

BRITISH STANDARD

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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 1: Specification for installation and
maintenance of flues**

ICS 91.060.40

**BS 5440-1:
2000**

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Committees responsible for this British Standard

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British Flue and Chimney Manufacturer's Association
Centrica
Combustion Engineers' Association
Consumer Policy Committee of BSI
Council for Registered Gas Installers
Department of Trade and Industry
Gas Consumers Council
Health and Safety Executive
Institute of Domestic Heating and Environmental Engineers
Institution of Gas Engineers
Liquified Petroleum Gas Industry Technical Association
Society of British Gas Industries
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Foreword

This British Standard has been prepared under the direction of the Engineering Sector Board. It is a revision of the Specification BS 5440-1:1990 which is superseded and withdrawn.

This revision has been undertaken for the following reasons:

- a) to cover recent developments in appliance design, flue material and practical experience in the disposal of products of combustion by means of flues;
- b) to recognize and refer to recent changes in gas safety and building legislation;
- c) to cover recent developments in European Standards and anticipate future applications;
- d) to improve advice on flue and ventilation installation practices and reduce occurrences of CO induced incidents attributable to flues and ventilation for gas appliances.

NOTE This standard is written as a practice specification (see clause 6 of PD 6501-1:1982) supported by recommendations. To comply with this specification, the user has to comply with all of its requirements. The user may depart from recommendations, but this would be at the user's own responsibility and the user would be expected to have good reasons for doing so.

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

This standard allows gas appliance and/or flue and chimney manufacturer's instructions to recommend a method of installation, testing, commissioning or maintenance which differs in points of detail from this standard. This reference to manufacturer's 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.

In particular, attention is drawn to the following regulations. The regulations may be amended from time to time and whichever regulations are currently in force at the time an installation is carried out should be complied with. The advice in this British Standard reflects the present state of the regulations in 2000.

- a) **The Gas Safety (Installation and Use) Regulations** [1]. 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 may undertake gas work.
- b) **The building regulations** [2] for the appropriate legislative region. These control work carried out in the construction of new or extension of existing buildings. Detailed advice for combustion appliances in England and Wales is given in approved documents [3], and for Northern Ireland in technical documents [4]. The Building Standards (Scotland) [5] are accompanied by methods that are deemed to conform to standards.
- c) **The Gas Appliance (Safety) Regulations** [6] control the supply of new gas appliances and specifies the conditions required for CE marking.

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **A1**. Tags indicating changes to text carry the number of the amendment. For example, text altered by amendment no. 1 is indicated by **A1** **A1**.

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 does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 87 and a back cover.

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1 Scope

1.1 Equipment

This Part of BS 5440 specifies the selection, design, installation and maintenance requirements for flue systems which form part of a new or replacement appliance installation for domestic or commercial purposes. It also specifies requirements for connecting gas appliances to existing flues. It specifies natural and fanned draught flues for appliances which carry the CE mark, utilize 1st, 2nd or 3rd family gases and have rated heat inputs based on net (lower) Calorific Value (CV) not exceeding 70 kW. It may also be used for installations of appliances which do not carry the CE mark, e.g. used appliances, where appropriate, providing the appliance manufacturer's instructions are available. In such circumstances, the installer should ensure that the appliance is safe in construction and condition, and can be used without constituting a danger.

The rating of 70 kW applies to an individual appliance connected to a flue system and, in the case of more than one appliance in the same room connected to a flue system, to the sum of the ratings. For shared flues, e.g. Se-ducts or U-ducts, the rating applies to the individual appliance rating per dwelling.

This standard deals with the complete flue equipment from the appliance connection, to the discharge point into outside air. It also covers flues that were intended originally for appliances burning other fuels but which are subsequently used for gas appliances.

This standard does not specify flue systems for decorative fuel effect fires which are specified in BS 5871-3.

This standard specifies residential park homes but not leisure accommodation vehicles. The latter are covered by BS EN 1949 or IGE document UP/8 [7].

NOTE 1 The range of appliances has been amended from 60 kW based on gross CV in the previous version of this standard to 70 kW based on net CV in order to achieve compatibility with the gas appliance product standards. For information on flues for appliances having rated inputs exceeding 70 kW, reference should be made to BS 6644. Although the present scope of BS 6644 includes the range 60 kW gross to 70 kW net, this part of BS 5440 should be used for flues in that range since it comprises the most up-to-date specification.

NOTE 2 This standard does not cover gas-fired incinerators. Such appliances require special considerations because of the high flue gas temperatures they generate. For specific information on incinerators see BS 3813-1.

NOTE 3 The installer should check the data given with an appliance to establish the basis on which the heat input is given. The data in this 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:net heat input is approximately 1.11:1 for natural gas, 1.09:1 for propane and 1.08:1 for butane. For example, convert 9 kW input based on gross CV for natural gas to the equivalent net CV input as follows:

$$\text{Net input} = 9.0/1.11 = 8.1 \text{ kW}$$

1.2 Competency

It is essential that persons carrying out the installation of any gas appliance and its flue be competent to do so, and, in the case of any work that is subject to the current Gas Safety (Installation and Use) Regulations [1], it is essential to comply with these regulations.

It is essential that persons who design the flue system should have the knowledge and understanding of the standards and regulations that apply to ensure that the completed plans will produce a safe and satisfactory installation.

COMMENTARY AND RECOMMENDATIONS ON 1.2.

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 the Council for Registered Gas Installers (CORGI). Thus it is essential that all business or self employed gas fitters should be registered with CORGI.

Guidance on the individual competency required for gas work is given in the Health and Safety Commission's Approved Code Of Practice (ACOP) — Standards of training in safe gas installation [8].

Persons deemed competent to carry out gas work are those who hold a current certificate of competence in the type of activity to be conducted issued under the ACOP arrangements, or by a certification body accredited by the United Kingdom Accreditation Service (UKAS).

Whilst it is essential to be competent to satisfy the Health and Safety at Work etc. Act [9] when installing a chimney or flue system, there is no requirement to be CORGI registered for such work providing it does not involve any associated work on a gas appliance/fitting.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of this British Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

BS 65, *Specification for vitrified clay pipes, fittings and ducts, also flexible mechanical joints for use solely with surface water pipes and fittings.*

BS 715, *Specification for metal flue pipes, fittings, terminals and accessories for gas-fired appliances with a rated input not exceeding 60 kW.*

BS 1289-1, *Flue blocks and masonry terminals for gas appliances — Part 1: Specification for pre-cast concrete flue blocks and terminals.*

BS 1289-2, *Flue blocks and masonry terminals for gas appliances — Part 2: Specification for clay flue blocks and terminals.*

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

BS 4543-2, *Factory made insulated chimneys — Part 2: Specification for chimneys with stainless steel flue linings for use with solid fuel fired appliances.*

BS 4543-3, *Factory made insulated chimneys — Part 3: Specification for chimneys with stainless steel flue linings for use with oil fired appliances.*

BS 5440-2:2000, *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 6461-1, *Installation of chimneys and flues for domestic appliances burning solid fuel (including wood and peat) — Part 1: Code of practice for masonry chimneys and flue pipes.*

BS 7435-1, *Fibre cement flue pipes, fittings and terminals — Part 1: Specification for light quality fibre cement flue pipes, fittings and terminals.*

BS 7435-2, *Fibre cement flue pipes, fittings and terminals — Part 2: Specification for heavy quality fibre cement flue pipes, fittings and terminals.*

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 60079-10, *Electrical apparatus for explosive gas atmospheres — Part 10: Classification of hazardous areas.*

3 Definitions

For the purposes of this standard the following definitions apply.

3.1

appliance compartment

an enclosure (not being a habitable space) specifically designed or adapted to house one or more gas appliances only

3.2

balanced compartment

a sealed enclosure (not being a habitable space) specifically designed or adapted to house one or more open fled gas appliances only, but which takes its air supply from a place outside the enclosure which is adjacent to the flue discharge point (See clause 10)

3.3

balanced-flue appliance

a 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 6579 (CR 1749).

A2

3.4**bathroom**

room or space containing a functional bath **A2**

3.5**branched flue system**

a shared open flue system serving appliances situated on two or more floors

3.6**builder's opening**

an enclosure constructed by the builders to accommodate fireplace components

3.7**chimney**

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

3.8**chimney liner**

a rigid or flexible pipe inserted in a chimney to form a flue, (also see flue lining)

3.9**chimney plate**

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

3.10**closed flue system**

a flue system 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.

3.11**common flue system**

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

3.12**condensate drain**

a fixture in a flue or appliance (resistant to corrosion from condensate formed from the products of combustion), where condensate can be drained

3.13**condensate-free length**

the length of individual open flue 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 will not form on the wall of the flue under the normal operating cycle of the appliance

3.14**condensate pipe**

a pipe, which may also be part of the flue pipe (resistant to corrosion from condensate formed from the products of combustion), which is leak free, and along which condensate may flow

3.15**condensing appliance**

an 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

3.16**connecting flue pipe**

a component used for connecting an appliance outlet to the flue within the chimney or flue system

3.17

decorative fuel effect gas appliance

an open-flued appliance designed to simulate a solid fuel open fire for decorative purposes and intended to be installed so that the products of combustion pass unrestricted from the firebed to the chimney or flue

3.18

draught break

an opening into any part of an open flue system, including that part integral with the appliance

3.19

draught diverter

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

3.20

equivalent height

the height of the 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 will produce the same flue flow rate as the flue under consideration

3.21

effective height – only for gas fires and combined gas fire/back boiler units

the height of straight vertical circular flue pipe, measured from the base of the fire to the outlet of the flue, of the same cross-sectional size as the flue under consideration, which will produce the same flue flow rate as the flue under consideration equal to equivalent height plus 0.65 m

3.22

fan-diluted flue system

a fanned draught open flue system in which the products of combustion are diluted with air

3.23

fanned draught flue system

a flue system in which the removal of flue products is dependent on a fan

3.24

fireplace recess

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

3.25

flat roof

a section of a roof which is horizontal or close enough to horizontal such that any airflow over it will not affect the operation of flue terminating above the roof, i.e. within 20° of the horizontal. This would include a bow string truss roof as may be encountered in a residential park home

3.26

flue

a passage for conveying combustion products to the outside air

3.27

flue break

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

3.28

flue lining

a wall of a chimney consisting of components the surface of which is in contact with the products of combustion. This includes a rigid or flexible chimney or flue liner inserted into a chimney to form the flue and the inner lining of a metal or masonry chimney construction. (See also chimney liner)

3.29**flue pipes**

a pipe enclosing a flue; for a double walled flue system or factory made insulated flue system it is the inner pipe

3.30**flue system**

a complete assembly of flue components that form a flue from one or more appliances to the flue outlet, for example as follows

a) *double wall flue system*

a factory made metal flue system as specified in BS 715 consisting of an inner metal lining and an outer metal casing. The gap between the lining and the casing is usually an air space or may incorporate insulation. This type of system may also be called a twin wall flue

b) *factory made insulated flue system*

a factory made metal flue system, as specified in BS 4543-2, for use with solid fuel burning appliances or, as specified in BS 4543-3, for use with oil fired appliances consisting of an inner lining and an outer metal casing

c) *gas flue blocks*

a factory made pre-cast concrete or clay flue blocks as specified in BS 1289 that are designed to be used solely for use with gas fired appliances and are installed together to form a flue, that can be built into or against a wall. There are also factory made blocks as specified in BS 6461-1 for solid fuel appliances which may also be used for gas appliances

3.31**individual flue system**

a flue system serving one appliance only

3.32**Installation instructions****3.32.1****appliance manufacturer's instructions**

those instructions prepared by the appliance manufacturer giving detailed information and requirements on how the appliance should be installed, and checked for their validity as part of the original appliance certification

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

3.32.2**flue and chimney manufacturer's instructions**

the printed instructions provided with the flue product or flue system by the manufacturer giving detailed information how the product or system is to be installed and checked

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

3.33**leisure accommodation vehicle**

a unit of living accommodation for temporary or seasonal occupation that may meet the requirement for the construction and use of road vehicles

3.34**main flue**

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

3.35**natural draught flue system**

a flue system in which the draught is provided by the thermal force arising from the heat of the products of combustion

3.36

open flue system

a flue system that evacuates the products of combustion to the outside air. The combustion air is drawn directly from the room or space containing the appliance

3.37

open-flued appliance

an appliance designed to be connected to an open flue system.

NOTE This is referred to as type B in PD 6579 (CR 1479).

3.38

pluming

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

3.39

room-sealed appliance

an 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 the open air outside the premises and which vents the products of combustion directly to open air outside the premises

NOTE This is referred to as type C in PD 1749 (CR 1479).

3.40

residential park home

a mobile home designed for permanent residential accommodation that does not meet the requirement for construction and use of road vehicles

3.41

secondary flue

that part of an open flue system connecting a draught diverter or draught break to the terminal

3.42

secondary flue height

the vertical distance between two horizontal planes passing respectively throughout the top of the draught diverter, or in the case of a gas fire the spigot, and the base of the terminal

3.43

secondary flue length

the distance along the central line of the flue between two horizontal planes passing respectively through the top of the draught diverter, or in the case of a gas fire the spigot, and the base of the terminal

3.44

Se-duct

a 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, room-sealed appliances (Type C₂)

3.45

shared flue or duct system

a flue or duct system serving two or more appliances

A₂

3.46

shower room

room or space containing a functional shower **A₂**

3.47

subsidiary flue

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

3.48**terminal**

a device fitted at the flue outlet to allow or assist products of combustion to escape, minimize downdraught and prevent entry of material which might block the flue

3.49**terminal guard**

a 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

3.50**termination**

the outlet of the flue system from which products of combustion discharge into external air

3.51**U-duct**

a 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 C₂), (both inlet air ducts and flue outlets) are fitted to the other limb

NOTE A continental European arrangement fits the air inlet duct of the appliance (Type C₄) to one limb and the flue outlets to the other. This practice is not specified in this standard.

4 Preliminary design considerations

4.1 Types of flue system

The appliance shall be connected to a suitable flue system in accordance with the appliance manufacturer's installation instructions. New or used appliances shall not be connected unless the manufacturer's instructions are available to the installer.

NOTE Detailed arrangements for timber framed dwellings on termination, weather sealing, temperature effects etc., are to be found in the Institution of Gas Engineers publication IGE/UP/7 [10].

COMMENTARY AND RECOMMENDATIONS ON 4.1

The effectiveness of a flue system in discharging products of combustion to the outside air is dependent on its internal flue size (cross-section), length, route, exposure and the materials used in its construction. The factors will be additionally influenced by the thermal efficiency of the appliance, its usage pattern as well as an adequate supply of combustion air. Reference should be made to the appropriate appliance and installation specifications, codes of practice and manufacturer's instructions for specific requirements.

Reference also should be made to Annex A which provides a procedure for estimating whether a flue is likely to ensure full clearance of combustion products. Alternatively, other sizing calculation methods which lead to an installation which clears the products of combustion may be used, e.g., manufacturer's recommendations and the method in prEN 13384-1.

Gas appliances may be classified according to the flue systems specified in PD 6579 (CEN CR 1749). A summary is given in Table 1 and the common types encountered in the UK are illustrated diagrammatically in Figure 1, Figure 2 and Figure 3.

There are three major categories of appliances, defined by the way in which they discharge their products of combustion, room sealed, open flued and flueless. The room-sealed form neither contributes to, nor places any requirement for combustion purposes on the ventilation of the room containing the appliance. Open flued systems 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 systems 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.

Flues and chimneys may also be classified according to a proposed European format prescribed in BS EN 1443 — Chimneys — General requirements, Annex B. The classification is based on the following performance characteristics:

- temperature;
- pressure;
- soot-fire resistance;
- resistance to condensate;
- corrosion resistance;
- thermal resistance;
- distance to combustibles.

Table 1 — Classification of gas appliances according to flue types — from CEN CR 1749 (Common types in the UK are shown with an asterisk *) († denotes fan downstream of draught diverter)

Letter	1st digit	2nd digit		
		Natural draught	Fan downstream of heat exchanger	Fan upstream of heat exchanger
A – Flueless		A ₁ *	A ₂	A ₂
	B ₁ – with draught diverter	B ₁₁ *	B ₁₂ * B ₁₄ †	B ₁₃ *
B – Open flued	B ₂ – without draught diverter, previously referred as “closed flues”	B ₂₁	B ₂₂ *	B ₂₃
	C ₁ – Horizontal balanced flue/inlet air ducts to outside air	C ₁₁ *	C ₁₂ *	C ₁₃ *
C – Room sealed	C ₂ – Inlet and outlet ducts connect to common duct system for multi-appliance connections A₂ (SE-duct or U-duct) A₂	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 – A₁ Inlet and outlet appliance connection ducts connected to a U shaped duct for multi-appliance system A₁	A₁ C ₄₁ A₁	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

Certain appliances are designed to extract latent heat from the water vapour in the products of combustion and require provision for the draining of the condensate. The temperature of the products at the appliance outlet may be low enough to permit the application of materials and constructions of novel form.

The choice of flue system for a specific situation will be dependent on the types of appliance available to provide the service required and the proposed location of the appliance.

As the motive power generated by a fan is considerably greater than that generated thermally, fanned systems may prove advantageous in view of their greater flexibility in flue run, reduced flue size and less critical termination and siting for single or multiple appliance installations. The choice of flue system for a specific situation will be dependent on the types of appliance available to provide the service required and the proposed location of the appliance. In making this choice, the following factors should be considered.

- a) *Restraints imposed on potential terminal locations by virtue of:*
 - *openings into buildings such as windows, air bricks and other ventilation openings;*
 - *existing terminals;*
 - *neighbouring properties;*
 - *boundaries;*
 - *combustible materials on the external face of the property;*
 - *structural and/or topographical features which might prevent a free flow of air over the terminal 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 etc.;*
 - *the need to guard low level terminals to protect passers by;*
 - *the effects of any plumbing on surfaces and neighbouring properties.*
- b) *The availability of existing chimneys for re-use.*
- c) *The function of the room in which the appliance is to be installed, particularly in the case of bathroom and bedroom/bed-sitting rooms where special rules apply.*
- d) *The 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 this might have on open flues.*
- f) *The potential role of an open flue to also satisfy the extract ventilation requirement of Approved Document F to the England & Wales Building Regulations [3].*
- g) *Whenever fans are used, additional safeguards are required to ensure that on flue flow failure the appliance is made inoperable. (See BS 5871-1:2000, 9.5 for further information.)*

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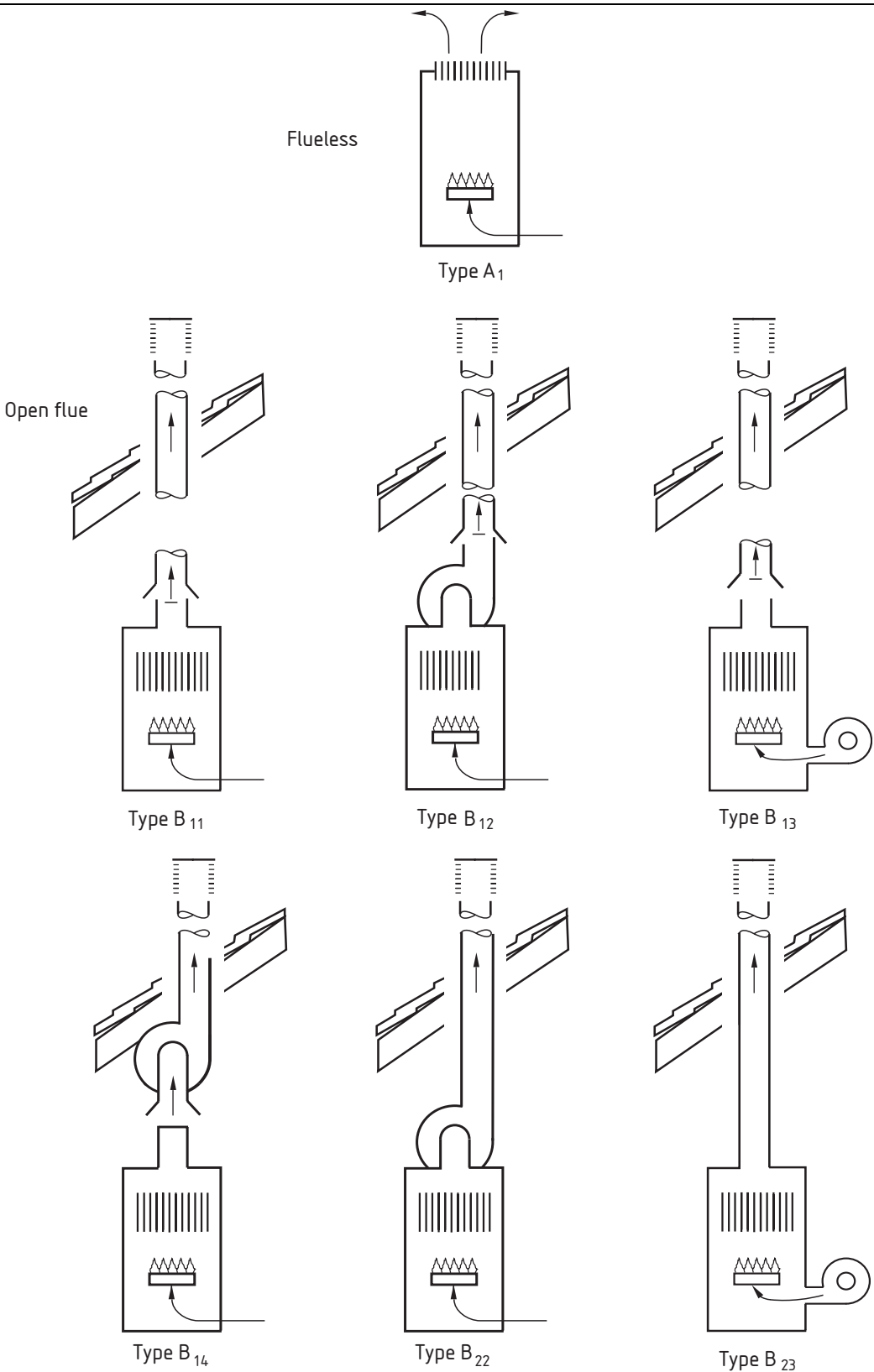
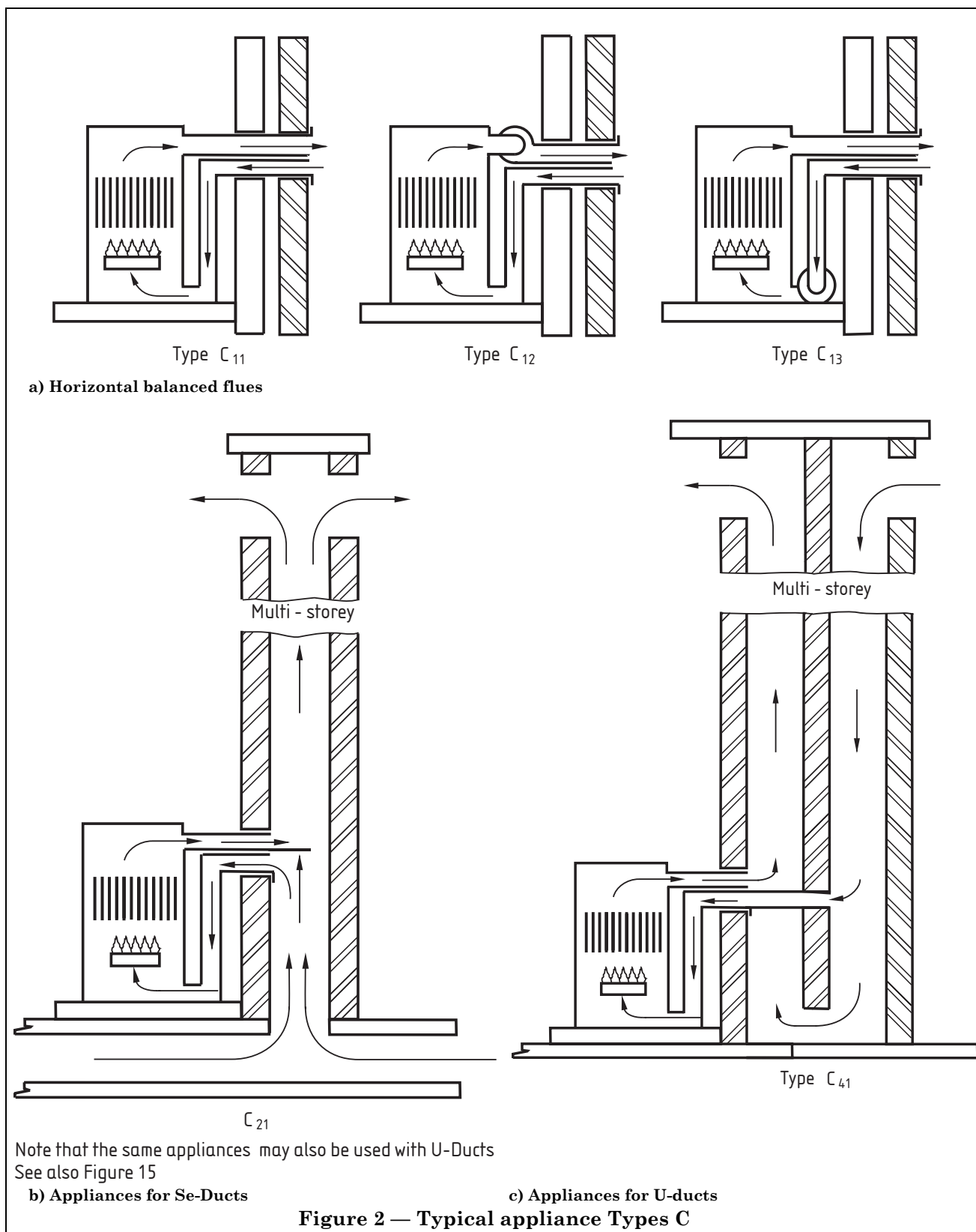


