Technical Handbook - Domestic

Table of Contents

Technical Handbook - Domestic 1
3. Environment 2
3.0 Introduction 2
3.1 Site preparation – harmful and dangerous substances 5
3.2 Site preparation – protection from radon gas 11
3.3 Flooding and groundwater 12
3.4 Moisture from the ground 14
3.5 Existing drains 18
3.6 Surface water drainage 20
3.7 Wastewater drainage 24
3.8 Private wastewater treatment systems – treatment plants 28
3.9 Private wastewater treatment systems – infiltration systems 31
3.10 Precipitation 35
3.11 Facilities in dwellings 46
3.12 Sanitary facilities 50
3.13 Heating 57
3.14 Ventilation 58
3.15 Condensation 68
3.16 Natural lighting 71
3.17 Combustion appliances – safe operation 72
3.18 Combustion appliances – protection from combustion products 77
3.19 Combustion appliances – relationship to combustible materials 83
3.20 Combustion appliances – removal of products of combustion 94
3.21 Combustion appliances – air for combustion 111
3.22 Combustion appliances – air for cooling 113
3.23 Fuel storage – protection from fire 114
3.24 Fuel storage – containment 118
3.25 Solid waste storage 121
3.26 Dungsteads and farm effluent tanks 122
3.27 Water efficiency 124

Technical Handbook - Domestic

Environment

3.0 Introduction

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 associated with 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 also needs to be carefully considered to prevent environmental pollution and uncontrollable run-off 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 helps reduce sewer surcharging
- absorbs greenhouse gases
- absorbs air pollution
- protects the roof finish from mechanical damage and ultra-violet radiation, and
- provides additional insulation.

Solid waste has increased enormously in the last couple of decades and disposal to land fill 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 or around buildings, 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 building

e. inadequate drainage from a building and from paved surfaces around a building

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 October 2013.

Standard 3.11 - revised guidance on enhanced apartments to small dwellings.

Standard 3.12 - improved guidance on locations and construction of robust walls.

Standard 3.14 - improved guidance on ventilation provisions to dwellings, including the provision of CO_2 monitoring equipment.

Standard 3.26 - guidance expanded, including new explanatory terms.

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.

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.

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 covers, among others, duties and powers of the local authority to control and dispose of solid waste.

The Environment Act 1995 covers, among others, duties and powers of the Scottish Environment Protection Agency.

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 were introduced to prevent pollution of groundwater and to manage groundwater resources in a sustainable way.

The Water Environment and Water Services (Scotland) Act 2003 sets up an integrated regime for water quality and quantity management.

The Water Byelaws apply to any water fitting installed or used in buildings where water is supplied by Scottish Water other than where specifically exempted.

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.

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.

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

Mandatory Standard

Standard 3.1

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.

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 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

Surface soil and vegetable matter can be detrimental to a buildings 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 upfilling 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 underbuilding above the lowest level of the adjoining ground to prevent any water build up below the building. Any part of the underbuilding that is in contact with the ground, such as on sloping ground, should be tanked see clause 3.4.7.

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 http://www.sepa.org.uk/and DEFRA http://www.defra.gov.uk/web sites which contain details of published and forthcoming guidance.

The Environment Agency manages an extensive research programme related to land contamination http://www.environment-agency.gov.uk/. 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.

Table 3.1 Possible contaminants and actions

Signs of possible contaminants	Possible contaminant	Possible remedial action recommended
Vegetation (absence, poor or unnatural growth)	metals, metal components	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 pnenols	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 odour (may indicate organic chemicals at very low concentrations)	flammable, explosive, toxic and asphyxiating gases including methane and carbon dioxide	removal or treatment; the construction 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 100mm 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 contamination. 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 1m (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 1m (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 a imperforate 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.

CIRIA and the EA websites http://www.ciria.org/ also contain useful data sheets on remedial treatment options.

3.1.7 Housing on land affected by contamination

The National House Building Council (NHBC) http://www.nhbc.co.uk/, 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 licenses 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, and
- 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.

Table 3.2 Substance Affecting Materials

Materials	Substance	Possible effect	Mitigation options
concrete, mortar, masonry	sulphates (acid & water soluble in soil) pyrites heavy metals	expansion, disintegration deterioration	• specify resistant materials • provide protective coatings, isolation or sacrificial layers excavate and remove affected material • excavate and remove affected material • contain contamination
	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	

Materials	Substance	Possible effect	Mitigation options
	inorganic and organic acids	corrosion	• design and construct site drainage to reduce or eliminate contact between contaminants and building structure or services
plastics, rubbers	alkalis, ammonia, chlorine, hydrocarbons, oils	swelling deterioration	
polythenes	benzene, toluene, phenol	permeation	

Additional information:

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

Mandatory Standard

Standard 3.2

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.

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/m^3). Further information relating to radon levels, testing, sources and effects can be accessed on the HPA website at http://www.ukradon.org/.

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

“Radon affected areas” have been designated by testing dwellings. Where tests on existing dwellings show that 1% of the dwellings 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 Health Protection Agency (HPA) and the British Geological Society jointly worked on detailing mapping in Scotland of radon potential. The report providing an overview of this work, titled "Indicative Atlas of Radon in Scotland", was published in July 2011 and is available to view or download from the HPA website http://www.ukradon.org/. The resulting high definition digital map indicates areas in Scotland with elevated radon potential. The new map provides a more accurate picture of areas of the country where radon levels are likely to be higher. The map also indicates a greater number of geographical regions that are now shown to have 'radon affected areas'.

Radon risk report - the atlas presented in the HPA report contains simplified maps that are indicative rather that definitive with each 1-km grid square coloured according to the highest radon potential found within it. A risk report giving the estimated radon potential for an individual dwelling or site can be obtained through the HPA website http://www.ukradon.org/.

3.2.2 Protection from radon gas

If a dwelling is to be located or extended on ground designated as a ‘radon affected area’, or on ground where radon is known to exist, 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

Mandatory Standard

Standard 3.3

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 proposed construction is designed to be more resistant or resilient.

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).

The Scottish Environment Protection Agency (SEPA) provides flood risk information on their indicative river and coastal interactive flood maps on their website. http://www.sepa.org.uk/.

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.

‘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

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.

‘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

Mandatory Standard

Standard 3.4

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.

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

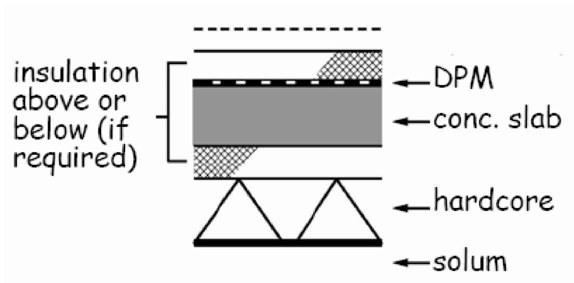
A floor, wall or other building element adjoining the ground should prevent moisture from the ground reaching the inner surface of any part of a dwelling that it could damage.

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

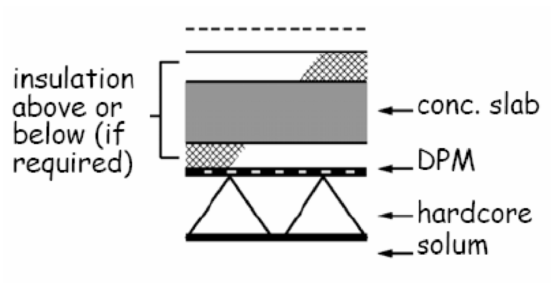
The solum is brought to a level surface. Hardcore bed 100mm thick of clean broken brick or similar inert material free from fine material and water soluble sulphates in quantities which would damage the concrete; blinded with suitable fine material and constructed to form a level, crack-free surface.

Figure 3.1 Ground supported concrete floors 1



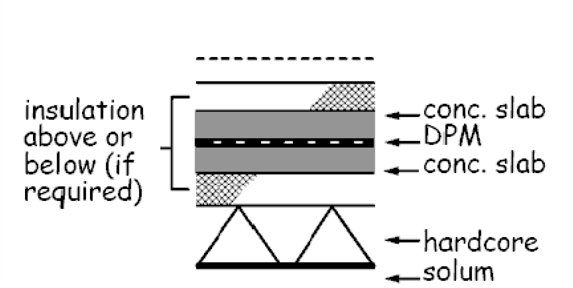
Concrete slab 100mm thick with insulation, if any, laid above or below the slab; with or without a screed or floor finish.

Figure 3.2 Ground supported concrete floors 2



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.

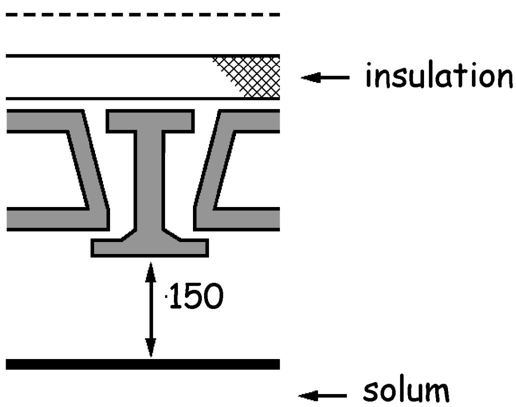
Figure 3.3 Ground supported concrete floors 3



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 ventilator 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 $1500mm^2$ for at least every metre run of the wall, or $500mm^2$ 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 150mm to the underside of the floor slab or beams.

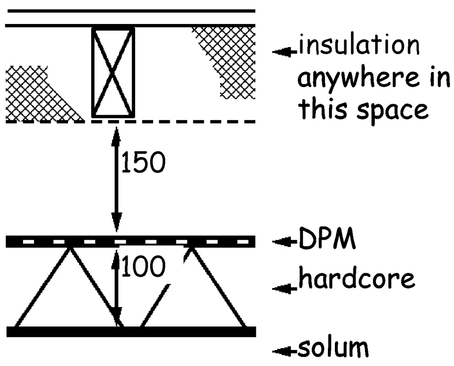
Figure 3.4 Suspended concrete floors



3.4.4 Suspended timber floors

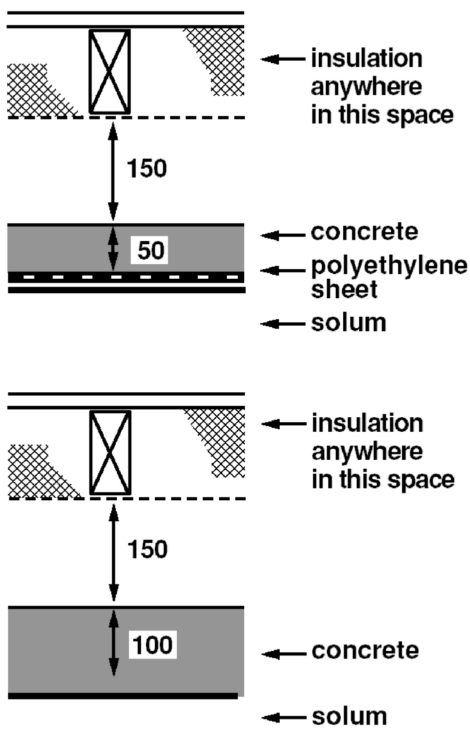
The solum is brought to an even surface; any up filling to be of hard, inert material. Hardcore bed as for clause 3.4.2; with either a dpm in accordance with section 3 of CP 102: 1973; or concrete 50mm thick laid on 0.25mm (1000 gauge) polyethylene sheet; or concrete 100mm thick; so that in any case the top surface is not below that of the adjacent ground.

Figure 3.5 Suspended timber floors 1



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 ventilator 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 1500mm^2 for at least every metre run of the wall, or 500mm^2 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 75mm in height from the site covering to the underside of any wall-plates and 150mm to the underside of the floor joists.

Figure 3.6 Suspended timber floors 2



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

Mandatory Standard

Standard 3.5

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 re-route 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.

Generally, public sewers are nor 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.

In exceptional circumstances, if it not possible to re-route an existing 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 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 may be appropriate if the drain or sewer and the structure are an integral construction on a rigid foundation. Where drains 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

Sewers or drains provide ideal nesting places 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 1.5m 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

Mandatory Standard

Standard 3.6

Every building, and hard surface within the curtilage of a building, must be designed and constructed with a surface water drainage system that will:

a. **ensure the disposal of surface water without threatening the building and the health and safety of the people in or around the building, and**

b. **have facilities for the separation and removal of silt, grit and pollutants.**

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 does not pose a risk to the environment by flooding or pollution.

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.

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 $50m^2$.

Conversions - in the case of conversions, as specified in regulation 4, the buildings as converted shall meet the requirements 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 $8m^2$ 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 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 storage container with an overflow discharging to any of the 4 following options, or

b. a SUD system designed and constructed in accordance with clause 3.6.4, or

c. 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

d. a public sewer provided under the Sewerage (Scotland) Act 1968, or

e. 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.

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 5m 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 are 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 http://www.environment-agency.gov.uk/ provides comprehensive advice on initial drainage design assessments and best practice guidance on the planning, design, construction, operation and maintenance of SUD systems.

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’ http://www.sepa.org.uk/. 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 Soakaway 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 5m 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 x 0.0145) – (a x f x 900) = S

Where - A is the area to be drained in m^2.

- a - is the internal surface area of the soakaway to 50% effective depth, excluding the base in m^2. 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 m^3.

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 re-use 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.

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 http://www.environment-agency.gov.uk/ provides helpful guidance on design considerations.

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 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.

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

Mandatory Standard

Standard 3.7

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 people in or 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 pipework connecting to a private wastewater treatment plant or septic tank.

Guidance on private wastewater treatment plants, septic tanks and infiltration fields is provided to 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 requirements 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 pipework 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:

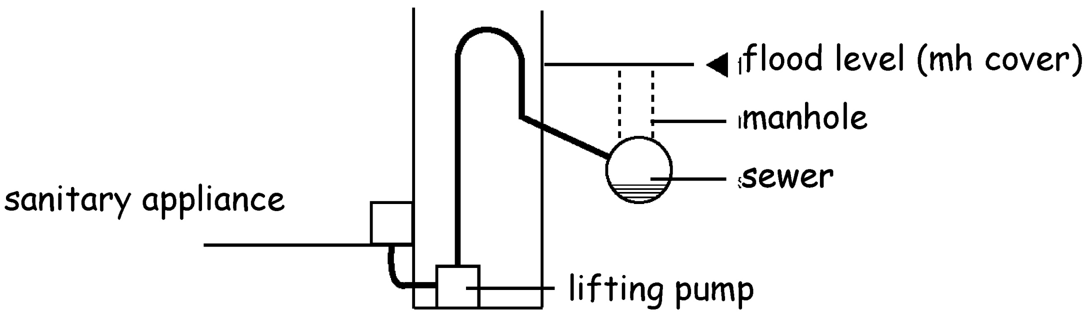
- System III (single discharge stack system with full bore branch discharge pipes) as described in Clause 4.2 of BS EN 12056-2: 2000 is the traditional system in use in the UK.
- However low water and energy consumption is now a major consideration in any design solution. With this in mind, System II (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.
- 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 may 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 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.

Figure 3.7 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 1m, 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 1.2m) should be provided in accordance with the requirements of Scottish Water in whom it is likely to be vested.

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

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 the requirements of ‘Sewers for Scotland’.

3.7.8 Ventilation of a drainage system

A Wastewater drainage system serving a building 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 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. in 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

Mandatory Standard

Standard 3.8

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 by Standard 3.7.

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).

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.

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 http://www.britishwater.co.uk/, 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.

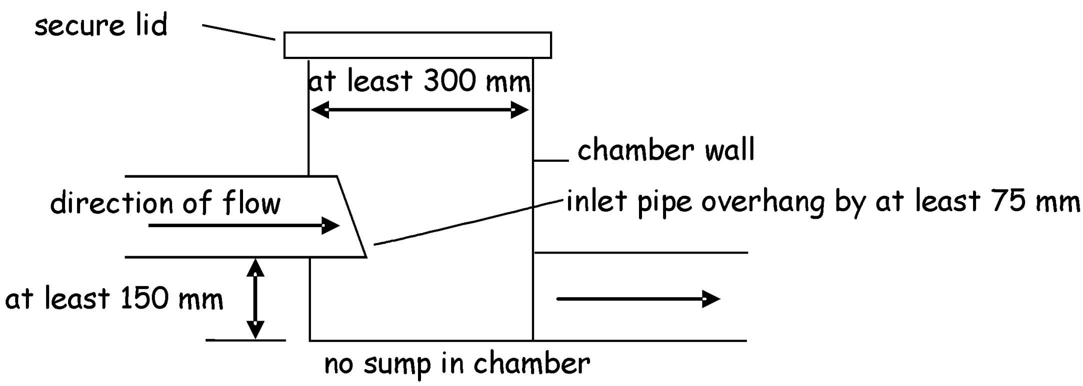
3.8.2 Treatment plant covers

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 can sample the effluent to ensure compliance with any discharge consent. A chamber should be provided in accordance with the following diagram.

Figure 3.8 Section through inspection chamber



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 liquid 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 5m from a dwelling.

Every part of a private wastewater plant and septic tank should be located at least 5m 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 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 25m from the tank where it is not more than 4m 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

Mandatory Standard

Standard 3.9

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.

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 requirements 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:

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.

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 2m deep, or a minimum of 1.5m 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 1m 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.

