Trust document [GPG 268](#) – ‘Energy efficient ventilation in housing- a guide for specifiers’.

6.7 Commissioning building services

- 6.7 Functional standard
- 6.7.0 Introduction
- 6.7.1 Inspection and commissioning

standard
6.7
mandatory

Every *building* must be designed and *constructed* in such a way that energy supply systems and *building* services which use fuel or power for heating, lighting, ventilating and cooling the internal environment and heating the water, are commissioned to achieve optimum energy efficiency.

Limitation:

This standard does not apply to:

- (a) major power plants serving the National Grid;
- (b) the process and emergency lighting components of a *building*;
- (c) heating provided solely for the purpose of frost protection; or
- (d) energy supply systems used solely for industrial and commercial processes, leisure use and emergency use within a *building*.

6.7.0 Introduction

Commissioning in terms of this section means, raising the *building* services systems covered by this guidance from a level of static completion to full working order and achieving the levels of energy efficiency that the component manufacturers expect from their product(s). Commissioning however, should also be carried out with a view to enabling the safe operation of the installation.

Although there is no requirement within section 6 for minimum efficiency levels of either, *building*-integrated or localised energy supply systems (e.g. diesel generators, micro wind turbines or photovoltaic arrays), there is a need for commissioning to be carried out to enable efficient use, unless they are exempt under schedule 1, regulation 3. Major power plants which serve a number of *buildings* (e.g. *housing* estates) and only export surplus electricity to the National Grid will also need to be commissioned, unless exempt in terms of schedule 1, regulation 3.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

6.7.1 Inspection and commissioning

A heating, hot water service, ventilating or cooling system and any decentralised equipment for power generation in a *dwelling* or other area of a *building* consisting of *dwellings* should be inspected and commissioned in accordance with manufacturers' instructions to enable optimum energy efficiency.

6.8 **Written information**

- 6.8 Functional standard
- 6.8.0 Introduction
- 6.8.1 Written information
- 6.8.2 Work on existing buildings

standard
6.8
mandatory

The *occupiers* of a *building* must be provided with written information by the owner:

- (a) on the operation and maintenance of the *building* services and energy supply systems; and
- (b) where any air-conditioning system in the *building* is subject to regulation 17, stating a time-based interval for inspection of the system.

Limitation:

This standard does not apply to:

- (a) major power plants serving the National Grid;
- (b) *buildings* which do not use fuel or power for heating, lighting, ventilating and cooling the internal environment and heating the water supply services;
- (c) the process and emergency lighting components of a *building*;
- (d) heating provided solely for the purpose of frost protection;
- (e) lighting systems in a *domestic building*; or
- (f) energy supply systems used solely for industrial and commercial processes, leisure use and emergency use within a *building*.

6.8.0 Introduction

Correct use and maintenance of *building* services equipment is essential if the benefits of enhanced energy efficiency are to be realised from such equipment. The intention of this standard is to make the information that will help achieve this available to the *occupier* of the *building*.

Although there is no requirement within section 6 for minimum efficiency levels of either *building*-integrated or localised energy supply systems (e.g. diesel generators, micro wind turbines or photovoltaic arrays), there is a need for user and maintenance instructions to enable efficient use, unless they are exempt under schedule 1, regulation 3.

Major power plants which serve a number of *buildings* (e.g. *housing* estates) and only export surplus electricity to the National Grid will also need to have user and maintenance instructions, unless exempt in terms of schedule 1, regulation 3.

Conversions

In the case of *conversions*, as specified in regulation 4, the *building* as *converted* shall meet the requirement of this standard (regulation 12, schedule 6).

6.8.1 Written information

Written information should be made available for the use of the *occupier* on the operation and maintenance of the heating, ventilation, cooling and hot water service system, any additional low carbon equipment installations and any decentralised equipment for power generation to encourage optimum energy efficiency. If an air conditioning system is installed in a *dwelling* the guidance to regulation 17 should be followed.

6.8.2 Work on existing *buildings*

Where alterations are carried out to *building* services on a piecemeal basis, the alterations may not result in optimum energy efficiency being attained for the whole system. In this case a list of recommendations which would improve the overall energy efficiency of the system should be provided.

6.9 Energy performance certificates

- 6.9 Functional standard
- 6.9.0 Introduction
- 6.9.1 Calculating the carbon dioxide emissions for a certificate
- 6.9.2 Information to be provided for dwellings
- 6.9.3 Location of an energy performance certificate
- 6.9.4 Conservatories and other stand-alone buildings

standard
6.9
mandatory

Every *building* must be designed and *constructed* in such a way that:

- (a) an energy performance certificate for the *building* is affixed to the *building*; and
- (c) the energy performance certificate is displayed in a prominent place within the *building*.

Limitation:

- (a) This standard does not apply to *buildings* which do not use fuel or power for controlling the temperature of the internal environment;
- (b) this standard does not apply to non-*domestic buildings* and *buildings* that are ancillary to a *dwelling* that are *stand-alone* having an area less than 50 square metres;
- (c) this standard does not apply to *conversions*, alterations and extensions to *buildings* other than alterations and extensions to *stand-alone buildings* having an area less than 50 square metres that would increase the area to 50 square metres or more, or alterations to *buildings* involving the fit-out of the shell which the subject of a continuing requirement;
- (d) this standard does not apply to *limited life buildings* which have an intended life of less than 2 years;
- (e) Standard 6.9(c) only applies to *buildings* with a floor area of more than 1000 square metres, which are occupied by public authorities and institutions providing public services, which can be visited by the public.

* Standard 6.9(b) removed by the [Building \(Scotland\) Amendment Regulations 2008](#)

6.9.0 Introduction

Article 7 of EU Directive ([2002/91/EC](#)) on the energy performance of *buildings* requires *energy performance certificates* (EPCs) to be made available to prospective owners and tenants when *dwellings* are *constructed*. Standard 6.9 achieves this by making EPCs fixtures within *buildings*.

[Existing buildings](#)

Scottish Ministers have directed local authorities to apply standard 6.9 to all existing *buildings* using Section 25 (2) of the *Building (Scotland) Act 2003*. The direction limits the description of the *buildings* to which it applies to those that are being sold or rented out. The [Energy Performance of Buildings \(Scotland\) Regulations 2008](#) place a duty on owners to make EPCs available to prospective buyers and tenants.

Guidance leaflets are available on the BSD website explaining the action that *building* owners need to take in order to comply.

[Guidance leaflets](#)

Guidance leaflets are available on the Building Standards Division website explaining the action that *building* owners need to take in order to comply.

Conversions

In the case of *conversions*, as specified in regulation 4, standard 6.9 does not apply.

6.9.1 Calculating the carbon dioxide emissions for a certificate

The EU Directive allows energy performance to be reflected in one or more numeric indicators. For this to be done in a transparent manner that is meaningful in terms of Scottish building regulations, the measure to be used is carbon dioxide.

Simplified approach

The certification must be carried out using the Directive compliant methodology and the calculation tool which was used to assess compliance with standard 6.1. In most cases [SAP 2009](#) will have been used for the new *dwelling*. However if the simplified approach referred to in clause 6.1.6 has been adopted for the new *dwelling*, the *construction* specification is well enough defined to allow the certificate to be generated using the simplified approach embedded in SAP software.

Use of actual values

For the purpose of establishing a rating for the *energy performance certificate* for a new *dwelling*, the values and specifications used to obtain a building warrant (as varied by any subsequent amendments to warrant) should be adopted. Where a *domestic building* contains multiple *dwellings*, a rating is required for each individual *dwelling*. However for certification purposes the rating may be recalculated with the percentage of low energy lighting and the type of heating as installed. Note, there will be no need to assume 10% electric secondary heating if secondary heating is not present.

Non-domestic use within *dwellings*

Accommodation up to 50 m² used by an occupant of a *dwelling* in their professional or business capacity should be considered as a part of the *dwelling*.

6.9.2 Information to be provided for *dwellings*

The *energy performance certificate* must display the following information:

- the postal address of the *building* for which the certificate is issued;
- the name of the approved organisation issuing the certificate (if applicable) and may include the member's membership number;
- the date of the certificate;
- the calculation tool used for certification;
- a specific indication of current CO₂ emissions and an indication of potential emissions;
- a seven band scale representing the following bands of carbon dioxide emissions; A, B, C, D, E, F and G, where A = excellent and G = very poor;
- the approximate energy use expressed in kWh per m² of floor area per annum; and
- a list of cost-effective improvements (lower cost measures).

The *energy performance certificate* should also display the following additional information:

- *building* type;
- the conditioned floor area of the *dwelling*;
- the main type of heating and fuel; and
- a statement to the effect of 'N.B. THIS CERTIFICATE MUST BE AFFIXED TO THE BUILDING AND NOT BE REMOVED UNLESS IT IS REPLACED WITH AN UPDATED VERSION'.

A model form for an *energy performance certificate* for a *dwelling* is given on the [Building Standards Division website](#)

Cost-effective improvements

There are only limited cost-effective, low-cost, energy efficiency improvements that can be made to a new *dwelling* (when no other *work* is proposed) such as upgrade insulation in an accessible *roof space* or fit low energy lamps throughout the *dwelling*. Measures presented on the certificate must meet Scottish building regulations, should be technically feasible and specific to the individual *dwelling*.

Additional advice

A piece of advice that is worthwhile including is that a *conservatory* (where one is installed) is only an energy efficiency benefit to the *dwelling* if it remains unheated and is not mechanically cooled. Certificates may give additional advice on projected energy costs and improvements that are cost-effective only when additional *work* is being carried out e.g. providing insulation when replacing *flat roof* coverings. Some experts providing certificates may wish to add extra value and give additional advice to their clients on improvements that are aspirational (e.g. photovoltaics). All of this is welcome, but in every case, such information should only be provided as an appendix to the certificate and be accompanied by advice on relevant warrants and building regulations.

6.9.3 Location of an energy performance certificate

The *energy performance certificate* should be indelibly marked and located in a position that is readily accessible, protected from weather and not easily obscured. A suitable location could be in a cupboard containing the gas or electricity meter or the water supply stopcock.

6.9.4 Conservatories and other stand-alone buildings

For *conservatories* and for other ancillary *stand-alone buildings* of less than 50 m² floor area, an *energy performance certificate* need not be provided. For those *buildings* of a floor area of 50 m² or more, the guidance in the non-domestic Technical Handbook should be followed and an additional certificate supplementing the one for the *dwelling* should be provided.

6.10 Metering

- 6.10 Functional standard
- 6.10.0 Introduction

standard

6.10

mandatory

Every *building* must be designed and *constructed* in such a way that each *building*, or part of a *building*, designed for *different occupation* is fitted with fuel and power meters.

Limitation:

This standard does not apply to:

- (a) *domestic buildings*;
- (b) district or block heating systems where each part of the *building* designed for *different occupation* is fitted with heat meters; or
- (c) heating fired by solid fuel or biomass.

