BRITISH STANDARD

BS 6461-1: 1984

*Incorporating Amendment No. 1*

# Installation of chimneys and flues for domestic appliances burning solid fuel (including wood and peat) —

## Part 1: Code of practice for masonry chimneys and flue pipes

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# Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Building Services Standards Committee (SEB/-) to Technical Committee SEB/32 upon which the following bodies were represented:

Association of British Solid Fuel Appliances Manufacturers
Brick Development Association
British Board of Agrément
British Flue and Chimney Manufacturers' Association
British Precast Concrete Federation Ltd.
Clay Pipe Development Association Ltd.
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Department of the Environment (Building Research Establishment)
Department of the Environment (Housing and Construction)
Domestic Solid Fuel Appliances Approval Scheme
Greater London Council
Institute of Building Control Officers
Institution of Municipal Engineers
Institution of Public Health Engineers
National Association of Plumbing, Heating and Mechanical Services Contractors
National Clayware Federation
National Coal Board
National Federation of Building Trades Employers
National Federation of Clay Industries
National Fireplace Council Manufacturers' Association
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Scottish Development Department
Solid Fuel Advisory Service
Woodburning Association of Retailers and Manufacturers

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# Contents



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# Foreword

This British Standard has been prepared under the direction of the Building Services Standards Committee and is a revision in two Parts of CP 131:1974, which is withdrawn. It takes account of current experiences on design, construction and erection of all forms of in situ built and factory-made and flue block domestic chimneys. It should be read in conjunction with CP 403, the scope of which has a considerable bearing on the recommendations given in this standard, particularly in relation to size and height of chimneys and the formation of a fireplace recess at the base of a chimney flue.

This Part of this standard covers masonry chimneys and flue pipes; factory-made chimneys are covered in Part 2 of this standard.

The changing energy availability and cost position, now and in the coming years, suggests that new houses should incorporate a chimney suitable for a variety of different forms of heating appliances and fuels that might need to be used during the lifetime of a house. Chimneys may also be required in houses built without a flue. This code gives advice on what to provide.

Because misunderstanding may arise on the distinction between a chimney and a flue, definitions of chimney and flue are given in clause **2**.

The construction of a chimney is presently controlled by the following regulations and amendments to them.

a) The Building Regulations 1976, applicable in England and Wales.

b) London Building (Constructional) By-laws, 1972-1979, applicable to Inner London.

c) The Building Standards (Scotland) Regulations 1981 and 1982.

d) The Building Regulations (Northern Ireland) 1977.

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**Summary of pages**

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 24, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.


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## 1 Scope

**1.1** This Part of BS 6461 gives recommendations for the construction of new flues, whether in chimneys or flue pipes, the operation of which depends on natural draught. It includes recommendations for chimneys built of brick, stone, concrete and flue blocks and also on the materials, components and installation of flue pipes. Warm air ducts forming an integral part of an installation are not included. Appendix A gives guidance on remedial action for defective chimneys.

The chimneys and flues are specifically suitable for use with all types of domestic solid fuel appliances, including wood burning appliances, but see Appendix B regarding cleaning and maintenance. They are also suitable for use with gas and oil fired appliances.

**1.2** This Part of this standard is confined to chimneys and flue pipes serving appliances with a maximum heat output of 45 kW and the temperature of the flue gases leaving the appliance has been assumed not to exceed 500 °C under normal operating conditions. The chimneys and flue pipes will normally withstand much higher temperatures that can arise during overrun conditions and chimney fires for short periods, but may need some repair.

NOTE The titles of the publications referred to in this Part of this standard are listed on the inside back cover.

## 2 Definitions

For the purposes of this Part of BS 6461, the following definitions apply.

**2.1**
**chimney**

a structure (including any part of the structure of a building) enclosing or forming part of a flue or flues other than a flue pipe, including any opening therein for the accommodation of an appliance but excluding the flue terminal

**2.2**
**chimney breast**

a projection beyond the thickness of a wall containing the fireplace and flue(s)

**2.3**
**chimney connector**

an accessory that connects an appliance or flue pipe to a chimney

**2.4**
**chimney jamb**

the walling at the side of a fireplace recess

**2.5**
**chimney stack**

part of a chimney enclosing one or more flues that rises above the roof of a building of which it forms a part and which includes the chimney terminal but not the flue terminal

**2.6**
**chimney terminal**

the uppermost part of a chimney stack

**2.7**
**corbel**

projection of masonry having a bearing in a wall to support a load

**2.8**
**core**

a sack filled with soft material to fit snugly in the flue, drawn up as the work proceeds

**2.9**
**coring**

freeing, by the use of a core, the inside of a flue from obstructions and mortar droppings

**2.10**
**drip throating**

a projection, throated on the underside, to facilitate the fall of rainwater clear of the wall or structure

**2.11**
**fireplace recess**

a space formed in a wall or chimney breast into which an appliance may be placed and from which a flue leads

NOTE This is sometimes referred to as builder's opening.

**2.12**
**flaunching**

the weathering formed in mortar at the top of a chimney or base of a terminal

**2.13**
**flue**

a passage that conveys the products of combustion from an appliance to the open air

**2.14**
**flue adaptor**

a fitting between the appliance flue outlet and the inlet to a flue pipe or to the chimney flue

**2.15**
**flue block**

a factory-made masonry unit that can be erected on site to form a chimney. It may contain voids for either insulation or for combustion air

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**2.16**
**flue lining**

a lining forming the wall of a flue for the purpose of protecting the chimney fabric

**2.17**
**flue pipe**

a pipe used for connecting the appliance flue outlet to the chimney flue or to outside atmosphere but not including a pipe used as a lining to a chimney

**2.18**
**flue terminal** (chimney pot)

A prefabricated or built up unit forming the outlet end of a flue

**2.19**
**fly ash**

fine particles of ash entrained in flue gases

**2.20**
**gather** (oncome)

the contraction over a fireplace recess to reduce it to the size of the flue

**2.21**
**lintel**

a loadbearing and/or throat forming beam above the fireplace recess

**2.22**
**offset**

a double bend introduced into a flue so that its direction remains parallel to its original direction

NOTE The effect is to give the path of the flue a lateral displacement.

**2.23**
**oversailing**

courses of stone or brickwork (masonry) arranged to project from the face of a wall or chimney stack largely for decorative effect

**2.24**
**rendering**

one or more coats of mortar or plaster on brick, concrete or stonework, or the act of laying such a coat or coats

**2.25**
**throat**

that part of the flue, if contracted, which is located between the fireplace and the chimney flue

**2.26**
**withe** (midfeather, bridge, brig)

a partition between adjacent flues in a chimney

## 3 Exchange of information

**3.1** The designer should acquire sufficient information to enable him effectively to detail the whole of the work. This should include particulars of the locality and exposure of the site, the proximity of trees and tall buildings, the direction of the prevailing winds, and the disposition of windows and other openings, in relation to the position of the fireplaces. Consideration should also be given to the possible subsequent installation of a different type of appliance in place of that originally intended. Full details should be obtained whenever possible from the manufacturers regarding any special requirements of appliances affecting flue size, insulation and chimney height. All relevant drawings, specifications and information should be provided to those responsible for carrying out the construction and erection of the chimneys and to others whose work may be affected.

**3.2** The construction of brick, stone or concrete chimneys will normally be undertaken with the main constructional work of the building.

**3.3** In the preparation of a time schedule for the main contract or one applicable to chimneys only, it should be noted that:

a) chimney stacks are usually completed before the roof covering is laid, when final coring of the flues can be carried out before the removal of the scaffolding and fixing of the appliances;

b) rendering of chimney walls adjacent to floors and roof members should be undertaken in the course of construction;

c) precast concrete blocks and units should be adequately cured before transportation to the site and before building-in.

## 4 General

### 4.1 Materials, appliances and components

#### 4.1.1 *British Standards*

**4.1.1.1** All materials, appliances and components used should comply with the relevant British Standard where applicable. Where materials are used that are not covered by a British Standard, the manufacturer's recommendation should be obtained as to their suitability.

**4.1.1.2** In addition to the British Standards referred to in the text, the following British Standards are relevant to the recommendations contained in this code.

BS 12, *Specification for ordinary and rapid-hardening Portland cement*.

BS 146, *Portland-blastfurnace cement*.

BS 890, *Building limes*.


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BS 915, *High alumina cement*.

BS 1014, *Pigments for Portland cement and Portland cement products*.

BS 1198, BS 1199 and BS 1200, *Building sands from natural sources*.

BS 3892, *Pulverized-fuel ash — Part 1 Specification for pulverized-fuel ash for use as a cementitious component in structural concrete*.

BS 4027, *Specification for sulphate-resisting Portland cement*.

BS 4729, *Shapes and dimensions of special bricks*.

BS 5224, *Specification for masonry cement*.

BS 6073, *Precast concrete masonry units*.

**4.1.2** *Mortars.* Mortar mixes should be selected to suit the conditions in the particular part of the chimney or flue in which they are to be used and specific recommendations are given in **5.2** and **5.3**.

Consideration should be given to:

a) the location of the building and chimney and the degree of exposure;

b) any local mixes that may have been used to deal satisfactorily with special conditions;

c) the recommendations given in CP 121.

Mortars should consist of one of the following mixes:

a) Portland cement and sand; or

b) Portland-blastfurnace cement and sand; or

c) high alumina cement and sand; or

d) lime and sand with Portland cement or Portland-blastfurnace cement; or

e) masonry cement and sand;

and the mix should be in proportions compatible with the masonry units that it is jointing.

A more impervious, high cement content mortar or the use of sulphate-resisting cement will provide greater resistance to sulphate attack.

NOTE See **5.1.1.2** regarding drying out of the mortar.

### 4.2 Design

**4.2.1** *General.* The most important general considerations of chimney design can be summarized as follows.

a) The materials used in the construction should be such that the construction is non-combustible, durable, resistant to high temperature and rapid changes in temperature and resistant to internal and external corrosion.

b) Masonry chimneys should be lined except when constructed in accordance with **5.6**.

c) The cross-sectional area of the flue and the vertical height should be considered in relation to the type of appliance it has to serve.

d) Excessive heat losses should be prevented and undesigned leakage of air into the flue avoided.

e) Rough internal surfaces, too flat gradients, abrupt changes of direction and sudden enlargements or contractions of the flue should be avoided.

f) The number of bends, where these are unavoidable, should be kept to a minimum and in no case should a bend be used with an angle of more than 45° (but see **4.5**).

g) In relation to the roof, terminals should be located to avoid as far as possible zones of wind pressure that are likely to cause downdraught. In addition, it is essential to avoid flue gases discharging in a position where they can enter a window or skylight capable of being opened or an air inlet to a ventilating system.

h) A chimney stack, and especially a chimney terminal, is particularly exposed to the weather and precautions are necessary, such as the proper selection of masonry units (particularly bricks and mortar) and protective detailing, as protection against the weather (see **5.2**).

i) Chimneys on internal walls are to be preferred in order to minimize loss of heat from the flue and also to retain useful heat within the dwelling.