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 5m apart along the line of and below the proposed invert level of the effluent distribution pipe. Each hole should be 300mm square to a depth of 300mm. Where deep drains are necessary, the holes should conform to this shape at the bottom but may be enlarged above the 300mm level to facilitate safe excavation. Fill the 300mm square section of the holes to a depth of at least 300mm 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 300mm and observe the time (t) in seconds, for the water to seep away from 75% to 25% full level. Divide this time by 150mm. The answer gives the average time in seconds (Vp) required for the water to drop 1mm. 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 x Vp x 0.25

A - is the area of the sub-surface drainage trench, in m^2

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 x Vp x 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

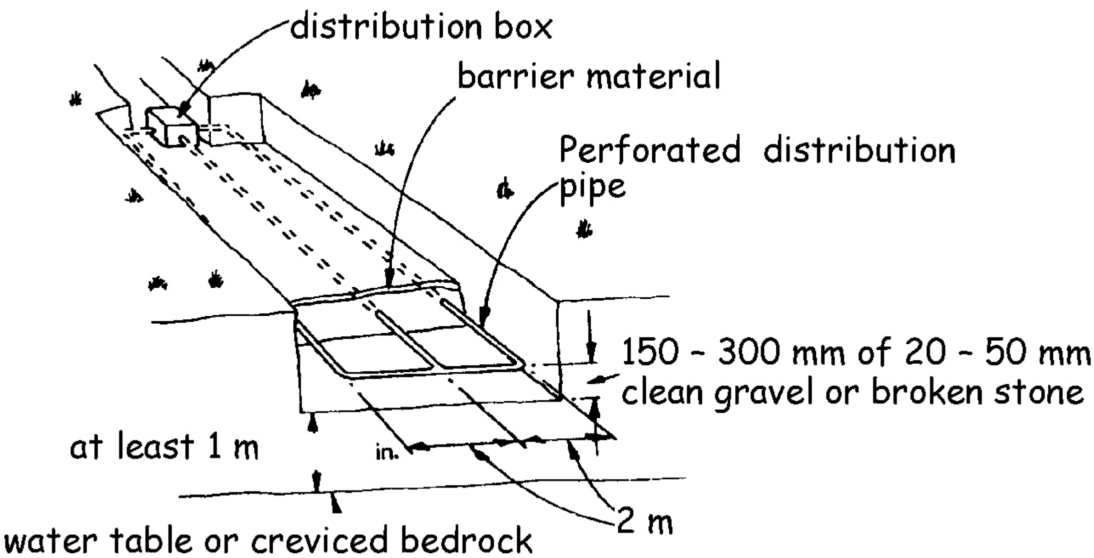
Normal percolation rates - where the percolation value (as demonstrated by the percolation test) is more than 15 secs/mm and not more than 100 secs/mm as:

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’.

Figure 3.9 Piped infiltration bed system



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:

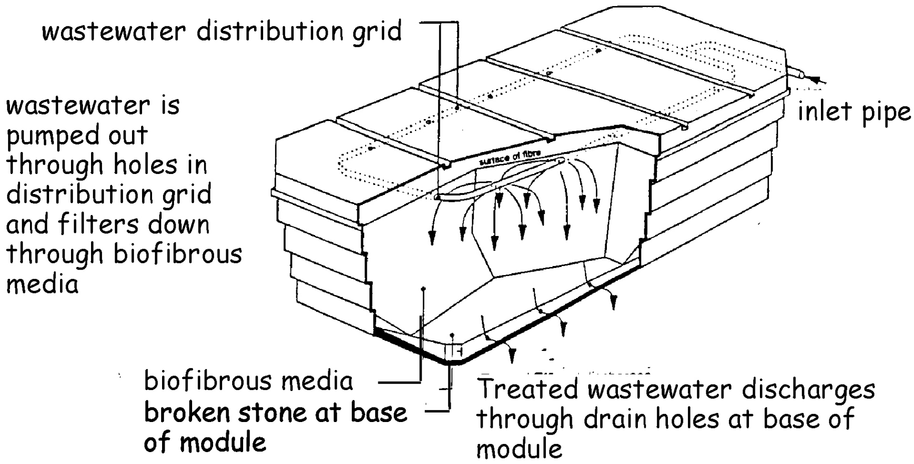
a. a reed bed complying with the requirements of the BRE, Good Building Guide, GBG 42, Parts 1 and 2 together with a piped infiltration system described in sub-clauses (a) and (b) with a normal percolation rate, or a suitable outfall, or

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).

Figure 3.10 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 x Vp x 0.2

A - is the area of the sub-surface drainage trench, in m^2

p - is the number of persons served, and

Vp - 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 50m from any spring, well or borehole used as a drinking water supply, and

b. at least 10m 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 5m from a building. An infiltration system should also be located at least 5m 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

Mandatory Standard

Standard 3.10

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 from precipitation penetrating to the inner face of the building.

Limitation:

This standard does not apply to a building where penetration of moisture from the outside will result in effects no more harmful than those likely to arise from use of the building.

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. There is evidence that the amount of rainfall has increased across much of Scotland. In addition, the majority of research indicates that this trend may continue as a consequence of climate change.

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.

For external wall constructions it is important that the wall is designed and constructed to suit the degree of exposure to wind and rain that it may be subject to.

BS EN ISO 15927-3: 2009 and BS 8104: 1992 provide a range of methodologies for the assessment of wind driven rain on the walls of a building:

- BS EN ISO 15927-3: 2009 – This methodology, which is based closely on BS 8104, uses two procedures to analyse hourly wind and rain data, collected for any location over a minimum 10 year period, to calculate a driving rain index.
- BS 8104: 1992 – This methodology determines the degree of exposure of a wall by using historical wind and rain data mapped at specific locations across the country.

An alternative simplified approach is provided within BR 262 'Thermal Insulation: Avoiding the risks'. This document is based on BS 8104 and provides a map that indicates exposures zones.

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 as described in BS EN ISO 15927-3: 2009 or 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 BS 5628: Part 3: 2005 and to suit the degree of exposure to wind and rain as described in BS EN ISO 15927-3: 2009 or 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 EN ISO 15927-3: 2009 or BS 8104: 1992; and the relevant recommendations of the following British Standards:

Table 3.3 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: Part 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:

Table 3.4 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
Flat roofs	roof	BS 6229: 2003
Bitumen felt	roof	BS 8217: 2005
Mastic asphalt	roof	BS 8218: 1998

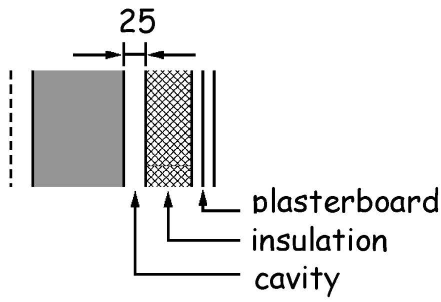
3.10.2 Wall constructions (solid, masonry)

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)

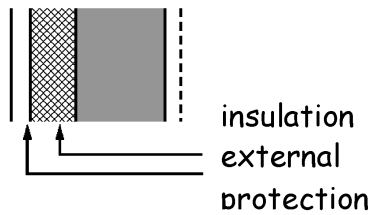
Solid wall, 200mm thick of bricks, blocks or slabs of clay, calcium silicate, concrete or cast stone. Wall rendered or unrendered externally. Insulation and plasterboard internally, with a cavity 25mm wide.

Figure 3.11 Wall type A



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.

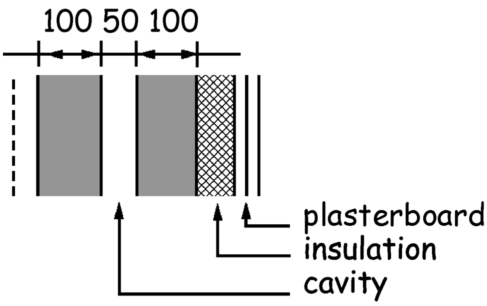
Figure 3.12 Wall type B



3.10.3 Wall constructions (cavity, masonry)

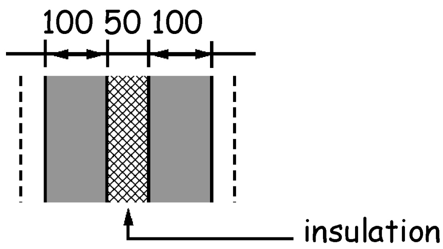
Wall type A (cavity wall with internal insulation) - Cavity wall of 2 leaves of masonry separated by a 50mm cavity; each leaf, 100mm thick, of either bricks or blocks of clay, calcium silicate or concrete. Wall rendered or unrendered externally. Insulation applied as a lining to the internal surface of the wall and plasterboard.

Figure 3.13 Wall type A



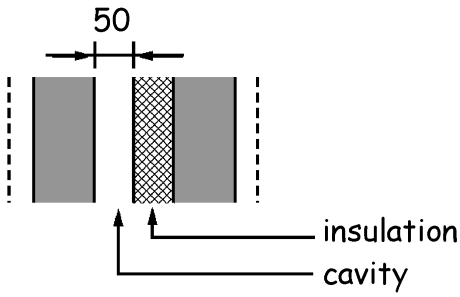
Wall type B (cavity wall with cavity fill insulation) - Cavity wall as (A) above. Wall rendered or unrendered externally. Insulation applied as a cavity fill. Wall with or without an internal surface finish of plaster or plasterboard. This construction is only recommended for sheltered conditions.

Figure 3.14 Wall type B



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 50mm wide. Wall with or without an internal surface finish of plaster or plasterboard.

Figure 3.15 Wall type C



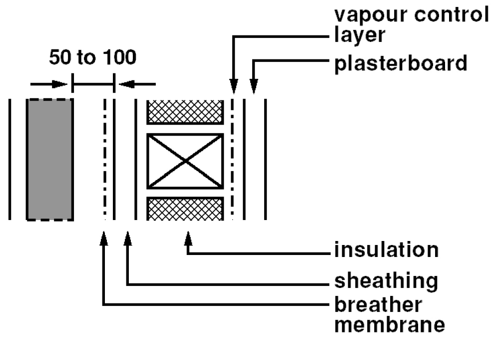
3.10.4 Conservatories and Extensions

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 raggled flashing (chased into the wall) may be sufficient.

3.10.5 Wall constructions (framed)

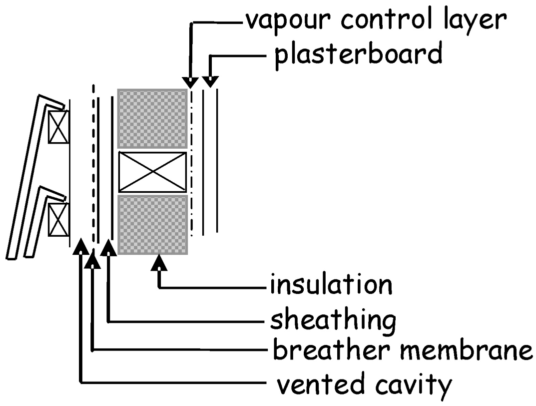
Wall type A (masonry cladding) - Framed wall of timber studs and dwangs, with a vapour permeable sheathing to the framing covered with a breather membrane. Masonry external cladding of 100mm thick clay brick or block, concrete or calcium silicate brick or block, dense in-situ concrete, lightweight concrete 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.

Figure 3.16 Wall type A



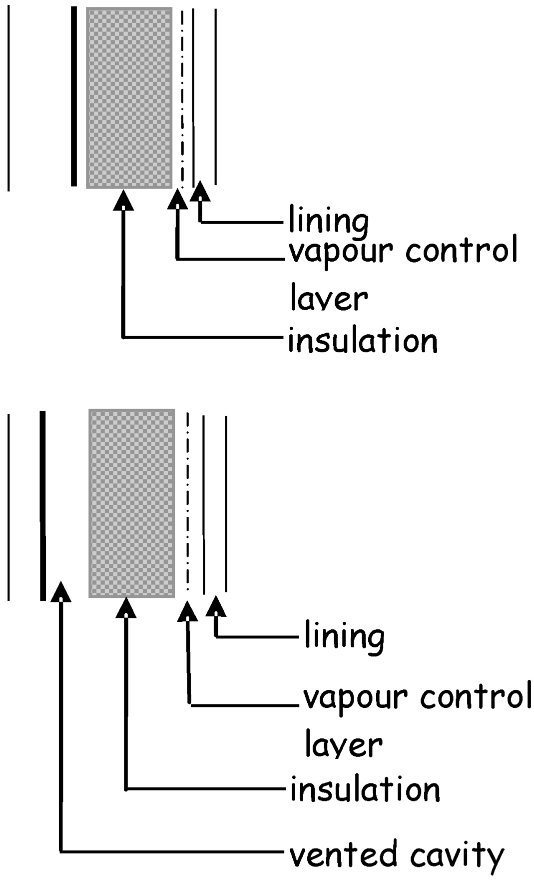
Wall type B (weatherboarding, tile or slate cladding) - framed wall of timber studs and dwangs with a breather membrane. Cladding material, on battens and counter battens as required, of timber weather boarding, tile or slate. Insulation and internal lining as (A) above.

Figure 3.17 Wall type B



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.

Figure 3.18 Wall type C



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 50mm 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 10mm 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 300mm^2 free opening area at 1.2m 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 can cause problems and these type of roofs 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

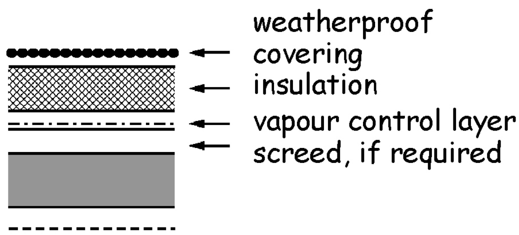
BS 6915: 2001 – CoP Design and construction of fully supported lead sheet roof and wall cladding

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

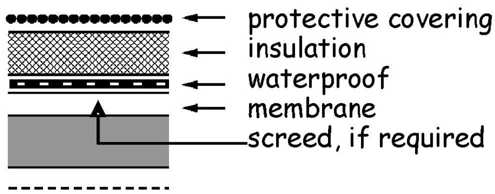
Roof type A (concrete - warm roof) - flat roof structure of in-situ or precast concrete with or without a screed; with or without a ceiling or soffit. External weatherproof covering; with insulation laid on a vapour control layer between the roof structure and the weatherproof covering. [Note 1]

Figure 3.19 Roof constructions - Type A



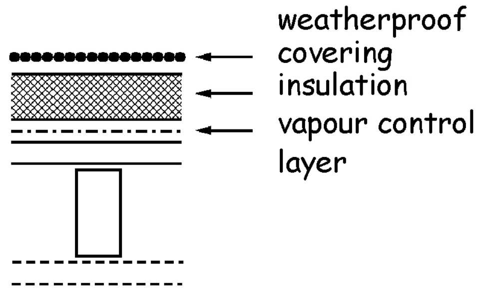
Roof type B (concrete - inverted roof) - flat roof structure as (A) above. External protective covering; with low permeability insulation laid on a waterproof membrane between the roof structure and the external covering.

Figure 3.20 Roof constructions - Type B



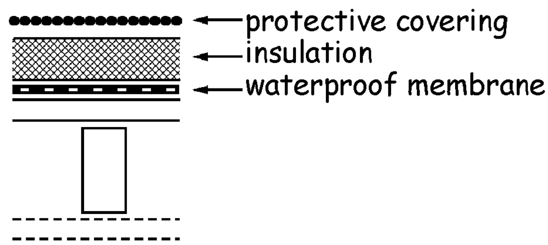
Roof type C (timber or metal frame - warm roof) - flat roof structure of timber or metal-framed construction with a board decking 19mm thick; with or without a ceiling or soffit. External weatherproof covering, insulation and vapour control layer as (A) above. [Note 1]

Figure 3.21 Roof constructions - Type C



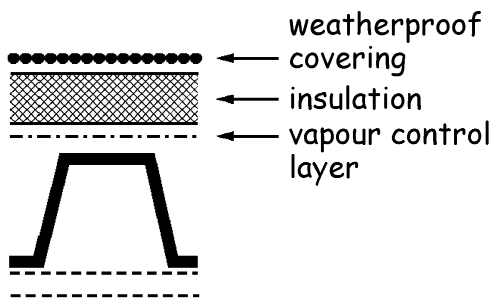
Roof type D (timber or metal frame - inverted roof) - flat roof structure as (C) above. External protective covering, insulation and waterproof membrane as (B) above.

Figure 3.22 Roof constructions - Type D



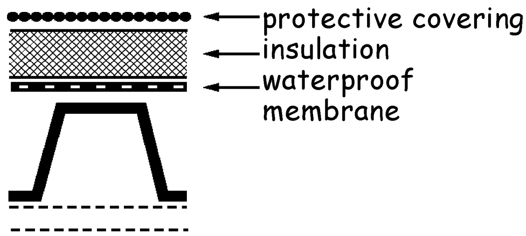
Roof type E (troughed metal decking - warm roof) - flat roof structure of timber or metal framed construction with a troughed metal decking; with or without a ceiling or soffit. External weatherproof covering and insulation and vapour control layer as (A) above. [Note 1]

Figure 3.23 Roof constructions - Type E



Roof type F (troughed metal decking - inverted roof) - flat roof structure as (E) above. External protective covering, insulation and waterproof membrane as (B) above.

Figure 3.24 Roof constructions - Type F



Note

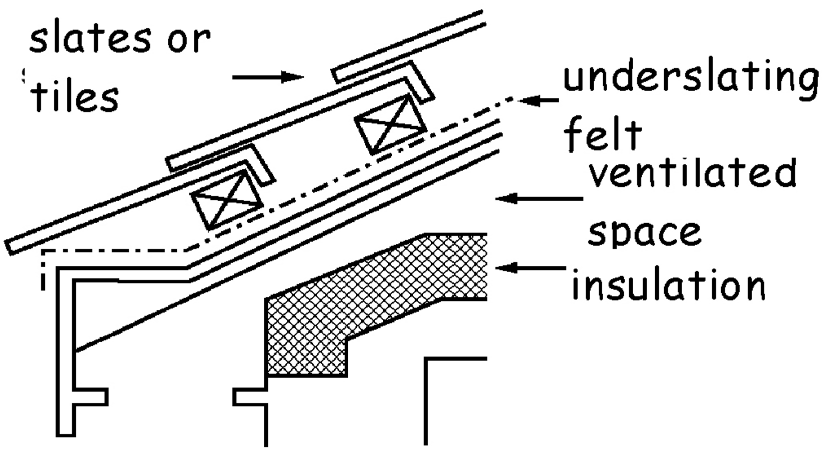
Roof types A, C and E are not suitable for sheet metal coverings that require joints to allow for thermal movement. See also sub-clause f of clause 3.10.1.

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.