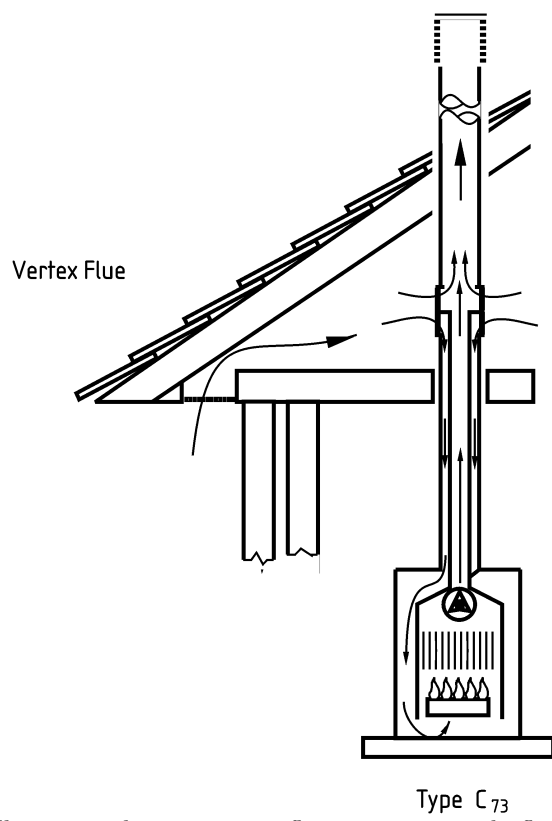
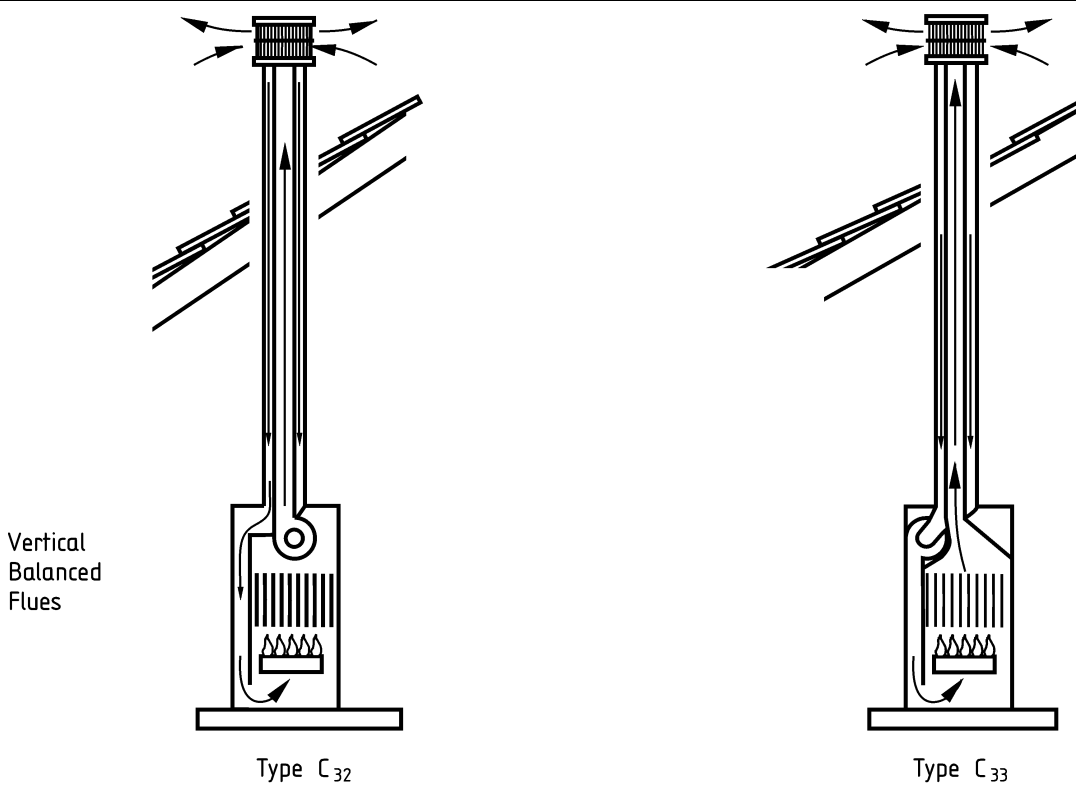
Figure 1 — Typical appliances Types A and B, classification to CR 1749

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NOTE Whilst both of these illustrations depict concentric flue arrangements, the flue and combustion air supply tube can also be constructed so that they are side by side.

Figure 3 — Typical appliance Types C₃ and C₇ classification to PD 6579 (CR 1749)

4.2 Flue termination

4.2.1 General

The various forms of termination and their acceptable locations (Figure 4, Figure 5, Figure 6 and Figure 7) are dependent on the type of flue system and shall conform to the requirements given in the relevant subclauses, (5.1.6, 6.1.3, 7.1.4, 8.2.1, 9.2.1, 10.4, 11.3). The termination shall not be obstructed.

COMMENTARY AND RECOMMENDATIONS ON 4.2.

The main function of the termination of a flue system is to effectively discharge the products of combustion to the outside air under all weather conditions. This is achieved by the design of the terminal and its siting. 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, plumbing can occur at the termination and, where possible, terminal positions where this could cause a nuisance should be avoided.

4.2.2 Basement areas, light wells and retaining walls

No flue termination or terminal shall be sited to discharge within the curtilage or confines of any enclosed basement area, light well or external space formed by any retaining wall or passage unless reasonable provision can be made to ensure the safe disposal of flue gases.

COMMENTARY AND RECOMMENDATIONS ON 4.2.2

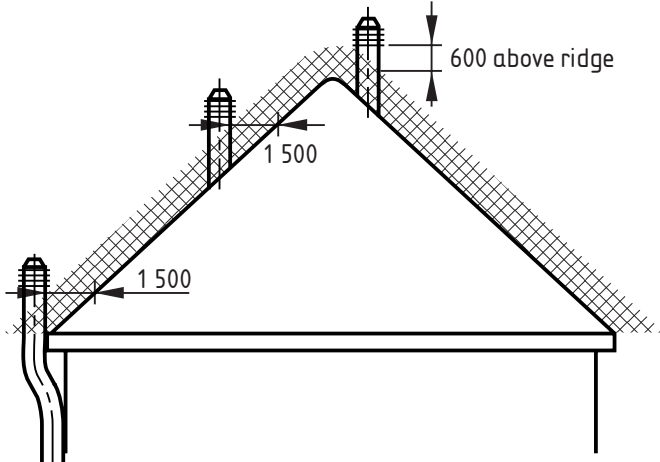
Terminals for balanced flued appliances and fanned draught open flued appliances may, be acceptable provided they are sited at a height of not more than 1 m below the top level of the basement area, light well or retaining wall. The combustion products should only discharge in free open air.

Where a basement area or light well is formed by a single retaining wall to create an uncovered passage way at least 1.5 m wide it may be possible, to site a fanned draught open flued appliance terminal or a fanned or natural draught balanced flued appliance terminal.

The passage should allow free air circulation beyond and around the ends of the structure and retaining wall. It is also essential that unobstructed air movement takes place at the open ends of any such formed passage way which should terminate at or above ground level. Subject to such provisions, a fanned-draught open-flued appliance terminal or a fanned or natural-draught balanced-flued appliance terminal may be installed in strict accordance with the appliance manufacturer's instructions.

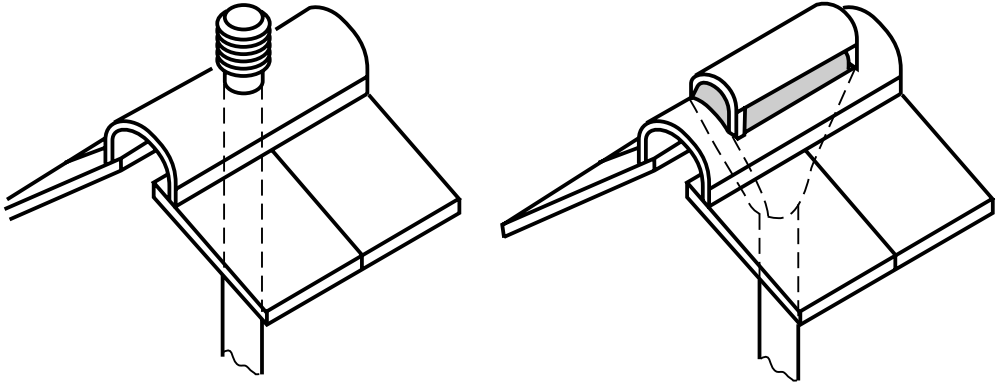
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All dimensions in millimetres



No part of the flue outlet shall be less than 1.5 m measured horizontally to the roof surface, or 600 mm above the ridge.

a) Terminal locations with respect to pitch



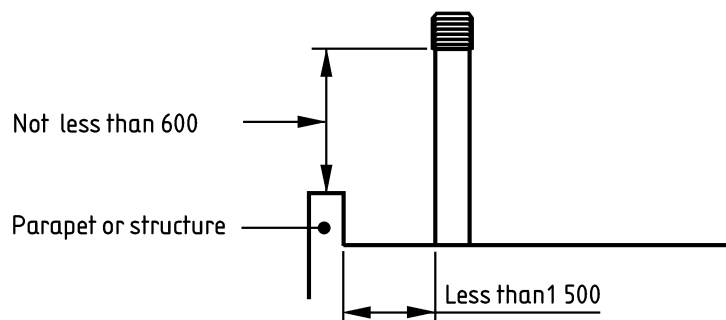
The terminal shall be positioned so that it is at least 1500 mm from any adjacent and higher structure i.e., a gable end wall.

b) Terminal location at a ridge tile

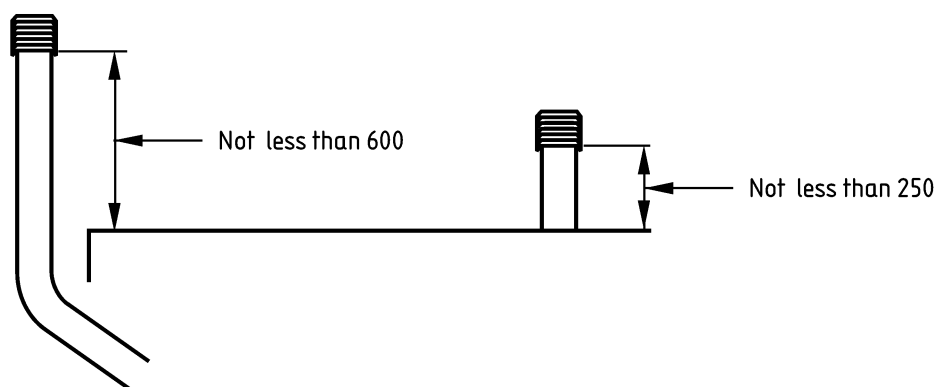
Figure 4 — Open flue terminal locations for pitched roofs

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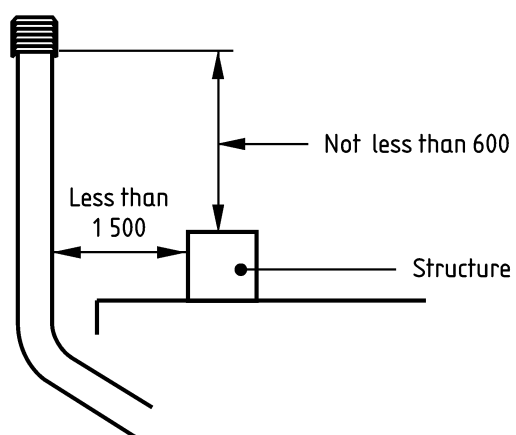
All dimensions in millimetres



a) Flat roof, with flue close to parapet



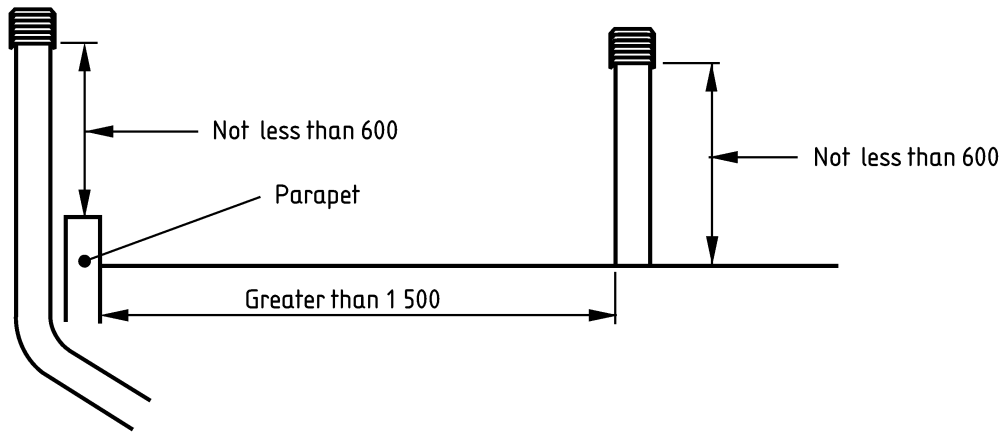
b) Flat roof with no parapet



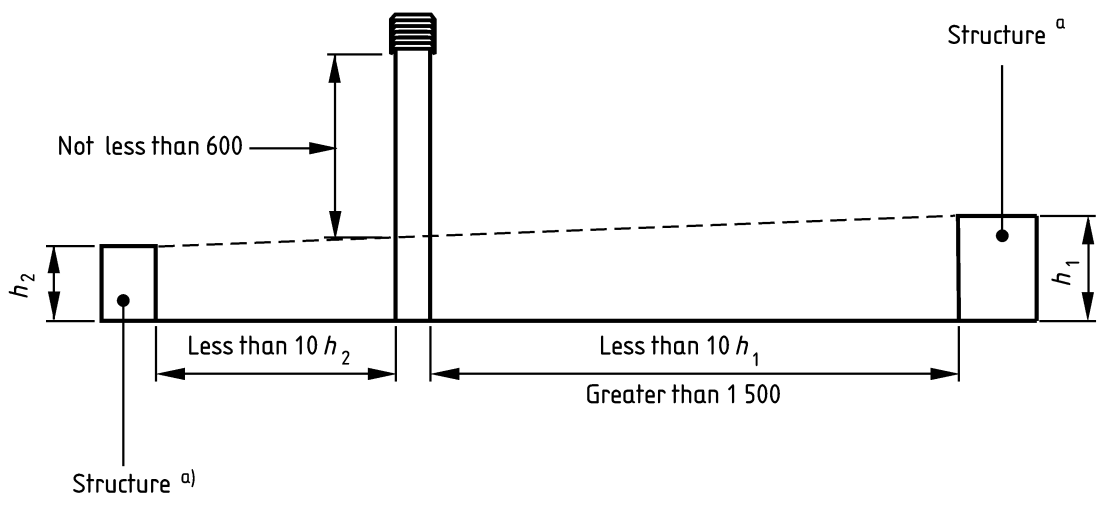
c) Flat roof with structure close to flue outlet

Figure 5 — Open flue terminal locations on flat roofs

All dimensions in millimetres

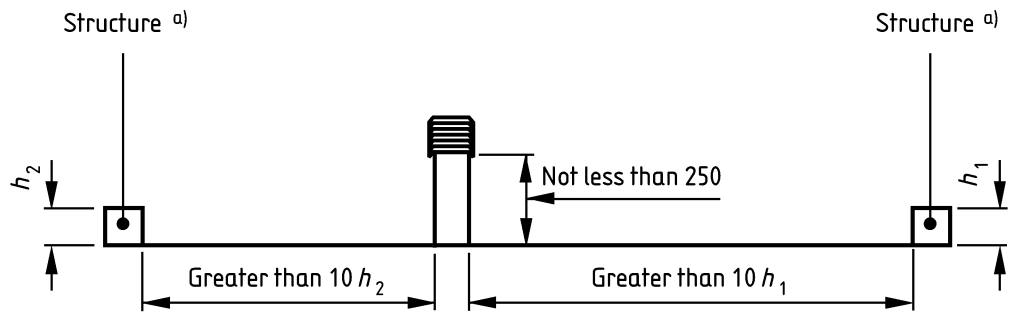


d) Flat roof with parapet



^{a)} Typical structures are e.g. plant rooms, lift motor rooms, storage water tanks.

e) Flat roof, envelope method

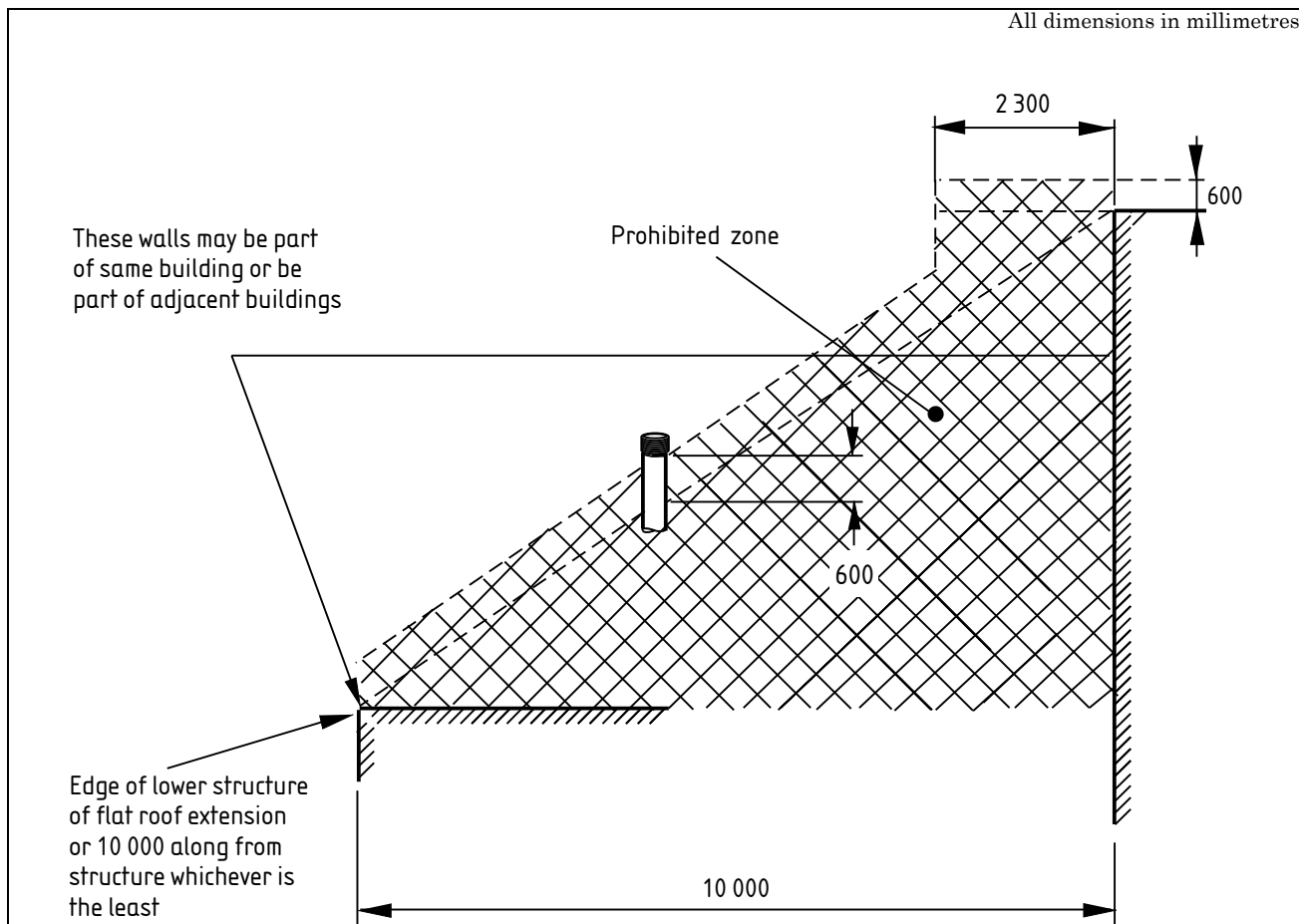


^{a)} Typical structures are, e.g. plant rooms, lift motor rooms, storage water tanks.

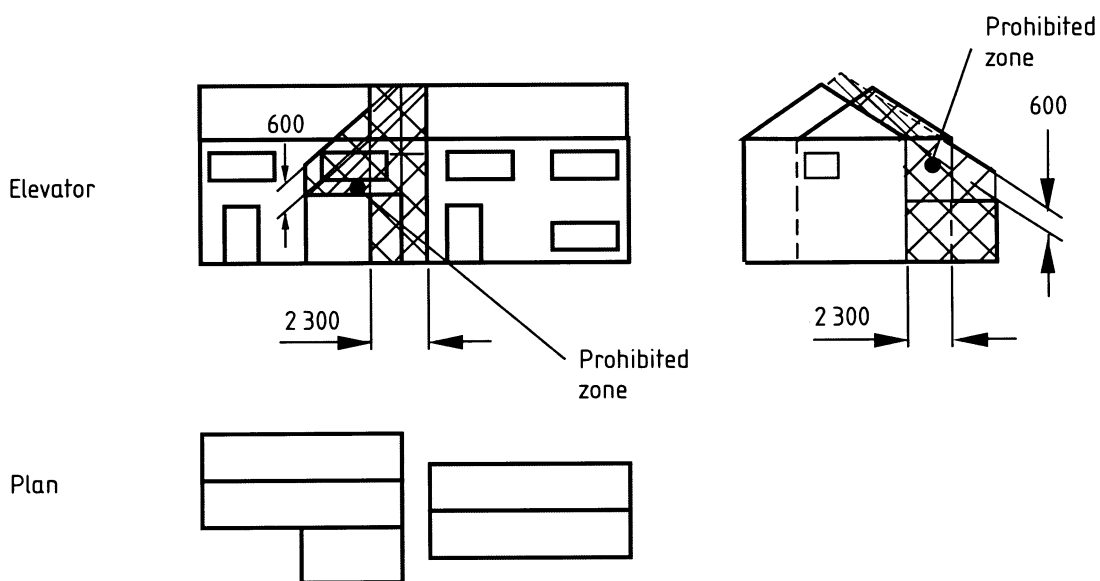
f) Flat roof, where the flue outlet is more than 10 heights (*h*) away from all structures

Figure 5 — Open flue terminal locations on flat roofs (continued)

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a) Prohibited zone — General principle

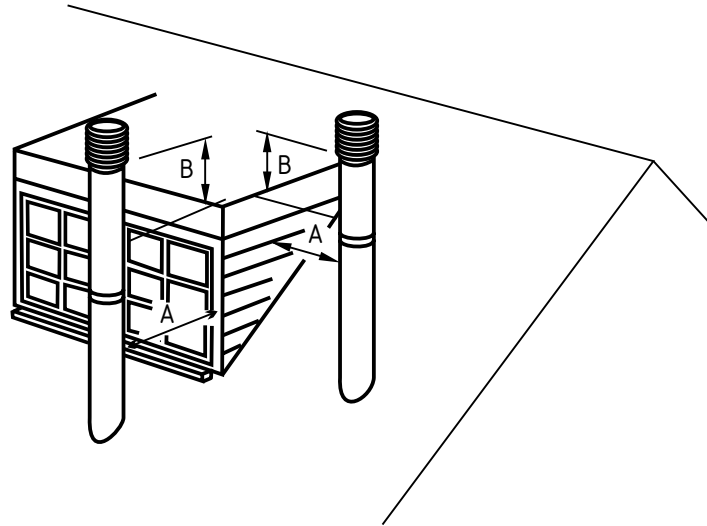


b) Example of prohibited zone near adjacent housing

Figure 6 — Open flue terminal locations near adjacent structures or buildings

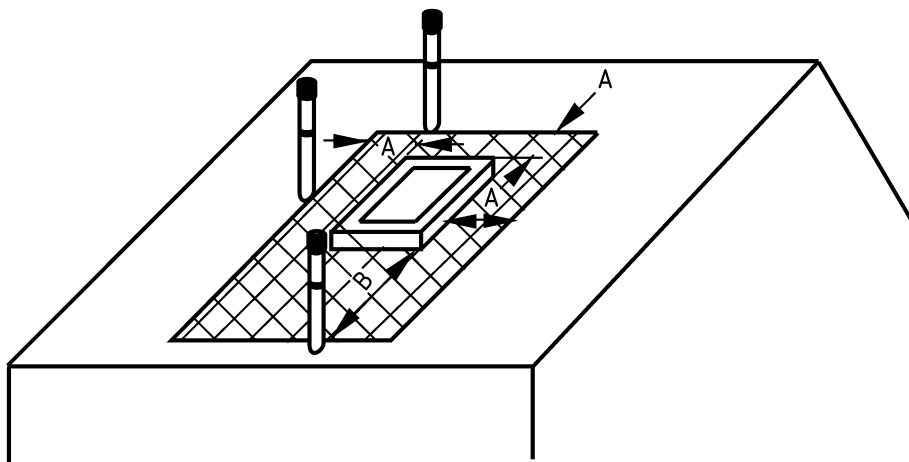
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If A is less than 1 500 mm, B shall be not less than 600 mm

a) Terminal locations for pitched roofs with structures



A = 600 mm

B = 2 000 mm

The flue shall not penetrate the shaded area of the roof and shall otherwise conform to Figure 4.

b) Terminals adjacent to window or openings on pitched roofs irrespective of pitch

Figure 7— Open flue terminal locations near structure, windows and openings on pitched roofs

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4.3 Terminal guards

Terminal guards shall be used where necessary to prevent blockage and/or injury to people, as required by the relevant building regulations.