**4.2.2** *Relationship to heating appliance.* The design of the chimney should be suitable for the variety of heating appliances that might be installed during the lifetime of the dwelling. The most critical design feature is the flue size. The requirements for a chimney serving an open fire differ from those for a chimney with a closed appliance in that considerably more excess air has to be carried up the flue and the total amount of flue gases (including excess air) is not necessarily directly related to the rate of combustion in the appliance. Open fireplaces function primarily as air collecting hoods in which small amounts of combustion products are diluted with relatively large amounts of air. Providing that a chimney is constructed in accordance with **4.2.1**, the most important factors influencing the size and height of a flue for an open fire are the configuration and dimensions of the throat, lintel and entry to the chimney flue, and the air flow velocity into the fireplace opening. Recommendations for the construction and design of fireplace recesses and the installation of open fires are given in CP 403.

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**4.2.3** ***Size and height of chimneys***

NOTE Where flue liner sizes are given, these refer to *internal* dimensions.

**4.2.3.1** *Chimneys serving an appliance recess.* For a chimney built with a fireplace recess in which an open fire, a room heater or stove may be fitted, a flue size of 185 mm nominal square or 225 mm nominal diameter is recommended with an absolute minimum size for circular flues of 200 mm diameter. These flue sizes are suitable for virtually all closed appliances and for open fires with an opening up to 500 mm by 550 mm. For larger sizes of open fire, or closed appliance that can be used as an open fire, the cross-sectional area of flue should be between 14.0 % and 16.0 % of the free, unobstructed area of the fire opening.

In cases where a closed appliance, such as a room heater, boiler or cooker, is installed with a chimney intended for an open fire and built in accordance with this code, it should not normally be necessary to make any alterations to the chimney or flue. If, however, the type and rating of the appliance to be installed is known before the chimney is built and it is unlikely that the chimney will be used for some form of open fire inset or free-standing, then the optimum size of the chimney can be determined for the particular installation.

**4.2.3.2** *Chimneys not serving an appliance recess.* For a boiler chimney, such as one situated in a kitchen or separate boiler house, a flue of 150 mm nominal square or diameter is recommended as being suitable for virtually any closed domestic heating appliance up to 30 kW.

A flue of a minimum of 175 mm nominal square or diameter is recommended as suitable for closed domestic heating appliances above 30 kW up to 45 kW output.

**4.2.3.3** *Chimney height.* For chimneys in brickwork, stonemasonry, concrete and hollow blocks built in accordance with this code, a height of about 4.5 m (the height being measured above the top of the fireplace opening) is normally sufficient for flue draught. The recommendations for the height of the chimney outlet above the roof of a building are given in **4.7**.

**4.3 Fireplace recess and throat**

**4.3.1** Mention has been made in **4.2.2** of the importance of good design in the construction of a fireplace recess for open fire installation. However, the design of the recess may be modified in order to be more suitable to the installation of other types of appliance, e.g. free-standing appliances or inset room heaters. It should also be noted that to facilitate the use of precast block chimneys, there are available compatible proprietary makes of prefabricated recess that normally comply with the requirements of a conventional brick-built recess. Different forms of recess construction are illustrated in Figure 1 and Figure 2. Recommendations for good design of the recess and the throat are also given in CP 403.

**4.3.2** In designing fireplace recesses, account may have to be taken of any need for providing access to boiler connections and the incorporation of ducts for some fanassisted appliances. Details of the dimensions of recesses for stand-in and free-standing appliances are given in CP 403.

**4.4 Condensation.** Condensation may occur when the appliance is lit and the flue surfaces are relatively cold and also where the temperature and volume of the flue gases are low, such as when a closed appliance is operating at a low burning rate.

The condensate forms acids from water vapour condensing on the flue surfaces and combining with flue gas deposits.

Burning wood on a closed appliance produces special problems of condensation due to the high concentrations of water vapour. The tar-like materials in the flue gases may pass out through the mortar joints and stain the brickwork externally (see Appendix A).

The use of flue linings assists in minimizing the effect of condensation within the flue.

**4.5 Bends and changes of section.** Flues should be vertical wherever possible. A bend above the flue mouth may help to reduce splashes of rain and soot that may fall on the hearth but the angle of the bend should be no greater than 45° and preferably less than 30°. The inside surface of the bend should be smooth and there should be no reduction in the area of the flue at the bend (see **5.1.5.4**).

There should be no more than two bends in the length of the flue.

NOTE The angles of bends have been redesignated using the method agreed in the International Organization for Standardization (ISO), i.e. the angle quoted is the angle through which the flow is diverted. Angles previously designated 135° and 150° are therefore now designated 45° and 30° (see Figure 3).


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### 4.6 Openings into flues and communicating flues

**4.6.1** No opening should be made into any flue in a masonry chimney except for:

a) inspection or cleaning, where the opening is fitted with a non-combustible cover of double door construction; or

b) a draught stabilizer, made from durable non-combustible material, fitted in the same room as the appliance.

**4.6.2** No flue should communicate with more than one room or internal space except in the case of an opening as in **4.6.1** a).

**4.6.3** A flue should serve only one appliance; therefore, where it is anticipated that more than one appliance will be used in a room, additional flues should be constructed.

### 4.7 Height and position of chimney outlets above roofs

**4.7.1** *General*. The height and position of a chimney outlet above a roof should be designed to ensure dispersal of combustion products and minimize the risks of fire. The height and position of a chimney in its relation to the roof has a very important bearing on the proper functioning of the flue. Wind may affect the action of a flue in several ways. Wind pressure and suction are dependent not only upon the slope of the roof but also upon external influences, such as the shape of the building, land contours and the proximity of adjacent buildings and trees. A complete set of rules to cover every case, however, cannot be laid down for the correct positioning and height of chimneys. It should be recognized that, in general, chimney terminals should not be placed in high pressure regions. Ignoring external influences, Figure 4 shows typical pressure and suction zones or belts caused by wind around a building.

It will be seen from Figure 4(a) that the pressure on the windward slope of a roof of appreciably steeper pitch than 30° is greatest in the region marked Z. A flue outlet in this position is liable to cause smoke/fume emission at the appliance unless it is high enough to escape the high pressure region. It will be observed also that there is a suction or low pressure zone on the leeward side of the building. If an appliance connected to a flue is sited in a room that has windows or other openings into this zone, the possibility of smoke/fume emission at the appliance is increased. Figure 4 also shows the desireability with a steeply pitched roof, for a chimney outlet on the prevailing windward slope to be as near the ridge as possible to avoid the pressure zone. With a shallow pitched roof as shown in Figure 4(b), the position of the chimney is not of such great importance. Generally, as far as pressure on the windward side of a roof of approximately 30° pitch or less is concerned, the action of the wind on the flue performance may be ignored. A very shallow pitch will approximate to the conditions for flat roofs.

Figure 4(c) shows a flat-roofed building and illustrates that a suction zone is created on the roof. From this it will appear that a chimney through a flat roof will be immune from smoke/fume emission at the appliance. However, the suction created on the leeward side of any building may be greater than that on parts of the roof, and if a window or door is opened in a room on the leeward side, the suction through the room may cause smoke/fume emission. Figure 4(c) shows that the nearer the flue is to the leeward side as at position X, the greater is the risk of smoke/fume emission from this cause.

**4.7.2** *Fire precautions.* It is important that the chimney terminates in a position where the vented products of combustion are neither a fire nor a health hazard.

**4.7.3** *Chimney terminal heights (excluding any flue terminal)* (see Figure 5). For pitched roofs with no other influences from high trees or buildings or from land contours, etc. the optimum terminal point for a chimney is outside the pressure zones, which means above the ridge level [see Figure 4(a) and Figure 4(b)]. This will give the flue the best opportunity to function properly. If a chimney passes through, or within, a horizontal distance of 0.6 m from the ridge, it should terminate a minimum of 0.6 m above the ridge level.

A chimney with any part passing through the roof greater than 0.6 m from the ridge but no further than the 2.3 m, should terminate at a minimum height level with the ridge.

A chimney situated further than a horizontal distance of 2.3 m from the ridge is not advised, because to bring the exit above the pressure zone may mean that its height above the roof is so great that extra support will be necessary (see **5.1.1**). Where it is not possible for the chimney to be within 2.3 m horizontal from the ridge, the outlet should be a *minimum* of 2.3 m horizontal distance from the roof slope.

For flat roofs a chimney outlet should be not less than 1.0 m above the roof.

To reduce the risk of inadequate draught where the discharge end of the chimney lies within a distance of 2.3 m of the ridge of any other nearby roof or structure, the height of the discharge should be increased to not less than 0.6 m above that roof or structure.

If any openable window, sky-light or ventilation duct opening is within 2.3 m horizontally of a chimney, the outlet of the chimney should be at least 1.0 m above the top of any such opening.

It should always be borne in mind that topographical features may require heights in excess of the quoted minimum, and local experience should be sought as appropriate.

### 4.8 Terminals

**4.8.1** *Flue terminals.* A flue terminal can assist the proper functioning of the flue and provide some protection against the effects of weather.

In masonry chimneys flue terminals complying with BS 1181 should normally be used. They should be built into the stack to give an embedment of not less than 125 mm, excluding any flaunching, or one-quarter the length of the terminal whichever is the greater. The terminal should be sealed to the flue lining with cement mortar. Alternatively, a flue terminal may be formed by extending the lining so that it projects not less than 20 mm above the head of the chimney.

For a flue serving a fireplace recess, the terminal should preferably be the same cross-sectional area as the flue and in any case no part of the terminal should be less than 200 mm diameter, or 185 mm square.

A chimney constructed in accordance with this code will, under most circumstances, generate sufficient updraught to overcome any downdraught problems. In cases of severe downdraught a special terminal may be used, preferably constructed from materials complying with BS 1181.

**4.8.2** *Chimney terminals.* A chimney terminal can assist in the protection of the top of the chimney stack against the action of the weather and may, especially when used in conjunction with an appropriate flue terminal, help in creating an area of low pressure at the flue outlet.