6.10.0 Introduction

This standard does not apply to *domestic buildings* as fuel providers e.g. gas companies, provide meters to *dwellings* to enable correct charging for fuel used by the customer.

Annex

6.A Compensating U-values for windows, doors and rooflights

6.A.0 Introduction

6.A.1 Example of trade-off between windows, doors and rooflights

annex

6.A

6.A.0 Introduction

This annex gives guidance on how to calculate the average *U-values* for windows, doors, and rooflights and supports the guidance to standards 6.1 and 6.2. It may be used with the elemental methods provided and, in particular:

- the simplified approach in the guidance to standard 6.1, where it is not possible to input the individual *U-values* for all the windows, doors and rooflights for the proposed new *dwelling* into the methodology (usually SAP 2009); and
- for *work* on existing *domestic buildings*, namely, *conversions*, extensions, replacements, alterations, and *conservatories* (clauses 6.2.6 to 6.2.12).

Individual windows, doors or rooflights may have *U-values* that exceed the relevant area-weighted average *U-values* identified in guidance provided that the average *U-value* calculated for all the windows, doors and rooflights is no greater than that relevant *U-value*.

The example that follows illustrates how this trade-off can be calculated.

6.A.1 Example of trade-off between windows, doors and rooflights

A proposed new semi-detached *house* has a total window area of 17.8 m² (including frames) and a total door area of 3.8 m². It is proposed to use 2 external quality timber finished *fire doors* with a *U-value* of 1.9 W/m²K.

In order to meet standards 6.1 and 6.2, the additional heat loss due to the use of the poorer external doors should be compensated for by more demanding *U-values* in the windows and/or rooflights so that the average overall *U-value* of such elements does not exceed 1.8 W/m²K (see table to clause 6.2.1).

Specifying windows with a *U-value* of 1.5 W/m²K can achieve this requirement, as shown by the following calculation:

Average *U-value* calculation

Element	Area (m ²)		U-value (W/m ² K)		Rate of heat loss (W/K)
Windows	16.9	x	1.5 [1]	=	25.5
Doors	3.8	x	1.9	=	7.22
Rooflights	0.9	x	1.8 [1]	=	1.62
Total	21.6				34.19

Notes:

- Note that although the windows and rooflights have the same *U-value*, for the purpose of calculation the rooflight value is 0.3 W/m²K poorer due to inclination from the vertical plane (see BR 443 – '[Conventions for U-Value Calculations](#)').

This gives an average *U-value* of 34.19÷21.6, or 1.58 W/m²K. The windows, doors and rooflights can therefore be considered to follow the objectives of the requirement for the *insulation envelope*.

Annex

6.B Compensatory approach - heat loss example

- 6.B.0 Introduction
- 6.B.1 Example: alteration to create rooms in a roof space
- 6.B.2 Proposed attic
- 6.B.3 'Notional attic'
- 6.B.4 The comparison
- 6.B.5 Additional insulation work

annex

6.B

6.B.0 Introduction

This annex gives an example of the compensatory approach for use in the design of *conversions*, extensions and alterations. This is likely to be of use where there is a need to specify one or more *constructions* with a *U-value* higher than the recommended maximum area-weighted average *U-values* given in either column a or b of the table to clause 6.2.9.

The example given in this instance is for an attic *conversion*, however the same principles apply to extensions and substantial alterations.

Note that this method cannot be used in conversions, if recommended *U-values* are only being met as far as is *reasonably practicable*.

Separate *work* under the same building warrant

A single compensatory approach calculation can be carried out to cover separate areas of *work* to an existing *dwelling* provided the same assessment criteria (maximum *U-values*, etc) are applicable to each area of *work*.

6.B.1 Example: alteration to create rooms in a roof space

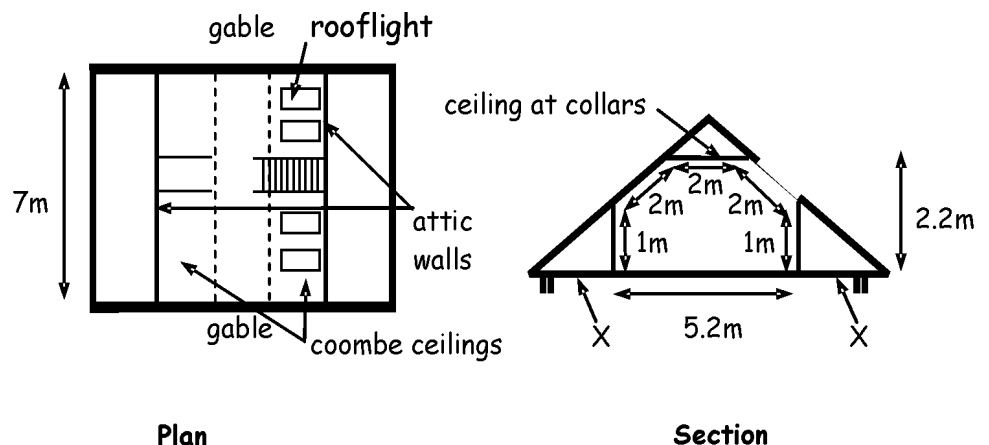
Note; in this example, the fabric performance of the existing *building* allows use of the values within column b in the table to clause 6.2.9.

Compensatory approach example

It is proposed to form two *rooms* in the *roof space* of an existing single storey *dwelling*. The extra floor area created (including opening for stairway) will be 36.4 m². A plan and section of the proposed layout is shown in the figure below. A key part of the design is to create as much headroom as possible below the new coombe ceilings. The existing rafters are only 150 mm deep therefore it is difficult to achieve the recommended elemental *U-value* of 0.18 (see column b in the table to clause 6.2.9), without using branders or having an excessive thickness of insulated ceiling lining. The principal compensatory measure will be to highly insulate the attic walls that occur directly below the lowest part of the coombes. The existing gables will be provided with insulated internal wall lining to improve the *U-value* where the insulation envelope now occurs. The four no. 1.5 m² rooflights installed have timber frames. The floor that will be formed at the line of the existing ceiling ties is wholly within the *insulation envelope* and is therefore disregarded for the purposes of this calculation.

Procedure:

- The internal exposed surface areas of each of the elements of the proposed *building insulation envelope* that has different area-weighted *U-values* are calculated.
- The heat loss for the proposed attic is calculated using proposed *U-values* for *building* elements, which may be higher or lower than those recommended in column b of the table to clause 6.2.9. The percentage area of windows/doors/rooflight area as proposed may also be greater or less than 25%.
- The heat loss for a 'notional attic' (i.e. an attic the same size and shape as the proposed attic but with the area of window/doors/ rooflights taken as a maximum 25% of the floor area) is calculated using the *U-values* in column b in the table to clause 6.2.9.
- Finally, the heat loss for the proposed attic should be less than or equal to that for the 'notional' one.



6.B.2 Proposed attic

Then calculate the rate of heat loss from the proposed attic as follows:

Data for proposed attic alteration

Exposed element	Exposed surface area (m ²)		Proposed U-value (W/m ² K)		Rate of heat loss (W/K)
Gables	19.0	x	0.30	=	5.70
Attic walls	14.0	x	0.20	=	2.80
Ceiling at collars	14.0	x	0.15	=	2.10
Coombe ceiling	22.0	x	0.32	=	7.04
Rooflights	6.0 (16.5%)	x	1.6	=	9.60
Total rate of heat loss					= 27.24

6.B.3 'Notional attic'

Then calculate the rate of heat loss from the 'notional attic' as follows:

Data for 'notional' attic alteration

Exposed element	Exposed surface area (m ²)		Column (b) U-value (W/m ² K)		Rate of heat loss (W/K)
Gables	19.0	x	0.22	=	4.18
Attic walls	14.0	x	0.22	=	3.08
Ceiling at collars	14.0	x	0.15	=	2.10
Coombe ceiling	18.9	x	0.18	=	3.40
Rooflights	9.1 (25%)	x	1.6	=	14.56
Total rate of heat loss					= 27.32

6.B.4 The comparison

From the above comparison, the rate of heat loss from the proposed attic (27.24) is less than that from the 'notional attic' (27.32). Proposals will comply.

6.B.5 Additional insulation work

The existing *dwelling* is of an age where there was no insulation provided in the *roof space* at the time of the original *construction*. Guidance on 'reconstruction of elements' within clause 6.2.11 recommends that where an element forming part of the insulation envelope is to be altered or dismantled and rebuilt, the opportunity should be taken to improve the level of thermal insulation.

In this example, there is no technical risk or other reason which prevents the level ceiling at the eaves of the roof (see X on the section) being upgraded to achieve a *U-value* of 0.15 as noted in column b of the table to clause 6.2.9.

This would therefore be required as part of the proposed *works*.

THE CONSTRUCTION PRODUCTS DIRECTIVE

The *Construction Products Directive* (CPD), implemented in the UK through the Construction Products Regulations 1991, has permitted the introduction of a wide range of standards and specifications recognised throughout the European Economic Area (EEA) (see Note 1). Standards of safety, suitability and fitness measured against factors common throughout Europe are intended to avoid unnecessary barriers to trade. The European Organisation for Standards (CEN) is expected to produce approximately 2000 harmonised European Standards (EN) by 2007 to replace the variety of standards used throughout Member States (see Note 2). These ENs have been or will be published in the UK by the British Standards Institution (BSI) as a BS EN. Once a BS EN is published, BSI declares the corresponding BS obsolescent and a transitional period (normally 1 year) comes into force during which both BS and BS EN may be referenced. At the end of the transitional period the BS is withdrawn and the BS EN must be adopted.

The complex processes involved in the production of European Standards can create lengthy development times. European Standards in draft form are termed prEN and are released into the public domain when they are issued for consultation. It has been found necessary, occasionally, to reference prEN in the Technical Handbooks where no other suitable document yet exists.

Any reference in the Technical Handbooks to a British Standard (BS), British Standard Code of Practice (CP), European Standard (BS EN or prEN) or International Standard (BS EN ISO) is to a standard published by the British Standards Institution. Where a revision or a newer standard has since been produced, this newer version may be used as an alternative, unless otherwise stated in the handbooks. Any reference in the handbooks to a particular requirement or recommendation of such a standard should be taken, unless the context otherwise requires, as including reference to any relevant commentary and defined terminology contained in that standard. Attention is also drawn to the status accorded to standards and specifications recognised elsewhere in the EEA which provide an equivalent standard – see the guidance to Regulation 8, Fitness and durability of materials, and workmanship. Compliance with the standards contained in publications in this category represent compliance with the appropriate standards referred to elsewhere in the handbooks and is acceptable until a relevant harmonised standard is introduced.

Harmonised test methods have been agreed collectively by Member States and CEN on the basis of the implications of health and safety of the product and on the particular nature and production process for the product itself. Certification, inspection and testing of construction products is carried out by *notified bodies* who have been appointed for the purpose by a Member State and whose name has been notified to the European Commission. The British Board of Agrément (BBA) is a *notified body* for certain products. Any reference in the handbooks to a certificate issued by a *notified body* or to a BBA Certificate should be construed as reference to the current certificate.