COMMENTARY AND RECOMMENDATIONS ON 4.3.

See 5.1.6, 5.2.6, 8.2.1 and 9.2.1 for advice.

4.4 Fire precautions

All the systems shall be installed to reduce the risk of ignition of any part of the building structure.

COMMENTARY AND RECOMMENDATIONS ON 4.4.

Specific precautions to be taken are detailed in 5.2.4, 8.2.3, 9.2.3 and 10.3.

For buildings of timber framed construction, adequate safeguards are achieved by, for example, the introduction of suitable sleeves or ducts where the flue system passes adjacent to combustible material, or 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 are to be found in the Institution of Gas Engineers Publications UP/7 [10].

4.5 Installations in bedrooms

Open-flued appliances with rated input of 12.7 kW net (14 kW gross) or less may only be installed in bedrooms, bed-sitting rooms and other rooms intended to be used as sleeping accommodation if they incorporate a safety control device which will shut down the appliance before there is a build up of dangerous quantity of combustion products in the room concerned.

Any appliance with a rated input above 12.7 kW net (14 kW gross) installed in a bedroom, bed-sitting room or other room intended to be used as sleeping accommodation shall be room-sealed.

COMMENTARY AND RECOMMENDATIONS ON 4.5.

Advice on permissible flueless appliances is given in BS 5540-2.

Care should be taken in the selection of non-room-sealed appliances for use in sleeping accommodation taking into account the following:

- a) *An appliance without a "CE" mark purchased second hand is unlikely to be fitted with an acceptable device.*
- b) *Some appliances carrying the "CE" mark purchased second hand will not be fitted with an acceptable device.*
- c) *New appliances will be fitted with an acceptable device. The user instructions should be checked to ensure that they contain advice on the action necessary should the device operate.*

Where there is any doubt as to whether the appliance is fitted with an acceptable device, it should not be installed in sleeping accommodation.

4.6 Installations in bathrooms or shower rooms

Any gas appliance installed in a bathroom or shower room shall be room-sealed.

4.7 Instantaneous water heaters

No instantaneous water heater shall be installed in any room unless it is room-sealed or fitted with a safety control which will shut off the appliance before a dangerous quantity of combustion products can build up in the room concerned.

4.8 A₂ Cupboards and compartments in bathrooms, shower rooms or bedrooms

A₁ Cupboards and compartments which have doors opening into bedrooms or bathrooms or shower rooms shall be treated as part of the bedroom or bathroom or shower room concerned.

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, shall be treated as part of the bedroom or bathroom or shower room concerned. A₁ A₂

4.9 Garages and other hazardous areas

Gas appliances and their flues in motor vehicle repair workshops shall be installed in accordance with the Institution of Gas Engineers IGE publication IM/28 [11].

Gas appliances shall not be installed in spaces classified as hazardous as defined in BS EN 60079-10:1996. COMMENTARY AND RECOMMENDATIONS ON 4.9.

The requirement for commercial applications is intended to apply where petroleum and other heavier than air flammable vapours are present. Wherever reasonably practicable the appliance should not be installed in such places.

There is no restriction on the type of flue or location of appliances that can be installed in a private garage.

A₁ Text deleted. A₁

4.10 Radon gas protection

Where radon gas extraction systems are installed, the spillage performance of every open flued appliance in the dwelling shall be rechecked with the radon gas extractive system in operation to ensure satisfactory clearance of combustion products. If spillage occurs, expert advice shall be sought to ensure that both the performance of the flue and the radon reduction are satisfactory. The appliance shall not be left connected to the gas supply unless it has successfully passed the spillage test specified in **5.3.2.3**.

COMMENTARY AND RECOMMENDATIONS ON **4.10**.

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

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

Further advice is available in BRE paper IP21/92 [12].

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4.11 Passive stack ventilation

Where a house contains both passive stack ventilation (psv) systems and open flue natural draught appliances, the respective terminals shall be sited to avoid the possibility of setting up a pressure gradient across the two systems that could lead to appliance flue reversal.

COMMENTARY AND RECOMMENDATIONS ON **4.11**

*In order to avoid the outlets for a passive stack ventilation system and an open flue being positioned in different pressure zones they should be located on the same face of the building, and the flue termination should be at the same or higher level than the passive stack ventilation outlet. **A2***

4.12 Exchange of information and planning

The designer or builder of the flue system, or the provider or installer of the gas appliance shall agree and document the pertinent details with the customer as appropriate. Where the flue system is provided as part of the appliance, e.g. a balanced flued appliance, the installer shall agree and document, with the customer, that the flue system is suitable for the application.

COMMENTARY AND RECOMMENDATIONS ON **4.12**.

When erecting a new flue system or modifying an existing one, the pertinent details will include the type, size and route of the flue 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 flue system and fitting the gas appliance.

When a gas appliance is to be fitted to an existing flue system, it is essential that the installer confirms that the flue system is suitable for the appliance.

Where appropriate, the end user (customer), should be consulted and involved in the decision making process. It is recommended that the customer should be advised of the reasons for the choice of appliance and the flueing system. Some factors that may 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 open flued or room-sealed may be influenced by attitudes to safety issues.

All appliances converting energy into useful heat (electrical and fossil fuels) may invoke some element of risk. Burning any fossil fuel (oil, solid fuel and gas) creates products of combustion which may lead to the creation of harmful elements if the combustion process and subsequent provisions for flueing are inadequate. Incidents involving gas utilization generally involve inadequate installation, subsequent lack of servicing or maintenance or misuse by the user. Flued systems will not operate correctly under conditions of inadequate or blocked flues, or inadequate or blocked air supply and under such conditions they spill products of combustion. Some examples of types of flueing systems are as follows, but these do not represent an exhaustive treatise.

Open flued appliances (Type B) draw air for combustion from the room in which the appliance is situated. In Type B, appliances, a draught diverter is included to minimize the effects of draught down the flue and also to assist the operation of the flue. A permanent air supply to the room is required. It is essential that a spillage test is carried out at the time of installation and when other work is carried out on the appliance. New appliances installed in domestic applications are required by the Gas Appliances (Safety) Regulations 1995 [6], 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 may not be fitted with such devices if they were manufactured before this became a requirement.

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

Room sealed appliances (Type C) are designed such that the air supply and the products of combustion are sealed within the appliance and separated from the room in which the appliance is situated. The common Type C1 balanced flue, is fitted with the air supply duct and flue at the factory. The siting of the terminal is important to ensure that no hazard is caused by products of combustion re-entering the building, albeit in a diluted form. There are also restrictions on siting terminals in restricted spaces such as some light-wells and passages (see 5.1.6.2).

Attention is drawn to a chimney plate which may be affixed to new chimneys to assist in matching an appliance to the flue, (see also 5.1.1).

5 Individual open flue: natural draught (for Types B₁₁, B₁₂, B₁₃ appliances)

5.1 Design

5.1.1 General

Any new flue system shall be constructed from the materials specified in 5.1.2, 5.1.3, routed and sized as specified in 5.1.4 and terminated as specified in 5.1.5 and 5.1.6.

Any existing flue systems shall conform to 5.1.8. Each flue shall only communicate with the room or space in which the appliance is installed.

COMMENTARY AND RECOMMENDATIONS ON 5.1.1.

Attention is drawn to Approved Document J to the Building Regulations for England and Wales [3] and to the Building Standard (Scotland) [5] 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.

5.1.2 Flue pipes

Metallic flue pipes shall conform to BS 715. Single walled flue pipe, defined by BS 715 as being for internal use only, shall not be used externally except as specified in 5.1.7. Double walled metal flue systems to BS 715 or BS 4543-2 or -3 shall be used externally in accordance with the flue manufacturer's instructions. Flue pipes connecting an appliance to the flue system shall conform to BS 715 or shall only be connected together if permitted by the manufacturer's instructions and using connections or adapters provided by the manufacturer.

Fibre cement flue pipes shall be in accordance with BS 7435 -1 and -2.

Asbestos materials shall not be used for new flue pipes.

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.

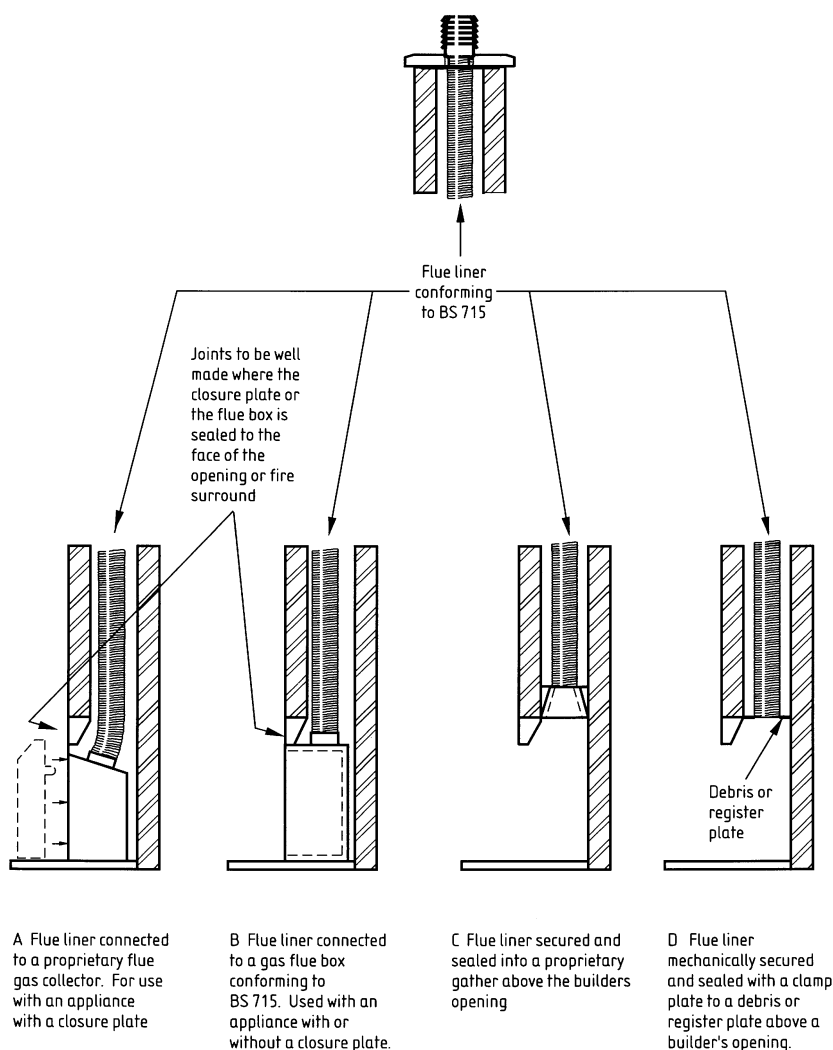
COMMENTARY AND RECOMMENDATIONS ON 5.1.2.

BS 567 and BS 835 cover asbestos¹⁾ materials, and existing flue systems constructed of these materials may be re-used (see 5.1.8).

Proprietary prefabricated flue boxes conforming to BS 715 may be used in conjunction with flue pipe also conforming to BS 715. Technical data and installation instructions will be provided with such boxes. Methods of installation using a flue box, flue pipe and flexible liner within the chimney are shown in Figure 8 and Figure 9. 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.

¹⁾ The Asbestos (Prohibition) Regulations (As Amended) 1999 [13] places further restrictions on the use of asbestos materials, including a total ban of asbestos cement and its products.

New (or alterations to existing) flue systems should not be constructed from materials containing asbestos. Existing flue systems may be re-used in situ as flue systems provided that they are mechanically sound and conform to the requirements of this British Standard.



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.

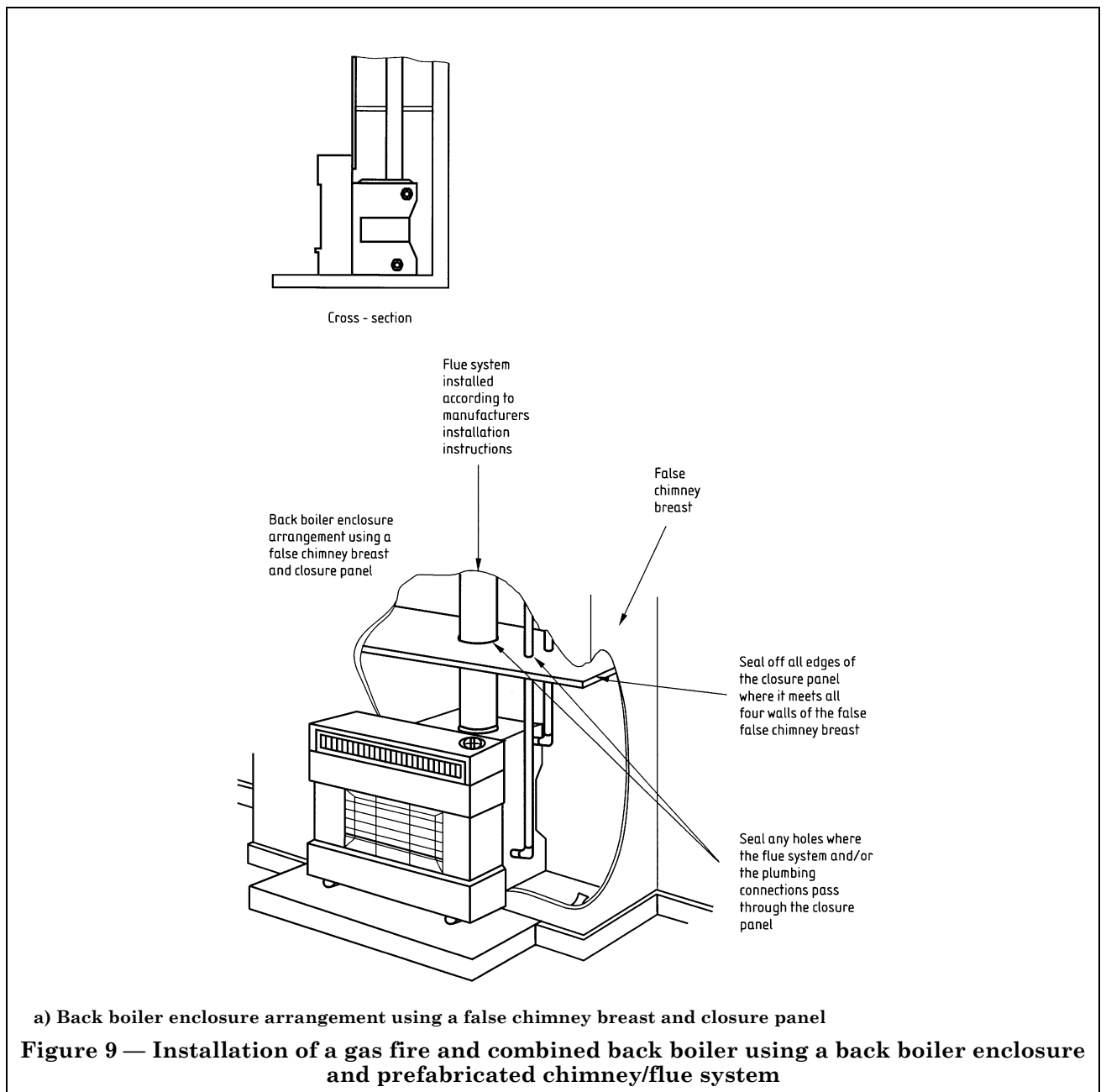
NOTE 2 The flexible liner should rise in one continuous length as near vertically as possible from the top of the appliance, gas flue box or fireplace recess and no part of the flue liner should form an angle greater than 45° from the vertical.

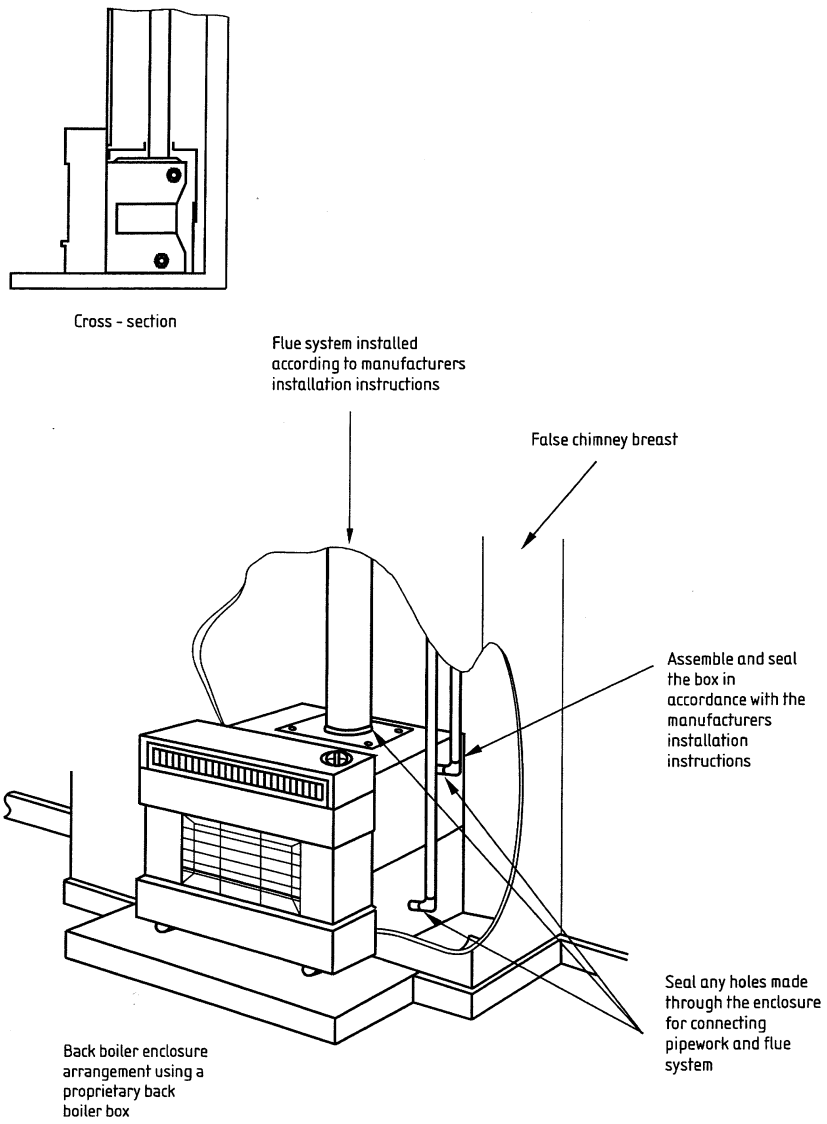
NOTE 3 The flexible liner should be installed in accordance with the manufacturer's instructions and be mechanically secured and sealed at the top of the chimney. Care should be taken to ensure that any materials used to seal and close off and seal the liner at the top of the chimney, do not drop down 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 8 — Typical methods of using a flue liner in a masonry chimney installation serving a gas appliance, other than a back boiler





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.

b) Back boiler enclosure arrangement using a proprietary back boiler box

Figure 9 — Installation of a gas fire and combined back boiler using a back boiler enclosure and prefabricated chimney/flue system (continued)

5.1.3 Chimneys

New chimneys shall be either:

- a) of brick or other masonry construction and lined with one of the following:
 - 1) clay flue linings conforming to BS EN 1457; or
 - 2) rebated and socketed clay pipes and fittings conforming to BS 65; or
 - 3) rebated or socketed flue linings made from kiln-burnt aggregate and high alumina-cement.

A1 Text deleted **A1**

- b) constructed of gas flue blocks conforming to BS 1289 (see Annex D) or chimney blocks as specified in BS 6461;
- c) factory-made insulated chimneys conforming to BS 4543.

A2 Text deleted **A2**

COMMENTARY AND RECOMMENDATIONS ON 5.1.3.

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, and the chimney should be constructed in accordance with the relevant building regulations.

A2 Text deleted **A2**

5.1.4 Route and sizing

The flue shall be routed and sized to ensure full clearance of combustion products.

The flue shall take the most practicable route consistent with structural stability, appearance and termination (see 5.1.6). Where changes in the route of the flue are necessary, these shall be limited so as to form an angle no greater than 45° to the vertical **A1** except for flue pipes connecting the appliance directly to the chimney base as detailed in the commentary and recommendations to 5.1.8.1. **A1**

A minimum of 600 mm of vertical flue directly above the draught diverter shall be provided unless otherwise stated in the manufacturer's installation instructions.

Where the flue runs outside the structure of the building are unavoidable double-wall circular flue pipes conforming to BS 715 or factory insulated flues conforming to BS 4543-2 and -3 shall be used (see 5.1.7).

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 flue systems or chimney installations for gas fires shall have a minimum circular cross-sectional area of 12,000 mm² unless the appliance manufacturer's instructions specifically permit otherwise. For new chimneys constructed with gas flue blocks, the minimum cross-sectional area shall not be less than 16,500 mm² with no dimension less than 90 mm as specified in BS 1289.

The following appliances shall not be connected to flue blocks having a cross-sectional area between 12,000 mm² and 13,000 mm² or having a minor dimension of 63 mm or less:

- a) drying cabinets;
- b) appliances having a flue outlet area greater than 13,000 mm²;
- 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 manufacturer's instructions specifically state that this is acceptable.
- d) appliances with manufacturer's instructions that state they are not suitable for connection to flue blocks.

COMMENTARY AND RECOMMENDATIONS ON 5.1.4.

An essentially vertical route from the draught diverter, if fitted, is recommended. Exceptions to this requirement may be permitted, e.g.

- a) flue systems, constructed in buildings other than single storey, and/or where calculations using Annex A indicate likely clearance of combustion products and subsequent commissioning tests prove satisfactory; or*
- b) gas heating stoves where the manufacturer's instructions specify that a section of the flue is horizontal; or*
- c) modular boilers incorporated into a fully integrated scheme.*

Single storey flue systems are especially sensitive to careful and accurate design.

To provide protection against problems associated with down-draught on steeply pitched roofs, it is recommended that the route of the flue system should lead to a termination 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:

- a) for bonding into and forming an integral part of the building structure (in which case they are mainly in new premises); or*
- b) for adding-on to either a new or existing building.*

It should be noted that rectangular flue blocks are generally more resistive to flow than are circular flue pipes of the same cross-sectional area. Not all appliances are suitable for connection to this type of chimney.

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

An existing gas fire and flue combination should have a minimum flue cross-sectional area of 12,000 mm². An exception may be permitted when replacing an appliance of a similar type to an existing flue where there is evidence that the previous appliance worked satisfactorily and where it can be demonstrated that there is clearance of combustion products, when checked in accordance with 5.3.2.

Further advice on flue systems and chimneys for gas fires is given in BS 5871.

Annex A describes a method of assessing whether a flue system is likely to give a satisfactory performance and is based on the concept of the equivalent vertical height of the flue. Annex A also refers to "effective height" since this is the term used in the installation instruction for some gas fires.

The British Standard BS 5258-8 for gas fire/back boiler units requires a minimum vertical height of 3 m. This is the minimum effective height to be used in calculations.

Long external flue runs should be avoided (see 5.1.7), particularly from appliances fitted in cellars and basements. Whenever possible, flues should be run inside the premises to ensure that the internal length exceeds the exposed external length of flue.

Chimneys and flues for decorative effect gas appliances should be installed in accordance with BS 5871-3.

5.1.5 Terminal design

When the diameter of a flue is 170 mm or less, a terminal conforming to BS 715, BS 1289 or BS 7435-1 and -2 shall be fitted.

Where a proprietary terminal is not used, the total free area of outlet openings on the termination shall be at least twice the cross-sectional area of the flue. Outlet openings shall be such that they will admit a 6 mm diameter ball but not a 16 mm diameter ball. The openings shall either be uniformly distributed around the termination or arranged at two opposite faces.

The free cross-section area of the terminal shall be appropriate for the appliance installed to the chimney.

COMMENTARY AND RECOMMENDATIONS ON 5.1.5

The free cross-sectional area of the terminal may be smaller than that of the flue as long as it is appropriate for the appliance.

5.1.6 Termination

5.1.6.1 General positioning

For all new installations and whenever an existing appliance is replaced, the terminal location shall be as follows.

Any terminal or termination shall be positioned so that combustion products can safely disperse at all times. Except in those circumstances specified in 5.1.6.2 the terminal shall be sited in accordance with A_1 Table 2 A_1 , Table C.1 and Annex C.