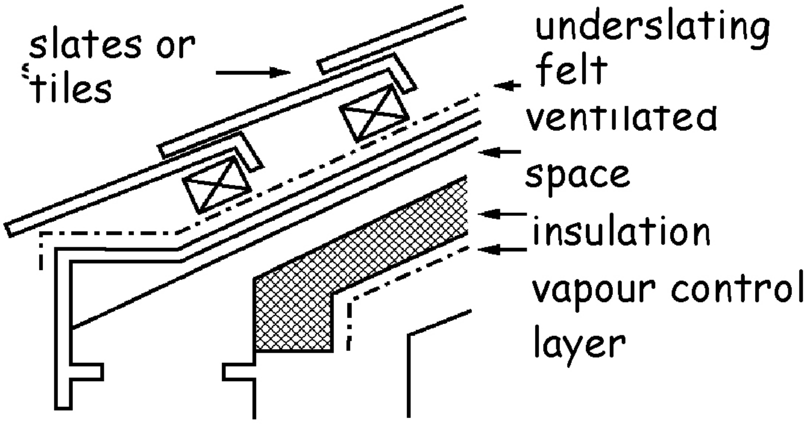
Roof type A (slate or tiles - insulation on a level ceiling) - pitched roof structure of timber or metal framed construction. External weatherproof covering of slates or tiles on under slating felt with or without boards or battens.

Figure 3.25 Roof constructions - Type A (slate or tiles - insulation on a level ceiling)



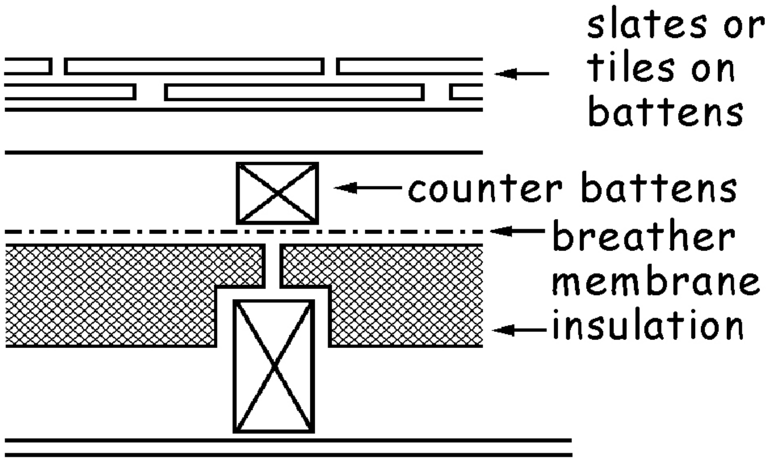
Roof type B (slate or tiles - insulation on a sloping ceiling) - pitched roof structure as (A) above. External weatherproof covering as (A).

Figure 3.26 Roof constructions - Type B (slate or tiles - insulation on a sloping ceiling)



Roof type C (slate or tiles - 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.

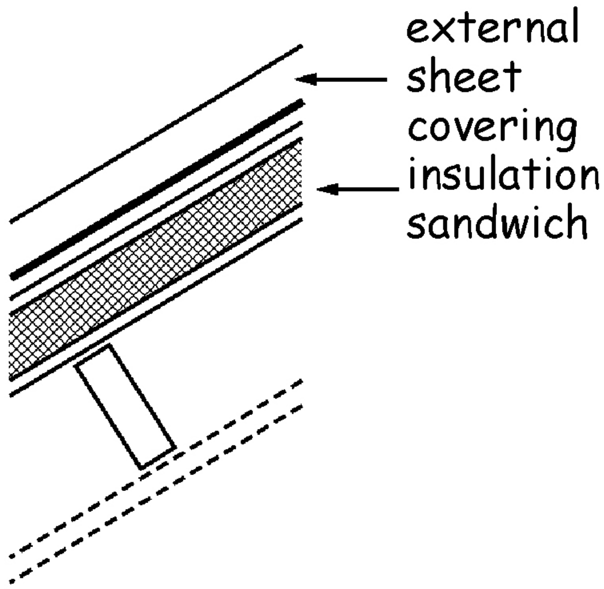
Figure 3.27 Roof constructions - Type C (slate or tiles - insulation on decking)



C. Slates or tiles - insulation as decking

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]

Figure 3.28 Roof constructions - Type D (metal or fibre cement sheet - sandwich insulation)



Note 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

Mandatory Standard

Standard 3.11

Every building must be designed and constructed in such a way that:

a. **the size of any apartment or kitchen will provide a level of amenity that ensures the welfare and convenience of all occupants and visitors, and**

b. **an accessible space is provided to allow for the safe, convenient and sustainable drying of washing.**

Limitation:

This standard applies only to a dwelling.

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.

Extending standards to address 'liveability' and the needs of occupants supports the Scottish Government'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.

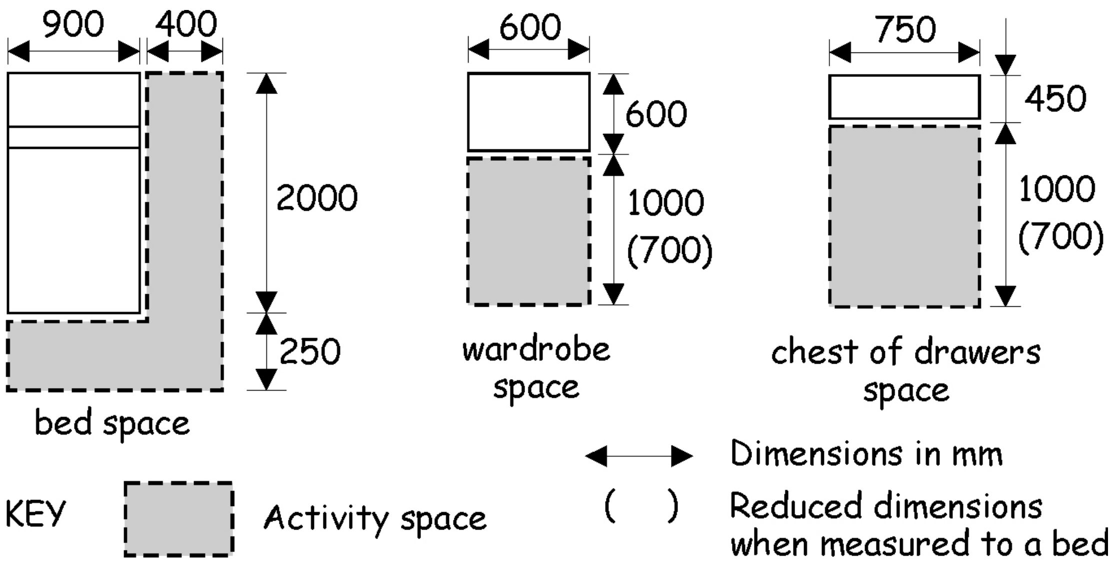
Recycling - designers should be aware of local authority initiatives on the recycling of solid waste and useful cross-references are provided in the guidance to Standard 3.25, Solid waste storage. Such initiatives may affect storage provision in a dwelling.

Conversions - in the case of conversions, as specified in regulation 4, the buildings 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.

Figure 3.29 Activity Spaces



Additional information:

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 $12m^2$ and a length and width at least 3.0m (see Note 1). This area should exclude any space less than 1.8m in height and any portion of the room designated as a kitchen, and

- contain a unobstructed manoeuvring space of at least a 1.5m by 1.5m square or an ellipse of at least 1.4m by 1.8m, 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 800mm wide, to the controls of any openable window or any heating appliance and between doors within the apartment.

Note 1: In some small dwellings (i.e. those with not more than 3 apartments) it may not always be reasonably practicable to achieve the minimum length or width of 3m. In such one or two bedroom properties, either the length or the width may be reduced to not less than 2.8m, however, a floor area of at least $12m^2$ should be maintained.

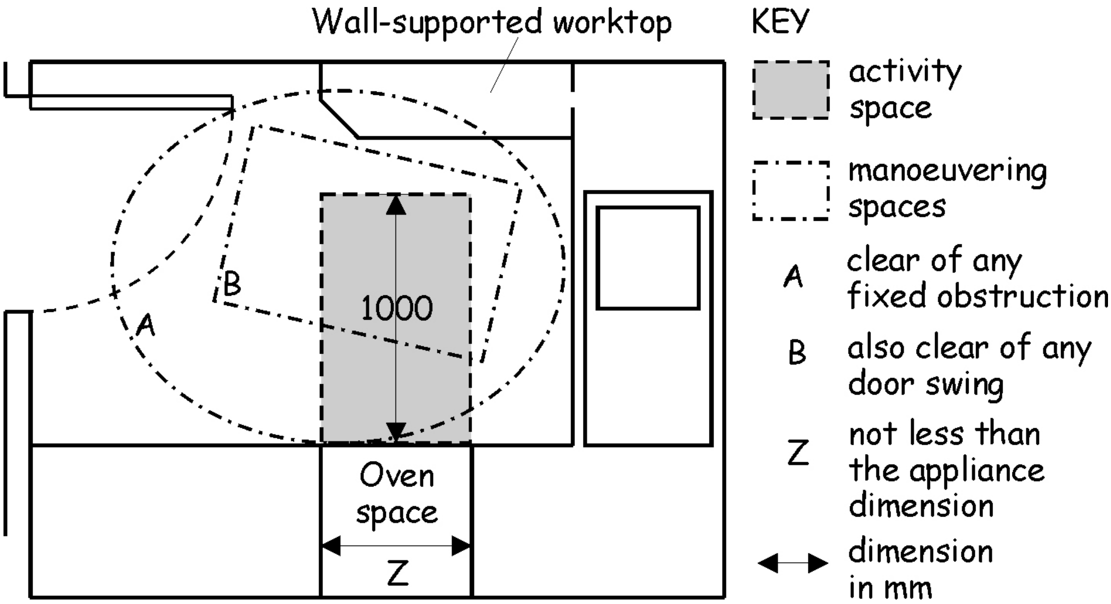
3.11.3 Kitchens

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 1.5m by 1.5m square or an ellipse of 1.4m by 1.8m. A door may open across this manoeuvring space but a clear space of at least 1.1m long by 800mm 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 750mm above floor level, may overlap the manoeuvring space by not more than 300mm.

Figure 3.30 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 $1m^3$ 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 1.8m.

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 works 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 1.7m 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 $1m^3$ and should have no dimension less than 700mm. The designated space should allow space for at least 1.7m 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

Mandatory Standard

Standard 3.12

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 simplifying 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 Government'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 - 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) http://www.snipef.co.uk/ and Scottish Water. http://www.scottishwater.co.uk/.

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 1.1m long by 800mm 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 800mm wide to each sanitary facility, and

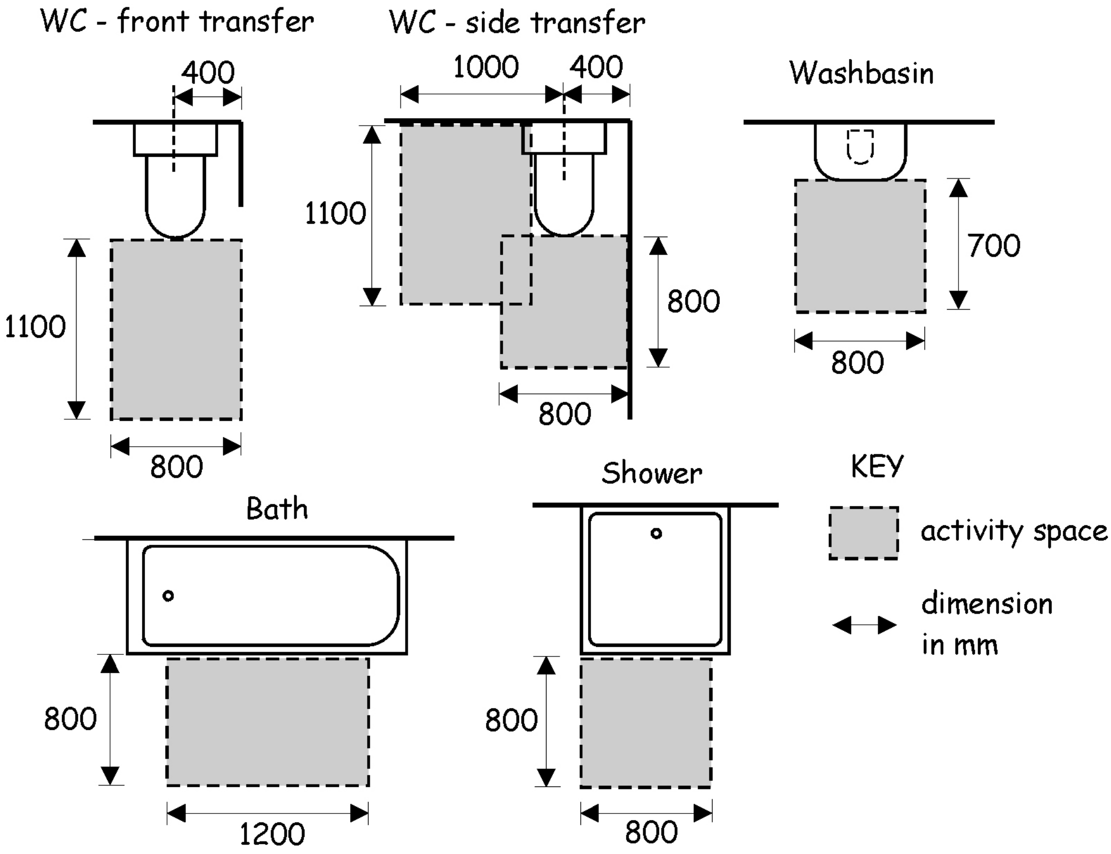
- an activity space for each sanitary facility, as noted in the diagram below. These may overlap with each other and with the manoeuvring space noted above. A door may open over an activity space, and

- an unobstructed height above each activity space and above any bath or shower of at least 1.8m 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 in the zones noted in figure 3.32 (all indicated sizes are minimum dimensions), and

- where incorporating a WC, space for at least one recognised form of unassisted transfer from a wheelchair to the WC.

Figure 3.31 Activity spaces for accessible sanitary facilities



Additional information:

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 300mm 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 700mm.

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.

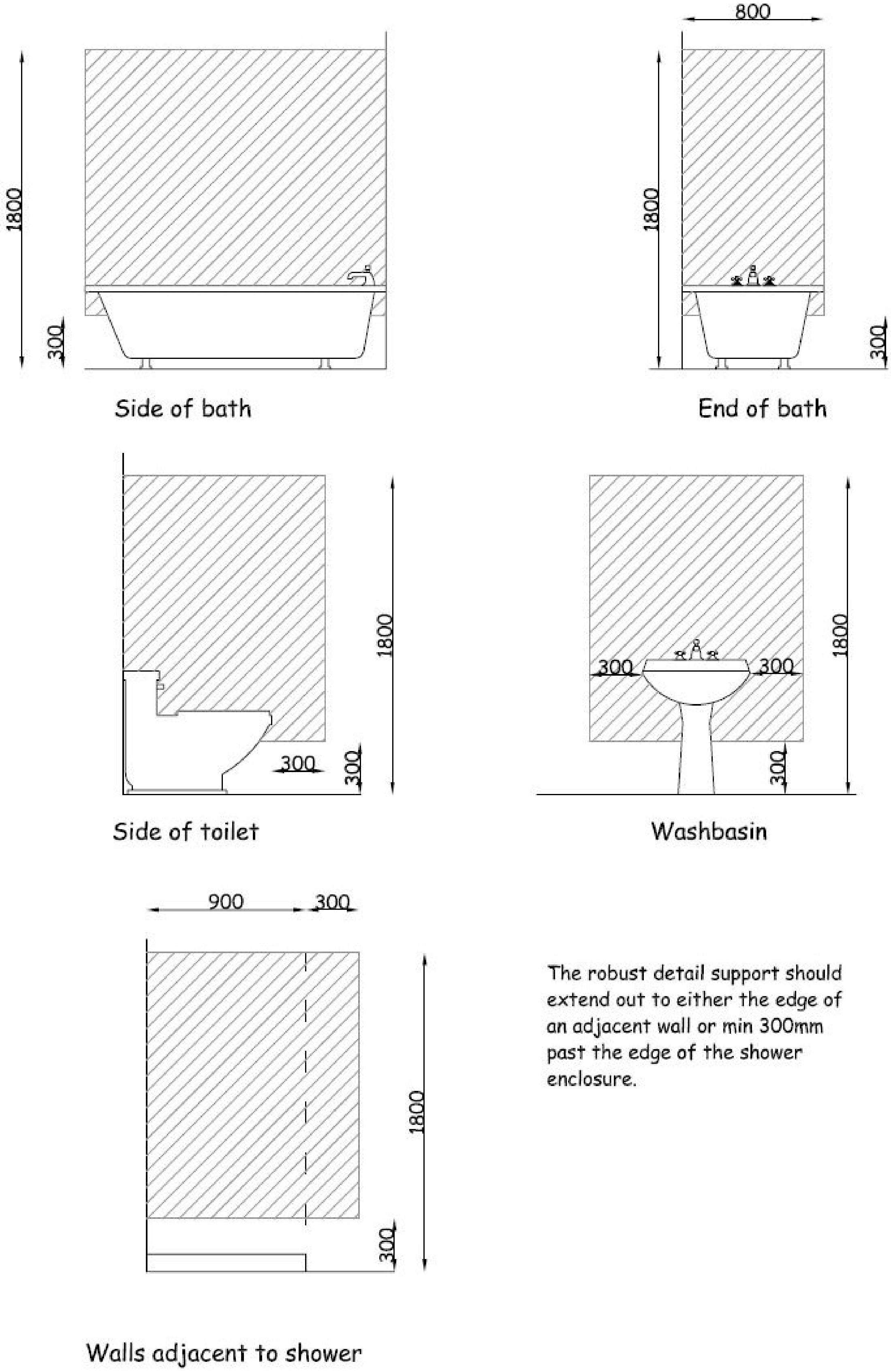
An accessible bathroom should be of a size that will accommodate a 1.7m x 700mm bath (or equivalent). The activity space in front of a bath may be at any position along its length. Within an accessible bathroom, it should be possible to replace the bath with an accessible shower without adversely affecting access to other sanitary facilities.

