BRITISH STANDARD

Flueing and ventilation for gas appliances of rated input not exceeding 70 kW net (1st, 2nd and 3rd family gases) –

Part 1: Specification for installation of gas appliances to chimneys and for maintenance of chimneys

ICS 91.060.40

Publishing and copyright information

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Foreword

Publishing information

This part of BS 5440 is published by BSI and came into effect on 31 March 2008. It was prepared by Technical Committee GSE/30, *Gas installations (1st, 2nd and 3rd family gases)* to support and complement BS EN 15287-1 and BS EN 15287-2.

Supersession

This part of BS 5440 supersedes BS 5440-1:2000+A2:2005, which is withdrawn.

Information about this document

BS 5440 is published in parts as follows:

- *Part 1: Specification for installation of gas appliances to chimneys and for maintenance of chimneys;*
- *Part 2: Specification for installation and maintenance of ventilation for gas appliances.*

This revision has been undertaken for the following reasons.

a) To acknowledge that European work on chimney standards has brought about the need to redefine chimney concepts and adopt common terminology consistent with the range of products used across the whole European Community. To align with European Standards, (the general requirements for which are given in BS EN 1443) where a chimney is treated as a structure containing a flue (the passageway) and might include a liner (inner wall), insulation and an outer wall. The common terminology in UK industry, which has regarded a chimney as a masonry structure generally associated with solid fuel appliances, has been superseded. Attention is drawn to the definitions for chimney (**3.9**), connecting flue pipe (**3.17**), flue (**3.28**) and flue liner (**3.31**), air supply duct (**3.1**) and room-sealed chimney configuration (**3.44**).

b) To recognize and refer to recent changes in building legislation.

c) To cover recent developments in appliance design, flue material and practical experience in the disposal of products of combustion by means of flues.

d) To improve advice on flueing and ventilation installation practices and reduce occurrences of CO related incidents attributable to flueing and ventilation for gas appliances.

It is essential that the appropriate specifications/codes of practice are consulted on all aspects of appliance and flue installation.

Use of this document

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

This British Standard allows gas appliance and/or chimney manufacturers' instructions to recommend a method of installation, testing, commissioning or maintenance which differs in points of detail from this standard. This reference to manufacturers' instructions is allowed only where it will result in at least an equivalent level of safety. In such circumstances, it is important that the manufacturer's instructions are followed.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Requirements in this standard are drafted in accordance with *The BSI guide to standardization – Section 2: Rules for the structure, drafting and presentation of British Standards*, subclause **11.3.1**, which states, "Requirements should be expressed using wording such as: 'When tested as described in Annex A, the product shall ...'". This means that only those products that are capable of passing the specified test will be deemed to conform to this standard.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

In particular, attention is drawn to the following statutory regulations.

a) The gas safety regulations for the appropriate legislative region:

- **Gas Safety (Installation and Use) Regulations 1998** [1];
- **Gas Safety (Installation and Use) Regulations (Northern Ireland) 2004** [2].

These control all aspects of the ways gas fired systems are installed, maintained and used, mainly in domestic and commercial premises, (e.g. offices, shops, hospitals, educational and other public buildings), and the classes of persons who might undertake gas work.

b) The building regulations for the appropriate legislative region:

- **Building Regulations for England and Wales 2000** [3];
- **Building Regulations (Northern Ireland) Statutory Rules 2000** [4];
- **Building Standards (Scotland) Regulations 1990** [5];
- **Building Regulations (Isle of Man) 2003** [6].

c) **Gas Appliance (Safety) Regulations 1995** [7].

These control the supply of new gas appliances and specify the conditions required for CE marking.

d) **Gas Safety (Application) (Isle of Man) Order 1996** [8].

1 Scope

This part of BS 5440 specifies requirements for the installation of gas appliances to chimneys, chimney installation work likely to be undertaken by gas engineers and operatives working under UK gas industry conditions and requirements for the maintenance of chimneys. It is applicable to open flue chimneys for Type B gas appliances and room-sealed chimney configurations for Type C gas appliances, each of rated input not exceeding 70 kW net (see Note 2 and Note 3), burning 1st, 2nd or 3rd family gases. It applies to chimneys of the natural draught or fanned draught type and is applicable to open flue chimneys and room-sealed chimneys supplied with the appliance as well as to those supplied separately.

NOTE 1 Type B and Type C appliances are explained in Table A.1.

It complements the requirements for the design, installation and commissioning of chimneys as required in BS EN 15287-1 and BS EN 15287-2 and requires extra details that are specific to the UK gas industry. This is kept in perspective by quoting some details of BS EN 15287-1 and BS EN 15287-2.

It specifies the following:

- requirements for the selection of the appropriate flueing option for gas appliances in the UK;
- requirements for the installation of gas appliances to new chimneys, or chimney configurations;
- requirements for the installation of gas appliances to existing chimneys or chimney configurations;
- requirements for the installation of appliances which carry a CE mark and for which the manufacturer's instructions are available to the installer;
- requirements installation of appliances which do not carry a CE mark and used/second-hand appliances for which the manufacturer's instructions are available to the installer.

This part of BS 5440 is applicable to:

- complete chimney and all chimney components from the appliance connection to the discharge point into outside air;
- the installation of gas appliances to existing chimneys that were intended originally for appliances burning other fuels;
- chimneys for residential park homes but not to chimneys for leisure accommodation vehicles.

This part of BS 5440 is not applicable to gas-fired incinerators. Refer to BS 5871-3 for the installation of decorative fuel effect appliances.

This part of BS 5440 includes compatibility of appliances installed in the UK with new chimneys designated under BS EN 1443 and with existing chimneys, including non-designated chimneys.

NOTE 2 In the case of an individual appliance connected to a chimney the 70 kW maximum rated input relates to that appliance. In the case of more than one appliance in the same room connected to a single chimney the 70 kW maximum rated input relates to the sum of the rated inputs of all the appliances. In the case of appliances in separate dwellings connected to a shared flue in a chimney, e.g. a SE-duct or a U-duct, the 70 kW maximum rated input relates to the rated input of each individual appliance.

NOTE 3 Installation of LPG (liquefied petroleum gas) systems in leisure accommodation vehicles is specified in BS EN 1949 and further guidance is given in the Institution of Gas Engineers and Managers publication IGE/UP/8 [9].

NOTE 4 Installation of gas-fired hot water boilers having rated inputs exceeding 70 kW is specified in BS 6644.

NOTE 5 The data in this British Standard refers to heat input expressed in terms of net calorific values (CV) with conversion given for natural gas gross CV quoted in brackets where appropriate. The ratio of gross heat input: net heat input is approximately 1.1:1 for natural gas propane and butane. For example, conversion of 9 kW input based on gross CV for natural gas to the equivalent net CV input is as follows:
net input = 9.0/1.1 = 8.2 kW.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 715, *Specification for metal flue boxes for gas-fired appliances not exceeding 20kW*

BS 5440-2:2000+A2:2004, *Installation and maintenance of flues and ventilation for gas appliances of rated input not exceeding 70 kW net (1st, 2nd and 3rd family gases) – Part 2: Specification for installation and maintenance of ventilation for gas appliances*

BS 5546, *Specification for installation of hot water supplies for domestic purposes, using gas-fired appliances of rated input not exceeding 70 kW*

BS 5864, *Installation and maintenance of gas-fired ducted air heaters of rated input not exceeding 70 kW net (2nd and 3rd family gases) – Specification*

BS 5871-1, *Specification for the installation and maintenance of gas fires, convector heaters, fire/back boilers and decorative fuel effect gas appliances – Part 1: Gas fires, convector heaters, fire/back boilers and heating stoves (2nd and 3rd family gases)*

BS 5871-2, *Specification for the installation and maintenance of gas fires, convector heaters, fire/back boilers and decorative fuel effect gas appliances – Part 2: Inset live fuel effect gas fires of heat input not exceeding 15 kW, and fire/back boilers (2nd and 3rd family gases)*

BS 5871-3, *Specification for the installation and maintenance of gas fires, convector heaters, fire/back boilers and decorative fuel effect gas appliances – Part 3: Inset live fuel effect gas fires of heat input not exceeding 15 kW, and fire/back boilers (2nd and 3rd family gases)*

BS 6230, *Specification for installation of gas-fired forced convection air heaters for commercial and industrial space heating (2nd and 3rd family gases)*

BS 6798, *Specification for installation of gas-fired boilers of rated input not exceeding 70 kW net*

BS 6896, *Specification for installation of gas-fired overhead radiant heaters for industrial and commercial heating (2nd and 3rd family gases)*

BS 7461, *Specification for electrically operated automatic gas shut-off valves fitted with throughput adjusters, proof of closure switches, closed position indicator switches or gas flow control*

BS EN 161, *Automatic shut-off valves for gas burners and gas appliances*

BS EN 1443:2003, *Chimneys – General requirements*

BS EN 1457, *Chimneys – Clay/ceramic flue liners – Requirements and test methods*

BS EN 1806, *Chimneys – Clay/ceramic flue blocks for single wall chimneys – Requirements and test methods*

BS EN 1856-1, *Chimneys – Requirements for metal chimneys – Part 1: System chimney products*

BS EN 1856-2, *Chimneys – Requirements for metal chimneys – Part 2: Metal liners and connecting flue pipes*

BS EN 1857:2003, *Chimneys – Components – Concrete flue liners*

BS EN 1858, *Chimneys – Components – Concrete flue blocks*

BS EN 13384-2, *Chimneys – Thermal and fluid dynamic calculation methods – Part 2: Chimneys serving more than one heating appliance*

BS EN 15287-1:2008, *Chimneys – Design, installation and commissioning of chimneys – Part 1: Chimneys for nonroomsealed heating appliances* [1)]

BS EN 15287-2:2008, *Chimneys – Design, installation and commissioning of chimneys – Part 2: Chimneys for roomsealed appliances* [1)]

BS EN 60079-10:2003, *Electrical apparatus for explosive gas atmospheres – Part 10: Classification of hazardous areas*

IGE/UP/7:2006 (Edition 2), *Gas installations in timber framed and light steel framed buildings* [2)]

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1) In preparation.

2) Available from the Institution of Gas Engineers and Managers, Charnwood Wing, Holywell Park, Ashby Road, Loughborough, Leicestershire, LE11 3GH. http://www.igem.org.uk/.

3 Terms and definitions

For the purposes of this part of BS 5440, the following terms and definitions apply.

3.1 air supply duct
duct in a chimney configuration only for conveying combustion air to a room-sealed appliance

3.2 appliance compartment
enclosure, not being a habitable space, specifically designed or adapted to house one or more gas appliances only

3.3 balanced compartment
sealed enclosure, not being a habitable space, specifically designed or adapted to house one or more open-flued gas appliances only, but which takes its air supply from a place outside the enclosure which is adjacent to the flue discharge point

*NOTE See Clause **11**.*

3.4 balanced flue appliance
room-sealed appliance which draws its combustion air from a point adjacent to the point at which the combustion products are discharged, the inlet and outlet being so disposed that wind effects are substantially balanced

NOTE This is referred to as Type C in PD CEN/TR 1749:2005.

3.5 bathroom
room or space containing a functioning bath

3.6 boundary
curtilage of the land or buildings belonging to and under the control of the building owner

3.7 branched chimney
shared chimney serving open-flued appliances situated on two or more floors

NOTE This was known as a branched flue system in BS 5440-1:2000.

3.8 builder's opening
enclosure constructed by the builders to accommodate fireplace components

3.9 chimney
structure consisting of a wall or walls enclosing a flue or flues

NOTE This includes chimneys of all materials (e.g. metal, masonry, plastic, etc.). It may be either an open flue chimney for use with an open-flued appliance or a room-sealed chimney configuration for use with a room-sealed appliance.

3.10 chimney plate
permanent plate or label fixed in a secure and accessible position in the building giving details of the chimney or flue installation

3.11 closed flue
flue that is closed to a room or internal space due to the absence of a draught diverter, flue break and any draught break within the chimney; combustion air is drawn directly from the room or space containing the appliance

NOTE This is now an obsolete term for an open flue without a draught diverter.

3.12 common flue system
shared open flue system serving two or more appliances installed in the same room or space

3.13 condensate discharge pipe
pipe, which might also be part of the appliance chimney, resistant to corrosion from condensate, formed from the products of combustion, which is leak free, and along which condensate flows

3.14 condensate drain
fixture in a chimney or appliance, resistant to corrosion from condensate formed from the products of combustion, where condensate can be drained

3.15 condensate-free length
length of individual chimney which can be calculated to maintain the temperature of the flue gases above the dew point and thereby ensure that condensate from the products of combustion does not form on the inner wall of the chimney under the normal operating cycle of the appliance

3.16 condensing appliance
appliance designed to make use of the latent heat from the water vapour in the combustion products by condensing the water vapour within the appliance

3.17 connecting flue pipe
component used for connecting an appliance outlet and the chimney

3.18 custom-built chimney
chimney that is installed or built on-site using a combination of compatible chimney components that may be from one or different sources

3.19 decorative fuel effect gas appliance
appliance designed to burn gas for a decorative effect

3.20 draught break
opening into any part of a chimney, including that part integral with the appliance

3.21 draught diverter
device for preventing conditions in a secondary flue from interfering with the combustion performance of an appliance

3.22 effective height
height of straight vertical circular chimney, measured from the base of the fire to the outlet of the chimney, of the same cross-sectional size as the chimney under consideration, produces the same flue flow rate as the chimney under consideration equal to the equivalent height plus 0.65 m

NOTE This definition applies only to gas fires and combined gas fire/back boiler units.

3.23 equivalent height
height of the straight vertical circular chimney, measured from the appliance flue spigot to the outlet of the chimney, of the same cross-sectional size as the chimney under consideration, which produces the same flue flow rate as the chimney under consideration

3.24 fan diluted chimney
fanned draught chimney connected to an open-flued appliance in which the products of combustion are diluted with air

3.25 fanned draught chimney
chimney in which the removal of the products of combustion is dependent on a fan

3.26 fireplace recess
recess formed by the inclusion of fireplace components in a builder's opening

3.27 flat roof
section of a roof which is horizontal or close enough to horizontal such that any airflow over it does not affect the operation of a chimney terminating above the roof, i.e. within 20° of the horizontal

NOTE This would include a bow string truss roof such as might be encountered in a residential park home.

3.28 flue
passage for conveying combustion products to the outside air

3.29 flue break
opening into a secondary flue in the same room as, and in addition to, the opening at the draught diverter

3.30 flue duct
duct containing the flue of a chimney

3.31 flue liner
wall of a chimney consisting of components the surface of which is in contact with the products of combustion

NOTE This includes a rigid or flexible liner inserted into a chimney to form the flue and the inner wall of a metal or masonry chimney construction.

3.32 flueless appliance (Type A)
appliance which is designed to be used without a flue and in which the products of combustion mix with the surrounding air

3.33 Installation instructions

3.33.1 appliance manufacturer's instructions
instructions prepared by the appliance manufacturer giving detailed information and requirements on how the appliance is to be installed

NOTE Such instructions should not be confused with other documents supplied by the manufacturer, e.g. sales literature.

3.33.2 chimney manufacturer's instructions
instructions provided with the product by the manufacturer giving detailed information on how the chimney or chimney component is to be installed and checked

NOTE Such instructions should not be confused with other sales or marketing related literature supplied by the manufacturer.

3.34 leisure accommodation vehicle
unit of living accommodation for temporary or seasonal occupation that might meet the requirement for the construction and use of road vehicles

3.35 main flue
part of a shared open flue system carrying products of combustion from two or more appliances

3.36 natural draught chimney
chimney in which the draught is provided by the thermal force arising from the heat of the products of combustion

3.37 open flue chimney
chimney that evacuates the products of combustion to the outside air, the combustion air being drawn directly from the room or space containing the appliance

3.38 open-flued appliance
appliance designed to be connected to an open flue chimney

NOTE 1 These appliances are referred to in BS EN 15287 as "non-room-sealed" appliances.

NOTE 2 This is equivalent to a Type B appliance in PD CEN/TR 1749:2005.

3.39 passive stack ventilation
form of natural ventilation created by pressure differences due to wind and/or temperature differences induced by an essentially vertical duct to remove odours and moisture-laden atmosphere at roof level

NOTE Used typically in "wet" rooms, e.g. kitchens, bathrooms/shower rooms.

3.40 plume management kit
chimney component designed to manage the discharge of the products of combustion such that any plume will not cause a nuisance

3.41 pluming
visible cloud formed when products of combustion exit from a chimney and are cooled below the dew point by mixing with external air

3.42 residential park home
mobile home designed for permanent residential accommodation that does not meet the requirements for construction and use for a road vehicle

3.43 room-sealed appliance
appliance whose combustion system is sealed from the room in which the appliance is located and which obtains air for combustion from a ventilated uninhabited space within the premises or from open air outside the premises and which vents the products of combustion directly to open air outside the premises

cf. definition in BS EN 15287-2.

NOTE This is equivalent to a Type C in PD CEN/TR 1749:2005.

3.44 room-sealed chimney configuration
unit consisting of a flue duct and air supply duct which can be concentric or separate for a room-sealed appliance

NOTE In this context "concentric" refers where a flue duct is located inside the air supply duct they do not necessarily share a common axis. (This includes assemblies previously called balanced flues).

3.45 secondary flue
flue in a chimney for an open-flued appliance connecting a draught diverter or draught break to a outlet

3.46 SE-duct
duct rising vertically through a building, open at its extremities, and serving to bring combustion air to, and to take products to the outside air from, Type C_2 room-sealed appliances

3.47 shared chimney
chimney serving two or more appliances

3.48 shower room
room or space containing a functioning shower

3.49 subsidiary flue
part of a shared open flue system which connects the appliance outlet to the main flue

3.50 system 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

3.51 terminal
fitting installed at the outlet of a chimney

NOTE These are fitted to assist products of combustion to escape, minimize downdraught and prevent entry of material which might block the flue.

3.52 terminal guard
device fitted over a terminal in order to protect persons from contact with, prevent interference with, and prevent damage to the terminal, and prevent flue blockage

3.53 U-duct
duct in the form of a vertical "U", the ends being open and adjacent, one limb of which provides combustion air to the bottom of the "U", whilst room-sealed appliances, (Type C_2), (both air supply duct and flue duct) are fitted to the other limb

*NOTE A continental European arrangement fits the air supply duct of the appliance (Type C_4) to one limb and the flue duct to the other (see Clause **12**).*

4 Competence

Persons carrying out any design, installation and maintenance work shall be competent.

*COMMENTARY ON CLAUSE **4***
Under the Gas Safety (Installation and Use) Regulations [1] a business or self employed person who carries out work on gas fittings has to be a "member of a class of persons approved for the time being by the Health and Safety Executive (HSE)".

At the time of publication, the body with HSE approval to operate and maintain a register of businesses who are members of a "class of persons" is CORGI. Therefore it is essential that all businesses or self employed gas installers are registered with CORGI.

Persons deemed competent to carry out gas work at premises covered by the Gas Safety (Installation and Use) Regulations [1] are those who hold a certificate of gas safety competence acceptable to CORGI which include (without limitation) the Accredited Certification Scheme (ACS) and the Gas Services S/NVQ that has been aligned to ACS.

Guidance on competence is given in HSC Approved Code of Practice and Guidance L56, Safety in the installation and use of gas systems and appliances [10].

Whilst it is a requirement under the Health and Safety at Work etc. Act [11] to be competent when designing or installing a chimney, except where the chimney is part of the appliance, there is no requirement to be CORGI registered for such work providing it does not involve any associated work on a gas appliance/fitting.

5 General

*NOTE Design of chimneys for non-room-sealed appliances is specified in BS EN 15287-1:2008, Clause **4**, and for room-sealed appliances in BS EN 15287-2:2008, Clause **4**. BS EN 15287-1 and BS EN 15287-2 specify that chimneys should conform to nationally accepted rules. General UK requirements for design of chimneys for both room-sealed and non-room-sealed gas appliances are specified in **5.1** to **5.7**.*

5.1 Compatibility of appliances and chimneys

*COMMENTARY ON **5.1***
The effectiveness of a chimney in discharging products of combustion to the outside air is dependent on the flue size (cross-section), length, route, exposure and the materials used in its construction. The effectiveness is also influenced by the thermal efficiency of the appliance and its usage pattern as well as being critically dependent on an adequate supply of combustion air.

For room-sealed appliances in which the chimney configuration is supplied with the appliance (referred to in BS EN 15287-2 as system chimneys), the manufacturer can be expected to have taken these factors into consideration in the integrated appliance and chimney configuration design.

For non-room-sealed (open-flued) appliances, calculations need to be carried out to determine the size of chimney required to ensure full clearance of combustion products. A calculation method for open flue chimneys is given in Annex B, alternatively the method given in BS EN 13384-1 may be used.

As the motive power generated by a fan is considerably greater than that generated thermally, fanned systems can be used with smaller flues than those required for corresponding non-fanned systems. This can have advantages in certain circumstances, for example it gives greater flexibility in the routing of the chimney and in the siting of the chimney outlet.

The chimney required for a specific situation will also be dependent on the proposed location of the appliance. In selecting the correct chimney, the following factors should be taken into account.

a) Constraints imposed on potential chimney outlet locations by the following:

- *openings into the building including windows, air bricks and other ventilation openings;*
- *existing chimney outlets;*
- *neighbouring properties;*
- *boundaries;*
- *combustible materials on the external face of the building;*
- *structural and/or topographical features which might prevent a free flow of air over the chimney outlet and/or lead to adverse pressure zones;*
- *the need to site low level terminals so as to avoid physical damage, e.g. from opening doors;*
- *the need to guard low level terminals to protect passers by;*
- *the effects of any pluming on surfaces of the building and neighbouring properties.*

b) The availability of existing chimneys for re-uses.

c) The function of the room in which the appliance is to be installed, particularly in the case of bathrooms, bedrooms and bed-sitting rooms where special rules apply under the Gas (Safety, Installation and Use) Regulations 1998 [1].

d) The need for provision of an adequate air supply for combustion and (where necessary) cooling.

e) The extent to which mechanical ventilation is present in the intended location and the effect that this might have on non-room-sealed appliances.

f) In the case of fan assisted chimneys, if additional safeguards are required to ensure that the appliance is shut down on failure of the fan. (See Clause 7 for further information.)

Attention is drawn to the Building Regulations [3], [4], [5], [6] and supporting documentation [12], [13]which require appliances and chimneys to be so constructed and installed as to reduce to a reasonable level the risk of people suffering burns or the building catching fire.

For buildings of timber framed construction, adequate safeguards can be achieved, for example, by the introduction of suitable sleeves or ducts where the chimney or chimney configuration passes adjacent to combustible material, or by other simple shielding arrangements. For such buildings, precautions are also necessary to preserve the integrity of any vapour barrier or cavity insulation and to minimize any effects on the thermal and acoustic insulation properties of the structure. Detailed arrangements can be found in the Institution of Gas Engineers and Managers Publication IGE/UP/7.

5.1.1 The appliance shall be connected to a chimney of a classification which is appropriate for the appliance type.

*COMMENTARY ON **5.1.1***
To ensure the safe and effective operation of an appliance and chimney it is essential that the appliance classification is compatible with the chimney designation. For room-sealed appliances it is common that the chimney configuration is certified and supplied by the appliance manufacturer. Certain appliances (e.g. Type C_2, Type C_4 and Type B_2) may be connected to a chimney supplied separately.

Gas appliances are classified in PD CEN/TR 1749:2005 according to the method of evacuation of the products of combustion as Type A (flueless) Type B (open-flued) and Type C (room-sealed). Type A appliances do not have a chimney and are outside the scope of this part of BS 5440. Chimneys are given a designation string in accordance with BS EN 1443 on the basis of their performance characteristics and the materials from which they are made. Details of these classification and designation systems are given in Annex A.

5.1.2 The appliance shall be connected to a compatible open flue chimney or room-sealed chimney configuration which is in accordance with:

a) the appliance manufacturer's installation instructions (see **5.1.3**) or, if these do not specify the chimney to be used, the default values given in Table A.2; and

b) the additional requirements for flueing specified in the following standards, as applicable:

   1) BS 5546 for water heaters;

   2) BS 5871-1 and BS 5871-2 for gas fires;

   3) BS 5871-3 for decorative fuel effect gas fires;

   4) BS 6798 for boilers;

   5) BS 5864 for ducted warm air heaters;

   6) BS 6230 for direct and indirect fired warm air heaters;

   7) BS 6896 for overhead radiant tubes and radiant plaques.

NOTE Detailed arrangements for flueing of gas appliances in timber framed and steel framed dwellings are given in the Institution of Gas Engineers and Managers publication IGE/UP/7.

5.1.3 New or used appliances shall not be connected unless the appliance manufacturer's installation instructions are available to the installer.

5.2 Chimney outlets

*NOTE 1 Chimney terminals for non-room-sealed appliances are specified in BS EN 15287-1:2008, **4.3.31** and chimney terminals for room-sealed appliances are specified in BS EN 15287-2:2008, **4.3.26**.*

*NOTE 2 The location of chimney outlets for non-room-sealed appliances is specified in BS EN 15287-1:2008, **4.3.18**, and for room-sealed appliances in BS EN 15287-2:2008, **4.3.17**. BS EN 15287-1 and BS EN 15287-2 specify that the location of chimney outlets should be in accordance with national rules. UK requirements for location of chimney outlets for gas appliances are specified in **5.2.1**, **5.2.2** and **5.2.3**.*

5.2.1 General

Chimney outlets shall be located as specified in Annex C.

The chimney outlet shall not be obstructed. Any obstructions such as adjacent aerials, small wind turbines mounted on the chimney stacks or nearby and above the chimney outlet and trees shall be removed or the chimney outlet sited elsewhere.

*COMMENTARY ON **5.2.1***
The main function of a chimney for both non-room-sealed and room-sealed appliances is to effectively discharge the products of combustion to the outside air under all weather conditions. This is achieved by the selection of the correct terminal and the correct outlet location.

Openings in the terminal are sized to prevent the ingress of foreign matter which would seriously impair the performance of the flue system. Under certain conditions, pluming can occur at the outlet and, where possible, chimney outlet positions where this could cause a nuisance should be avoided.

Aerials, small wind turbines mounted on chimney stacks or nearby and above the chimney outlet, trees and other obstructions could impede the operation of the chimney.

5.2.2 Location of chimney outlets in relation to basement areas, light wells and retaining walls

Chimney outlets shall be sited so as not to discharge within the curtilage or confines of any enclosed basement area, light well or external space formed by a retaining wall or passage unless provision is made to ensure the safe dispersal of flue gases as follows.

a) Chimney outlets from room-sealed appliances and fanned draught non-room-sealed appliances may be sited in such areas provided that they are sited not more than 1 m below the top level of the basement area, light well or retaining wall.

b) Chimney outlets from room-sealed appliances and fanned draught non-room-sealed appliances may be sited in a basement area or light well where this is formed by a single retaining wall that creates an uncovered passageway at least 1.5 m wide. This shall only be done if the passage allows free air circulation beyond and around the ends of the structure and the retaining wall, if the passageway terminates at or above ground level and if unobstructed air movement can take place at the open ends of the passageway.

5.2.3 Terminal guards

*COMMENTARY ON **5.2.3***
Attention is drawn to the Building Regulations [3], [4], [5], [6] and supporting documentation [12], [13].

Terminal guards shall be used where there is a risk of blockage of, and/or damage to, the terminal and/or where there is a risk of injury to people including exposure to excessive temperatures.

NOTE Blockage of the terminal can be caused, for example, by nesting birds and other wildlife.

5.3 Chimneys for use with condensing appliances (open-flued and room-sealed)

5.3.1 General

*COMMENTARY ON **5.3.1***
Condensing appliances are normally of the fanned room-sealed type, although other types are not necessarily excluded. The manufacturer might specify the flue route, siting and terminal.

When installing a condensing appliance, extra provisions (compared to a non-condensing appliance) shall be made to accommodate the condensate by selecting and constructing the chimney of materials in accordance with **5.3.2**, incorporating arrangements for condensate disposal in accordance with **5.3.3** and siting the chimney outlet in accordance with **5.3.4**.

5.3.2 Chimney materials

The materials selected for chimney components and any sealing devices shall be suitable for use with condensed combustion products which are mildly acidic.

*COMMENTARY ON **5.3.2***
Materials such as copper, mild steel and certain grades of stainless steel are not suitable for this particular application. Where doubt exists, advice should be sought from the appliance manufacturer.

Plastics material should be used only where the appliance to be connected is CE marked and the manufacturer's installation instructions specifically permit and specify such flue system materials and constructions and detail the requirements for their use. In all other circumstances, advice should be sought from the manufacturer.

5.3.3 Condensate disposal

Where the appliance installation instructions specify that a condensate drain needs to be provided for the appliance, provision shall be made also for the collection and/or disposal of condensate formed in the flue.

Material, sizing and routing of the condensate drain shall be in accordance with the appliance manufacturer's instructions.

*COMMENTARY ON **5.3.3***
If the appliance installation instructions state that it is permissible, the chimney may be designed to conduct the condensate from the flue back to the appliance for disposal through the appliance's condensate drain. Alternatively or additionally, provision can be made to drain the chimney at any convenient point. Some appliances might combine the chimney and condensate drain as a single pipe.

In most circumstances a chimney drain pipe requires a trap to prevent flue products escaping, air from entering the flue, or smells from entering the premises.

Where the appliance input does not exceed 4 kW it might be acceptable to discharge the condensate other than to a drain provided that this is in accordance with the appliance manufacturer's instructions. Any combined chimney and condensate discharge pipe should project a minimum of 75 mm from the point of exit on an external wall and be sited such that condensate cannot drain onto a pathway where freezing of the condensate might cause a hazard.

Detailed advice on condensate drains for boilers is given in BS 6798 and for water heaters is given in BS 5546.

5.3.4 Siting of the flue duct outlet

5.3.4.1 General

The flue duct outlet shall be sited so that the wet combustion products are unlikely to cause damage or nuisance.

*COMMENTARY ON **5.3.4.1***
Appliances (particularly condensing appliances) have a tendency to form a plume of water vapour from the flue duct outlet. The effect of wind conditions and the dispersal of the plume relative to adjacent wall surfaces, openable windows and neighbouring property should be considered.

5.3.4.2 Proximity to a boundary

The flue duct outlet shall be sited in accordance with **C.3**.

5.4 Location of appliances

5.4.1 General

Location of appliances shall be in accordance with the appliance manufacturer's instructions.

*COMMENTARY ON **5.4.1***
Attention is drawn to Regulation 30 of the Gas Safety (Installation and Use) Regulations [1] with respect to installations in bedrooms, bathrooms or shower rooms and to instantaneous water heaters.

- *An appliance, purchased second hand, without a "CE" mark is unlikely to be fitted with an appropriate safety control. Some appliances, purchased second hand, carrying the "CE" mark might not be fitted with an appropriate safety control.*
- *Where there is any doubt as to whether the appliance is fitted with an acceptable safety control, it should not be installed, or be allowed to be used in sleeping accommodation.*
- *The Gas Safety (Installation and Use) Regulations [1] require cupboards and compartments which have doors opening into bedrooms or bathrooms or shower rooms to be treated as part of the bedroom or bathroom or shower room concerned.*
- *The Gas Safety (Installation and Use) Regulations [1] also require cupboards and compartments which have doors opening into other rooms or spaces, but are ventilated through adjoining walls, floors or ceilings into bathrooms or shower rooms or bedrooms, to be treated as part of the bedroom or bathroom or shower room concerned.*

5.4.2 Garages and other hazardous areas

Gas appliances and their chimneys in commercial repair workshops for motor vehicles shall be installed in accordance with the British Gas publication IM/28 [14].

Gas appliances shall not be installed in spaces classified as hazardous as defined in BS EN 60079-10:2003.

*COMMENTARY ON **5.4.2***
The requirement for commercial workshops is intended to apply where petroleum and other heavier than air flammable vapours are present. Wherever reasonably practicable, appliances should not be installed in such places.

Since the Gas Safety (Installation and Use) Regulations 1998 [1] came into force, there is no longer any specific restriction under the on the type of chimney or location of appliances that may be installed in a private garage.

5.5 Passive stack ventilation

*COMMENTARY ON **5.5***
In order to avoid the outlets for a passive stack ventilation system and a chimney being positioned in different pressure zones, both the outlets should be located on the same face of the building, and the chimney outlet should be at the same or at a higher level than the passive stack ventilation outlet.

Where a building contains both passive stack ventilation systems and open-flued natural draught appliances, the respective chimney outlets shall be sited so as to avoid the possibility of setting up a pressure gradient across the two systems that could lead to appliance flue reversal.

5.6 Exchange of information and planning

The designer or installer of the chimney, and the provider or installer of the gas appliance shall agree and document the pertinent compatibility details (see **5.1**) with the customer as appropriate. Where the chimney is provided as part of the appliance, e.g. a room-sealed configuration (including balanced flue) appliance, the installer shall agree and document, with the customer, that the chimney configuration is suitable for the application.

*COMMENTARY ON **5.6***
When erecting a new chimney or chimney configuration or modifying an existing one, the pertinent details include the type, size and route of the chimney and the type and size of gas appliance that is intended to be connected to it. This is particularly pertinent when different trades are involved in the erection of the chimney or chimney configuration and fitting the gas appliance.