The chimney terminal should be constructed of stone or concrete. An ideal terminal would incorporate a weathered upper surface and a drip throating which helps to discharge rainwater away from the stack and assist in the prevention of saturation of that part of the chimney stack immediately below (see Figure 6).

An alternative type of chimney terminal incorporates a slab or hood supported on piers. The flue terminal should project 20 mm to 25 mm and where the chimney contains two or more flues, the withes between adjacent flues should be carried up to the underside of the slab. The height of the piers should be arranged to provide a total area of opening to the atmosphere of not less than twice the area of the flue(s) in the chimney. The piers should be designed to give a stable structure. The surface of the masonry through which the flue projects should be flaunched with cement mortar.

A chimney terminated simply with a cement mortar flaunching is not satisfactory.

## 5 Masonry chimneys

### 5.1 General

#### 5.1.1 *Durability, strength and stability*

**5.1.1.1** Chimneys that are an integral part of a structure should be so constructed that they remain structurally sound during the life of the building. General recommendations for chimneys of different materials, brickwork, blockwork, stonework, concrete and flue block are given in **5.2** to **5.6**. In general, and subject to these recommendations, the height of a chimney stack should not exceed 4.5 times its least overall horizontal dimension or, in cases where it is adequately stayed, the height above the stay should not exceed this amount. Where this height is exceeded or where the building is in an abnormally exposed position, the chimney stack should be designed to withstand the appropriate wind pressure estimated in accordance with CP 3:Chapter V-2. No tensile resistance should be relied upon in chimney stacks with damp proof courses incapable of developing tensile strength.


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**5.1.1.2** The drying out and therefore the strength characteristics of the finished structure will depend upon the mortar being allowed to dry naturally. For that reason, the chimney should not be used to serve any fire or heating appliance until at least two weeks after the completion of the construction of the chimney.

**5.1.1.3** Where staying is necessary for chimneys of brick, stonemasonry, concrete or hollow block construction, a band should be closely clamped to the stack for the purpose of attaching the stays. Stays and bands should be of stainless steel or non-ferrous metal and of cross-sectional area capable of sustaining a safe load equal to that on the face of the chimney opposite to the stay when acted upon by a wind pressure as calculated in CP 3:Chapter V-2. The stays should be secured by suitable bolts to a member capable of carrying the load exerted by the stay. Careful attention should be paid to the roof flashing around the stays and the materials selected for this purpose (see BS 5534-1, CP 143 and CP 144).

**5.1.1.4** Where the thickness of the chimney wall does not exceed that of the adjoining walls of the building, it will be sufficient to provide foundations similar to that of the adjoining walls. In cases where the chimney is of exceptional height and mass, the area of the foundations should be obtained by calculations and be such that the unit load on the soil will equal the unit load from the adjoining walls to avoid differential settlement.

**5.1.1.5** Withes should be not less than 100 mm thick and should be properly bonded to the walls of the chimney.

### 5.1.2 *Structural fire precautions*

**5.1.2.1** The materials used in the construction of a chimney should be such that the outer surface of the chimney does not, under normal operating conditions, exceed 70 °C. For building materials of brick, stone or concrete, the minimum thickness of the chimney wall needed to meet this condition may be taken as 100 mm.

**5.1.2.2** Any flue in a chimney should be surrounded by, and separated from any other flue in the chimney by, solid non-combustible material not less than 100 mm thick. This dimension should not include the thickness of the flue lining except where such lining is an integral part of the construction. The material separating flues should be the same as that surrounding those flues.

In addition, if the chimney forms part of a party wall between buildings and is not back-to-back with another chimney in the adjoining building, that part of the chimney which is below the roof and separates the flue from the adjoining building should be either of solid non-combustible material not less than 200 mm thick or, if a cavity wall, each leaf of the wall should be not less than 100 mm thick.

**5.1.2.3** Combustible material should not be incorporated in the construction of a chimney or fireplace recess, nor should combustible material be contained in a wall in such a way as to be within 200 mm of a flue or chimney recess.

**5.1.2.4** Where the thickness of solid non-combustible material surrounding a flue is less than 200 mm, no combustible material other than a floor or skirting board, dado or picture rail, mantle shelf or architrave should be nearer than 40 mm to the outer surface of the chimney wall.

**5.1.2.5** No metal fastening that is in contact with combustible material and forming a heat bridge should be so placed in a chimney as to be nearer than 50 mm to the flue or to the inner surface of a fireplace recess.

### 5.1.3 *Damp penetration*

**5.1.3.1** To prevent damp rising from the ground, the damp-proof course at the base of the main walling should be carried through the chimney base.

In addition to the usual external back gutter and flashing, stepped side flashings, front flashings and apron, further precautions are usually required at the intersection with the roof. For masonry chimneys, a continuous flexible damp-proof course should be inserted in the mortar joint directly beneath the flashing and just above the underside of the roof timbers at the back of the chimney shaft or stack. Further preventive measures may have to be taken against moisture penetration by vertical flashing or surface treatment to the exposed portion of the stack below the damp-proof course.

**5.1.3.2** A damp-proof course should not be necessary in chimneys of plain-dense concrete. For lightweight concrete (no-fines, foamed slag or expanded-clay concrete) cast in situ, the precautions outlined in **5.1.3.1** should be taken and all external surfaces rendered with a mix of cement, lime and sand not stronger than 1 : 1 : 6 applied in two coats.

**5.1.4** *Provision for cleaning.* All flues should be easily accessible for inspection and cleaning. For chimneys built of brick, stonemasonry or concrete and designed to serve free-standing appliances not installed in a fireplace recess, e.g. an independent boiler, a cleanout opening with a tight-fitting soot door should be provided. The door should be double-walled and the frame should be carefully built-in and of suitable size to permit easy access to the flue. The cleanout opening and the chamber (usually termed "soot box") should be located sufficiently below the point of entry of the flue pipe to avoid blockage of the flue pipe outlet by the deposition of soot and fly ash. Care should be taken to avoid forming an unnecessarily large void, as this might interfere with the proper working of the chimney.

**5.1.5** ***Flue linings***

**5.1.5.1** Suitable linings are:

a) clay flue linings with rebated or socketed joints that comply with BS 1181;

b) non-perforated clay pipes and fittings with socketed joints that comply with BS 65.

**5.1.5.2** In addition, linings, pipes and fittings made from kiln-burnt aggregate and high alumina cement, with rebated or socketed joints may be used provided they:

a) are non-combustible;

b) have suitable permeability and strength;

c) are reasonably smooth internally;

d) are properly jointed;

e) are able to withstand without any significant change in properties the effects of the temperatures, flue gases and condensates experienced during normal operating conditions (see **1.2**);

f) are able to withstand without spalling the temperatures experienced during overrun conditions and chimney fires (see **1.2**).

**5.1.5.3** Flue linings may be subject to damage, particularly at rebates, spigots and sockets, unless carefully handled. They are not normally subject to deterioration by exposure to weather but care should be taken in storage to prevent accidental damage.

**5.1.5.4** Where bends and tees are required for changes in direction, it is essential that these are purpose-made and that no attempt is made to form a change in direction by use of short straight sections, by cutting straight sections or casting mortar in situ in lieu of the appropriate bends or tees.

**5.1.5.5** Care should be taken to ensure that the lining of the flue is commenced in such a manner that a workmanlike joint is made to the lintel, starter-block or throat unit, and that no cavity occurs between these elements and the bottom of the lining. The centre line of the flue should be co-ordinated with that of the fireback (see CP 403).

**5.1.5.6** The linings should be fixed with the socket or rebate of each section or fitting uppermost so as to prevent any condensate running out and to prevent any caulking material being adversely affected. Joints between liners and any void between the lining and the brickwork should be filled with the mortar used for the relevant part of the chimney or the mortar recommended by the manufacturer. Care should be taken to leave the internal bore clean (see **5.1.6**).

**5.1.6** *Coring of flues.* In order to free the flue from all mortar droppings or other obstructions that might adhere to the lining, the flue should be cored during construction. Coring should not be delayed until the chimney is complete, otherwise mortar droppings may have set hard and be difficult to remove.

The core can be composed of a sack filled with a resilient material so that it fits the flue properly, to which a rope is attached. It should be inserted at the base of the flue and pulled through as the work proceeds.

When the chimney is complete, final core testing should take place in accordance with **7.3.2** to ensure that all obstructions are removed.

**5.2 Brickwork chimneys**

**5.2.1** *General.* This clause should be read in conjunction with BS 187, BS 3921, BS 6073-1 and CP 121. The durability and stability of brickwork generally is dealt with in BS 5628, CP 111 and CP 121. Mortar designation is described in CP 121.

**5.2.2** *Chimney terminal.* Clay bricks should be special quality or those ordinary quality bricks that are claimed by the manufacturer to be frost resistant. They should be jointed with mortar of designation (i) containing sulphate-resisting cement.

Calcium silicate bricks should be class 4 or stronger and concrete bricks should be category 30. They should be jointed with mortar of designation (ii) containing sulphate-resisting cement.


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**5.2.3** *Chimney stack.* Clay bricks should preferably be special quality. However, ordinary quality bricks that are claimed to be frost resistant by the manufacturers or ordinary quality bricks that are protected by a projecting chimney coping bedded on a damp-proof course in mortar of designation (i) may be used. Clay bricks should be jointed with mortar of designation (ii). Calcium silicate bricks should be class 3 and concrete bricks should be category 20, jointed with mortar of designation (iii). Sulphate-resisting cement should be used in the mortar if smoke billowing engulfing the chimney stack is likely to occur.

**5.2.4** *Chimney below roof level.* Bricks and mortar may be as other elements of superstructure brickwork as described in CP 121.

**5.2.5** *Stability.* Where a chimney starts on an upper floor without support from a chimney breast or piers below, the brickwork should be supported by corbelling, steel, reinforced concrete beams or cantilevers.

Where oversailing or corbelling is employed, the total projection of the brickwork above should not exceed the thickness of the wall below and the projection of each course should not exceed 60 mm.

**5.3 Blockwork chimneys.** Mortar designation is described in CP 121. Solid clay (see BS 3921) or concrete (see BS 6073-1) building blocks laid in mortar of designation (iii) may be used for chimney construction. Unless purpose-made as flue blocks (see **5.6**), hollow or cellular clay or concrete building blocks should not, in general, be used unless the voids in the blocks are filled with concrete, in which case the thickness of the walls and the construction of the chimneys may be as described for precast concrete units.

Where voids are not filled, there is a risk that due to the heat in the flue the outer walls and ribs of the blocks may break. Unfilled hollow blocks, therefore, should be used only when serving an appliance having a low-heat junction to the flue and the chimney walls inside buildings should be constructed in two thicknesses of at least 100 mm thick blocks set with staggered joints; external walls may be one block thick of not less than 200 mm.