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 1.0m x 1.0m (or equivalent) or a 900mm x 900mm 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.

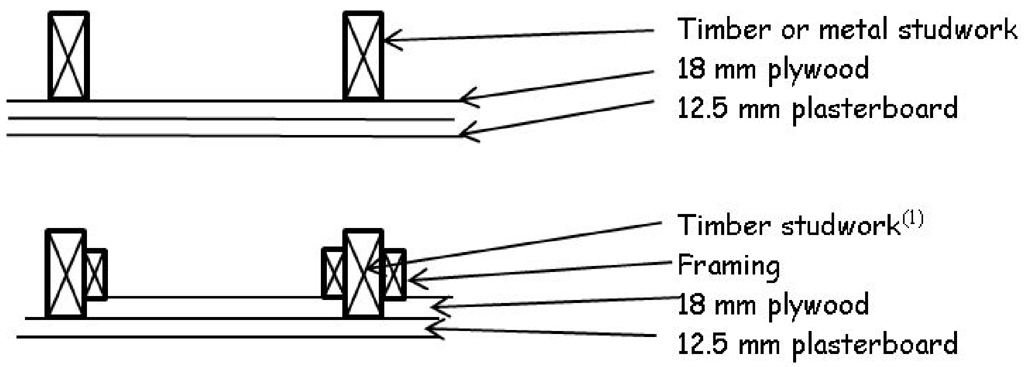
This space should have a drainage connection, positioned to allow installation of either a floor shower or raised shower tray, sealed and terminated either immediately beneath floor level under a removable access panel or at floor level in a visible position. The structure and insulation of the floor 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.

Figure 3.32 Robust wall construction



Examples of robust wall construction include masonry walling and suitably reinforced timber and metal stud partitioning. The following sketches indicate how timber or metal stud partitioning may be reinforced in preparation for the future installation of grab rails.

Figure 3.33 Typical Robust wall construction



Additional information:

1. Refer to manufacturer's information for suitable construction details for fixing or securing plywood reinforcement to metal stud partitioning.

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 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.

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 800mm wide x 750mm 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

Mandatory Standard

Standard 3.13

Every building must be designed and constructed in such a way that it can be heated and maintain heat at temperature levels that will not be a threat to 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^{0}C in at least 1 apartment and 18^{0}C elsewhere, when the outside temperature is minus 1^{0}C.

There is no need to maintain these temperatures in storage rooms with a floor area of not more than $4m^{2}$.

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.

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^{0}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.

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

Mandatory Standard

Standard 3.14

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.

So that contaminants do not exceed acceptable levels and thereby endanger the health of the occupants, it is important that dwellings are adequately ventilated. Research has shown that occupants of dwellings are, for the most part, unaware of the standard of air quality within their homes. The lack of recognition of poor air quality has frequently resulted in occupants not being aware of the need to open ventilators or windows, particularly in bedrooms.

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.

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 $4m^2$. This is not intended to include a domestic sized kitchen or utility room where ventilation should be in accordance with the recommendations in clause 3.14.3.

Ventilation should be to the outside air. However clauses 3.14.6 and 3.14.8 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 3m above any floor level in that space may be disregarded.

3.14.2 Ventilation awareness in dwellings

Carbon dioxide (CO_2) is present in the external air we breathe at concentration levels of around 400 parts per million and is not harmful to health at low concentration levels. However, as people release CO_2 into the air when they exhale, increased levels of CO_2 in occupied buildings can occur. This is generally accepted as being a reasonable indication that ventilation action is necessary.

CO_2 monitoring equipment should be provided in the apartment expected to be the main or principal bedroom in a dwelling where infiltrating air rates are less than $15m^3/hr/m^2$ @ 50 Pa. This should raise occupant awareness of CO_2 levels (and therefore other pollutants) present in their homes and of the need for them to take proactive measures to increase the ventilation. Guidance on the operation of the monitoring equipment, including options for improving ventilation when indicated as necessary by the monitor, should be provided to the occupant. For more detailed information on the provision of guidance to occupants, reference may be made to “*Domestic Ventilation*” Scottish Government 2015 http://www.gov.scot/Resource/0040/00409104.pdf.

The installed monitoring equipment for CO_2 should be mains operated and may take the form of a self-contained monitor/detector or a separate monitor and detector head. The monitor should have an easily understood visual indicator and be capable of logging data to allow the occupant to gain information on CO_2 levels for at least the preceding 24 hour period. If the detector/monitor has an audible alarm this should be capable of being permanently deactivated.

CO_2 monitoring equipment should be capable of recording and displaying readings within a range of at least 0 – 5,000 parts per million. The equipment should also be capable of logging data at no more than 15 minute intervals, over a 24 hour period.

Where carbon dioxide monitors/detectors are within the scope of either or both:

- European Directive 2006/95/EC – Low Voltage Directive, and/or
- European Directive 1999/5/EC – Radio and Telecommunication Terminal Equipment Directive

they should be constructed to fully comply with all applicable safety aspects of the Directive(s).

A carbon dioxide detector head requires a flow of air over it to operate correctly, therefore, it should not be located in an area that is likely to restrict the free movement of air. Unless otherwise indicated by the manufacturer, a carbon dioxide detector head should not be sited:

- if ceiling mounted, within 300mm of any wall
- if wall mounted, within 150mm of the ceiling or a junction with another wall
- where it can be obstructed (for example by curtains, blinds or furniture)
- next to a door or window, or
- next to an air vent or similar ventilation opening.

Unless otherwise indicated by the manufacturer, a carbon dioxide monitor, with or without an integral detector, should be mounted between 1.4m and 1.6m above floor level. A carbon dioxide detector head (or monitor if integrated) should not be sited within 1m of the expected location of a bed-head.

Where a separate detector head and monitor is installed, the monitor may be located other than in the room containing the detector head, for example, the hallway. This may be desirable if more than one detector head is installed.

3.14.3 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 $10m^3/h/m^2$@ 50 Pa will be achieved as a matter of course in modern dwellings. However where the designer intends to use low fabric infiltration air rates of less than $5m^3/h/m^2$@ 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 3.14.11).

Table 3.5 Recommended ventilation of a dwelling

	Ventilation recommendations	**Trickle ventilation [1]**
Apartment	A ventilator with an opening area of at least 1/30th of the floor area it serves.	$12,000mm^2$
Kitchen	either: a. mechanical extraction capable of at least 30 l/sec (intermittent) above a hob [3], or	$10,000mm^2$

	Ventilation recommendations	Trickle ventilation [1]
	b. mechanical extraction capable of at least 60 l/sec (intermittent) if elsewhere [3], or c. a passive stack ventilation system [4].	
Utility room	either: a. mechanical extraction capable of at least 30 l/sec (intermittent) [3], or b. a passive stack ventilation system [4].	10,000mm^2
Bathroom or shower room (with or without a WC)	either: a. mechanical extraction capable of at least 15 l/sec (intermittent), or b. a passive stack ventilation system [4].	10,000mm^2
Toilet	either: a. a ventilator with an opening area of at least 1/30th of the floor area it serves, or b. mechanical extraction capable of at least 3 air changes per hour.	10,000mm^2

Additional information:

1. Where the trickle ventilator is ducted, the recommended areas in the table should be doubled (see clause 3.14.6).

2. The overall provision of trickle ventilation in a dwelling may be provided at an average of 11,000mm^2 per room with a minimum of 11,000 mm^2 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 10m^3/h/m^2 @ 50 Pa, which may often be the case in existing buildings, the size of trickle ventilation may be reduced to 8000mm^2 for apartments and 4000mm^2 for all other rooms. Alternatively, the overall provision of trickle ventilation in a dwelling may be provided at an average of 6000mm^2 per room, with a minimum provision of 4000mm^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 1.75m above floor level.

3.14.4 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 $1/5^{th}$ 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 1.75m for ventilators, high level or roof vents are best placed to minimise the effects of heat build-up and reduce stratification.

3.14.5 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 3.14.7.

Guidance to Standard 3.11 gives information on the space recommended for the drying of washing.

3.14.6 Trickle ventilators

A trickle ventilator, sometimes called 'background ventilation', is a small ventilation opening, normally provided with a controllable shutter. Although routinely provided in the head of a window frame this is often not the best location as the free movement of air can be restricted, for example by curtains or blinds. They should be provided in naturally ventilated areas to allow fine control of air movement. The location of trickle ventilators should be carefully considered so that they are capable of providing the intended ventilation, taking into account factors such as the size and shape of the room and availability of external walls. A permanent ventilator is not recommended since occupants like control over their environment and uncontrollable ventilators are usually permanently sealed up to prevent draughts.

Trickle vent efficiency - it is recognised that the air flow performance through trickle ventilators can vary, dependent on the design and arrangement of air routes through the ventilator. For the purpose of performance, the recommended areas in the table to clause 3.14.3 should be achieved by the use of ventilators that are sized by the equivalent area, as determined using BS EN 13141-1:2004. When determining the equivalent area, the whole ventilator installation, including the external grille or canopy, should be considered as a single unit.

Where the trickle ventilator has to be ducted, e.g. to an internal room, the equivalent area of the trickle ventilator should be increased to double that shown in the table to clause 3.14.3, 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.

Alternatives to 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 3.14.3
- 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.

Location of trickle ventilators - should be positioned to encourage movement of air within the dwelling and reduce stratification. To assist air movement consideration should be given to providing two or more trickle ventilators within rooms, installed at different heights.

Although ventilation should normally be to the external air, a trickle or permanent 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 3.14.3. 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.

To assist air movement within dwellings with an air infiltration rate of less than $10m^3/hr/m^2$@ 50 Pa, trickle ventilation to rooms with dMEVs could be formed by “undercutting” the room door to achieve an air space of at least $8,000mm^2$. This air space should be clear of any actual or notional floor coverings.

3.14.7 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 8m maximum length of stack) as the stack effect will diminish as the air cools.

Every passive stack 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 25mm thick material having a thermal conductivity of 0.04W/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 125mm 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 10,000mm^2.

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.

3.14.8 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.

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.

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.

3.14.9 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.

3.14.10 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 legionnella 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 legionalla.

3.14.11 Mechanical ventilation and systems

The design, installation and commissioning of a mechanical ventilation system should mean that it is capable of performing 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 building 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 $5m^3/h/m^2$@ 50 Pa are intended, such a system should be used. The following are examples of mechanical systems that will aid ventilation in a dwelling:

- 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 not operating. Openable windows may also be needed for fire escape purposes

- centralised mechanical extract ventilation (MEV) installed in accordance with the guidance in BRE Digest 398

- where the infiltration rate is not less than $3m^3/hr/m^2$ @ 50 Pa, decentralised mechanical extract ventilation units (dMEV), in rooms where there is likely to be high humidity such as kitchens, bathrooms and shower rooms. A dMEV should be designed, installed and commissioned to provide minimum continuous extraction rates in accordance with the following table:

Table 3.6 Minimum continuous extraction rates for dMEVs

Kitchen	6 litres/sec with 13 litres/sec boost
Utility room	4 litres/sec with 8 litres/sec boost
Bathroom	4 litres/sec with 8 litres/sec boost
Toilet	3 litres/sec with 6 litres/sec boost

Where dMEVs are located in rooms adjacent to bedrooms the noise generated by them on a continuous rate should not exceed 30 $dBL_{Aeq,T}$ calculated in accordance with BS 8233: 1999.

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'.

3.14.12 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 $60m^2$ in area are constructed but guidance on such structures is provided in the non-domestic Technical Handbook.

Small garages - garages of less than $30m^2$ 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 $30m^2$ but not more than $60m^2$ 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:

a. where the garage is naturally ventilated, by providing at least 2 permanent ventilators, each with an open area of at least $1/3000^{th}$ of the floor area they serve, positioned to encourage through ventilation with one of the permanent ventilators being not more than 600mm 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 600mm above floor level.

3.15 Condensation

Mandatory Standard

Standard 3.15

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 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 specialists and often involves distinctive construction methods and materials required to produce buildings that are fit for purpose under the known conditions.

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 must be improved to as close to the requirement of that standard as is reasonably practicable, and in no case be worse than before the conversions (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 the external wall 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 air space 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.

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 1.2W/m^2k.

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)

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 air space 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.

Both the warm deck and warm deck inverted roof constructions, where the insulation is placed above the roof deck, are considered preferable.

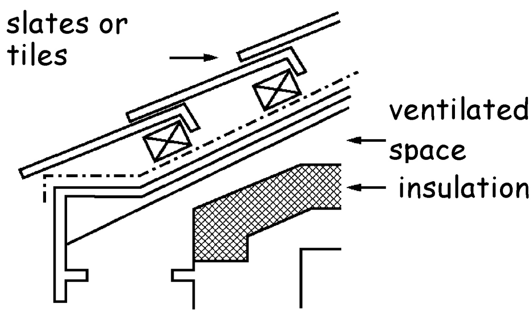
3.15.7 Roof constructions (pitched)

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.

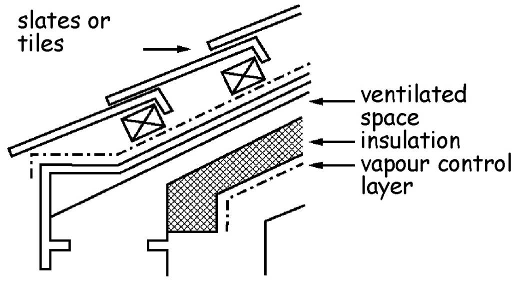
Figure 3.34 Roof type A insulation on a level ceiling



Roof type B insulation on a sloping ceiling

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.

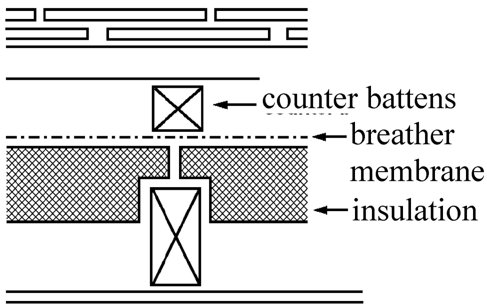
Figure 3.35 Roof type B insulation on a sloping ceiling



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.

Figure 3.36 Roof type B insulation on a sloping ceiling



3.16 Natural lighting

Mandatory Standard

Standard 3.16

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 3.14.8 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 3.14.8, covering ventilation, also recommends that the existing room and extension are treated as a single space.

3.17 Combustion appliances – safe operation

Mandatory Standard

Standard 3.17

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 and 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 that is 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 50kW, oil-firing appliances with an output rating not more than 45kW and gas-fired appliances with a net input rating not more than 70kW.

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 Service 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 50kW, oil-firing appliances with an output rating more than 45kW and gas-fired appliances with a net input rating more than 70kW.

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 Sold 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 300kW'.

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 (http://www.hetas.co.uk/) 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

The Oil Firing Technical Association (OFTEC)(http://www.oftec.org.uk/) 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 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

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 in given in the Health and Safety Commission's Approved Code of Practice 'Standards of Training in Safe Gas Installations'. The Gas Safe Register (http://www.gassaferegister.co.uk/) operates 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)

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:

Figure 3.37 Safety Label

IMPORTANT SAFETY INFORMATION **This label must not be removed or covered**	
Property address	*20 Main Street* *New Town*
The fireplace opening located in the....................... Is at the base of a chimney with a designation string...	*name of room* *designation string*
and, for example, is suitable for a	*dfe gas fire*
Chimney liner	*xx mm diameter*
Installed on	*date*
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 dwellings 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:

a. for solid fuel appliances, extract ventilation should not generally be installed in the same room or alternatively seek further guidance from HETAS. However in certain cases, such as large rooms where there is free flowing replacement air, a fan may be fitted provided a satisfactory spillage test is carried out in accordance with BRE Information Paper IP 7/94

b. for oil-firing appliances, limit fan capacities as described in OFTEC Technical Book 3 and then carry out flue draught interference tests as described in Book 3 or BS 5410: Part 1: 1997

c. for a gas-fired appliance, where a kitchen contains an open-flued appliance, 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

Mandatory Standard

Standard 3.18

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 in 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.

The National Association of Chimney Engineers (NACE) (http://www.nace.org.uk/) 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) (http://www.feta.co.uk/). These organisations do not have a mandatory status.

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.

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.

Table 3.7 Recommended designation for chimneys and flue-pipes for use with oil-firing appliances with a flue gas temperature not more than 250ºC

Appliance type	Fuel oil	Designation
Boiler including combustion boiler - pressure jet	Class C2	T250 N2 D 1 Oxx
Cooker - pressure jet burner	Class C2	T250 N2 D 1 Oxx
Cooker and room heater - vaporising burner	Class C2	T250 N2 D 1 Oxx
Cooker and room heater - vaporising burner	Class D	T250 N2 D 2 Oxx
Condensing pressure jet burner appliances	Class C2	T160 N2 W 1 Oxx
Cooker - vapourising burner appliances	Class D	T160 N2 W 2 Oxx

Additional information:

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.

Table 3.8 Recommended designation for chimneys and flue-pipes for use with gas appliances

Appliance	Type	Designation
Boiler - open - flued	• natural draught	T250 N2 D 1 Oxx

Appliance	Type	Designation
	• fanned draught • condensing	T250 P2 D 1 Oxx[1] T250 P2 W 1 Oxx[1]
Boiler - room - sealed	• natural draught • fanned draught	T250 N2 D 1 Oxx T250 P2 D 1 Oxx[1]
Gas fire	• radient/convector • ILFE or DFE	T250 N2 D 1 Oxx
Air heater	• natural draught • fanned draught • SE duct	T250 N2 D 1 Oxx T200 P2 D 1 Oxx[1] T450 N2 D 1 Oxx

Additional information:

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 incorporate 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: 2006, 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 400ºC, 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 250ºC, e.g. burning Class C2 oil (kerosene)

d. T250 N2 D V1 (or Vm - Lxxxxx) Oxx where it serves a gas appliance.

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 0.40mm.

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 be a rigid mesh that will prevent vermin from building a nest beside the warm chimney. Mesh should prevent an 8mm 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 3mm 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 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.