When a gas appliance is to be fitted to an existing open flue chimney or room-sealed chimney configuration, it is essential that the installer confirms that the chimney is suitable for the appliance.

Where appropriate, the end user (customer), should be consulted and involved in the decision making process. The customer should be advised of the reasons for the choice of appliance and the flueing option. Some factors that might be relevant, such as cost, aesthetic appearance, and positioning relative to furniture, fittings and the building structure, are beyond the scope of this standard. However, the choice of an open-flued or room-sealed appliance might be influenced by attitudes to safety issues.

All appliances converting energy into useful heat (i.e. electrical and fossil fuel-fired appliances) might invoke some element of risk. Incidents involving gas utilization generally involve inadequate installation, subsequent lack of servicing or maintenance or misuse by the user.

Burning any fossil fuel (oil, solid fuel and gas) creates products of combustion which could lead to the creation of harmful elements if the combustion process and subsequent provisions for flueing are inadequate.

Open flue chimneys do not operate correctly under conditions of inadequate or blocked flues, or inadequate or blocked air supply and under such conditions may spill products of combustion.

New appliances installed in domestic applications are required by the Gas Appliances (Safety) Regulations [7], to be marked with the CE mark and have devices fitted that are designed to shut down the appliance before there is a dangerous build up of the products of combustion in the room.

Some used appliances might not be fitted with such devices if they were manufactured before this became a mandatory requirement.

Some commercial appliances might not require such devices if they are installed in commercial situations.

*Attention is drawn to chimney plates, which may be available to assist in matching the appliance to the chimney or chimney configuration (see also **6.1.1**). Attention is drawn to the Building Regulations [3], [4], [5], [6].*

5.7 Maintenance

The responsible person shall be advised that, for continued efficient and safe operation of the appliance and its chimney, it is important that adequate and regular maintenance is carried out by a competent person (i.e. a CORGI-registered gas installer) in accordance with the appliance manufacturer's recommendations.

*COMMENTARY ON **5.7***
The Gas Safety (Installation and Use) Regulations [1] impose a general obligation on landlords providing gas appliances in tenanted premises to have these maintained in a safe condition and checked for safety every 12 months.

Where an independently mounted carbon monoxide (CO) detector to BS 7927 or BS EN 50379-3 is fitted in or recommended for a room containing a gas appliance the installer should advise the user that a detector should not be regarded as a substitute for proper installation and regular servicing by a competent person.

Where any defects that cannot be rectified are identified as part of any maintenance or safety check activity, reference should be made to the requirements of the Gas Industry Unsafe Situations Procedure [15].

6 Individual open-flued natural draught Types B_{11}, B_{12}, B_{13} appliances

6.1 Design

6.1.1 General

*COMMENTARY ON **6.1.1***
Attention is drawn to the Building Regulations [3], [4], [5], [6], supporting documentation [12], [13] and additional guidance (DFP Technical Booklet Part L: 2006 [16] and Scottish Building Regulations Handbook, Domestic, section 3.17–3.21 [17]) that specify a chimney plate which is to be fixed to the building to advise appliance installers of the characteristics of the chimney. Installers should establish that the chimney and any hearth are suitable for the appliance and the chimney plate is intended to assist in this respect.

Any new chimney specified for installing an open-flued gas appliance shall be designed in accordance with BS EN 15287-1 and shall have a classification that is allowed by the appliance manufacturer. Default classifications are given in Annex A. For the UK, the materials to be specified are summarized in **6.1.2** and **6.1.3**. The chimneys shall be routed and sized as specified in **6.1.4** and terminated as specified in **6.1.6** and **6.1.7.**

Any existing chimney shall conform to **6.1.7**. Each flue shall only communicate with the room or space in which the appliance is installed.

Asbestos materials shall not be used for new chimneys (for existing chimneys see **6.1.7**).

6.1.2 Selection of chimneys

*COMMENTARY ON **6.1.2***
Attention is drawn to the Building Regulations [3], [4], [5], [6] and supporting documentation [12], [13] for relining of flues. In the case of new masonry chimneys, it should be noted that poured concrete linings are not acceptable as a method of lining a chimney.

New chimneys shall be either:

a) of brick or other masonry construction and lined with one of the following:
   1) clay flue liners conforming to BS EN 1457; or
   2) concrete flue liners conforming to BS EN 1857.

b) constructed of flue blocks (see Annex D) conforming to:
   1) BS EN 1806 (clay); or
   2) BS EN 1858 (concrete).

c) factory-made insulated metal chimneys conforming to BS EN 1856-1. Single walled metal chimneys shall not be used externally except as specified in **6.1.6**. Where metal chimneys are to be used externally, they shall be double walled insulated metal chimneys as specified in BS EN 1856-1 installed in accordance with the chimney manufacturer's instructions.

NOTE New chimneys can be classified as either:

- *system chimneys; or*
- *custom-built chimneys.*

6.1.3 Connecting flue pipes and flue boxes

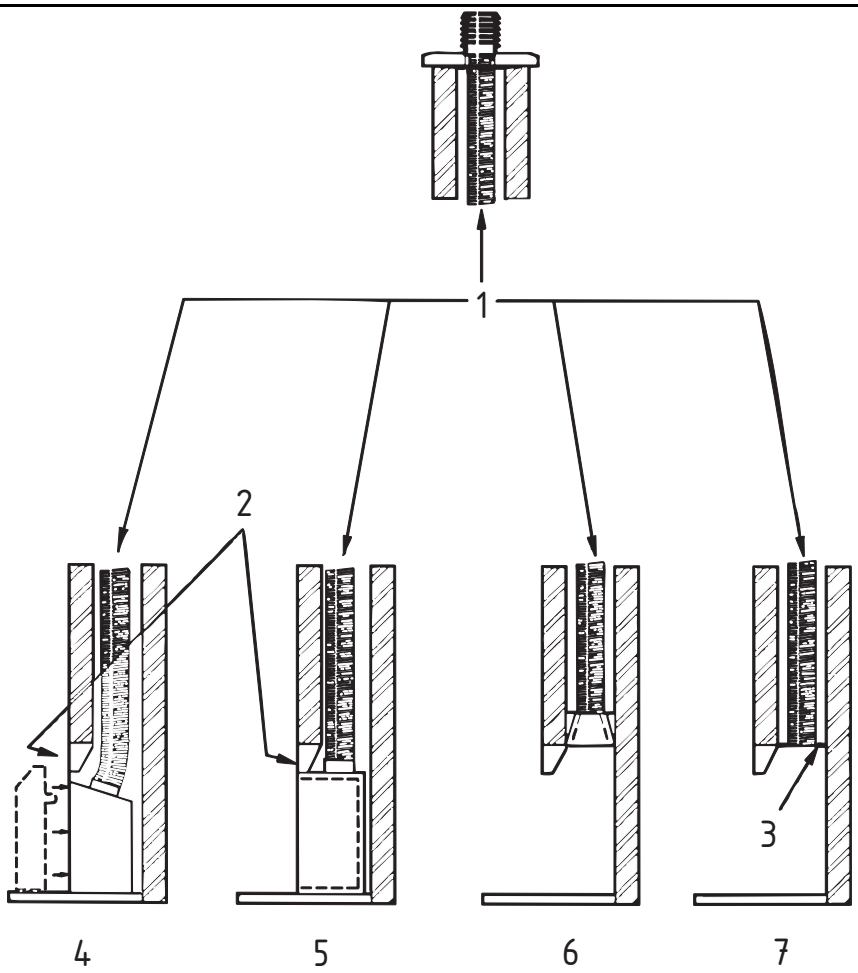
Connecting flue pipes between an appliance and the chimney shall conform to BS EN 1856-2.

Sheet metal flue boxes shall conform to BS 715. A flue box shall only be used to accommodate a fire where it has been identified as being suitable for such use by the appliance manufacturer and/or the flue box manufacturer.

*COMMENTARY ON **6.1.3***
Proprietary prefabricated flue boxes conforming to BS 715 may be used in conjunction with metal chimneys conforming to BS EN 1856-1 or BS EN 1856-2. Technical data and installation instructions will be provided with such boxes.

Methods of installation using a flue box, metal chimney or flexible liner within a masonry chimney are shown in Figure 1, Figure 2, Figure 3 and Figure 7. It should be noted that flue boxes are not suitable for solid fuel appliances, and this should be stated (via a permanent badge/label) on the flue box.

Figure 1 **Typical methods of using a flue liner in a masonry chimney installation serving a gas appliance, other than a back boiler**

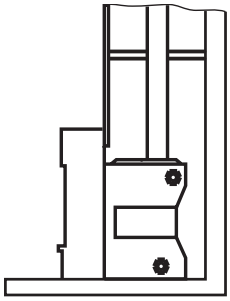


Key

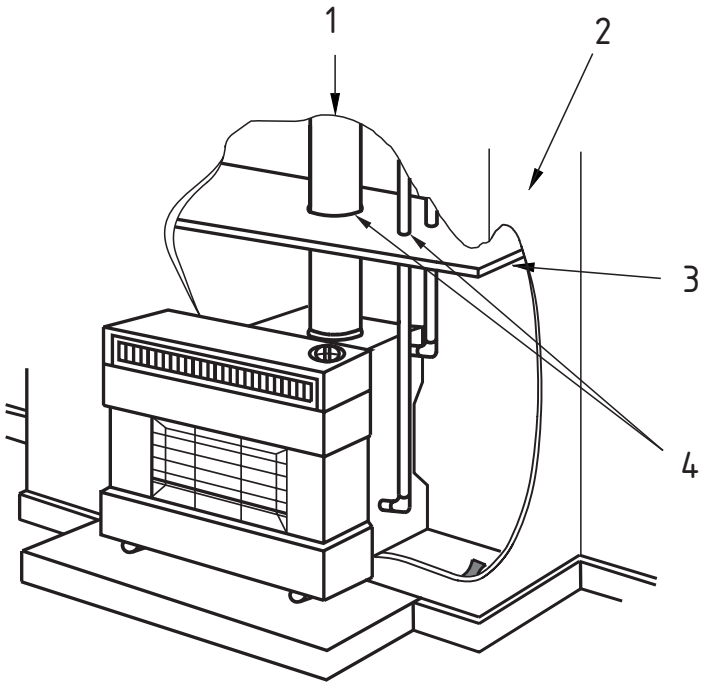
1 Flue liner conforming to BS EN 1856-2
2 Joints to be well made where the closure plate or the flue box is sealed to the face of the opening or fire surround
3 Debris or register plate
4 Flue liner connected to a proprietary flue gas collector. For use with an appliance with a closure plate
5 Flue liner conforming to BS EN 1856-2 connected to a gas flue box conforming to BS 715
6 Flue liner secured and sealed into a proprietary gather above the builder's opening
7 Flue liner mechanically secured and sealed with a clamp to a debris or register plate above a builder's opening
NOTE The liner should not project below the plate more than a nominal 25 mm

NOTE 1 If the gas supply to the appliance is to be made through the wall of the gas flue box, it should be routed as close as practicable to the bottom of the box and sealed into the box with a non-setting sealant.
NOTE 2 The flexible liner should rise in one continuous length as near vertically as possible from the top of the appliance, gas flue box or fireplace recess and no part of the flue liner should form an angle greater than 45° from the vertical.
NOTE 3 The flexible liner should be installed in accordance with the appliance manufacturer's instructions and be mechanically secured and sealed at the top of the chimney. Care should be taken to ensure that any materials used to seal and close off and seal the liner at the top of the chimney, do not drop down the void around the outside of the liner.
NOTE 4 An approved terminal should be used to protect the end of the flue where its diameter is less than 170 mm.
NOTE 5 In each of the illustrations above, the requirements are the same if a fire surround is applied to the front of the opening.

Figure 2 **Installation of a gas fire and combined back boiler using a back boiler enclosure and prefabricated chimney: enclosure arrangement using a false chimney breast and closure panel**



Cross-section



Key

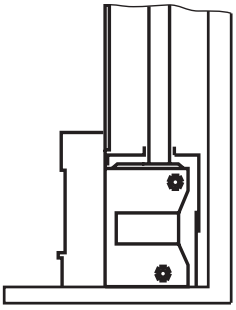
1 Chimney installed according to manufacturer's installation instructions

2 False chimney breast

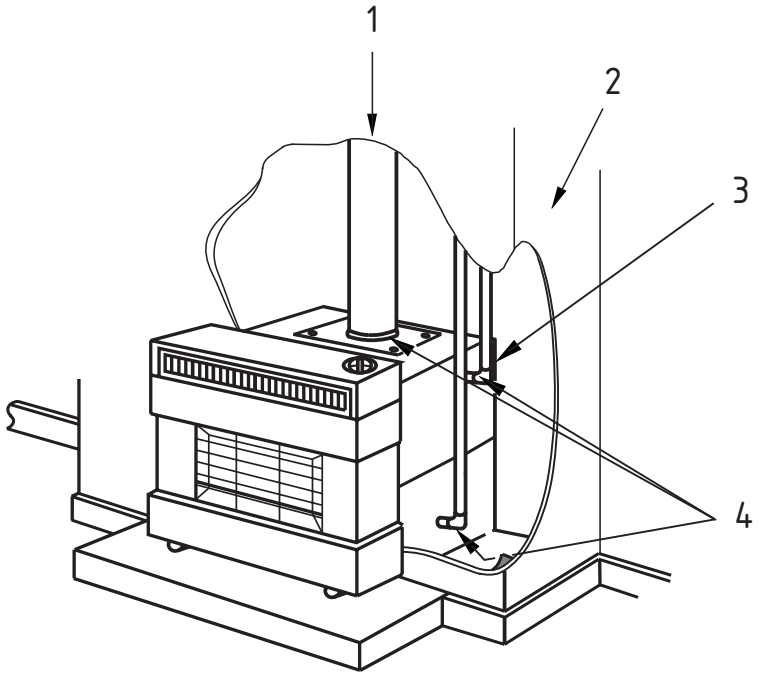
3 Seal off all edges of the closure panel where it meets all four walls of the false chimney breast

4 Seal any holes where the flue system and/or the plumbing connections pass through the closure panel.

Figure 3 **Installation of a gas fire and combined back boiler using a back boiler enclosure and prefabricated chimney: enclosure arrangement using a proprietary back boiler box**



Cross-section



Key

1 Chimney installed according to manufacturer's installation instructions

2 False chimney breast

3 Assemble and seal the box in accordance with the manufacturer's installation instructions

4 Seal any holes made through the enclosure for connecting pipework and flue system

NOTE If the gas supply to the appliance is to be made through the wall of the back boiler box, it should be located as close as practicable to the bottom of the box and be sealed into the box with a non-setting sealant.

6.1.4 Routing and sizing

The chimney shall be routed and sized to ensure full clearance of combustion products. A minimum of 600 mm of vertical chimney directly above the draught diverter shall be provided unless otherwise stated in the appliance manufacturer's instructions.

The chimney shall, where practicable, take a vertical, internal route consistent with structural stability, appearance and possible chimney outlet position. Where vertical sections are not practicable, these shall be as short as possible and form an angle no greater than 45° to the vertical except for a connecting flue pipe which connects the appliance directly to the chimney base (see **6.1.3**).

Where it is necessary for a metal chimney to be run outside the structure of the building, an insulated metal chimney conforming to BS EN 1856-1 shall be used (see **6.1.6**).

The minimum cross-sectional area of flues for appliances other than gas fires shall be not less than the area of the flue spigot.

New chimneys for gas fires shall have a minimum circular cross-sectional area of 12 000 mm^2 unless otherwise stated in appliance manufacturer's instructions. For new chimneys constructed with gas flue blocks, the minimum cross-sectional area shall not be less than 16 500 mm^2 with no dimension less than 90 mm.

The following appliances shall not be connected to flue blocks having a cross-sectional area between 12 000 mm^2 and 13 000 mm^2 or having a minor dimension of 63 mm or less:

a) drying cabinets;

b) appliances having a flue duct outlet area greater than 13 000 mm^2;

c) gas fires and combined appliances incorporating a gas fire unless a special starter block/adapter has been designed for the purpose, tested and supplied by the appliance manufacturer or the appliance manufacturer's instructions specifically state that this is acceptable.

NOTE Some appliance manufacturers' instructions state that they are not suitable for connection to flue blocks of certain sizes, e.g. constructed to BS 1289:1975 which allowed flue blocks with a minimum dimension on 63 mm, whereas BS 1289-1:1986 had increased this minimum dimension to 90 mm.

*COMMENTARY ON **6.1.4***

An essentially vertical route from the draught diverter, if fitted, is recommended. Exceptions to this might be permitted in, for example:

a) chimneys, constructed in buildings other than single storey, and/or where calculations using Annex B indicate likely clearance of combustion products and subsequent commissioning tests prove satisfactory; or

b) gas heating stoves where the appliance manufacturer's instructions specify that a section of the flue is horizontal; or

c) modular boilers incorporated into a fully integrated scheme.

NOTE Particular care should be taken with appliances installed on single storey chimneys, due to their short flue length.

To provide protection against problems associated with down-draught on steeply pitched roofs, it is recommended that the route of the chimney leads to an outlet at the highest point of the roof (e.g. at or near to the ridge) rather than on the slope of the roof.

Chimneys constructed of flue blocks may be designed either:

1) for bonding into and forming an integral part of the building structure (in which case they are mainly in new premises); or

2) for adding-on to either a new or existing building.

It should be noted that rectangular gas flue blocks are generally more resistive to flow than are circular metal chimneys of the same cross-sectional area. Not all appliances are suitable for connection to gas flue blocks. The appliance manufacturer's instructions should be consulted in this regard.

Changes in appliance design mean that a chimney that has performed adequately with an existing appliance cannot be assumed to be satisfactory for a replacement appliance of the same type.

Annex B describes a method of assessing whether a chimney is likely to give a satisfactory performance and is based on the concept of the equivalent vertical height of the flue. Annex B also refers to effective height since this is the term used in the installation instruction for some gas fires. Gas fire/back boiler units require a minimum vertical height of 3 m and this is the minimum effective height to be used in calculations.

Long external flue runs should be avoided, particularly from appliances fitted in cellars and basements. Whenever possible, chimneys should be routed inside the premises to ensure that the internal length exceeds the exposed external length.

6.1.5 Chimney outlets

6.1.5.1 General positioning

For all new installations and whenever an existing appliance is replaced, the chimney outlet location shall be in accordance with **C.1**, except in those circumstances specified in **6.1.5.2.**

*COMMENTARY ON **6.1.5.1***
Where there is evidence that a chimney is used by nesting birds, squirrels or other wild life or there is such a known problem in the neighbourhood, a suitable guard or terminal should be fitted to the chimney to prevent entry. This is particularly important in areas where birds such as jackdaws are known to roost. Before fitting a terminal or guard the chimney should be inspected, and where necessary reinforced, to ensure that it can support such a terminal or guard. After fitting a terminal guard, the appliance should be checked for spillage to ensure that the products of combustion are being cleared.

6.1.5.2 Adjacent structures

*COMMENTARY ON **6.1.5.2***
Where the horizontal distance between the chimney and a structure on a flat roof exceeds 1.5 m and is greater than ten times the height of that structure above the point where the chimney passes through the roof, then that structure can be discounted as having any effect on the performance of that chimney (see Figure C.4).

Where there are adjacent vertical structures which might affect the performance of a chimney above a flat roof, the height of the chimney outlet shall not be less than 600 mm measured above a line joining the neighbouring high points where it crosses the central axis of the flue (see Figure C.5). If more than two separate structures are sited on the roof the condition resulting in the highest chimney outlet shall be employed.

The base of any chimney outlet serving an open-flued appliance shall be at least 600 mm vertically above a line passing through the highest part of an adjacent higher structure and the edge of a lower structure where the lower structure is 10 m or less from the higher structure. It shall not be within 2.3 m measured horizontally from the highest part of the structure (i.e. within the envelope shown in Figure C.5).

6.1.6 Condensation

Unless the chimney has been designed for wet applications, i.e. to resist condensation, the following steps shall be taken to maintain the flue gases at their maximum temperature to avoid problems of excessive condensation, forming in the chimney.

a) Gas appliances shall not be installed on single wall chimneys which are routed externally, except for the protrusion above a roof line, since this increases the likelihood of condensation occurring, particularly on cold start up of the appliance.

b) Gas appliances shall not be installed on metal twin walled chimneys which have only an air gap for insulation and have external lengths in excess of 3 m.

c) Where prolonged condensation cannot be avoided, only flue liner and jointing materials classified as suitable for wet applications (contains W in the designation string) shall be used, and provision shall be made for the collection and disposal of the condensate from the chimney.

COMMENTARY ON ***6.1.6***
With the increasing efficiency of gas-fired appliances, flue gas temperatures are likely to be lower and chimneys more vulnerable to condensation. Steps should be taken to ensure that new chimneys are routed internally in the building. Where this cannot be achieved, insulated chimneys with a minimum resistivity of R 22 (i.e. 0.22 $m^2 \cdot K/W$) of insulation should be used externally, where condensation is to be expected for high efficiency appliances.

Heavy condensation in a poured in situ concrete lined chimneys previously used with another fuel, might cause the liner to spall. If condensation is predicted in such a liner, an additional flexible flue liner should be installed of a size suitable for the intended purpose. Also see ***6.1.2****.*

Means of avoiding condensation include:

a) in the case of a brick chimney, lining the chimney with a flexible chimney liner conforming to BS EN 1856-2 approved for wet applications (W), see ***6.1.6****c);*

b) using a chimney having a lower heat loss such as a double wall metal chimney conforming to BS EN 1856-1.

Where condensation cannot be avoided then a chimney should be chosen that can incorporate sealed joints, to prevent condensation leaking out through the joints. In such cases provision should be made for the collection and disposal of condensate from the lowest section of the base of the vertical section of the chimney in accordance with the chimney manufacturer's instructions.

Specific requirements for condensing appliances are specified in ***6.1.6****.*

Table 1 and Figure 4a) and Figure 4b) give the maximum flue lengths for which problems with condensation during normal winter conditions are unlikely. Table 1 is for gas fires of net efficiency not greater than 77%, and Figure 4a) and Figure 4b) are for other types of appliance of net efficiency not greater than 88%.

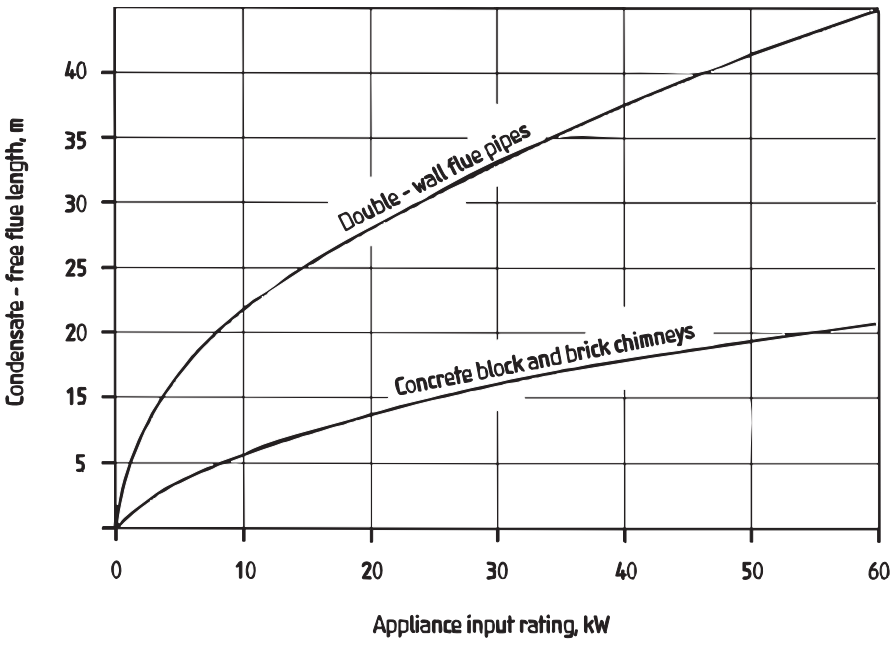
Table 1 **Condensate-free lengths of individual open flue used with a gas fire**

Flue exposure	**Condensate-free length**		
	225 mm × 225 mm brick chimney: pre-cast concrete block flue of area 13 000 mm² and aspect ratio of up to 4:1 or area 20 000 mm² and aspect ratio[B] of up to 5:1	**125 mm diameter metal chimney**	
		Single wall mm	**Double wall** mm
Internal[A]	12	20	33
External	10	Not allowed	28

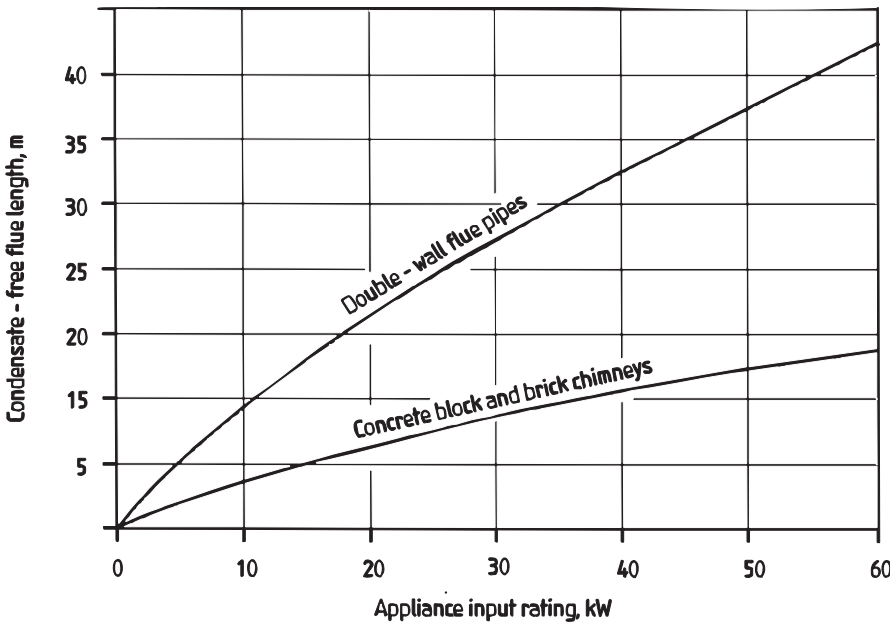
[A] An internal chimney is one of which the only surfaces exposed to external temperatures are those of that length of chimney above the roof, and that length should not exceed 1.5 m unsupported or one quarter of the flue height, whichever is the shorter.

[B] Aspect ratio means ratio of width to depth measured in a horizontal plane.

Figure 4 **Maximum lengths for condensate-free chimneys for appliances other than gas fires**



a) Internal flues



b) External flues

6.1.7 Existing chimneys

6.1.7.1 Suitability and adoption

Any existing chimney which is to be used shall conform to the requirements of **6.1** or the equivalent requirements of these clauses in earlier British Standards, for example BS 5440-1:2000[3)], and be fit for the purpose intended and be of sound construction. Where such a chimney is known to have given unsatisfactory performance with a previous appliance or fuel, it shall be examined and any faults rectified and, if necessary, in the case of a masonry or unlined brick chimney, the chimney shall be lined.

Where it is suspected that an existing chimney or chimney component (e.g. connecting flue pipe) contains asbestos, a risk assessment shall be conducted prior to carrying out any work.

An existing asbestos chimney or chimney component shall only be re-used if it is sound and does not require cutting or machining.

NOTE Attention is drawn to the Asbestos (Prohibition) Regulations [18].

*COMMENTARY ON **6.1.7.1***
In seeking to ascertain whether an existing chimney conforms to this British Standard it is advisable to check the following.

a) The route of the chimney, in order to establish whether there are any changes of direction which might adversely affect the performance of the chimney or result in blockage.

b) The existence of other connections.

*c) The terminal should be examined and replaced as necessary (see **6.1.5**). It is particularly important to ensure that the chimney has not been closed over or otherwise modified.*

d) The condition of the chimney to ensure that it is sound. If unlined, the inner surface is not showing signs of deterioration such as loose mortar or parging.

e) Faults to be considered for rectification should include chimney flaunching, damp-proof course at roof level, brick pointing and terminal integrity.

Where a gas fire is connected to an unlined brick chimney having a flue size greater than 170 mm it is generally unnecessary for the chimney terminal (pot) to be replaced, or for a terminal to be fitted. Bird guards should be fitted where necessary.

*If the chimney terminal (pot) is removed and it is intended to slab over the chimney and continue to use the chimney, by providing side outlets, then an area of at least 12 000 mm^2 per flue on each of the opposite sides should be provided in accordance with the dimensional requirements for non-proprietary terminals in **6.1.5**.*

The outlets should be suitably protected to prevent bird entry.

*Suitable checks for existing chimneys are specified in **6.3.2**.*

If an existing chimney is to be used, whether internal or external to the building, its fixings and stability should be checked, joints inspected and made good where necessary.

3) Withdrawn on publication of BS 5440-1:2008.

A pre-cast flue block chimney designed for use with gas appliances may continue to be used when a fire or fire back boiler combination is to be replaced, but only if the replacement appliance manufacturer's installation instructions specifically state that the new appliance(s) is (are) suitable for such flue block chimneys and the flue size they provide which should be free of any protrusions of jointing material or mortar. It is essential, that care is taken to ascertain that no spillage occurs from any new appliance since it is possible that a previous appliance showed no signs of spillage since it was more tolerant in respect of chimney requirements than the replacement.

Any connecting flue pipe which connects the appliance directly to the chimney base, e.g. into the gather from a larger fireplace recess [see Figure 5b)], should be protected from debris by projecting it above the inside base of the chimney by not less than 250 mm and by fitting it with a deflector not less than one pipe diameter above the top of the connecting flue pipe, or a 90° bend. There should be a clearance of not less than 75 mm between the deflector or outlet of the bend and the wall of the gather. Where the appliance is connected into a gas flue block chimney, this should be by a suitable starter unit (see Figure D.1).

6.1.7.2 Obstructions, connections, sweeping and sealing

Any register plates, restrictor plates or dampers shall be removed or permanently secured in the open position to leave the main part of the flue unobstructed.

Under-grate air ducts shall be closed and permanently sealed.

The appliance shall be connected directly into the chimney and not via any existing fuel burning appliance.

The chimney shall be swept unless the previous appliance was a gas appliance.

Only one gas appliance shall be connected to a chimney unless the chimney is specifically designed to be shared (see Clause **8**) Any other openings, e.g. vents and soot box doors, shall be permanently sealed with materials no less substantial than those of which the chimney is constructed.

Where the appliance is not fitted at the bottom of the chimney, that portion of the chimney below the appliance shall be sealed at a position not less than 250 mm and not more than 1 m below the point of connection and means shall be provided which enable debris to be removed (see Figure 5).

*COMMENTARY ON **6.1.7.2***
When fitting any new appliance to an existing chimney, consideration should be given to sweeping the chimney.

The following factors determine whether to sweep the chimney.

a) If the immediately previous use of the chimney has been for a solid fuel appliance, the chimney might have accumulated soot deposits which could be corrosive to any proposed metal liner, or be causing some blockage, and the chimney should be swept. Where a gas appliance has been used previously, this is less likely.

b) All existing chimneys, irrespective of the fuel used, might have been constructed without a properly clear flue or, especially if they have been out of service for a long period of time, might have become obstructed by wildlife, bird's nests, spider's webs, etc., Sweeping is one way of ensuring an unobstructed flue. It might not reveal any holes, lack of integrity or discontinuities in the chimney.

The effects of other chimneys in the same room (including through lounges) should be considered. Where there is more than one gas appliance the heat output of both appliances should be similar and their chimneys should terminate at the same height, preferably close together so that they are subjected to the same wind conditions.

6.1.7.3 Fitting an appliance to an unlined chimney

Where an appliance is fitted to an unlined brick chimney the methods of connection to the chimney shall minimize the entry of debris into the appliance flue spigot or connecting flue pipe (see Figure 5).

Where a gas fire is to be fitted into a fireplace recess and the chimney is not lined, the space shall be readily accessible for clearance of debris, for example by removal of the gas fire and closure plate.

Where an appliance is connected to an existing chimney and the chimney is not lined, a void below the point of connection, or, in the case of a gas fire, below the appliance spigot, shall be provided as specified in Table 2.

Provision shall be made for the inspection and removal of debris from the void, e.g. by providing an access plate or by removal of the appliance.

6.1.7.4 Lining

Unlined brick chimneys with a flue length greater than that given in Table 3 for the appropriate appliance shall be lined.

Where an existing chimney or flue is lined with a flexible liner, the liner shall be examined by a competent person (see Clause **4**) for signs of deterioration and replaced where necessary or if there is any doubt about its integrity.

The annular space between the liner and the chimney shall be sealed at the base and at the top of the chimney (see Figure 1). At the base this shall be done in such a way that the sealant cannot fall out. The flue liner shall be supported at the top of the chimney.

For back boilers, where an existing chimney has been lined during construction, e.g. with a clay or concrete lining, a short length of either rigid or flexible flue pipe of size appropriate for the back boiler flue duct outlet shall be used to connect the appliance to the chimney liner. The annular space between the short length of connecting flue pipe and the chimney liner shall be sealed using a suitable jointing material, in such a way that it does not restrict the connecting flue pipe exit and cannot fall out into the back boiler enclosure.