**5.4 Stonework chimneys**

**5.4.1** Provided a chimney is constructed in accordance with this code, then no special precautions need to be taken in selecting stone to cater for the risk of unduly high temperatures above the level of the chimney throat. Conditions of exposure above the roof make it desirable to use only stone known to withstand exposure well and reference should be made to local practice for particular stones. The masonry wall surrounding a fireplace recess should be protected by refractory material; if, however, for decorative reasons stone is required, sandstone should be used. Granite, slate and limestone are unsuitable unless protected by a refractory fireback and side cheeks.

**5.4.2** The height of courses and the width of bed will depend on the nature of the stone, but width of beds should be not less than 100 mm. Below the junction of the chimney and the roof, the minimum thickness of the flue wall should be 200 mm inclusive of any brick or concrete backing. Stacks or shafts should have a minimum thickness of flue wall of 150 mm when stone alone is used or of 200 mm when the stone has a backing of brick or concrete. All work should be fully bonded at the quoins; above roof level it is desirable to use dowels. Owing to the difficulty of forming a bond in random rubble, it is preferable to use squared, coursed or uncoursed rubble, or fully dressed coursed ashlar for all work above roof level. Flint walling and some types of rubble walling, including that in which the individual stones are of roughly spherical shape, are normally not suitable for shaft constructions. Where these types are used for the main walls of the building, it is recommended that chimney construction from a short distance below the junction with the roof be either of brick or of coursed stone.

Where stonemasonry is backed with concrete, construction of the chimney should proceed in lifts or stages corresponding to the sectional length of the lining, concrete being poured between the lining and the stonework, using the lining as permanent shuttering.

Stone or cast stone cappings should be formed in as few units as possible consistent with easy hoisting and bedding.

**5.4.3** Chimneys built of coursed stonemasonry should be designed in accordance with **5.1.1**; the staying of stacks should be avoided wherever possible. The permissible height of a stack or shaft above the highest junction with the roof depends upon its construction and whether it has backing of brick or concrete, but this height should not exceed 4.5 times its least overall horizontal dimension.

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The general recommendations for oversailing or corbelling and for beams and cantilevers should be as stated in **5.2.5**, except that oversailing courses and corbels may project an amount equal to half the thickness of the flue wall immediately below the projecting course, provided they are bonded into the body of the work a distance equal to at least twice their projection. Oversailing should not be formed of uncoursed rubble and flint work.

**5.5 Concrete chimneys**

**5.5.1** *General.* Concrete chimneys may be either cast in situ or precast or a combination of both, and may be either plain or reinforced. Where the walls of the buildings are of no-fines or other lightweight concrete, the chimneys may be constructed of these same materials, provided flue linings are used to give adequate protection to the concrete against the effects of heat and the risk of staining and disintegration due to any condensate. Due consideration should be given to wind pressure.

The fireplace recess and the throat should be in accordance with **4.3**, but the lintel over the fireplace opening may be reinforced concrete, either precast or formed in situ.

Concrete chimneys should be designed in accordance with CP 110, CP 114, CP 115 or CP 116. Reinforcement used in chimney construction should have a minimum cover from the external face and from the face of the flue as recommended in the appropriate design code of practice.

Portland cement, Portland-blastfurnace cement or rapid hardening Portland cement are normally suitable for the construction of concrete chimneys, but sulphate-resistant Portland cement may be necessary where increased resistance to sulphate attack is required.

**5.5.2** *Precast concrete units.* The types of precast unit blocks are numerous and no definite recommendations can be made, as the choice of block will depend in many cases on the nature of the construction of the walls of the building.

They can include blocks laid with the aid of lifting tackle, shallow hollow blocks embracing a flue with its walls and withes and with in situ concrete filling, or deep hollow blocks bonded to form the walls and withes, all with or without reinforcement. In the case of hollow blocks with or without in situ filling, the walls of the blocks should be not less than 25 mm thick with 25 mm thick ribs suitably connecting the two faces. All interior corners should have a radius not less than 25 mm, and the surface of the blocks required to make contact with the concrete filling should have a roughened or keyed finish.

Bends in flues may be formed with special blocks but, in cases where the manufacture of these is not warranted, the portion incorporating the bends may be cast in situ. The formation of bends should be such that the full effective area of the flue is maintained.

As in the case of concrete chimneys cast in situ, the precast units may be of plain-dense concrete or of lightweight concrete, of the several mixes and types of aggregate recommended for cast in situ chimneys, and may be plain or reinforced. The infilling between the units and any liners may be of 1 : 3 : 6 plain-dense cement concrete or of 1 : 2 : 4 lime concrete.

**5.6 Flue block chimneys.** Chimneys of purpose-made blocks and fittings are available in various forms. Whatever the design or composition they should above all else satisfy **4.2.1** a) and **5.1.2.1**. When constructed of concrete, the aggregates used should consist of natural or kiln burnt materials having moderate and smooth thermal expansion characteristics and should not contain such amounts of crystalline silica, e.g. quartz, cristobalite or tridymite, as might cause rupture of the concrete when subjected to rapid heating. In addition, they should be relatively inert up to 1 000 °C and should not contain limestone or any other material that might break down or deteriorate below this temperature.

Refractory concrete is generally based on aggregates of the type described above, bonded with high alumina cement. Concrete made with Portland cement is not normally adequate for use as the inner flue forming portion of the block. However, Portland cement concretes incorporating a pozzolana[1)] in the correct proportion and suitably cured can perform satisfactorily.

The design of the block may fall into one of the following categories:

a) blocks incorporating a separate lining in accordance with **5.1.5**;

b) blocks constructed monolithically of suitable concrete;

c) blocks constructed of different concretes cast integrally together to form a composite block.

[1)] See BS 4627 for definition.


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Blocks of all the above categories should have a minimum overall wall thickness of 100 mm; where this includes sealed air spaces, preferably each space should be not greater than 25 mm to restrict heat transference by air movement and there should be no space within 25 mm of the outer surface of the block. Blocks should be produced in unit lengths that correspond to a mass that can be conveniently handled on site. They should have sufficient loadbearing strength to withstand the uniform application of a load equal to that of a 20 m chimney formed from the blocks.

Blocks of categories (b) and (c) should have dense, even internal surfaces and radiused internal corners. They should have rebated ends such that when the blocks are placed with the socket face uppermost, any excess of condensate will pass downward with minimum penetration of the joint.

The form of rebate should facilitate alignment of the blocks with each other and enable a tight mortar joint to be made, particularly on the inner faces adjacent to the flue.

## 6 Flue pipes

### 6.1 Materials

**6.1.1** Cast iron flue pipes should comply with BS 41. The fittings in that standard include bends 90°, 67½° and 45°[2)], with or without soot doors. In order to minimize obstruction by fly ash or soot, all bends in flue pipes should be not greater than 45°.

**6.1.2** Low carbon steel flue pipes should be fabricated from steel not less than 3 mm thick.

**6.1.3** Stainless steel flue pipes should be not less than 1.0 mm thick and should comply with grade 316S11, 316S13, 316S31 or 316S33 of BS 1449-2, or the equivalent Euronorm 88-71 designation.

**6.1.4** Vitreous enamelled flue pipes should be constructed from low carbon steel coated internally and externally with acid resistant enamel. The thickness of metal used and quality of enamel applied should be as follows.

a) *Metal thickness.* For flue pipes up to 113 mm diameter, a nominal thickness of 0.9 mm is recommended; for larger flue pipes a nominal thickness of 1.2 mm is recommended.

b) *Quality of enamel.* The vitreous enamel coating should be resistant to thermal shock, combustion products and heat when tested in accordance with BS 1344-1, BS 1344-3 and BS 1344-7. In the test for resistance to combustion products, the enamel should achieve a classification not less than SA.

### 6.2 Installation

**6.2.1** The excessive chilling of the flue gases can lead to the formation of deposits within the flue pipe and chimney and the undesirable condensation of moisture. This will reduce the updraught created by the chimney and may lead to permanent damage or possible blockage. It is, therefore, important to ensure that the length of any flue pipe used to connect an appliance to a chimney be kept as short as practicable. Flue pipes should not be used as a complete chimney; they should only be utilized to connect an appliance to a suitable chimney.

**6.2.2** Before erection, the flue pipe and fittings should be examined to ensure that they are free from damage and rough edges which, if left, encourage the collection of dust and soot deposits.

**6.2.3** Flue pipes with spigot-and-socket joints should be erected with the sockets pointing upwards. The spigot end should not rest on the shoulder of the socket, but a small gap should be allowed for expansion.

**6.2.4** Proper jointing material for flue pipes is essential. Surplus and extruded jointing material should be removed from the internal surfaces to avoid constriction and roughness.

**6.2.5** Joints should be made as follows.

a) *Cast iron pipes.* Joints should be made with a suitable heat resistant, non-combustible string, well caulked to a distance of about 10 mm from the top of the socket and finished externally by pointing with a smooth finished fire clay or cement mortar fillet.

b) *Steel pipes.* Steel pipes (including vitreous enamelled steel pipes) should be jointed in accordance with the manufacturer's instructions.

**6.2.6** Where a flue pipe is used to make a connection between an appliance spigot outlet and a flue, there should be no more than two bends in the length of flue pipe. No part of the flue pipe should make an angle above the horizontal of less than 45°. In all cases additional provision should be made for chimney cleaning.

[2)] See note of **4.5**.

Where it is necessary to discharge a back outlet appliance into a fireplace recess or builder's opening, the appliance flue spigot outlet should be sealed directly into a vertical register plate, provided there is sufficient space to work. If not, then a short length of flue pipe not exceeding 150 mm in length may be used. The register plate should be firmly fixed and sealed on all sides to the fireplace recess or builder's opening (see Figure 7).

Where a back outlet appliance is to be connected to a flue, the flue pipe connection should make an angle of not less than 45° to the horizontal. A debris trap having an airtight cleaning access should be formed at the base of the flue (see Figure 7).

**6.2.7** The full length of the installed flue pipe should be accessible for inspection and maintenance.

### 6.3 Fire precautions

**6.3.1** In order to prevent a chance ignition of combustible material it is essential that any flue pipe be so sited and/or shielded as to reduce the effects of radiated heat transmission to an acceptable level. In order to attain this condition a flue pipe should not pass through:

a) any wall constructed out of combustible material;

b) any ceiling.

NOTE Any combustible decorative material used to clad a wall through which a flue pipe is used to connect an appliance to a chimney should be kept well clear of the flue pipe.