A_1 The terminal for an open-flued natural draught flue system on the apex of a pitched roof shall not be positioned within 1.5 m of a higher structure. The terminal for an open-flued natural draught flue system 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, they shall all terminate at the same height. Ridge terminals which are open on all four sides, shall be sited so that they are not less than 300 mm apart. A_1

Table 2 — Location of roof mounted terminals for individual natural draught open flue systems (minimum height of base of terminal)

Type of roof		Location not within 1.5 m of a vertical surface ^a of a structure on the roof		Location within 1.5 m of a vertical surface of a structure on the roof	
		Internal route		External route (height of base of terminal above the level of the adjacent roof edge)	Internal route and external route (height of base of terminal above the top of the structure)
		On ridge	Not on ridge		
Pitched		At or above ridge level (see Figure 4b)	No part of the flue outlet shall be less than 1.5 m measured horizontally to the roof surface, or 600 mm above the ridge (see Figure 4a)	See Figure 4a	600 mm (see Figure 7a)
Flat ^c	With parapet	Not applicable	600 mm above flue roof intersection (see Figure 5) ^b	600 mm (see Figure 5)	600 mm above structure (See Figure 5)
	Without parapet		250 mm above flue/roof intersection (see Figure 5) ^b		

^a For example, a chimney stack, dormer window, tank room, lift motor room, parapet, etc.

^b When the flue outlet is a horizontal distance greater than 10 times the height h of the parapet or structure, the terminal outlet height need be only 250 mm above the roof.

^c Flat is defined as being within 20° of horizontal.

NOTE The heights A_1 of the terminals A_1 above should be increased by 500 mm when there is a sloping hill or embankment within a distance of 4 times the height and having a height between ½ and 1 times the height of the building.

Further caution is required A_1 in more severe circumstances or A_1 when there is a combination of external flue, steep pitch, high efficiency appliance, complex roof geometry, nearby hills, adjacent buildings. The height should be 2 m and an extractive terminal used.

COMMENTARY AND RECOMMENDATIONS ON 5.1.6.1.

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

Terminal positions at or near the ridge of a pitched roof are often preferable to those on the slope of the roof (see 5.1.4 (commentary and recommendations and 5.1.7).

Where there is evidence that a chimney is used for nesting birds, squirrels or other wild life etc., 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 it will 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.

Where multiple flue outlets terminate alongside each other, the minimum distance between outlets should be not less than 50 mm.

5.1.6.2 Adjacent structures

Where there are adjacent vertical structures which may affect the performance of a flue above a flat roof, the height of the terminal 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 (as in Figure 5) ~~(A1) Text deleted (A1)~~. If more than two separate structures are sited on the roof the condition resulting in the highest flue termination shall be employed.

The base of any flue terminal serving an open flued appliances, 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 6a)].

COMMENTARY AND RECOMMENDATIONS ON 5.1.6.2.

Where the horizontal distance between the flue and a structure on a flat roof exceeds 1.5 m and is greater than 10 times the height of that structure above the point where the flue passes through the roof, then that structure may be discounted as having any effect on the performance of that flue (A1) (see Figure 5e) (A1).

Table 3 — 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 mm ² and aspect ratio of up to 4:1 or area 20 000 mm ² and aspect ratio ^b of up to 5:1 m	125 mm diameter flue pipe	
		Single wall m	Double wall m
Internal ^a	12	20	33
External	10	Not allowed	28

^a An internal flue is one of which the only surfaces exposed to external temperatures are those of that length of flue above the roof, and that length should not exceed 1.5 m 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.

5.1.7 Condensation

- a) All reasonable steps shall be taken to maintain the flue gases at their maximum temperature to avoid problems of excessive condensation, forming in the flue.
- b) $\square A_1$ Single wall flues shall not be used 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. $\square A_1$
- c) Twin wall flues with only an air gap for insulation shall not be used externally for lengths in excess of 3 m.
- d) Where prolonged condensation cannot be avoided, the flue wall or lining and the jointing materials shall be non-permeable, and provision shall be made for the collection and disposal of the condensate from the flue.

COMMENTARY AND RECOMMENDATIONS ON 5.1.7.

With the increasing efficiency of gas-fired appliances, flue gas temperatures are likely to be lower and flues more vulnerable to condensation. Steps should be taken to ensure that flues are run internally in the building. Where this cannot be achieved, then insulated flues with a minimum $\square A_1$ resistivity of R 22 (i.e. $0.22 \text{ m}^2 \cdot \text{K}/\text{W}$) $\square A_1$ of insulation should be used externally, where condensation is to be expected for such applications as condensing or semi-condensing boilers.

Heavy condensation in a poured in situ concrete lined flue previously used with another fuel, may 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 5.1.3.

Means of avoiding condensation include:-

- a) *in the case of a brick chimney, lining the chimney with a flexible chimney liner conforming to BS 715;*
- b) *using a flue system having a lower heat loss such as a factory manufactured insulated chimney conforming to BS 4543 -2 and -3 or double wall flue system conforming to BS 715.*

Where condensation cannot be avoided then a chimney system should be chosen that can incorporate sealed joints, to prevent condensation leaking out through the joints.

Provision should be made for the collection and disposal of condensate from the lowest section of the base of the vertical-section of the flue using a non-corrodable drain pipe.

Specific requirements for condensing appliances are specified in clause 12. Table 3 and Figure 10a) and Figure 13b) give the maximum flue lengths for which problems with condensation during normal winter conditions are unlikely. Table 3 is for gas fires of gross efficiency not greater than 70 %, and Figure 10a) and Figure 10b) are for other types of appliance of gross efficiency not greater than 80 %.

5.1.8 Existing chimneys and other flue systems

5.1.8.1 Suitability and adopting

Any existing chimney or flue which is to be used shall conform to the requirements of 5.1.1, 5.1.2, 5.1.3, 5.1.4, 5.1.5, 5.1.6 and 5.1.7 and be fit for the purpose intended and be of sound construction. Where such a chimney or flue 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.

COMMENTARY AND RECOMMENDATIONS ON 5.1.8.1.

In seeking to ascertain whether an existing chimney or flue conforms to this standard it is advisable to check the following.

- a) *The route of the flue, in order to establish whether there are any changes of direction which may adversely affect the performance of the flue or result in blockage.*
- b) *The existence of other connections.*
- c) *The termination should be examined and replaced as necessary (see 5.1.5 and 5.1.6). It is particularly important to ensure that the chimney has not been closed over or otherwise modified.*
- d) *The condition of the flue to ensure that it is sound, and if unlined, the surface is not showing signs of deterioration such as loose mortar or parging.*
- e) *Faults to be considered for rectification should include chimney flaunching, DPC 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 pot to be replaced, or for a terminal to be fitted. Bird guards should be fitted where necessary.

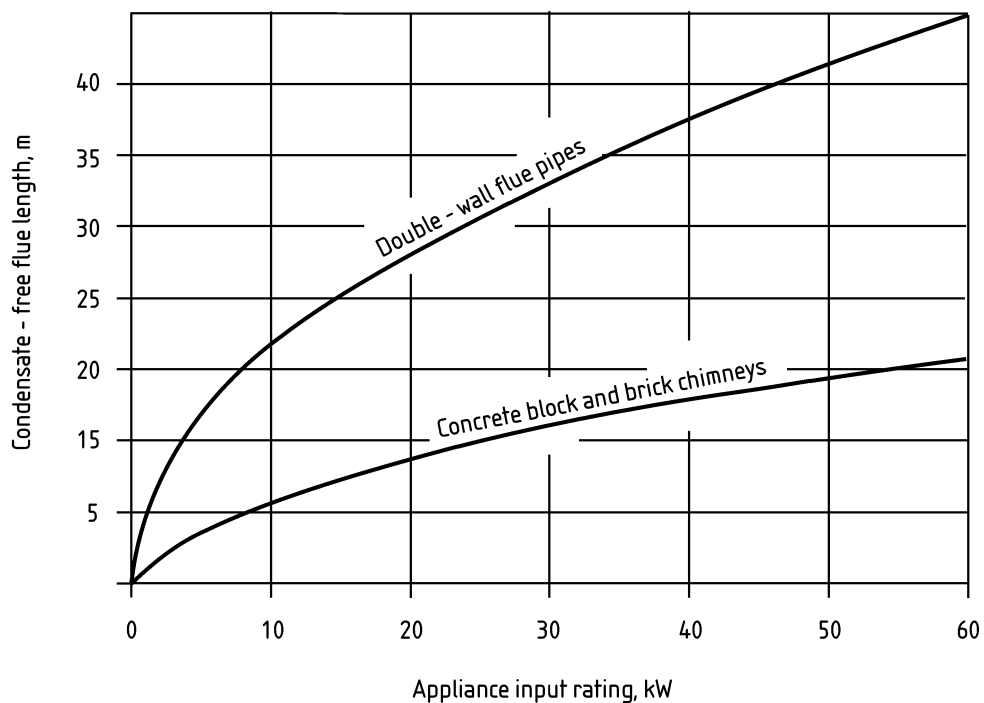
If the chimney pot is removed and it is intended to slab over the chimney and continue to use the chimney, by providing side outlets, then an area of at least 12 000 mm² (A₁) per flue (A₁) on each of the opposite sides should be provided in accordance with the dimensional requirements for non-proprietary terminals in 5.1.5. The outlets should be suitably protected to prevent bird entry.

Suitable checks for existing flues and chimneys are specified in 5.3.2.

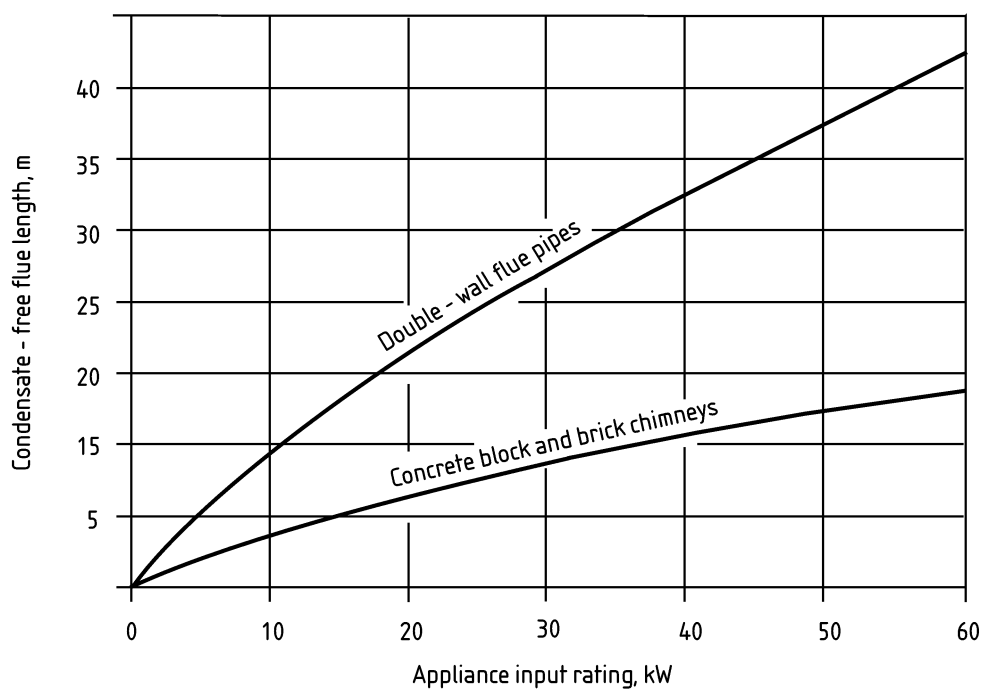
If an existing flue pipe system is to be used, whether internal or external to the building, its fixings and stability should be checked, and joints inspected and made good where necessary.

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, as for all installations, that care should be taken to ascertain that no spillage occurs from the new appliance(s) since it is possible that the previous appliance(s) were more tolerant in respect of flue requirements than the replacements.

Any flue pipe connecting the appliance directly to the chimney base, e.g. into the gable from a larger fireplace recess [see Figure 11b)], 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 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 gable. Where the appliance is connected into a gas flue block chimney, this should be by a suitable starter unit (see 5.2.3.3 and Figure D.1).



a) Internal flues



b) External flues

Figure 10 — Maximum lengths for condensate-free flues for appliances other than gas fires

Table 4 — Appliance/chimney combinations which require the chimney to be lined

Appliance type	Flue 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	Flue lengths greater than those given in Table 3 and A1 Figure 10 A1

5.1.8.2 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 flueway unobstructed.

Under-grate air ducts shall be closed and sealed.

The appliance shall be connected directly into the flue and not via any previous fuel burning appliance. The latter shall be removed.

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

Only one gas appliance shall be connected to the chimney or flue. 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 or flue is constructed.

Where the appliance is not fitted at the bottom of the chimney or flue, that portion of the flue below the appliance shall be sealed at a position not less than the 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 11).

COMMENTARY AND RECOMMENDATIONS ON 5.1.8.2.

When fitting any new appliance to an existing chimney, consideration should be given to sweeping the flue. The following factors will determine whether to sweep the flue.

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

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

The effects of other flues 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 flues should terminate at the same height, preferably close together so that they are subjected to the same wind conditions.

Table 5 — 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/flue system to BS 715 (new or unused, or used with gas)	75	0.002 (2 litres)
Any appliance fitted to flue block chimney/flue system to BS 715 (previously used with solid fuel or oil)	250	0.012 (12 litres)

5.1.8.3 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 prevent the entry of debris into the appliance flue spigot or flue connection piece (see Figure 11).

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 flue or 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 5.

Provision shall be made for the inspection and removal of debris from the void.

5.1.8.4 Lining

An unlined brick chimney with a flue length greater than that given in Table 4 for the appropriate appliance shall be lined.

Where an existing chimney or flue is lined with a flexible liner, the liner shall be examined 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 8). At the base this shall be done in such a way that the sealant will not fall into the back boiler enclosure. 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 outlet shall be used to connect the appliance to the chimney liner. The annular space between the short length of flue pipe and the chimney liner shall be sealed using a suitable flue jointing material, in such a way that it does not restrict the flue pipe exit and will not fall out into the back boiler enclosure.

A2 Where poured concrete or other lining systems are to be installed in existing chimneys, they shall be installed by a method which has been independently certified as being suitable for the intended purpose. **A2**

COMMENTARY AND RECOMMENDATIONS ON 5.1.8.4.

Where an unlined chimney is to be lined with a flexible flue liner, the condition of the flue 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 may 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 will 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 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 may 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 may 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.

A1 Further advice is given in BS 5871-1:2000 and BS 5871-2:2000. **A1**

A2 Poured concrete linings installed in existing chimneys after 1987 should meet the British Board of Agrément (BBA) approval scheme [14]. Where there is no certificate of compliance with the BBA scheme, or other documentary evidence available for the liner, a further liner, e.g. flexible stainless steel liner, should be installed. Other flue lining systems and methods of application may be used which have been independently certified as suitable for the intended purpose. **A2**

5.2 Installation

5.2.1 General

5.2.1.1 An appliance shall only be installed on to a flue if the appliance manufacturer's instructions are available to the installer.

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

5.2.1.3 An individual open flue system shall have no opening into any room other than the one in which the appliance or appliances are situated. All openings into voids created by false chimney breast or cladding or dry lining around the flue system shall be sealed with a high temperature silicone sealant to prevent the possibility of spillage of products of combustion escaping into other areas (see Figure 9). For a chimney installation, 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, and any below or above ground air ducts into the builder's opening shall be sealed.

All dimensions in millimetres

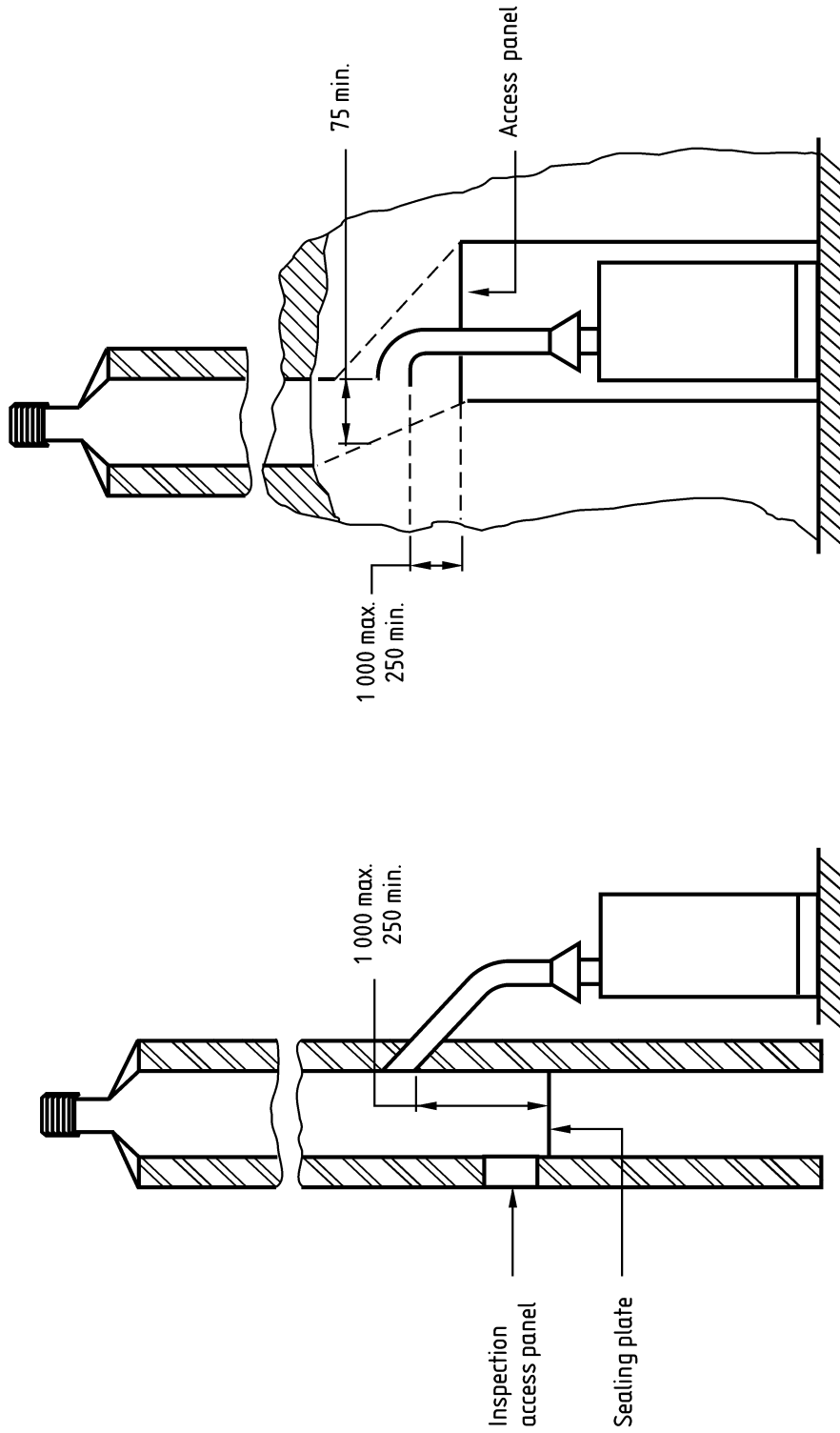


Figure 11 — Boiler connections to existing brick chimney

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

5.2.1.5 Flues installed in a timber framed building shall be in accordance with IGE/UP/7[10].

5.2.2 Support

The flue shall be supported. For a flue pipe system connected to a ridge terminal, neither the terminal nor the ridge tile adaptor shall be used as a means of support.

COMMENTARY AND RECOMMENDATIONS ON **5.2.2.**

Flue pipe should be supported by brackets fitted throughout its length at intervals not exceeding 1.8 m particularly at bends, or as instructed otherwise in the flue manufacturer's instructions.

Pre-cast flue block systems should, if constructed at the same time as the building, be bonded into the building structure. Such systems when installed as an add-on feature should be tied back to the structure as specified by the flue block manufacturer.

5.2.3 Jointing and weatherproofing

5.2.3.1 General

Flue and chimney components shall be jointed and weather proofed in accordance with the manufacturer's instructions.

All joints shall be made and sealed in accordance with the manufacturer's instructions. All spigot and socket joints shall be made and weatherproofed in accordance with the flue pipe manufacturer's instructions, in general the socket of each component is fitted uppermost.

Where an existing chimney or flue is lined, the annular space between the liner and the chimney or flue shall be sealed at its upper and lower ends. (See **5.1.8.4**)

Where a flue pipe or 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 (see footnote to commentary and recommendations on **5.1.2**), 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 flue system 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 flue system.

COMMENTARY AND RECOMMENDATIONS ON **5.2.3.1**

The method of jointing between flue and chimney components differs according to the product. Some products, such as a connecting flue pipe 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 design methods of installing a flue pipe through a slated or tiled roof is given in BS 5534-1 and on workmanship for slating and tiling in BS 8000-6.

5.2.3.2 Double-wall flue pipe

The grade of pipe specified in BS 715 for internal and external application shall be used.

Double-wall metal flue pipe shall be installed with the male ends uppermost. Where bayonet joints are employed, the full twist movement shall be taken up, to ensure the joint is complete.

When connecting a flue pipe to appliances or other fittings, or when connecting different makes of double-wall flue pipe, the flue pipe manufacturer's recommended adaptor shall be used, and the appliance manufacturer's instructions shall be followed.

Double-wall flue pipe or fittings shall not be cut unless specifically permitted in the manufacturer's installation instructions.

Adjustable bends shall not be strained such as to cause structural breakdown of the internal wall.

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

COMMENTARY AND RECOMMENDATIONS ON **5.2.3.2.**

As double-wall flue pipe 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 manufacturer's instructions. Any clamping mechanism supplied for use with an adjustable length should be used.

Some bends are of the adjustable type, but attempting to force adjustment outside the design criteria may cause failure of the internal wall.

The internal wall is the flue, and if this is perforated, the section should not be used. Sections incorporating damaged joints should not be used.

5.2.3.3 Flue blocks

Flue blocks used in the construction of flues shall not be broken or cracked. Minor imperfections and surface damage shall be deemed not to affect compliance.

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.

A raking or offset block shall be used to effect any necessary change in direction with a maximum offset of 30°, as specified in BS 1289.

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

When connecting a flue pipe to flue blocks, the manufacturer's transfer block shall be used. Any flue pipe connected to such a block shall not project into the flueway so as to restrict the cross-sectional area of the flue.

When connecting gas fires 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 5.

COMMENTARY AND RECOMMENDATIONS ON **5.2.3.3.**

Flue blocks are more resistive to flow than flue pipes of the same cross-sectional area, and any mortar extrusions at joints will 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.

5.2.4 Temperature effects

Any chimney, flue pipe or flue block shall be so constructed and be of such thickness or, in the case of a flue pipe, be so placed or shielded, as to prevent ignition or damage of any part of any building.

A flue pipe 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 having a fire resistance as specified in the appropriate building regulations.

COMMENTARY AND RECOMMENDATIONS ON **5.2.4.**

A flue pipe should be so routed so as to avoid the risk of ignition of combustible material. Where this is unavoidable, and the flue gas temperature is likely to exceed 80 °C, a flue pipe should be at least 25 mm from any combustible material. 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 flue pipe with a 25 mm air space.

For double-wall flue pipe conforming to BS 4543-2 and -3, the external skin and air gap constitutes insulation to a standard where no extra clearance from combustible material is required, other than normal installation tolerances. For a double-wall flue pipe conforming to BS 715, the 25 mm separation distance should be measured from the outside surface of the inner liner.

Flue block chimneys should not be directly faced with plaster, otherwise unsightly plaster cracking may 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 flue is thus faced it is essential that any gaps created between the flue blocks and facing should be sealed around the flue opening.

5.2.5 Protection of flue pipe

Any flue pipe shall be so placed or shielded to ensure that whether the pipe is inside or outside the building, there is neither risk of accidental damage to the flue pipe, nor danger to persons in or about the building.

COMMENTARY AND RECOMMENDATIONS ON **5.2.5**.

Where a flue pipe is situated within a dwelling, the risk of damage to the flue pipe or to persons may be minimized by enclosing the flue pipe within a duct (not necessarily imperforate) and maintaining a gap between inner surfaces of the duct and the flue pipe. Consideration should be given to the requirements of 5.2.4 when selecting the duct material.

5.2.6 Termination

Any terminal shall conform to **5.1.5** and the termination shall be located as specified in **5.1.6**.

COMMENTARY AND RECOMMENDATIONS ON **5.2.6**.

Any chimney with a flue of 170 mm diameter or less should be fitted with a terminal conforming to 5.1.5.

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 etc., 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 it will 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.

5.3 Commissioning

5.3.1 General

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

The performance of a flue and its associated appliance shall be checked in accordance with **5.3.2** to ensure that after initial installation, replacement or reinstallation of the appliance the products of combustion are completely discharged through the flue to atmosphere. Correct operation and integrity of the flue shall be verified by carrying out a flue flow test (smoke test) in accordance with **5.3.2.2**. Furthermore, there shall be no spillage of combustion products into the room when the flue and flue/appliance combination is tested in accordance with **5.3.2.3**.