Where gas appliances are to be installed to chimneys using a cast in situ concrete lining system, the system shall be suitable for the intended purpose.

NOTE 1 Some suitable methods are identified in the HETAS document "The official guide to approved solid fuel products and services" [19] which lists cast in situ concrete re-lining systems suitable for solid fuel. HETAS listing requires that a cast in situ re-lining system meets with appropriate clauses of BS EN 1857:2003 at the level T400 N2 D3 G and that the materials are specified, prepared and installed in accordance with an independently approved and monitored Code of Practice. These systems are also suitable for use with gas appliances.

NOTE 2 Attention is drawn to Approved Document J [13] to the Building Regulations [3] which permits the use of cast in situ concrete lining systems to be installed in existing chimneys, providing they are installed by a method which has been independently certified as being suitable for the intended purpose.

COMMENTARY ON ***6.1.7.4***
Where an unlined chimney is to be lined with a flexible flue liner, the condition of the chimney should be checked for soundness and swept if necessary. Where the chimney has been previously used for solid fuel, it should be swept to remove any obstructions or deposits that might be corrosive to the liner.

When replacing an existing appliance connected to a chimney lined with a metallic liner, the existing liner should be replaced unless it is considered that it can continue to operate safely throughout the life span of the new appliance.

Under normal operating conditions, a correctly installed metallic liner conforming to BS 715:1989[4)] or BS 715:1993[4)] or BS EN 1856-2 should operate safely for at least the operational life span of an appliance, normally 10 years to 15 years.

An existing chimney may be lined with a flexible liner in order to render that chimney fit for use, even if the appliance to be fitted does not otherwise require the chimney to be lined.

The support at the top of a liner can be made by means of a sealing plate or other suitable means. A typical way of sealing the annular space between the chimney and the flexible flue liner would be by the use of mineral wool. For larger openings, it might be necessary to use, for example, a register plate to hold the mineral wool in place. The advice given by the liner manufacturer regarding installation should be followed, particularly in relation to the location of the liner where it passes around bends in the chimney.

Further advice is given in BS 5871-1 and BS 5871-2.

Other flue lining systems and methods of application may be used which have been independently certified as suitable for the intended purpose.

Table 2 **Minimum void dimensions required below appliance connections**

Circumstances	**Depth** mm	**Volume** m^3
Any appliance fitted to an unlined brick chimney	250	0.012 (12 litres)
Any appliance fitted to a lined brick chimney (new or unused, or used with gas)	75	0.002 (2 litres)
Any appliance fitted to a lined brick chimney (previously used with solid fuel or oil)	250	0.012 (12 litres)
Any appliance fitted to flue block chimney/metal chimney (new or unused, or previously used with gas)	75	0.002 (2 litres)
Any appliance fitted to flue block chimney/metal chimney (previously used with solid fuel or oil)	250	0.012 (12 litres)

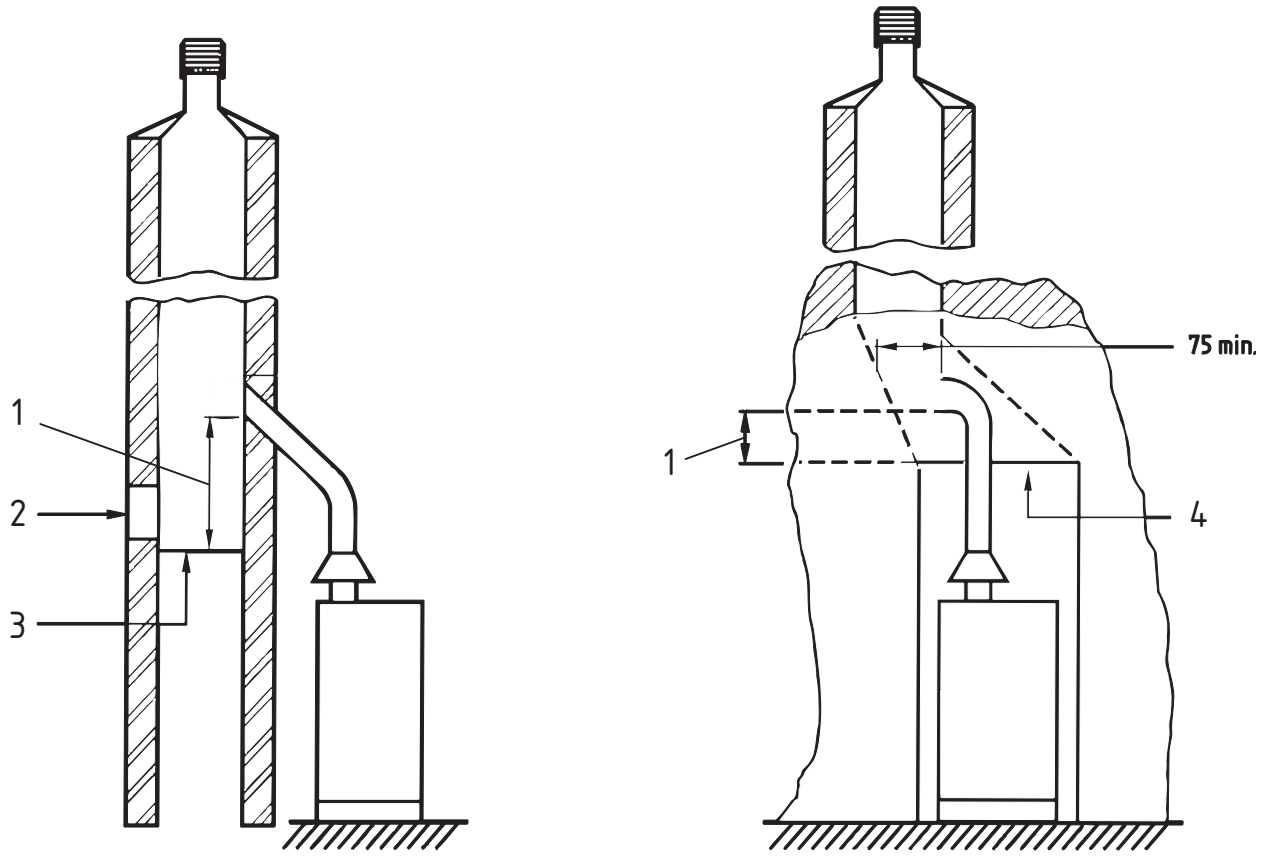
4) This edition of BS 715 is withdrawn.

Table 3 **Appliance/chimney combinations which require the chimney to be lined**

Appliance type	Chimney length
Gas fire	>10 m (external wall)
	>12 m (internal wall)
Gas fire with back boiler unit	Any length
Gas fire with circulator	>10 m (external wall)
	>12 m (internal wall)
Circulator	>6 m (external wall)
	>1.5 m external length and total length >9 m
Other appliance	Chimney lengths greater than those given in Table 1 and Figure 4

Figure 5 **Boiler connections to existing brick chimney**

All dimensions in millimetres



a) Example A

b) Example B

Key

1 Catchment space, height 1 000 mm (max.), 250 mm (min.)
2 Inspection access panel
3 Sealing plate
4 Access panel

6.2 Installation

6.2.1 General

6.2.1.1 An appliance shall only be installed onto a chimney if the appliance manufacturer's instructions are available to the installer.

6.2.1.2 Supporting joists, beams, roof timbers and any other load bearing elements of the building shall not be cut into when constructing chimneys, unless this can be done without affecting the structure of the building or unless appropriate compensating structural measures are taken.

6.2.1.3 An individual chimney shall have no openings into any room other than the one in which the appliance or appliances are situated. All openings into voids created by a false chimney breast or cladding or dry lining around the chimney shall be sealed with a high temperature silicone or equivalent sealant to prevent spillage of products of combustion escaping into other areas (see Figure 2 and Figure 3). There shall be no ventilation openings in the builder's opening, other than those provided by the appliance manufacturer, e.g. closure plate relief opening. Any below or above ground air ducts into the builder's opening shall be sealed.

6.2.1.4 Where a draught diverter is supplied or specified by the manufacturer, it shall be fitted in the same room, space or appliance compartment as the appliance, and in accordance with the appliance manufacturer's instructions.

6.2.1.5 Chimneys installed in a steel or timber framed building shall be in accordance with Institution of Gas Engineers and Managers publication IGE/UP/7.

6.2.2 Support

A metal chimney shall be supported by brackets fitted throughout its length at intervals not exceeding 1.8 m particularly at bends, unless otherwise stated in the chimney manufacturer's instructions. For metal chimney components connected to a ridge terminal, neither the terminal nor the ridge tile adaptor shall be used as a means of support.

Pre-cast flue block systems installed as an add-on feature shall be tied back to the structure as specified by the flue block manufacturer.

6.2.3 Jointing and weatherproofing

6.2.3.1 General

*COMMENTARY ON **6.2.3.1***
The method of jointing between chimney components differs according to the product. Some products, such as a connecting flue pipe or a metal chimney incorporating spigot and socket ends, require the sections to be fitted with the socket uppermost, whereas, for example, flue blocks usually require the socket to be facing down and sealed with jointing material.

Further information on slating and tiling around chimneys is given in BS 5534 and on workmanship in BS 8000-6.

Chimney components shall be jointed, sealed and weatherproofed in accordance with the chimney manufacturer's instructions.

Where a chimney passes through a tiled or slated roof the joint shall be weatherproofed using a purpose-made plate with a minimum upstand 150 mm above the highest point of the junction with the roof.

Where a pipe passes through a roof of asphalt, corrugated asbestos, galvanized sheet iron or other roofing material, it shall be contained in a sleeve which has been securely fitted to the roofing material.

When a chimney is terminated with a ridge terminal, the ridge terminal adaptor shall be fitted, and all securing bolts shall be in place and be tightened.

A weatherproof joint shall be made between the terminal and the chimney.

6.2.3.2 Double-wall metal chimney (previously referred as double-wall flue pipe)

*COMMENTARY ON **6.2.3.2***
As a double-wall metal chimney is assembled, each joint should be fully tightened before proceeding to the next stage.

Pipe sections containing both a male and female joint should not be cut. Adjustable lengths containing an open female end may be trimmed to length at that end, but only in accordance with the chimney manufacturer's instructions. If a clamping mechanism is supplied for use with an adjustable length this should be used.

Some bends are of the adjustable type, but attempting to force adjustment outside the design criteria might cause failure of the liner (inner wall).

Double-wall metal chimneys shall be installed with the internal socket uppermost. Where bayonet joints are employed, the full twist movement shall be taken up, to ensure that the joint is complete.

When connecting a double-wall metal chimney to an appliance or chimney components, or when connecting different makes of metal chimneys, the chimney manufacturer's recommended adaptor shall be used, and the appliance manufacturer's instructions shall be followed.

Metal chimney components or fittings shall not be cut unless specifically permitted in the manufacturer's installation instructions.

Individual sections shall be examined before assembly and sections with damaged joints or internal damage shall not be used.

6.2.3.3 Flue blocks

*COMMENTARY ON **6.2.3.3***
Flue blocks are more resistive to flow than metal chimneys of the same cross-sectional area, and any mortar extrusions at joints increase resistance still further. Internally extruded mortar should be removed and coring should be carried out through the erection to remove all extrusions and droppings.

If any flue blocks become damaged during this process, and become holed, they should be removed and replaced.

Flue blocks used in the construction of a chimney shall not be broken or cracked.

NOTE Minor imperfections and surface damage do not constitute a broken or cracked flue block.

Blocks shall be aligned during construction. Any jointing material extruded into the flue shall be removed during construction. The block manufacturer's recommended method and jointing material shall be used.

An offset block shall be used to effect any necessary change in direction with a maximum offset of 30° (see Figure D.1).

Where a gas fire or fire back boiler unit is to be connected to the chimney, the chimney manufacturer's starter or recess block(s) appropriate for that appliance type shall be fitted at the base of the chimney together with a lintel or cover block.

When connecting a metal chimney component to a flue block chimney, the manufacturer's transfer block shall be used. Any metal chimney component connected to such a block shall not project into the flue such that it restricts the cross-sectional area of the flue. When connecting a gas fire to the base of a flue block chimney there shall be a debris collection space below the spigot of the fire in accordance with Table 2.

6.2.4 Temperature effects

System chimneys shall be installed in accordance with the separation and/or shielding requirements of the chimney manufacturer's instructions.

For custom-built chimneys, the designer shall specify the minimum distance to combustible materials in the classification format (see **A.2**).

A chimney passing through dwellings other than that in which the appliance is installed shall be separated from that dwelling by an enclosure made from non-combustible material.

*COMMENTARY ON **6.2.4***
Attention is drawn to the Building Regulations [3], [4], [5], [6] with respect to the fire resistance of enclosures.

A chimney should be routed so as to avoid the risk of ignition of combustible material.

*The minimum distance to combustible materials specified by the manufacturer in accordance with European product standards for system chimneys (see **A.3**) should be adhered to. Where these distances are not available for either a system chimney or a custom built chimney and where the flue gas temperature is likely to exceed 80 °C, a metal chimney should be at least 25 mm from any combustible material.*

For a single walled metal chimney the 25 mm is measured from the outside surface. For a double walled metal chimney the 25 mm is measured from the outside surface of the inner liner.

Where passing through a combustible wall, floor or roof (other than a fire compartment wall or floor) a suitable method would be to use a non-combustible sleeve enclosing the metal chimney with a 25 mm air space.

Flue block chimneys should not be directly faced with plaster, otherwise unsightly plaster cracking might occur. They should either be faced with concrete blocks (or similar materials), or with plasterboard. Where plasterboard is used as dry lining, any supporting dabs or battens should not be in direct contact with the flue blocks or bridge the gap between the flue blocks and the plasterboard (see Figure D.4).

No fixing devices should penetrate the block.

When a chimney is thus faced it is essential that any gaps created between the flue blocks and facing should be sealed around the fireplace opening.

6.2.5 Protection of metal chimneys

Any metal chimney, whether it is inside or outside the building, shall be located or shielded in such a way as to minimize the risk of damage to the chimney and minimize the danger to persons in or about the building.

*COMMENTARY ON **6.2.5***
*Where a metal chimney is situated within a dwelling, the risk of damage to the chimney or to persons can be minimized by enclosing the chimney within a duct (not necessarily imperforate) and maintaining a gap between inner surfaces of the duct and the chimney. Consideration should be given to the requirements of **6.2.4** when selecting the duct material.*

6.2.6 Terminals

Any terminal shall conform to **6.1.5** and the chimney outlet shall be located as specified in Annex C.

*COMMENTARY ON **6.2.6***
*Any chimney with a flue of 170 mm diameter or less should be fitted with a terminal conforming to **6.1.5**.*

Chimneys with a flue diameter larger than 170 mm (built for solid fuel appliances), and using a chimney pot do not require any other terminal when they serve a gas fire or circulator.

Where there is evidence that a chimney is used for nesting by birds, squirrels or other wild life, or if such a problem is known in the neighbourhood, a suitable guard or terminal should be fitted to the chimney to prevent entry. This is particularly important in areas where birds such as jackdaws are known to roost. Before fitting a terminal or guard the chimney should be inspected, and where necessary reinforced, to ensure that it can support such a terminal or guard. After fitting a terminal guard, the appliance should be checked for spillage to ensure that it is clearing its products of combustion.

6.3 Commissioning

6.3.1 General

The appliance shall only be commissioned if the appliance manufacturer's instructions are available to the installer.

The performance of a chimney and its associated appliance shall be checked in accordance with **6.3.2** to ensure that after initial installation, replacement or reinstallation of the appliance the products of combustion are completely discharged through the chimney to the atmosphere. Correct operation and integrity of the chimney shall be verified by carrying out a flue flow test (smoke test) in accordance with **6.3.2.2**. Furthermore, there shall be no spillage of combustion products into the room when the chimney and chimney and appliance combination is tested in accordance with **6.3.2.3**.

6.3.2 Methods of test

6.3.2.1 Visual check

*COMMENTARY ON **6.3.2.1***
The loft space should be inspected to ensure that any chimney passing through it is complete, continuous and not damaged, that all joints are properly made, and that it is properly supported using suitable brackets, especially non-vertical sections.

Masonry chimneys should, as far as practicable, be inspected to ensure that they are free from debris and soundly constructed. Any debris should be removed.

If a masonry chimney is in poor condition it should be renovated to ensure safe operation. One solution might be to fit a correctly sized liner.

The chimney, whether existing, newly erected, adapted or altered, shall be visually checked before fitting an appliance to ensure that it is fit for the intended use with the intended appliance (see **5.1**), and:

a) is unobstructed, complete, and continuous throughout its length;

b) serves only one room or appliance;

c) has the terminal correctly sited in accordance with **6.1.5** and a weather tight joint between the terminal and the chimney;

d) any dampers or restrictor plates have been removed or permanently fixed in the open position to leave the main part of the flue unobstructed;

e) any catchment space is the correct size, free of any debris and any gaps into the catchment space are sealed from the surrounding structure.

Where an existing chimney has been used, any signs of spillage shall be investigated and faults rectified.

6.3.2.2 Flue flow test (smoke test)

On satisfactory completion of the visual check in accordance with **6.3.2.1** the flue flow shall be checked as follows.

a) Having established that an adequate air supply for combustion has been provided in accordance with the appliance requirements, close all doors and windows in the room in which the appliance is to be installed.

b) Carry out a flow visualization check using a smoke pellet that generates at least 5 m^3 of smoke in 30 s burn time at the intended location for the appliance. Ensure that there is discharge of smoke from the correct terminal only and no leakage into the room. Where the chimney is reluctant to draw and there is smoke spillage, introduce some heat into the chimney for a minimum of ten minutes using a blow torch or other means and repeat the test.

When the chimney is tested in accordance with a) and b) there shall be:

- no significant escape of smoke from the appliance position;
- no seepage of smoke over the length of the chimney; and
- a discharge of smoke from only the correct terminal.

If these conditions are not met, the chimney has failed the test and no gas appliance shall be left connected to the gas supply until the faults have been rectified.

COMMENTARY ON ***6.3.2.2***

A flue flow check should be carried out to ensure the effectiveness of the chimney and that there is no leakage into other rooms and spaces at the premises concerned (including loft space) and, as far as is practicable, other adjoining premises. Refer to Annex D for additional guidance on checking flue block installations either during construction or when investigating problems with the chimney.

For gas fires which are designed to be installed with a closure plate, the flue flow (smoke) test should be carried out with that closure plate in situ.

Smoke coming out of a chimney outlet other than the correct one, or a downdraught or "no flow" condition, indicates that the chimney has failed the test. A thorough examination of the chimney should be undertaken to identify any obvious cause of failure, and the appliance should not be connected until any defect has been found and rectified. If the chimney has been correctly applied and constructed, adequate and safe performance should then be determined with the appliance connected and lit and the test satisfactorily repeated.

A smoke test is very subjective and is only intended to establish that the chimney serving the appliance is of sufficient integrity that it can safely remove the products of combustion when the appliance is alight. Metallic chimney systems might show small signs of leakage from the joints which reflect permitted leakage of the certified chimney product.

Weather conditions, the temperature of the chimney and the combination of materials used to construct the chimney can all influence the smoke test. The pre-heating process might require as much as half an hour before the chimney behaves as intended, as a blow torch does not provide a representative volume of heat into the chimney consistent with normal appliance operation. If the chimney continues to "fail" after a longer "pre-heating" period, and there is no obvious reason, it might be necessary to have the appliance installed in position but not connected to the gas supply, so that the smoke test can be carried out with representative flue flow conditions. Note that whilst the capping of a chimney during a smoke test might be useful by assisting in the detection of a particular leakage point and potential structural fault, it should only be done for that reason. Capping the chimney during the normal smoke test procedure is not required and could lead to a dangerous situation if left in place after the test.

6.3.2.3 Checks with appliance connected (spillage test)

On satisfactory completion of the test in **6.3.2.2** the chimney with the appliance connected shall be checked as follows.

a) New or used appliances shall not be installed unless the appliance manufacturer's instructions are available to the installer. Where the appliance manufacturer's instructions are not available, the appliance manufacturer shall be consulted.

b) In the room:

- close all doors and windows;
- close all adjustable vents;
- switch off any mechanical ventilation supply to the room other than any that provides combustion air to an appliance;
- operate any fan and open any passive stack ventilation.

With the appliance in operation at its set input setting, check that the appliance clears its products of combustion using the method described in the appliance manufacturer's instructions. If spillage is detected switch off the appliance, disconnect, and rectify the fault.

c) Close any passive stack ventilation and repeat the test. If spillage is detected, switch off the appliance, disconnect, and rectify the fault.

d) Where the installation instructions do not contain specific instructions for checking spillage, proceed as follows.

1) In the room:
   - close all doors and windows;
   - close all adjustable vents;
   - switch off any mechanical ventilation supply to the room other than any that provides combustion air to an appliance;
   - operate any fan and open any passive stack ventilation.
2) With the appliance in operation carry out a flow visualization check by applying a smoke producing device, e.g. smoke match, puffer, or joss stick, to the edge of the draught diverter or gas fire canopy within five minutes of lighting the appliance. Apart from an occasional wisp, which may be discounted, all the smoke shall be drawn into the chimney and evacuated to the outside air.
3) Close any passive stack ventilation and repeat the test.
4) If spillage occurs leave the appliance operating for a further ten minutes and re-check. If spillage still occurs switch off, disconnect the appliance and rectify the fault.

e) If there are fans elsewhere in the building the tests shall be repeated with all internal doors open, all windows, external doors and adjustable vents closed and all fans in operation.

*COMMENTARY ON **6.3.2.3***
If spillage is evident in any of these cases (including the situation when no fan is present) the test should be repeated with a window slightly open. If the appliance now clears its products of combustion, then additional ventilation should be provided. Where spillage continues, the appliance should be removed and both the appliance and chimney examined.

Examples of fans which might affect the performance of the chimney by reducing the ambient pressure near to the appliance are as follows:

- *fans in cooker hoods;*
- *wall or window mounted room extract fans;*
- *fans in the chimneys of open-flued appliances including tumble dryers;*
- *circulating fans of warm air heating or air conditioning systems (whether gas fired or not);*
- *ceiling (paddle) fans, these could particularly affect inset live fuel effect fires.*

All fans within the appliance room and adjoining rooms should be operated at the same time. In addition, if a control exists on any such fan, then the fan should be operated at its maximum extract setting when the spillage test is carried out.

For gas fires, instructions on the method of spillage testing are normally given on a badge attached to the appliance and also detailed in the appliance instructions. For further information see BS 5871-1, BS 5871-2, BS 5871-3 or BS 5871-4 as appropriate.

The appliance shall not be left connected to the gas supply unless it has successfully passed these spillage tests. The gas supply to the appliance shall be disconnected, the user/ owner or responsible person shall be informed and a label shall be affixed to the appliance to warn that it shall not be used until the fault is remedied in accordance with the Gas Industry Unsafe Situations Procedure [15].

NOTE It is an offence, under the Gas Safety (Installation and Use) Regulations [1], to use or allow the use of a dangerous appliance.

6.4 Radon gas systems present

Where radon gas extraction systems are installed, the spillage performance of every open-flued appliance in the building shall be tested in accordance with **6.3.2.3** with the radon gas extractive system in operation. The appliance shall not be left connected to the gas supply unless it has successfully passed the spillage test specified in **6.3.2.3**.

*COMMENTARY ON **6.4***
It is essential that if spillage occurs expert advice is sought to ensure that both the performance of the chimney and the radon reduction are satisfactory.

Where extract ventilation below ground floor level is provided to reduce radon gas levels, the spillage performance of open-flued appliances could be affected.

Room-sealed appliances are insensitive to extractive radon gas protective measures.

Further advice is available in BRE publication GBG 25 [20].

6.5 Maintenance

The maintenance operative shall check that the chimney is in a safe condition such that there is no spillage or leakage of combustion products into the room or leakage into any other room through which the chimney passes.

*COMMENTARY ON **6.5***
*Routine maintenance should be carried out on all gas appliances and their chimneys, in accordance with the appliance manufacturer's instructions, to ensure their safe operation. Where appliance manufacturer's instructions are not available the appliance manufacturer should be consulted and the procedure of **6.3.2** followed as far as is practicable.*

*The chimney should be checked to ensure that it conforms to the requirements of **6.1** and that it has been installed in accordance with **6.2**. A visual check, flue flow check and spillage check with the appliance connected should be carried out in accordance with **6.3.2** for the appliance and chimney concerned. The flue flow check can be carried out without moving the appliance. An electronic portable combustion gas analyser (see BS 7967-4) may be used to indicate that the combustion of the appliance is satisfactory, but this is only a supplementary aid to comprehensive servicing and it is essential that other checks are carried out.*

7 Individual open-flued fanned draught Types B_{14}, B_{22}, B_{23} appliances and fanned draught chimneys

NOTE This clause is intended to apply to Type B_{14}, B_{22}, B_{23} appliances fitted with a fan supplied with, or specified by, the appliance manufacturer. Additional information is included for applications where the fan is an independent unit selected by the installer and installed in the secondary flue.

7.1 Design

7.1.1 General – fanned draught chimneys

The chimney shall be constructed from the materials specified in **6.1.2** and with positive pressure classification where the fan is in the appliance or negative classification where the fan is located at the chimney outlet. It shall be routed as specified in **7.1.4**, and the chimney shall be terminated as specified in **7.1.2.**

*COMMENTARY ON **7.1.1***
The requirements of this clause relate to chimneys for individual open-flued appliances where a fan forms an integral part of the appliance as purchased or after a fan has been fitted which has been supplied or specified by the appliance manufacturer (Types B_{14}, B_{22} and B_{23}) and the whole appliance is CE marked. Where the fan is not factory fitted, it should be connected to the appliance in accordance with the appliance manufacturer's instructions. Modifications should not be made to the appliance without the agreement of the appliance manufacturer.

Attention is drawn to the Gas Safety (Installation and Use) Regulations [1] concerning all fanned flued appliances and the requirements to incorporate a device to shut down the appliance in the event of failure of draught.

This type of appliance and chimney combination is usually employed to take advantage of the greater flexibility in siting the appliance and chimney outlet, and possibly a smaller chimney.

7.1.2 Terminals

Terminals shall be installed in accordance with Annex C (open flues, fanned draught).

Any opening in the terminal shall be such that it can admit a 6 mm diameter ball but not a 16 mm diameter ball.

*COMMENTARY ON **7.1.2***
Individual fanned draught chimneys do not require a terminal of the types specified for natural draught open flue chimneys, although a terminal might be convenient, for example to exclude rain. The terminal should be sited so that combustion products from it do not cause damage to adjacent building features.

When locating fanned draught open-flued appliances, the position of the terminal should be such as to minimize the risk of re-entry of combustion products through openable windows, vents, etc., of opposite or adjacent properties. A plume of products of combustion might be observed, especially in cold weather or if a condensing appliance is involved.

7.1.3 Extra requirements for fans installed on site in the chimney

NOTE This subclause applies to fans fitted to chimneys typically serving Type B_{11}, B_{12} and B_{13} appliances.

7.1.3.1 Fan and chimney

The fan shall be chosen and the chimney shall be routed and sized to ensure full clearance of combustion products against adverse wind pressures as in **7.1.4**.

NOTE Attention is drawn to Regulation 27(4) of the Gas Safety (Installation and Use) Regulations [1].

*COMMENTARY ON **7.1.3.1***
*Flue flow assistance can be provided by a terminal or in-line fan. It should be noted that proprietary fan kits are available which include fail safe features in accordance with **7.1.3.2** and which allow the installer to regulate the fan speed during installation and commissioning so as to ensure satisfactory evacuation of combustion products.*

It should be noted that some appliances make provision for the connection of external fans such that they become interlocked with the appliance's own safety features. Such interlocking should never be attempted unless authorized by the appliance manufacturer.

The design of an individual appliance fanned secondary flue system necessitates calculation of the resistance to flow (including the specified adverse pressure) at the design flow rate and its comparison with the pressure available from the chosen fan. The responsibility for safe installation lies with the installer and the appliance manufacturer, the fan manufacturer and the chimney manufacturer should be consulted as appropriate.

The flow rate necessary to ensure full clearance of combustion products varies significantly between appliances, but other than in exceptional cases the CO_2 concentration and corresponding flow rates as given in Table 4 can provide clearance.

The flue flow rates in Table 4 are at 15 °C and 1 013 mbar and appropriate correction has to be made to allow for the actual temperature of the combustion products.

7.1.3.2 Safety control

Where the fan is fitted in the secondary flue, the chimney shall incorporate a safety control in the secondary flue external to the appliance so that the gas supply to the main burner cuts off if the flow in the secondary flue becomes insufficient, for more than 6 s, to ensure that all the products of combustion pass through the secondary flue.

The arrangement of the safety control shall be such that the flue flow sensor is proved to be in the "no flow" position before the fan can be set into operation.

The safety control shall be such that after it has operated, manual intervention is required to re-establish the gas supply to the main burner, unless the appliance incorporates a flame supervision device and the correct flue flow is re-established.

The gas valve operated by the safety control shall conform to BS 7461 or BS EN 161 as appropriate.

7.1.4 Choice of fan, chimney route and size

*COMMENTARY ON **7.1.4***
The appliance manufacturer's instructions should be consulted for advice on the flue size and maximum length of flue permitted.

The appliance shall be selected and the chimney shall be routed and sized to ensure full clearance of combustion products against adverse wind pressures as follows:

a) 0.15 mbar if the chimney outlet is located as specified in **6.1.5**;

b) 0.75 mbar except when the chimney outlet is located as specified in **6.1.5**.

7.2 Installation

*COMMENTARY ON **7.2***
The use of a fan can introduce relatively high pressure differences which necessitate additional precautions in the construction of the chimney.

The installation of fanned open flue chimneys shall conform to **6.2.**

*NOTE Particular attention should be paid in ensuring that the joints in the chimney are sound (see **7.3.2**).*

7.3 Commissioning

7.3.1 Fans integral with an appliance

For fans integral with an appliance the commissioning shall be in accordance with the appliance manufacturer's instructions.

7.3.2 Fans installed on site

The commissioning of open flues with a fan installed on site in the secondary flue shall conform to **6.3** and the following:

a) the fan speed shall be set in accordance with the fan manufacturer's commissioning instructions;

b) all safety controls specified by **7.1.3.2** shall be checked for safe operation;

c) the safety control shall be checked to ensure that it shuts off the gas supply to the main burner within 6 s of any spillage occurring from the draught diverter or any other flue break in accordance with the appliance manufacturer's instructions;

d) clearance of combustion products from any other open-flued appliance in the room or adjoining room or space shall be checked with the fan-powered chimney in operation and all external doors and windows closed, and with the interconnecting door open.

The minimum flow rates for fanned flues shall be as given in Table 4.

Table 4 **Minimum flow rates for fanned flues**

Appliance	**Maximum CO_2 concentration** %	**Minimum flue flow rate** m^3/h per kW input [A)]
Gas fire	1	10.7
Fire/back boiler	2	5.4
All other appliances	4	2.6

[A)] These figures refer to natural gas.

NOTE 1 This table may be used to calculate flue velocity although care is required to relate a specific measured velocity to a mean volumetric flue flow rate. The final test for correct operation of a chimney is a spillage test at the appliance.

NOTE 2 In the case of decorative fuel effect gas appliances reference should be made to BS 5871-3.

7.4 Maintenance

The installer of the chimney shall advise the owner or occupier of the premises in writing of the need to test the chimney and open flue, fanned draught appliance in accordance with **6.3.2** and to ensure that as a result of this test there is no leakage of combustion products into the room.

*COMMENTARY ON **7.4**.*
Routine maintenance should be carried out on all gas appliances and their chimneys, in accordance with the appliance manufacturer's instructions, to ensure their safe operation.

*The chimney should be checked to ensure that it conforms to the requirements of **7.1** and that it has been installed in accordance with **7.2**. The safety controls should be checked using the method specified in **7.3**.*

*A visual check, flue flow check and spillage check with the appliance connected should be carried out in accordance with **6.3.2** for the appliance/chimney installation concerned. The flue flow check may be carried out without moving the appliance. An electronic portable combustion gas analyser may be used (see BS 7967-4) to indicate that the combustion of the appliance is satisfactory, but this is only a supplementary aid to comprehensive servicing and it is essential that other checks are carried out.*

8 Shared open flue chimney for natural draught Types B_{11}, B_{12}, B_{13} appliances

8.1 Design

8.1.1 General

Where two or more appliances are connected into the same flue, the following shall apply:

a) each appliance shall be of the natural draught type and fitted with a draught diverter;

b) each appliance shall be fitted with a flame supervision device;

c) each appliance shall incorporate a safety control which is designed to shut down the appliance before there is a build up of a dangerous quantity of the products of combustion in the room concerned;

d) the flue shall be sized so as to ensure complete evacuation of the combustion products from the whole installation;

e) the chimney shall be installed so that there is access for inspection and maintenance;

f) appliances shall be in the same room or space, or on different floors as described in **8.1.3**.

Unless otherwise specified in this clause, the requirements for a shared flue shall be the same as those for an individual flue (see Clause **6**).