Any reference in the handbooks to a publication should be construed as a reference to that publication as detailed in Column 1 of the list of publications given in this Appendix, subject to such amendments, supplements or addenda as are detailed in the list.

Where a publication referred to in the handbooks itself refers to another publication, the reference to such other publication should be considered to be a reference to the latest edition including any amendments, supplements or addenda.

Where the standards listed in this Appendix have been amended or replaced since the publication of the handbooks, it is no longer necessary to await the publication of updated guidance. The verifier can accept a design to the new standard if it considers the relevant expanded functional standard is met.

Note 1. The European Economic Area Agreement is given affect in the UK by the European Economic Area Act 1993 and entered into force on 1 January 1994.

Note 2. A Member State is a state which is a member of the European Union or the European Free Trade Association and is a contracting party to the European Economic Area Agreement.

BRITISH STANDARDS

Number	Title	Amended	Section
41: 1973 (1988)	Specification for cast iron spigot and socket flue or smoke pipes and fittings	-	3
BS 476: Part 3: 2004	Fire tests on building materials and structures - External fire exposure roof tests	-	2
BS 476: Part 4: 1970 (1984)	Fire tests on building materials and structures - Non-combustibility test for materials	AMD 2483 AMD 4390	2
BS 476: Part 6: 1989 (2009)	Fire tests on building materials and structures - Method of test for fire propagation for products	-	2
BS 476: Part 7: 1997	Fire tests on building materials and structures - Method for classification of the surface spread of flame of products	AMD 6249 AMD 7030 AMD 7612	2
BS 476: Part 11: 1982 (1988)	Fire tests on building materials and structures - Method for assessing the heat emission from building materials	-	2
BS 476: Part 20: 1987	Fire tests on building materials and structures - Method for determination of the fire resistance of elements of construction (general principles)	AMD 6487	2
BS 476: Part 21: 1987	Fire tests on building materials and structures - Methods for determination of the fire resistance of loadbearing elements of construction	-	2
BS 476: Part 22: 1987	Fire tests on building materials and structures - Methods for determination of the fire resistance of non-loadbearing elements of construction	-	2
BS 476: Part 23: 1987	Fire tests on building materials and structures - Methods for determination of the contribution of components to the fire resistance of a structure	-	2
BS 476: Part 24: 1987	Fire tests on building materials and structures - Method for determination of the fire resistance of ventilation ducts	-	2
BS 476: Part 31: 1983	Fire tests on building materials and structures - Methods for measuring smoke penetration through doorsets and shutter assemblies – method of measurement under ambient temperature conditions (Section 31.1)	AMD 8366	2

BRITISH STANDARDS

Number	Title	Amended	Section
BS 585: Part 1: 1989	Wood stairs - Specification for stairs with closed risers for domestic use, including straight and winder flights and quarter or half landings	AMD 6510	4
BS 648: 1964	Schedule of weights of building materials.	-	2
BS 750: 2006	Specification for underground fire hydrants and surface box frames and covers	-	2
BS 1377:Part 2: 1990	Methods of test for soils for civil engineering purposes - Classification tests	-	3
BS 1449: SEC 1-1: 1991	Steel plate, sheet and strip - Carbon, carbon-manganese plate, sheet and strip, Sect 1.1, General specification	-	3
BS 1566: Part 1: 2002	Copper indirect cylinders for domestic purposes - Open vented copper cylinders – Requirements and test methods	-	6
BS 1566: Part 2: 1984 (1990)	Copper indirect cylinders for domestic purposes - Specification for single feed indirect cylinders	AMD 5791 AMD 6601	6
BS 2782: 2004	Methods of testing plastics. Rate of burning (laboratory method) (Method 508A).	-	2
BS 2869: 2006	Specification for fuel oils for agricultural, domestic and Industrial engines and boilers	-	3
BS 3198: 1981	Specification for copper hot water storage combination units for domestic purposes	AMD 4372 AMD 6599	6
BS 3251: 1976	Indicator plates for fire hydrants and emergency water supplies	-	2
BS 3955: 1986	Specification for electrical controls for household and similar general purposes	-	4
BS 4076: 1989	Specification for steel chimneys	-	1
BS 4211: 2005	Specification for permanently fixed ladders	-	4
BS 4514: 1983 (1998)	Specification for unplasticised PVC soil and ventilating pipes, fittings and accessories	AMD 4517 AMD 5584	2
BS 4604: Part 1: 1970	Use of high strength friction bolts in structural steelwork. Metric series. General grade.	-	1

BRITISH STANDARDS

Number	Title	Amended	Section
BS 4604: Part 2: 1970	Use of high strength friction bolts in structural steelwork. Metric series. Higher grade.	-	1
BS 4987: Part 1: 2005	Coated macadam for roads and other paved areas - Specification for constituent materials and for mixtures	AMD 8122 AMD 8400	4
BS 4987: Part 2: 2003	Coated macadam for roads and other paved areas - Specification for transport, laying and compaction	AMD 8158 AMD 8361	4
BS 5041: Part 4: 1975 (1987)	Fire hydrant systems equipment - Specification for boxes for landing valves for dry risers	AMD 5503	2
BS 5228: Part 1: 1984 (1997)	Noise and vibration control on construction and open sites - Code of practice for basic information and procedures for noise and vibration control	-	5
BS 5250: 2002	Code of practice for control of condensation in buildings	-	3
BS 5262: 1991	Code of practice for external renderings	-	3
BS 5266: Part 1: 2005	Emergency lighting - Code of practice for the emergency lighting of premises	-	2
BS 5266-7: 1999	Lighting application - Emergency lighting (see BS EN 1838: 1999)	-	
BS 5268: Part 2: 2002	Structural use of timber - Code of practice for permissible stress design, materials and workmanship	-	1
BS 5268-3: 2006	Structural use of timber - Code of practice for trussed rafter roofs	-	1
BS 5268: Part 4.1: 1978	Structural use of timber. Fire resistance of timber structures. Recommendations for calculating fire resistance of timber members.	AMD 2947 AMD 6192	2
BS 5268: Part 4.2: 1990	Structural use of timber. Fire resistance of timber structures. Recommendations for calculating fire resistance of timber stud walls and joisted floor constructions	-	2

BRITISH STANDARDS

Number	Title	Amended	Section
BS 5268: Part 6.1: 1996	Structural use of timber. Code of practice for timber frame walls. Dwellings not exceeding four storeys (Section 6.1)	AMD 9265	1
BS 5268: Part 6.2: 2001	Structural use of timber. Code of practice for timber frame walls. Buildings other than dwellings not exceeding four storeys.	-	1
BS 5268: Part 7.1: 1989	Structural use of timber. Recommendations for the calculation basis for span tables. Domestic floor joists.	-	1
BS 5268: Part 7.2: 1989	Structural use of timber. Recommendations for the calculation basis for span tables. Joists for flat roofs.	-	1
BS 5268: Part 7.3: 1989	Structural use of timber. Recommendations for the calculation basis for span tables. Ceiling joists.	-	1
BS 5268: Part 7.4: 1989	Structural use of timber. Ceiling binders.	-	1
BS 5268: Part 7.5: 1990	Structural use of timber. Recommendations for the calculation basis for span tables. Domestic rafters.	-	1
BS 5268: Part 7.7: 1990	Structural use of timber. Recommendations for the calculation basis for span tables. Purlins, supporting sheeting or decking.	-	1
BS 5306: Part 0: 1986	Fire extinguishing installations and equipment on premises. Guide for the selection of installed systems and other fire equipment.	-	2
BS 5306: Part 1: 1976 (1988)	Fire extinguishing installations and equipment on premises - Hydrant systems, hose reels and foam inlets	AMD 4649 AMD 5756	2
BS 5306: Part 4: 2001	Fire extinguishing installations and equipment on premises - Specification for carbon dioxide systems.	-	2
BS 5306: Part 6.1: 1988	Fire extinguishing installations and equipment on premises - Foam systems- Specification for low expansion foam systems.	-	2
BS 5306: Part 6.2: 1989	Fire extinguishing installations and equipment on premises - Specification for medium and high expansion foam systems.	-	2

BRITISH STANDARDS

Number	Title	Amended	Section
BS 5395: Part 2: 1984	Stairs, ladders and walkways - Code of practice for the design of helical and spiral stairs	AMD 6076	4
BS 5395: Part 3: 1985	Stairs, ladders and walkways - Code of practice for the design of industrial type stairs, permanent ladders and walkways	AMD 14247	2, 4
BS 5400: Part 1: 1988	Steel, concrete and composite bridges. General statement.	AMD 14179	1
BS 5400: Part 2: 2006	Steel, concrete and composite bridges. Specification for loads.	-	1
BS 5400: Part 3: 2000	Steel, concrete and composite bridges. Code of practice for design of steel bridges.	AMD 13200 AMD 16404 AMD 16480	1
BS 5400: Part 4:1990	Steel, concrete and composite bridges. Code of practice for design of concrete bridges.	-	1
BS 5400: Part 5: 2005	Steel, concrete and composite bridges. Code of practice for design of composite bridges.	-	1
BS 5400: Part 7: 1978	Steel, concrete and composite bridges. Specification for materials and workmanship, concrete, reinforcing and prestressing tendons.	-	1
BS 5400: Part 8: 1978	Steel, concrete and composite bridges. Recommendations for materials and workmanship, concrete, reinforcing and prestressing tendons.	-	1
BS 5400: Part 10: 1980	Steel, concrete and composite bridges. Code of practice for fatigue.	AMD 9352	1
BS 5410-1: 1997	Code of practice for oil firing - Installations up to 45 kW output capacity for space heating and hot water supply purposes	-	3
BS 5410-2: 1978	Code of practice for oil firing - Installations of 44 kW and above output capacity for space heating, hot water and steam supply purposes	AMD 3638	3
BS 5422: 2009	Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40°C to +700°C	Corrigendum 1 November 2009	6

BRITISH STANDARDS

Number	Title	Amended	Section
BS 5438: 1989 (1995)	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	AMD 6509 AMD 8308	2
BS 5440-1: 2000	Installation of flues and ventilation for gas appliances of rated input not exceeding 60 kW (1st, 2nd and 3rd family gases) - Specification for installation of flues	AMD 8819	3
BS 5440-2: 2000	Installation of flues and ventilation for gas appliances of rated input not exceeding 60 kW (1st, 2nd and 3rd family gases) - Specification for installation of ventilation for gas appliances	AMD 8128	3
BS 5446: Part 2: 2003	Fire detection and fire alarm devices for dwellings	-	2
BS 5492: 1990	Code of practice for internal plastering	-	5
BS 5499: Part 1: 2002	Graphical symbols and signs. Safety signs, including fire safety signs. Specification for geometric shapes, colours and layout.	-	2
BS 5499: Part 4: 2000	Safety signs, including fire safety signs. Code of practice for escape route signing.	-	2
BS 5499: Part 5: 2002	Graphical symbols and signs. Safety signs, including fire safety signs. Signs with specific safety meanings (Specification for additional signs to those given in BS 5378: Part 1)	-	4
BS 5502-22: 2003	Buildings and structures for agriculture. Code of practice for design, construction and loading	-	1
BS 5502-50: 1993.	Buildings and structures for agriculture. Code of practice for design, construction and use of storage tanks and reception pits for livestock slurry	-	3
BS 5534: 2003	Code of practice for slating and tiling - Design	-	3
BS 5588: Part 5: 2004	Fire precautions in the design, construction and use of buildings - Code of practice for fire-fighting stairs and lifts	AMD 7196	2