5.3.2 Methods of test

5.3.2.1 Visual check

The flue system, whether existing, newly erected, adapted or altered, shall be visually checked to ensure that it is fit for the intended use with the intended appliance, conforms to this standard 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 **5.1.6** and a weather tight joint between the terminal and the flue system;

d) where appropriate, any dampers or restrictor plates have been removed or permanently fixed in the open position to leave the main part of the flueway unobstructed

e) where appropriate, any catchment space is the correct size, free of any debris and any gaps into the space are sealed.

Where an existing flue system has been used, any signs of spillage shall be investigated and any fault rectified.

COMMENTARY AND RECOMMENDATIONS ON 5.3.2.1.

The loft space should be inspected to ensure that any flue system passing through it is complete, continuous and not damaged, and all joints are properly made, and it is properly supported using suitable brackets.

Masonry flues 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 flue is in poor condition it should be renovated to ensure safe operation. Consideration should be given to fitting the correctly sized flue liner.

5.3.2.2 Flue flow test (smoke test)

On satisfactory completion of the visual check in accordance with 5.3.2.1 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 visualisation check with a smoke pellet at the intended position for the appliance. Ensure there is discharge of smoke from the correct terminal only and no leakage into the room. Where the flue is reluctant to draw and there is smoke spillage, introduce some heat into the flue for a minimum of 10 minutes using a blow torch or other means and repeat the test;

c) the test is satisfactory if there is no significant escape of smoke from the appliance position, no seepage of smoke over the length of the flue and discharge of smoke from only the correct terminal. If these conditions are not met, the flue has failed the test and no gas appliance shall be left connected to the gas supply until the faults have been rectified.

COMMENTARY AND RECOMMENDATIONS ON 5.3.2.2.

A flue flow check should be carried out to ensure the effectiveness of the flue 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 flue.

The flue flow test should be carried out using a suitable smoke pellet. For chimneys and flues systems specified in this British Standard, the minimum performance of pellet that should be used is one which the pellet manufacturer claims generates 5 m³ of smoke in 30 seconds burn time.

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

Smoke coming out of other than the correct terminal only, or a draught or “no flow” condition, indicates the “flue” has failed the test. A thorough examination of the flue should be undertaken to identify any obvious cause of failure, and the appliance shall not be connected until any defect has been found and rectified. If the flue system 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 only intended to establish that the flue system serving the appliance is of sufficient integrity that it will safely remove the products of combustion when the appliance is alight. Weather conditions, the temperature of the flue and a combination of materials used to construct the flue can all influence the smoke test. The pre-heating process may require as much as half an hour before the flue behaves as intended, as a blow torch does not provide a representative volume of heat into the flue consistent with normal appliance operation. If the flue continues to “fail” after a longer “pre-heating” period, and there is no obvious reason, it may 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 flue during a smoke test may 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 flue during the normal smoke test procedure is not required and could lead to a dangerous situation if left in place after the test.

5.3.2.3 Checks with appliance connected (spillage test)

A2 On satisfactory completion of the test in **5.3.2.2** the flue system with the appliance connected shall be checked as follows.

- a) New or used appliances shall not be installed unless the manufacturer’s instructions are available to the installer. Where the 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 5 minutes of lighting. Apart from an occasional wisp, which may be discounted, all the smoke shall be drawn into the flue 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 10 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.

The appliance shall not be left connected to the gas supply unless it has successfully passed the spillage tests specified in the preceding paragraph. 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.

NOTE It is an offence, under the Gas Safety (Installation and Use) Regulations [1], to use or allow the use of a dangerous appliance. **A2**

COMMENTARY AND RECOMMENDATIONS ON 5.3.2.3.

A2 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 the flue examined. **A2**

Examples of fans which may affect the performance of the flue 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 flues 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 may particularly affect inset live fuel effect fires (ILFE's).

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 is normally given on a badge attached to the appliance and also detailed in the appliance instructions. For further information see BS 5871.

5.4 Maintenance

The flue shall only be used if it is in a safe condition. There shall be no spillage or leakage of combustion products in to the room or leakage into any other room through which the flue passes, when the flue and flue/appliance is tested in accordance with 5.3.2.

COMMENTARY AND RECOMMENDATIONS ON 5.4.

Routine maintenance should be carried out on all gas appliances and their flues, in accordance with the appliance manufacturer's instructions, to ensure their safe operation. **A2** Where manufacturer's instructions are not available the appliance manufacturer should be consulted and the procedure of 5.3.2 followed as far as is practicable. **A2**

The flue system should be checked to ensure that it conforms to the requirements of 5.1 and that it has been installed in accordance with 5.2. A visual check, flue flow check and spillage check with the appliance connected, should be carried out in accordance with 5.3.2 for the appliance/flue installation concerned. The flue flow check may be carried out without moving the appliance. A flue 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 should be carried out.

6 Individual open flue: fanned draught (for Types B₁₄, B₂₂, B₂₃ appliances)

NOTE This section is intended to apply Type B₁₄, B₂₂, B₂₃ appliances fitted with a fan supplied with or specified by the appliance manufacturer. Additional subclauses (6.1.3, 6.3.2) have been included for applications where the fan is an independent unit selected by the installer and installed in the secondary flue.

6.1 Design

6.1.1 General — Fans fitted to flues, typically serving Type B₁₄, B₂₂, B₂₃ appliances

The flue system shall be constructed from the materials specified in 5.1.2 or 5.1.3, routed as specified in **A1** 6.1.4 **A1**, and the flue shall be terminated as specified in **A1** 6.1.2 **A1**.

COMMENTARY AND RECOMMENDATIONS ON 6.1.1.

The requirements of this clause relate to flues for individual open flue 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 B₁₄, B₂₂ and B₂₃) 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 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 flue system is usually employed where it has advantages of greater freedom in siting the appliance and flued terminal, and possibly a smaller flue pipe.

6.1.2 Termination

The terminals shall be designed and positioned so that combustion products can safely disperse at all times.

Flue terminals shall be installed in accordance with Annex C (open flues, fanned draught) of this standard unless the appliance manufacturer's say otherwise.

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

COMMENTARY AND RECOMMENDATIONS ON 6.1.2.

Fanned individual open flues do not require a terminal of the types specified for natural draught open flues, although a terminal may be convenient, for example to exclude rain. The terminal should be sited so that the combustion products do not cause damage to adjacent building features.

*When locating **A1** fanned draught open-flued appliances **A1**, 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 may be readily observed, especially in cold weather or if a condensing appliance is involved.*

It is recommended that a fanned flue terminal should 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.*

6.1.3 Extra requirements for fans installed on site

NOTE This clause applies to fans fitted to flues typically serving B₁₁, B₁₂ and B₁₃ appliances.

6.1.3.1 Fan and flue

The fan shall be chosen and the flue shall be routed and sized to ensure full clearance of combustion products against adverse wind pressures as in **6.1.4**.

COMMENTARY AND RECOMMENDATIONS ON 6.1.3.1.

*Flue flow assistance may 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 **6.1.3.2** 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 care should be taken to consult the appliance manufacturer, the fan manufacturer and the flue manufacturer as appropriate.

The flow rate necessary to ensure full clearance of combustion products varies significantly between appliances, but it can be assumed that other than in exceptional cases the CO₂ concentration and corresponding flow rates as given in Table 6 will provide clearance.

The flue flow rates 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.

6.1.3.2 Safety control

Where the fan is fitted in the secondary flue, the flue system shall incorporate a safety control in the secondary flue external to the appliance so that the gas supply to the main burner shall be cut off should the flow in the secondary flue become 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.

After the safety control has operated, manual intervention shall be 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.

6.1.4 Choice of fan, flue route and size

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

- a) 0.15 mbar if the flue termination is located as specified in 5.1.6;
- b) 0.75 mbar except when the flue termination is located as specified in 5.1.6.

COMMENTARY AND RECOMMENDATIONS ON 6.1.4.

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

6.2 Installation

The installation of fanned open flues shall conform to 5.2 and be suitable for the positive pressures generated in the flue. Joints in the flue system shall be sound.

COMMENTARY AND RECOMMENDATIONS ON 6.2.

The use of a fan can introduce relatively high pressure differences which necessitate additional precautions in the construction of the flue system.

6.3 Commissioning

6.3.1 Fans integral with appliance

The commissioning shall be in accordance with the manufacturer's instructions.

6.3.2 Fans installed on site

The commissioning of open flues with a fan installed on site in the secondary flue shall conform to 5.3 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 6.1.3.2 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 $\overline{A_1}$ in accordance with the manufacturer's instructions $\overline{A_1}$;
- 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 flue in operation and all external doors and windows closed, and with the interconnecting door open.

Table 6 — Minimum flow rates for fanned flues

Appliance	Maximum CO ₂ concentration (%)	Minimum flue flowrate (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 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 flue is a spillage test at the appliance.

6.4 Maintenance

The flue shall only be used if it is in a safe condition. There shall be no leakage of combustion products into the room when the flue and flue/appliance is tested in accordance with **5.3.2**.

COMMENTARY AND RECOMMENDATIONS ON **6.4**.

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

*The flue system 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**. The safety controls should be checked using the method of **6.3**.*

*A visual check, flue flow check and spillage check with the appliance connected, should be carried out in accordance with **5.3.2** for the appliance/flue installation concerned. The flue flow check may be carried out without moving the appliance. A flue 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 should be carried out.*

7 Shared open flue: natural draught (for Types B₁₁, B₁₂, B₁₃ appliances)

7.1 Design

7.1.1 General

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

- a) each appliance shall be \square_{A2} of the natural draught type and \square_{A2} 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 flue products from the whole installation;
- e) the chimney shall be installed so that there is access for inspection and maintenance.

Unless otherwise specified in this clause, the requirements for a shared flue system shall be the same as those for an individual system (see clause **5**).

7.1.2 Appliances using a common flue in the same room

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 shall prevent the discharge of flue 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 manufacturer's flue conditions are met under all operational conditions.

COMMENTARY AND RECOMMENDATIONS ON **7.1.2**.

Further advice, regarding sizing, when two appliances use one flue in the same room, can be obtained from publication IM/11 – the British Gas document “Flues for commercial and industrial sized boiler and air heaters” [15] official photocopies of which are now available from the Institution of Gas Engineers.

Where one appliance is likely to be used more regularly or for longer periods, then this shall be connected at the nearest point to the main flue.

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

7.1.3 Appliances installed on different floors of a building

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

- a) The main flue shall not be formed of a chimney being part of an external wall or by a flue pipe 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 mm², and shall be sized in accordance with Table 7.
- c) Each appliance shall discharge into the main flue by way of subsidiary flue not less than 1.2 m above the outlet of the appliance which it serves (see Figure 12). In the case of a gas fire, the subsidiary for a connection shall be a minimum of 3 m above that outlet of the appliance which it serves.
- d) For newly built flues, all appliances shall be of the same type, being any one of the types specified in Table 7, and the number and total input rating of such appliances shall not exceed those specified in Table 7 according to the type of appliance and the cross-sectional area of the main flue.
- e) When connecting new appliances to existing flues, 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, i.e. B₁₄, B₂₂, B₂₃ shall not be used.
- g) All appliances shall be labelled to indicate that the flue system is shared.

COMMENTARY AND RECOMMENDATIONS ON 7.1.3.

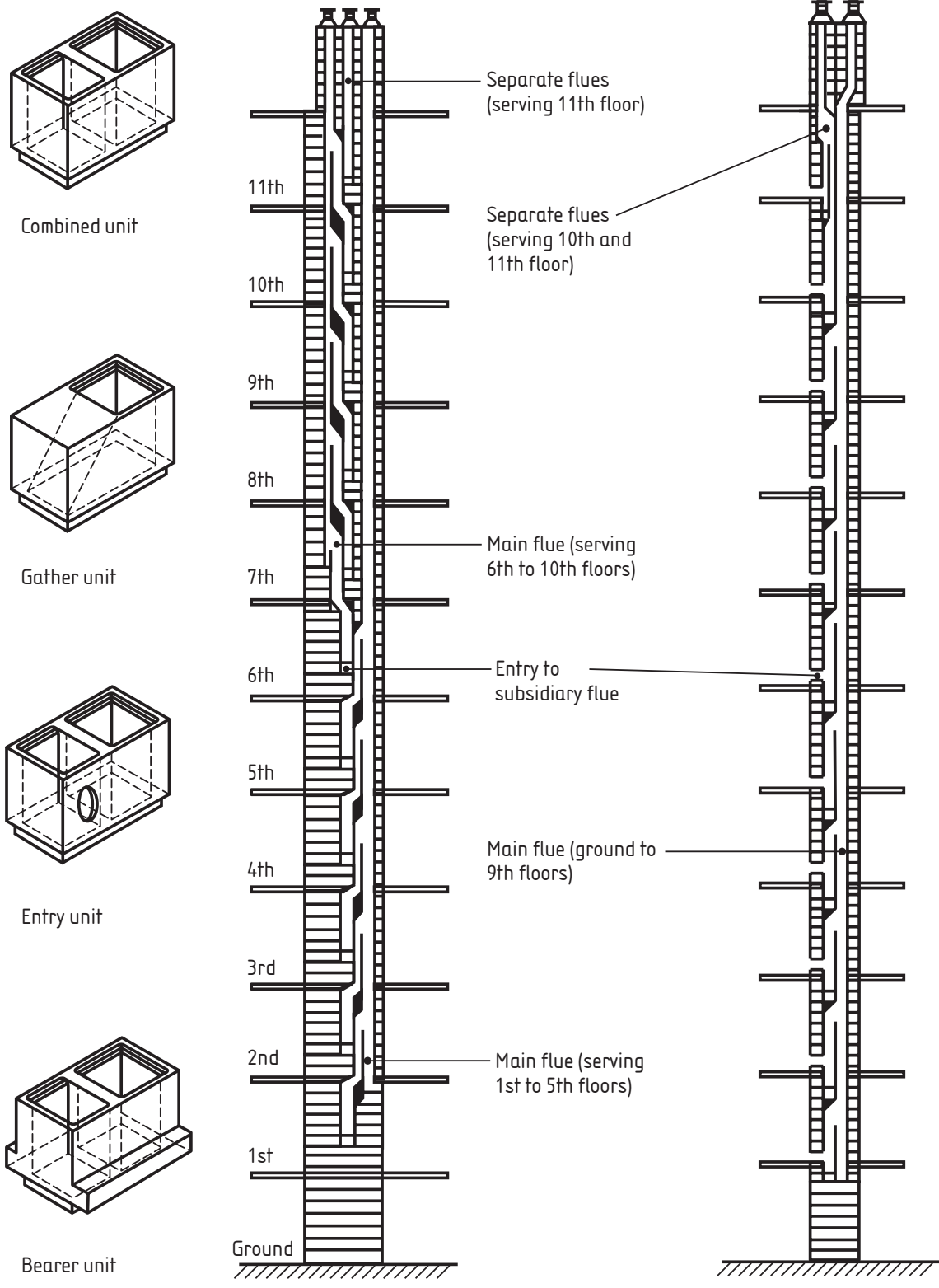
In each room or internal space containing an appliance connected to the shared flue, the number of permanent ventilation openings, should be the same and have a similar aspect. The main flue should be without offsets and should not be inclined at an angle of more than 10° from the vertical. Specialized flue blocks are available to simplify the design and construction of shared flue systems. Examples are given in Figure 12.

A typical label that should be attached to an appliance should state "This appliance is fitted to a shared flue system and must 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 5440-1:2000."

Table 7 — Appliances discharging by way of subsidiary flues into a main flue

Type of appliance	Nominal cross-sectional area of main flue			
	Not less than 40 000 mm ² but less than 62 000 mm ²		62 000 mm ² 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

A1



a) Flue block types

b) System for gas fires

c) System for gas fires or water heaters

Figure 12 — Shared flue systems and flue block types

A1

7.1.4 Terminal design and location

The terminal design shall be in accordance with 5.1.6.

The outlet of a main flue 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 so situated that the outlet is not less than 6 m above any appliance served by the flue.

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

Where the chimney or flue pipe passes through a flat roof the $\boxed{A_1}$ location shall be in accordance with 5.1.6. $\boxed{A_1}$

7.2 Installation

The installation shall be in accordance with 5.2.

7.3 Maintenance

7.3.1 Maintenance of the shared flue system

A shared open flue serving natural draught appliances, shall be checked to ensure that it conforms to the requirements of 7.1 and 7.2 and that the appliances connected to it can be used safely.

COMMENTARY AND RECOMMENDATIONS 7.3.1.

The responsibility for a shared flue lies with the landlord or the person responsible for the building. It is essential that a landlord of a "relevant" premises shall carry out annual checks on the flue systems, including parts of the flue which are shared. (Attention is drawn to the Gas Safety (Installations and Use) regulations [1] and Health and Safety at Work legislation for the responsibilities of landlords [16].

Since inadequate installation or the operation of any one appliance connected to a shared flue system may affect the safe operation of others, it is important that routine inspections should be carried out on all appliances. As far as is reasonably practicable, the design and installation features including the roof termination should be checked for structural integrity and compliance with 7.1 and 7.2.

7.3.2 $\boxed{A_1}$ Clause deleted $\boxed{A_1}$

8 Balanced flue: natural draught (for Type C₁₁ appliances)

8.1 General

Only appliances specifically designed for balanced flue applications shall be used for that purpose.

The flue duct and air supply system forms an integral part of a balanced-flued appliance and it shall be installed in accordance with the appliance manufacturer's instructions.

All components of the flue duct and air supply system shall be supplied by the appliance manufacturer.

NOTE Detailed arrangements for timber framed dwellings on termination, weather sealing, temperature effects etc., are to be found in the Institution of Gas Engineers publication IGE/UP/7 [10].

COMMENTARY AND RECOMMENDATIONS ON 8.1.

A natural draught balanced-flued appliance incorporates a terminal in its design and this is intended to be located on, or adjacent to an outside wall of a building. The products of combustion outlet is adjacent to the air inlet, an arrangement that minimizes wind effects on the appliance performance.

8.2 Installation

8.2.1 Termination

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

Flue 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 (balanced flues: natural draught).

Terminals shall not be sited in covered passageways between buildings.

The appliance manufacturer shall specify a protective guard where persons could come into contact with the terminal or if it could be subject to damage. The dimensions of the guard shall be such that, when fitted in accordance with the manufacturer's instructions, no part of the guard shall be less than 50 mm from any part of the terminal (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. Proprietary guards to this specification are available.

COMMENTARY AND RECOMMENDATIONS ON 8.2.1.

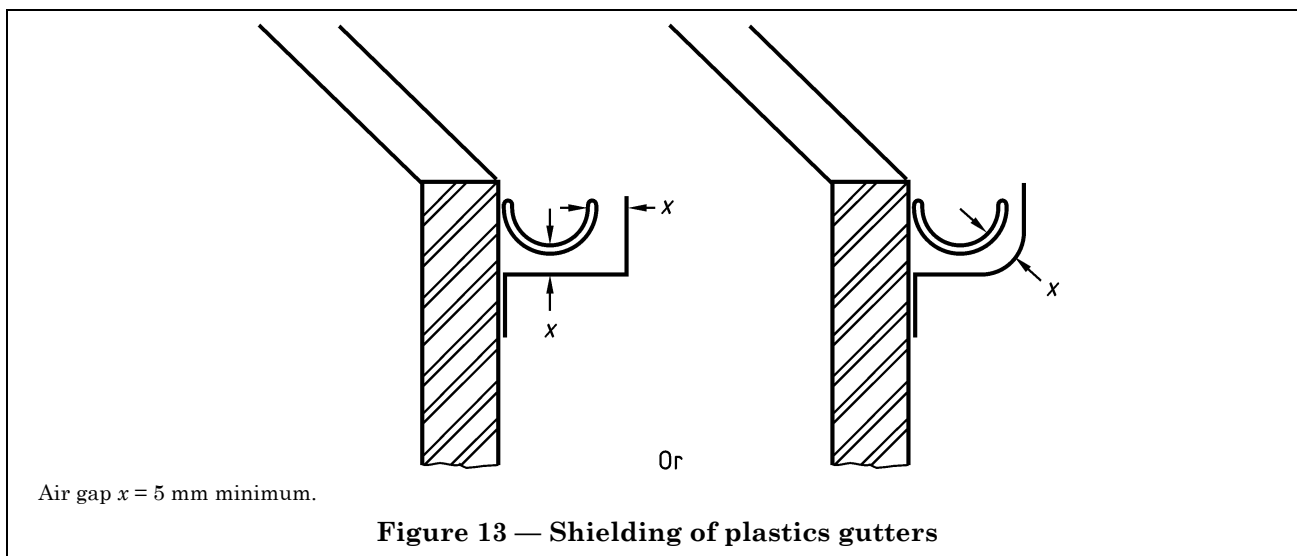
The terminal should be positioned so that the combustion products do not cause a nuisance, for example, not onto a passageway, pathway or over adjoining property.

If a natural draught terminal is fitted less than 1 m below a plastics gutter or less than 0.5 m below painted eaves or any other painted surface a suitable shield at least 1 m long should be fitted to protect the surface (see Figure 13).

In the absence of any specific instruction from the manufacturer, a suitable guard should be provided whenever a terminal is fitted less than 2 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:

- the car port or other add-on extension should have at least two open and unobstructed sides;*
- the dimension F given in Table C.1, Annex C should be taken as the vertical distance between the lowest point of the roof and the top of the terminal;*
- 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.*



8.2.2 Jointing and weather sealing

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

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

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

COMMENTARY AND RECOMMENDATIONS ON 8.2.2.

When installing balanced-flued 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.

8.2.3 Temperature effects

The flue assembly shall be so placed or shielded as to prevent ignition or damage to any part of the building. When installing a flue assembly through a wall of combustible construction, or containing combustible materials, the 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 method shall be adopted.

That section of the flue assembly 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 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 terminal and to maintain the 25 mm gap. The joint between the plate and the wall surface shall be weatherproofed.

8.3 Installation checks

Before leaving the appliance connected to the gas supply, the installer shall visually examine the appliances, the flue duct and air inlet duct to ensure that:

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

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, then any sealing tape required by the manufacturer's instructions has been fitted;
- c) no debris is contained within the flue assembly;
- d) the joint between the terminal and the wall is weatherproof;
- e) internal equipment, e.g. thermocouple, wires etc., are securely held or positioned to ensure that they will not interfere with the sealing of the combustion circuit, and all grommets etc. are in place.

8.4 Maintenance

The flue shall only be used if it is in a safe condition.

The checks of 8.3 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 so corroded to affect soundness.

COMMENTARY AND RECOMMENDATIONS ON 8.4.

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

The flue system should be checked to ensure that it conforms to the requirements of 8.1 and that it has been installed in accordance with 8.2. A flue 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 should be carried out.

9 Room sealed: fanned draught

9.1 Design options

9.1.1 General

The flue duct and air supply system form an integral part of a room-sealed flued appliance, and shall be installed in accordance with the appliance manufacturer's instructions.

All components of the flue duct and air supply system shall be supplied by the appliance manufacturer, except for C₆ appliances.

NOTE Detailed arrangements for timber framed dwellings on termination, weather sealing, temperature effects etc., are to be found in the Institution of Gas Engineers publication IGE/UP/7 [10].

9.1.2 Room sealed: Balanced flue appliances (C₂, C₃)

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

COMMENTARY AND RECOMMENDATIONS ON **9.1.2**.

*In the UK, terminals are generally supplied with balanced flue Type C₂, C₃ appliances. If a terminal is not supplied with the appliance, i.e. a Type C₆ appliance, then see **9.1.3** as follows.*

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

9.1.3 Room sealed: Non-balanced flue (C₅)

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 another appliance terminals in accordance with the siting requirements for air supply specified in Table 1 of BS 5440-2:2000. The flue outlet shall be sited in accordance with Table C.1 and Figure C.1.

COMMENTARY AND RECOMMENDATIONS ON **9.1.3**.

The air inlet and flue outlet may be located on the same or different faces of a building. A fanned draught, room sealed appliance will normally be supplied with separate air inlet and flueing components which are assembled on site. The manufacturer's instructions will provide details of the maximum length of ducts and number of bends etc., which may be used in the installation.

9.1.4 Room sealed: terminals supplied separately from appliance (C₆)

NOTE This option is not generally available in the UK.

The installer shall establish the compatibility and correct installation and sealing of the flue/air supply terminal.

COMMENTARY AND RECOMMENDATIONS ON **9.1.4**.

The installer has a duty to establish the compatibility of a terminal system with the appliance. The appliance manufacturer's advice should be sought and followed.

9.2 Installation

9.2.1 Termination

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

Flue 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 (balanced flue; fanned draught).

Terminals shall not be sited in covered passageways between buildings.

The appliance manufacturer shall specify a protective guard where persons could come into contact with the terminal or if it could be subject to damage. The dimensions of the guard shall be such that, when fitted in accordance with the manufacturer's instructions, no part of the guard shall be less than 50 mm from any part of the terminal (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. Proprietary guards to this specification are available.

COMMENTARY AND RECOMMENDATIONS ON **9.2.1**.

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

[A] *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 may be readily observed, especially in cold weather or if a condensing appliance is involved.*

It is recommended that a fanned flue terminal should 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. **[A]***

In the absence of any specific instruction from the manufacturer, a suitable guard should be provided whenever a terminal is fitted less than 2 m above ground, above a balcony or above a flat roof to which people have access.