8.1.2 Appliances in the same room using a common flue

*COMMENTARY ON **8.1.2***
Further advice, regarding sizing, when two appliances use one flue in the same room, can be obtained from the Institution of Gas Engineers and Managers publication IGE/UP/10 [21].

Where two or more appliances are to be installed in the same room or enclosed space and connected to the same flue, advice should be sought from the appliance manufacturer(s).

Where the discharge from the appliance could create a positive pressure, the design and operation of the system shall be such that the buoyancy within the common flue prevents the discharge of combustion products through appliances which are not in operation at the time.

Gas fired appliances shall not share a flue with a solid fuel fired appliance. The flue shall be sized to ensure that the appliance operates correctly under all operational conditions.

8.1.3 Appliances installed on different floors of a building

*COMMENTARY ON **8.1.3***
In each room or internal space containing an appliance connected to the shared flue, the number of permanent ventilation openings should be the same and have a similar aspect. The main chimney should be without offsets and should not be inclined at an angle of more than 10° from the vertical. Specialized flue blocks are available to simplify the design and construction of chimneys with shared flues. Examples are given in Figure 6.

A typical label that should be attached to an appliance would state for example "This appliance is fitted to a chimney with a shared flue and should not be removed or replaced without reference to the person responsible for the building, phone or contact details are ..... Further advice is given in BS 5440-1:2008."

Where appliances are installed on different floors of a building the following requirements shall be met.

a) The main chimney shall not be part of an external wall or a metal chimney encased in a duct comprising part of an external wall or situated externally.

b) The nominal cross-sectional area of the main flue serving two or more appliances installed in different storeys of a building shall be not less than 40 000 mm^2, and shall be sized in accordance with Table 5.

c) Each appliance shall discharge into the main flue by way of a subsidiary flue or connecting flue pipe not less than 1.2 m above the outlet of the appliance which it serves (see Figure 6). In the case of a gas fire, the subsidiary for a connection shall be a minimum of 3 m above the outlet of the appliance which it serves.

d) For newly built chimneys, all appliances shall be of the same type, being any one of the types specified in Table 5, and the number and total input rating of such appliances shall not exceed those specified in Table 5 according to the type of appliance and the cross-sectional area of the main flue.

e) When connecting new appliances to existing chimneys, replacement appliances shall be of the same type and not greater in input to the original appliances and suitable for the size of the flue. Reference shall be made to the person responsible for the building.

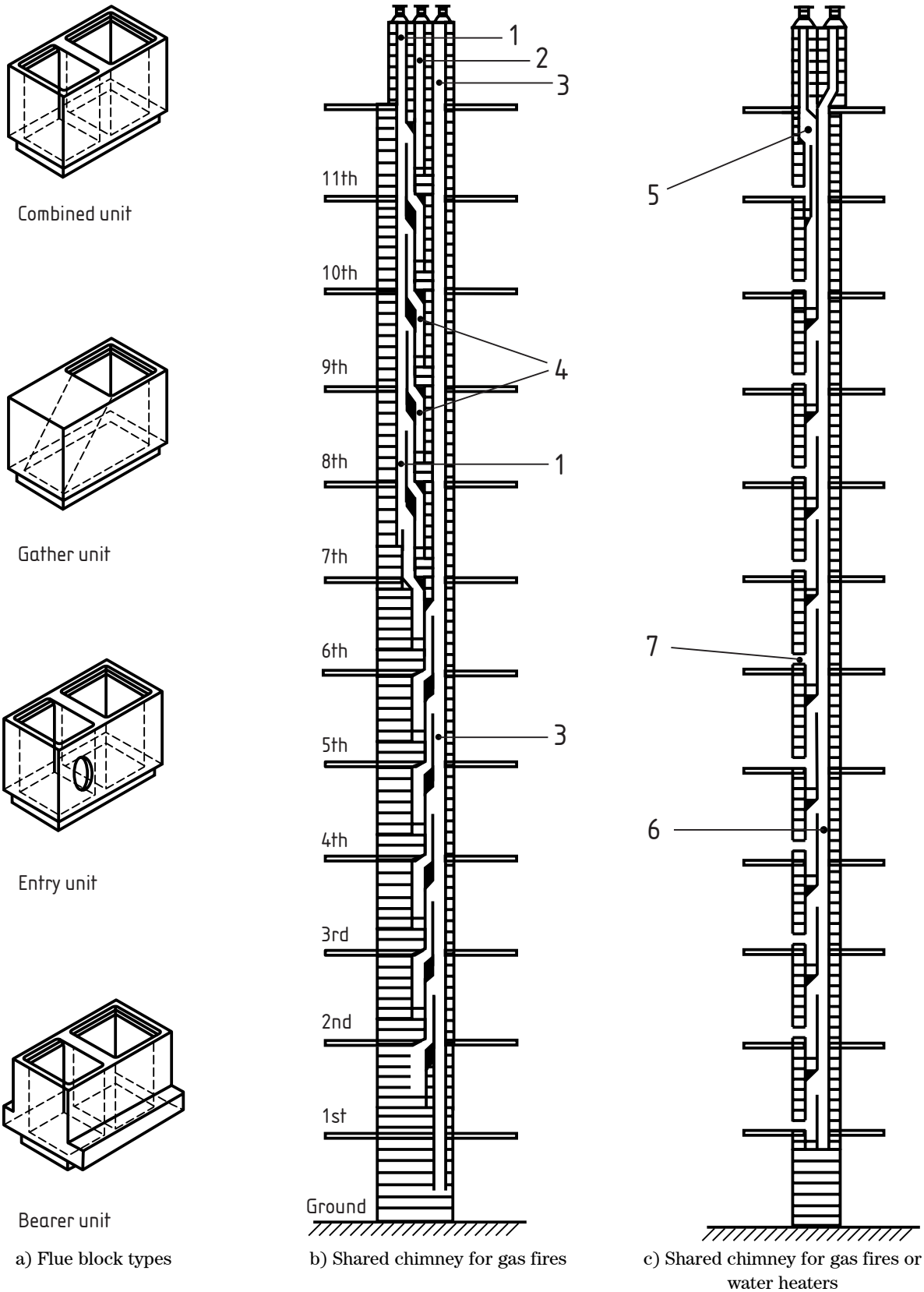
f) Fanned flued appliances of Types B_{14}, B_{22} and B_{23} shall not be used.

g) All appliances connected to the flue shall be labelled as such to indicate that the flue is shared.

Table 5 **Appliances discharging by way of subsidiary flue into a main flue**

Type of appliance	**Nominal cross-sectional area of main flue**			
	Greater than 40 000 mm² but less than 62 000 mm²		**62 000 mm² or more**	
	Maximum number of appliances	**Total input rating** kW	**Maximum number of appliances**	**Total input rating** kW
Gas fire	5	30	7	45
Instantaneous water heater	10	300	10	450
Storage water heater, central heating unit or air heater	10	120	10	180

Figure 6 **Flue block types and shared chimney**



a) Flue block types

b) Shared chimney for gas fires

c) Shared chimney for gas fires or water heaters

Key

1 Main flue (serving 6th to 10th floors)
2 Single flue (serving 11th floor)
3 Main flue (serving ground to 5th floors)
4 Subsidiary flues
5 Shared flue (serving 10th and 11th floors)
6 Main flue (serving ground to 9th floors)
7 Opening to subsidiary flue

8.1.4 Terminal design and location

The terminal design shall be in accordance with **6.1.5**.

The outlet of a main chimney serving two or more gas appliances installed in different storeys of a building, and into which each appliance discharges by way of a subsidiary flue shall be situated so that the outlet is not less than 6 m above any appliance served by the chimney.

Where the chimney passes through a pitched roof, the base of the outlet shall be above the level of the ridge of the roof.

Where the chimney passes through a flat roof the location shall be in accordance with **6.1.5**.

8.2 Installation

The gas installer shall verify from the person responsible for the building that the chimney serving a natural draught appliance conforms to the requirements of **8.1**.

The installation shall be in accordance with **6.2**.

On completion of the installation, the gas installer shall advise the person responsible for the building in writing of the need for regular maintenance of the whole chimney.

8.3 Maintenance

The gas installer shall check a shared open-flued chimney serving natural draught appliances to ensure that it conforms to the requirements of **8.1** and **6.2** and that the appliances connected to it can be used safely.

*COMMENTARY ON **8.3***
Attention is drawn to the Gas Safety (Installations and Use) Regulations [1] and Health and Safety at Work legislation [11] which require a landlord, or person responsible for the building, of a "relevant" premise to carry out annual checks on the chimney, including parts which are shared.

*Since inadequate installation or the operation of any one appliance connected to a shared flue might affect the safe operation of others, it is important that routine inspections are carried out on all appliances. As far as is reasonably practicable, the design and installation features including the roof terminal should be checked for structural integrity and compliance with **8.1** and **6.2**.*

9 Room-sealed natural draught chimney configurations (balanced flue) for Type C_{11} appliances

9.1 General

Only an appliance specifically designed for a room-sealed chimney configuration (includes appliances previously called balanced flue) applications shall be used for that purpose and it shall be installed in accordance with the appliance manufacturer's instructions.

NOTE Detailed arrangements for gas appliances in timber framed and light steel framed dwellings on chimney outlets, weather sealing, temperature effects, etc., are to be found in the Institution of Gas Engineers publication IGE/UP/7.

*COMMENTARY ON **9.1***
In the UK, the flue duct and air supply duct usually form an integral part of a natural draught room-sealed appliance which has usually been loosely referred to as a "balanced flue appliance". In modern European chimney parlance incorporates a "balanced flue chimney configuration". The appliance is intended to be located on, or adjacent to an outside wall of a building. For the UK market, all components of the flue duct and air supply configuration are usually supplied by the appliance manufacturer as a combined fitting (terminal). The flue duct outlet is adjacent to the air inlet, an arrangement that minimizes wind effects on the appliance performance.

9.2 Installation

9.2.1 Terminal

The terminal shall be positioned so that combustion products can safely disperse at all times.

Terminals shall be installed in accordance with the appliance manufacturer's instructions, when supplied. In the absence of any specific instructions from the appliance manufacturer for siting terminals the terminal position shall be in accordance with **C.2** (balanced flues: natural draught).

Terminals shall not be sited in covered passageways between buildings.

Where persons could come into contact with the terminal or if it could be subject to damage a protective guard shall be used. The guard shall be fitted such that no part of the guard is less than 50 mm from any part of the terminal (not including any wall plate). The guard shall not have any sharp edges nor shall any opening permit the entry of a ball of 16 mm diameter when applied with a force of 5 N.

*COMMENTARY ON **9.2.1***
The terminal should be positioned so that the combustion products do not cause a nuisance, for example, not onto a passageway, pathway or over adjoining property.

In the absence of any specific instruction from the manufacturer, a suitable guard should be provided whenever a terminal is fitted less than 2.1 m above ground, above a balcony or above a flat roof to which people have access. Such a guard has two purposes: to protect the terminal against damage or interference and to protect passers-by.

When a terminal is to be sited in a car port or building extension, the following additional recommendations apply:

a) the car port or other add-on extension should have at least two open and unobstructed sides;

b) the dimension F given in Table C.2, should be taken as the vertical distance between the lowest point of the roof and the top of the terminal;

c) if the roof is of plastics material then the installation should be treated with great care as there is no simple method of protecting the roof.

9.2.2 Jointing and weather sealing

*COMMENTARY ON **9.2.2**.*
When installing room-sealed appliances in properties of timber framed construction, care should be taken to minimize the effect of the installation on the insulation and moisture resistance of the structure, see the Institution of Gas Engineers and Managers publication IGE/UP/7.

Where room-sealed chimney configuration components are required to be joined, the jointing methods and materials specified by the appliance manufacturer shall be used.

Any gaps between the assembly and the structure shall be weather sealed.

Any ingress of moisture shall be prevented from affecting the internal wall face, e.g. by using a drip ring to prevent rain bridging the cavity along the chimney assembly.

9.2.3 Temperature effects

The room-sealed chimney configuration shall be placed or shielded so as to reduce the risk of ignition or damage to any part of the building.

When installing a chimney configuration through a wall of combustible construction, or containing combustible materials, any installation requirements specified by the appliance manufacturer for that type of installation shall be followed.

In the absence of any such instructions, unless the manufacturer states that no additional precautions are required, the following method shall be adopted.

- That section of the chimney configuration contained within the combustible part of the wall shall be contained in a sleeve, itself constructed of non-combustible material. The sleeve shall be sized to ensure a minimum air gap of 25 mm between it and the outermost skin of the assembly. At its entry and exit points in the combustible wall, any gaps between the sleeve and the surrounding material shall be sealed with a mastic compound.
- If the outside surface of the wall is of combustible material, a non-combustible plate shall be used to centre the chimney configuration and to maintain the 25 mm gap. The joint between the plate and the wall surface shall be weatherproofed.

9.3 Installation checks

Before leaving the appliance connected to the gas supply, the installer shall visually examine the appliance and its chimney configuration to ensure that:

a) the seal between the combustion circuit and the room is effective;

NOTE This includes checking that any sight glasses or gaskets are properly fitted and ensuring that the appliance back plate or case has not been distorted such as to make any seal ineffective.

b) the flue duct and air duct are either continuous through the wall or, if of the telescopic variety, that any sealing tape required by the appliance manufacturer's instructions has been fitted;

c) no debris is contained within the assembly;

d) the joint between the terminal and the wall is weatherproof;

e) internal equipment, e.g. thermocouples, wires, are securely held or positioned to ensure that they do not interfere with the sealing of the combustion circuit, and all grommets, etc., are in place.

9.4 Maintenance

*COMMENTARY ON **9.4***
Routine maintenance should be carried out on all gas appliances and their chimney configuration, in accordance with the appliance manufacturer's instructions, to ensure their safe operation.

*The chimney configuration should be checked to ensure that it conforms to the requirements of **9.1** and that it has been installed in accordance with **9.2**. An electronic portable combustion gas analyser may be used to indicate that the combustion of the appliance is satisfactory, but this is only a supplementary aid to comprehensive servicing and it is essential that other checks are carried out. BS 7967-4 provides guidance on using combustion gas analysers.*

The checks of **9.3** shall be carried out wherever practicable in addition to the following:

a) the fastenings or fittings supplied by the manufacturer for securing the combustion circuit seal shall be undamaged;

b) the combustion circuit seal material/gasket shall be in a safe condition for use or it shall be replaced by a seal/gasket specified by the appliance manufacturer;

c) the combustion circuit components, e.g. case, etc., shall show no sign of distortion that affect sealing;

d) the combustion circuit shall not be corroded to such an extent that the soundness of the case is affected.

10 Room-sealed: fanned draught chimney configurations for balanced flue (Type C_{12}, C_{13}, C_{32} and C_{33}) and non-balanced flue (Type C_{52}, C_{53}, C_{62} and C_{63}) appliances

10.1 Design options

10.1.1 10.1.1 General

The appliance and the chimney configuration shall be installed in accordance with the appliance manufacturer's instructions.

NOTE 1 Except for Type C_6 appliances all components of the flue duct and air supply system will be supplied by the appliance manufacturer.

NOTE 2 Detailed arrangements for gas appliances in timber framed and light steel framed dwellings on chimney outlets, weather sealing, temperature effects, etc., are to be found in the Institution of Gas Engineers publication IGE/UP/7.

10.1.2 Room-sealed: balanced flue appliances (Types C_{12}, C_{13}, C_{32}, C_{33})

The air inlet and flue duct shall be in the form of a proprietary configuration (concentric or separate) and supplied with the appliance or meeting the criteria specified by the appliance manufacturer.

*COMMENTARY ON **10.1.2***
*In the UK, terminals are generally supplied with balanced flue Type C_{12}, C_{13}, C_{32}, or C_{33} appliances. If a terminal is not supplied with the appliance, i.e. a Type C_6 appliance, then **10.1.4** should be referred to.*

A fanned draught, balanced flue appliance might incorporate a terminal to the chimney configuration in its design and this is intended to be located on, or adjacent to an outside wall of a building. The chimney outlet for products of combustion is adjacent to the air inlet, an arrangement that minimizes wind effects on the appliance performance.

10.1.3 Room-sealed: non-balanced flue appliances (Types C_{52}, C_{53})

*COMMENTARY ON **10.1.3***
The air inlet and flue terminal can be located on the same or different faces of a building, i.e. in different pressure zones. A fanned draught, room-sealed appliance is normally supplied with separate air ducts and flue ducts which are assembled on site. The appliance manufacturer's instructions provide details of the maximum length of ducts and number of bends, etc., which may be used in the installation.

The air inlet and flue duct shall be in the form of proprietary ducts supplied with the appliance or meeting the criteria specified by the appliance manufacturer.

The air inlet and flue duct shall be assembled and supported in accordance with the appliance manufacturer's instructions.

The air inlet shall be sited to enable free flow of air into the appliance and be separated from any other appliance terminal in accordance with the siting requirements for air supply specified in BS 5440-2:2000+A2:2004, Table 1.

10.1.4 Room-sealed: terminals supplied separately from appliance (Types C_{62}, C_{63})

*COMMENTARY ON **10.1.4***
The installer should establish the compatibility of a terminal system with the appliance. The appliance manufacturer's advice should be sought and followed.

NOTE This option is not generally available in the UK.

For room-sealed appliances with terminals supplied separately from the appliance the installer shall establish the compatibility and correct installation and sealing of the room-sealed chimney configuration terminal.

10.2 Installation

10.2.1 Terminals

The terminal shall be positioned so that combustion products can safely disperse at all times in accordance with Table C.2 and Figure C.8.

Room-sealed chimney configuration terminals shall be installed in accordance with the appliance manufacturer's instructions, when supplied. In the absence of any specific instructions from the appliance manufacturer for siting terminals then the flue terminal position shall be in accordance with Annex C.

Terminals shall not be sited in covered passageways between buildings.

Plume management kits shall only be used when provided or specified by the appliance manufacturer. They shall be installed such that the resulting chimney outlet is in accordance with Table C.2 and Figure C.8.

If the plume management kit separates the flue duct and air inlet duct then the position of the flue duct outlet shall remain in the same pressure zone as the air inlet (e.g. on the same face of a building) and positioned to avoid the possibility of recirculation of products of combustion.

Where any terminal or air inlet is accessible from ground level or if it could be subject to damage, it shall be fitted with a protective guard. In the absence of any specific instruction from the manufacturer, a suitable guard shall be provided whenever a terminal or air inlet is fitted less than 2.0 m above ground, above a balcony or above a flat roof to which people have access. The dimensions of the guard shall be such that, when fitted in accordance with the appliance manufacturer's instructions, no part of the guard shall be less than 50 mm from any part of the terminal or air inlet (not including any wall plate). The guard shall not have any sharp edges likely to cause injury nor shall any opening permit the entry of a ball of 16 mm diameter when applied with a force of 5 N.

COMMENTARY ON ***10.2.1***
The terminal should be positioned so that the combustion products do not cause a nuisance, for example the terminal should not be positioned on a passageway, pathway or over adjoining property.

When locating a fanned flued room-sealed appliance, the position of the terminal should be such as to minimize the risk of re-entry of combustion products through openable windows, vents, etc., of opposite or adjacent properties. A plume of products of combustion might be readily observed, especially in cold weather or if a condensing appliance is involved.

It is recommended for a fanned flue terminal to be positioned as follows:

a) at least 2.0 m from an opening in a building directly opposite; and

b) so that the products of combustion are not directed to discharge across a boundary.

Some appliances are designed to disperse condensate in a spray form within the combustion products discharge. With these types of appliance particular care is necessary when siting the terminal to ensure condensate does not impinge directly onto any structure or object.

When a terminal is to be sited in a car port or building extension the following additional requirements apply:

1) the car port or other add-on extension should have at least two open and unobstructed sides;

2) the dimension F given in Figure C.8 should be taken as the vertical distance between the lowest point of the roof immediately above the terminal and the top of the terminal;

3) if the roof is of plastics material then the installation should be treated with great care as there is no simple method of protecting the roof.

If any of these recommendations cannot be satisfied, then specialist advice should be sought.

10.2.2 Jointing and weatherproofing

*COMMENTARY ON **10.2.2***
When installing room-sealed chimney configurations in properties of timber framed construction, (see the Institution of Gas Engineers and Managers publication IGE/UP/7), care should be taken to minimize the effect of the installation on the insulation and moisture resistance of the structure.

Where flue duct components are required to be joined, the jointing methods and materials specified by the appliance manufacturer shall be used.

The annular space between the flue duct and air supply duct and their respective surrounding structures shall be sealed.

Any ingress of moisture shall be prevented from affecting the internal wall face.

10.2.3 Temperature effects

The flue duct or combined chimney configuration shall be so placed or shielded as to prevent ignition or damage to any part of any building.

When installing a flue duct or combined chimney configuration through a wall of combustible construction, or containing combustible materials, any additional installation requirements specified by the appliance manufacturer for that type of installation shall be followed.

In the absence of any such instructions, unless the manufacturer states that no additional precautions are required, the following methods shall be adopted.

- That section of the flue duct or combined chimney configuration contained within the combustible part of the wall shall be contained in a sleeve, itself constructed of non-combustible material. The sleeve shall be sized to ensure a minimum air gap of 10 mm between it and the outermost skin of the flue assembly. At its entry and exit points in the combustible wall, any gaps between the sleeve and the surrounding material shall be sealed with a mastic compound.
- If the outside surface of the wall is of combustible material, a non-combustible plate shall be used to centre the flue duct or combined chimney configuration and to maintain the 10 mm gap. The joint between the plate and the wall surface shall be weatherproofed.

10.2.4 Enclosed chimneys

*COMMENTARY ON **10.2.4***
Many modern room-sealed fanned draught appliances are designed for long flues which enables builders to site appliances away from external walls and conceal the flue and air supply ducts within voids. Attention is drawn to the Gas Safety (Installations and Use) Regulations [1] concerning the need for inspection throughout the length of the flue duct.

Detailed information is given in CORGI Technical Bulletin 200 [22].

Where chimneys are enclosed, e.g. within ceiling voids, they shall be installed in accordance with appliance manufacturer's instructions and provision made for visual inspection.

10.3 Installation checks

Before leaving the appliance connected to the gas supply, the installer shall visually examine the appliance and the chimney configuration to ensure that:

a) the sealing method used by the appliance manufacturer to provide the room seal between the combustion chamber and the room is intact and in good condition;

NOTE This includes checking that any sight glasses are properly fitted and ensuring that the appliance back plate or case has not been distorted such as to make any seal ineffective.

b) the flue duct or combined chimney configuration are either continuous throughout the wall or, if they are telescopic, then any sealing tape required by the appliance manufacturer's instructions has been fitted;

c) no debris is contained within the room-sealed chimney configuration;

d) the joint between the terminal and the wall is weatherproof;

e) internal equipment, e.g. thermocouples, wires, are securely held or positioned to ensure that they can not interfere with the sealing of the combustion circuit, and all grommets, etc., are in place.

10.4 Maintenance

10.4.1 General

*COMMENTARY ON **10.4.1***
Routine maintenance should be carried out on all gas appliances and their chimney configurations, in accordance with the appliance manufacturer's instructions, to ensure their safe operation.

*The room-sealed chimney configuration should be checked to ensure that it conforms to the requirements of **10.1** and that it has been installed in accordance with **10.2**. An electronic portable combustion gas analyser may be used to indicate that the combustion of the appliance is satisfactory in accordance with BS 7967-4.*

The checks of **10.3** shall be carried out wherever practicable in addition to the following:

a) the fastenings or fittings supplied by the manufacturer for securing the combustion circuit seal shall be undamaged;

b) the combustion circuit seal material/gasket shall either be in a safe condition for use or it shall be replaced by a seal/gasket specified by the appliance manufacturer;

c) the combustion circuit components, e.g. case, shall show no sign of distortion that might affect sealing;

d) the combustion circuit shall not be corroded so as to affect soundness.

10.4.2 Room-sealed fan assisted positive pressure gas appliances

For room-sealed fan assisted positive pressure gas appliances, the following shall be checked:

a) the general integrity of the appliance;

b) that any leakage of combustion products from the case seals is minimal.

*COMMENTARY ON **10.4.2***
A checklist for checking the general integrity and leakage from the case seals is given in Figure E.1. Advice on identifying which appliances are affected can be obtained from CORGI (http://www.trustcorgi.com).

Historically, fanned draught room-sealed boilers were of the positive pressure type. For a positive pressure appliance, it is essential to ensure that the combustion chamber casing is firmly secured to the boiler, as the manufacturer intended, with the correct seal in a good condition.

If this is not achieved, there is a real risk that products of combustion might escape into the room and due to the poor combustion that is likely to occur; high levels of carbon monoxide (CO) could be produced creating a dangerous environment.

Attention is drawn to Regulation 26(9) of the Gas Safety (Installation and Use) Regulations 1998 [1] which requires an examination of the effectiveness of any flue following work on a gas appliance.

The checklist given in Figure E.1 will help ensure that case seals of positive pressure gas appliances conform to the requirements of the Gas Safety (Installation and Use) Regulations [1].

The appliance certification criteria permit a limited amount of case and seal leakage due to manufacturing tolerances. It is therefore likely that some minor leakage might be identified on positive pressure fanned flue boilers, in particular where a thermocouple lead/thermostat capillary or ignition high tension lead, etc., passes through a grommet/gasket, or where there is a metal fold/joint that forms a corner on the boiler case itself. In these instances it is necessary to assess whether the leakage is due to normal manufacturing tolerances or to a defect with the grommet/gasket taking into account any previous customer reports of fumes, signs of staining, condition of the grommet/gasket, etc., before deciding that the leakage identified is due to normal manufacturing tolerances and whether the appliance is safe to leave in operation.

If there is any concern as to whether the level of leakage is significant and providing the point of leakage is not due to a defect in the main boiler case seal, e.g. around a grommet or gasket, it might be possible to effect a permanent repair by supplementing the original grommet/gasket with high temperature silicone sealant. It is essential that perforations in the case material due to corrosion are not temporarily repaired and any defective main boiler case seals requiring replacement should only be replaced with the manufacturer's supplied or authorized component.

11 Balanced compartment

11.1 General

*COMMENTARY ON **11.1***
The balanced compartment is a method of installing an open-flued appliance in a room-sealed situation and arranging the chimney and ventilation so that a balanced flue effect is achieved (see Figure 7).

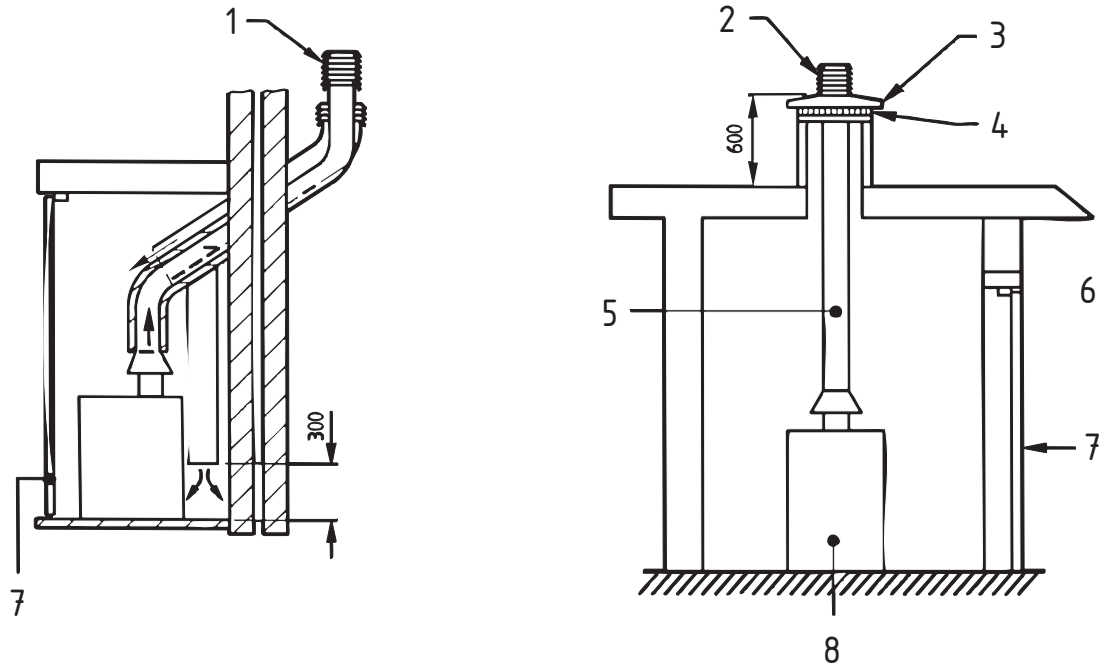
The method is particularly suitable for higher rated appliances. The method can also provide an alternative to long external flue runs or for use when the boiler house is adjacent to a taller building.

Where an appliance is to be installed in a balanced compartment, it shall conform to **11.2**, **11.3**, **11.4**, **11.5**, **11.6** and **11.7** in addition to **6.1.2**, **6.1.3** and **6.2**.

The flue shall be sized in accordance with **6.1.6**.

Figure 7 **Balanced compartment installations**

All dimensions in millimetres



a) Adjacent termination

b) Roof termination

Key

1 *NOTE This chimney outlet location is only suitable for balanced compartment applications*
2 Chimney outlet
3 Weathering to air intakes
4 Air intakes protected by bird wire guards
5 Insulated flues used internally to boiler compartments
6 No other holes or openings into compartment
7 Self-closing door with notice affixed
8 Open-flued appliance

11.2 Design

*COMMENTARY ON **11.2.1***
Chimney and ventilation arrangements can be designed for individual applications, or proprietary systems can be used. The configurations should be installed in accordance with the chimney manufacturer's instructions and the appliance manufacturer's recommendations

11.2.1 The chimney and ventilation arrangements for balanced compartments shall be such as to ensure full clearance of combustion products.

*COMMENTARY ON **11.2.2***
*Where a proprietary system such as that referred to in the recommendations on **11.2.1** is used, the system manufacturer's and appliance manufacturer's instructions should be followed.*

Where the ceiling of the balanced compartment is more than 300 mm higher than the base of the skirt of the appliance draught diverter, a high level opening should be provided in the air supply duct. This opening should be of the same cross-sectional area as that of the duct. The opening in the duct might be provided by a T or Y piece inserted at high level.

11.2.2 The combustion air shall be ducted down from a point adjacent to the chimney terminal.

The position of the air supply duct inlet shall be no more than 150 mm below the base of the chimney outlet.

Where the air is ducted to a low level, i.e. 300 mm or less from the floor [see Figure 7a)] within the balanced compartment, the cross-sectional area of the air supply duct shall be not less than 7.5 cm^2 per kW (net) of the appliance maximum rated input.

NOTE 1 This is calculated from 1.5 times the allowance for the maximum air vent area for a high level, direct to outside air opening specified for open-flued appliances in BS 5440-2.

Where the air is ducted to a high level only [see Figure 7b)] within the balanced compartment, the cross-sectional area of the air supply duct shall be not less than 12.5 cm^2 per kW (net) of the appliance maximum rated input.

NOTE 2 This is calculated from 2.5 times the allowance for the maximum air vent area for a high level, direct to outside air opening specified for open-flued appliances in BS 5440-2.

11.3 Balanced compartment construction

*COMMENTARY ON **11.3***
A room-sealed effect is essential to the safe operation of a balanced compartment. When the appliance is capable of being operated it is essential that the balanced compartment is effectively isolated from its surroundings, except for the flue and ventilation arrangements.

A balanced compartment shall have a self-closing flush door which fits tightly in its frame and incorporates a draught sealing strip. The door shall not open into a room containing a bath or shower or, if the appliance has a rated input greater than 12.7 kW (14 kW gross), into a room intended for sleeping accommodation.

A notice shall be attached to the door or access cover stating that the door shall be kept closed.

There shall be no other ventilation openings into the balanced compartment (see Figure 7).

The door shall be fitted with a switch to act as an electrical isolator which shuts the appliance down when the door is opened.

11.4 Temperature effects

The length of chimney and any exposed hot water carrying pipework or air supply ducts within the balanced compartment shall be insulated to minimize heat transfer to the balanced compartment.

*COMMENTARY ON **11.4***
Double-wall flue pipe conforming to BS EN 1856-1 would meet the insulation requirements for flue pipes. Hot water carrying pipework insulation material should be not less than 19 mm thick with a thermal conductivity (k) of not greater than 0.045 W/mK or of the appropriate thickness and value of k to give no greater loss.

11.5 Terminals

Where a chimney outlet position as specified in **6.1.5** is not possible, information and requirements shall be agreed and documented between the compartment designer, installer and customer.

*COMMENTARY ON **11.5***
*The chimney outlet of a balanced compartment installation is not as critical as an individual open flue installation. However, if positions other than those specified in **6.1.5** are advantageous, appropriate advice should be available from the compartment designer or (in the case of a proprietary chimney) the chimney manufacturer.*

11.6 Commissioning

The chimney and its associated appliance shall be commissioned in accordance with **6.3** or **9.3** as appropriate to the appliance type. Following commissioning, the door interlocking switch shall be reinstated and its operation checked to ensure that it is functioning correctly.