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 0.40mm.

3.19 Combustion appliances – relationship to combustible materials

Mandatory Standard

Standard 3.19

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

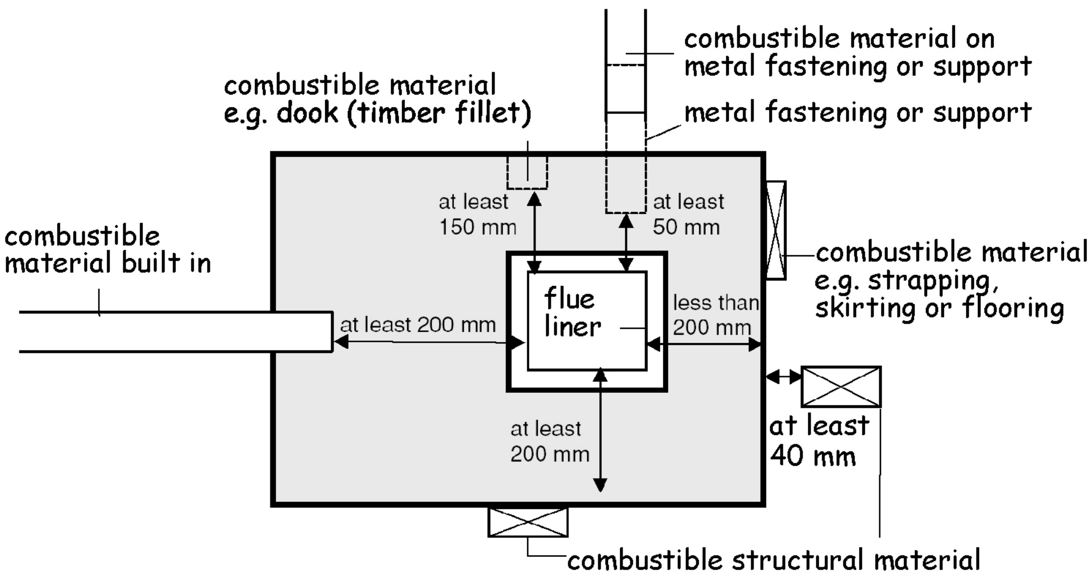
practicable, and in no case be worse than before the conversion (regulation 12, schedule 6).

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 200mm from the surface surrounding a flue in a masonry chimney. However some combustible materials will not be a risk and do not need a 200mm separation distance nor do the flue gasses generated from some appliances reach a sufficiently high temperature to require it. The following materials may be located closer than 200mm 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 150mm from the surface of the flue
- combustible structural material may be located not less than 40mm 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.

Figure 3.38 Plan view of masonry chimney



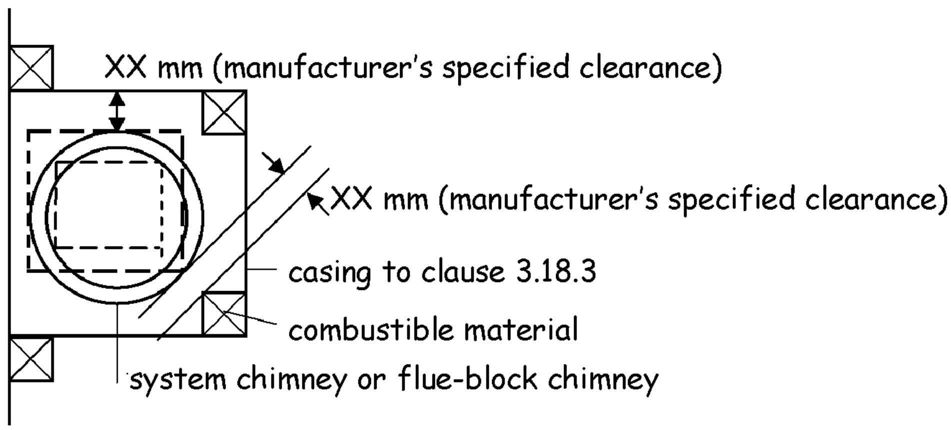
Any metal fastening in contact with combustible material, such as a joist hanger, should be at least 50mm from the surface surrounding a flue to avoid the possibility of the combustible material catching fire due to conduction.

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 this 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 85ºC when related to an ambient temperature of 20ºC.

Figure 3.39 Plan of casing round a factory-made chimney

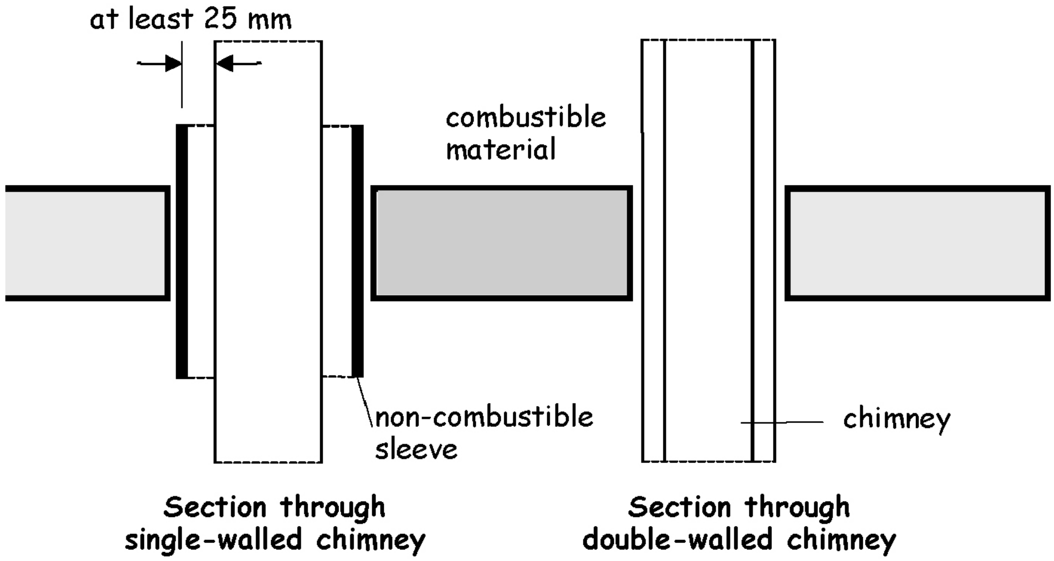


BS EN 1806: 2000 relates to clay flue-block chimneys but does not give a value for distances to combustible materials. These types of chimneys therefore should be regarded as a custom built chimneys and the minimum values in this clause 3.19.1 or clause 3.19.2 should be used and declared.

3.19.3 Relationship of metal chimneys to combustible material

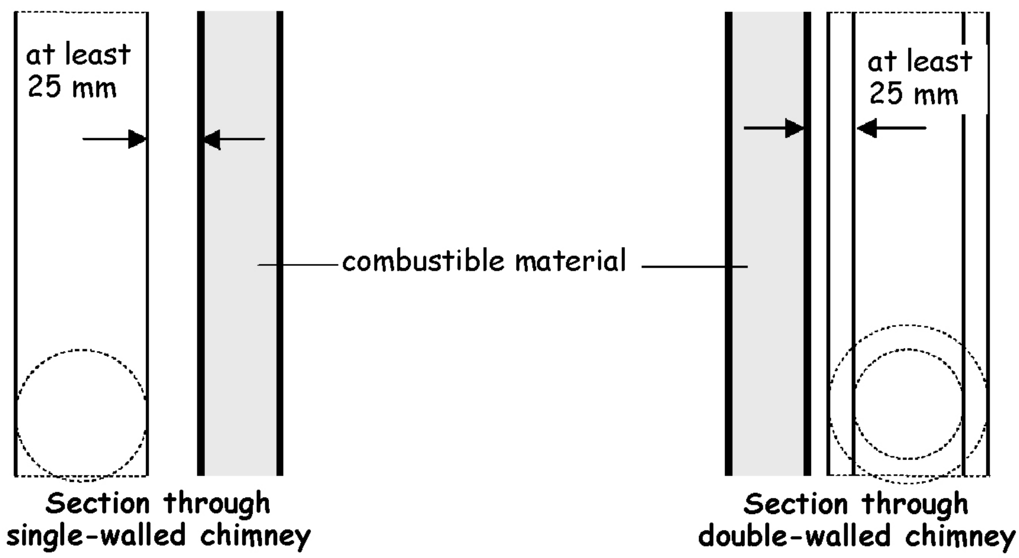
There should be a separation distance where a metal chimney passes through combustible material. This is specified, as part of the designation string for a system chimney when used for oil or gas, as (Gxx), where xx is the distance in mm. Where no data is available, the separation distance for oil or gas applications with a flue gas temperature limit of T250 or less should be 25mm from the outer surface of a single-walled chimney to combustible material. The 25mm 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 100ºC.

Figure 3.40 Section through single-walled Chimney (vertical)



There should also be a separation distance where the metal chimney runs in close proximity to combustible material. The separation distance should be 25mm from the outer surface of a single-walled chimney to combustible material. The 25mm 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 100ºC.

Figure 3.41 Section through double-walled Chimney (horizontal)



3.19.4 Relationship of flue-pipes to combustible material

To prevent the possibility of radiated heat starting a fire, a flue-pipe should be separated from combustible material by:

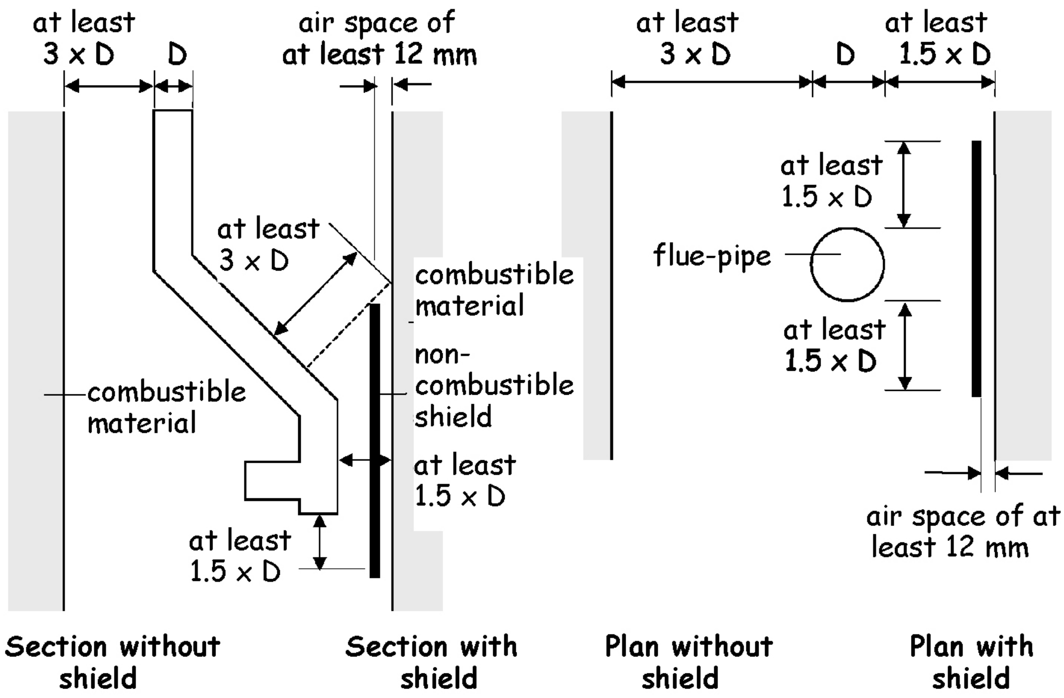
a. a distance according to the designation of the flue-pipe in accordance with BS EN 1856-2: 2005, or

b. 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 12mm thick with a thermal conductivity of not more than 0.065W/mK.

Figure 3.42 Relationship of flue-pipes to combustible material



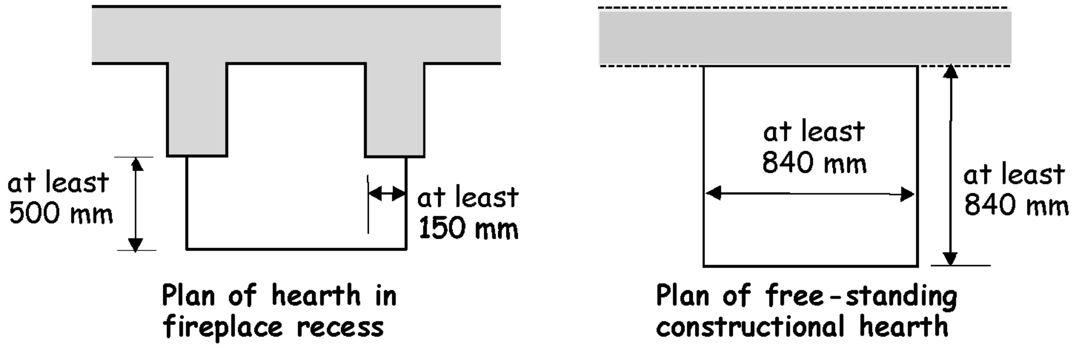
3.19.5 Relationship of solid fuel appliance to combustible material

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 125mm thick and with plan dimensions in accordance with the following sketches, or

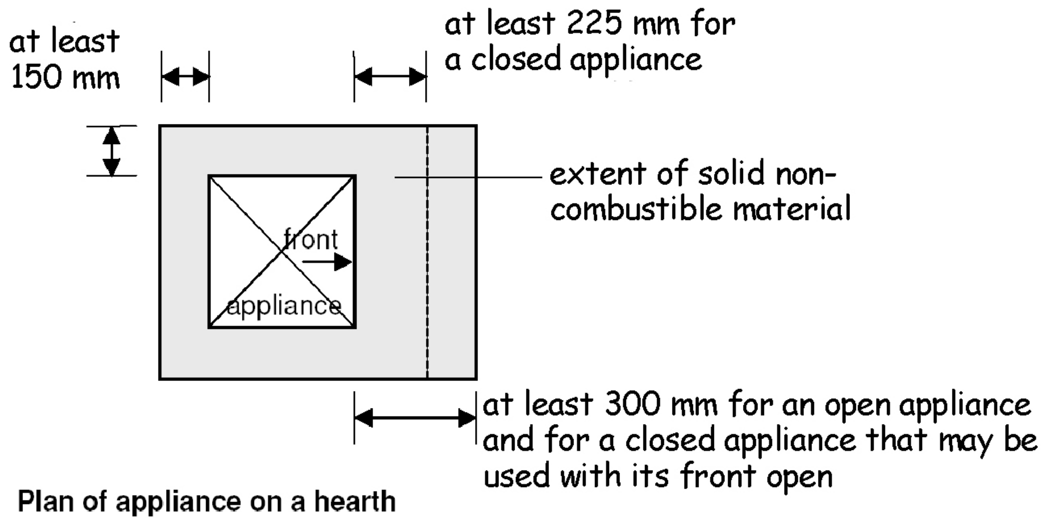
b. a free-standing, solid, non-combustible hearth at least 840 x 840mm minimum plan area and at least 12mm thick, provided the appliance will not cause the temperature of the top surface of the hearth on which it stands to be more than 100ºC.

Figure 3.43 Hearth construction



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:

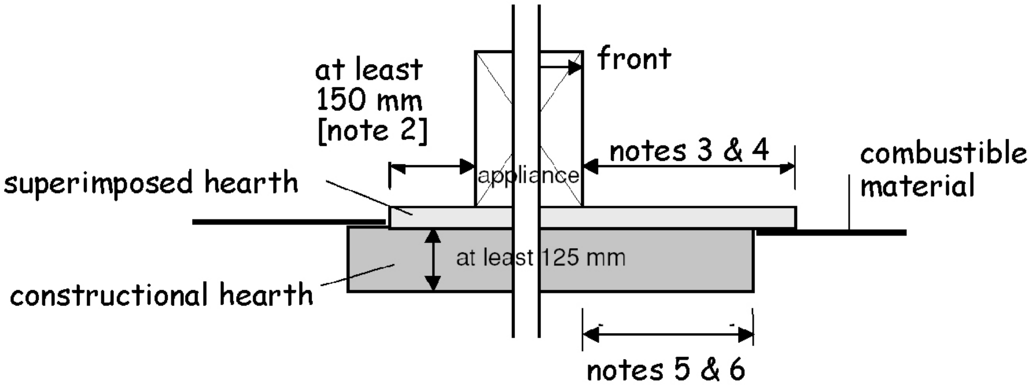
Figure 3.44 Appliance location



The 150mm 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 50mm thick in accordance with the following diagram:

Figure 3.45 Superimposed hearths



Section through superimposed hearth

Additional information:

1. SUPERIMPOSED HEARTH means a finish of solid, non-combustible material, usually decorative, at least 50mm thick and positioned on a constructional hearth.

2. There need not be a 150mm 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 225mm for a closed appliance.

4. At least 300mm 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.

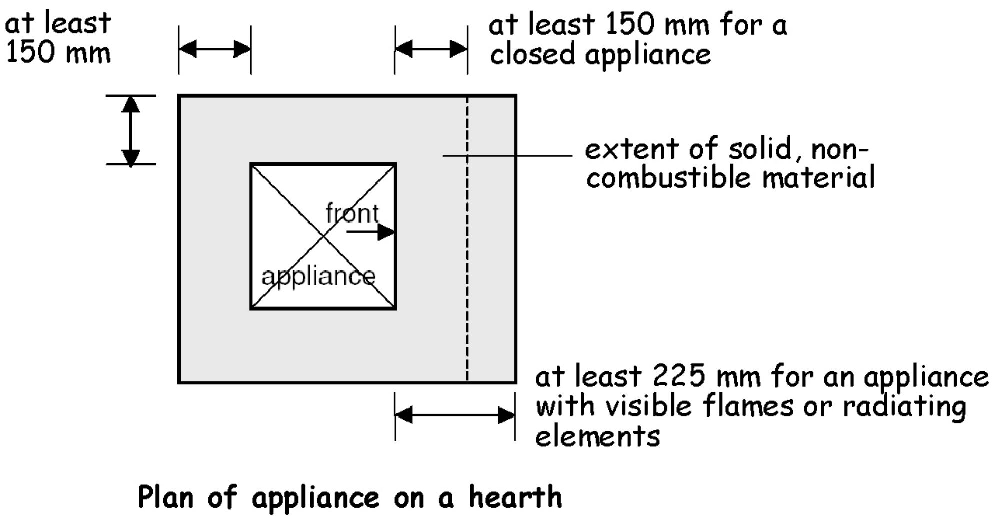
6. At least 150mm to combustible material measured horizontally.