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

- a) *the car port or other add-on extension should have at least two open and unobstructed sides;*
- b) *the dimension **[A]** F **[A]** given in Annex C should be taken as the vertical distance between the lowest point of the roof **[A]** immediately above the terminal **[A]** 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.*

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

9.2.2 Jointing and weatherproofing

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 assembly and surrounding structure shall be sealed.

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

COMMENTARY AND RECOMMENDATIONS ON **9.2.2**.

When installing balanced flue 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.

9.2.3 Temperature effects

The flue assembly shall be so placed or shielded as to prevent ignition or damage to any part of any building.

When installing a flue assembly through a wall of combustible construction, or containing combustible materials, the 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 assembly 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 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 terminal 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 the flue duct and air inlet duct 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 and air duct are either continuous throughout the wall or, if they are telescopic, then any sealing tape required by the manufacturer's instructions has been fitted;
- c) no debris is contained within the flue assembly;
- d) the joint between the terminal and the wall is weatherproof;
- e) internal equipment, e.g. thermocouples, wires etc., are securely held or positioned to ensure that they will not interfere with the sealing of the combustion circuit, and all grommets etc. are in place.

9.4 Maintenance

A₂

9.4.1 General **A₂**

The flue shall only be used if it is in a safe condition.

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 so corroded to affect soundness.

COMMENTARY AND RECOMMENDATIONS ON **9.4.1**.

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

*The flue system 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**. A flue 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 should be carried out.*

A₂

9.4.2 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 AND RECOMMENDATIONS ON **9.4.2**.

A checklist for checking the general integrity and leakage from the case seals is given in Figure E.1 of Annex E.

Advice on identifying which appliances are affected can be readily obtained from CORGI www.corgigroup.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.

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

A checklist to help ensure that case seals of positive pressure gas appliances conform to the requirements of the GSIUR, has been developed and is given in Figure E.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 will 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/authorized component. ^(A2)

10 Balanced compartment

10.1 General

Where an appliance is to be installed in a balanced compartment, it shall conform to **10.2**, **10.3**, **10.4**, **10.5**, **10.6** and **10.7**. These requirements are additional to those specified in **5.1.2**, **5.1.8** and **5.2**. The flue shall be sized in accordance with **5.1.5**.

COMMENTARY AND RECOMMENDATIONS ON **10.1**.

The balanced compartment is a method of installing an open-flued appliance in a room-sealed situation and arranging the flueing and ventilation so that a balanced-flued effect is achieved [see Figure 14a)].

The method is particularly suitable for larger applications (having a heat input of 35 kW to 70 kW) where room sealed appliances are generally not available. The method may also provide an alternative to long external flue runs or for use when the boiler house is adjacent to a taller building.

10.2 Design

10.2.1 The flueing and ventilation arrangements shall be such as to ensure full clearance of combustion products.

COMMENTARY AND RECOMMENDATIONS ON **10.2.1**.

Flueing and ventilation arrangements may either be designed for individual applications, or proprietary systems may be used. The systems should be installed in accordance with the flue manufacturer's instructions and the appliance manufacturer's recommendations.

10.2.2 The combustion air shall be ducted down from a point adjacent to the flue terminal.

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

The cross-sectional area of the air inlet duct shall be in accordance with Table 8.

Table 8 — Balanced compartment air inlet duct sizing

Ducted to low level vent inside appliance compartment [see Figure 14a)]	Ducted to high level only [see Figure 14b)]
1.5 ^a	2.5 ^a

^a is the maximum air vent area for a high level, direct to outside air opening specified for open-flued appliances in BS 5440-2.

COMMENTARY AND RECOMMENDATIONS ON 10.2.2.

Where a proprietary system such as that referred to in the commentary and recommendations on 10.2.1 is used, the system manufacturer's and appliance manufacturer's instructions should be followed.

Where the ceiling of the appliance 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 inlet duct. This opening should be of the same cross-sectional area to that of the duct. The opening in the duct may be provided by a T or Y piece inserted at high level.

10.3 Appliance compartment construction

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 A_1 (see Figure 14). A_1

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

COMMENTARY AND RECOMMENDATIONS ON 10.3.

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 appliance compartment should be effectively isolated from its surroundings, except for the flue and ventilation arrangements.

10.4 Temperature effects

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

COMMENTARY AND RECOMMENDATIONS ON 10.4.

Double-wall flue pipe conforming to BS 715 or factory made insulated metal chimney conforming to BS 4543 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 of the appropriate thickness and value of k to give no greater loss.

10.5 Termination

Where a terminal position as specified in 5.1.6 is not possible, information and requirements shall be agreed and documented between the manufacturer, installer and customer.

COMMENTARY AND RECOMMENDATIONS ON 10.5.

The termination of a balanced compartment installation is not as critical as an individual open flue installation. However, if positions other than those specified in 5.1.6 are advantageous, appropriate advice should be available from the appliance manufacturer or (in the case of a proprietary flue system) the flue system manufacturer.

10.6 Commissioning

The flue system and its associated appliance shall be commissioned in accordance with 5.3 or 8.3 as appropriate to the appliance type. Following commissioning, the switch shall be reinstated and its operation checked to ensure it is functioning correctly.

COMMENTARY AND RECOMMENDATIONS ON 10.6.

In most applications, the balanced compartment will be sufficiently large to permit the commissioning engineer to remain in the appliance compartment to undertake the test method specified in 5.3.

Where this is not the case the test may be carried out with the appliance compartment door open. It will be necessary to temporarily bypass the switch specified in 10.6 to undertake this work.

10.7 Maintenance

The flue shall only be used if it is in a safe condition. There shall be no spillage or leakage of combustion products from the room when the flue and flue/appliance is in operation. The checks of 8.4 shall be carried out where appropriate to the appliance type.

COMMENTARY AND RECOMMENDATIONS ON 10.7.

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

As far as is practicable, the flue system should be checked to ensure that it conforms to the requirements of 10.2, 10.3, 10.4 and 10.5. A visual check, flow flue check and check with the appliance connected, should be carried out in accordance with 5.3.2 as far as is practicable for the appliance/flue installation concerned. A flue 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 should be carried out.

11 Shared room-sealed: (for Types C₂, C₄ appliances)

11.1 Design

11.1.1 General

Shared-room sealed systems shall not be used with 3rd family gases. A_2 The appliance(s) shall satisfy the test requirements for Se-duct and U-duct appliances as specified in the appropriate appliance standards. A_2

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.

COMMENTARY AND RECOMMENDATIONS ON 11.1.1.

The route of a Se-duct or U-duct is an intrinsic part of the design of a building.

This type of flueing system is intended primarily for use in multi-storey applications. Typical Se-duct and U-duct configurations are shown in Figure 14. Further information on block and flue sizes is given in Table 9, Table 10 and Table 11. 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.

11.1.2 Se-ducts

Each Se-duct shall be constructed as a vertical duct through the building. The 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.

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

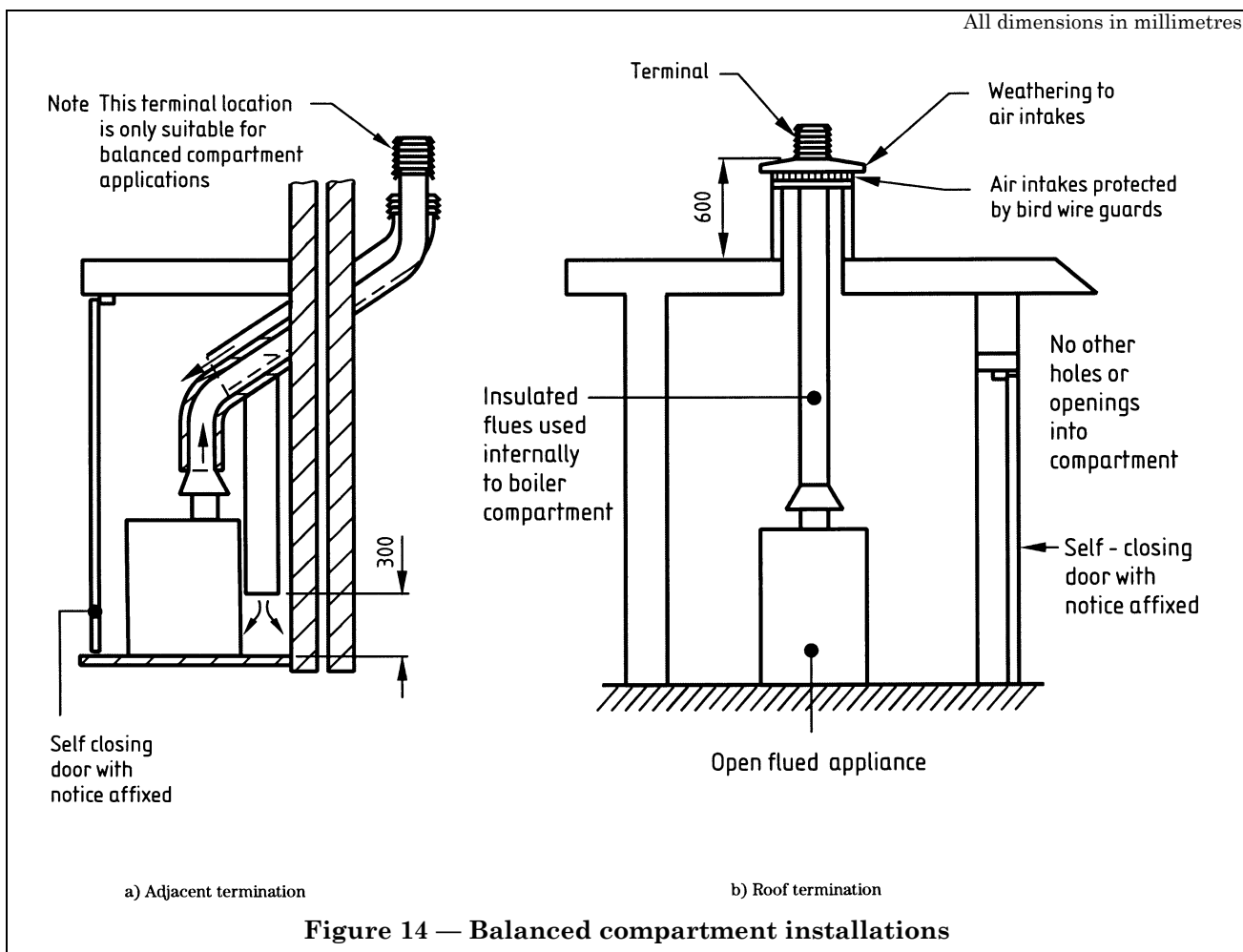
The vertical duct shall be constructed of pre-cast concrete sections or fabricated from non-combustible material. The duct shall meet the fire resistance requirement specified in the Building Regulations [2].

COMMENTARY AND RECOMMENDATIONS ON 11.1.2.

Pre-cast sections are normally available in heights of 455 mm or in storey heights, with floor-bearing units to spread the load imposed by the mass of the duct. These units are available in a normal range of sizes as specified in Table 9. Similar construction may be employed for the horizontal base duct or it may be cast in situ during the erection of the building. 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 may be convenient to construct the ducting of metal at ceiling level; non-combustible fire-resistant cladding may be necessary in some circumstances. Buildings supported on columns or having a well-ventilated sub-floor space will normally satisfy the neutral pressure zone requirement.

Table 9 — Normal Se-duct block sizes

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



11.1.3 U-ducts

Both limbs of the U-duct shall be constructed as a vertical duct through the building. The 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.

11.2 Sizing

The Se-duct size for an appliance shall conform to Table 10 or Table 11. Where a U-duct is to be used, the duct area shall be 1.24 times that specified for a Se-duct.

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

11.3 Termination design and location

11.3.1 Roof Termination

The base of the opening of the terminal 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 terminal shall be positioned not less than 1.5 m from such structures, or where this is not possible, the terminal shall be raised so that the base of its opening is above the top of the structure. The terminal design shall be in accordance with 5.1.6.

COMMENTARY AND RECOMMENDATIONS ON 11.3.1.

Specialist advice should be sought at the design stage concerning the duct termination.

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

11.3.2 Low level entry duct design

Where the duct terminates in a neutral pressure zone below a building, see **A1** Figure 15 **A1**, 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 will 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 AND RECOMMENDATIONS ON **11.3.2**.

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 5440-1:2000. It must 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 5440-1:2000. It must not be blocked or restricted under any circumstances. For more information refer to the person responsible for the building; Name and contact details"*

11.4 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.

11.5 Appliance selection and installation

11.5.1 Se-duct (C2) and U-duct (C4) appliance installation

Only appliances which are suitable for the application shall be used on either Se-duct and 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 shall project into the duct the distance specified by the manufacturers of the appliance. Fanned draught appliances shall not be fitted back to back into a duct.

After the appliance has been connected to the duct, any gaps between the air inlet/flue outlet spigots and the duct wall shall be sealed.

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

COMMENTARY AND RECOMMENDATIONS ON **11.5.1**.

Appliances suitable for shared flues are badged as such by the appliance manufacturer.

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 may 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 CO₂ concentration of 2 % at the inlet to the top appliance. The current requirements are based on a 1.5 % CO₂ concentration and the duct sizing charts have been computed accordingly.

A typical label that should be attached to an appliance should state "This appliance is fitted to a shared flue system and must 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 5440-1:2000."

11.5.2 Replacement appliances

The following additional requirements apply to the replacement of appliances on either a Se-duct or a U-duct.

A2 When connecting new appliances to existing flues, replacement appliances shall be not greater in input to the original appliances and suitable for the size of the flue. **A2** Reference shall be made to the person responsible for the building.

The duct shall be inspected to ensure that the cross-sectional area of the duct conforms to Table 10 or Table 11.

When installing a combination boiler, use Table 10 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 11.

The duct shall be inspected as far as is practicable 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, and of sufficient size to cover the existing holes in the duct wall. The flue outlet/air inlet holes for the replacement appliance shall be drilled in both the sealing plate and the 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 AND RECOMMENDATIONS ON 11.5.2.

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.

Table 10 — Se-duct sizes for continuously burning appliances (e.g. boilers, gas fires) in flats

Rated input of continuously burning appliance	Number of storeys											
	3	4	6	8	10	12	14	16	18	20	24	28
	Se-duct cross-sectional area											
kW, net (gross)	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 (3)	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 (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 (10)	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 (15)	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 (20)	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 (25)	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 (30)	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.

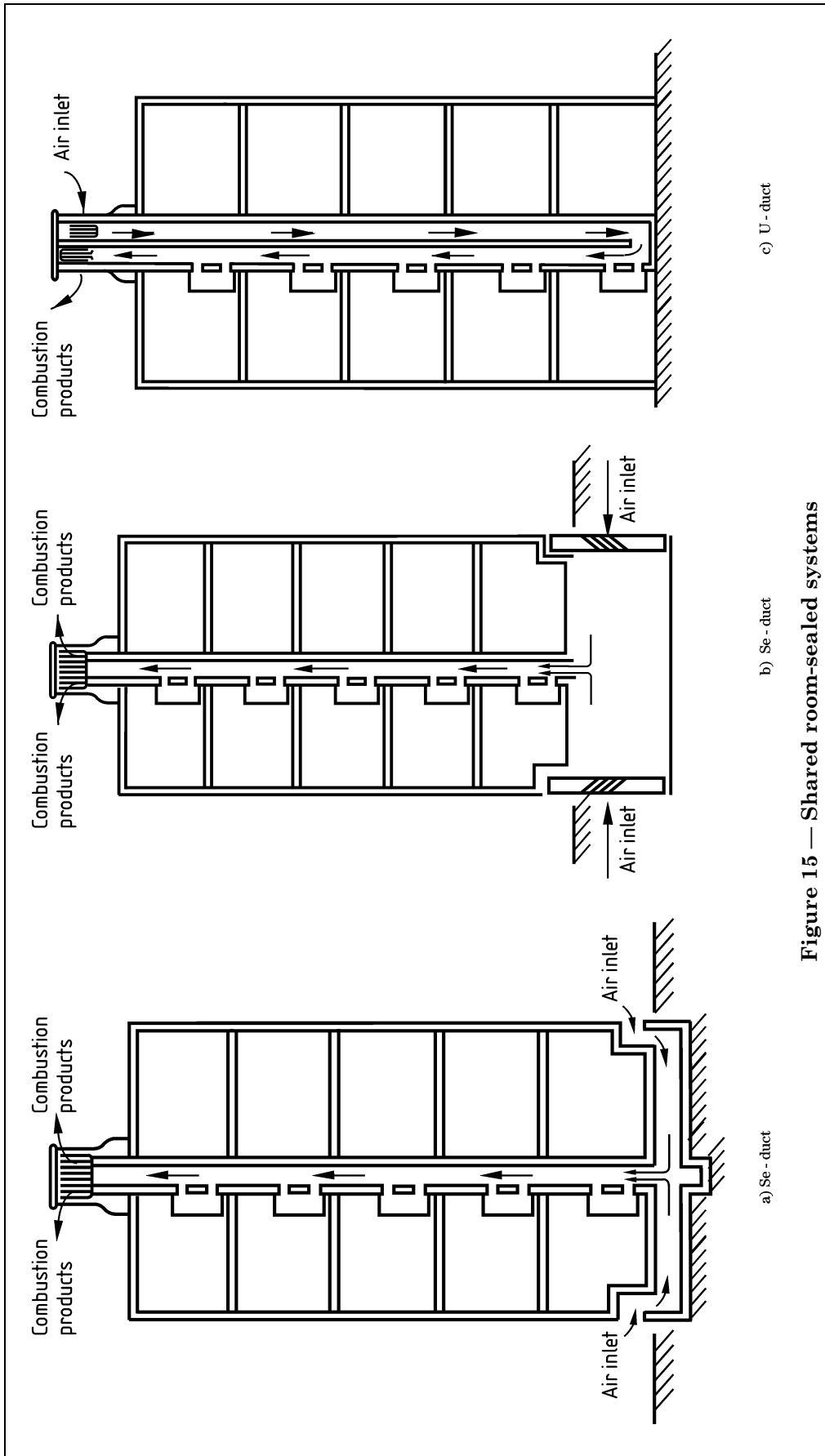


Figure 15 — Shared room-sealed systems

A) 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 m².

For 18.0 kW (net) the cross-sectional area required is 0.233 m².

The cross-sectional area for 15 kW is therefore:

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

$$\sqrt{0.206 \text{ m}^2} = 454 \text{ mm}$$

This would be satisfied by a flue block 454 mm × 454 mm, or greater, or size No. 4 from Table 9, i.e. 380 mm × 560 mm = 0.213 m².

For a U-duct

The cross-sectional area for 15 kW is 0.205 × 1.24 ≈ 0.254 m²

(see 11.2)

$$\sqrt{0.254 \text{ m}^2} = 504 \text{ mm}$$

This would be satisfied by a flue block 504 mm × 504 mm or greater. $\sqrt{A_1}$

Table 11 — Se-duct sizes for combinations of instantaneous water heaters (30 kW input rating) and continuously burning appliances (e.g., boilers, gas fires) in flats

Rated input of continuously burning appliance	Number of storeys											
	3	4	6	8	10	12	14	16	18	20	24	28
	Se-duct cross-sectional area											
kW, net (gross)	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 (3)	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 (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 (10)	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 (15)	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 (20)	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 (25)	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 (30)	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.

11.6 Commissioning

11.6.1 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.

11.6.2 Existing buildings: single replacement appliances

See 11.5.2. The appliance shall be commissioned as though it were connected to a single flue.

COMMENTARY AND RECOMMENDATIONS ON 11.6.1 AND 11.6.2.

Some existing Se-ducts are fitted with restrictor plates at the terminal grilles to reduce the duct air velocity under extreme wind conditions.

11.7 Maintenance

11.7.1 Maintenance of the shared flue system

A Se-duct or U-duct shall be checked to ensure that it conforms to 11.1, 11.2, 11.3 and 11.4 and that the appliances connected to it can be used safely.

The responsibility for a shared flue is the landlord's or the person's responsible for the building. A landlord of a "relevant" premise shall carry out annual checks on the flue systems, including parts of the flue which are shared. (Attention is drawn to the Gas Safety (Installations and Use) regulations [1] and Health and Safety at Work legislation [6] for the responsibilities of landlords.

COMMENTARY AND RECOMMENDATIONS ON 11.7.1.

Since inadequate installation or the operation of any one appliance connected to a shared flue system may affect the safe operation of others, it is important that routine inspections should be 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 termination should be checked for structural integrity and conformance to 11.3.

11.7.2 Maintenance of room sealed appliances connected to a shared flue system

The appliance shall be maintained in accordance with manufacturer's instructions and 8.4 as appropriate. In so far as is reasonably practicable, the Se-duct or U-duct shall be checked to ensure that it meets the requirements of 11.1, 11.2, 11.3 and 11.4 and such that the appliances connected to it can be used safely.

COMMENTARY AND RECOMMENDATIONS ON 11.7.2.

Where practicable, the appliance connections should be inspected to ensure the flue installations conform to 11.5.1. An inspection of the whole flue duct may be necessary if an appliance is not operating correctly, e.g., persistent pilot outage. Problems may 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.

[A] *An inspection of the whole flue duct may be necessary if an appliance is not operating correctly, e.g. persistent pilot outage.* **[A]**

12 Special categories of flue system

12.1 Flue systems for use with condensing appliances

12.1.1 General

The flue system shall be constructed of materials in accordance with 12.1.2. Arrangements for condensate disposal shall be in accordance with 12.1.3.

Except where permitted otherwise in the manufacturer's instructions, the requirements for siting and routing of the flue, flue termination and temperature effects shall be the same as for the equivalent appliance of the non-condensing type.

COMMENTARY AND RECOMMENDATIONS ON 12.1.1.

Condensing appliances will normally be of the fanned room-sealed type, although other types are not necessarily excluded. Additional safety controls which may be required for such appliances will be specified in the appropriate appliance specification and tested at the time of certification. The manufacturer may also specify flue route, siting and termination which will also be verified at the time of appliance certification.

The siting of the flue terminal. *Condensing appliances have a tendency to form a plume of water vapour from the flue terminal. The terminal should be sited so that the wet combustion products are unlikely to cause damage or nuisance. The effect of wind conditions and the dispersal of the plume relative to adjacent wall surfaces, openable windows and neighbouring property should be considered.*

12.1.2 Flue system materials

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

COMMENTARY AND RECOMMENDATIONS ON **12.1.2.**

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 or the supplier of the fuel.

Plastics material should be used only where the appliance to be connected is certificated to conform to the appropriate appliance specification and its installation instructions specifically permit and specify such flue system materials and constructions and detail the requirements for its use.

12.1.3 Condensate disposal

Where the appliance installation instructions specify that a condensate drain has to be provided for the appliance, provision shall be made also for the collection and/or disposal of condensate formed in the flue. The appliance manufacturer's instructions shall be followed in respect of material selection, sizing and routing.

COMMENTARY AND RECOMMENDATIONS ON **12.1.3.**

If the appliance installation instructions state that it is permissible, the flue 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 may be made to drain the flue at any convenient point. Some appliances may combine the flue and condensate drain as a single pipe.

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

***A2** Where the appliance input does not exceed 4 kW it might be acceptable to discharge the condensate other than to a drain provided this is in accordance with the appliance manufacturer's instructions; any combined flue 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.*

*For boilers refer to BS 6798 and for water heaters refer to BS 5546. **A2***

A2** Text deleted **A2

12.1.4 Commissioning

The appliance shall be commissioned in accordance with **5.3** or **6.3** dependent on whether the appliance is natural draught or fan draught.

12.1.5 Maintenance

The flue shall only be used if it is in a safe condition. There shall be no spillage or leakage of combustion products in to the room when the flue and flue/appliance is tested in accordance with **5.3** or **6.3**.

COMMENTARY AND RECOMMENDATIONS **12.1.5.**

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

*As far as is reasonably practicable, the flue system should be checked to ensure that it conforms to the requirements of **12.1.1**, **12.1.2** and **12.1.3**. A flue 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 should be carried out.*

12.2 Open flue systems without a draught diverter (for Type B₂ appliances)

12.2.1 Type B₂ appliance (previously called a closed flue)

Where the appliance incorporates an open flue system without a draught diverter (previously called a closed flue) the flue specified by the appliance manufacturer shall be sized and routed in accordance with the installation instructions.

COMMENTARY AND RECOMMENDATIONS ON 12.2.1.

Since the size and length of the flue depends on various characteristics specific to the appliance, the manufacturer will provide this information and it will have been checked at the time of certification of the appliance.

12.2.2 Type B₂ appliance termination

The terminal shall be positioned such that the combustion products can be safely dispersed at all times. Flue 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 the flue terminal position shall be as given in Annex C (open flues: fanned draught).

COMMENTARY AND RECOMMENDATIONS ON 12.2.2.

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

If the terminal is fitted less than 1 m below a plastics gutter or less than 0.5 m below painted eaves, painted gutter or any other painted surface, then a suitable shield at least 1 m long should be fitted to protect the surface.

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 D given in Annex C 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.*

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

12.2.3 Type B₂ appliance flue material

Plastics material shall be used only where the appliance to be connected is certified to conform to the appropriate appliance specification and its installation instructions specifically permit and specify such flue materials and constructions and detail the requirements for its use.