*COMMENTARY ON **11.6***
*In most applications, the balanced compartment is sufficiently large to permit the commissioning engineer to remain in the balanced compartment to undertake the test method specified in **6.3**.*

*Where this is not the case the test may be carried out with the balanced compartment door open. The switch specified in **11.6** needs to be bypassed temporarily in order to undertake this work.*

11.7 Maintenance

The installer of the chimney shall advise the owner or occupier of the premises in writing of the importance of regular maintenance of the balanced compartment and appliance(s).

The maintenance operative shall, in addition to the usual appliance checks, also check the function of the door interlock switch, self closing mechanism and the soundness of the seals of the compartment.

*COMMENTARY ON **11.7***
Routine maintenance should be carried out on all gas appliances and their chimneys, in accordance with the appliance manufacturer's instructions, to ensure their safe operation.

*As far as is practicable, the chimney should be checked to ensure that it conforms to the requirements of **11.2**, **11.3**, **11.4** and **11.5**. A visual check, flow flue check and check with the appliance connected, should be carried out in accordance with **6.3.2** as far as is practicable for the appliance/chimney installation concerned.*

An electronic portable combustion gas analyser can be used, in accordance with BS 7967-4 to indicate that the combustion of the appliance is satisfactory.

12 Room-sealed Types C_2 and C_4 appliances for shared chimneys

12.1 Selection and installation of a suitable chimney

12.1.1 General

*COMMENTARY ON **12.1.1***
The route of a SE-duct or U-duct is an intrinsic part of the design of a building. System chimneys may be incorporated into the building or added to existing buildings.

Typical SE-duct, U-duct and shared system chimneys are shown in Figure 8. Further information on SE-duct sizing is given in Table 6, Table 7 and Table 8 and Table 9 and Table 10 for system chimneys. These tables are for guidance only. Where it is not practicable to obtain combustion air from the base of the building a U-duct configuration should be used.

It is not necessary to take specific precautions against condensation.

NOTE In principle, shared chimneys allow a number of appliances on different storeys of a building to conduct the products of combustion to a common chimney outlet at high level, thus avoiding multiple chimneys outlets at each storey level.

For many decades, shared chimneys for room-sealed appliances have been installed in the UK utilizing masonry components, e.g. concrete blocks. These were designed for use with non-condensing appliances and many are continuing to operate satisfactorily so that gas operatives carrying out maintenance or appliance replacement need to be aware of original design criteria.

More recently, as condensing appliances have become widely used, new versions of shared chimneys have been developed using system chimneys. The design parameters have thus changed, and are presented separately below.

Only a C_2 appliance shall only be connected to a SE-duct or U-duct chimney (where the flue duct and air supply duct of the appliance are connected into the same common duct of the chimney) in accordance with the appliance manufacturer's installation instructions. Only a C_4 appliance shall be used with the shared chimney where the flue duct and the air supply duct of the appliance are connected to separate common ducts of the shared chimney.

Table 6 **Normal SE-duct block sizes in existing buildings**

Size	**Internal dimensions** mm	**External dimensions** mm	**Mass** kg	**Height** mm
No. 1	205 × 305	255 × 355	28	455
No. 2	230 × 395	280 × 445	35	455
No. 3	330 × 480	390 × 540	55	455
No. 4	380 × 560	455 × 635	75	455

12.1.2 SE-ducts

*COMMENTARY ON **12.1.2***
The horizontal ductwork for the air entry to the base of the vertical sections may be below ground floor level. Where the ground floor consists of shops, storage accommodation, etc., it might be convenient to construct the ducting of metal at ceiling level; non-combustible fire-resistant cladding might be necessary in some circumstances. Buildings supported on columns or having a well-ventilated sub-floor space normally satisfy the neutral pressure zone requirement.

Each SE-duct shall be constructed as a vertical duct through the building. The SE-duct shall discharge above roof level.

Combustion air to the base of the duct shall be provided via either:

a) a horizontal duct run from one side of the building to another; or

b) a single inlet taken from a zone of neutral pressure, e.g. an underground space.

All ducts shall be open to the atmosphere at their extremities.

The vertical duct shall be constructed of pre-cast concrete sections or fabricated from non-combustible material.

If the base of the rising duct and/or the horizontal duct are located below or close to ground floor level, suitable measures shall be taken to minimize flooding of the duct or blockage by, for example, leaves or snow.

12.1.3 Sizing SE-duct and U-duct chimneys

Specialist advice shall be sought at the design stage of a SE-duct; Table 7 and Table 8 may be used as a reference guide only concerning existing installations as they were compiled for use with appliances and materials no longer available.

Where the duct is rectangular in section, the major dimension shall be no larger than twice the minor dimension.

Table 7 **SE-duct sizes for continuously burning appliances (e.g. boilers, gas fires) in flats**
(This table should only be used for non-condensing appliances installed on precast concrete block chimneys)

Rated input of continuously burning appliance kW, net	**Number of storeys**											
	3	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**24**	**28**
	SE-duct cross-sectional area											
	m^2	m^2	m^2	m^2	m^2	m^2	m^2	m^2	m^2	m^2	m^2	m^2
2.7	0.025	0.030	0.039	0.046	0.052	0.058	0.062	0.067	0.072	0.076	0.085	0.091
4.5	0.031	0.037	0.048	0.057	0.064	0.072	0.078	0.084	0.089	0.095	0.107	0.120
9.0	0.042	0.051	0.066	0.078	0.088	0.100	0.111	0.122	0.132	0.141	0.168	0.189
13.5	0.051	0.062	0.081	0.097	0.113	0.128	0.142	0.156	0.178	0.193	0.219	0.246
18.0	0.059	0.072	0.094	0.116	0.137	0.154	0.180	0.199	0.217	0.233	0.266	0.298
22.5	0.065	0.081	0.110	0.136	0.158	0.189	0.211	0.233	0.253	0.273	0.311	0.347
27.0	0.073	0.090	0.125	0.153	0.189	0.216	0.242	0.266	0.288	0.311	0.353	0.393

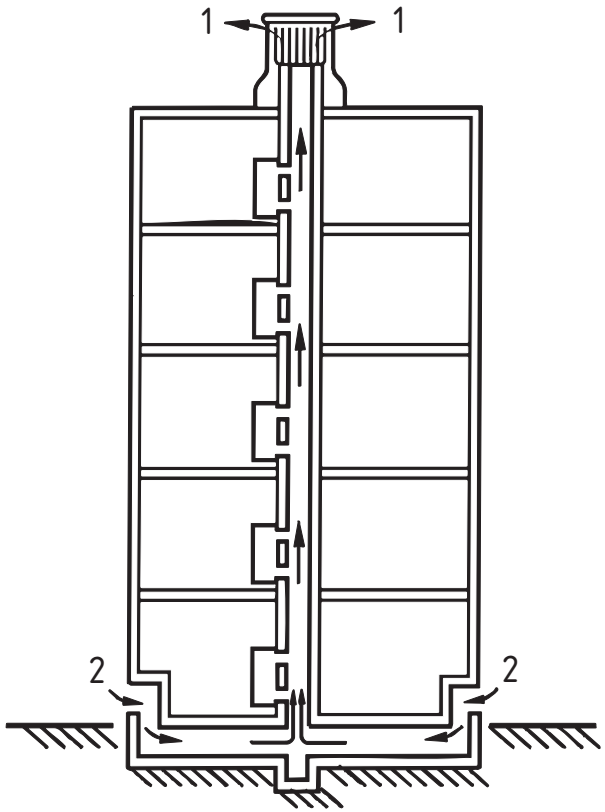
NOTE For intermediate heat inputs the area may be obtained by interpolation.

Table 8 **SE-duct sizes for combinations of instantaneous water heaters (30 kW input rating) and continuously burning appliances (e.g. boilers, gas fires) in flats**
(This table should only be used for non-condensing appliances installed on precast concrete block chimneys)

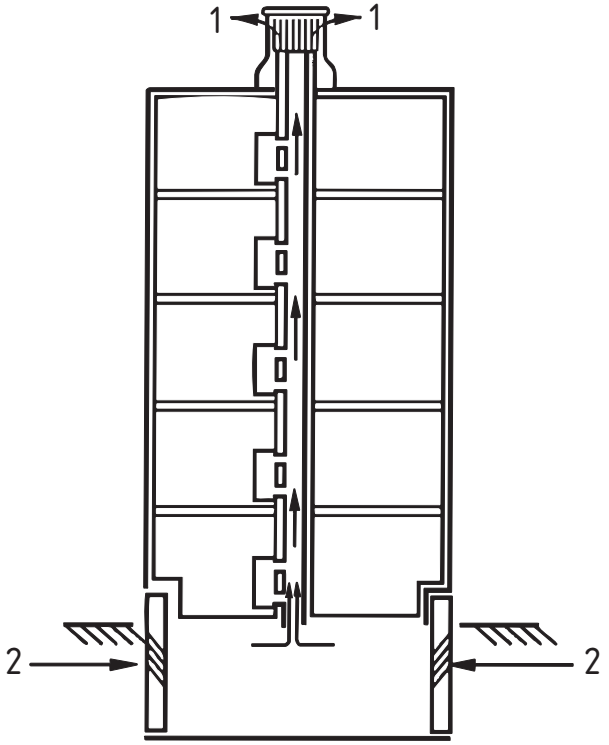
Rated input of continuously burning appliance kW, net	**Number of storeys**											
	3	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**24**	**28**
	SE-duct cross-sectional area											
	m^2	m^2	m^2	m^2	m^2	m^2	m^2	m^2	m^2	m^2	m^2	m^2
0	0.053	0.055	0.060	0.083	0.086	0.107	0.127	0.131	0.149	0.174	0.196	0.218
2.7	0.058	0.061	0.068	0.092	0.098	0.122	0.143	0.148	0.177	0.197	0.221	0.246
4.5	0.060	0.065	0.073	0.100	0.107	0.132	0.154	0.168	0.192	0.213	0.239	0.265
9.0	0.067	0.075	0.087	0.119	0.130	0.157	0.193	0.202	0.228	0.252	0.284	0.314
13.5	0.074	0.084	0.102	0.138	0.153	0.192	0.222	0.235	0.263	0.289	0.326	0.362
18.0	0.081	0.093	0.117	0.156	0.182	0.219	0.251	0.268	0.299	0.326	0.368	0.408
22.5	0.087	0.103	0.131	0.181	0.206	0.245	0.280	0.299	0.332	0.363	0.409	0.453
27.0	0.094	0.113	0.146	0.201	0.228	0.270	0.309	0.330	0.365	0.399	0.449	0.498

NOTE For intermediate heat inputs the area may be obtained by interpolation.

Figure 8 **Shared room-sealed systems**



a) SE-duct



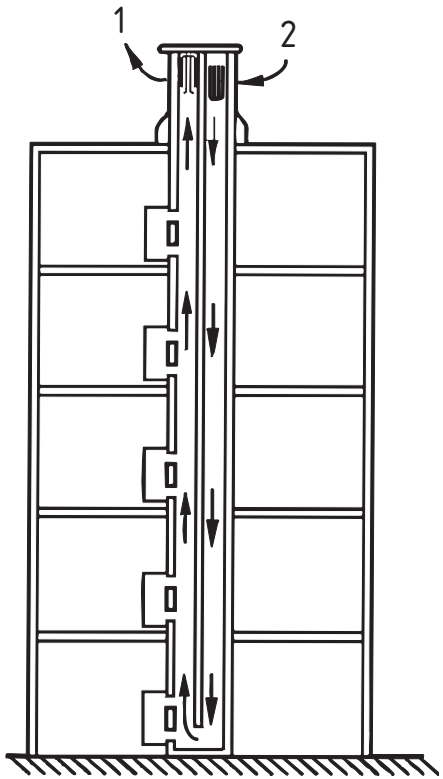
b) SE-duct

Key

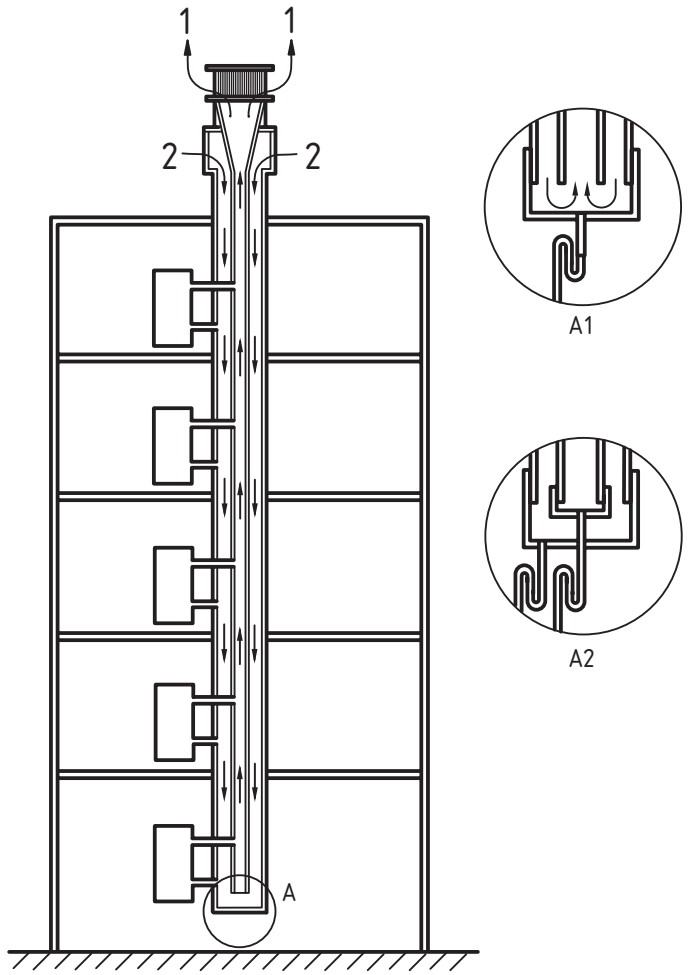
1 Combustion products

2 Air inlet

Figure 8 **Shared room-sealed systems** (*continued*)



c) U-duct



d) Shared system chimney

Key

1 Combustion products

2 Air inlet

A1 Detail for natural ventilation/negative pressure chimneys

A2 Detail for fanned appliances/positive pressure chimneys

12.1.4 U-ducts

Both limbs of the U-duct shall be constructed as a vertical duct through the building. The U-duct shall discharge above roof level. Combustion air shall be provided from the top of the building by a vertical duct adjacent to that venting the appliances and connected to it at the base.

12.1.5 Shared system chimneys (common balanced flue)

NOTE The following variations on the chimney systems are dependent on the application.

a) Concentric negative pressure chimney which can be used on room-sealed fan or non-fan draught condensing or non-condensing C_4 appliances.

b) Concentric positive pressure chimney which can be used on room-sealed fan draught condensing or non-condensing appliances. There is no recognized calculation method available at this time and the chimney manufacturer should be consulted. Appliances designed for this application should be fitted with a non-return valve in the flue duct of the appliance, specifically designed for this purpose.

c) Separate (twin pipe) negative pressure flue ducts which can be used on room-sealed fan draught condensing or non-condensing appliances.

d) Separate (twin pipe) positive pressure flue ducts which can be used on room-sealed fan draught condensing or non-condensing appliances. There is no recognized calculation method available at this time and the chimney manufacturer should be consulted. Appliances designed for this application should be fitted with a device to prevent combustion products from other appliances connected to that shared system chimney entering the flue duct of the appliance.

Each chimney system is designed, using standard parts, for an individual installation.

Each shared system chimney shall be constructed as a vertical duct internal or external to the building. The common balanced flue chimney shall discharge above roof level. The point at which the combustion products are discharged shall be adjacent to the point from which the combustion air is taken, and both so disposed.

12.1.6 Sizing for shared system chimneys

The sizing shall be calculated according to BS EN 13384-2. The parameters used in this calculation shall be provided by the appliance and chimney manufacturers; where no such data is available, Table 9 and Table 10 may be used.

NOTE 1 The values within Table 9 and Table 10 are typical and have been calculated in accordance with BS EN 13384-2 and are intended for guidance only. Other cross-sectional areas can be used where specified by the chimney and/or appliance manufacturer.

NOTE 2 For concentric circular chimneys the outside diameter of the chimney system can be calculated from the sum of the flue and air supply cross-sectional areas.

Table 9 **Cross-sectional area for ducts in shared system chimneys used for condensing and non-condensing appliances (one appliance per storey)**

One appliance per storey	Number of storeys									
	2		3		4		5		6	
Rated input, net kW	Cross-sectional area									
	Flue m^2	Air m^2	Flue m^2	Air m^2	Flue m^2	Air m^2	Flue m^2	Air m^2	Flue m^2	Air m^2
9.0	0.018	0.046	0.018	0.046	0.018	0.046	0.018	0.046	0.018	0.046
13.5	0.018	0.046	0.018	0.046	0.018	0.046	0.018	0.046	0.025	0.065
18.0	0.018	0.046	0.018	0.046	0.018	0.046	0.025	0.065	0.025	0.065
22.5	0.018	0.046	0.018	0.046	0.025	0.065	0.025	0.065	0.033	0.086
27.0	0.018	0.046	0.018	0.046	0.025	0.065	0.033	0.086	0.033	0.086

One appliance per storey	Number of storeys									
	7		8		9		10		11	
Rated input, net kW	Cross-sectional area									
	Flue m^2	Air m^2	Flue m^2	Air m^2	Flue m^2	Air m^2	Flue m^2	Air m^2	Flue m^2	Air m^2
9.0	0.025	0.065	0.025	0.065	0.033	0.086	0.040	0.102	0.049	0.128
13.5	0.025	0.065	0.025	0.065	0.033	0.086	0.040	0.102	0.049	0.128
18.0	0.033	0.086	0.033	0.086	0.033	0.086	0.040	0.102	0.049	0.128
22.5	0.033	0.086	0.040	0.102	0.040	0.102	0.049	0.128	0.049	0.128
27.0	0.040	0.102	0.040	0.102	0.049	0.128	0.049	0.128	0.071	0.189

One appliance per storey	Number of storeys									
	12		13		14		15		16	
Rated input, net kW	Cross-sectional area									
	Flue m^2	Air m^2	Flue m^2	Air m^2	Flue m^2	Air m^2	Flue m^2	Air m^2	Flue m^2	Air m^2
9.0	0.049	0.128	0.071	0.189	0.071	0.189	0.096	0.262	0.096	0.262
13.5	0.071	0.189	0.071	0.189	0.071	0.189	0.096	0.262	0.096	0.262
18.0	0.071	0.189	0.071	0.189	0.071	0.189	0.096	0.262	0.096	0.262
22.5	0.071	0.189	0.071	0.189	0.071	0.189	0.096	0.262	0.096	0.262
27.0	0.071	0.189	0.071	0.189	0.071	0.189	0.096	0.262	0.096	0.262

One appliance per storey	Number of storeys							
	17		18		19		20	
Rated input, net kW	Cross-sectional area							
	Flue m^2	Air m^2	Flue m^2	Air m^2	Flue m^2	Air m^2	Flue m^2	Air m^2
9.0	0.096	0.262	0.096	0.262	0.126	0.316	0.126	0.316
13.5	0.126	0.316	0.126	0.316	0.126	0.316	0.159	0.408
18.0	0.126	0.316	0.126	0.316	0.159	0.408	0.159	0.408
22.5	0.126	0.316	0.126	0.316	0.159	0.408	0.159	0.408
27.0	0.126	0.316	0.126	0.316	0.159	0.408	0.159	0.408

Table 10 **Cross-sectional area for ducts in shared system chimneys used for condensing and non-condensing appliances (two appliances per storey)**

Two appliances per storey	**Number of storeys**									
	1		**2**		**3**		**4**		**5**	
Rated input, net kW	**Cross-sectional area**									
	Flue m^2	**Air** m^2	**Flue** m^2	**Air** m^2	**Flue** m^2	**Air** m^2	**Flue** m^2	**Air** m^2	**Flue** m^2	**Air** m^2
9.0	0.018	0.046	0.018	0.046	0.018	0.046	0.025	0.065	0.025	0.065
13.5	0.018	0.046	0.018	0.046	0.025	0.065	0.025	0.065	0.033	0.086
18.0	0.018	0.046	0.018	0.046	0.025	0.065	0.033	0.086	0.040	0.102
22.5	0.018	0.046	0.025	0.065	0.033	0.086	0.040	0.102	0.049	0.128
27.0	0.018	0.046	0.025	0.065	0.033	0.086	0.049	0.128	0.071	0.189
Two appliances per storey	**Number of storeys**									
	6		**7**		**8**		**9**		**10**	
Rated input, net kW	**Cross-sectional area**									
	Flue m^2	**Air** m^2	**Flue** m^2	**Air** m^2	**Flue** m^2	**Air** m^2	**Flue** m^2	**Air** m^2	**Flue** m^2	**Air** m^2
9.0	0.033	0.086	0.033	0.086	0.049	0.128	0.071	0.189	0.071	0.189
13.5	0.040	0.102	0.049	0.128	0.049	0.128	0.071	0.189	0.071	0.189
18.0	0.049	0.128	0.071	0.189	0.071	0.189	0.071	0.189	0.071	0.189
22.5	0.071	0.189	0.071	0.189	0.071	0.189	0.096	0.262	0.096	0.262
27.0	0.071	0.189	0.071	0.189	0.096	0.262	0.096	0.262	0.126	0.316

12.2 Terminal design and location

12.2.1 Roof terminals

*COMMENTARY ON **12.2.1***
Specialist advice should be sought at the design stage concerning the chimney terminal.

Positioning a terminal away from roof structures is preferable to raising the terminal.

The chimney outlet terminal shall be located in accordance with **6.1.5** for room-sealed appliances. The base of the opening of the chimney outlet/air intake shall be not less than 250 mm above the roof. Where there are structures on the roof such as plant rooms, storage tanks, outer walls or parapets, either the chimney outlet shall be positioned not less than 1.5 m from such structures, or where this is not possible, the chimney outlet shall be raised so that the base of its opening is above the top of the structure.

Terminals shall comply with the aerodynamic performance criteria specified in Annex F.

12.2.2 Low level entry duct design

Where the duct terminates in a neutral pressure zone below a building, see Figure 8, the base of the duct shall have a removable grill to prevent debris from falling into the area below. The grill openings shall be such that they can admit a 10 mm diameter ball but not a 16 mm diameter ball. All grilles and the duct base shall be labelled indicating the purpose of the duct and identifying the person responsible for the building.

*COMMENTARY ON **12.2.2***
The responsible person, e.g. the local council, landlord, or managing agent, should provide labels for the ducts and grilles with the following information.

a) Air Inlet Duct Label. "This duct supplies air to the building's gas appliances and their flueing system in accordance with BS 5440-1:2008. It should not be blocked or restricted under any circumstances. For more information refer to the person responsible for the building; Name and contact details.....".

b) Duct Grille Label. "The duct behind this grille supplies air to the building's gas appliances and their flueing system in accordance with BS 5440-1:2008. It should not be blocked or restricted under any circumstances. For more information refer to the person responsible for the building; Name and contact details .....".

12.3 Inspection

After construction all debris shall be removed and the duct visually inspected to ensure that all openings, such as joint holes and inspection panels are correctly sealed by the sealing plug(s) or plate(s) supplied by the duct manufacturer.

12.4 Selection and installation of compatible appliances

*COMMENTARY ON **12.4***
A label should be attached to an appliance, typically stating "This appliance is fitted to a shared flue system and should not be removed or replaced without reference to the person responsible for the building, phone or contact details are ..... Further advice is given in BS 5440-1:2008."

12.4.1 SE-duct and U-duct installations using Type C_2 appliances

Only appliances which are designated by the manufacturer as suitable for the application shall be used on either SE-duct or U-duct installations. Such appliances shall be fitted such that the air inlet connection is flush with the inner wall of the duct and the flue spigot projects into the duct at the distance specified by the manufacturers of the appliance. A fanned draught appliance shall not be fitted back to back with any other appliance.

After the appliance has been connected, any gaps around the air supply duct/flue duct spigots shall be sealed.

All appliances connected to the flue system shall be labelled to indicate that the flue system is shared.

*COMMENTARY ON **12.4.1***
Type C_2 appliances suitable for SE-ducts and U-ducts and Type C_4 suitable for negative pressure shared system chimneys are identified as such by their flue category designation as defined in Table A.1. The appliance data label will identify the flue category to which the appliance has been tested.

When calculating the total required projection of the flue spigot due consideration should be given to the various thicknesses of duct wall and cladding that might be encountered. Fanned draught appliances have high discharge velocities and this could lead to re-circulation of products of combustion at low flue duct velocities due to the jet being deflected by the opposite wall.

The majority of SE-ducts and U-ducts were built prior to the advent of natural gas, and were sized for a maximum duct CO_2 concentration of 2% at the inlet to the top appliance. The current requirements are based on a 1.5% CO_2 concentration and the duct sizing charts have been computed accordingly.

12.4.2 Appliances for shared system chimneys

12.4.2.1 Type C_4 for negative pressure shared system chimneys

Only appliances which are designated by the manufacturer as suitable for the application shall be used on shared system chimneys. All appliances connected to the flue system shall be labelled to indicate that the chimney is shared.

12.4.2.2 Appliances for positive pressure shared system chimneys

Only appliances which are designated by the manufacturer to work with positive pressure shared system chimneys shall be used for that purpose. These include a device to prevent combustion products from other appliances connected to that shared system chimney entering the flue duct of the appliance.

NOTE At the time of publication these appliances are classified as a variant of Type C_4 but it is awaiting its own C-type classification within PD CEN/TR 1749.

12.4.3 Replacement appliances

When connecting new appliances to existing shared chimneys, replacement appliances shall be not greater in input to the original appliances and suitable for the size of the flue.

It is acceptable to replace a natural draught appliance with a fanned draught appliance and to mix fanned and natural draught appliances on the same SE-duct or U-duct system providing the rated input of the replacement appliances do not exceed that of their respective appliances replaced. A fanned draught appliance shall not be fitted back to back with any other appliance. Condensing appliances shall not be installed in existing SE-duct or U-duct chimneys unless specialist advice is sought or they are replacing condensing appliances.

Condensing appliances shall only be fitted to shared system chimneys which have been designed for that purpose. Condensing appliances working under positive pressure conditions shall only be replaced by a similar condensing appliance suitable for operation on positive pressure in order to match the original appliance specification. The replacement appliance manufacturer shall be consulted to confirm compatibility.

The duct shall be inspected to ensure that it is not damaged.

Any existing, but unwanted, holes shall be sealed with a plate manufactured from steel, or other non-combustible material, of sufficient size to cover the existing holes in the duct wall. The holes for the air supply duct/flue duct for the replacement appliance shall be drilled in both the sealing plate and the shared chimney duct wall using the appliance manufacturer's instructions and template. Any cracked or damaged sections of duct shall be repaired or replaced.

Care shall be taken to prevent rubble created during the preceding operation from falling into the duct.

*COMMENTARY ON **12.4.3***
When installing a combination boiler, use Table 7 if the maximum gas rate for the heating mode is the same as the maximum gas rate for the hot water mode. If the maximum gas rate for the heating mode is lower than the maximum gas rate for the hot water mode, use Table 8.

Table 7 and Table 8 should be used as a reference guide only (concerning existing installations) as they were compiled for use with appliances and materials no longer available.

Rotary percussion drills should not be used when cutting new holes in pre-cast concrete ducts. The hole should be formed either by using a core drill or by stitch drilling.

When servicing or fitting new or replacement appliances it is important to ensure that the duct is not left open to the dwelling for longer than necessary, as leakage of products of combustion from appliances on other floors could give rise to hazardous conditions.

EXAMPLE

A 15 kW (net) boiler in a 20 storey block of flats.

For a SE-duct:

For 13.5 kW (net) the cross-sectional area required is 0.193 m^2.

For 18.0 kW (net) the cross-sectional area required is 0.233 m^2.

The cross-sectional area for 15 kW is therefore:

$$\frac{(15.0-13.5)}{(18.0-13.5)} \times (0.233-0.193) = 0.206 m^2$$

This would be satisfied by a flue block of size:

$\sqrt{0.206}$ *, i.e. 0.454 m × 0.454 m*

454 mm × 454 mm or greater or size No. 4 from Table 8, i.e. 380 mm × 560 mm = 0.213 m^2.

For a U-duct:

The cross-sectional area for 15 kW is:

$0.205 \times 1.24 = 0.254\ m^2$

*(see **12.2**)*

This would be satisfied by a flue block of size:

$\sqrt{0.254}$ *, i.e. 0.504 m × 0.504 m*

504 mm × 504 mm or greater.

12.5 Commissioning

*COMMENTARY ON **12.5***
Some existing SE-ducts are fitted with restrictor plates at the terminal grilles to reduce the duct air velocity under extreme wind conditions.

12.5.1 New buildings: all new appliances

The performance shall be checked with all space heaters in the building plus 33% of the instantaneous water heaters, all of which shall be in the top third of the building, in operation. The combustion air entering the topmost appliance shall not contain more than 1.5% by volume of carbon dioxide.

12.5.2 Existing buildings: single replacement appliances

The appliance shall be commissioned as though it were connected to a single flue (see **12.6.2**).

12.6 Maintenance

12.6.1 Maintenance of the shared flue system

The installer of the shared flue system shall advise the owner or occupier of the premises in writing of the need to check SE-ducts and U-ducts to ensure that they conform to **12.1**, **12.2**, **12.3** and **12.4** and that the appliances connected to it can be used safely.

NOTE Attention is drawn to the Gas Safety (Installations and Use) Regulations [1] and Health and Safety at Work legislation [11] for the responsibilities of landlords.

*COMMENTARY ON **12.6.1**.*
*Since inadequate installation or the operation of any one appliance connected to a shared flue system might affect the safe operation of others, it is important that routine inspections are carried out on all appliances. As far as is reasonably practicable, the duct inlet and/or base should be checked for debris or obstruction and the roof terminal should be checked for structural integrity and conformance to **12.3**.*

12.6.2 Maintenance of room-sealed appliances connected to a shared flue system

The installer of the chimney shall advise the owner or occupier of the premises in writing of the need to maintain the appliance maintained in accordance with appliance manufacturer's instructions and **9.4** as appropriate.

In so far as is reasonably practicable, the shared chimney shall be checked to ensure that it meets the requirements of **12.1**, **12.2**, **12.3** and **12.4** and such that the appliances connected to it can be used safely.

*COMMENTARY ON **12.6.2***
*Where practicable, the appliance connections should be inspected to ensure the chimney installations conform to **12.5.1**. An inspection of the whole flue duct might be necessary if an appliance is not operating correctly, e.g. persistent pilot outage. Problems might occur if a replacement appliance has been installed on another floor such that its flue connection and/or air inlet duct protrude excessively into the duct.*

When servicing or fitting new or replacement appliances it is important to ensure that the duct is not left open to the dwelling for longer than necessary, as leakage of products of combustion from appliances on other floors could give rise to hazardous conditions.

13 Special categories of chimney

13.1 Chimneys for Type C_7 ("Vertex") appliances

*COMMENTARY ON **13.1***
An uninhabited ventilated roof space designed and constructed to be ventilated to the standard required by the Building Regulations [3] (users are advised that the requirements of the Building Regulations (Northern Ireland) [4], the Building Standards (Scotland) Regulations [5] and the Building Regulations (Isle of Man) [6] might differ) will provide sufficient air supply. However, the ventilation design parameters should be considered and any roof space ventilators should be checked to ensure they are unobstructed by insulation, etc.

Where a chimney for a Type C_7 appliance is used, the primary flue and draught break, which are both parts of the appliance, shall be installed in accordance with the instructions provided by the appliance manufacturer. The secondary flue connected to the appliance draught break in the roof space shall be installed in accordance with the instructions provided by the chimney manufacturer.

Provision shall be made for an adequate unobstructed air supply to the roof space in which the draught break is located. The secondary flue connected to the appliance draught break shall be constructed of a non-corrosive material such as stainless steel and that section shall be vertical. If a change of direction (offset) is unavoidable, the first section of the chimney above the draught break shall rise vertically by a minimum of 600 mm before it changes direction. The offset section of chimney shall not exceed 20% of the total length of the secondary flue, and shall terminate through the roof with a normal terminal. Provision shall be made to collect and remove any condensate that forms above the draught break. The break shall be located at least 300 mm above the level of any insulation in the roof space.

A spillage test for Type C_7 appliances in accordance with the appliance manufacturer's instructions is carried out at the draught break in the roof space.

13.2 Other open flue fanned draught chimneys

13.2.1 Shared open flue fanned draught chimneys

The design and installation of shared open flue fanned draught chimneys is a specialist matter and shall be carried out only by persons who are competent to do so. The requirements of the appliance manufacturer and chimney manufacturer shall be followed.

*COMMENTARY ON **13.2.1***
*Shared open flue fanned draught chimneys might be used for two or more similar or dissimilar appliances, although the most common application is for two or more boilers connected to the same flue. Systems used can include branched chimneys (appliances in different rooms and/or on different floors) and fan diluted flue systems for multiple appliance installations in the same room (see **13.2.2**).*

13.2.2 Fan diluted flue systems

The design and installation of a fan diluted flue system is a specialist matter and shall be carried out only by persons who are competent to do so and such that the requirements of the appliance manufacturer and flue system manufacturer are met, as appropriate.