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Number	Title	Amended	Section
BS 5588: Part 6: 1991	Fire precautions in the design, construction and use of buildings - Code of practice for places of assembly	AMD 10212	2
BS 5588: Part 9: 1999	Fire precautions in the design, construction and use of buildings - Code of practice for ventilation and air conditioning ductwork	-	2
BS 5617: 1985	Specification for urea-formaldehyde (UF) foam systems suitable for thermal insulation of cavity walls with masonry or concrete inner and outer leaves	-	3
BS 5618: 1985 (1992)	Code of practice for thermal insulation of cavity walls (with masonry or concrete inner and outer leaves) by filling with urea-formaldehyde (UF) foam systems	AMD 7114	3
BS 5628-1: 2005	Code of practice for use of masonry - Structural use of unreinforced masonry	-	1
BS 5628-2: 2005	Code of practice for use of masonry - Structural use of reinforced and prestressed masonry	-	1
BS 5628-3: 2005	Code of practice for use of masonry - Materials and components, design and workmanship	-	1, 3
BS 5720: 1979	Code of practice for mechanical ventilation and air conditioning in buildings	-	
BS 5839: Part 1: 2002	Fire detection and alarm systems for buildings - Code of practice for system design, installation commissioning and maintenance	-	2
BS 5839: Part 3: 1988	Fire detection and alarm systems for buildings - Specification for automatic release mechanisms for certain fire protection equipment	AMD 102707	2
BS 5839: Part 6: 2004	Fire detection and alarm systems for buildings - Code of practice for the design and installation of fire detection and alarm systems in dwellings	AMD 9135	2
BS 5839: Part 8: 2008	Fire detection and fire alarm systems for buildings - Code of practice for the design, installation, commissioning and maintenance of voice alarm systems	-	2

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Number	Title	Amended	Section
BS 5839: Part 9: 2003	Fire detection and fire alarm systems for buildings. Code of practice for the design, installation, commissioning and maintenance of emergency voice alarm systems	-	2
BS 5864: 2004	Installation and maintenance of gas-fired ducted air heaters of rated input not exceeding 70 kW net (2nd and 3rd family gases). Specification	-	6
BS 5867: Part 2: 1980 (1993)	Specification for fabrics for curtains and drapes - Flammability requirements	AMD 4319	2
BS 5871-1: 2005	Specification for the installation of gas fires, convector heaters, fire/back boilers and decorative fuel effect gas appliances. Gas fires, convector heaters and fire/back boilers (1st, 2nd and 3rd family gases)	-	3
BS 5871-2: 2005	Specification for the installation of gas fires, convector heaters, fire/back boilers and decorative fuel effect gas appliances. Inset live fuel effect gas fires of heat input not exceeding 15kW (2nd and 3rd family gases)	-	3
BS 5871-3: 2005	Specification for the installation of gas fires, convector heaters, fire/back boilers and decorative fuel effect gas appliances. Decorative fuel effect gas appliances of heat input not exceeding 15kW (2nd and 3rd family gases)	AMD 7033	3
BS 5871-4: 2007	Installation Guidance for Independent flueless gas fires	-	3
BS 5930: 1999	Code of practice for site investigations	-	3
BS 5950: Part 1: 2000	Structural use of steelwork in building - Code of practice for design. Rolled and welded sections	AMD 13199 AMD 17137	1
BS 5950: Part 2: 2001	Structural use of steelwork in building - Specification for materials, fabrication and erection. Rolled and welded sections	-	1
BS 5950: Part 3: 1990 (Section 3.1)	Structural use of steelwork in building - Design in composite construction - Code of practice for design of simple and continuous composite beams	-	1

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Number	Title	Amended	Section
BS 5950: Part 4: 1994	Structural use of steelwork in building - Code of practice for design of composite slabs with profiled steel sheeting	-	1
BS 5950: Part 5: 1998	Structural use of steelwork in building - Code of practice for design of cold formed thin gauge sections	AMD 16502	1
BS 5950: Part 6: 1995	Structural use of steelwork in building - Code of practice for design of light gauge profiled steel sheeting	AMD 10239 AMD 10475	1
BS 5950: Part 7: 1992	Structural use of steelwork in building - Specification for materials and workmanship: cold-formed thin gauge sections	-	1
BS 5950: Part 8: 2003	Structural use of steelwork in building - Code of practice for fire resistant design	AMD 8858	1. 2
BS 5950: Part 9: 1994	Structural use of steelwork in building - Code of practice for stressed skin design	AMD 8315 AMD9326	1
BS 5979: 2000	Code of practice for remote centres for alarm systems.	AMD 9235	2
BS 6180: 1999	Barriers in and about buildings – Code of practice	AMD 13292	4
BS 6229: 2003	Flat roofs with continuously supported coverings. Code of practice	-	3
BS 6262: Part 4: 2005	Glazing for buildings. Code of practice for safety related to human impact	-	4
BS 6283: Part 2: 1991	Safety devices for use in hot water systems - Specification for temperature relief valves for pressures from 1 bar to 10 bar	-	4
BS 6297: 1983	Code of practice for design and installation of small sewage treatment works and cesspools	AMD 6150	3
BS 6387: 1994	Specification for performance requirements for cables required to maintain circuit integrity under fire conditions.	-	2
BS 6399: Part 1: 1996	Loading for buildings - Code of practice for dead and imposed loads	AMD 13669	1, 4

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BS 6399: Part 2: 1997	Loading for buildings - Code of practice for wind loads	-	1
BS 6399: Part 3: 1988	Loading for buildings - Code of practice for imposed roof loads	AMD 6033 AMD 9187 AMD 9452	1
BS 6440: 1999	Powered lifting platforms for use by disabled persons - Code of practice	AMD 10960	2
BS 6461: Part 1: 1984	Installation of chimneys and flues for domestic appliances burning solid fuel (including wood and peat) - Code of practice for masonry chimneys and flue pipes	AMD 5649	3
BS 6676: Part 1: 1986 (1994)	Thermal insulation of cavity walls using man-made mineral fibre batts (slabs) - Specification for man-made mineral fibre batts (slabs)	-	3
BS 6677: Part 1: 1986 (1997)	Clay and calcium silicate pavers for flexible pavements - Specification for pavers	-	4
BS 6717: 2001	Precast, unreinforced concrete paving blocks. Requirements and test methods	-	4
BS 6915: 2001	Specification for design and construction of fully supported lead sheet roof and wall coverings	-	3
BS 6999: 1989 (1995)	Specification for vitreous-enamelled low-carbon-steel flue pipes, other components and accessories for solid-fuel-burning appliances with a rated output of 45kW	AMD 8949	3
BS 7036: 1996	Code of practice for safety at powered doors for pedestrian use.	-	2
BS 7206: 1990	Specification for unvented hot water storage units and packages	AMD 9343	4
BS 7273: Part 4: 2007	Code of practice for the operation of fire protection measures. Actuation of release mechanisms for doors	-	2
BS 7502: 1989	General criteria for the assessment of testing laboratories	-	0

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Number	Title	Amended	Section
BS 7533: Part 2: 2001	Pavements constructed with clay, natural stone or concrete pavers - Guide for the structural design of lightly trafficked pavements constructed of precast paving blocks.	-	4
BS 7543: 2003	Guide to durability of buildings and building elements, products and components	-	0
BS 7566: Part 1: 1992	Installation of factory-made chimneys to BS4543 for domestic appliances - Method of specifying installation design information	-	3
BS 7566: Part 2: 1992	Installation of factory-made chimneys to BS4543 for domestic appliances - Specification for installation design	-	3
BS 7566: Part 3: 1992	Installation of factory-made chimneys to BS4543 for domestic appliances - Specification for site installation	-	3
BS 7566: Part 4: 1992	Installation of factory-made chimneys to BS4543 for domestic appliances - Recommendations for installation design and installation	-	3
BS 7671: 2001	Requirements for electrical installations, IEE Wiring Regulations, Sixteenth edition	AMD 13628 AMD 14905	0, 4
BS 7974: 2001	Application of fire safety engineering principles to the design of buildings – Code of Practice	-	2
PD 7974-0: 2002	Application of fire safety engineering principles to the design of buildings. Guide to design framework and fire safety engineering procedures	-	2
PD 7974-1: 2003	Application of fire safety engineering principles to the design of buildings. Initiation and development of fire within the enclosure of origin (Sub-system 1)	-	2
PD 7974-2: 2002	Application of fire safety engineering principles to the design of buildings. Spread of smoke and toxic gases within and beyond the enclosure of origin (Sub-system 2)	-	2

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Number	Title	Amended	Section
PD 7974-3: 2003	Application of fire safety engineering principles to the design of buildings. Structural response & fire spread beyond the enclosure of origin (Sub-system 3)	-	2
PD 7974-4: 2003	Application of fire safety engineering principles to the design of buildings. Part 4: Detection of fire and activation of fire protection systems. (Sub-system 4)	-	2
PD 7974-5: 2002	Application of fire safety engineering principles to the design of buildings. Fire service intervention. (Sub-system 5)	-	2
BS 8000: Parts 1 to 16	Workmanship on building sites	-	0
BS 8002: 1994	Code of practice for earth retaining structures.	AMD 8851 AMD 12062 AMD 13386	1
BS 8004: 1986	Code of practice for foundations	-	1
BS 8102: 1990	Code of practice for protection of structures against water from the ground	-	3
BS 8103: Part 3: 2009	Structural design of low rise buildings. Code of practice for timber floors and roofs for housing	-	1
BS 8104: 1992	Code of practice for assessing exposure of walls to wind-driven rain	AMD 8358	3
BS 8110: Part 1: 1997	Structural use of concrete - Code of practice for design and construction	AMD 9882 AMD 13468 AMD 16016 AMD 17307	1
BS 8110: Part 2: 1985	Structural use of concrete - Code of practice for special circumstances	AMD 5914 AMD 12061	1, 2
BS 8110 Part 3: 1985	Structural use of concrete - Design charts for singly reinforced beams, doubly reinforced beams and rectangular columns	AMD 5918	1
BS 8118: Part 1: 1991	Structural use of aluminium - Code of practice for design	AMD 10485	1