**6.3.2** The effects of radiated heat can be reduced by:

a) shielding;

b) insulation.

Figure 8 shows the separation of a flue pipe from a combustible surface.

**6.4 Provision for cleaning.** Any flue pipe should be erected in such a way that it can be swept through its length without difficulty or causing damage to any part. A sealed cleaning door having a durable fixing should be fitted if access cannot be achieved through the appliance or via a suitable soot door within the chimney that allows easy access to the flue pipe.

## 7 Inspection on site

### 7.1 Masonry chimneys

**7.1.1** During the construction of a chimney, inspections should be carried out to ensure that the cross-sectional area of the flue is not reduced at any point and also that all details, such as throatings, terminals, damp-proof courses and flashings, are effectively carried out in accordance with this code. The flue should be kept clear of mortar droppings, intrusions of jointing material and other obstructions; the final coring should be undertaken prior to removal of scaffolding.

**7.1.2** Before the completion of constructional and decorative work, an inspection should be made to ensure that all requirements relating to fire precautions (proximity to combustible material) have been observed.

**7.2 Flue pipes.** When the installation is completed, an inspection should be carried out to see that all joints have been properly made and that all supports and clips are properly located and secured in accordance with the manufacturer's installation instructions.

### 7.3 Testing

**7.3.1** *Introduction.* The function of a chimney system is to provide an unimpaired passage for the complete evacuation of the products of combustion generated by the burning of a fuel at its base. Any chimney system designed, constructed or assembled in accordance with this code of practice will satisfy this function.

The success of any product constructed or assembled on site relies on the skill of the person(s) undertaking the work. Failure to follow the recommendations made within this code could have the most serious consequences. It is therefore recommended that all newly constructed or assembled chimney systems should be checked for blockage and soundness.

The tests described in **7.3.2** and **7.3.3** are designed to identify any major blockage or flue gas leakage on a new chimney. It is not possible to quantify the smoke test as during normal operation a chimney is under a small negative pressure whilst a positive pressure is created by the smoke pellets. Any leakage of smoke observed during the test should be investigated and the test repeated after the necessary remedial action has been carried out.

**7.3.2** *Coring ball test.* This test should be carried out before smoke testing (see **7.3.3**); it is not applicable to flue pipes. The appliance, if fitted, should not be alight at the time of the test.

A suitably sized coring ball of cast metal or concrete suspended by means of a rope should be gently lowered from the chimney terminal to the appliance recess. This test need only be carried out once unless some obstruction is encountered, in which case the blockage should be removed and the test repeated.

**7.3.3** *Smoke test.* The appliance, if fitted, should not be alight at the time of test.


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Before commencing, the chimney flue should be warmed by a gas blow lamp or similar heating device for about 10 min. The ashpit door of the appliance and thermostat (if fitted) should be in the closed position. Any soot doors or flue pipe access doors should be closed.

Two smoke pellets[3)] should be placed in the appliance firebox or the bottom of the chimney or the appliance recess and ignited. When smoke starts to form, the heating appliance or appliance recess or the bottom of the chimney should be closed and the smoke allowed to drift upwards. When smoke is observed rising from the chimney, the terminal should be sealed. An inflatable rugby ball bladder is ideal for this as it will accommodate any variations in dimensions. Alternatively, a polyethylene bag can be placed over the terminal and sealed around the edges.

The chimney breast and surrounding walls should then be observed at ground level, first floor level, roof space level and terminal level to check for major smoke leakage. As this may occur some distance from the original fault particular attention should be taken at barge overhangs to end of terrace dwellings and at eaves for leakage from cavities. The smoke test should be allowed to continue for at least 5 min.

If there is no sealed heating appliance but an open-type fire or appliance recess, a piece of board should be placed over the fire opening and sealed around the edges after igniting the smoke pellets.

NOTE If the chimney being tested forms part of a multi-flued construction as in a back-to-back situation, the fire(s) connected to the other flues should not be alight.

[3)] Suppliers of suitable smoke pellets include P H Smoke Products Ltd., Eldwick, Yorks. This company supplies pellets of a suitable size in packs of four.

## Appendix A Remedial action for defective chimneys

### A.1 General

In houses built before 1966, chimney flues were usually lined with lime mortar parging. Where such chimneys are exposed on outside walls, and especially when serving modern high efficiency closed appliances, such as domestic hot water boilers which can be operated at low outputs for long periods, the parging is liable to deteriorate in time, exposing the brickwork or masonry to flue gases. Damage to the chimney fabric can then result from the effects of condensation of the water vapour and acidic products of combustion and also from acidic salts in the brickwork. This is outlined in **4.4**. In some cases, condensation will penetrate the brickwork of the chimney and will stain plaster and inside decorations. This usually shows as damp stains or even tarry patches, often with an unpleasant smell, on walls and ceilings adjacent to an outside chimney, especially in rooms on upper floors.

In very bad cases of damage caused to the chimney structure, e.g. severe cracks in the walls of the chimney, leaning or disintegrating chimney stack, or very bad wall staining, it may be necessary to rebuild part or all of the chimney, in which case the recommendations in this code for the construction and lining of chimneys should be observed to guard against a repetition of such trouble.

Where damage has not caused the chimney to become structurally unsafe, or where it is considered prudent to protect the chimney fabric from possible deterioration in the future, less costly methods can be adopted to repair or protect an existing chimney, but each involves applying a suitable form of lining to the flue to protect the brickwork and mortar joints from the products of combustion.

Wherever possible, insulation of the flue against excessive heat loss should also be incorporated to reduce the incidence of condensation.

It is essential that the flue should be thoroughly swept before any repairs are carried out.

Various methods by which repair and protection work can be applied to existing chimneys are described in **A.2** and **A.3**.

### A.2 Clay and refractory concrete flue linings and pipes

Materials described in **5.1.5.1** and **5.1.5.2** are all suitable flue lining materials. These linings and pipes usually require holes to be cut through the brickwork at intervals through-out the height of the flue to allow the sections to be jointed together. If it is desirable to line an existing chimney in this way, any space between the liner or pipe and the brickwork should be filled with suitable insulating material, as the work progresses, unless provision for insulation is incorporated in the construction in the liner.

### A.3 Flexible metal linings

Thin gauge stainless steel flexible convoluted flue liners of the type specified in BS 715 for lining existing chimneys serving gas fired appliances should not be used for lining chimneys serving solid fuel appliances.

## Appendix B Chimney and flue pipe cleaning and maintenance

### B.1 Cleaning

#### B.1.1 *Introduction*

**B.1.1.1** This appendix is intended to give guidance on the cleaning of domestic chimneys and flue pipes serving appliances burning solid fuels and wood, peat, etc. It high-lights the problems encountered on site, and lists the equipment available to carry out sweeping.

It is intended to highlight the problems encountered on site, provide information on the types of appliances likely to be found and lists the equipment available to carry out sweeping.

**B.1.1.2** The frequency of chimney sweeping will depend on many factors, i.e. type of fuel and quantity used and method of operation of the appliance. Failure to maintain a clean chimney can result in the emission of toxic gases into the dwelling or structural damage from possible chimney fires. It is therefore necessary to sweep chimneys at regular intervals. The interval will be determined by user experience but under no circumstances should this be less than once a year. It is advisable that all chimneys should be swept at the start of the heating season.

**B.1.1.3** Any flue pipe connecting an appliance to a chimney may be of a smaller cross-sectional area than the chimney. It is therefore necessary to clean any flue pipe at intervals not exceeding one month. There will be circumstances when this period will need to be reduced; this should be determined by user experience.


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**B.1.2** ***Conditions on site***

**B.1.2.1** The inherent differences in fuels and the way that they are burned can in varying degrees affect the type and quantity of material likely to be deposited within a chimney or flue pipe.

**B.1.2.2** Solid mineral fuels (coal, coke, etc.) produce various deposits depending on the type of product and the method of usage. Bituminous coals can have volatile matter contents up to 40 %; a proportion of this can, under certain circumstances be deposited within the flue way in the form of soot. Naturally occurring or manufactured smokeless fuels have a much lower volatile matter content: this greatly reduces the amount of soot encountered within the flue. Fly ash may be entrained in the flue gases which may deposit out at any point within the chimney or flue pipe.

**B.1.2.3** Wood burning produces deposits of soot, tarry matter and wood ash in the chimney or flue pipe. The amount of tarry deposit can be reduced by using well seasoned wood air dried for at least 6 months, preferably 12 months, and by ensuring that an active bright fire is maintained.

**B.1.2.4** Peat as a domestic fuel is available in two forms, briquetted (soft or hard type) or hand cut (stacked and air dried). These two forms produce considerable quantities of tar in the chimney. This is likely to be associated with quantities of peat ash which is light and "fluffy" in consistency and readily carried into the chimney or flue pipe by the flue gases. The quantity of tar deposits can be kept to a minimum by maintaining an active and bright fire.

**B.1.2.5** A variety of appliance types can be encountered on site. The following list outlines two broad categories.

a) *Appliance recess:*

open fire without boiler, inset or free-standing;

open fire with boiler, inset or free-standing;

room heater without boiler, inset or free-standing;

room heater with boiler, inset or free-standing;

stove without boiler, free-standing;

stove with boiler, free-standing.

b) *Chimney not serving appliance recess:*

open fire without boiler, free-standing;

open fire with boiler, free-standing;

room heater without boiler, free-standing;

room heater with boiler, free-standing;

stove without boiler, free-standing;

stove with boiler, free-standing;

independent boiler, free-standing;

cooker without boiler, free-standing;

cooker with boiler, free-standing.

NOTE Lists a) and b) do not attempt to classify the types of fuel to be burnt. This can vary depending upon the appliance although the manufacturer's recommendations on suitable fuels should be followed.

**B.1.2.6** The types and range of chimneys found on site vary considerably. Size and design play an important part in the considerations required for effective sweeping. The following list encompasses the chimney systems described in this code of practice:

a) brickwork chimneys;

b) blockwork chimneys;

c) stonework chimneys;

d) concrete chimneys;

e) flue pipes.

NOTE Factory-made insulated chimneys are covered in Part 2 of this standard.

**B.1.3** ***Equipment***

**B.1.3.1** The equipment commonly used for the cleaning of domestic chimneys consists of two basic components, i.e. the brush head and the rods. There is additional equipment to complete the work in an easier and more effective manner although these components are not essential.

**B.1.3.2** The brush head is normally available in a range of sizes and designs. There are two basic forms of construction for this component which are the spiral wound wire body construction with bass, polypropylene or steel bristles and the wooden boss type utilizing the same range of bristles. The former brushes frequently incorporate a free-running wheel or fixed ball on the leading face to guide the head around bends within the chimney.