*COMMENTARY ON **13.2.2***
In the case of fan diluted flue systems, a fan is used to introduce fresh air into the flue duct of the installation in the same room in order to dilute the flues gas to a safe concentration at the points of exit, thus facilitating discharge at locations that would otherwise be unacceptable or undesirable. This method is mostly used with two or more boilers, but is equally suited to single appliance installations. In all cases, the design and installation of such systems is a specialist matter.

Further details on the design of fan diluted flue systems can be found in BS 6644 and Institution of Gas Engineers and Managers publication IGE/UP/10 [21].

Annex A (informative) Classifications

A.1 Classification of appliances by method of evacuation of products of combustion

Gas appliances are classified in PD CEN/TR 1749 according to the method of evacuation of products of combustion. A summary is given in Table A.1 and the common types encountered in the UK [flueless, open-flued and room-sealed (including balanced flue)] are illustrated diagrammatically in Figure A.1, Figure A.2 and Figure A.3.

The room-sealed form neither contributes to, nor places any requirement for combustion purposes on the ventilation of the room containing the appliance. Open flue chimneys operate with appliances receiving air for combustion from the installation space, which thus requires a source of air supply, and discharging the combustion products to outside atmosphere. Open flue chimneys participate in the ventilation of the room or space by inducing a flow of air through the room and appliance. Flueless appliances take air from, and discharge combustion products into, the room in which they are installed and have special ventilation requirements for safe operation, see BS 5440-2 for specific ventilation requirements.

Table A.1 **Classification of gas appliances used in the UK according to the method of evacuation of products of combustion (types) – from PD CEN/TR 1749:2005**

Letter classification and appliance type	Classification and 1st digit	Classification and 2nd digit		
		Natural draught	Fan downstream of heat exchanger	Fan upstream of heat exchanger
A – Flueless (see Figure A.1)	—	A_1 *	A_2	A_3
B – Open-flued (see Figure A.1)	B_1 – with draught diverter	B_{11} *	B_{12} * B_{14} [A)]	B_{13} *
	B_2 – without draught diverter [B)]	B_{21}	B_{22}*	B_{23}
C – Room-sealed (see Figure A.2 and Figure A.3)	C_1 – Horizontal balanced flue/inlet air ducts to outside air	C_{11} *	C_{12} *	C_{13} *
	C_2 – Inlet and outlet ducts connect to common duct system for multi-appliance connections (SE-duct or U-duct)	C_{21} *	C_{22}	C_{23}
	C_3 – Vertical balanced flue/inlet air ducts to outside air	C_{31}	C_{32} *	C_{33} *
	C_4 [C)] – Inlet and outlet appliance connection ducts connected to a U-shaped duct for multi-appliance system	C_{41}	C_{42}	C_{43}
	C_5 – Non-balanced flue/inlet air ducted system	C_{51}	C_{52}	C_{53}
	C_6 – Appliance sold without flue/air inlet ducts	C_{61}	C_{62}	C_{63}
	C_7 – Vertical flue to outside air with air supply ducts in loft. Draught diverter in loft above air inlet	C_{71}	C_{72} * (“Vertex”)	C_{73} * (“Vertex”)
	C_8 – Non-balanced system with air supply from outside and flue into a common duct system	C_{81}	C_{82}	C_{83}

*NOTE Common types in the UK are shown with an asterisk *.*

A) This has a fan downstream of the draught diverter.

B) Previously referred to as “closed flues”.

C) Type C_2 appliances are used for SE-ducts and U-ducts in the UK.

A.2 Classification according to European chimney format prescribed in BS EN 1443:2003

The European format prescribed in BS EN 1443:2003, Annex B classifies chimneys by the following performance characteristics:

- temperature class (T);
- pressure class (N, P or H);
- resistance to condensate class (W or D);
- corrosion resistance class (1, 2, 3);
- soot-fire resistance class (G or O), followed by a distance to combustibles (xx).

Chimney products are specified in European chimney standards according to the materials used, that is concrete, clay/ceramic, metal or plastic, but independent of the fuel to be used. Design, installation and commissioning requirements for all these types of chimneys are given in BS EN 15287. Their relationship to British Standards and application in England and Wales is given in Approved Document J [13].

In the European chimney standards, a chimney is treated as a structure containing a flue (the passageway) and might include a liner (inner wall), insulation and an outer wall. Product standards are specified for each of these components on their performance characteristics in contrast to the traditional UK practice of prescribing dimensions that have been shown to work in the past. Chimneys are regarded as system chimneys if they are installed using compatible components obtained from one manufacturing source where the manufacturer takes product responsibility for the whole chimney, e.g. a factory made chimney. In contrast, a custom built chimney is constructed on site using compatible components that can be obtained from one or more sources.

A.3 Default values to European chimney formats

The default values provided by the UK appliance manufacturers for the principal domestic appliance categories are given in Table A.2. Where individual appliance manufacturers specify other values for specific appliances those values should be used.

Table A.2 **Default values in accordance with BS EN 1443:2003**

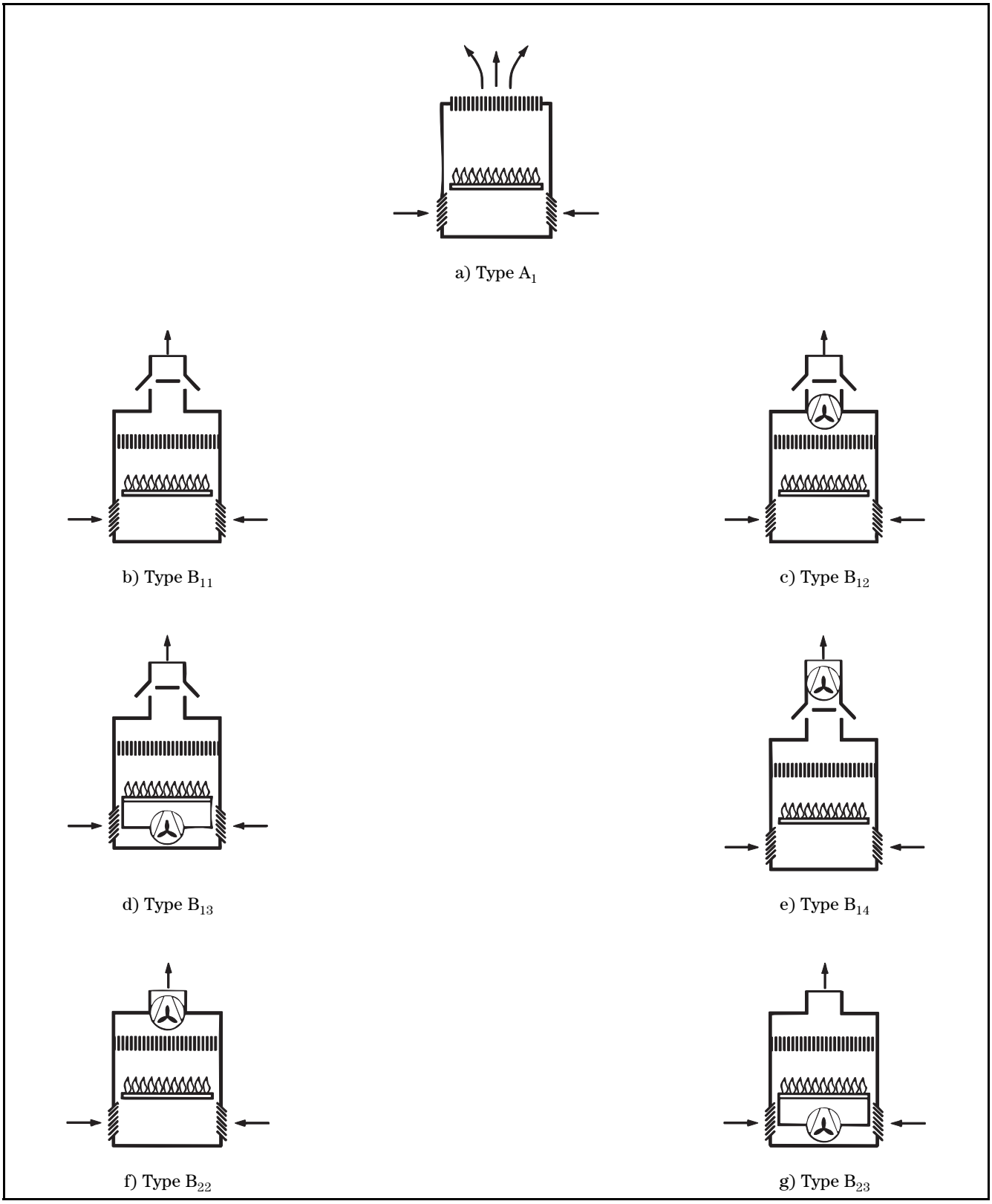
Appliance	**Temperature class**	**Pressure class** [A] **N = negative P = positive**	**Resistance to condensate class W = wet D = dry**	**Corrosion resistance class 1 = gas**	**Sootfire resistance class G = yes O = no**
Boiler: open-flued					
Natural draught	T250	N2	D	1	O xx [A]
Fan draught	T250	P2 [B]	D	1	O xx
Condensing	T160	P2 [B]	W	1	O xx
Boiler: room-sealed vertical flue					
Natural draught	T250	N2	D	1	O xx
Fan draught	T250	P2 [B]	D	1	O xx
Condensing	T160	P2 [B]	W	1	O xx
Gas fire					
Radiant convector	T250	N2	D	1	O xx
ILFE	T250	N2	D	1	O xx
DFE	T250	N2	D	1	O xx
Air heater					
Natural draught	T250	N2	D	1	O xx
Fan draught	T250	P2 [B]	D	1	O xx
SE-duct	T450	N2	D	1	O xx

[A] Pressure class N2 denotes a maximum permissible leakage rate of 3.0 litres per second per m^2 when tested at 20 Pa of negative pressure.Pressure class P2 denotes a maximum permissible leakage rate of 0.120 litres per second per m^2 when tested at 200 Pa of positive pressure.

[B] 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 connecting flue pipes with the negative pressure designation even for many fanned draught gas appliances, including condensing boilers, which might otherwise have positive pressure at the outlet to the flue. If there is any doubt, and/or unless the appliance manufacturer specifies N2, the designation P2 should apply. The draught generated in a chimney may be calculated according to BS EN 13384-1 and BS EN 13384-2.

xx refers to the minimum distance to combustible materials. This is determined by the chimney manufacturer and marked on the chimney. It is not relevant to determining the compatibility of the appliance and the chimney so no values are specified for this parameter.

Figure A.1 **Typical appliances Types A and B, classification to PD CEN/TR 1749:2005**



a) Type A_1

b) Type B_{11}

c) Type B_{12}

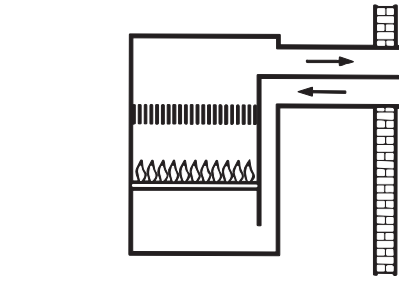
d) Type B_{13}

e) Type B_{14}

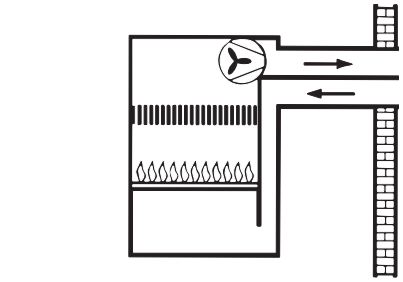
f) Type B_{22}

g) Type B_{23}

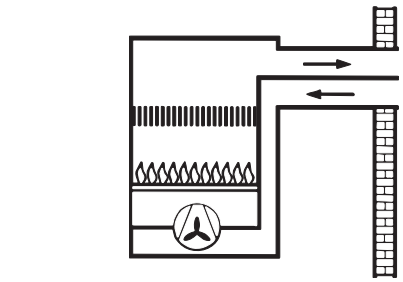
Figure A.2 **Typical appliance Types C, classification to PD CEN/TR 1749:2005**



Type C_{11}



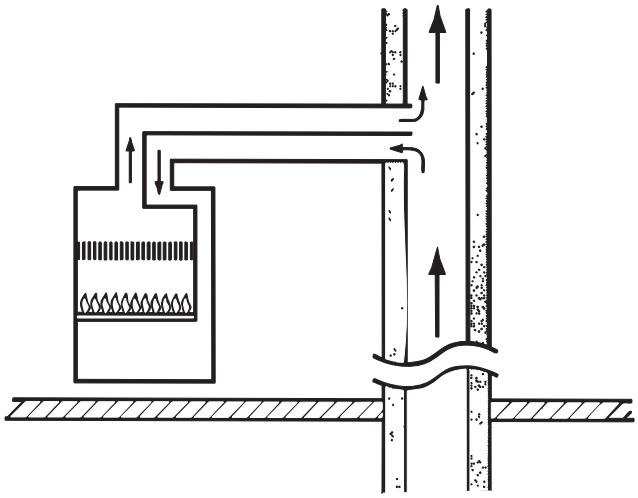
Type C_{12}



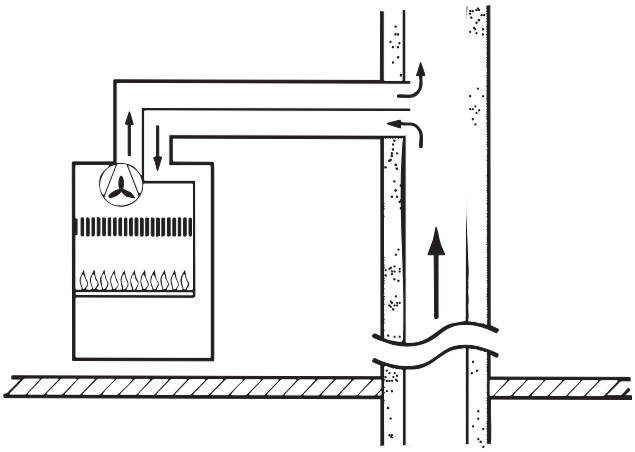
Type C_{13}

a) Horizontal balanced chimney configurations

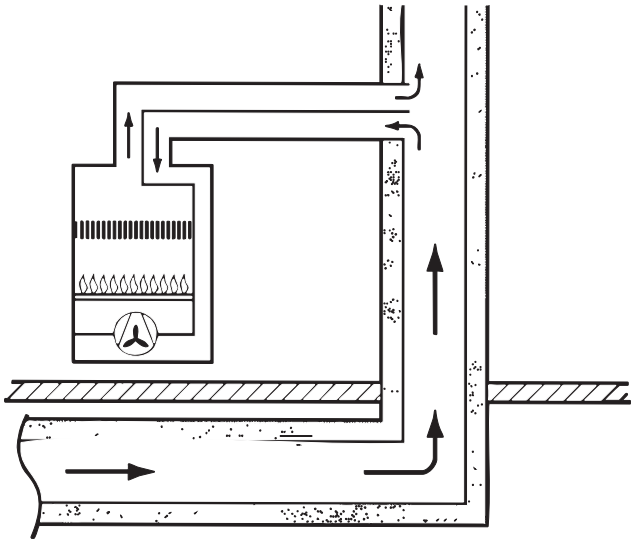
Figure A.2 **Typical appliance Types C, classification to PD CEN/TR 1749:2005** (*continued*)



Type C_{21}



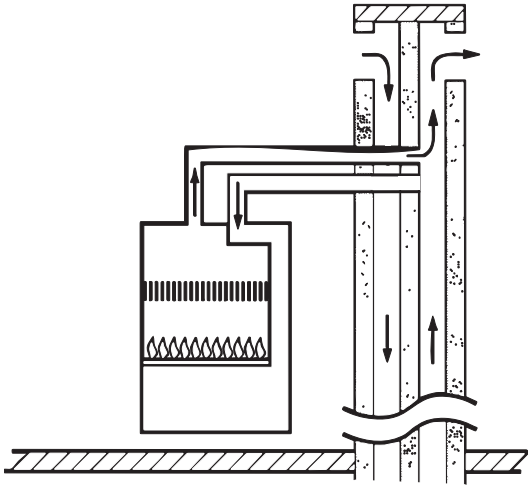
Type C_{22}



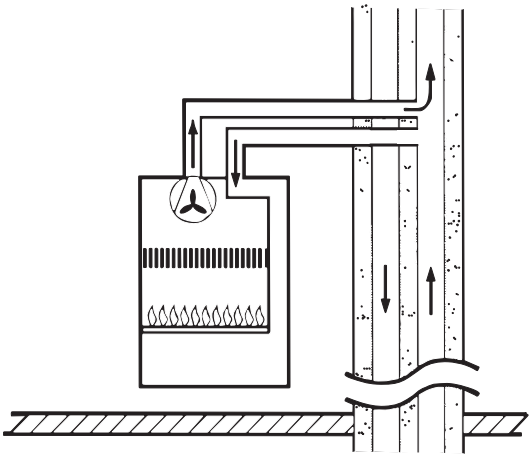
Type C_{23}

b) Appliances for SE-ducts

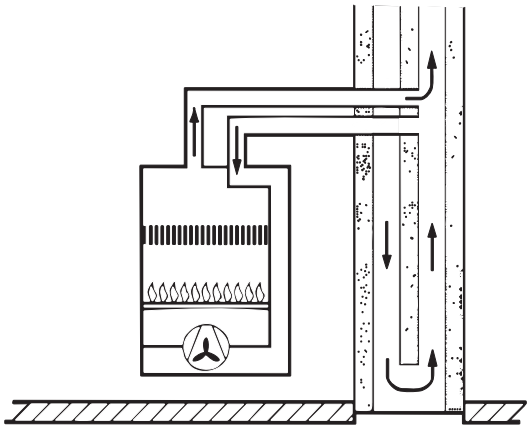
Figure A.2 **Typical appliance Types C, classification to PD CEN/TR 1749:2005** (*continued*)



Type C_{21}



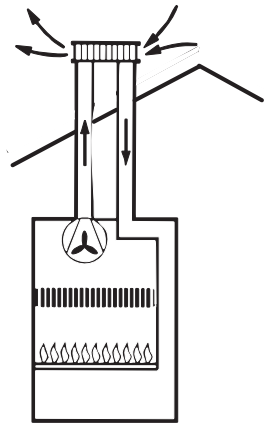
Type C_{22}



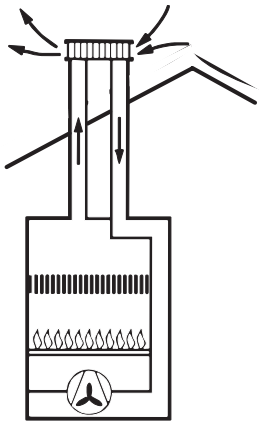
Type C_{23}

c) Appliances for U-ducts

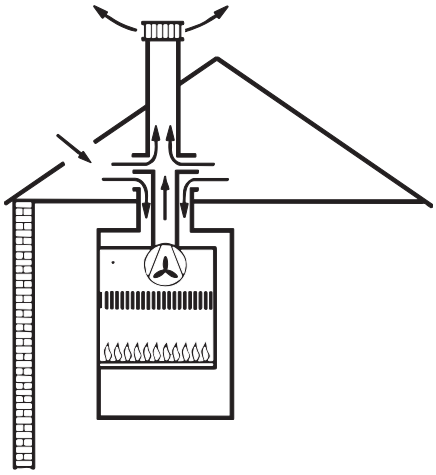
Figure A.3 **Typical appliance Types C_3 and C_7, classification to PD CEN/TR 1749:2005**



Type C_{32}



Type C_{33}



Type C_{72}

Annex B (informative)

Calculation method for flue sizing

This annex provides a procedure for estimating whether a given flue design is likely to ensure full clearance of combustion products.

It is not intended to be used in conjunction with incinerators.

The procedure is based on calculating the "equivalent height" of the flue under consideration, i.e. that height of straight vertical circular flue pipe measured from the flue spigot to the outlet of the flue pipe, of the same cross-sectional size as the flue under consideration which produces the same flow rate as the flue under consideration. The equivalent height is calculated from the formula:

$$H_e = H_a \times \frac{(K_i + K_o)_e}{(K_i + K_o)_a - K_e H_a + \Sigma K}$$

where:

H_e is the height of the equivalent flue;

H_a is the vertical height of the actual or proposed flue measured from the flue spigot;

K_i is the inlet resistance of the flue;

K_o is the outlet resistance from the flue;

subscript "e" refers to the equivalent flue diameter;

subscript "a" refers to the actual or proposed flue diameter;

K_e is the resistance per unit length of the equivalent flue;

ΣK is the resistance (other than the inlet and outlet resistances) of the actual or proposed flue.

NOTE *K and ΣK are obtained from Table B.1. K_o and K_i are obtained from Table B.2.*

Table B.1 gives resistance factors for common flue system components for use in formula Table B.2 contains the appropriate inlet and outlet flue resistances.

The flue is likely to be satisfactory if its equivalent height exceeds that given in Table B.3. Table B.3 gives the minimum flue heights with which appliances are required by the relevant safety standards to be capable of clearing their combustion products.

Table B.1 **Resistance factors for use in calculating equivalent heights**
(Use specific factors from flue or chimney manufacturer's instructions where possible)

Component	**Internal size** mm	**Resistance factor** K_e	
Gas flue blocks	197 × 67	0.85	per metre run
	231 × 65	0.65	
	317 × 63	0.35	
	140 × 102	0.60	
	200 × 75	0.60	
	183 × 90	0.45	
Pipe	100	0.78	per metre run
	125	0.25	
	150	0.12	
Masonry chimney	213 × 213	0.02	per metre run
90° bend	100 mm pipe	1.22	per fitting
	125 mm pipe	0.50	
	150 mm pipe	0.24	
135° bend	100 mm pipe	0.61	per fitting
	125 mm pipe	0.25	
	150 mm pipe	0.12	
	197 × 67	0.30	
	231 × 65	0.22	
	317 × 63	0.13	
Offset raking block	Any	0.30	per block
Transfer block	Any	0.50	per block
Terminal	100 mm ridge	2.50	per fitting
	125 mm ridge	1.00	
	150 mm ridge	0.48	
	100 mm GCI	0.60	
	125 mm GCI	0.25	
	150 mm GCI	0.12	

Table B.2 **Inlet and outlet resistances**

Appliance	**Inlet resistance** K_i
Gas fire (12 000 mm^2 equivalent flue size)	3.00
Gas fire/back boiler unit	2.00
Other appliances:	
100 mm spigot	2.50
125 mm spigot	1.00
150 mm spigot	0.48

Appliance	**Outlet resistance** K_o
100 mm flue	2.50
125 mm flue	1.00
150 mm flue	0.48

NOTE These factors do not apply to decorative fuel effect gas appliances nor to inset appliances.

Table B.3 **Minimum equivalent heights needed**

Appliance	**Minimum equivalent height**
Gas fire [A] (to be connected to pre-cast block flues)	2.0 m of 125 mm flue pipe
Other gas fires [A]	2.4 m of 125 mm flue pipe
Gas fire/back boiler unit [A]	2.4 m of 125 mm flue pipe
Other appliance, e.g. boiler [B]	1.0 m flue pipe of the same diameter as the appliance flue spigot

[A] For gas fires, effective height = equivalent height + 0.65 m.
[B] These factors do not apply to decorative fuel effect gas appliances nor to inset appliances.

Worked calculation examples

Example 1 (see Figure B.1).

A pre-cast block flue with 125 mm flue pipe in the loft leading to a ridge terminal, designed for a gas fire.

From Table B.2:

inlet resistance of actual flue	= 3.0
outlet resistance of actual flue	= 1.0
inlet resistance of equivalent flue	= 3.0
outlet resistance of equivalent flue	= 1.0

From Table B.1:

other resistances of actual flue:

terminal	1.00
pipe bend	0.25
3.5 m pipe (3.5 × 0.25)	0.87
adapter block	0.50
2 raking blocks	0.60
4.5 m blocks (4.5 × 0.65)	2.93

$$\text{Equivalent height} = 6.5 \times \frac{(3+1)}{(3+1)-(0.25\times 6.5)+6.15} = 3.05 \text{ m}$$

This exceeds 2.0 m and the flue is therefore satisfactory for a gas fire.

NOTE The effective height would be 3.05 + 0.65 = 3.7 m.

Example 2 (see Figure B.2).

A bungalow flue, also using gas flue blocks, designed for a combined gas fire/back boiler unit.

From Table B.2:

inlet resistance of actual flue	= 2.0
outlet resistance of actual flue	= 1.0
inlet resistance of equivalent flue	= 2.0
outlet resistance of equivalent flue	= 1.0

From Table B.1:

other resistances of actual flue:

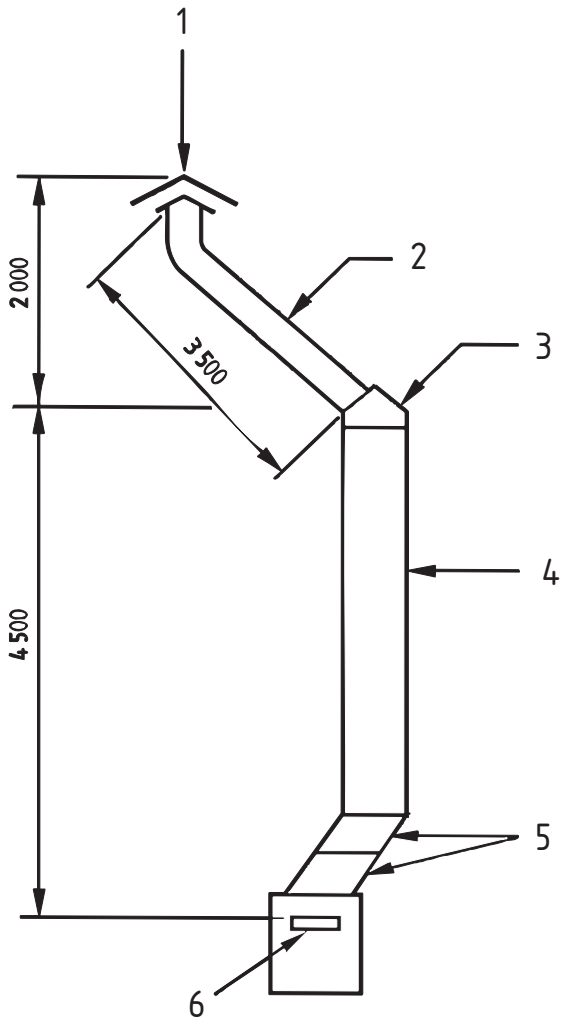
terminal	1.00
pipe bend	0.25
3.5 m pipe (3.5 × 0.25)	0.87
adapter block	0.50
2 m blocks (2 × 0.65)	1.30
	3.92

$$\text{Equivalent height} = 4 \times \frac{(2+1)}{(2+1)-(0.25\times 4)+3.92} = 2.05 \text{ m}$$

This is less than 2.4 m (taken from Table B.3) as well as being less than the 3 m required by BS 7977-2 (see **6.1.4**) and the flue is therefore not suitable for a combined gas fire/back boiler unit.

Figure B.1 **Worked example 1**

All dimensions in millimetres

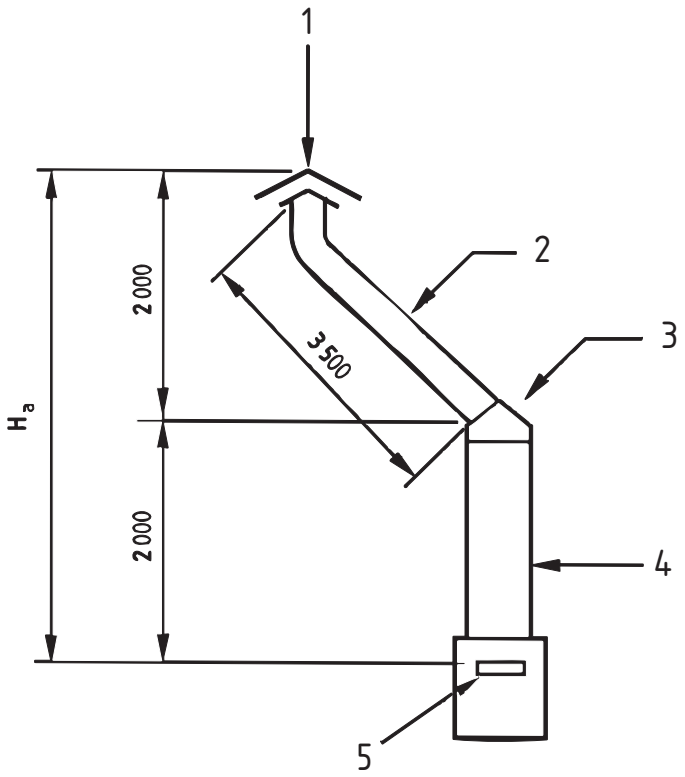


Key

1 Ridge terminal
2 Flue pipe ∅ 125 mm
3 Transfer block (135°)
4 Gas flue blocks, 231 mm × 65 mm
5 Offset blocks
6 Flue spigot

Figure B.2 **Worked example 2**

All dimensions in millimetres



Key

1 Ridge terminal
2 Flue pipe ∅ 125 mm
3 Transfer block (135°)
4 Gas flue blocks, 231 mm × 65 mm
5 Flue spigot

Annex C (normative) Chimney outlet positions

NOTE Terminal positions are given diagrammatically in this annex (Figure C.1 to Figure C.10) for all variations of open flue and room-sealed chimneys for both natural draught and fanned draught.

C.1 Open flue chimney outlet

*COMMENTARY ON **C.1***
*Terminal positions at or near the ridge of a pitched roof are often preferable to those on the slope of the roof (see **6.1.5** commentary and **6.1.8**).*

Additional precautions might be needed in siting a terminal in certain circumstances, such as on sloping site or near to a very large structure.

The heights of the terminals shown in Figure C.1, Figure C.2, Figure C.3, Figure C.4 and Figure C.5 should be increased by 500 mm when there is a sloping hill or embankment which:

- *is within a distance of four times the height of the building; and*
- *has a height between a half and one times the height of the building.*

Further caution is required in more severe circumstances, for example when there is a combination of factors such as external chimney, steep pitch, complex roof geometry, nearby hills, adjacent buildings. In such cases, the height of the terminal above the chimney/roof intersection should be a minimum of 2 m and an extractive terminal used.

Attention is drawn to the Building Regulations [3], [4], [5], [6] in respect of terminal locations relative to adjacent boundaries and properties.

Outlet positions for open flue, natural draught chimneys shall be as specified in Figure C.1, Figure C.2 and Figure C.3 for pitched roofs, in Figure C.4 for flat roofs, in and Figure C.5 for locations near adjacent structures or buildings locations.

Outlet positions for open flue, fanned draught chimneys are shown in Figure C.6 and Figure C.7; where an open flue, fanned draught chimney terminal is located above a flat roof, no part of the terminal shall be within 300 mm of the roof.

A fanned draught chimney terminal shall be positioned as follows:

a) at least 2 m from an opening in a building directly opposite; and

b) so that the products of combustion are not directed to discharge across a boundary;

c) for condensing appliances discharging horizontally, at least 2.5 m from a facing wall, fence, building or property boundary.

Other terminal positions shall be as specified in Figure C.8.

NOTE It is essential that Table C.1, i.e. the key to Figure C.8, is not used in isolation, but only in conjunction with the clause dealing with the type of flue under consideration and in conjunction with Figure C.9 which illustrates how the terminal is to be measured relative to openable elements in the building fabric, e.g. a window.

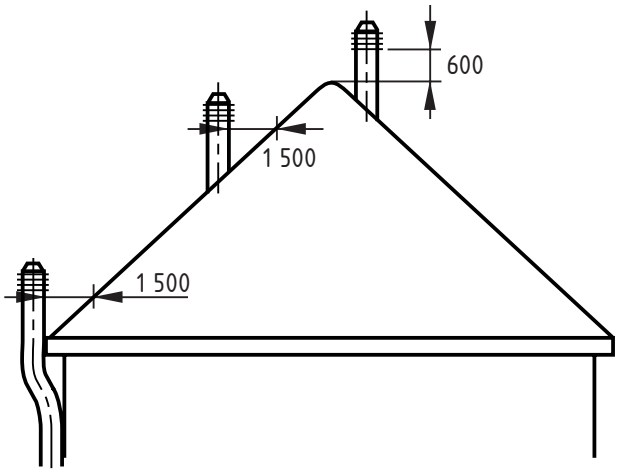
For new and replacement installations the terminal for an open flue natural draught flue system shall not be positioned on a wall surface. The terminal for an open flue natural draught chimney on the apex of a pitched roof shall not be positioned within 1.5 m of a higher structure. The terminal for an open flue natural draught chimney elsewhere on a pitched roof or a flat roof shall not be positioned within 2.3 m of a higher structure.

Where three or more flues terminate in close proximity, the outlet from any one shall not impede on any of the others. Unless outlets are greater than 300 mm apart, all operational terminals or chimney pots shall terminate at the same height and at or above the height of any non-operational terminal or chimney pot. Where multiple chimneys terminate alongside each other, the minimum distance between outlets shall be at least 50 mm.

Ridge terminals which are open on all four sides shall be sited so that they are not less than 300 mm apart.