3.19.6 Relationship of oil-firing appliance 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 100ºC 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:

Figure 3.46 Plan of appliance on a hearth (oil-firing)



The 150mm 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 100ºC under normal working conditions. Separation may be by:

a. a shield of non-combustible material at least 25mm thick, or

b. an air space of at least 75mm.

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:

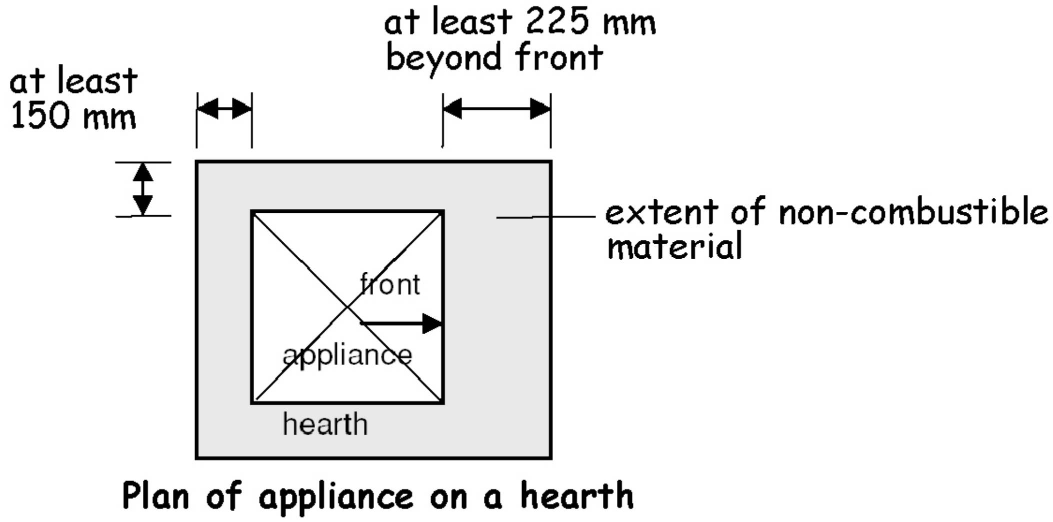
a. Clause 12 of BS 5871: Part 1: 2005 for a gas fire, convector heater and fire/back boiler

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 12mm thick and at least the plan dimension shown in the diagram to this specification:

Figure 3.47 Plan of appliance on a hearth (gas-fired)



The 150mm 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 225mm above the floor, or

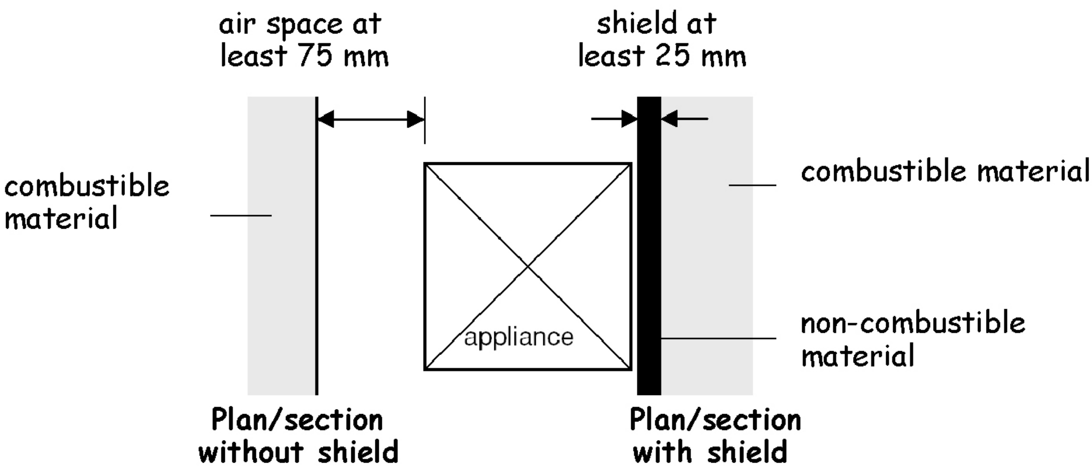
b. where the appliance is designed not to stand on a hearth, such as a wall mounted appliance or a gas cooker.

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 100ºC under normal working conditions. Separation may be by:

1. a shield of non-combustible material at least 25mm thick, or

2. an air space of at least 75mm.

Figure 3.48 Plan of appliance on a hearth (separation)



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 material

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 150mm from the hearth, constructed of solid, non-combustible material in accordance with the diagram and table to this specification.

Figure 3.49 Relationship of hearths to combustible material

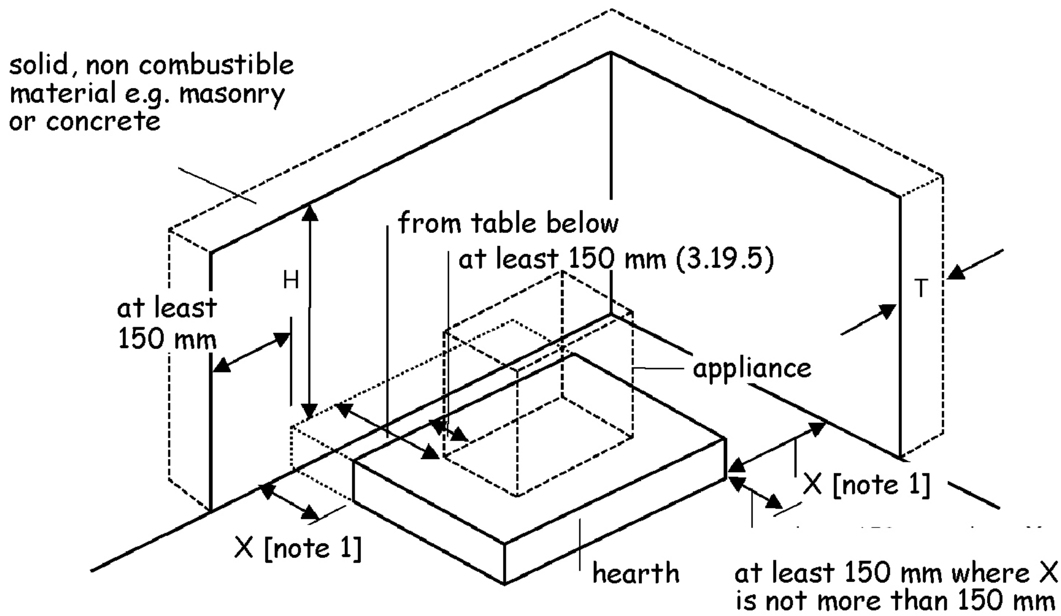


Table 3.9 Hearth and appliance adjacent to any part of a building

Location of hearth or appliance	Thickness (T) of solid, non-combustible material	Height (H) of solid non - combustible material
Where the hearth abuts a wall and the appliance is not more than 50mm from the wall	200mm	at least 300mm above the appliance or 1.2m above the hearth whichever is the greater.
Where the hearth abuts a wall and the appliance is more than 50mm but not more than 300mm from the wall	75mm	at least 300mm above the appliance or 1.2m above the hearth whichever is the greater.

Location of hearth or appliance	Thickness (T) of solid, non-combustible material	Height (H) of solid non - combustible material
Where the hearth does not abut a wall and is not more than 150mm from the wall	75mm	at least 1.2m above the hearth.

Additional information:

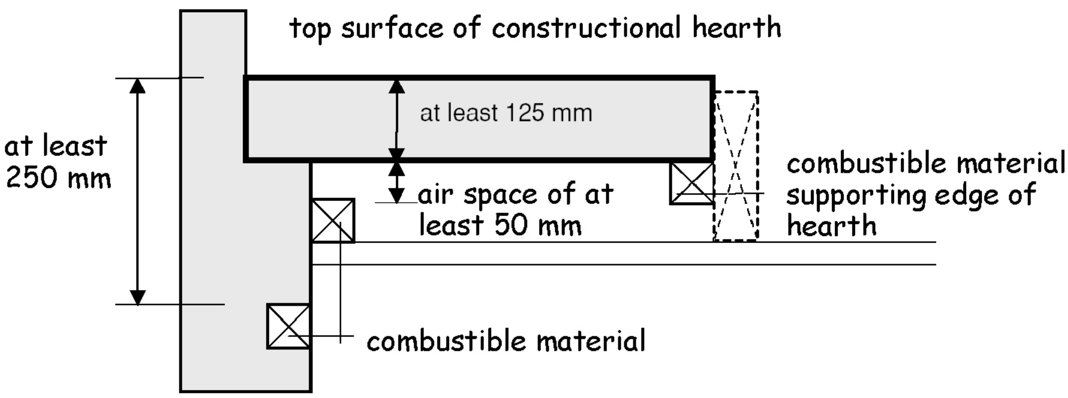
1. There is no requirement for protection of the wall where X is more than 150mm.

All combustible material under a constructional hearth should be separated from the hearth by an air space of at least 50mm. 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 250mm, or

b. the combustible material supports the front and side edges of the hearth.

Figure 3.50 Section through 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 1700kg/m^3, and

c. installed on a constructional hearth, and

d. of components having a minimum thickness shown in the table below:

Table 3.10 Thickness of solid fuel appliance chamber components

Component	Minimum thickness (mm)
Base	50

Component	Minimum thickness (mm)
Sides	75
Back panel and top slab	100
Hood and bar lintels	100

3.20 Combustion appliances – removal of products of combustion

Mandatory Standard

Standard 3.20

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

The guidance to this standard includes design and construction issues relating to chimneys and flues. In 2010-11 Fire fighters attended 1565 chimney fires in Scotland. The main cause of these fires was inadequate maintenance of the chimneys, including routine cleaning of flues.

Combustion 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. Poisonous CO gas is produced when fuel does not burn properly. Incidents of poisoning can also occur through deterioration of the structure of the flue or chimney. Every year in Scotland there are fatalities from CO poisoning directly attributed to combustion appliances installed in buildings. In addition to these deaths there are also a considerable number of incidents where people are treated in hospital for the effects of CO poisoning. In some cases CO poisoning can result in serious and permanent injury to persons affected. Where CO gas may occur within a building early detection and warning can play a vital role in the protection and safety of the occupants. This is particularly important in buildings with sleeping accommodation.

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.

The use of fanned flues allows combustion appliances to be located away from external walls. In such installations the flues can often be concealed within ceiling or wall voids making it difficult to determine whether the flue is still in good condition when an appliance is serviced or maintained.

Damaged or poorly maintained flues can allow CO gases to escape from the flue before the intended termination point. Therefore flues passing through a building should be minimised. Where it is not possible to avoid a flue passing through the building the route of the flue should be carefully considered to minimise the risk to occupants.

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 Chimney and flue-pipe serving appliance 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 250ºC while modern boilers that bear the CE mark indicating compliance with the Boiler (Efficiency) Regulations 1993 will normally have flue gas temperatures less than 250ºC. 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 250ºC.

High flue gas temperatures - where the flue gas temperatures are more than 250ºC, 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 250ºC, 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 Installation in timber framed and light steel framed buildings', where the chimney or flue-pipe is in a timber frame 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 & Use) Regulations 1998 has specific requirements for room-sealed appliances in these locations.

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:

- BS EN 12391-1: 2003, for solid fuel appliances
- BS 5410: Part 1: 1997, for oil-firing appliances

- 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.

Table 3.11 Thickness of solid fuel appliance chamber components

Appliance	Minimum flue size [3]
Fireplace with an opening more than 500mm x 550mm, 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 500mm x 550mm	200mm diameter or rectangular/square flues having the same cross sectional area and a minimum diameter not less than 175mm
Closed appliance with rated output more than 30kW but not more than 50kW, burning any fuel	175mm diameter or rectangular/square flues having the same cross sectional area and a minimum diameter not less than 150mm
Closed appliance with rated output not more than 30kW burning any fuel	150mm diameter or rectangular/square flues having the same cross sectional area and a minimum diameter not less than 125mm
Closed appliance with rated output not more than 20kW that burns smokeless or low volatiles fuel	125mm diameter or rectangular/square flues having the same cross sectional area and a minimum diameter not less than 100mm for straight flues or 125mm for flues with bends or offsets

Additional information:

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 120000mm^2 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.

Figure 3.51 Fireplace opening areas

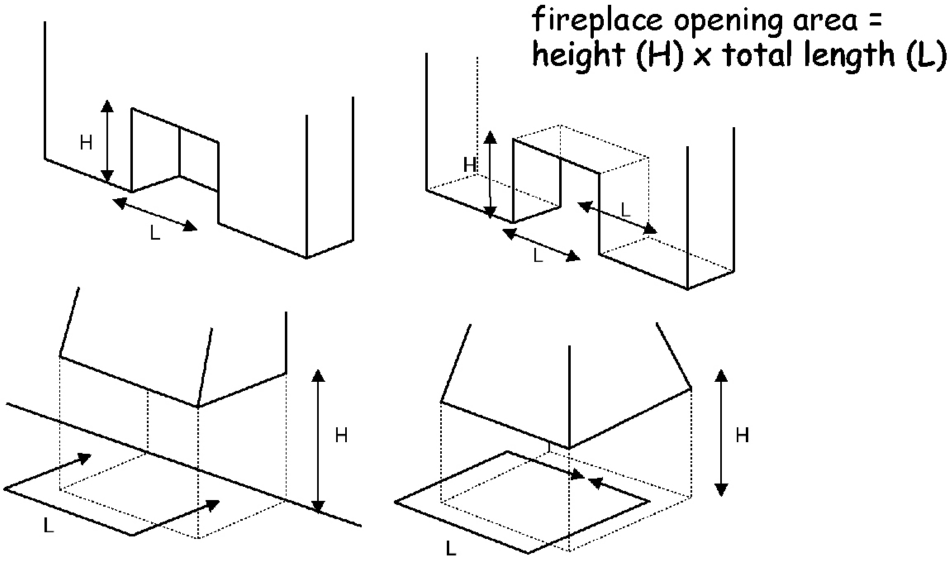
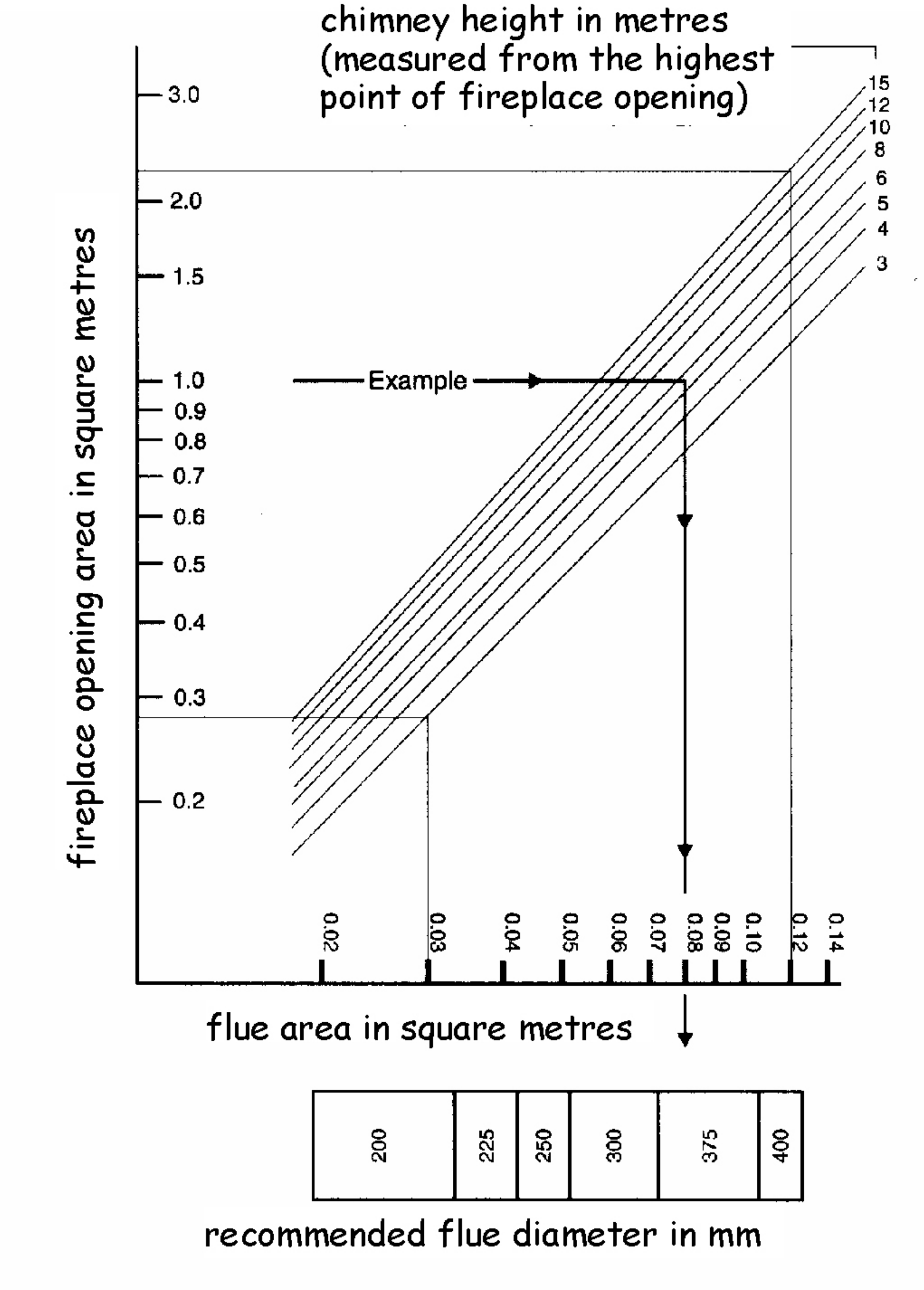


Figure 3.52 Flue sizing for larger solid fuel open fires



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:

- Clause 9 of BS 5871: Part 3: 2005, for a decorative fuel-effect gas appliance
- BS 5871: Part 2: 2005, for an inset live fuel-effect gas appliance
- 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.