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Number	Title	Amended	Section
BS 8118: Part 2: 1991	Structural use of aluminium - Specification for materials, workmanship and protection	AMD 10486	1
BS 8200: 1985	Code of practice for design of non-loadbearing external vertical enclosures of buildings	-	3
BS 8206: Part 2: 2008	Lighting for buildings. Code of practice for daylighting	-	6
BS 8208: Part 1: 1985	Guide to assessment of suitability of external cavity walls for filling with thermal insulants - Existing traditional cavity construction	AMD 4996	3
BS 8213: Part 1: 2004	Windows, doors and rooflights - Design for safety in use and during cleaning of windows, including door-height windows and roof windows. Code of practice	-	4
BS 8214: 1990	Code of practice for fire door assemblies with non-metallic leaves (Sections 1 and 2)	AMD 7438	2
BS 8217: 2005	Reinforced bitumen membranes for roofing, Code of practice	-	3
BS 8218: 1998	Code of practice for mastic asphalt roofing	-	3
BS 8297: 2000	Code of practice for design and installation of non-loadbearing precast concrete cladding	-	3
BS 8298: 1994	Code of practice for design and installation of natural stone cladding and lining	-	3
BS 8300: 2001	Design of buildings and their approaches to meet the needs of disabled people. Code of practice	AMD 15617 AMD 15982	4
BS 8301: 1990	Commentary on BS 8301, Code of practice on building drainage	AMD 5904 AMD 6580	3
BS 8303: Part 1: 1994	Installation of domestic heating and cooking appliances burning solid mineral fuels. Specification for the design of installations	-	3
BS 8303: Part 2: 1994	Installation of domestic heating and cooking appliances burning solid mineral fuels. Specification for installing and commissioning on site	-	3

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Number	Title	Amended	Section
BS 8303: Part 3: 1994	Installation of domestic heating and cooking appliances burning solid mineral fuels. Recommendations for design and on site installation	-	3
BS 8313: 1997	Code of practice for accommodation of building services in ducts	-	2
BS 8414: Part 1: 2002	Fire performance of external cladding systems. Test method for non-loadbearing external cladding systems applied to the face of the building	-	2
BS 8414: Part 2: 2005	Fire performance of external cladding systems. Test method for non-loadbearing external cladding systems fixed to and supported by a structural steel frame.	-	2
BS 8515: 2009	Rainwater harvesting systems	-	3
BS 9251: 2005	Sprinkler systems for residential and domestic occupancies. Code of practice	-	2
BS 9990: 2006	Code of practice for non-automatic fire fighting systems in buildings	-	2
BS 10175: 2001	Investigation of partially contaminated sites - Code of practice	-	3
PAS 67: 2008	Laboratory tests to determine the heating and electrical performance of heat-led micro-cogeneration packages primarily intended for heating dwellings	-	6

CODES OF PRACTICE (BRITISH STANDARDS)

Number	Title	Amended	Section
CP 102: 1973	Code of practice for protection of buildings against water from the ground	AMD 1511 AMD 2196 AMD 2470	3
CP 143: Part 5: 1964	Code of practice for sheet roof and wall coverings - Zinc	-	3
CP 143: Part 10: 1973 (1988)	Code of practice for sheet roof and wall coverings - Galvanised corrugated steel: Metric units	-	3
CP 143: Part 12: 1970 (1988)	Code of practice for sheet roof and wall coverings - Copper: Metric units	AMD 863 AMD 5193	3
CP 143: Part 15: 1973 (1986)	Code of practice for sheet roof and wall coverings - Aluminium: Metric units	AMD 4473	3

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Number	Title	Amended	Section
BS EN 54-11: 2001	Fire detection and fire alarm systems - Manual call points.	-	2
BS EN 81-1: 1998	Safety rules for the construction and installation of lifts - Electric lifts	-	2
BS EN 81-2: 1998	Safety rules for the construction and installation of lifts - Hydraulic lifts	-	2
BS EN 81-58: 2003	Safety rules for the construction and installation of lifts - Examination and tests. Landing doors fire resistance test.	-	2
BS EN 81-70: 2003	Safety rules for the construction and installation of lifts. Particular applications for passenger and goods passenger lifts. Accessibility to lifts for persons including persons with disability.	AMD 14675 AMD 14751	4
BS EN 81-72: 2003	Fire fighters lifts	-	
BS EN ISO 140-1: 1998	Acoustics. Measurement of sound insulation in buildings and of building elements. Requirements for laboratory test facilities with suppressed flanking transmission	-	5
BS EN ISO 140-2: 1991	Acoustics. Measurement of sound insulation in buildings and of building elements determination, verification and application of precision data.	-	5
BS EN ISO 140-4: 1998	Acoustics. Measurement of sound insulation in buildings and of building elements. Field measurements of airborne sound insulation between rooms	-	5
BS EN ISO 140-6: 1998	Acoustics. Measurement of sound insulation in buildings and of building elements. Laboratory measurements of impact sound insulation of floors	-	5
BS EN ISO 140-7: 1998	Acoustics. Measurement of sound insulation in buildings and of building elements. Field measurements of impact sound insulation of floors	-	5

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Number	Title	Amended	Section
BS EN ISO 140-8: 1998	Acoustics. Measurement of sound insulation in buildings and of building elements. Laboratory measurements of the reduction of transmitted impact noise by floor coverings on a heavyweight standard floor	-	5
BS EN 179: 2008	Building hardware - Emergency exit devices operated by a lever handle or push pad for use on escape routes - Requirements and test methods.	AMD 13332 AMD 13992	2
BS EN 303-1: 1999	Heating boilers. Heating boilers with forced draught burners. Terminology, general requirements, testing and marking	-	3
BS EN 303-5: 1999	Heating boilers- Heating boilers with forced draught burners	-	3
BS EN ISO 306: 2004	Plastics. Thermoplastic materials. Determination of Vicat softening temperature (VST)	-	2
BS EN 450-1: 2005	General criteria for the operation of various types of bodies performing inspection	-	0
BS EN 483: 2000 +A4:2007	Gas-fire central heating boilers. Type C boilers of nominal heat output not exceeding 70 kW	AMD 13369 + AMD 16504	6
BS EN 525: 2009	Non-domestic direct gas-fired forced convection air heaters for space heating not exceeding a net heat input of 300 kW	-	6
BS EN 621: 2009	Non-domestic gas-fired forced convection air heaters for space heating not exceeding a net heat input of 300 kW, without a fan to assist transportation of combustion air and/or combustion products	-	6
BS EN ISO 717-1: 1997	Acoustics. Rating of sound insulation in buildings and building elements - Airborne sound insulation	-	5
BS EN ISO 717-2: 1997	Acoustics. Rating of sound insulation in buildings and building elements - Impact sound insulation	-	5
BS EN 752: 2008	Drain and sewer systems outside buildings -	-	3

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BS EN 778: 2009	Domestic gas-fired forced convection air heaters for space heating not exceeding a net heat input of 70 kW, without a fan to assist transportation of combustion air and/or combustion products	-	6
BS EN 1020: 2009	Non-domestic forced convection gas-fired air heaters for space heating not exceeding a net heat input of 300 kW incorporating a fan to assist transportation of combustion air or combustion products	-	6
BS EN 1111: 1999	Sanitary tapware. Thermostatic mixing valves (PN 10). General technical specification.	-	4
BS EN 1125: 1997	Building hardware - panic exit devices operated by a horizontal bar - Requirements and test methods.	AMD 13311 AMD 13993	2
BS EN 1155: 1997	Building hardware - electrically powered hold-open devices for swing doors - Requirements and test methods.	-	2
BS EN ISO 1182: 2002	Reaction to fire tests for building products - Non-combustibility test	-	2
BS EN 1287: 1999	Sanitary tapware. Low pressure thermostatic mixing valves. General technical specification.	AMD 10964	4
BS EN 1295-1: 1998	Structural design of buried pipelines under various conditions of loading. General requirements	-	3
BS EN 1319: 1999	Domestic gas-fired forced convection air heaters for space heating, with a fan-assisted burners not exceeding a net heat output of 70 k W	-	6
BS EN 1344: 2002	Clay pavers - requirements and test methods	-	4
BS EN 1363-1: 1999	Fire resistance tests - General requirements	-	2
BS EN 1363-2: 1999	Fire resistance tests - Alternative and additional procedures	-	2
BS EN 1363-3: 2000	Fire resistance tests - Verification of furnace performance	-	2
BS EN 1364-1: 1999	Fire resistance tests for non-loadbearing elements - Walls	-	2

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BS EN 1364-2: 1999	Fire resistance tests for non-loadbearing elements - Ceilings	-	2
BS EN 1365-1: 1999	Fire resistance tests for loadbearing elements - Walls	-	2
BS EN 1365-2: 2000	Fire resistance tests for loadbearing elements - Floors and roofs	-	2
BS EN 1365-3: 2000	Fire resistance tests for loadbearing elements - Beams	-	2
BS EN 1365-4: 1999	Fire resistance tests for loadbearing elements -Columns	-	2
BS EN 1366-1: 1999	Fire resistance tests for service installations - Ducts	-	2
BS EN 1366-2: 1999	Fire resistance tests for service installations - Fire dampers	-	2
BS EN 1443: 2003	Chimneys - general requirements	-	3
BS EN 1457: 1999	Chimneys - Clay/ceramic flue liners - Requirements and test methods	-	3
BS EN 1490: 2000	Building valves. Combined temperature and pressure relief valves, tests and requirements.	-	4
BS EN 1507: 2006	Ventilation for buildings. Sheet metal air ducts with rectangular section. Requirements for strength and leakage	-	6
BS EN 1566-1: 2000	Plastics piping systems for soil and waste discharge (low and high temperature) within building structure - chlorinated poly (vinyl chloride) (PVC-C) specifications for pipes, fittings and the system	-	6
BS EN 1610: 1998	Construction and testing of drains and sewers	-	3
BS EN 1634-1: 2008	Fire resistance and smoke control tests for door and shutter assemblies - openable windows and elements of building hardware, Part 1 - Fire resistance tests for doors, shutters and openable windows.	-	2

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Number	Title	Amended	Section
BS EN 1634-2: 2008	Fire resistance and smoke control tests for door and shutter assemblies - openable windows and elements of building hardware, Part 2 - Fire resistance characterisation test for elements of building hardware.	-	2
BS EN 1634-3: 2004	Fire resistance and smoke control tests for door and shutter assemblies - openable windows and elements of building hardware, Part 3 - Smoke control test for door and shutter assemblies	-	2
BS EN ISO 1716: 2002	Reaction to fire tests for building products - Determination of the gross calorific value	-	2
BS EN 1806: 2000	Chimneys. Clay/ceramic flue blocks for single wall chimneys - Requirements for test methods.	-	3
BS EN 1838: 1999 BS 5266-7: 1999	Lighting applications - Emergency Lighting	-	2
BS EN 1856-1: 2003	Chimneys - Performance requirements for metal chimneys - System chimney products	-	3
BS EN 1856-2: 2005	Chimneys. Performance requirements for metal chimneys - Metal liners and connecting flue pipe products	-	3
BS EN 1857: 2003	Chimneys - Chimney components - Concrete flue liners	-	3
BS EN 1858: 2003	Chimneys - Chimney components - Concrete flue blocks.	-	3
BS EN 1990: 2002	Basis of structural design.	-	1
BS EN 1991-1-1:2002	Actions on structures. General actions - Densities, self-weight and imposed loads for buildings.	-	1
BS EN 1991-1-2:2002	Actions on structures - Part1-2: General actions - Actions on structures exposed to fire.	-	1, 2
BS EN 1991-1-3:2003	Actions on structures. General actions. Snow loads.	-	1
BS EN 1991-1-4:2005	Actions on structures. General actions. Wind actions.	-	1