**B.1.3.3** The rods used for chimney cleaning are normally manufactured from cane or polypropylene and are available in a range of lengths. These components should be strong, yet flexible enough to bend as much as 45°.

**B.1.3.4** The brushes and rods described in **B.1.3.1** to **B.1.3.3** are unsuitable for cleaning flue pipes. It is recommended that a spiral wound bristle brush designed for such a purpose be used in this part of the operation.

**B.1.3.5** Industrial vacuum cleaners have proved to be an extremely useful aid in collecting the soot and dust produced by mechanical sweeping.

**B.1.4** ***Cleaning operation***

**B.1.4.1** Factors that affect the method of sweeping are as follows;

a) type of fuel being burnt;

b) type of appliance fitted;

c) construction of chimney system.

**B.1.4.2** The type of fuel burnt (see **B.1.2.2**, **B.1.2.3** and **B.1.2.4**) will determine the type of brush head to be used. Light deposits of soot can be removed using a brush with soft bristles, while heavy deposits of tar and creosote will require a brush with steel bristles. In cases where the deposits of tar are considerable, it may be necessary to use a metal scraper to replace the brush head.

**B.1.4.3** The type of appliance found on site will influence the method of sweeping. The installation of a soot/cleaning door into chimneys not serving an appliance recess enables cleaning to be carried out without the brush head having to pass through the appliance. However, it is important in this case to ensure that deposits are removed from the chimney or flue pipe below the level of the soot door. Appliances installed either inset or free-standing into a recess give rise to separate problems. The open fire provides easy access to the chimney for sweeping. Inset or free-standing room heaters with or without boiler that meet the required standards set by the Domestic Solid Fuel appliance Approval Scheme (DSFAAS) can be swept by passing a spiral wound brush from the firebox to the chimney. With certain open fires or room heaters a damper plate or throat plate may need to be removed. Certain room heaters and stoves do not allow the brush head to pass through; it is therefore necessary either to remove the appliance prior to sweeping or to fit a suitable soot door into the chimney. Independent boilers and cookers are normally connected to chimneys not serving an appliance recess, access to the chimney via a soot door should therefore be provided. Provision should be made to clean the flue pipe.

**B.1.4.4** The size and type of construction will influence the type of equipment to be used. The diameter of the brush head should be compatible with the internal diameter of the chimney flue as sweeping with too small a brush may not be effective and too large may cause damage. Masonry chimneys can be cleaned using any of the brush heads given in **B.1.3.2**. Generally a diameter of 50 mm above chimney size is suitable.

**B.1.4.5** Having selected the correct equipment for any particular installation it is important to ensure that the brush head passes throughout the length of the flue including any terminals.

**B.1.4.6** After the cleaning operation has been completed, it is essential to ensure that any deposits that may have fallen down the chimney or flue pipe into the appliance below are removed. Particular attention should be given to the cleaning of internal flueways within the appliance.

**B.1.4.7** The use of chemical chimney cleaners cannot be recommended as a substitute for sweeping. Mechanical sweeping is recommended because soot, etc. is not the only material that may block a chimney. Pargeting and portions of brickwork can become dislodged and birds have been known to nest in chimneys. Such materials can only be removed by sweeping or in the case of serious blockage by the use of a coring ball (see **7.3.2**).

**B.1.4.8** Unskilled cleaning methods, such as dragging chicken wire balls or dropping heavy weights down the chimney or deliberate chimney firing, should not be used. These procedures can cause considerable structural damage and gives rise to an unsafe chimney system.

**B.1.5** *Chimney fires.* If a chimney fire does occur, professional advice should be sought regarding the condition of the chimney.

**B.2 Maintenance**

**B.2.1** *Masonry chimneys.* Masonry structures, if designed in accordance with this standard, BS 5628 and CP 121, will require little, if any, maintenance other than chimney sweeping.

The choice of the correct brick type and mortar designation in relation to these constructional details will ensure satisfactory performance, and it is generally only in regard to design and workmanship that failures occur.

Flue liners provide a barrier to flue gases and condensates attacking brick and mortar internally and thus maintenance, if necessary, is confined generally to the external exposed brick faces, the chimney terminal and the exposed section of the flue liner.

The junctions of the flue with the chimney and that of the flue with the cavity wall construction require regular inspection to check for possible damage caused by differential settlement.

Brickwork should be examined after each winter season to check for any frost damage and any rain penetration through failures of damp proof courses and flashings. Any defective bricks should be cut out and replaced, after determining the cause of failure. Similarly, mortar joints should be checked for expansion, cracking, breaking out or disintegration and where such damage has occurred, they should be raked out cleanly and grouted, if necessary, and repointed. If failure is extensive, rebuilding with correct units and mortar of the correct designation may be necessary.


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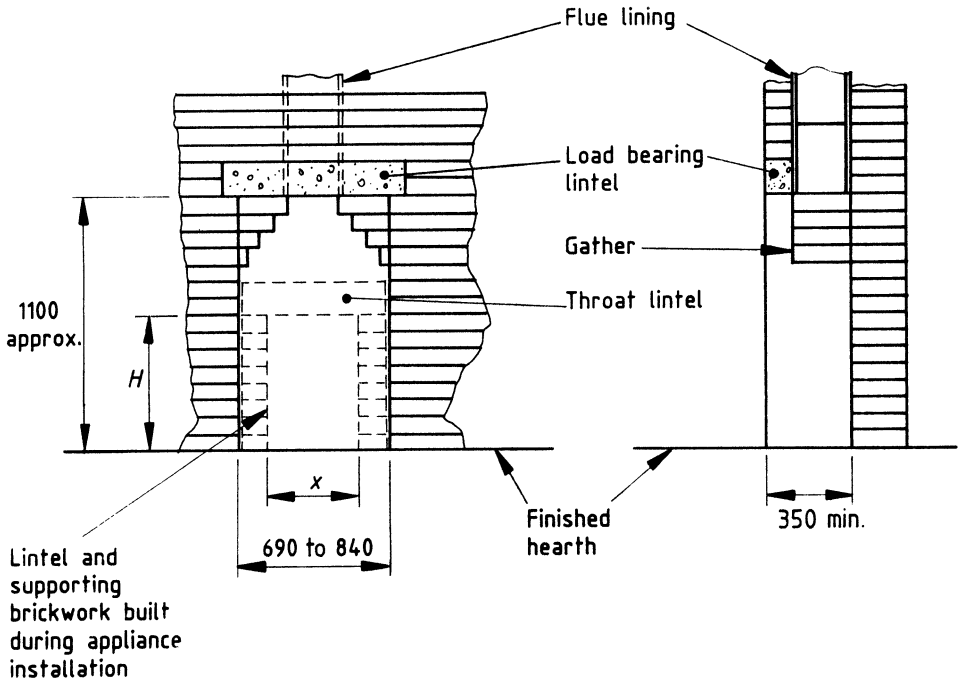
Damp-proof courses and flashings in compatible non-ferrous metal should be checked and replaced, refixed or the joints in adjacent bricks repointed in sulphate-resisting cement where necessary. Pointing should be finished flush or weather-struck to ensure maximization of water shedding.

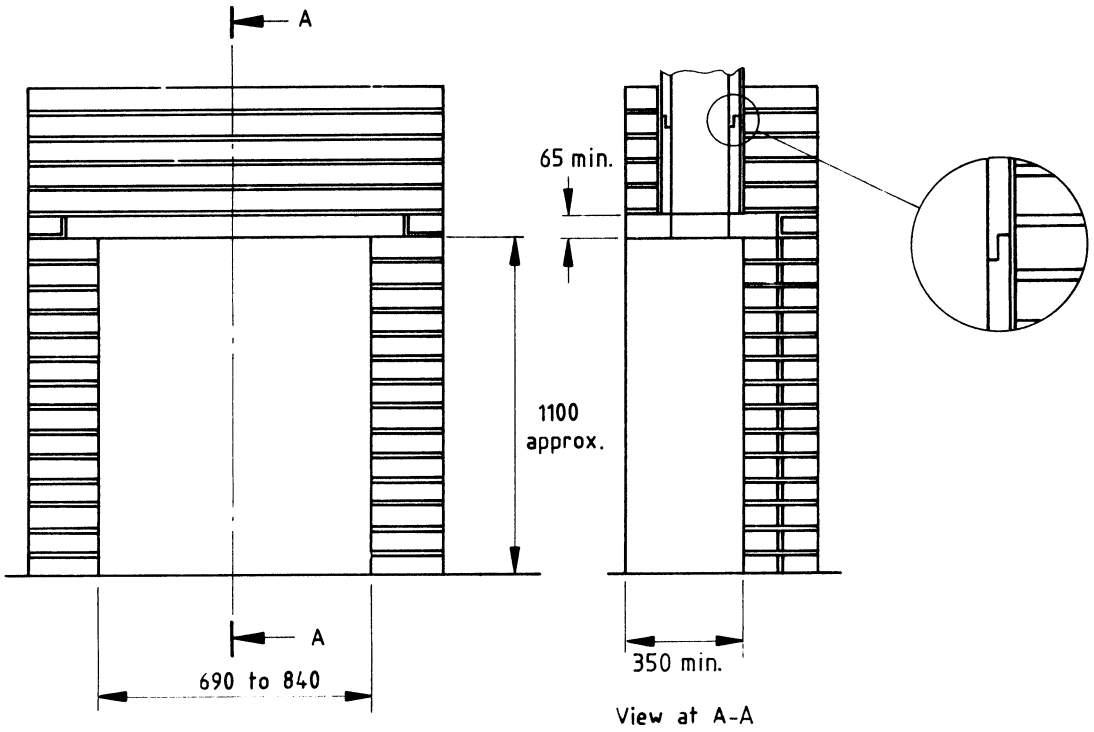
**B.2.2** *Flue block chimneys.* The chimney arrangement should be inspected at least once a year to see if external claddings, render, flashings, cappings, terminals or any other items need repairing or replacement.

**B.2.3** *Flue pipes.* Flue pipes and flue pipe joints should be inspected at least annually to confirm that the flue pipe is sound and that joints remain secure.




NOTE x is the opening to accommodate a fireback complying with BS 1251.
*H* is 15 to 30 greater than height of surround opening from finished hearth level.

**Figure 1 — Construction of fireplace recess with corbelled gather (applicable to the installation of inset open fires and room heaters)**




All dimensions are in millimetres.