Every solid fuel appliance should be connected to a separate flue.

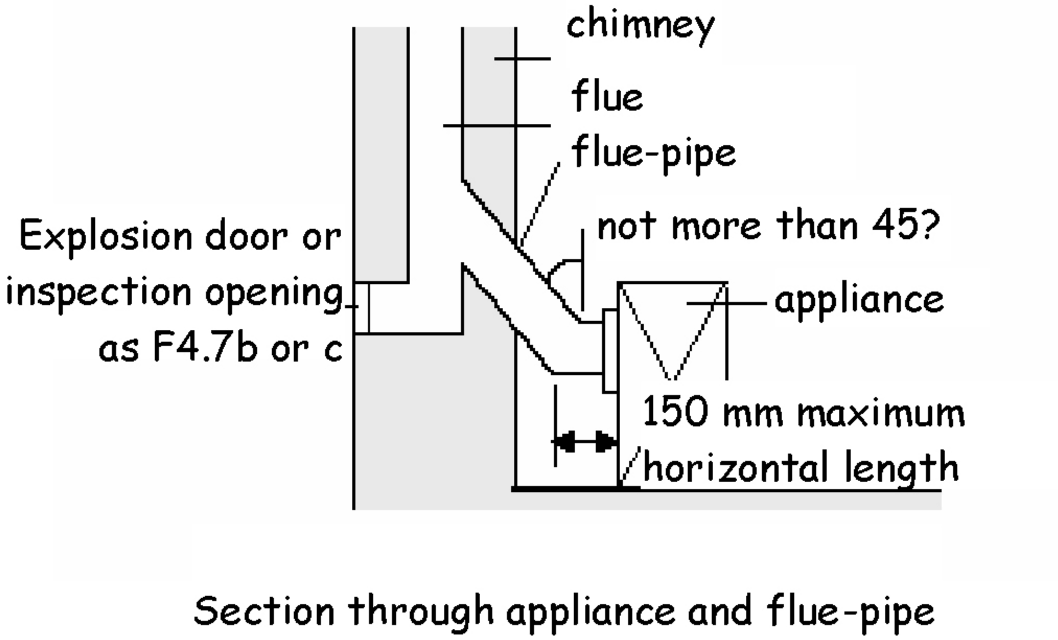
Every oil-firing appliance should be connected to a separate flue. However this is not necessary where all the appliances have pressure jet burners and are connected into a shared flue.

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 150mm.

Figure 3.53 Flue-pipe connection to back-entry solid fuel appliance



Where bends are essential, they should be angled at not more than 45º 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.

Adequate provision for inspecting flues that are positioned within a void, for example a service duct or above a suspended ceiling, should be provided. Such provisions will allow essential safety checks to be made by engineers when a combustion appliance is worked on, both during initial commissioning and any subsequent servicing.

Access hatches should be 300mm x 300mm or larger where necessary to allow sufficient access to the void to look along the length of the flue. The number and position of access hatches should allow the entire length of the concealed flue to be inspected with at least one hatch located within 1.5m of any joint in the flue system.

Access hatches are intended for inspection purposes only, it is not intended that they allow full physical access to the flue system.

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 gasses at the point of discharge can be at a high temperature. Therefore flues discharging at low level where they may be within each 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:

Figure 3.54 Solid fuel - flue outlets

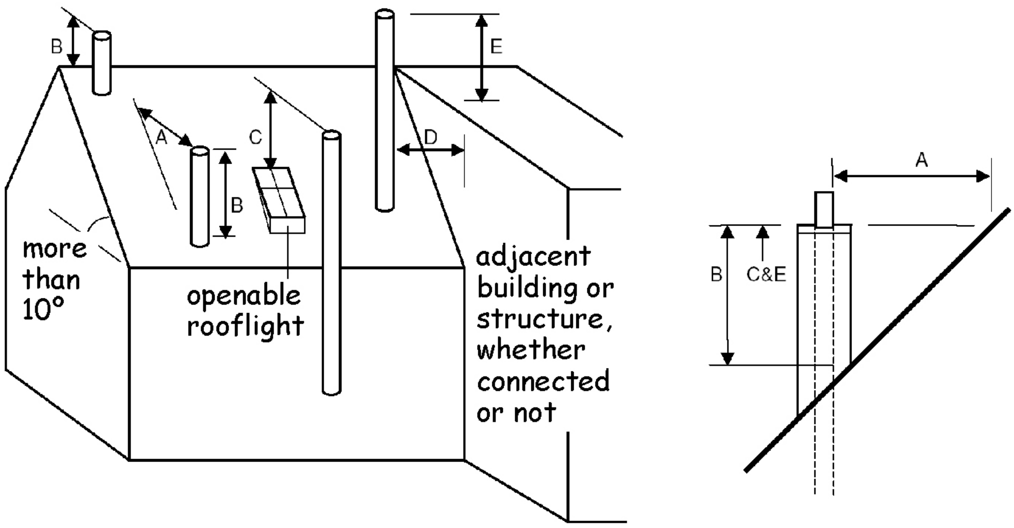


Table 3.12 Minimum dimension to flue outlets

Location	Minimum dimension to flue outlets
A	2.3m horizontally clear of the weather skin.
B	1.0m provided A is satisfied or 600mm where above the ridge. However, where the roof is thatch or shingles, the dimensions should be as figure 3.53 to clause 3.20.17.
C	1.0m above the top of any flat roof and 1.0m above any openable rooflight, dormer or ventilator, etc. within 2.3m measured horizontally.
D/E	Where D is not more than 2.3m, E must be at least 600mm.

Additional information:

1. Horizontal dimensions are to the surface surrounding the flue.

2. Vertical dimensions are to the top of the chimney terminal.

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:

Figure 3.55 Combustible roof coverings

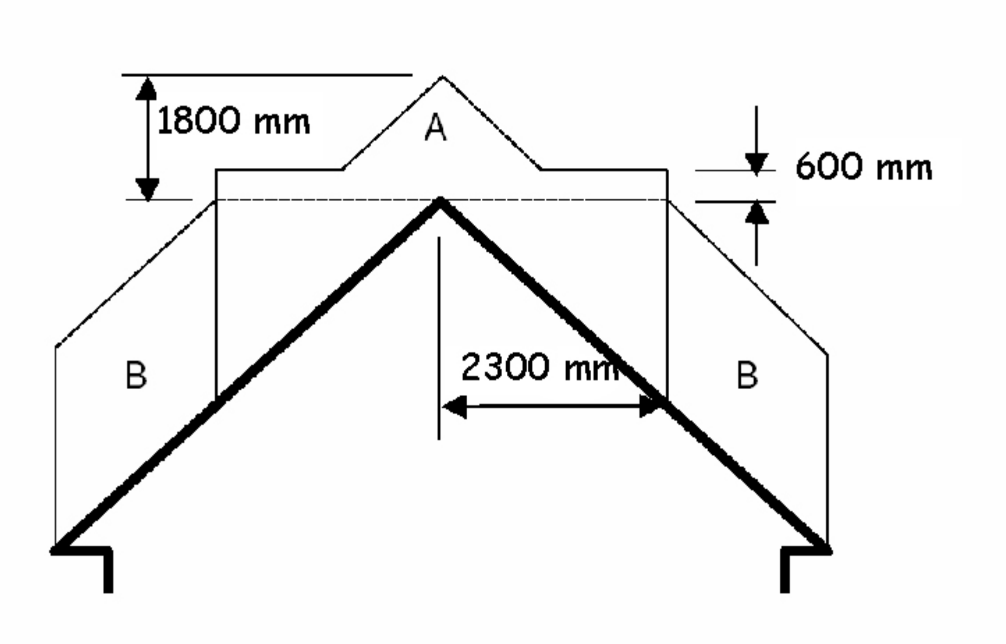


Table 3.13 Location of flue terminals relative to easily ignitable roof coverings

Location	Location of flue terminals relative to easily ignitable roof coverings
Zone A	At least 1.8m vertically above the weather skin and at least 600mm above the ridge.
Zone B	At least 1.8m vertically above the weather skin and at least 2.3m 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:

Figure 3.56 Oil-firing - flue outlets

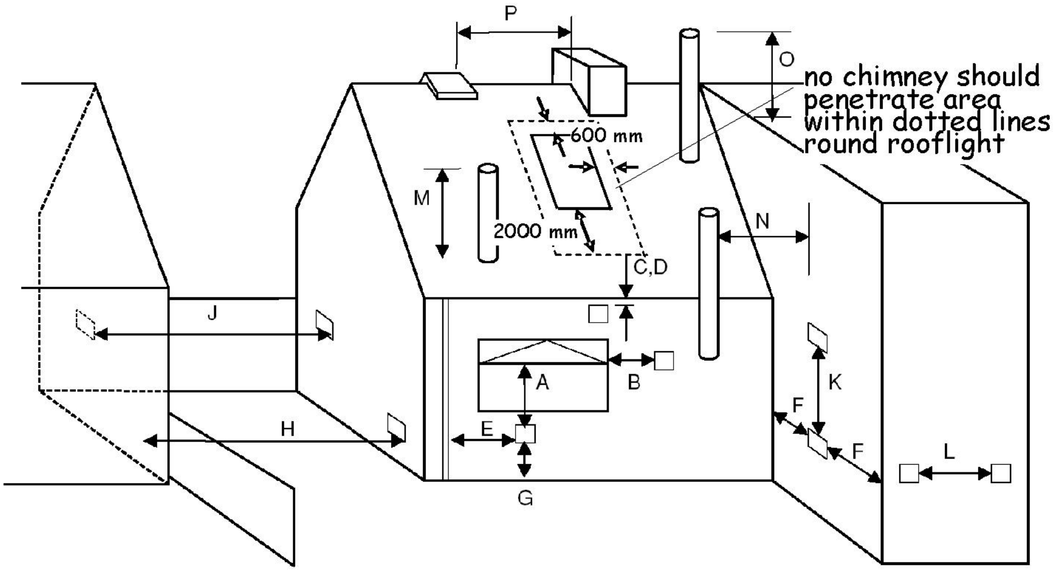


Table 3.14 Flue terminal positions for oil-firing appliances

Location	Minimum distance to terminal (mm)	
	pressure jet	**vaporising**
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 boundary 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 750mm 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

Additional information:

1. Appliances burning Class D oil should discharge the flue gases at least 2m 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 1800mm from an oil storage tank unless a wall with a non-combustible construction type 7, short duration (see table to 2.B.1) and more than 300mm higher and wider each side than the tank is provided between the tank and the terminating position.

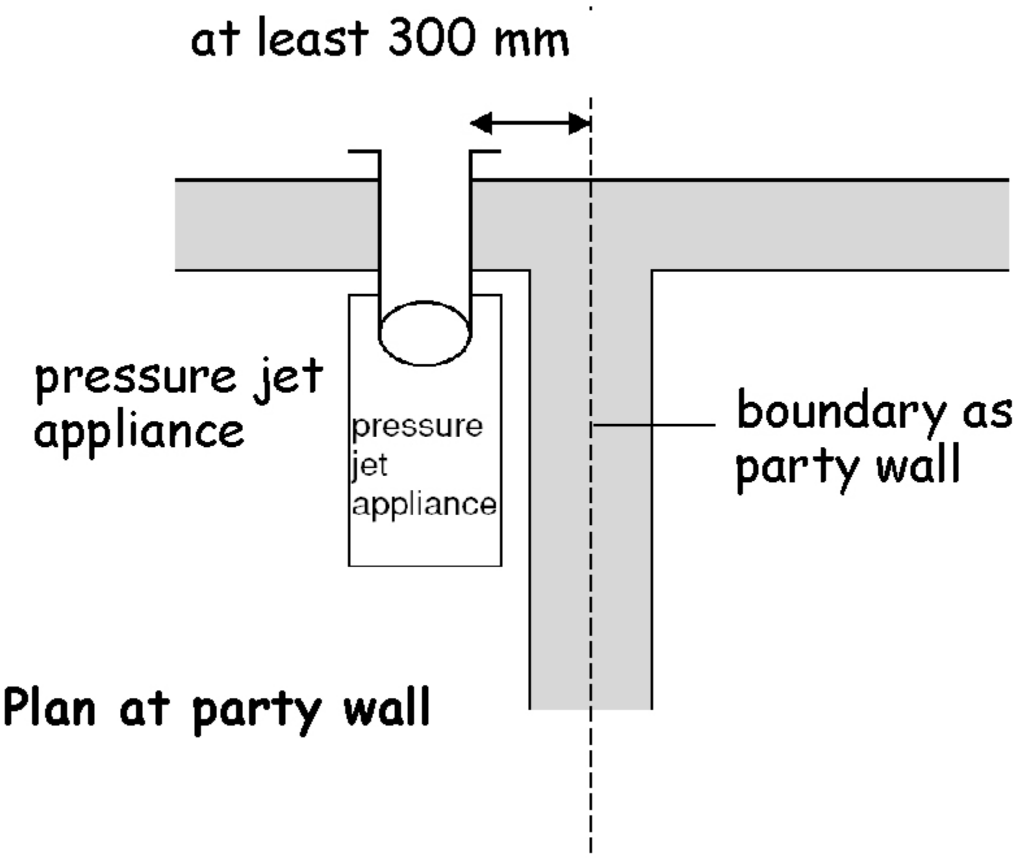
6. Where a flue terminates not more than 600mm below a projection and the projection is plastic or has a combustible finish, then a heat shield of at least 750mm wide should be fitted.

7. The distance from an appliance terminal installed at right angles to a boundary may be reduced to 300mm 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 2300mm should be provided between the terminal and the roof line.

9. Notwithstanding the dimensions above, a terminal should be at least 300mm from combustible material.

Figure 3.57 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:

Figure 3.58 Gas-fired - flue outlets

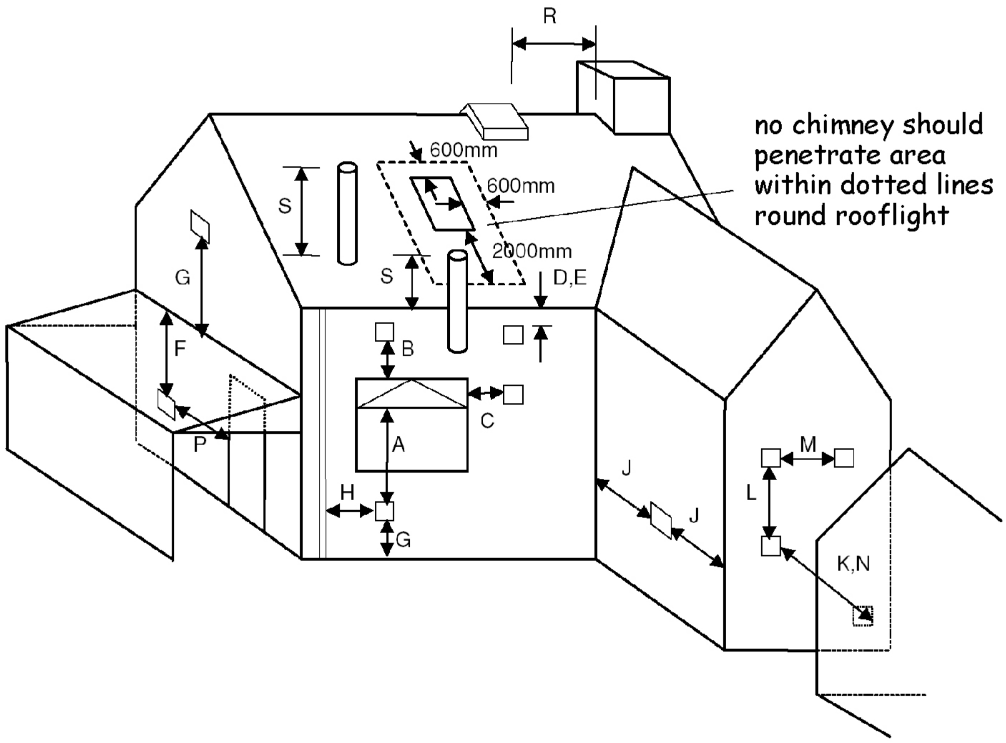


Table 3.15 Flue terminal positions for gas-fired appliances

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	300	n/all	300

Location	Minimum distance to terminal in mm			
	Balanced flue, room-sealed appliance		Open flue	
	natural draught	fanned draught	natural draught	fanned draught
	(>14-70 kW) 600			
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 carport 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 boundary 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 carport (e.g. door, window) into the building	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

Additional information:

1. Notwithstanding the dimensions in the table, a terminal serving a natural draught and fanned draught appliance of more than 3kW heat input, should be at least 300mm and 150mm respectively from combustible material.

2. Where a natural draught flue terminates not more than 1m below a plastic projection or not more than 500mm below a projection with a painted surface, then a heat shield at least 1m long should be fitted.

3. This dimension may be reduced to 75mm for appliances of up to 5kW heat input.

4. The products of combustion should be directed away from discharging across a boundary.

5. The distance from a fanned draught appliance terminal installed at right angles to a boundary may be reduced to 300mm in accordance with diagram 2 to clause 3.20.17.