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Number	Title	Amended	Section
BS EN 1991-1-5:2003	Actions on structures. General actions. Thermal actions.	-	1
BS EN 1991-1-6:2005	Actions on structures. General actions. Actions during execution.	-	1
BS EN 1991-1-7:2006	Actions on structures. General actions. Accidental actions.	-	1
BS EN 1991-2: 2003	Actions on structures. Traffic loads on bridges.	-	1
BS EN 1991-3: 2006	Actions on structures. Actions induced by cranes and machines.	-	1
BS EN 1991-4: 2006	Actions on structures. Silos and tanks.	-	1
BS EN 1992-1-1:2004	Design of concrete structures. General rules and rules for buildings.	-	1
BS EN 1992-1-2:2004	Design of concrete structures - Part 1-2: General rules - Structural fire design.	-	1,2
BS EN 1992-2: 2005	Design of concrete structures. Concrete bridges. Design and detailing rules.	-	1
BS EN 1992-3: 2006	Design of concrete structures. Liquid retaining and containing structures.	-	1
BS EN 1993-1-1: 2005	Design of steel structures. General rules and rules for buildings.	-	1
BS EN 1993-1-2: 2005	Design of steel structures. General rules - Structural fire design.	-	2
BS EN 1993-1-3: 2006	Design of steel structures. General rules. Supplementary rules for cold formed members and sheeting.	-	1
BS EN 1993-1-4: 2006	Design of steel structures. General rules. Supplementary rules for stainless steels.	-	1
BS EN 1993-1-5: 2006	Design of steel structures. Plated structural elements.	-	1
BS EN 1993-1-6: 2007	Design of steel structures. General. Strength and stability of shell structures.	-	1

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Number	Title	Amended	Section
BS EN 1993-1-7: 2007	Design of steel structures. Plated structures subject to out of plane loading.	-	1
BS EN 1993-1-8: 2005	Design of steel structures. Design of joints.	-	1
BS EN 1993-1-9: 2005	Design of steel structures. Fatigue.	-	1
BS EN 1993-1-10: 2005	Design of steel structures. Material toughness and through - thickness properties.	-	1
BS EN 1993-1-11: 2006	Design of steel structures. Design of structures with tension components.	-	1
BS EN 1993-1-12: 2007	Design of steel structures. Additional rules for the extension of EN 1993 to grades S700.	-	1
BS EN 1993-2: 2006	Design of steel structures. Steel bridges.	-	1
BS EN 1993-3-1: 2007	Design of steel structures. Towers, masts and chimneys. Towers and masts.	-	1
BS EN 1993-3-2: 2008	Design of steel structures. Towers, masts and chimneys. Chimneys.	-	1
BS EN 1993-4-1: 2007	Design of steel structures. Silos, tanks and pipelines. Silos.	-	1
BS EN 1993-4-2: 2007	Design of steel structures. Silos, tanks and pipelines. Tanks.	-	1
BS EN 1993-4-3: 2007	Design of steel structures. Silos, tanks and pipelines. Pipelines.	-	1
BS EN 1993-5: 2007	Design of steel structures. Piling.	-	1
BS EN 1993-6: 2007	Design of steel structures. Crane supporting structures	-	1
BS EN 1994-1-1: 2004	Design of composite steel and concrete structures. General rules and rules for buildings.	-	1
BS EN 1994-1-2: 2005	Design of composite steel and concrete structures. General rules - Structural fire design.	-	2
BS EN 1994-2: 2005	Design of composite steel and concrete structures. General rules and rules for bridges.	-	1

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Number	Title	Amended	Section
BS EN 1995-1-1: 2004	Design of timber structures. General. Common rules and rules for buildings.	-	1
BS EN 1995-1-2: 2004	Design of timber structures. General rules. Structural fire design.	-	2
BS EN 1995-2-1: 2004	Design of timber structures. Bridges.	-	1
BS EN 1996-1-1: 2005	Design of masonry structures. General rules for reinforced and unreinforced masonry structures.	-	1
BS EN 1996-1-2: 2005	Design of masonry structures. General rules. Structural fire design.	-	2
BS EN 1996-2: 2005	Design of masonry structures. Design considerations, selection of materials and execution of masonry	-	1
BS EN 1996-3: 2006	Design of masonry structures. Simplified calculation methods for unreinforced masonry structures.	-	1
BS EN 1997-1: 2004	Geotechnical design. General rules	-	1
BS EN 1997-2: 2007	Geotechnical design. Ground investigation and testing.	-	1
BS EN 1998-1: 2004	Design of structures for earthquake resistance. General rules. Seismic actions for buildings.	-	1
BS EN 1998-2: 2005	Design of structures for earthquake resistance. Bridges.	AMD 1/2009	1
BS EN 1998-3: 2005	Design of structures for earthquake resistance. Assessment and retrofitting of buildings.	-	1
BS EN 1998-4: 2006	Design of structures for earthquake resistance. Silos, tanks and pipelines.	-	1
BS EN 1998-5: 2004	Design of structures for earthquake resistance. Foundations, retaining structures and geotechnical aspects.	-	1
BS EN 1998-6: 2005	Design of structures for earthquake resistance. Towers, masts and chimneys.	-	1
BS EN 1999-1-1: 2007	Design of aluminium structures. General rules.	-	1

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Number	Title	Amended	Section
BS EN 1999-1-2: 2007	Design of aluminium structures. General rules - Structural fire design.	-	
BS EN 1999-1-3: 2007	Design of aluminium structures. Additional rules for structures susceptible to fatigue.	-	1
BS EN 1999-1-4: 2007	Design of aluminium structures. Supplementary rules for trapezoidal sheeting.	-	1
BS EN 1999-1-5: 2007	Design of aluminium structures. Supplementary rules for shell sheeting.	-	1
BS EN 5864: 2004	Installation and maintenance of gas-fired ducted air heaters of rated output not exceeding 70 kW (second and third family gases). Specification.	-	6
BS EN ISO 6946:2007	Building components and building elements. Thermal resistance and thermal transmittance - Calculation method	-	6
BS EN 7512: 1989	General requirements for bodies operating assessment and certification/registration of quality systems	-	0
BS EN ISO 8990: 1996	Thermal insulation. Determination of steady-state thermal transmission properties. Calibrated and guarded hot box	-	6
BS EN ISO 9000-1: 1994	Quality management and Quality assurance standards	-	0
BS EN ISO 10077-1: 2006	Thermal performance of windows, doors and shutters Calculation of thermal transmittance - Simplified method	Corrigendum (Feb 2010)	6
BS EN ISO 10077-2: 2003	Thermal performance of windows, doors and shutters. Calculation of thermal transmittance - Numerical method for frames	-	6
BS EN ISO 10211: 2007	Thermal bridges in building construction. Heat flows and surface temperatures. Detailed calculations	-	6
BS EN ISO 11925-2: 2000	Reaction to fire tests for building products. Ignitability when subjected to direct impingement of a flame	-	2

EUROPEAN STANDARDS

Number	Title	Amended	Section
BS EN 12056-1: 2000	Gravity drainage systems inside buildings. Gravity drainage systems inside buildings. General and performance requirements.	-	3
BS EN 12056-2: 2000	Gravity drainage systems inside buildings. Sanitary pipework, layout and calculation	-	3
BS EN 12056-3: 2000	Gravity drainage systems inside buildings. Roof drainage, layout and calculation	-	3
BS EN 12056-4: 2000	Gravity drainage systems inside buildings. Wastewater lifting plants. Layout and calculation	-	3
BS EN 12101-3:2003	Smoke and heat control systems. Specification for powered smoke and heat exhaust ventilators.	-	2
BS EN 12101-6:2005	Smoke and heat control systems. Specification for pressure differential systems.	-	2
BS EN 12237: 2003	Ventilation for buildings. Ductwork. Strength and leakage of circular sheet metal ducts	-	6
BS EN 12354-5: 2009	Building Acoustics - Estimation of acoustic performance of buildings from the performance of elements.	-	5
BS EN 12380: 2002	Air admittance valves for drainage systems. Requirements, test methods and evaluation of conformity.	-	3
BS EN 12391-1: 2003	Chimneys. Execution standards of metal chimneys. Part 1. Chimneys for non-roomsealed heating appliances	-	3
BS EN 12416-2:2001	Automatic fire suppression- Powder systems	-	2
BS EN 12446: 2003	Chimneys – Components, concrete outer wall elements	-	3
BS EN 12524: 2000	Building materials and products. Hygrothermal properties – Tabulated design values	-	6
BS EN 12566-1: 2000	Small wastewater treatment systems for up to 50PT. Prefabricated septic tanks	-	3

EUROPEAN STANDARDS

Number	Title	Amended	Section
BS EN 12567-2: 2005	Thermal performance of windows and doors - determination of thermal transmittance by hot box method roof windows and other projecting windows	-	6
BS EN 12664: 2001	Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Dry and moist products of medium and low thermal resistance	AMD 14031	6
BS EN 12667: 2001	Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Products of high and medium thermal resistance.	-	6
BS EN 12809: 2001	Residential independent boilers fired by solid fuel.	-	3
BS EN 12845: 2004 +A2: 2009	Fixed fire-fighting systems. Automatic sprinkler systems. Design, installation and maintenance.	-	2
BS EN 12939: 2001	Thermal performance of building materials and products - determination of thermal resistance by means of guarded hot plate and heat flow meter methods - thick products of high and medium thermal resistance - includes corr14030 Dec 02	AMD14030	6
BS EN 12975-1: 2006	Thermal solar systems and components - solar collectors general requirements - includes amd16423 May 06	-	6
BS EN 12975-2: 2006	Thermal solar systems and components - solar collectors test methods - includes amd16424 May 06	AMD 16424 (May 2006)	6
BS EN 13162: 2001	Thermal insulation products for buildings, Factory made mineral wool (MW) products specification	-	3
BS EN 13229: 2001	Inset appliances including open fires fired by solid fuel	-	3
BS EN 13240: 2001	Room heaters fired by solid fuel	-	3
BS EN ISO 13370: 2007	Thermal performance of buildings. Heat transfer via the ground. Calculation methods.	Corrigendum (March 2009)	6