**Figure 2 — Construction of fireplace recess with raft lintel**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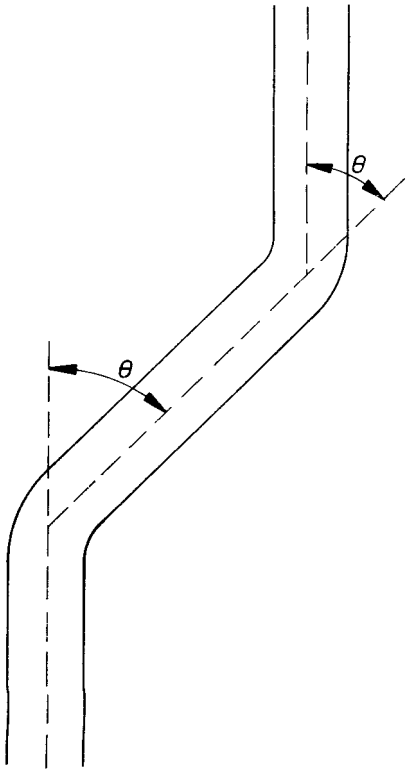


NOTE $\theta$ is less than 45° and preferably less than 30°.

**Figure 3 — Bends in flues (when unavoidable)**

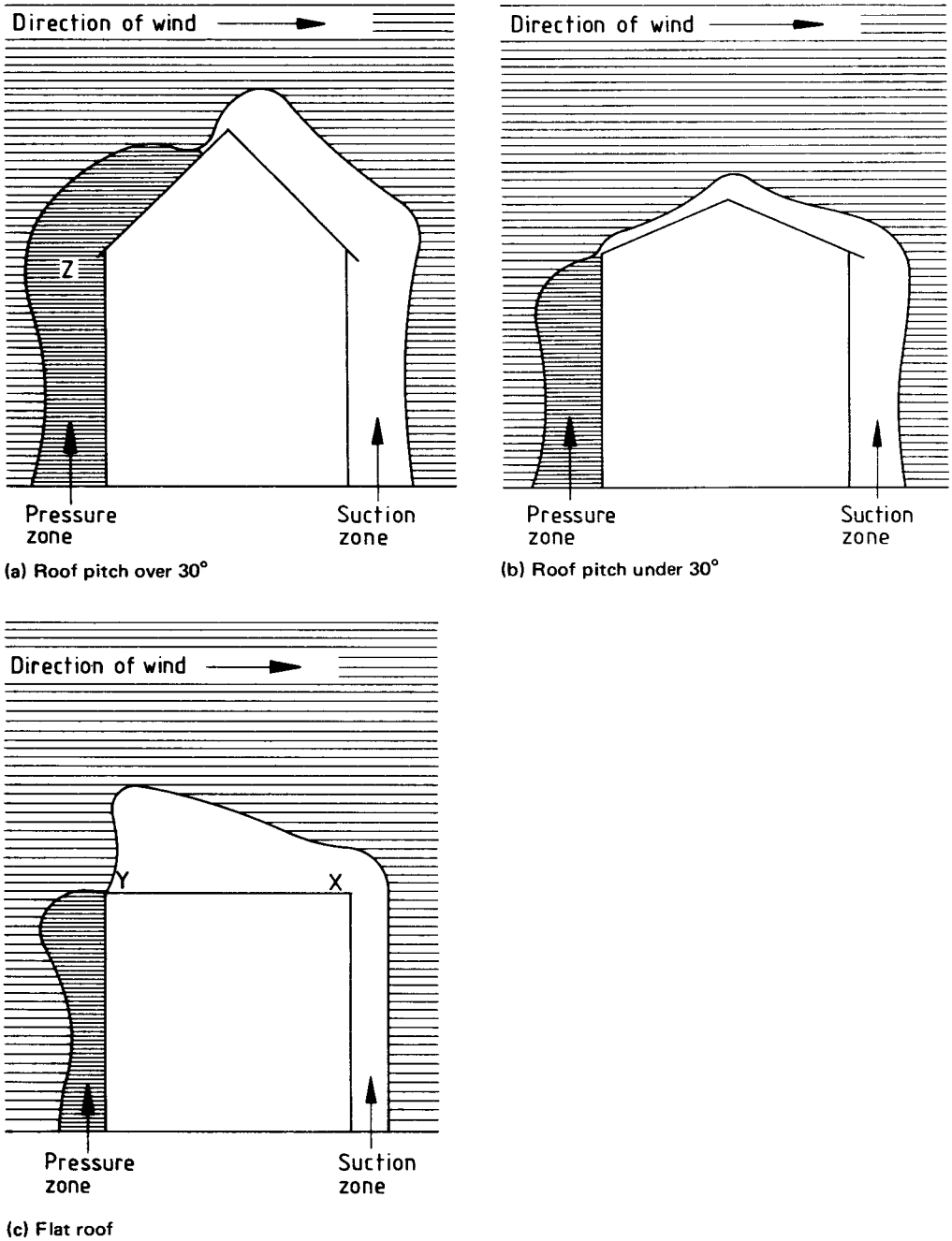


**Figure 4 — Typical wind pressure and suction zones**


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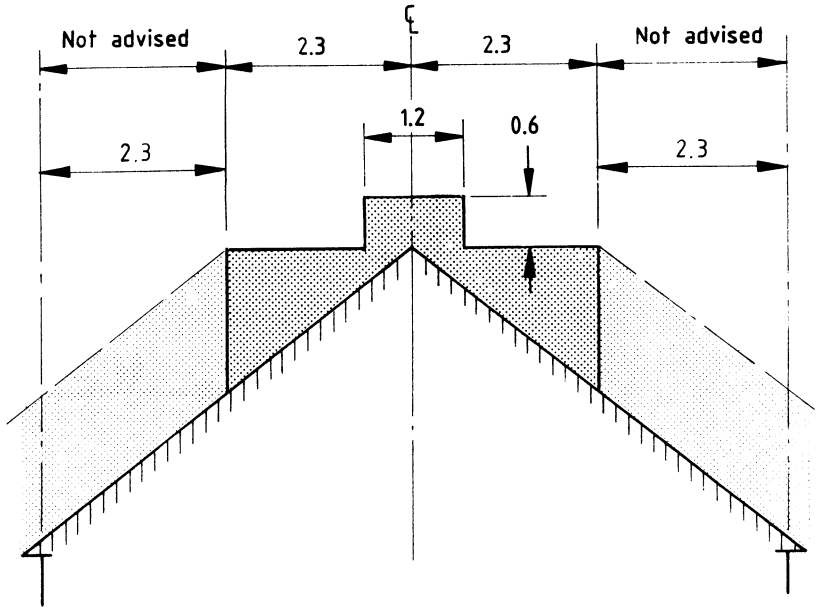
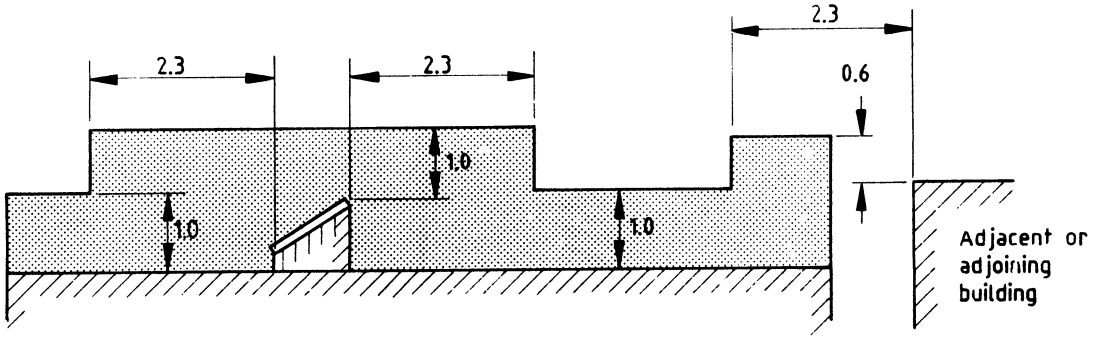



(a) Pitched roof



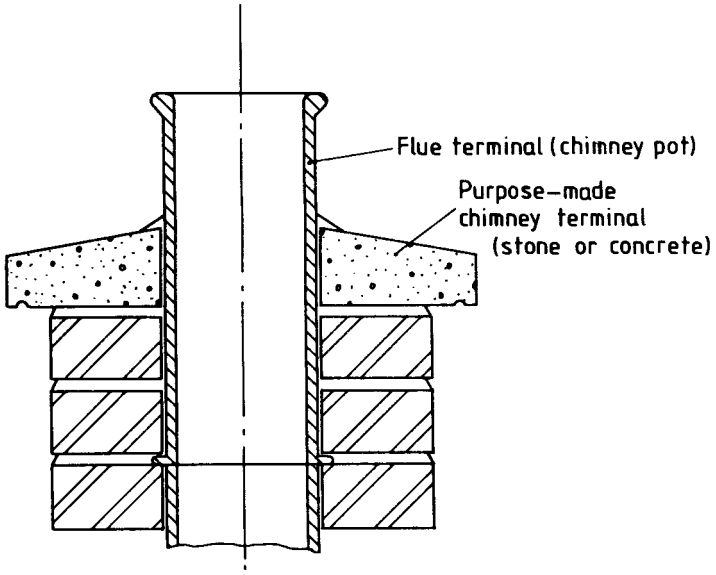

(b) Flat roof with openable sky-light

All dimensions are in metres.

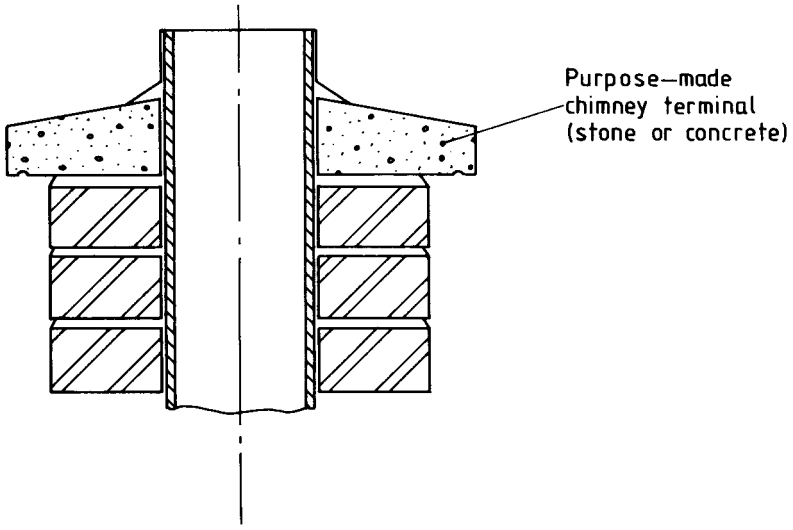
NOTE 1 Any pitch less than 10 is considered flat.