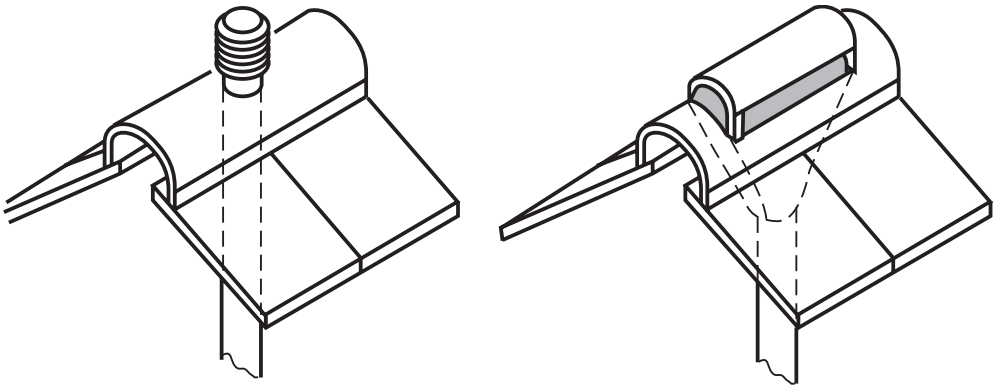
Figure C.1 **Open flue, natural draught chimney outlet locations for pitched roofs**

All dimensions in millimetres



No part of the chimney outlet shall be less than 1 500 mm measured horizontally to the roof surface, or 600 mm above the ridge.

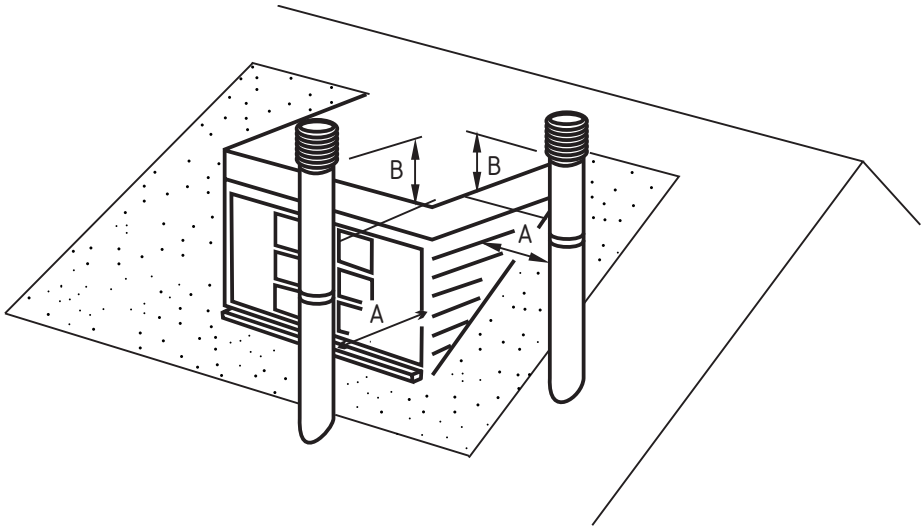
a) Outlet locations with respect to pitch



The outlet shall be positioned so that it is at least 1 500 mm from any adjacent and higher structure, i.e. a gable end wall.

b) Outlet location at ridge tile

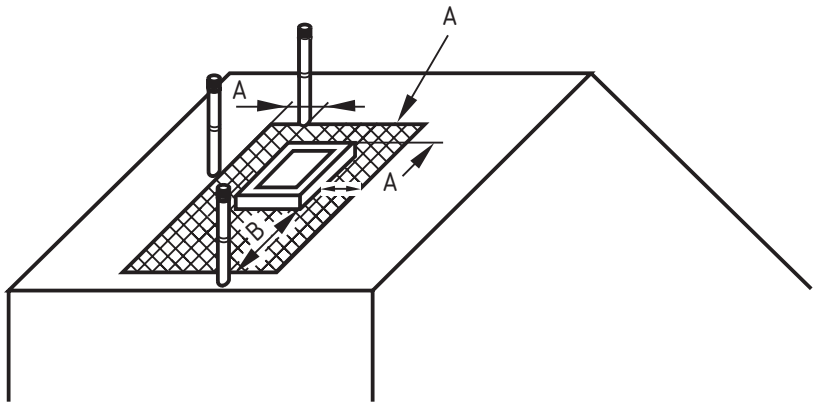
Figure C.2 **Open flue, natural draught chimney outlet locations adjacent to structures on pitched roofs**



If chimney penetrates dotted area such that A is less than 1 500 mm, B shall not be less than 600 mm.

NOTE Examples of a structure referred here include a dormer window, chimney stack or parapet.

Figure C.3 **Open flue or room-sealed, natural or fanned draught chimney outlet locations adjacent to windows or openings on pitched roofs**



Key

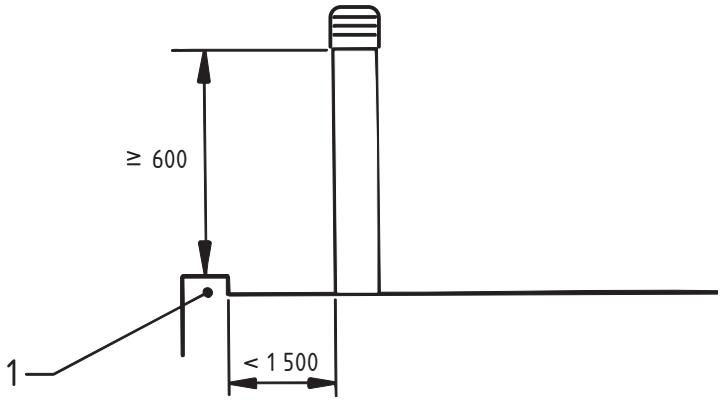
A 600 mm

B 2 000 mm

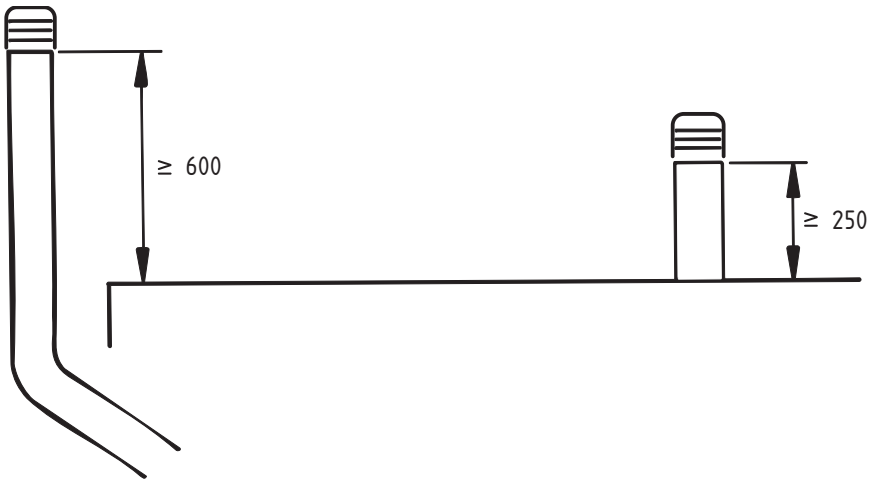
The chimney shall not penetrate the shaded area of the roof and shall otherwise conform to Figure C.1

Figure C.4 **Open flue, natural draught chimney outlet locations on flat roofs**

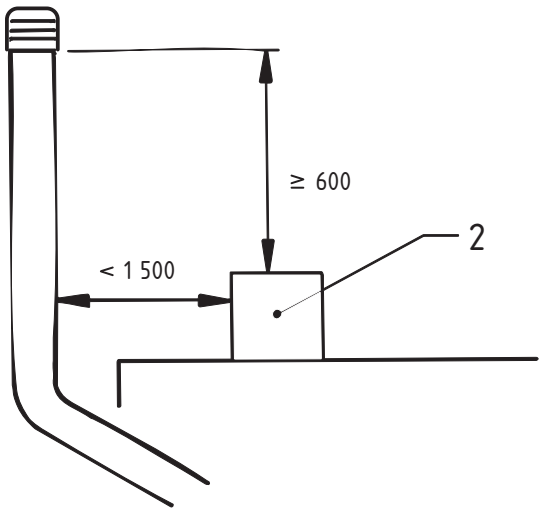
All dimensions in millimetres



a) Flat roof, with chimney close to parapet



b) Flat roof with no parapet



c) Flat roof with structure close to chimney outlet

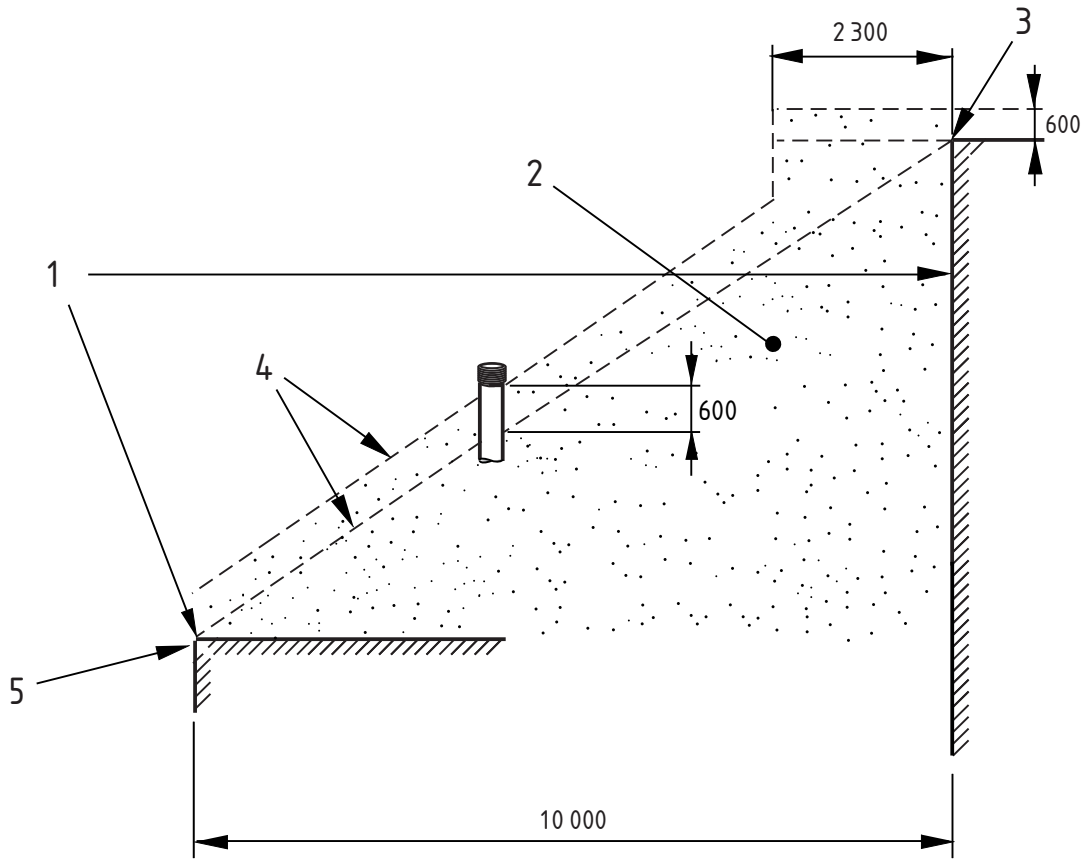
Key

1 Parapet or structure

2 Structure

Figure C.5 **Open flue, natural draught chimney outlet locations near adjacent structures or buildings**

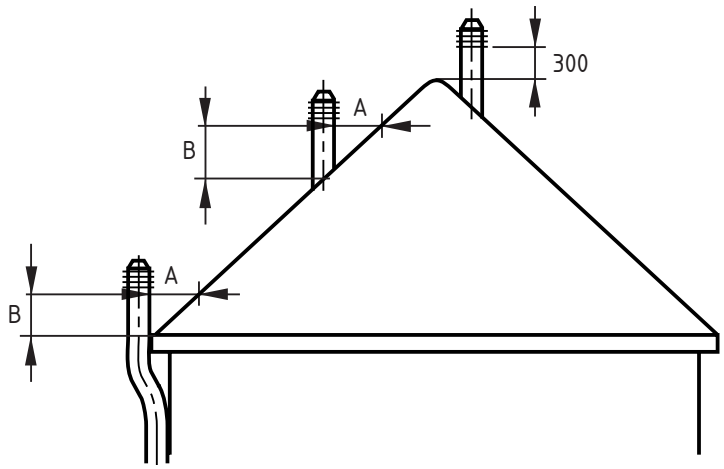
All dimensions in millimetres



Key

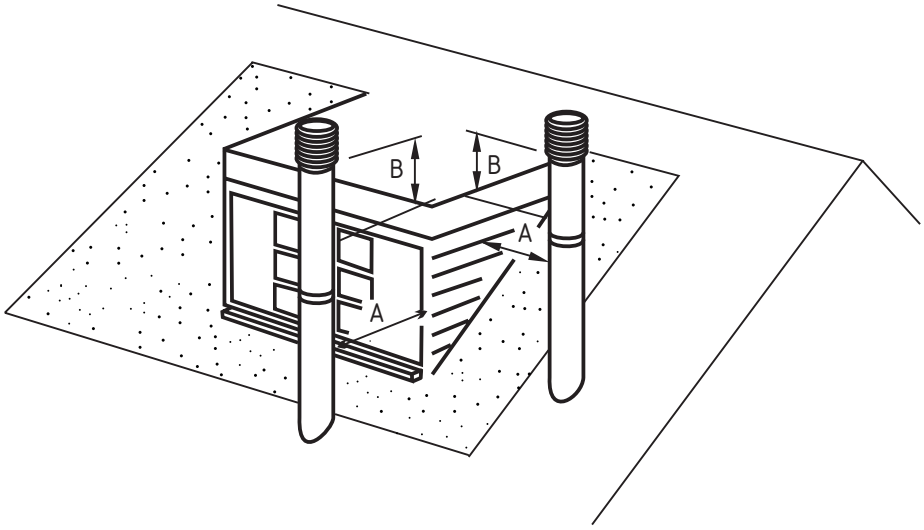
1 These walls may be part of same building or be part of adjacent buildings
2 Prohibited zone
3 Edge of higher structure
4 Imaginary lines
5 Edge of lower structure of flat roof extension or 10 000 mm along from structure, whichever is least

Figure C.6 **Room-sealed configuration outlet location on pitched roofs**



A and B shall be at least 300 mm

Figure C.7 **Open flue, fanned draught chimney and room-sealed configuration outlet locations adjacent to structures on pitched roofs**



If chimney penetrates dotted area such that A is less than 300 mm, B shall not be less than 300 mm.

NOTE Examples of a structure referred here include a dormer window, chimney stack or parapet.

Figure C.8 **Chimney outlet positions**
(Refer to Table C.1 for open flue chimney outlets and Table C.2 for room-sealed chimney configuration outlets)

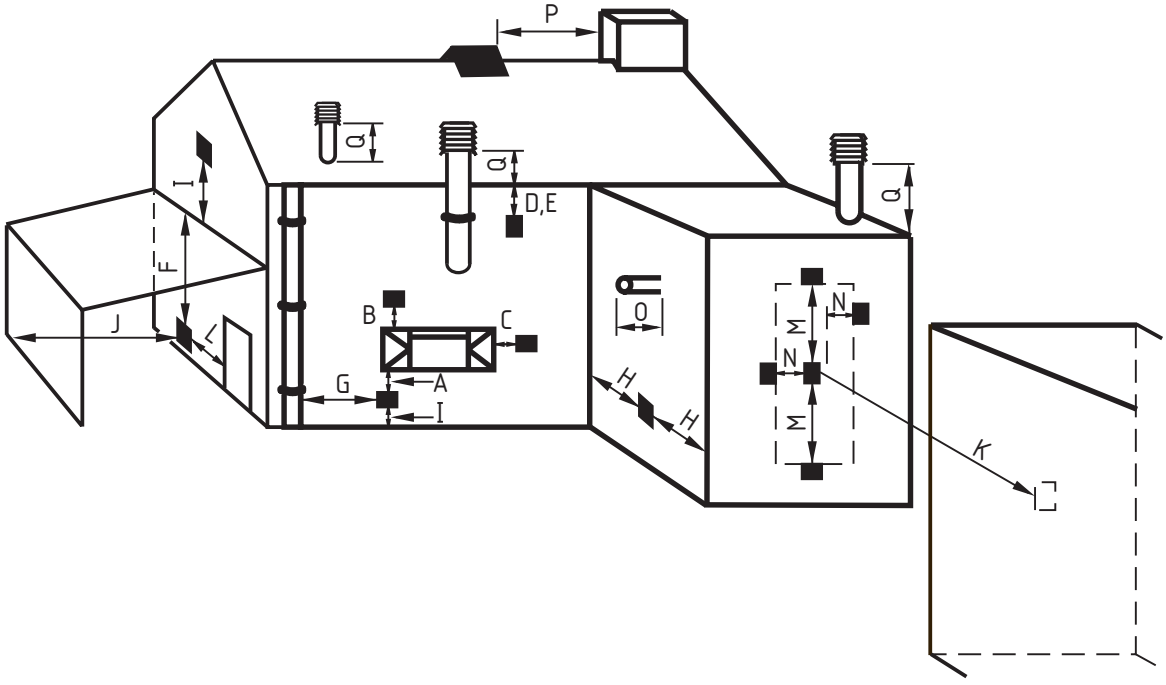


Table C.1 **Minimum dimensions of open flue chimney outlet positions** (refer to Figure C.8)

Symbol	Location	Minimum dimensions	
		Natural draught	**Fanned draught**
A [A)]	Directly below an opening, air brick, opening windows, etc.	Not allowed	300 mm
B [A)]	Above an opening, air brick, opening window, etc.	Not allowed	300 mm
C [A)]	Horizontally to an opening, air brick, opening window, etc.	Not allowed	300 mm
D	Below temperature-sensitive building components, e.g. plastic gutters, soil pipes or drain pipes	Not allowed	75 mm
E	Below eaves	Not allowed	200 mm
F	Below balconies or car port roof	Not allowed	200 mm
G	From a vertical drain pipe or soil pipe	Not allowed	150 mm
H [B)]	From an internal or external corner	Not allowed	200 mm
I	Above ground, roof or balcony level	Not allowed	300 mm
J	From a surface facing the terminal	N/A	600 mm
K	From a terminal facing the terminal	N/A	1 200 mm
L	From an opening in the car port (e.g. door, window) into the dwelling	N/A	1 200 mm
M	Vertically from a terminal on the same wall	N/A	1 500 mm
N	Horizontally from a terminal on the same wall	N/A	300 mm
O	From the wall on which the terminal is mounted	N/A	50 mm
P	From a vertical structure on the roof	1 500 mm	300 mm
Q	Above intersection with roof	See Figure C.1	150 mm

NOTE N/A = Not applicable.

A) In addition, for temperature and structural reasons, the terminal should not be nearer than 150 mm (fanned draught) or 300 mm (natural draught) to an opening in the building fabric formed for the purpose of accommodating a built-in element such as a window frame (see Figure C.9). Separation distances are linked to the rated heat inputs as shown.

B) The reference to external corners does not apply to building protrusions not exceeding 450 mm, such as disused chimneys on external walls for: fanned draught appliances; natural draught appliances not exceeding a net input of 7 kW; any other appliances if detailed in the appliance manufacturer's instructions.

C.2 Room-sealed chimney configuration outlets

C.2.1 Horizontal outlets

Outlets positions for room-sealed chimney configurations are specified in and Figure C.6, Figure C.7, Figure C.8 and Figure C.9.

It is essential that Table C.2 (the key to Figure C.8) is not used in isolation, but only in conjunction with the clause dealing with the type of flue under consideration and in conjunction with Figure C.9 which illustrates how the outlets is to be measured relative to openable elements in the building fabric, e.g. a window.

C.2.2 Vertical outlets

Outlet positions for vertical room-sealed chimney configurations shall be as shown in Figure C.6 or as specified by the appliance manufacturer.

Where two or more vertical fanned draught chimney configurations terminate in close proximity at the same height, they shall be separated by at least 300 mm. Where any one vertical outlet is more than 300 mm above the other, then they shall be separated by at least 1 500 mm.

Where any vertical fanned draught chimney configuration outlets is within 2 000 mm measured horizontally of an opening window, then it shall be at least 300 mm above the opening.

Table C.2 **Minimum dimensions of room-sealed chimney outlet positions** (refer to Figure C.8)

Symbol	Location (kW input expressed in net)		Minimum dimensions	
			Natural draught	Fanned draught
A [A)]	Directly below an opening, air brick, opening windows, etc.	(0–7 kW)	300 mm	300 mm
		(>7–14 kW)	600 mm	
		(>14–32 kW)	1 500 mm	
		(>32–70 kW)	2 000 mm	
B [A)]	Above an opening, air brick, opening window, etc.	(0–7 kW)	300 mm	300 mm
		(>7–14 kW)	300 mm	
		(>14–32 kW)	300 mm	
		(>32–70 kW)	600 mm	
C [A)]	Horizontally to an opening, air brick, opening window, etc.	(0–7 kW)	300 mm	300 mm
		(>7–14 kW)	400 mm	
		(>14–32 kW)	600 mm	
		(>32–70 kW)	600 mm	
D	Below temperature-sensitive building components, e.g. plastic gutters, soil pipes or drain pipes		300 mm	75 mm
E	Below eaves		300 mm	200 mm
F	Below balconies or car port roof		600 mm	200 mm
G	From a vertical drain pipe or soil pipe		300 mm	150 mm [B)]
H [C)]	From an internal or external corner		600 mm	300 mm
I	Above ground, roof or balcony level		300 mm	300 mm
J	From a surface facing the terminal		600 mm	600 mm
K	From a terminal facing the terminal		600 mm	1 200 mm
L	From an opening in the car port (e.g. door, window) into the dwelling		1 200 mm	1 200 mm
M	Vertically from a terminal on the same wall		1 500 mm	1 500 mm
N	Horizontally from a terminal on the same wall		300 mm	300 mm
O	From the wall on which the terminal is mounted		0	0
P	From a vertical structure on the roof		N/A	N/A
Q	Above intersection with roof		N/A	300 mm

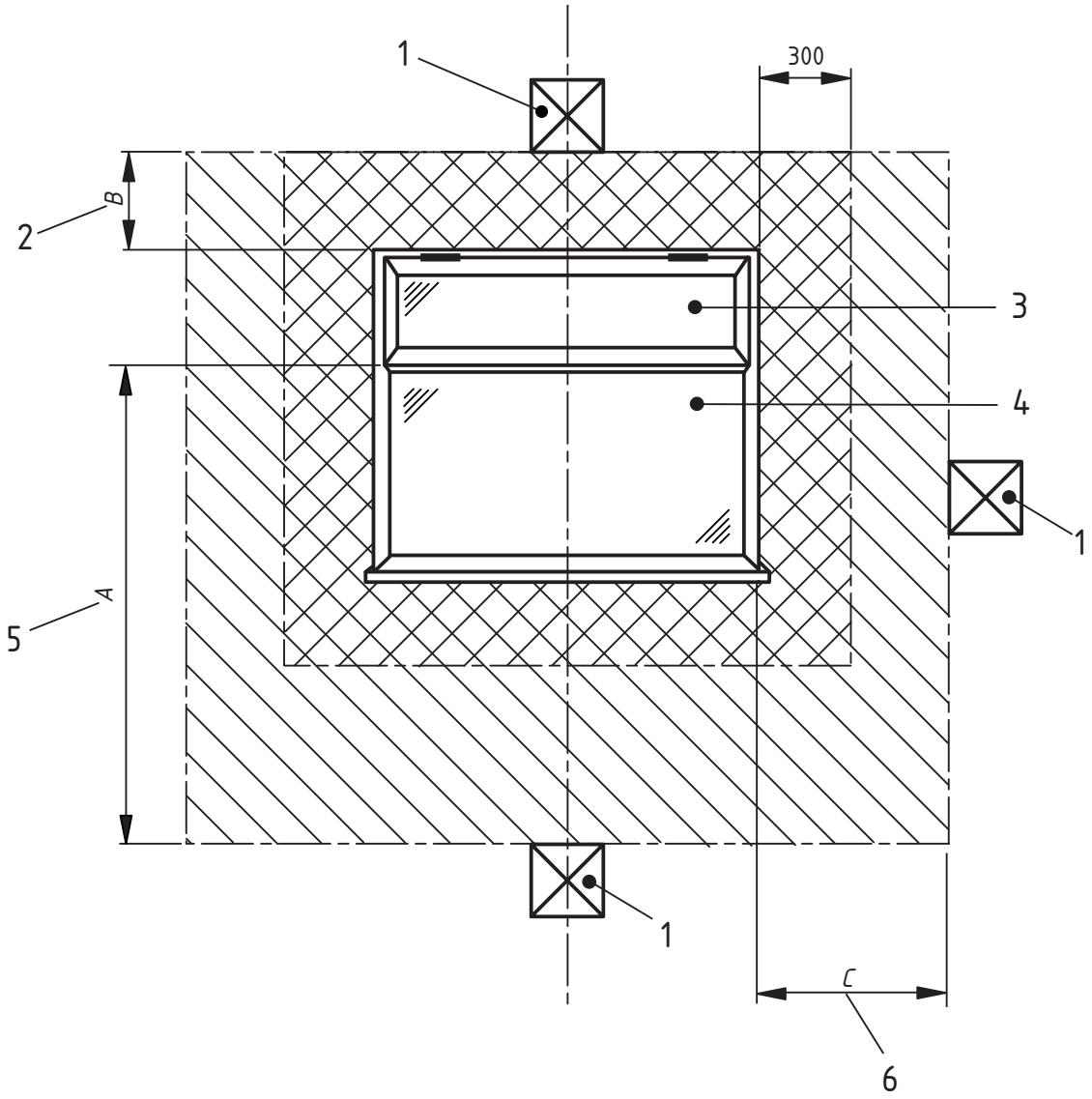
NOTE N/A = Not applicable.

A) In addition, for temperature and structural reasons, the terminal should not be nearer than 150 mm (fanned draught) or 300 mm (natural draught) to an opening in the building fabric formed for the purpose of accommodating a built-in element such as a window frame (see Figure C.9). Separation distances are linked to the rated heat inputs as shown.

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

C) The reference to external corners does not apply to building protrusions not exceeding 450 mm, such as disused chimneys on external walls for: fanned draught appliances; natural draught appliances not exceeding a net input of 7 kW; any other appliances if detailed in the appliance manufacturer's instructions.

Figure C.9 **Example of how a natural draught, room-sealed chimney configuration outlet position is measured**



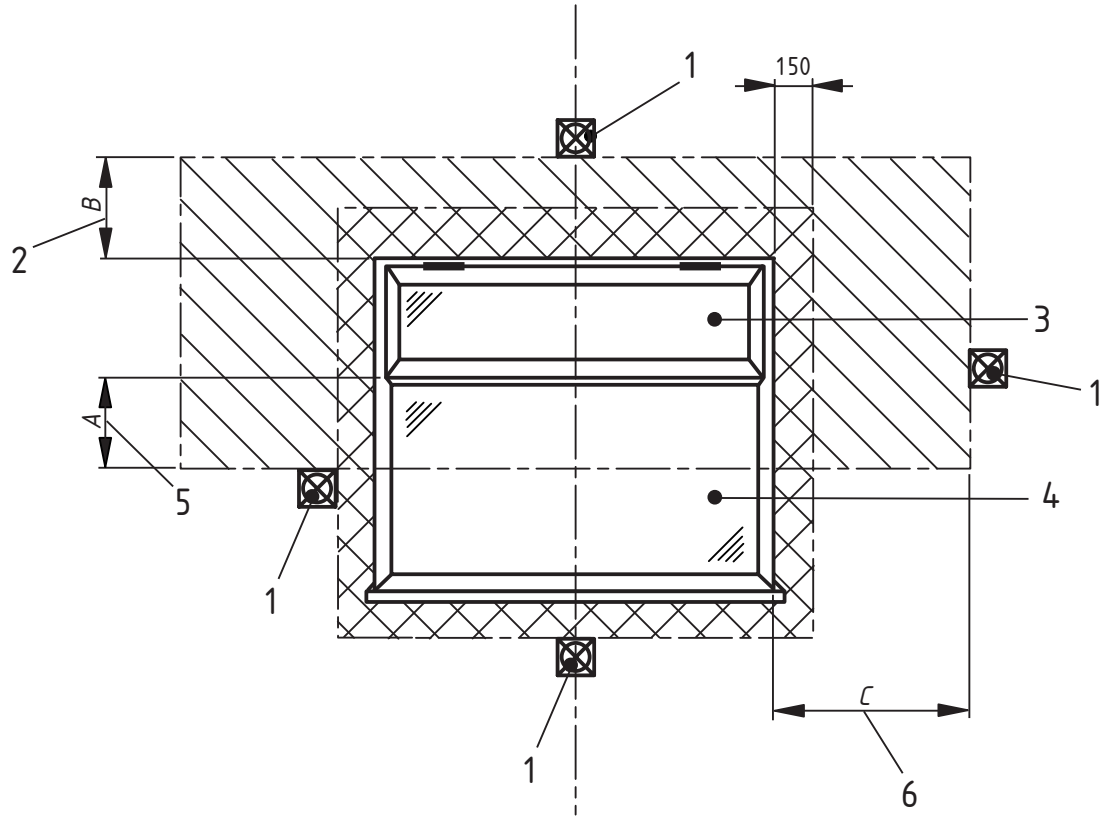
Key

1 Outlet
2 *B* (see Table C.2)
3 Opening window
4 Fixed window
5 *A* (see Table C.2)
6 *C* (see Table C.2)

Chimney outlets prohibited within the hatched zone due to structural and/or temperature issues (see Note to Table C.2)

Chimney outlets prohibited within this zone due to consideration of combustion products

Figure C.10 **Example of how a fanned draught room-sealed chimney configuration outlet and a fanned draught open flue chimney outlet position is measured**



Key

1 Outlet
2 *B* (see Table C.2)
3 Opening window
4 Fixed window
5 *A* (see Table C.2)
6 *C* (see Table C.2)

Air inlet ducts and chimney outlets prohibited within the hatched zone due to structural and/or temperature issues (see Note to Table C.2)

Chimney outlets prohibited within this zone due to consideration of combustion products

C.3 Proximity of flue duct outlets to boundaries

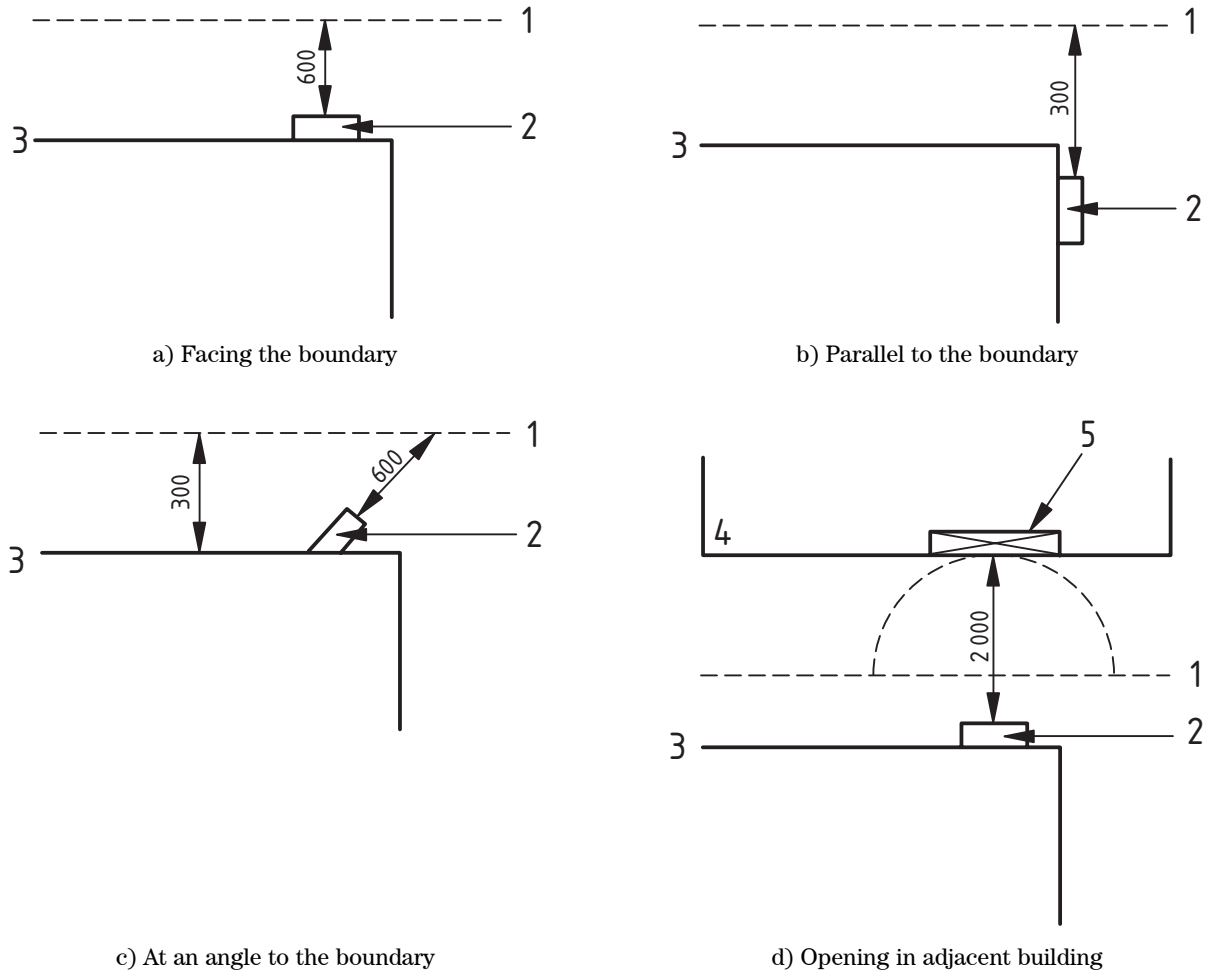
A flue duct outlet of an appliance shall be sited so that it is at least 600 mm [see Figure C.11a)] from the boundary line when facing it and at least 300 mm from the boundary line when running parallel to it [see Figure C.11b)].