EUROPEAN STANDARDS

Number	Title	Amended	Section
BS EN 13384-1: 2002	Chimneys. Thermal and fluid dynamic calculation methods. Chimneys serving one appliance	-	3
BS EN 13501-1: 2007	Fire classification of construction products and building elements. Classification using test data from reaction to fire tests	-	2
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).	-	2
BS EN 13501-3: 2005	Fire classification of construction products and building elements. Classification using data from fire resistance tests on products and elements used in building service installations. Fire resisting ducts and fire dampers (other than smoke control systems).	-	2
BS EN 13501-4: 2007	Fire classification of construction products and building elements. Classification using data from fire resistance tests on smoke control systems.	-	2
BS EN 13501-5: 2005	Fire classification of construction products and building elements. Classification using data from external exposure to roof tests	-	2
BS EN ISO 13789: 2007	Thermal performance of buildings. Transmission heat loss co-efficient - Calculation method.	-	6
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
BS EN 13829: 2001	Thermal performance of buildings - determination of air permeability of buildings - fan pressurisation method'	-	6
BS EN 13842: 2004	Oil fired forced convection air heaters. Stationary and transportable for space heating	-	6
BS EN 14511: 2007	Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling.	-	6

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Number	Title	Amended	Section
BS EN 14785:2006	Residential space heating appliances fired by wood pellets.	-	3
BS EN 15232: 2007	Energy performance of buildings. Impact of building automation, controls and building management	-	6
BS EN 15450: 2007	Heating systems in buildings. Design of heat pump heating systems	-	6
BS EN ISO/IEC 17011: 2004	Calibration and testing laboratory accreditation systems – general requirements for operation and recognition	-	0
BS EN ISO/IEC 17020:2004	General criteria for the operation of various types of bodies performing inspections	-	0
BS EN ISO/IEC 17021:2006	Conformity assessment-Requirements for providing audit and certification of management systems	-	0
BS EN ISO/IEC 17024: 2003	General criteria for certification bodies operating certification of personnel	-	0
BS EN ISO/IEC 17025: 2005	General requirements for the competence of testing and calibration laboratories	-	0
BS EN ISO/IEC 17050-1: 2004	Conformity assessment - Suppliers declaration of conformity	-	0
BS EN ISO/IEC 17050-2: 2004	General criteria for supplier's declaration of conformity	-	
BS EN 45002: 1989	General criteria for the assessment of testing laboratories	-	0
BS EN 45011: 1998	General requirements for bodies operating product certification systems	-	0
BS EN 60742 : 1996	Isolating transformers and safety isolating transformers. Requirements	-	4

DRAFTS FOR DEVELOPMENT (EUROPEAN STANDARDS)

Number	Title	Amended	Section
DD ENV 1187: 2002 + A1: 2005	Test methods for external fire exposure to roofs.	-	2

Note:

Copies of British Standards and British Standards Codes of Practice, European Standards, Drafts for Development and International Standards may be purchased from the British Standards Institution.

LEGISLATION - STATUTORY INSTRUMENTS

Title	Section
Boiler (Efficiency) Regulations, 1993	3
Building (Procedure)(Scotland) Regulations, 2004	6
Building (Scotland) Act, 2003	0
Cinematographic (Safety) (Scotland) Regulations 1955	2
Civic Government (Scotland) Act, 1982 – Order 2000	2
Construction (Design and Management) Regulations, 1994	5
Construction (Design and Management) Regulations, 2007	1,2,5
Control of Pollution Act 1974	3
Dangerous Substances and Explosive Atmosphere Regulations 2002	2
Electricity Act 1989	4
Electricity Safety, Quality and Continuity Regulations 2002	4
Energy Act 1983	4
Environment Act 1995	3
Environmental Protection Act, 1990	3
EU Directive 2002/91/EC on the Energy Performance of Buildings (EPBD)	6
EU Directive 2004/108/EC Electromagnetic Compatibility Directive	6
EU Directive 2006/32/EC on energy end-use efficiency and energy services	6
EU Directive 2006/95/EC Low Voltage Directive	6
EU Directive 2009/28/EC on the promotion of the use of energy from renewable sources	6
Factories Act 1961	4
Fire (Scotland) Act 2005 as amended	2
Fire Safety (Scotland) Regulations 2006	2
Fire Safety and Safety of Places of Sport Act 1987	1,2
Gas Appliance (Safety) Regulations, 1995	3

LEGISLATION - STATUTORY INSTRUMENTS

Title	Section
Gas Safety (Installation and Use) Regulations, 1998	3, 4
Groundwater Regulations 1998	3
Health & Safety at Work etc Act 1974	0
Health and Safety (Safety Signs and Signals) Regulations 1996	2
Management of Health & Safety at Work Regulations 1999	2
Manual Handling Operations Regulations, 1992	5
Mines and Quarries Act 1954	4
Pipelines Safety Regulations 1996, SI 1996 No 825	2
Regulation of Care (Scotland) Act 2001	2
Safety of Sports Grounds Act, 1975	1,2
Sewage (Scotland) Act, 1968	3
Water Byelaws 2004	3
Water Environment (Controlled Activities)(Scotland) Regulations 2005	3
Water Environment (Oil Storage)(Scotland) Regulations 2006	3
Technical Standards for compliance with the Building Standards (Scotland) Regulations, 1990, as amended	6

OTHER PUBLICATIONS

Title	Reference	Publisher	Section
Section 0 - General			
CE Marking under the Construction Products Directive (2001)	-	DETR	0
Section 1 - Structure			
Appraisal of existing structures (2009).	-	Institution of Structural Engineers.	1
Design guidance for disproportionate collapse	-	UK Timber Frame Association	1
Dynamic performance requirements for permanent grandstands subject to crowd action. Recommendations for management design and assessment (2008).	-	Institution of Structural Engineers.	1
Guide to Safety at Sports Grounds, Fifth Edition (2008).	-	The Stationary Office	1,2
How to design concrete buildings to satisfy disproportionate collapse requirements.	-	The Concrete Centre	1
Masonry Design for Disproportionate collapse Requirement under Regulation A3 of the Building Regulations (England and Wales).	-	Brick Development Association	1
Natural stone masonry in modern Scottish construction	-	Scottish Stone Liaison Group	1
Small Buildings Structural Guidance (2010).	-	Scottish Government	1
Temporary demountable structures - Guidance on procurement, design and use (2007).	-	Institution of Structural Engineers.	1
The Building Regulations 2004 Edition- England and Wales- Requirement A- Disproportionate Collapse	-	NHBC	1

OTHER PUBLICATIONS

Title	Reference	Publisher	Section
Section 2 - Fire			
A simplified approach to alternative fire safety strategies (2010)	-	Scottish Government	2
Code of Practice on Sprinklers in Schools	-	British Automatic Fire Sprinkler Association	2
Construction Products Directive, as amended by CE Marking Directive (93/68/EEC) and Fixing and use of CE Marks Directive (93/465/EEC)	89/106/EEC	EC	2
Defect Action Sheet (Design), Housing Defects Prevention Unit (1985)	DAS8	Building Research Establishment	2
Design, Construction, Specification and Fire Management of Insulated Envelopes for Temperature Controlled Environments (2008).	-	International Association of Cold storage Construction (European Division)	2
Design methodologies for smoke and heat exhaust ventilation (1999).	BR 368	Building Research Establishment	2
EC Commission Decision 2000/147/EC on 8.2.00 implementing Council Directive 89/106/EEC	2000/147/EC	EC	2
EC Commission Decision 2000/367/EC on 3.5.00 implementing Council Directive 89/106/EEC	2000/367/EC	EC	2
EC Commission Decision 94/611/EC implementing Council Directive 89/106/EEC	94/611/EC	EC	2
EC Commission Decision 96/603/EC implementing Council Directive 89/106/EEC	96/603/EC	EC	2
External Fire Spread: Building Separation and Boundary Distances (1991)	BR 187	Building Research Establishment	2
Firecode, Edition 3, NHS Scotland Property and Environment Forum (2003)	-	NHS Scotland	2
Fire Performance of external thermal insulation for walls of multi-storey buildings (2002)	BR 135	Building Research Establishment	2

OTHER PUBLICATIONS

Title	Reference	Publisher	Section
Fire safe design: A new approach to multi-storey steel framed buildings (2000)	P288	Steel Construction Institute	2
Guidelines for the Construction of Fire Resisting Structural Elements	BR 128	Building Research Establishment	2
Guide for Practitioners 6 - Conversion of traditional buildings (2007)	-	Historic Scotland	2
Hardware for Fire and Escape Doors - Issue 2: 2006	-	Door and Hardware Federation and the Guild of Architectural Ironmongers	2
International Fire Engineering Guidelines 2005	-	Australian Building Codes Board	2
Loss Prevention Council - Rules for Automatic Sprinkler Installations 2009 (Incorporating BS EN 12845)	-	LPC	2
Safety signs and signals: Guidance on Regulations - The Health and Safety (Safety Signs and Signals) Regulations 1996.	-	Health and Safety Executive	2
Single storey steel frame buildings in fire boundary conditions (2002).	P313	Steel Construction Institute	2
Smoke shafts protecting fire-fighting shafts: their performance and design (2002).	-	Building Research Establishment	2
Technical memorandum TM19 (1995)	-	Chartered Institute of Building services	2
Vehicle finishing units fire and explosion hazards, Guidance Note (1981)	PM25	Health and Safety Executive	2
Section 3 - Environment			
Achieving air tightness	GBG 67	Building Research Establishment	3
Advice on Flues for Modern Open Flued Oil Fired Boilers (2001)	Technical Book 3	Oil Firing Technical Association	3

OTHER PUBLICATIONS

Title	Reference	Publisher	Section
Air Supply Requirements (2001)	Technical Book 3	Oil Firing Technical Association	3
Assessment of the risk of environmental damage being caused by spillage from domestic oil storage tanks (1999)	Technical Book 3	Oil Firing Technical Association	3
CIBSE Guide B: 1986: section B2 (1986)	-	Chartered Institution of Building Services Engineers	3
Code of practice for ground floor, multi-storey and underground car parks, section 4 (1994)	-	Association for Petroleum and Explosive Administration	3
Contaminants in soils, collation of toxicological data and intake values for humans	CLR9	Environment Agency	3
Contaminated land exposure assessment (CLEA) model, technical basis and algorithms	CRL10	Environment Agency	3
Continuous mechanical ventilation in dwellings: design, installation and operation (1994)	Digest 398	Building Research Establishment	3
Control of legionella bacteria in water systems - approved code of practice	HSE L8	Health and Safety Executive	3
Dangerous Substances Directive	76/464/EEC	EC	3
Design Guidance on Flood Damage to Dwellings (1996)	-	Scottish Executive	3
Development and Flood Risk	C624	CIRIA	3
Development of Contaminated Land - Planning Advice Note	PAN 33	Scottish Executive	3
Drainage Assessment: a guide for Scotland	-	SEPA	3
Fire Protection of Oil Storage Tanks (2001)	Technical Book 3	Oil Firing Technical Association	3
Flows and Loads - 2, Code of practice	-	British Water	3
Garage installations (1999)	Technical Book 3	Oil Firing Technical Association	3