NOTE 2 The chimney should terminate outside the shaded areas.

**Figure 5 — Minimum chimney heights**




(a) Chimney pot




(b) Flue lining acting as flue terminal

**Figure 6 — Typical chimney and flue terminal details**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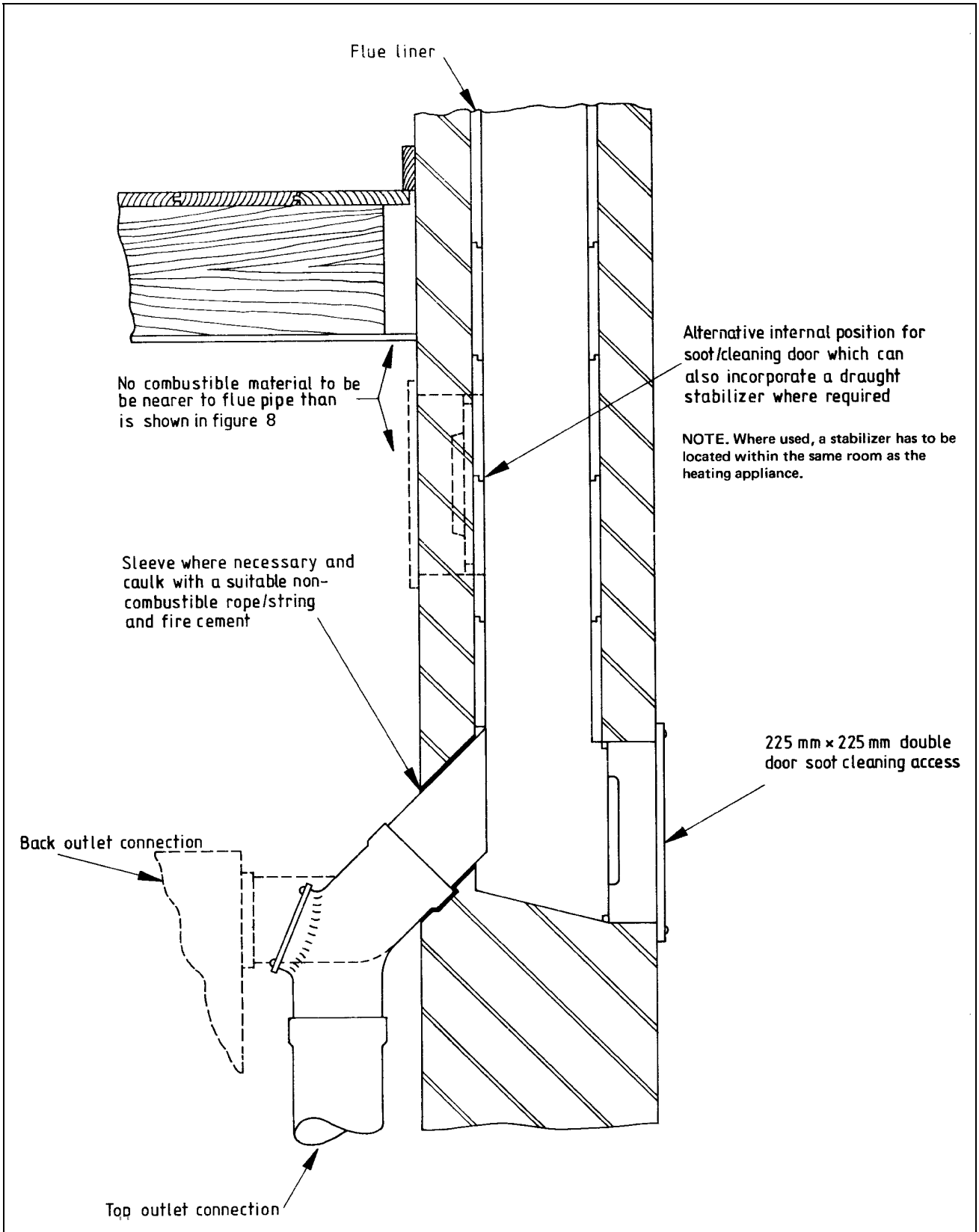
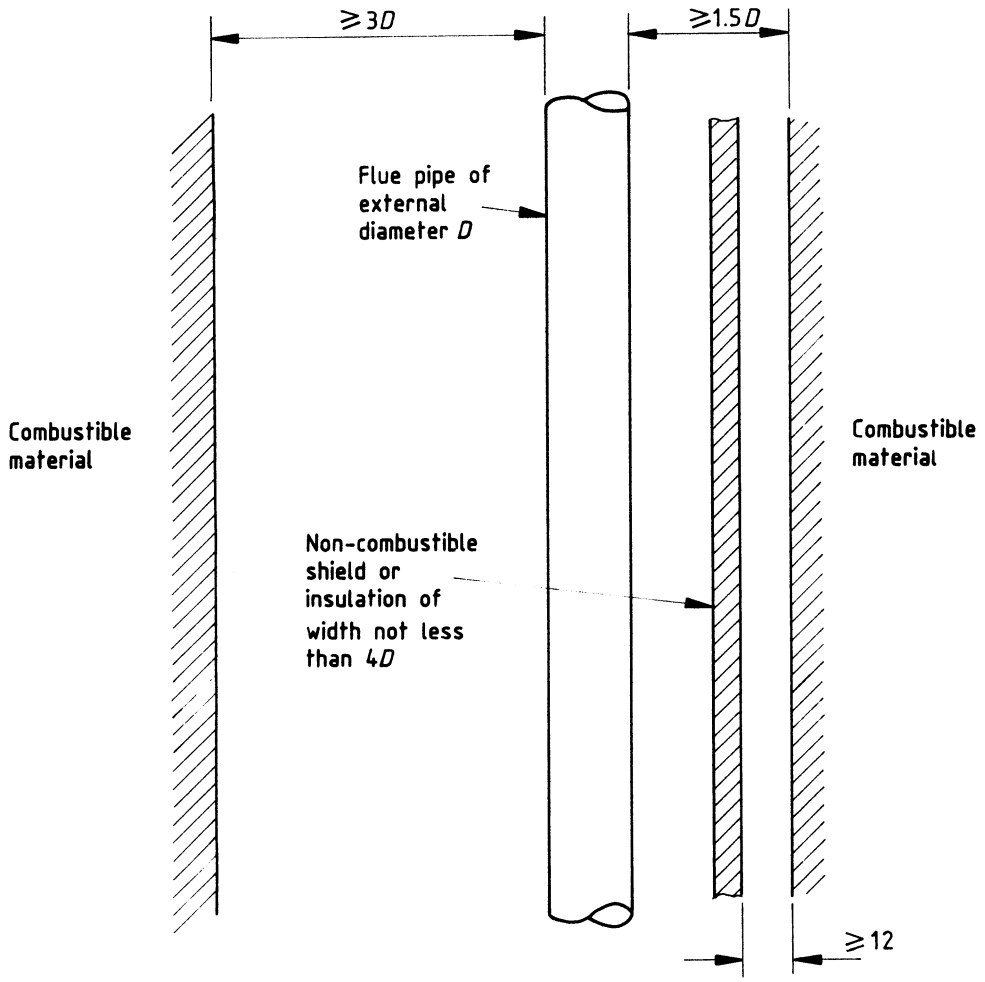



**Figure 7 — Typical flue pipe arrangements**




Dimension is in millimetres.

**Figure 8 — Separation of a flue pipe from a combustible surface**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# Publications referred to

BS 12, *Specification for ordinary and rapid-hardening Portland cement.*
BS 41, *Cast iron spigot and socket flue or smoke pipes and fittings.*
BS 65, *Specification for vitrified clay pipes, fittings and joints.*
BS 146, *Portland-blastfurnace cement.*
BS 187, *Specification for calcium silicate (sandlime and flintlime) bricks.*
BS 476, *Fire tests on building materials and structures.*
BS 476-3, *External fire exposure roof test.*
BS 715, *Sheet metal flue pipes and accessories for gas fired appliances.*
BS 835, *Asbestos-cement flue pipes and fittings, heavy quality.*
BS 890, *Building limes.*
BS 915, *High alumina cement.*
BS 1014, *Pigments for Portland cement and Portland cement products.*
BS 1181, *Clay flue linings and flue terminals.*
BS 1198, BS 1199 and BS 1200, *Building sands from natural sources.*
BS 1251, *Open fireplace components.*
BS 1344, *Methods of testing vitreous enamel finishes.*
BS 1344-1, *Resistance to thermal shock of coatings on articles other than cooking utensils.*
BS 1344-3, *Resistance to products of combustion containing sulphur compounds.*
BS 1344-7, *Resistance to heat.*
BS 1449, *Steel plate, sheet and strip.*
BS 1449-2, *Stainless and heat resisting steel plate, sheet and strip.*
BS 3892, *Pulverized-fuel ash.*
BS 3892-1, *Specification for pulverized-fuel ash for use as a cementitious component in structural concrete.*
BS 3921, *Clay bricks and blocks.*
BS 4027, *Specification for sulphate-resisting Portland cement.*
BS 4543, *Factory-made insulated chimneys.*
BS 4627, *Glossary of terms relating to types of cements, their properties and components.*
BS 4729, *Shapes and dimensions of special bricks.*
BS 5224, *Specification for masonry cement.*
BS 5534, *Code of Practice for slating and tiling.*
BS 5534-1, *Design.*
BS 5628, *Code of practice for the structual use of masonry.*
BS 6073, *Precast concrete masonry units.*
BS 6073-1, *Specification for precast concrete masonry units.*
BS 6461, *Chimneys and flues for domestic appliances burning solid fuel (including wood and peat).*
BS 6461-2, *Factory-made insulated chimneys for internal applications.*
CP 3, *Code of basic data for the design of buildings.*
CP 3: Chapter V, *Loading.*
CP 3-2, *Wind loads.*
CP 110, *The structural use of concrete.*
CP 111, *Structural recommendations for loadbearing walls.*
CP 114, *Structural use of reinforced concrete in buildings.*
CP 115, *Structural use of prestressed concrete in buildings.*
CP 116, *The structural use of precast concrete.*
CP 121, *Walling.*
CP 143, *Sheet roof and wall coverings.*
CP 144, *Roof coverings.*
CP 403, *Installation of domestic heating and cooking appliances burning solid fuel.*

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