6. The distance of a fanned flue terminal located directly opposite an opening in a building should be at least 2m.

7. Vertical structure includes a chimney-stack, dormer window, tank room, lift motor room or parapet.

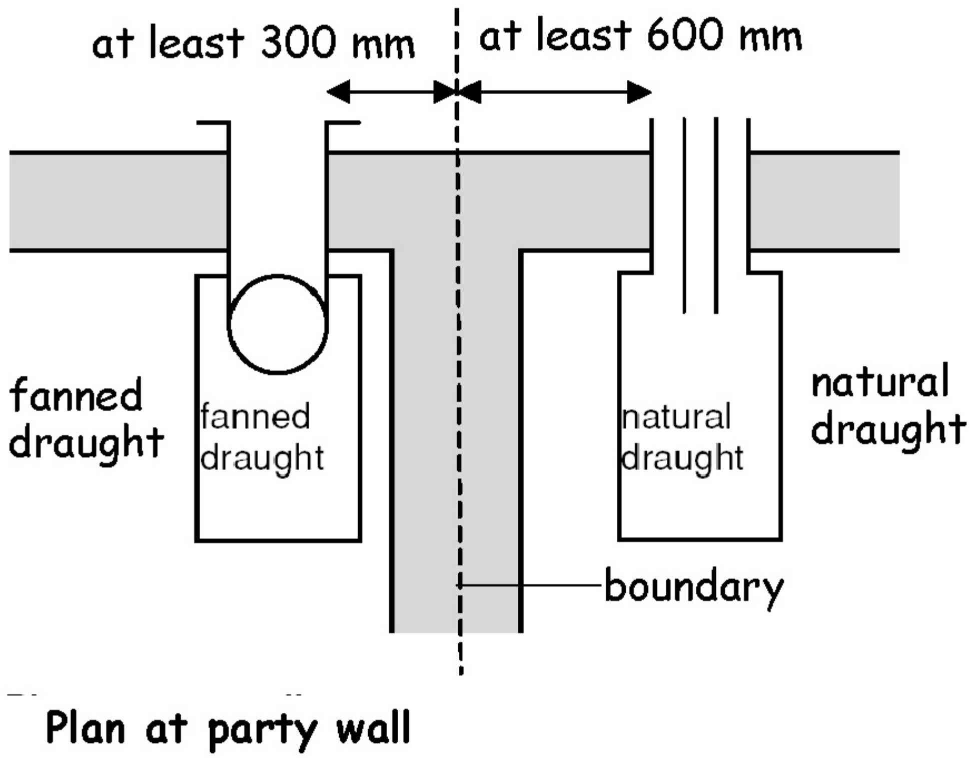
8. 1500mm if measured to a roof terminal, otherwise as Table 2 in BS 5440-1: 2000.

9. To manufacturer’s instructions.

10. As Table 2 in BS 5440-1: 2000.

11n/all = not allowed. n/app = not applicable.

Figure 3.59 Separation between a boundary and terminal at right angles



3.20.20 Carbon monoxide detection

Carbon monoxide (CO) is a colourless, odourless, and tasteless gas. Low levels of CO gas can be present in the atmosphere, however, it is highly toxic and dangerous to humans and animals in higher quantities. The gas is produced in high levels from appliances where incomplete combustion of a carbon based fuel occurs. Incomplete combustion could occur in appliance installations that are defective, lack proper maintenance or have inadequate provision for combustion air.

In order to alert occupants to the presence of levels of carbon monoxide which may be harmful to people, a detection system should be installed in all dwellings where:

- a new or replacement fixed combustion appliance (excluding an appliance used solely for cooking) is installed in the dwelling, or
- a new or replacement fixed combustion appliance is installed in an inter-connected space, for example, an integral garage.

Carbon monoxide detectors should comply with BS EN 50291-1:2010 and be powered by a battery designed to operate for the working life of the detector. The detector should incorporate a warning device to alert the users when its working life is due to expire. Hard wired mains operated carbon monoxide detectors complying with BS EN 50291-1:2010 (Type A) with fixed wiring (not plug in types) may be used as an alternative, provided they are fitted with a sensor failure warning device.

Where carbon monoxide detectors are within the scope of either or both:

- European Directive 2006/95/EC – Low Voltage Directive, and/or
- European Directive 1999/5/EC – Radio and Telecommunication Terminal Equipment Directive

they should be constructed to fully comply with all applicable safety aspects of the Directive(s).

The guidance in this clause takes account of the audibility levels in adjoining rooms and the effect of carbon monoxide moving throughout the building. Carbon monoxide detectors should include an integral sounder.

A carbon monoxide detection system to alert occupants to the presence of carbon monoxide should consist of at least:

- 1 carbon monoxide detector in every space containing a fixed combustion appliance (excluding an appliance used solely for cooking), and
- 1 carbon monoxide detector to provide early warning to high risk accommodation, that is, a bedroom or principal habitable room, where a flue passes through these rooms.

Unless otherwise indicated by the manufacturer, carbon monoxide detectors should be either:

- ceiling mounted and positioned at least 300mm from any wall, or
- wall mounted and positioned at least 150mm below the ceiling and higher than any door or window in the room.

Carbon monoxide detectors in the space containing the combustion appliance should be sited between 1m and 3m from the appliance.

Note: where the combustion appliance is located in a small space it may not be possible to locate the detector within that space. In such circumstances the detector may be located at the appropriate distance outwith the space.

A carbon monoxide detector should not be sited:

- in an enclosed space (for example in a cupboard or behind a curtain)
- where it can be obstructed (for example by furniture)
- directly above a sink
- next to a door or window
- next to an extract fan
- next to an air vent or similar ventilation opening
- in an area where the temperature may drop below -10°C or exceed 40°C, unless it is designed to do so
- where dirt and dust may block the sensor
- in a damp or humid location, or
- in the immediate vicinity of a cooking appliance.

Additional guidance on the siting of carbon monoxide detectors, including enhanced coverage, can be found in BS EN 50292:2002.

The provision of a carbon monoxide detection system should not be regarded as a substitute for the correct installation and regular servicing of a combustion appliance.

3.21 Combustion appliances – air for combustion

Mandatory Standard

Standard 3.21

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.

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).

3.21.1 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 vents, 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 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 permanent ventilated direct to the open air. An air supply should be provided in accordance with the following table:

Table 3.16 Supply of air for combustion

Type of appliance	Minimum ventilation opening size [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 flue.
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 550mm^2 for each kW of combustion appliance rated output more than 5kW. (A combustion appliance with an output rating of not more than 5kW has no minimum requirement, unless stated by the appliance manufacturer).

Additional information:

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 300mm^2/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 5871-3: 2005, for a decorative fuel-effect gas appliance

b. BS 5871-2: 2005, for an inset live fuel-effect gas appliance

c. BS 5440-2: 2000, for any other gas-fired appliance.

3.21.5 Flue-less gas heating appliances

Flue-less 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 flue-less appliances are used as the only means of heating a room or space then not withstanding BS 5440-2:2000, the appliance standard BS 5871-4: 2007 provides additional installation and ventilation guidance for independent flue-less 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

Mandatory Standard

Standard 3.22

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

Mandatory Standard

Standard 3.23

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.

The acceptance of climate change and the environmental policies put in place to mitigate its impact 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.

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’ http://www.scotland.gov.uk/topics/built-environment/building/building-standards

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:

Table 3.17 Location of oil storage tank not more than 3500 litres capacity

<table>
<tr><th rowspan="2">Location of tank</th><th colspan="2">Protection recommended</th></tr>
<tr><th>Building without openings</th><th>Building with openings</th></tr>
<tr><td>Not more than 1.8m from any part of any building</td><td>• non-combustible base, and
• any part of the eaves not more than 1.8m from the tank and extending 300mm beyond each side of the tank must be non-combustible, and either:
a. any part of a building not more than 1.8m from the tank should be of non-combustible construction type 7, short duration [2], or
b. a barrier [1].</td><td>• non-combustible base, and
• any part of the eaves not more than 1.8m from the tank and extending 300mm beyond each side of the tank must be non-combustible, and
• a barrier between the tank and any part of a building not more than 1.8m from the tank.</td></tr>
<tr><td>More than 1.8m from any building</td><td colspan="2">non-combustible base</td></tr>
<tr><td>Not more than 760mm from a boundary</td><td colspan="2">• non-combustible base, and
• a barrier
• or a wall with a non-combustible construction type 7, short duration [2]</td></tr>
<tr><td>More than 760mm from a boundary</td><td colspan="2">non-combustible base</td></tr>
<tr><td>Externally, wholly below ground</td><td colspan="2">no protection required</td></tr>
</table>

Additional information:

1. BARRIER means an imperforate, non-combustible wall or screen at least 300mm higher and extending 300mm 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 100mm thick or of paving slabs at least 42mm thick that extends at least 300mm beyond all sides of the tank would be appropriate. However, where the tank is within 1m of the boundary and not more than 300mm 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 the guidance to 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, all 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 their contents, bulk storage for wood fuels should be located in accordance with the following table:

Table 3.18 Bulk storage of woody biomass fuel

Location of container	Protection recommended
External and not more than 1.8m from any part of any building	a. any part of the building eaves not more than 1.8m from the container and

Location of container	Protection recommended
	extending 300mm beyond each side of the container must be non-combustible, and b. a barrier [1]
External not more than 1m from any boundary	the container should be constructed to have medium fire resistance duration to its boundary walls
Within a building	a. separated from the building with internal wall constructions providing medium fire resistance duration, type 4 [2] with any door to be outward opening to type 7 [2], and b. any door to be outward opening providing short fire resistance duration type 6 [2], and c. separated from the building with floor constructions providing short fire resistance duration, type 2 [2], and d. external walls constructed that provide short fire resistance duration type 7 or type 8 [2] as appropriate

Additional information:

1. BARRIER means an imperforate, non-combustible wall or screen at least 300mm higher than and extending 300mm beyond either end of the container 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 the 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

Mandatory Standard

Standard 3.24

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: 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**

b. **the volume of woody biomass fuel storage allows the number of journeys by delivery vehicles to be minimised.**

Limitation:

This standard does not apply to portable containers.

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.

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.

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

The following terms are included below to provide clarity to their meaning in this Technical Handbook.

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.

Integrally bunded tank - means a tank together with a catchpit manufactured as a self-contained unit.

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 houses. Information on woody biomass fuel can be found on the BSD website under: ‘Storage of woody biomass fuel for heating equipment’ http://www.scotland.gov.uk/topics/built-environment/building/building-standards.

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).

3.24.1 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

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.

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.

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:

a. tank located within 10m of the water environment (i.e. rivers, lochs, coastal waters)

b. tank located where spillage could run into an open drain or to a loose fitting manhole cover

c. tank within 50m of a borehole or spring

d. tank over ground where conditions are such that oil spillage could run-off into a watercourse

e. tank located in a position where the vent pipe outlet is not visible from the fill point

f. any other potential hazard individual to the site.

OFTEC Technical Book 3 provides a simple and helpful cross check to the above list.

A catchpit or integrally bunded 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 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 bulk deliveries need not be made at intervals of less that 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 3 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 provided in the non-domestic Technical Handbook.

Table 3.19 Bulk woody biomass fuel storage: 100% heating (primary) and DHW

Dwelling size	Wood pellets	Wood chips	Logs - stacked
< $80m^2$	$1.5m^3$	$3.5m^3$	$3m^3$
80 -$160m^2$	$2m^3$	$5m^3$	$4m^3$
> $160m^2$	$3m^3$	$6m^3$	$5m^3$

Additional information:

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.

The following table provides recommended size of storage for secondary heating for a variety of dwelling types:

Table 3.20 Woody biomass fuel storage: secondary heating

Dwelling size	Wood pellets	Wood chips	Logs - stacked
< $80m^2$	$0.3m^3$ (9 bags)	$1m^3$	$0.5m^3$

Dwelling size	Wood pellets	Wood chips	Logs - stacked
80 - 160m^2	0.5m^3 (13 bags)	1.5m^3	1m^3
> 160m^2	0.7m^3 (16 bags)	2m^3	1m^3

Additional information:

1. The figures in the table relate to deliveries made every 6 months.

3.25 Solid waste storage

Mandatory Standard

Standard 3.25

Every building must be designed and constructed in such a way that accommodation for solid waste storage is provided which:

a. **permits access for storage and for the removal of its contents**

b. **does not threaten the health of people in and around the building, and**

c. **does not contaminate any water supply, ground water or surface water.**

Limitation:

This standard applies only to a flat or maisonette.

3.25.0 Introduction

Scotland produces large quantities of waste – almost 17 million tonnes in 2010. This comes from a range of sources with household waste accounting for 2.8 million tonnes. The revised EU Waste Framework Directive establishes the legislative framework for handling of waste in the European Union. The Directive lays down that Member States must have a National Waste Management Plan, or Plans.

In June 2010 the Scottish Government launched its Zero Waste Plan which set out actions to deliver important changes to how Scotland treats and manages waste. The plan includes a 70% recycling rate for household and all other waste streams by 2025. The Waste (Scotland) Regulations 2012 provide statutory measures to support delivery of the zero waste agenda by requiring, amongst other aspects, separate collection and treatment of waste.

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. Under the Zero Waste Plan local authorities are required to provide householders with separate collection services for dry recyclables (glass, metals, plastics, paper and card) by the end of 2013 and for food waste by the end of 2015.

Currently local authorities meet their obligations in different ways and designers need to be aware of these local initiatives and make suitable provision in their designs.

Flats and maisonettes generally have communal storage with the associated risks to health and the environment.

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 flat and maisonette 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 150mm between and around the containers. Communal enclosures with a roof that are also accessible to people should be at least 2m 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 flat or maisonette. 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 permanent 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 15mm diameter to pass through at any point.

3.26 Dungsteads and farm effluent tanks

Mandatory Standard

Standard 3.26

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 proportion 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 below ground. The container must be impermeable.

The guidance to this standard should not be read in isolation. Appropriate sections of other legislation, such as the Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) (Scotland) Regulations 2003 and The Water Environment (Controlled Activities) (Scotland) Regulations 2011, as amended would also normally require to be met. The Scottish Environmental Protection Agency is the body responsible for enforcing these environmental regulations and further information may be obtained from their website www.sepa.org.uk [http://www.sepa.org.uk].

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.

Explanation of terms

The following terms are included to provide clarity to their meaning in this Technical Handbook.

Dungstead means a permanent storage facility for all farmyard manures including solid and semi-solid animal excreta. The construction should allow for any liquid to be contained within the store or be allowed to seep out for collection in a leak-proof storage tank.

Farm Effluent Tank means a leak-proof storage facility for liquid animal excreta (slurry), dirty water (water contaminated with slurry) and silage effluent that is of a consistency that allows it to be pumped or discharged by gravity at any stage of the handling process.

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 premises used wholly or partly for the preparation or consumption of food so as not to prejudice the health of people in the food premises. The dungstead or farm effluent tank should be located at least 15m from the food premises.

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.

3.27 Water efficiency

Mandatory Standard

Standard 3.27

Every building must be designed and constructed in such a way that sanitary facilities with water efficient fittings which are designed for the prevention of undue consumption of water are installed.

Limitation:

This standard applies only to a dwelling.

3.27.0 Introduction

Using less water saves energy and reduces Carbon Dioxide (CO_2) emissions. This is achieved by reducing the energy that is used in key areas including:

- treating water to a standard suitable for drinking
- distribution of water to homes
- collection and pumping of generated wastewater
- treatment of the wastewater generated
- heating of water for health and hygiene

Scottish Water estimate that the average consumption of wholesome water per person in Scotland is around 150 litres per day. Water consumption has increased over the last few decades and is projected to continue to rise. Around 30% of the average household's heating bills are spent on heating water for sanitary, health or hygiene purposes. Therefore the provision of sanitary appliances and fittings that use water more efficiently can assist in the reduction of associated carbon emissions and the home owner's energy costs.

The Scottish Water Byelaws set requirements which must be adhered to in all properties that have a public water supply. They cover the design, installation and maintenance of plumbing systems, water fittings and water-using appliances. Scottish Water now require all new industrial or commercial buildings to be metered. Meters may also be installed in dwellings if requested.

Further information on water efficiency and related carbon emission savings can be found on the websites of Scottish Water, Waterwise and the Energy Saving Trust.

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).

3.27.1 Water use

Water is used for various purposes within a dwellings. The national independent organisation 'Waterwise' advise that the daily percentage of demand in key use areas of the total supplied water for dwellings to be as follows:

WC Flushing	Baths and taps	Laundry	Showers	Drinking and other	Washing up	External
30%	21%	13%	12%	9%	8%	7%

The actual water used within a dwellings will be influenced by both the behaviour of the occupants in how they use the sanitary facilities and associated water fittings and also the volume of water discharged from them. Therefore, controlling the volume of water discharged from sanitary facilities and fittings should contribute to reducing the use of water.

Efficiency measures can be applied to most sanitary facilities with varying degrees of benefits. For certain sanitary facilities reducing the water use will be related to its function. For example a bath is generally filled to a water level that suits the occupant and therefore controlling water flow from taps to that facility would only serve to extend the amount of time taken to fill the bath.

Most WCs produced today are now of the dual flush type which give users the option of a reduced flush, generally for liquid waste or a full flush for solid waste. The flush volume will generally be achieved through the valve mechanism of the WC cistern.

To reduce the water flow rates at taps for wash or hand rinse basins (WHBs) options include the installation of flow restrictors, or aerators. These may be fitted in either the water supply pipes serving the sanitary facilities or incorporated within the tap components.

3.27.2 Water efficient fittings

Water efficient fittings should be provided to all WCs and WHBs within a dwelling.

Dual flush WC cisterns should have an average flush volume of not more than 4.5 litres. Single flush WC cisterns should have a flush volume of not more than 4.5 litres.

Taps serving wash or hand rinse basins should have a flow rate of not more than 6 litres per minute.

Many bathroom and fittings manufacturers are now using the latest technology to offer comprehensive portfolios of water efficient products that deliver satisfactory performance. Further guidance and comparison of water efficient appliances and fittings for the industry can be obtained from schemes such as the water efficient product labelling scheme from the Bathroom Manufacturers Association.

When specifying water efficient fittings consideration should be given to the operational flow rates that some heating or hot water appliances, such as combination boilers, need to activate their water heating function.

When installing low volume flush WCs, the pipe diameter, discharge and gradient inter-relationship of the drainage system is critical in order that the new and any existing sections of the drain operate as intended.

Plumbing and associated water installations should be carried out and commissioned by persons who possess sufficient technical knowledge, relevant practical skills and experience for the nature of the work undertaken.

An approved Certifier of Construction, who has been assessed to have the professional skills and relevant experience, can certify compliance of plumbing, heating or drainage installations.