OTHER PUBLICATIONS

Title	Reference	Publisher	Section
Gas installation in timber frame and light steel framed buildings (2006)	IGE/UP/7 (Edition 2)	Institution of Gas Engineers	3
Good Building Guide, Parts 1 and 2	GBG 42	Building Research Establishment	3
Groundwater Directive	80/68/EEC	EC	3
Guidance for the safe development of housing on land affected by contamination (2000)	-	National House Building Council and Environment Agency	3
Harvesting Rainwater for domestic use:- an information guide	-	Environment Agency	3
Housing For Varying Needs, 1999	-	Communities Scotland	3
Installing Oil Supply Pipes Underground (2001)	Technical Book 3	Oil Firing Technical Association	3
Improving the flood performance of new buildings. 2007	-	Construction Industry Research and Information Association (CIRIA)	3
Land contamination risk assessment tools: an evaluation of some of the commonly used methods	Technical Report P260	Environment Agency	3
Lifetime Homes Standards	-	Joseph Rowntree Foundation	3
Mound filter systems for domestic wastewater	BR 478	Building Research Establishment	3
National Waste Plan, 1999	-	SEPA	3
Non-liquid saturated treatment systems (1999)	NSF/ANSI 41-1999	National Sanitation Foundation (USA)	3
Oil fired appliances and extract fans (1996)	Technical Book 3	Oil Firing Technical Association	3
Oil Firing Equipment Standard – Flues for use with Oil Fired Boilers with Outputs not above 50 kW (2001)	Standard OFS E106	Oil Firing Technical Association	3

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Title	Reference	Publisher	Section
Oil Firing Equipment Standard – Steel Oil Storage Tanks and Tank Bunds for use with Distillate Fuels, Lubrication Oils and Waste Oils (2002)	Technical Standard OFS T200	Oil Firing Technical Association	3
Oil firing industry technical advice on fire valves	Technical Book 3	Oil Firing Technical Association	3
Oil-fired appliance standard heating boilers with atomising burners, output up to 70kW and maximum operating pressures of 3Bar (1998)	Applied Standards A100	Oil Firing Technical Association	3
Oil Firing Technical Association	Applied Standard OFS A101	Oil Firing Technical Association	3
Passive stack ventilation systems (1994)	IP 13/94	Building Research Establishment	3
Performance of building materials in contaminated land (1994)	BR255	Building Research Establishment	3
Planning and Building Standards Advice on Flooding	PAN 69	Scottish Executive	3
Planning and Flooding, Scottish Planning Policy (2003)	SPP7	Scottish Executive	3
Planning and Sustainable Urban Drainage Systems	PAN61	Scottish Executive	3
Polyethylene oil tanks and bunds for distillate fuel (1999)	Technical Standard OFS T100	Oil Firing Technical Association	3
Positioning of flue terminals	Technical Book 3	Oil Firing Technical Association	3
Preparing for Floods (2003)	-	ODPM	3
Prevention of Environmental Pollution from Agricultural Activity, Code of practice (2005)	-	Scottish Executive	3
Priority contaminants report	CLR 8	Environment Agency	3
Radon: guidance on protection measures for new dwellings in Scotland (1999)	BR376	Building Research Establishment	3

OTHER PUBLICATIONS

Title	Reference	Publisher	Section
Radon in dwellings in Scotland:2008 Review and Atlas	-	Health Protection Agency (HPA)	3
Rainwater and greywater use in buildings: best practice guidance	C539	CIRIA	3
Reed beds, BRE Good Building Guide 42, Parts 1 and 2 (2000)	GBG 42	Building Research Establishment	3
Roofs and roofing – performance, diagnosis, maintenance, repair and avoidance of defects	-	Building Research Establishment	3
Room heaters with atomising or vapourising burners with or without boilers, heat output up to 25kW	Applied Standard A102	Oil Firing Technical Association	3
Secondary model procedure for the development of appropriate soil sampling strategies for land contamination	R&D Technical Report P5	Environment Agency	3
Sewers for Scotland (2001)	-	Water Research Council	3
Soakaway design (1991)	BRE Digest 365	BRE Digest 365	3
Spillage of flue gases from solid fuel combustion appliances, Information Paper (1994)	IP 7/94	Building Research Establishment	3
Standards for the repair of buildings following flooding	C623	CIRIA	3
Standards of Training in Safe Gas Installations, Approved Code of practice	-	Health and Safety Commission	3
SUDS Advice Note – Brownfield Sites	-	SEPA	3
Sustainable Urban Drainage Systems: Design Manual for Scotland and Northern Ireland (2000)	ISBN	CIRIA	3
Technical aspects of site investigation	R&D Technical report P5	Environment Agency	3
The official guide to approved solid fuel products and services (2004-2005)	-	HETAS	3
Thermal Insulation: Avoiding Risks, Report (2002)	BR 262	Building Research Establishment	3

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Title	Reference	Publisher	Section
Underground storage tanks for liquid hydrocarbons	-	Scottish Executive	3
Wastewater recycling/reuse and Water conservation devices (1996)	NSF 41	National Sanitation Foundation (USA)	3
Water Regulatory Advisory Scheme: Information and Guidance Note	9-02-04 9-02-05	WRAS	3
Section 4 - Safety			
Accessible Thresholds in New Housing	-	DETR	4
Building Sight (1995)	-	RNIB	4
Code for Lighting (2002)	-	CIBSE	4
Code of Practice 1: 'Bulk LPG Storage at Fixed Installations - Part 4 - Buried / Mounded LPG Storage Vessels, as amended	-	Liquid Petroleum Gas Association	4
Code of Practice 1: 'Bulk LPG Storage at Fixed Installations - Part 1 – 'Design, Installation and Operation of Vessels Located Above Ground', as amended.	-	Liquid Petroleum Gas Association	4
Code of Practice 1: 'Bulk LPG Storage at Fixed Installations - Part 2 – 'Small bulk Propane Installations for Domestic and Similar Purposes', as amended	-	Liquid Petroleum Gas Association	4
Code of Practice 24: 'Use of LPG cylinders': Part 1 - The Use of Propane in Cylinders at Residential Premises.	-	Liquid Petroleum Gas Association	4
Guidance on the use of Tactile Paving Surfaces (1998)	-	The Scottish Office/DETR	4
Guidance to the Water Supply (Water Fittings) Regulations 1999	-	DEFRA	4
Housing for Varying Needs, Parts 1 and 2	-	Communities Scotland	4
Inclusive Design - Planning Advice Note (2006)	PAN 78	Scottish Executive	4

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Title	Reference	Publisher	Section
Inclusive Mobility (2002)	-	Department for Transport	4
Preventing hot water scalding in bathrooms: using TMVs	IP 14/03	BRE	4
Safety in window cleaning using portable ladders (2003)	MISC 613	HSE	4
Section 5 - Noise			
Housing and sound insulation: Improving attached dwellings and designing for conversions (2006)	-	Arcamedia	5
Planning and Noise, Planning Advice Note (1999)	PAN56	Scottish Executive	5
Review of Sound Insulation Performance in Scottish Domestic Construction	-	Scottish Executive	5
Scottish House Condition Survey, Scottish Homes (1996)	-	Communities Scotland	5
Sound Advice on Noise: don't suffer in silence (2001)	-	Scottish Executive	5
Section 6 - Energy			
Accredited Construction Details (Scotland)	-	SBSA	6
Air Leakage in Commercial and Public Buildings	BR 448	Building Research Establishment	6
A Practical Guide to Ductwork Leakage Testing (2000)	DW/143	HVCA	6
Assessing Condensation Risk and Heat loss at Thermal Bridges around Openings (1994)	IP 12/94	Building Research Establishment	6
Assessing the Effects of Thermal Bridging at Junctions and Around Openings	IP 1/06	Building Research Establishment	6
BSRIA Commissioning Guides (various)	-	BSRIA	6
Building Energy Metering	TM 39	Chartered Institution of Building Services Engineers	6

OTHER PUBLICATIONS

Title	Reference	Publisher	Section
Building Log Book Toolkit (2006)	TM 31	Chartered Institution of Building Services Engineers	6
Building Standards Circular on Energy, 2004	-	Scottish Building Standards Agency	6
CIBSE Commissioning Codes (various)	-	Chartered Institution of Building Services Engineers	6
CIBSE Guide (2006)	Section A3	Chartered Institution of Building Services Engineers	6
Code for Lighting (2009)	-	Society of Light and Lighting	6
Conventions For Calculating Linear Thermal Transmittance and Temperature Factors'	BR 497	Building Research Establishment	6
Conventions for U-value calculations (2006)	BR 443	Building Research Establishment	6
Design for Improved Solar Shading Control' 2006	TM 37	Chartered Institution of Building Services Engineers	
Domestic Building Services Compliance Guide	-	CLG	6
Energy Efficiency Best Practice in Housing publication - Effective use of insulation in dwellings, September 2003	CE23	Energy Saving Trust	6
Energy efficient lighting - guidance for installers and specifiers	CE 61	Energy Saving Trust	6
Good Practice Guide 302 published by Energy Efficiency Best Practice in Housing	GPG 302	Energy Saving Trust	6
Guide for assessment of the thermal performance of aluminium curtain wall framing, September 1996	-	Council for Aluminium in Building	6

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Title	Reference	Publisher	Section
iSBEM User Guide	-	Building Research Establishment (for CLG)	6
Low Energy Domestic Lighting	GIL 20	Energy Saving Trust	6
Measuring Air Permeability of Building Envelopes	TS 1	ATTMA	6
Metal Cladding: assessing the performance of built-up systems which use Z-spacers, Information Paper	IP 10/02	Building Research Establishment	6
Metal Cladding: U-value calculation: Assessing thermal performance of built-up metal roof and wall cladding systems using rail and bracket spacers, 2002	P312	Steel Construction Institute	6
Non-Domestic Building Services Compliance Guide	-	CLG	6
Non Domestic Lighting (2009)	GBG 61 Part 3	Building Research Establishment	6
People and Lighting Controls	IP 6/96	Building Research Establishment	6
Reducing Overheating – A Designer’s Guide (2005)	TM 36	CIBSE	6
Reducing Overheating – A Designer’s Guide	CE 129	Energy Saving Trust	6
SAP 2009	-	Building Research Establishment	6
SBSA Technical Handbook - ‘Conservatories’	-	SBSA	6
SBSA Technical Guide: ‘U- values’	-	SBSA	6
Selecting Lighting Controls (2006)	Digest 498	Building Research Establishment	6
Specification for Sheet Metal Ductwork	DW/144	HVCA	6
Testing Buildings for Air Leakage	TM 23	CIBSE	6

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Title	Reference	Publisher	Section
The Government's Standard Assessment Procedure for energy rating of dwellings	SAP 2005	Building Research Establishment on behalf of DEFRA	6
Thermal Insulation: Avoiding Risks, Report (2002)	BR 262	Building Research Establishment	6
U-values for light steel frame construction,	BRE Digest 465	Building Research Establishment	6

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