COMMENTARY AND RECOMMENDATIONS ON 12.2.3.

Closed flue appliances are such that the appliance manufacturer should specify the flue, its route and its siting (see 12.2.1).

12.2.4 Commissioning

The appliance and its flue shall be commissioned in accordance with the appliance manufacturer's instructions.

12.2.5 Maintenance

The appliance and its flue shall be maintained in accordance with the appliance manufacturer's instructions.

12.3 Type C₇ (“Vertex”) flues

Where a C₇ flue 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 flue system 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 where possible. If a change of direction (offset) is unavoidable, the first section of the flue above the draught break shall rise vertically by a minimum of 600 mm before it changes direction. The offset section of flue 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 will form 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 shall be carried out at the draught break in the roof space.

COMMENTARY AND RECOMMENDATIONS ON **12.3.**

A roof space ventilated to the standard required by the 1985 Building Regulations for England and Wales [2] will provide sufficient air supply but roof space ventilators should be checked to ensure they are unobstructed by insulation etc.

A₂

12.4 Other open flue fanned draught systems

12.4.1 Shared open flue fanned draught systems

The design and installation of shared open flue fanned draught systems is a specialist matter and shall be carried out only by persons who are competent to do so. Care shall be taken to ensure that the requirements of the appliance manufacturer and flue system manufacturer are followed as appropriate.

Fan dilution flue systems shall conform to **12.4.2.**

COMMENTARY AND RECOMMENDATIONS ON **12.4.1**

*Shared open flue fanned draught systems may 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 vary from branched systems (appliances in different rooms and/or on different floors) to fan-diluted flue systems (see **12.4.2**)*

12.4.2 Fan dilution flue system

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 AND RECOMMENDATIONS ON **12.4.2**

In the case of fan-diluted flue systems, a fan is used to introduce fresh air into the flue outlet duct of the installation in the same room in order to dilute the flue 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 and should only be undertaken by those competent to do so.

*Further details on the design of fan-diluted flue systems can be found in BS 6644 and IGEN publication UP/10. **A₂***

12.5 **A₂ Categories of flue system not covered by 12.1 to 12.4 **A₂****

Flueing systems which fall outside the categories specified in **12.1**, **12.2**, **12.3** and **12.4** shall be integral with a specific appliance.

Detailed instructions shall be provided by the appliance manufacturer for installation and commissioning of the flueing system with particular attention given to any additional precautions necessary for the safe operation of the system.

Annex A (informative)

Calculation method for flue sizing

A.1 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 will produce 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 A.1. K_o and K_i are obtained from Table A.2.

Table A.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
	231 × 65	0.65	run
	317 × 63	0.35	
	140 × 102	0.60	
	200 × 75	0.60	
	183 × 90	0.45	
Pipe	100	0.78	
	125	0.25	
	150	0.12	
Masonry Chimney	213 × 213	0.02	
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	
Terminal	100 mm ridge	2.5	
	125 mm ridge	1.0	
	150 mm ridge	0.48	
	100 mm GCI	0.6	
	125 mm GCI	0.25	
	150 mm GCI	0.12	

A.2 Table A.1 gives resistance factors for common flue system components for use in formula. Table A.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 A.3. Table A.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 A.2 — Inlet and outlet resistances

Appliance	Inlet resistance K_i
Gas fire (12 000 mm ² equivalent flue size)	3.0
Gas fire/back boiler unit	2.0
Other appliances:	
100 mm spigot	2.5
125 mm spigot	1.0
150 mm spigot	0.48
Flue	Outlet resistance K_o
100 mm flue	2.5
125 mm flue	1.0
150 mm flue	0.48

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

Table A.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 A.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 A.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 A.1

other resistances of actual flue:

terminal	1.0
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
	6.15

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

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

NOTE The effective height would be $3.05 + 0.65 = 3.7 \text{ m}$.

Example 2 (see Figure A.2). A bungalow flue, also using gas flue blocks, designed for a combined gas fire/back boiler unit.

From Table A.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

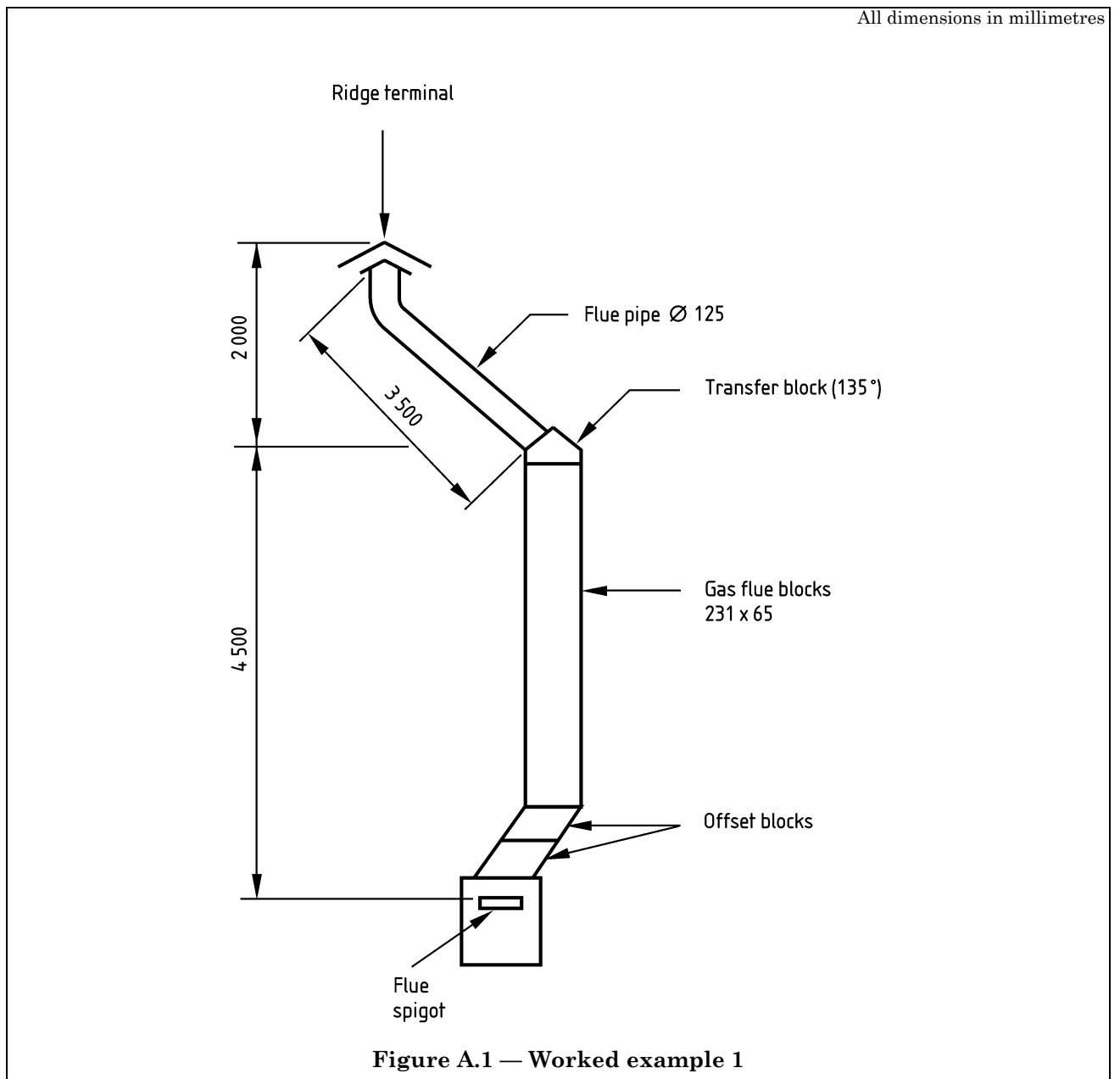
From Table A.1:

other resistances of actual flue:

terminal	1.0
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

$$\text{Equivalent height} = 4 \times \frac{(2 + 1)}{(2 + 1) - (0.25 \times 4) + 3.92} = 2.03 \text{ m}$$

This is less than 2.4 m (taken from Table A.3) as well as being less than the 3 m required by BS 5258-8 (see 5.1.4) and the flue is therefore not suitable for a combined gas fire/back boiler unit.



All dimensions in millimetres

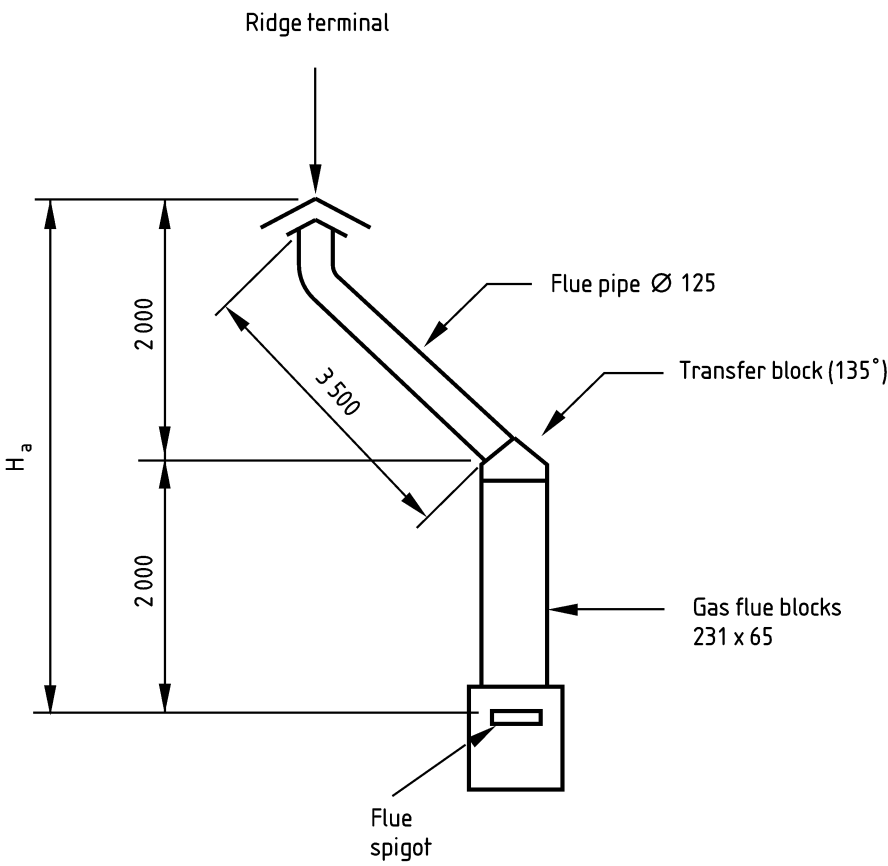


Figure A.2 — Worked example 2

Annex B (informative)**Designation system used in European Chimney Standards**

The designation system is intended to identify the performance characteristics of a chimney or chimney product, using the following codes in which different letters and numbers are used to denote the performance value of the product. It is intended that chimney products will be labelled. Each characteristic is specified in detail in BS EN 1443.

Table B.1 — Defining characteristics

Characteristic	Example
Temperature class (nominal working temperature)	T120
Pressure class, N (negative), P (positive) or H (high positive)	P1
Sootfire resistance class S or O (with or without sootfire resistance)	0
Resistance to condensate, W (wet) or D (dry)	W
Thermal resistance (in units of $m^2K/W \times 100$)	R22
Distance to combustibles (in units of mm)	C50

Table B.2 — Common applications of metal chimneys for gas appliances and their equivalent designations

Individual manufacturer's may advise other figures for some specific appliances.

Appliance	Temperature class	Pressure class	Sootfire resistance class	Resistance to condensate class	Corrosion resistance class
		N-Negative P-positive	O-none	W-wet D-dry	1-gas
Boiler – open flued					
nat. draught	T 250	N 2	O	D	1
fan draught	T 250	P 2	O	D	1
condensing	T 250	P 2	O	W	1
Boiler – room sealed					
vertical flue					
nat. draught	T 250	N 2	O	D	1
fan draught	T 250	P 2	O	D	1
Gas fire radiant					
convector	T 300	N 2	O	D	1
ILFE	T 300	N 2	O	D	1
DFE	T 300	N 2	O	D	1
Air heater					
nat. draught	T 250	N 2	O	D	1
fan draught	T 200	P 2	O	D	1
Se-duct	T 450	N 2	O	D	1

Annex C (normative)

Flue terminal positions

Table C.1 gives the dimensions to be used when siting appliance flue terminals. It is essential that Table C.1 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.2 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-flued natural draught flue system is not positioned on a wall surface.

Ⓐ

Table C.1 — Minimum dimensions of flue terminal positions (all types) (see Figure C.1)

Dimension	Terminal position (kW input expressed in net)		Balanced flues room sealed		Open flues	
			Natural draught	Fanned draught	Natural draught	Fanned draught
A ^a	Directly below an opening, air brick, opening windows, etc.	(0-7 kW)	300 mm	300 mm	Not allowed	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	Not allowed	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	Not allowed	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	Not allowed	75 mm
E	Below eaves		300 mm	200 mm	Not allowed	200 mm
F	Below balconies or car port roof		600 mm	200 mm	Not allowed	200 mm
G	From a vertical drain pipe or soil pipe		300 mm	150 mm ^b	Not allowed	150 mm
H ^c	From an internal or external corner		600 mm	300 mm	Not allowed	200 mm
I	Above ground, roof or balcony level		300 mm	300 mm	Not allowed	300 mm
J	From a surface facing the terminal (also see 6.1.2)		600 mm	600 mm	N/A	600 mm
K	From a terminal facing the terminal		600 mm	1 200 mm	N/A	1 200 mm
L	From an opening in the car port (e.g. door, window) into the dwelling		1 200 mm	1 200 mm	N/A	1 200 mm
M	Vertically from a terminal on the same wall		1 500 mm	1 500 mm	N/A	1 500 mm
N	Horizontally from a terminal on the same wall		300 mm	300 mm	N/A	300 mm
O	From the wall on which the terminal is mounted		N/A	N/A	N/A	50 mm
P	From a vertical structure on the roof		N/A	N/A	Ⓐ See Table 2 and Figure 6 Ⓐ	N/A
Q	Above intersection with roof		N/A	To manufacturer's instructions	See Table 2 and Figure 4	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.2). 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 manufacturer's instructions.

Ⓐ

A1

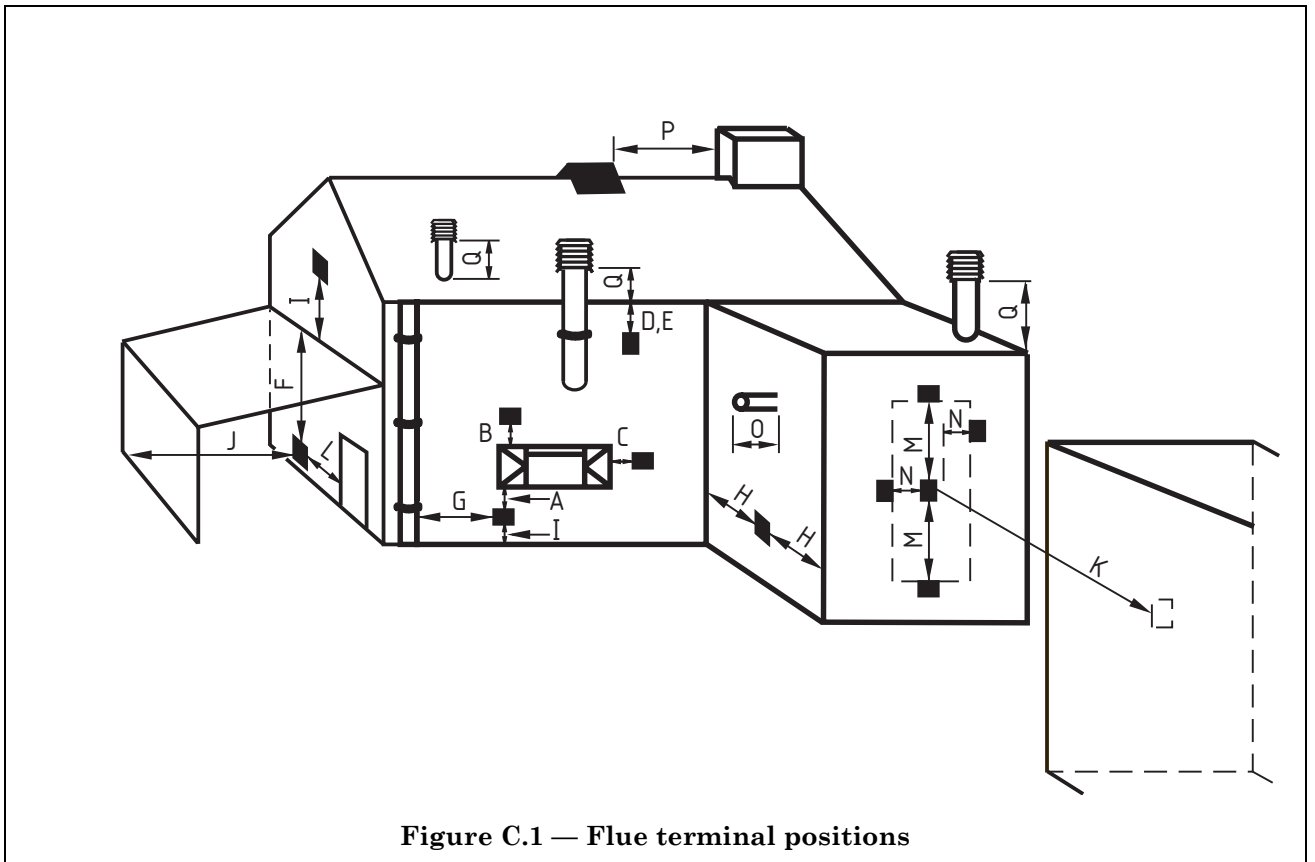
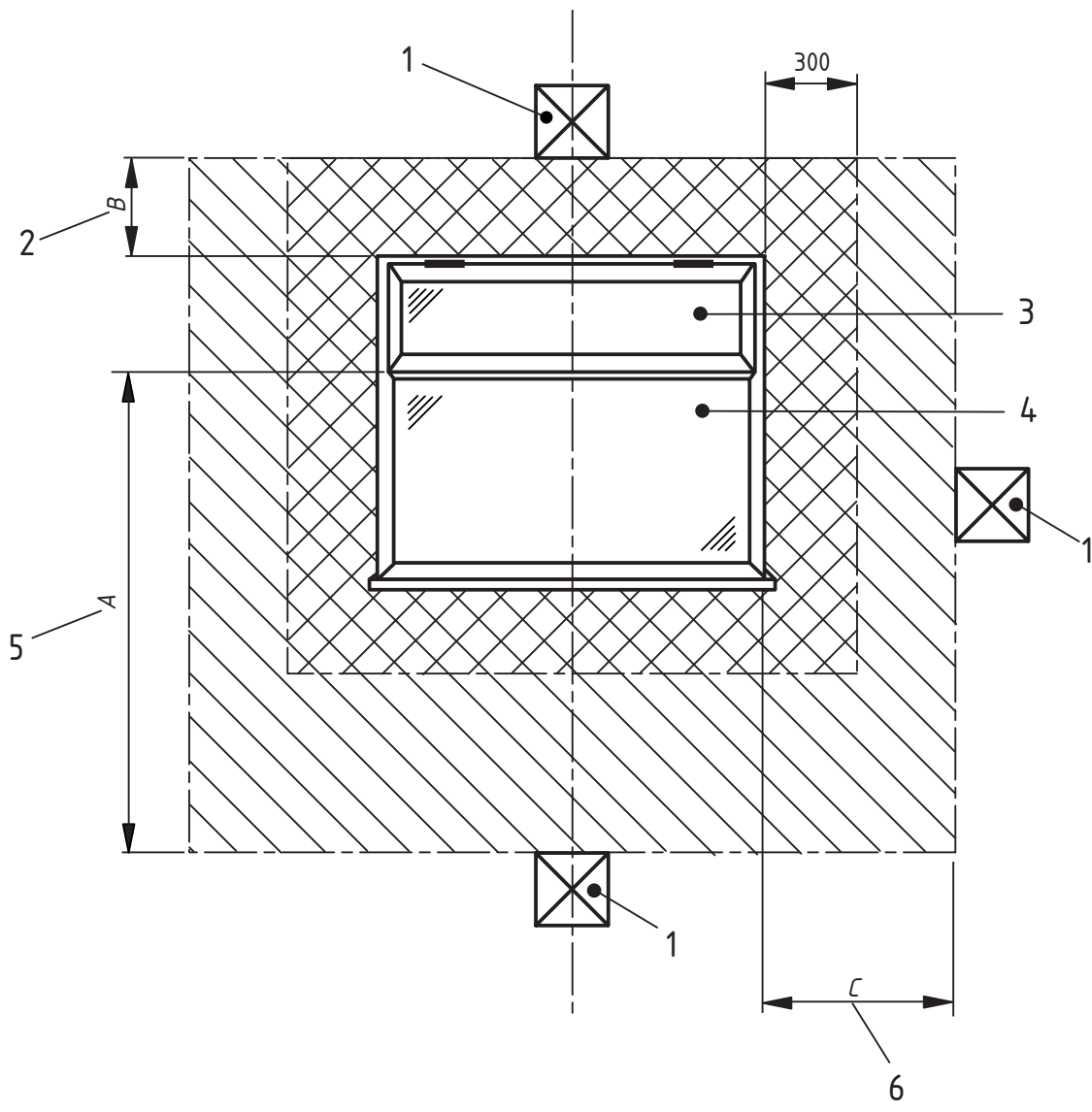


Figure C.1 — Flue terminal positions

A1

A2



a) Natural draught terminal

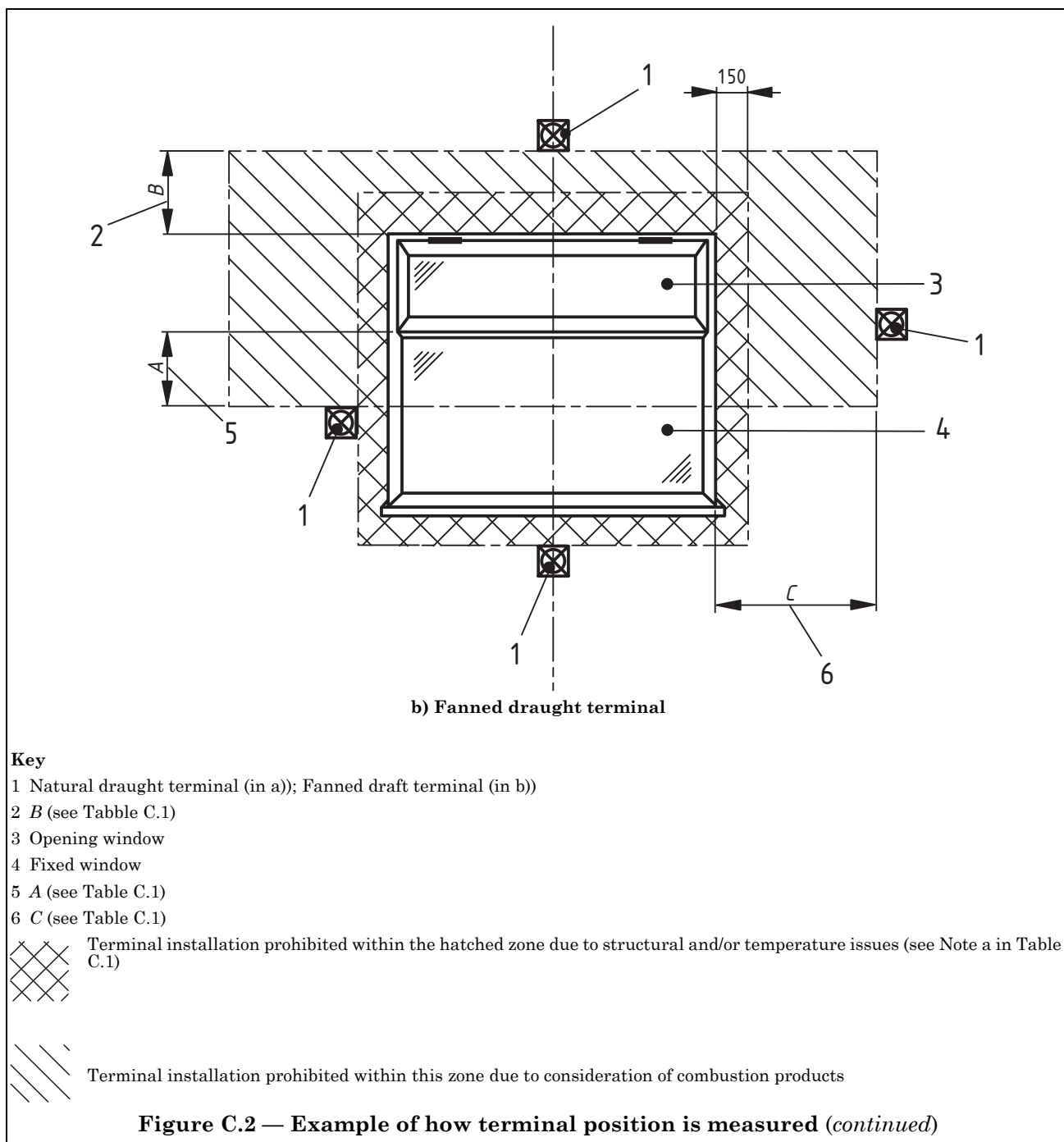
Key

- 1 Natural draught terminal (in a)); Fanned draft terminal (in b))
- 2 *B* (see Table C.1)
- 3 Opening window
- 4 Fixed window
- 5 *A* (see Table C.1)
- 6 *C* (see Table C.1)

Terminal installation prohibited within the hatched zone due to structural and/or temperature issues (see Note a in Table C.1)

Terminal installation prohibited within this zone due to consideration of combustion products

Figure C.2 — Example of how terminal position is measured



A2

Annex D (informative)

Guidance on the design and installation of flue block systems

D.1 General

D.1.1 *When designing and installing a gas flue block system it is essential to ensure that:*

- a) the gas flue blocks conform to BS 1289;
- 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, D.3, D.4, D.5, D.6, D.7, D.8** and **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.