NOTE 1 Where the flow of products of combustion is not at right angles to the boundary, the 600 mm dimension may be measured in the direction of flow as long as the terminal is not less than 300 mm from the boundary [see Figure C.11c)].

NOTE 2 It is recommended that terminals are not sited within 2 m of an opening in an adjacent building [see Figure C.11d)] or within 2 m of the boundary facing the terminal if the plume from the appliance is likely to cause a nuisance to a neighbour, e.g. a condensing appliance discharging over a walkway or patio. For further guidance see "Guide to the Condensing Boiler Installation Assessment Procedure for Dwellings" published by ODPM (now CLG) [23].

Figure C.11 **Proximity of flue duct outlet to a boundary**

All dimensions in millimetres



Key

1 Boundary
2 Terminal
3 Building
4 Adjacent building
5 Window

Annex D (informative) Guidance on the design and installation of flue block systems in the UK

D.1 General

When designing and installing a gas flue block system it is essential to ensure that:

a) the gas flue blocks conform to BS EN 1806 (clay) or BS EN 1858 (concrete);

b) the flue block system is installed in accordance with the flue manufacturer's installation instructions;

c) any surplus jointing material projecting into or deposited in the flue is removed during installation;

d) the additional guidance given in **D.2** to **D.9** is followed.

NOTE 1 This annex does not give design criteria for the wall containing the flue block system, e.g. structural stability, sound transmission and thermal insulation.

NOTE 2 Examples of typical gas flue blocks are shown in Figure D.1 and typical gas flue block installation layouts are shown in Figure D.2, Figure D.3 and Figure D.4.

D.2 Design considerations

The satisfactory performance of a complete flue system is dependent on ensuring that its layout and construction is correctly carried out. The following design considerations should be followed.

a) The flue should take the most direct practicable route from the appliance to the outlet. Where practical an essentially vertical route from the appliance to the outlet is desirable with the minimum of inclined runs of flue (see **6.1.4**).

b) The layout of the flue should be designed to avoid affecting or cutting into supporting joists, beams, roof timbers and any other load bearing elements of the building.

c) A minimum of 600 mm of vertical flue directly above the appliance connection or the recess created by the starter and cover gas flue blocks should be provided.

d) The gas flue block system should have an equivalent height at least equal to that required for the appliance to be connected to the flue system, as recommended in this British Standard.

e) When a gas flue block system is to be connected to a terminal using a flue pipe system the recommendations given in **D.8** should be followed.

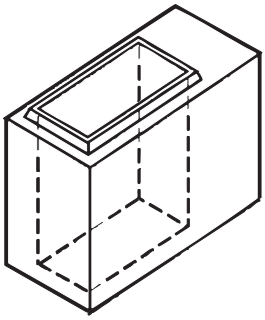
f) When using bonded gas flue blocks, the design and installation should take into account the height of the starter block and the height of the lintel block, to ensure that the gas flue blocks above align with and bond into the masonry courses.

g) The layout of the complete flue from the outlet of the appliance to the outlets should be designed to meet the flue requirements of the appliance to be installed including, where necessary, the appropriate starter units and lintel block to provide the recess opening required to accommodate the appliance.

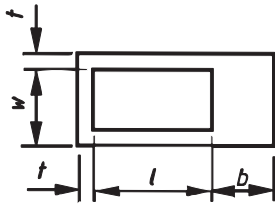
NOTE The starter units and cover block should not be altered or cut to accommodate the appliance.

h) Flue block systems should only be used where the gas appliance manufacturer's instructions state that it is permitted. The connection should be by a direct and standard connection to the starter block or by the use of purpose-designed ancillary components provided by the gas appliance manufacturer.

Figure D.1 **Gas flue blocks**

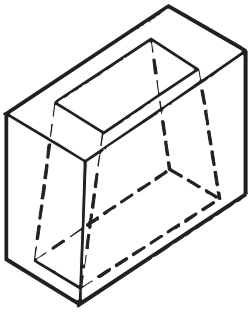


NOTE Flue block may be assembled spigot or socket uppermost.

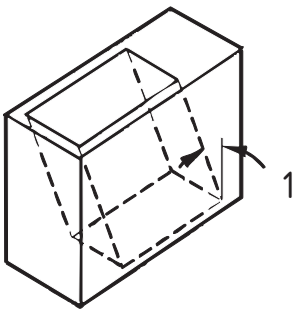


l is the length of flue
w is the width of the flue
t is the wall thickness
b is the bonding extension ($\geqslant$75 mm)

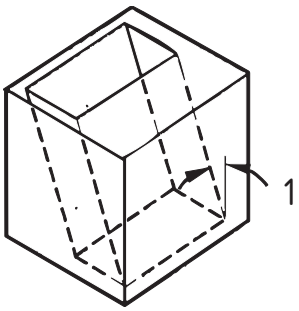
a) Straight section bonding block



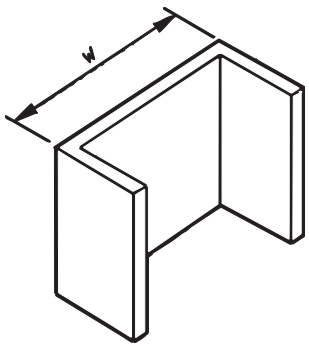
b) Lintel cover block



c) Lateral offset block

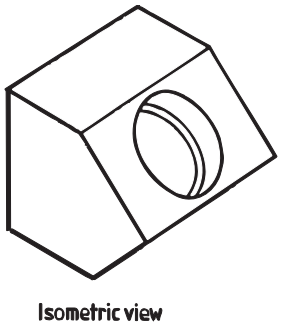


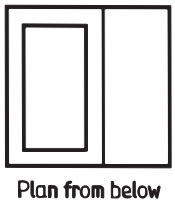
d) Rear offset block

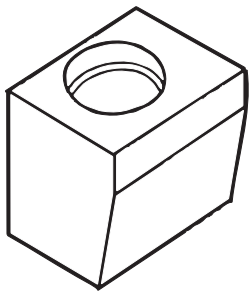


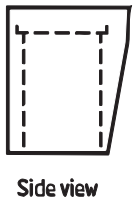
w is the width of opening

e) Starter block/access component

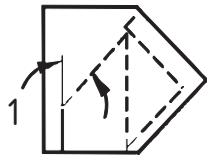








g) Transfer block (straight)

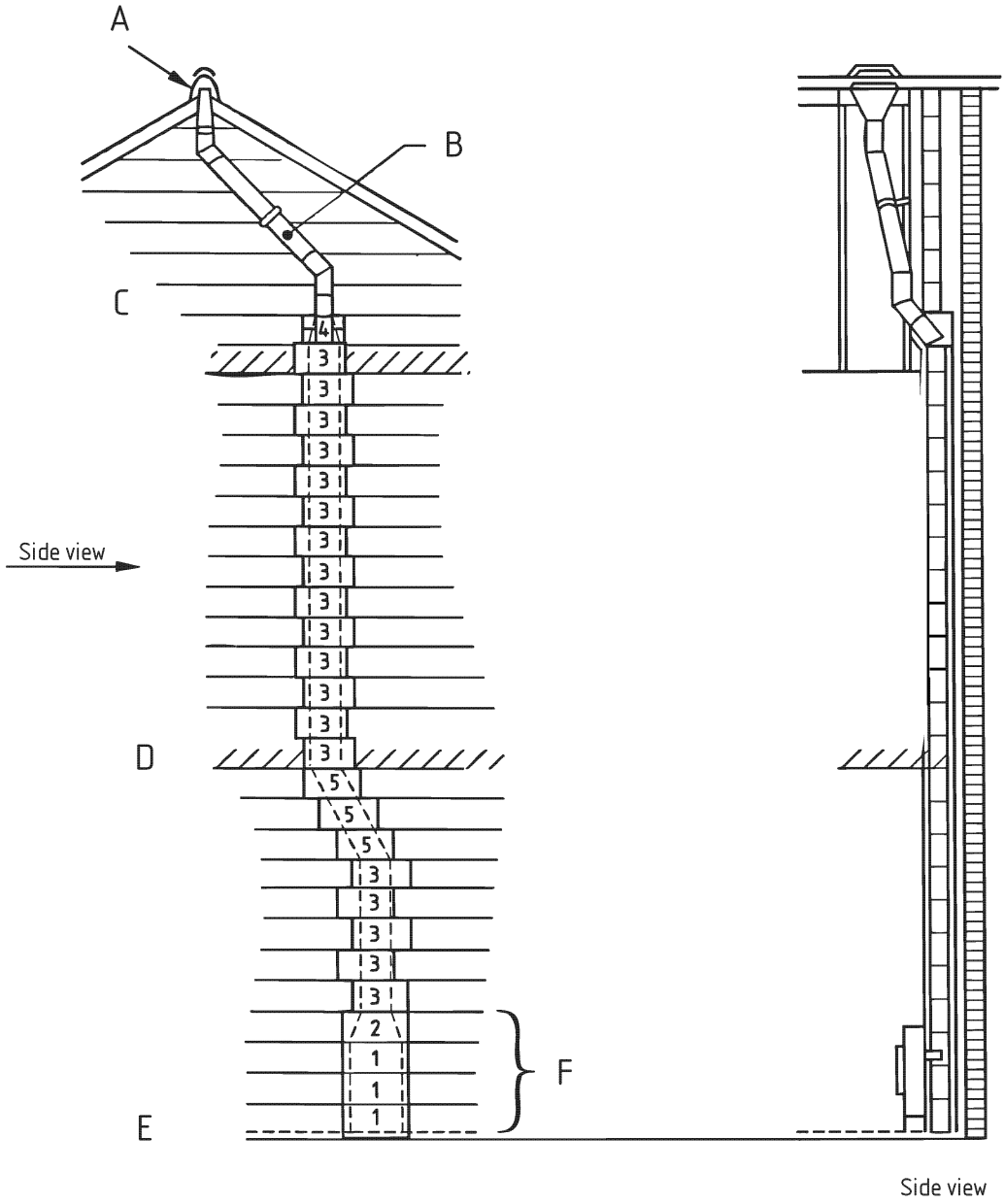


f) Transfer block (offset)

Key

1 Angle of offset

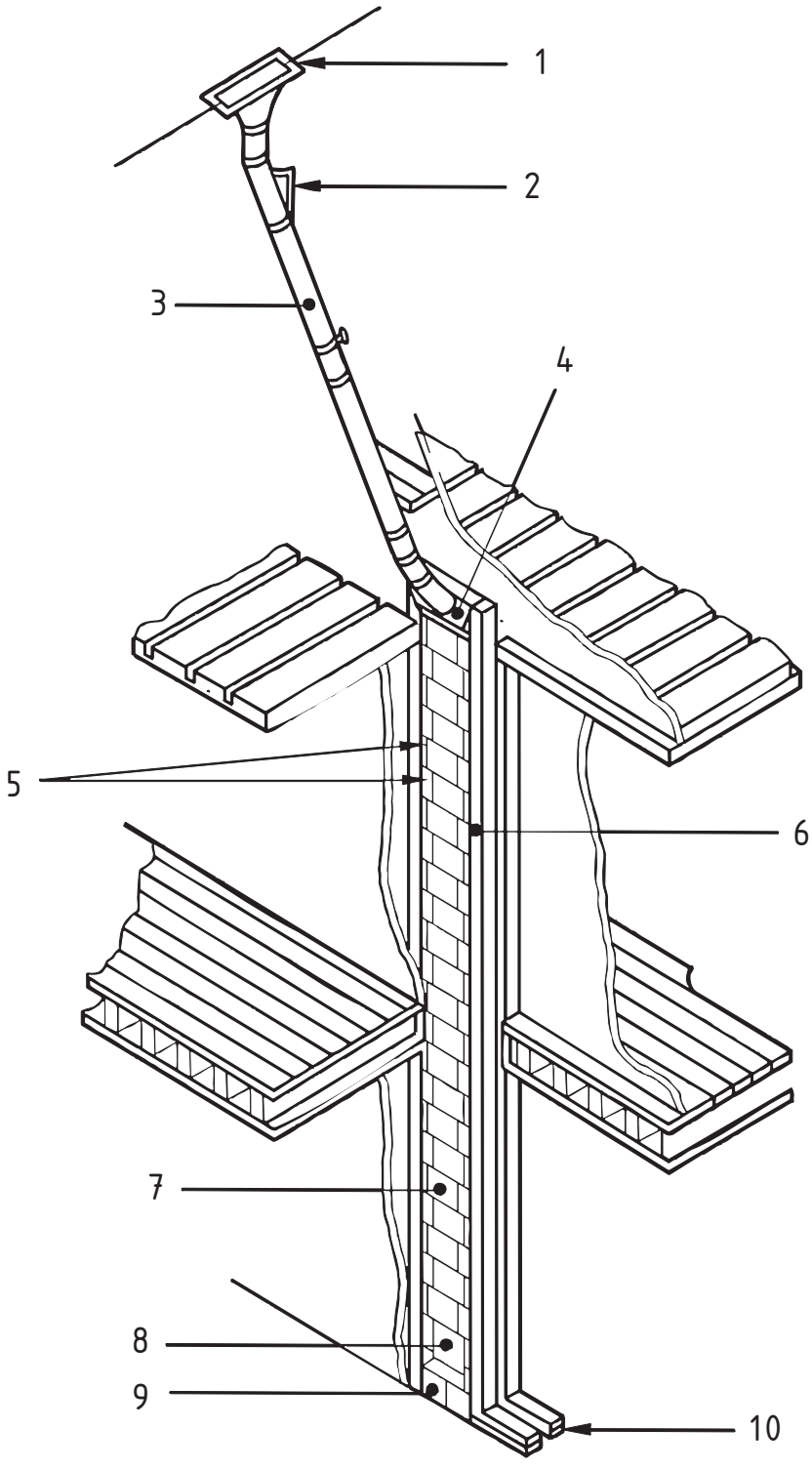
Figure D.2 **Typical flue block systems (general arrangement)**



Key

1 Starter block/access component [see Figure D.1e)]
2 Lintel cover block [see Figure D.1b)]
3 Straight section bonding block [see Figure D.1a)]
4 Transfer block (offset) [see Figure D.1f)]
5 Lateral offset block [see Figure D.1c)]
A Ridge terminal
B Secondary flue
C Roof space
D First floor
E Ground floor
F May be produced as one or two piece set

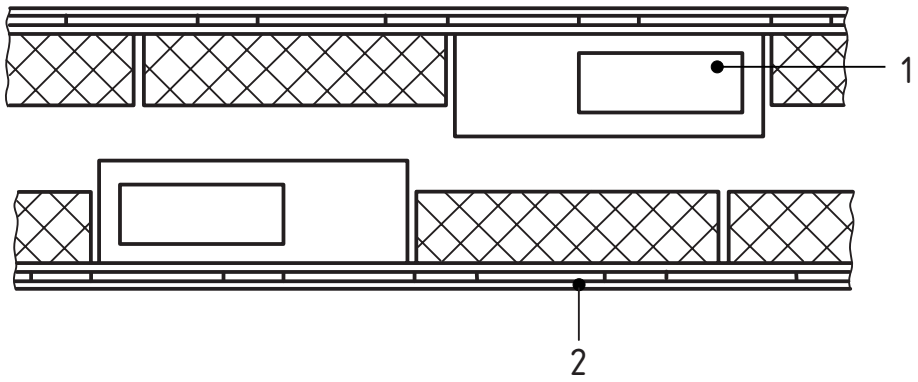
Figure D.3 **Bonded gas flue block system for timber frame construction**



Key

1 Ridge title adaptor
2 Flue support brackets
3 Secondary flue
4 Offset transfer block
5 Alternate spacer blocks
6 Galvanized steel U channels for flue support without restricting vertical movement
7 Plain flue or bonding blocks
8 Starter block
9 Plain masonry units
10 Sole plates

Figure D.4 **Typical construction details for gas flue block systems in internal walls**

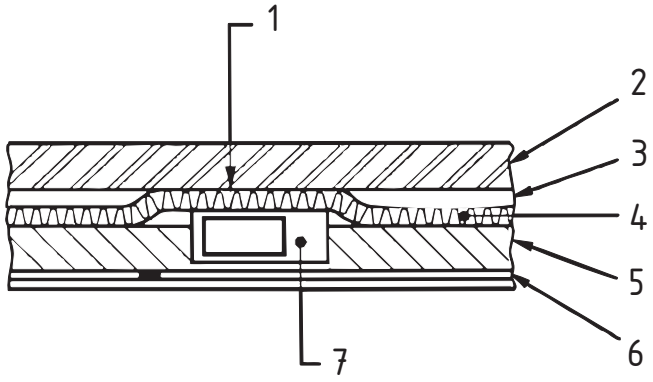


Key

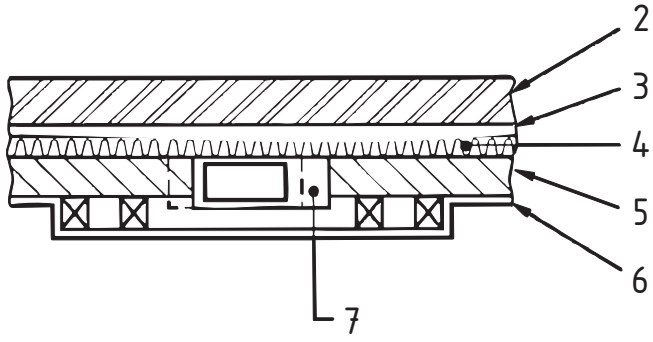
1 Flue block (stagger flues in accordance with the manufacturer's instructions)

2 Gypsum-based board (nominal 8 kg/m^2) on dabs

Figure D.5 **Typical construction details for gas flue block systems in external walls**



a) Cavity wall with insulation (d.p.m. with cavity barrier)



b) Insulated wall (with or without cavity). Projecting flue

Key

1 Brick

2 Cavity

3 Flue block

4 Vertical d.p.m.

5 Non-combustible insulation

6 Block

7 False breast

D.3 Temperature effects

The following design considerations should be followed.

a) Due to possible high surface temperature on the wall directly above an appliance the gas flue blocks should not be directly faced with plaster, otherwise unsightly plaster cracking might occur. They should either be faced with brick or insulating blockwork (or similar materials), or with a plasterboard facing with an air space or insulation material between the outer surface of the gas flue blocks and the facing material.

b) When a facing is placed in front of the gas flue blocks it is essential that any gaps created between the gas flue blocks and facing around the recess opening is permanently sealed.

c) It is considered good practice to provide a minimum clearance of 50 mm between the inner face of the gas flue blocks and any adjacent structural timbers such as floor joists or roof trusses. However, non-structural timber such as floor boards, skirting, dado and picture rail may be placed against the gas flue blocks.

d) Fixing devices should not penetrate any of the gas flue blocks.

e) Where a flue block system is constructed as part of an external wall, the cavity at that location should be insulated with appropriate non-combustible material to a distance of 200 mm either side of the vertical path of the flue. Such material should be applied so that it does not compromise the damp-proofing or water shedding construction of the cavity.

D.4 Outlets

The outlet of the flue should be sited and be in accordance with this British Standard to ensure that the products of combustion can be safely dispersed into the outside atmosphere.

a) When a gas flue block system is to be connected to a terminal using a flue pipe system the recommendations given in **D.8** should be followed.

b) If a masonry chimney stack is required to be above the roof line, the gas flue blocks should be continued up to the outlets and be surrounded in the desired masonry cladding that should provide the necessary structural stability and weatherproofing including provision of flashings and damp-proof courses to prevent entry of water into the building.

   Alternatively, clay flue liners in accordance with BS EN 1457 or concrete flue liners in accordance with BS EN 1857 may be used provided they have a minimum internal diameter of 125mm or cross sectional flue dimensions that match the gas flue blocks or outlet of the transfer block.

c) The gap between the liners and surrounding masonry cladding may be left as a small air space or preferably filled with a lightweight insulating backfill, such as a weak mix concrete consisting of expanded clay pellets mixed with Ordinary Portland cement in the ratio by volume of 1 part cement to 20 parts of pellets with a small amount of potable water.

d) The free-standing height of the masonry chimney stack should be structurally stable. It is good practice for the maximum free-standing height of a masonry chimney stack to be no greater than 4.5 times the smallest horizontal cross-section of the stack measured at the point where it intersects with the roofline or last point of structural restraint.

D.5 Installation of the gas flue blocks

The following procedure should be used.

a) Each gas flue block should be examined before installation. Any gas flue blocks which are broken or cracked should not be used. Minor surface damage or imperfections should be acceptable provided this does not affect satisfactory construction and jointing. No gas flue block should be cut or altered unless this is specifically permitted by the flue manufacturer.

b) Bonded gas flue blocks should be built in, course by course, with the surrounding masonry as the work proceeds and bonding should begin immediately above the starter or cover block. It is important to ensure that gas flue blocks having a bonding nib are built with the nib being positioned on alternate sides as each successive course is laid to achieve structural integrity of the wall.

c) Non-bonded gas flue blocks or blocks designed to be built free-standing or against a wall should be properly supported or tied into adjacent walls in accordance with the flue manufacturer's installation instructions.

d) Inclined sections of flue should only be made using the appropriate offset gas flue blocks.

e) The gas flue blocks should be laid and jointed in accordance with the flue manufacturer's installation instructions, which might specify assembly with the spigot or socket of the block being uppermost.

f) Joints between gas flue blocks should be fully bedded and sealed with jointing material to produce a continuous flue. Any jointing material that projects into or is deposited in the flue should be removed during installation to ensure that there is no obstruction in the flue.

NOTE Particular care is needed to ensure deposits of jointing material do not accumulate or set where the flue is offset.

D.6 Jointing material

A choice of jointing materials might be recommended in the flue manufacturer's installation instructions, such as fire cement or silicone compound in cartridge form applied using a caulking gun. This method allows greater accuracy in jointing gas flue blocks.

a) Jointing material, such as ready mix fire cement, refractory hydraulically setting mortar or standard mortar as used for constructing blockwork walls might also be recommended. However, as these materials are usually applied by trowel, particular care is needed to ensure complete joints are made and that any excess material is removed from the flue.

b) Whatever jointing material is used it should be proven as being able to withstand the temperatures and products of combustion created during the operation of the heating appliance.

c) As some of these jointing materials can take many hours to harden, the flue construction should be protected against exposure to rain. It is recommended that a partially built flue construction is covered by a waterproof sheet at the end of each day or when heavy rain is encountered.

D.7 Gas flue block installations projecting into cavity wall construction

When gas flue blocks project into or across the cavity of an external cavity wall, so reducing or eliminating the cavity, a non-combustible vertical damp-proof membrane (d.p.m.) should be inserted and secured behind the gas flue blocks as the installation proceeds. Non-combustible insulation material can be used to hold the membrane in position (see Figure D.4).

D.8 Flue pipe system installation in roof space connecting to the outlets

The following procedure should be used.

a) When a gas flue block system is to be connected to an outlet above the roof or at the roof ridge using a flue pipe system, the flue pipe system should have a minimum flue diameter of 125 mm and be a factory made double wall flue system in accordance with BS EN 1856-1.

NOTE Single wall metal flue pipe or flexible flue liners are not to be used for this purpose.

b) A transfer block should be used to facilitate the connection to the flue pipe system and be located to ensure that the flue pipe system can take the most practicable vertical route to the outlets without an excessive inclined run.

c) The flue pipe system should be installed and supported in accordance with the flue pipe manufacturer's installation instructions. It is good practice for support brackets to be used at intervals not exceeding 1.8 m of flue run and at bends in the flue system, or as directed by the flue pipe manufacturer's instructions. If connected to a ridge terminal the flue pipe system should not be supported by the ridge tile adapter or terminal.

d) The flue pipe system should generally be installed at an angle not more than 45° from the vertical (see **6.1.4**).

e) If adjustable bends are used care should be taken to ensure that they are not strained such as to cause damage or structural breakdown of the internal wall of the flue.

f) Flue pipe system components should not be cut unless specifically permitted in the manufacturer's installation instructions.

g) All joints should be checked to ensure that they are securely made and any components that are damaged, particularly at the joints or in the flue are not used.

To ensure that a flue can perform satisfactorily, it is essential that the installation is in accordance with the required specification and that regular checks are carried out during construction, followed by a final inspection once the entire flue has been completed.

D.9 Checking the gas flue blocks during and after installation

D.9.1 To ensure that a flue can perform satisfactorily, it is essential that the installation is installed in accordance with the recommendations given in this annex and that regular checks are carried out during construction, followed by a final inspection once the entire flue has been completed. The following guidance should therefore be followed.

a) Ensure that all the gas flue blocks, including any starter and lintel blocks are in good condition and installed correctly.

b) Check that all joints have been correctly made to achieve a completely sealed joint.

c) Visually inspect the flue and remove any excess jointing material or mortar that has extruded or dropped into the flue.

d) To ensure that all joints have been correctly made it is recommended that the flue flow smoke test specified in **5.3.2.2** is carried out on the flue block installation when it reaches each floor joist level and once the last block or transfer block is installed. The top of the flue can be closed off (e.g. by a bag filled with sand) for a more severe test that should readily indicate whether there are any incomplete joints or faults that require remedial action.

D.9.2 When the flue has been completed, carry out a visual inspection to ensure the following has been achieved.

a) That the gas flue blocks, and if used the flue pipe system, have been installed correctly to the required layout to create a continuous flue to the outlet.

b) That all joints have been properly sealed.

c) That the flue throughout its length is clear of any jointing material, mortar or debris.

d) That any flue pipe system, if used, is correctly installed and supported.

e) That the correct terminal is securely fitted in the correct position.

D.9.3 Once the visual inspection has been satisfactorily completed, including where necessary any remedial action that is required, the flue flow smoke test specified in **5.3.2.2** of this British Standard should be carried out prior to installation of the appliance.

NOTE When carrying out the flue flow test it is useful to have an additional person who can examine the flue construction if it passes through a roof space or loft. Where the flue is built into a cavity wall it is recommended that a check is made to ensure that no smoke leaks into the cavity, which might indicate a poorly made or incomplete joint between the gas flue blocks.

Should it be discovered that poor or incomplete joints have been made, it might be possible to consider remedial solutions such as applying a specialist sealant in the flue to seal any incomplete joints. However, any sealant applied should not reduce the area of the flue and should be proven suitable for this purpose.

Annex E (informative) Checking of case seals and the general integrity of room-sealed fan assisted positive pressure gas appliances

The checklist in Figure E.1 gives the current agreed gas industry guidance on the checking of case seals and the general integrity of room-sealed fan assisted positive pressure gas appliances.

Figure E.1 **Checklist for checking of case seals and the general integrity of room-sealed fan assisted positive pressure gas appliances**

Step 1

Before the case is put back on the appliance the following checks should be carried out:

- are any water leaks evident?
- is the backplate or case corroded?
- where corrosion is evident, is it likely to affect the integrity of the case, backplate or seal?

  NOTE The extent of the corrosion should be carefully checked with a sharp instrument e.g. a screwdriver. If the instrument does not perforate the corroded area, this should be deemed acceptable, but the gas user should be advised of the problem and potential consequences if a repair is not made.
- are the combustion chamber insulation linings intact?
- is the backplate or the case distorted or damaged? Pay particular attention to the area where the case and seal meet. This may have been caused by explosive ignition of the main burner.
- is the case sealing material intact and in good condition (e.g. pliable, free from discoloration, trapped debris, etc.)? Will it continue to form an adequate seal between the case and the backplate?
- is anything trapped or likely to be trapped when the case is put back on (e.g. wires, thermocouple capillaries, tubes, etc.)?
- are other gaskets and seals intact?
- is the pilot inspection glass undamaged?
- are the case fastenings and fixings (including fixing lugs) in good condition (e.g. screws/nuts stripped)?
- are there any signs of discoloration on or around the appliance, which may have been caused by leaks of products of combustion from the appliance?

Rectify any defects identified in Step 1 as necessary and proceed to Step 2.

NOTE Where defects are identified they should be classified using the following criteria in accordance with the current CORGI Gas Industry Unsafe Situations Procedure. Where there are inappropriate or missing case fittings or defective seals, which cannot be remedied, but there is no evidence of leakage, the appliance should be classified as At Risk (AR). If there is evidence of actual leakage, then the appliance should be deemed Immediately Dangerous (ID). Where suitable replacement seals are no longer available the appliance should be classed as ID and regarded as obsolete.

Step 2

When the case has been put on the appliance the following checks should be carried out:

- is the case fitted correctly?
- is a "mark" visible showing that the case had previously been fitted closer to the backplate?
- are all the case screws adequately tightened?
- is a bright area visible on the screw thread of any of the case securing screws, indicating that the screw was previously secured more tightly?
- is anything trapped and showing through the case seal?

Rectify any defects identified in Step 2 as necessary. Proceed to Step 3.

Step 3 – Operate/light the appliance.

Ensure that the main burner remains lit (i.e. set the appliance and room thermostats to their highest settings).

Check for possible leakage; initially this can be done by running your hands around the boiler casing and backplate.

Then check for possible leakage, etc. as in Step 4 where practicable.

Step 4 – Check for possible leakage of combustion products from the appliance.

Where joints have been disturbed, check with leak detection fluid to confirm that there are no gas escapes. Check for possible leakage of combustion products from the appliance using a taper, an ordinary match, or similar. (A taper can be used to get into less accessible locations.)

NOTE Whilst smoke tubes and smoke matches can be used, the results may require further interpretation and these methods are currently being validated.

Light the taper/match and allow the flame to establish. Position the flame very close to the case seal or any possible leakage point (e.g. back panel).

The flame will be blown quite easily by the draught caused by a leak. Move the taper around the entire seal, using fresh tapers as required.

To investigate the seal at the bottom of the case – hold the lit taper between the bottom of the case and the appliance control panel. Does the flame flicker slowly or is it disturbed by leakage flowing from the case? Try the taper in several positions.

ATTENTION: DO NOT confuse natural convection with leakage. DO NOT look for a gas escape with this method.

Rectify any defects as necessary and re-check. If still unsure seek expert advice.

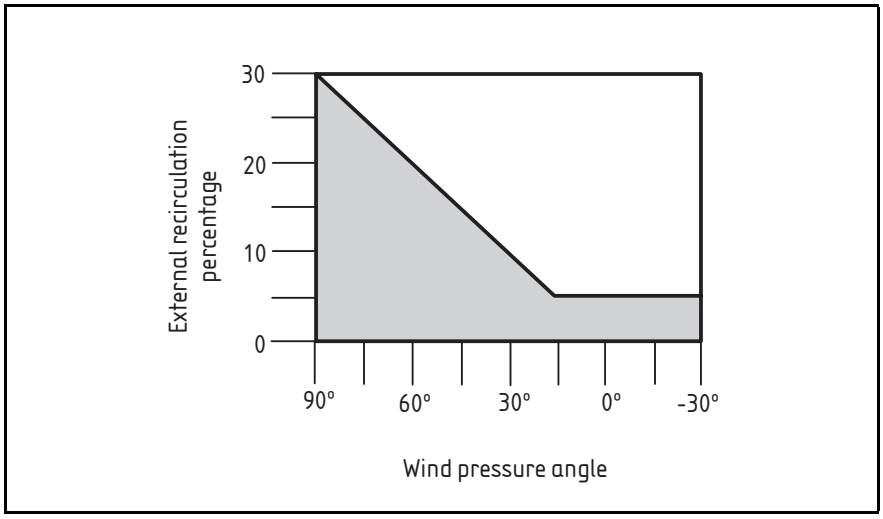
NOTE When using this method, be careful not to set fire to surrounding fixtures/furnishings.

Annex F (normative) Design criteria for terminals for shared system chimneys

Terminals for shared system chimneys shall fulfil the following requirements:

- The terminal shall have proven aerodynamic properties so that under wind conditions the pressure in the flue duct will always be lower than the pressure in the air intake duct.
- The percentage of recirculation of combustion products into the air entry shall fall within the shaded area of the Figure F.1, even under wind conditions.

Figure F.1 **Permitted recirculation of combustion products**



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[5] This edition of BS 715 is withdrawn.
[6] Withdrawn, superseded by BS 1289-1:1986.
[7] Withdrawn, superseded by BS EN 1858:2003.
[8] Withdrawn on publication of BS 5440-1:2008.

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