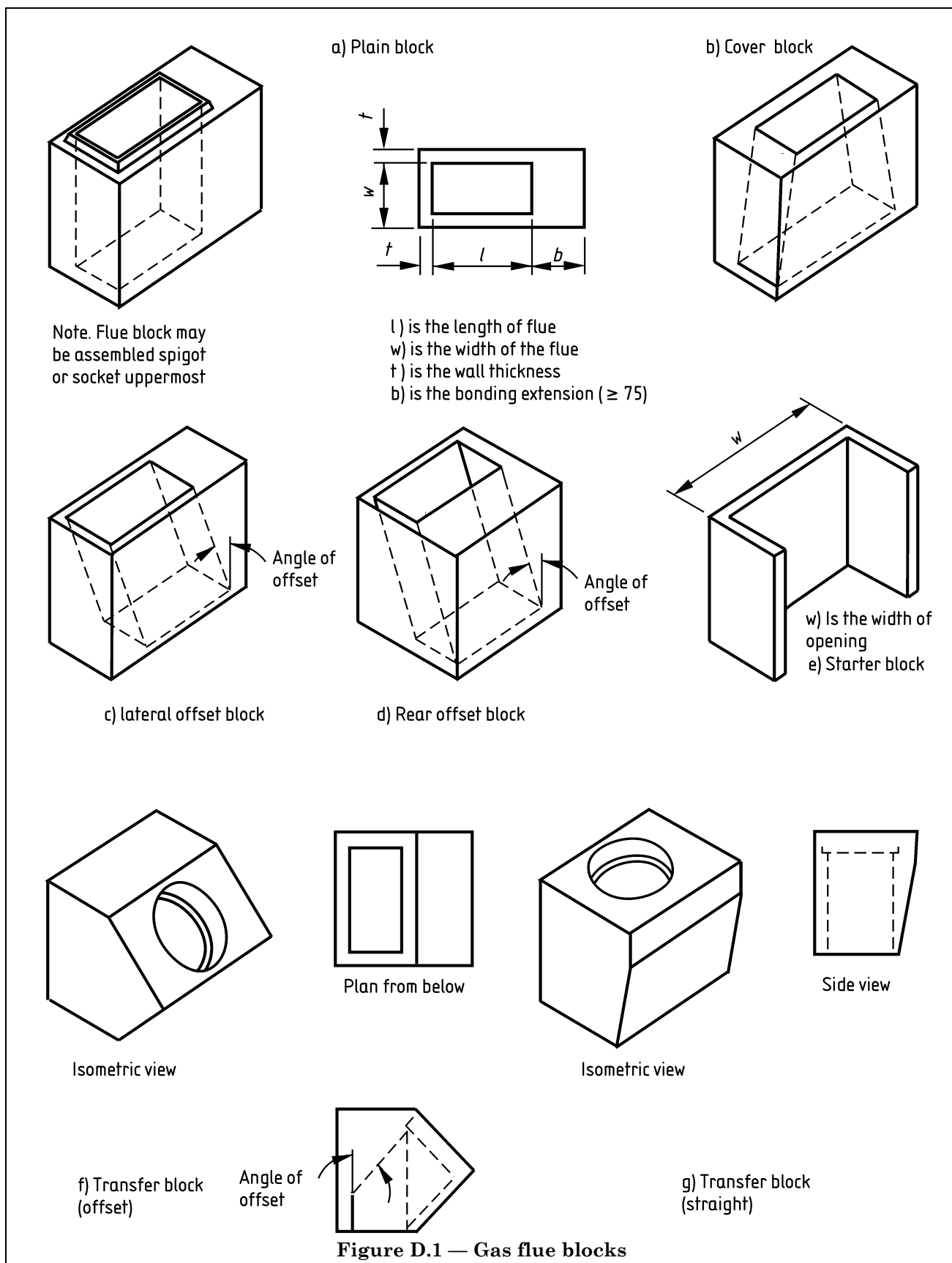
D.2 Design considerations

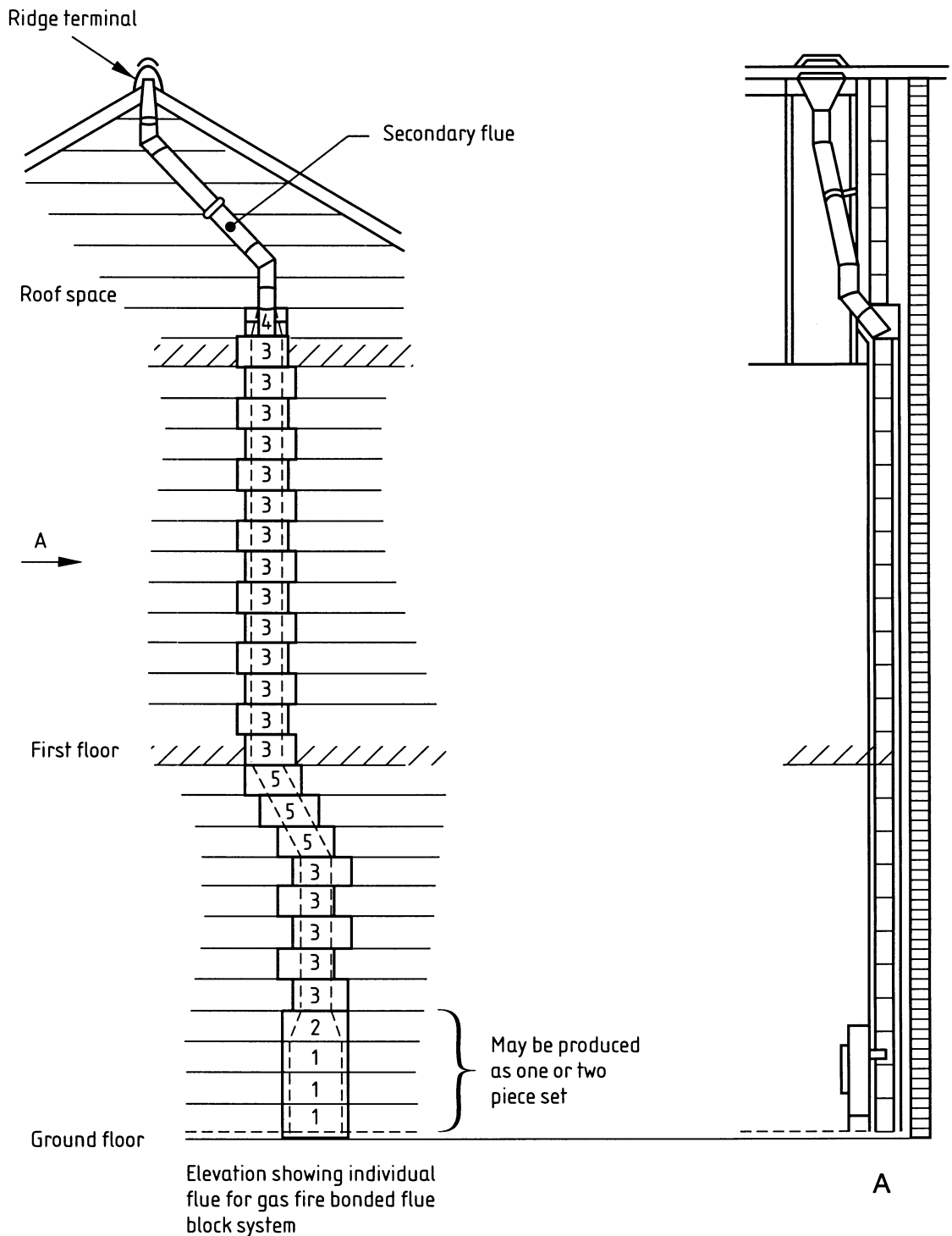
The satisfactory performance of a complete flue system is dependent on ensuring its layout and construction is correctly carried out. The following design considerations shall be followed;

- a) The flue should take the most direct practicable route from the appliance to the terminal. Where practical an essentially vertical route from the appliance to termination is desirable with the minimum of inclined runs of flue.
- 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 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 terminal 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.

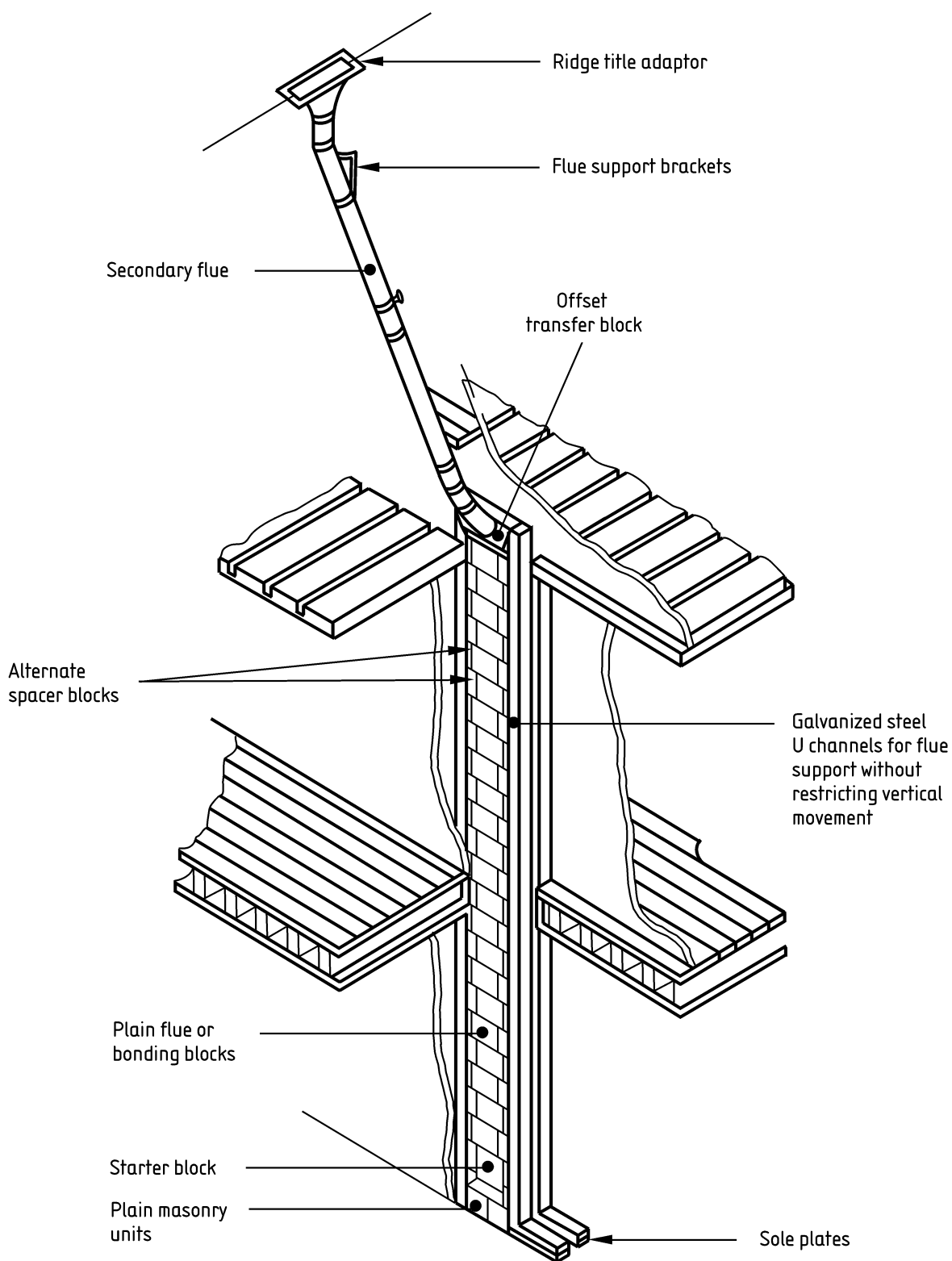
- h) Flue block systems should only be used where the gas appliance manufacturer's instructions state that it is permitted. The connection should be by a direct and standard connection to the starter block or by the use of purpose-designed ancillary components provided by the gas appliance manufacturer.





- 1. Is a starter block
- 2. Is the lintel cover block
- 3. Is a plain bonding block
- 4. Is the offset transfer block
- 5. Is the lateral offset block

Figure D.2 — Typical flue block systems (general arrangement)



Bonded gas flue block system for timber frame construction

Figure D.3 — Bonded gas flue block system for timber frame construction

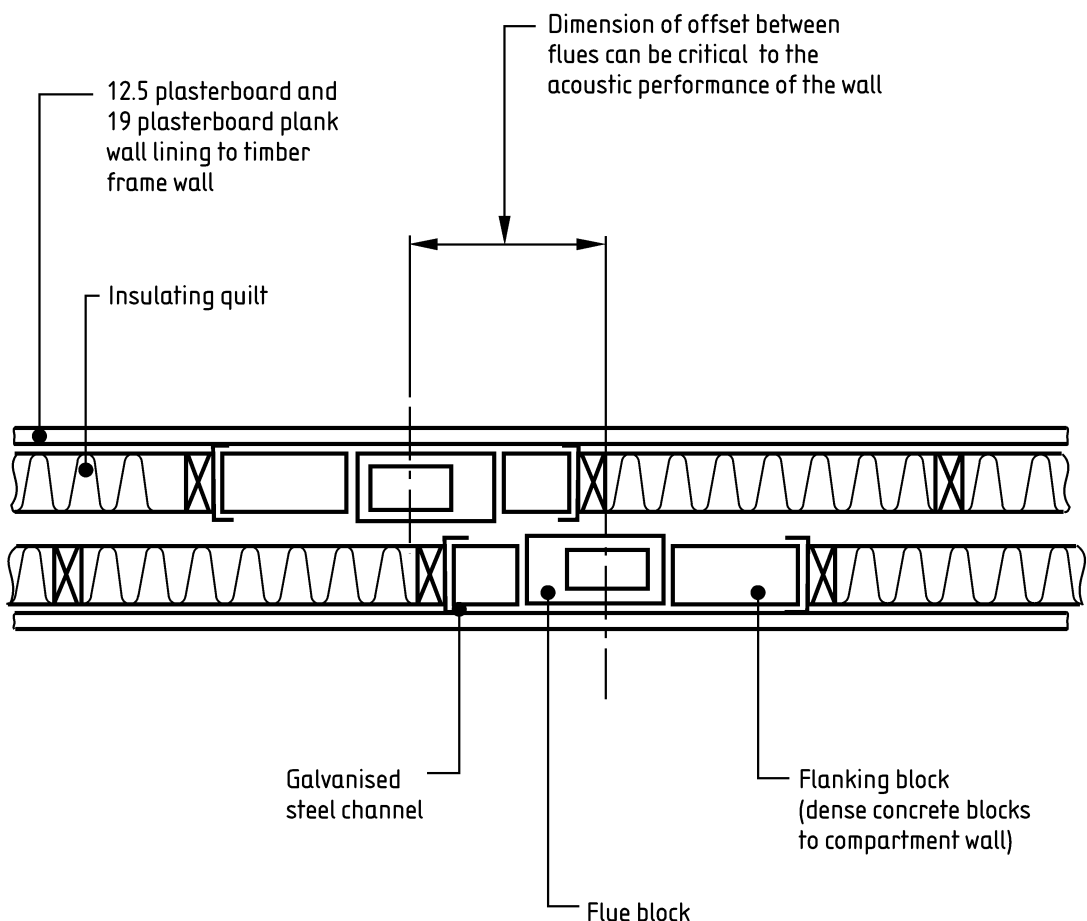
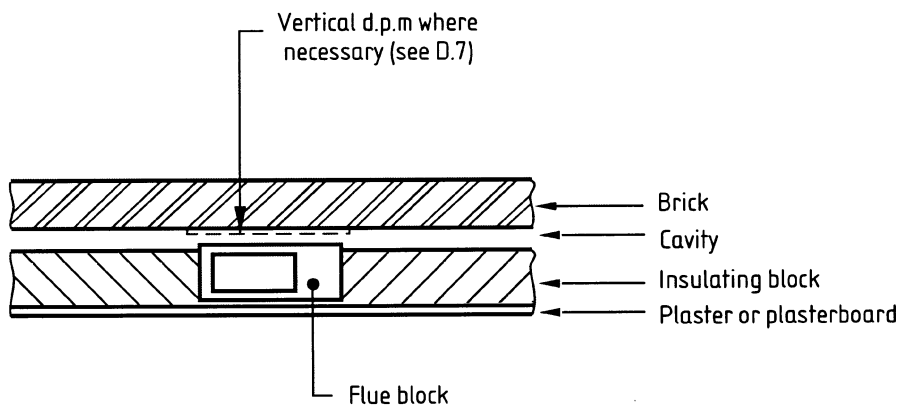
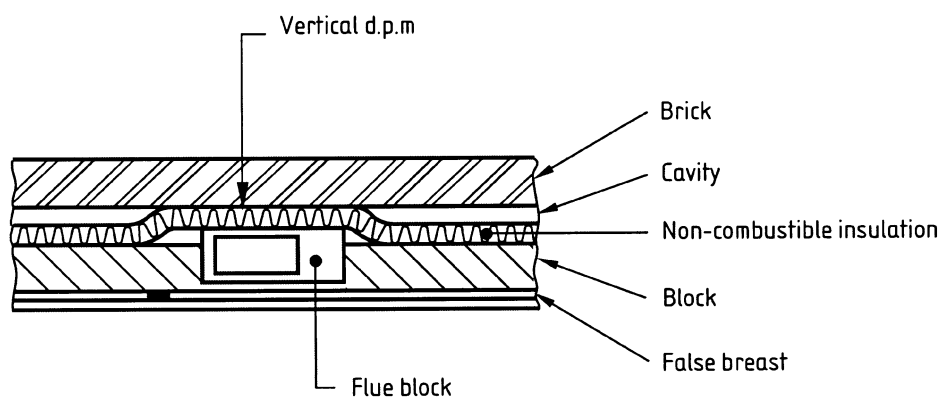


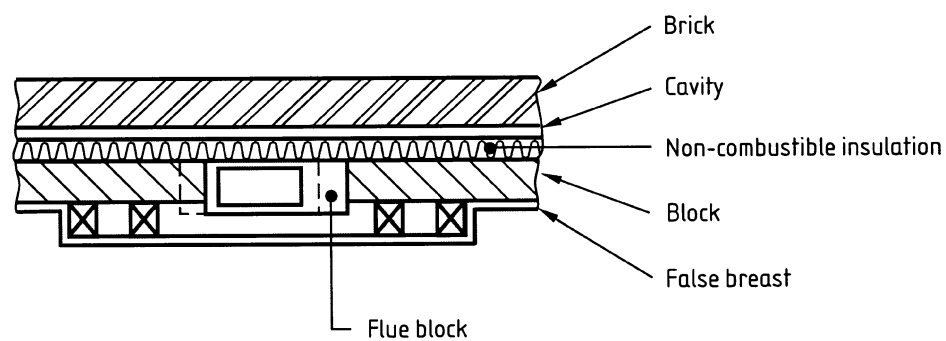
Figure D.4 — Typical construction details for gas flue block systems in internal walls



a) Cavity wall with insulating block



b) Cavity wall with insulation (d.p.m. cavity barrier)



c) Insulated wall (with or without cavity). Projecting flue

Figure D.5 — Typical construction details for gas flue block systems in external walls

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 may occur. They should either be faced with brick or concrete 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) No fixing devices should 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 Termination

The termination of the flue should be sited and be in accordance with this 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 terminal and be surrounded in the desired masonry cladding that should provide the necessary structural stability and weather proofing including provision of flashings and damp proof courses to prevent entry of water into the building.
- c) Alternatively, clay flue liners to BS 1181 or concrete flue liners having the same material specification as the gas flue blocks or being proven suitable for use with solid fuel burning appliances may be used, provided they have a minimum internal diameter of 125 mm or cross-sectional flue dimensions that match the gas flue blocks or outlet of the transfer block.
- d) 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.
- e) 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 4½ 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 and it will not affect the safe performance of the flue.
- 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, that may 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 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 may 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 should be covered by a waterproof sheet at the end of each day or when heavy rain should be 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 (dpm) 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 termination

The following procedure should be used.

- a) When a gas flue block system is to be connected to a terminal 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 to BS 715 or a factory made insulated chimney system to BS 4543-2 or -3.

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 terminal 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 metres 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 $\angle A_1$ not $\angle A_2$ more than 45° from the vertical (see commentary and recommendations on 5.1.4).
- e) If adjustable bends are used care should be taken to ensure 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 they are securely made and any components that are damaged, particularly at the joints or in the flue should not be used.

To ensure that a flue will 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 will 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 terminal.
- 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 standard is to 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 may 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.

A2

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.

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 discolouration, 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 discolouration 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.

Figure E.1 — Checklist for checking of case seals and the general integrity of room-sealed fan assisted positive pressure gas appliances A2

Bibliography

Standards publications

BS 567, *Specification for asbestos-cement flue pipes and fittings, light quality.*

BS 835, *Specification for asbestos-cement flue pipes and fittings, heavy quality.*

BS 1181, *Specification for clay flue terminals.*

BS 3813-1, *Specification for incinerators for waste from trade and residential premises — Part 1: Capacities between 50 lb/h and 100 lb/h.*

BS 5258-8, *Safety of domestic gas appliances — Part 8: Combined appliances: gas fire/back boiler.*

BS 5534-1, *Code of practice for slating and tiling — Part 1: Design.*

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

BS 5871-1:1991, *Specification for installation 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 (1st, 2nd and 3rd family gases).*

BS 5871-3, *Specification for installation of gas fires, convector heaters, fire/back boilers and decorative fuel effect gas appliances — Part 3: Decorative fuel effect gas appliances of heat input not exceeding 20 kW (2nd and 3rd family gases).*

BS 6644, *Specification for installation of gas-fired hot water boilers of rated inputs between 60 kW and 2 MW (2nd and 3rd family gases).*

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

BS 8000-6:1990, *Workmanship on building sites — Part 6: Code of practice for slating and tiling of roofs and claddings.*

PD 6501-1:1982, *The preparation of British Standards for building and civil engineering — Part 1: Guide to the types of British Standard, their aims, relationship, content and application.*

PD 6579, *European scheme for the classification of gas appliances according to the method of evacuation of the products of combustion (types).*

prEN 13384-1, *Chimneys. Thermal and fluid dynamic calculation methods — Part 1: Chimneys serving one appliance.*

BS EN 1949, *Specification for the installation of LPG-systems for habitation purposes in leisure accommodation vehicles and other road vehicles.*

CR 1749:1998, *European schedule for class of gas appliances, according to method of products of combustion (Types).*

BS EN 1443, *Chimneys. General requirements.*

Other publications

[1] GREAT BRITAIN. The Gas Safety (Installation and Use) Regulations:1998. London: The Stationery Office.

[2] GREAT BRITAIN. The Building Regulations:1991. London: The Stationery Office.

[3] Approved document J to the England and Wales Building Regulations.

[4] Building Regulations (Northern Ireland) (Statutory Rules for Northern Ireland 1994 No. 234 Technical documents, part L.

[5] GREAT BRITAIN. The Building Standards (Scotland) Regulations:1990. London: The Stationery Office. Part F.

[6] The Gas Appliance (Safety) Regulations.

[7] Institution of Gas Engineers IGE document UP/8 *Gas in caravans, holiday homes and boats*²⁾

[8] Health and Safety Commission's Approved Code of Practice (ACOP) — *Standards of training in safe gas installation.*

[9] GREAT BRITAIN. Health and Safety at Work etc. Act:1974. London: The Stationery Office.

²⁾ In preparation.

- [10] Institution of Gas Engineers IGE document UP/7 *Gas installations in timber frame buildings* IGE Communication 1651:1998.
- [11] Institution of Gas Engineers IGE publication IM/28 *Appliances in commercial garages*:1993.
- [12] Building Research Establishment paper 21/92 *Spillage of flue gases from open-flued combustion appliances*.
- [13] GREAT BRITAIN. The Asbestos (Prohibition) Regulations (As Amended) 1999. London: The Stationery Office.
- [14] British Board of Agreement (BBA) Approval Scheme for installers.
- [15] British Gas document IM/11 *Flues for commercial and industrial sized boilers and air heaters — A guide to the assessment of chimney heights and flue design*:1989³⁾.
- [16] GREAT BRITAIN. Health and Safety at Work legislation for the responsibilities of landlords. London: The Stationery Office.

³⁾ In preparation

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