

Specification for

Open fires burning solid mineral fuels with convection, with or without boilers

Foyers ouverts à convection utilisant des combustibles minéraux solides et raccordés ou non à une chaudière - Spécifications

Konvektionsheizgeräte für feste Brennstoffe (mit oder ohne Kessel)

Committees responsible for this British Standard

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Association of British Solid Fuel Appliance Manufacturers
British Coal Corporation
Consumer Policy Committee of BSI
DSFAAS Ltd.
Department of Energy
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Real Fire Association
Solid Fuel Advisory Service
Solid Smokeless Fuels Federation
Waterheater Manufacturers' Association

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Foreword

This British Standard has been prepared under the direction of the Refrigeration, Heating and Air Conditioning Standards Policy Committee and supersedes BS 3376 : 1982 which is withdrawn.

The main technical changes from the previous edition are as follows:

- (a) inclusion of appliances with rectangular bottomgrates, with additional requirements for units designated suitable to burn bituminous coal at enhanced efficiency;
- (b) extension of nominal widths to 550 mm;
- (c) changes of test fuels and modification of test procedure for appliances with underfloor air supply;
- (d) reduction of the boiler damper opening under the high boiler output (HBO) test condition;
- (e) inclusion of requirements for materials for general construction;
- (f) change in ashpan requirements;
- (g) change in requirements for front firebars;
- (h) provision of a gas ignition burner changed from a mandatory to an optional requirement;
- (i) introduction of a boiler cleaning procedure between tests when burning coal;
- (j) inclusion of requirements for ashpan ash collection;
- (k) preference for the flue loss method as defined in BS 3250 : Part 1, although the alternative method using the hood method described in BS 3250 : Part 2 is included;
- (l) changes to requirements for thermal performance.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Section 1. General

1.1 Scope

This British Standard specifies constructional, dimensional and performance requirements for inset or freestanding open fires giving space heating by convection in addition to radiation and designed to burn solid mineral fuels (i.e. bituminous coal, Welsh dry steam coal, anthracite or manufactured fuels derived from these coals).

NOTE 1. This standard does not apply to inset open fires without convection (see BS 4834).

The standard covers appliances of nominal widths 350 mm, 400 mm, 450 mm, 500 mm and 550 mm designed for use either with fireplace components specified in BS 1251 or with special fireplace components or boilers supplied with the appliance.

The essential components of appliances covered by this standard are the firefront, bottomgrate, ashpit cover, ashpan, means of primary air control and a convection chamber.

Specified optional features may comprise a deepening bar, deepening plate, front firebars, undergrate gas igniter, boiler and throat restrictor. Fan(s) may be incorporated for supplying combustion air and/or convection air.

Appliances are designated as either intermittent or overnight.

NOTE 2. The titles of the publications referred to in this standard are listed on the inside back cover.

1.2 Definitions

For the purposes of this British Standard, the definitions given in BS 1846 : Part 1, BS 6100 : Subsection 1.5.1 and BS 3323 apply together with the following.

1.2.1 effective grate area

The area *Y* in the plane of the bottomgrate, enclosed by the back and sides of the firebox and by the firefront, when the appliance is installed in accordance with the manufacturer's instructions (see A.6.5).

1.2.2 rectangular bottomgrate

A bottomgrate, the sides of which form a rectangle.

1.2.3 tapered bottomgrate

A bottomgrate, the sides of which form a trapezium.

1.2.4 normal output boiler

A boiler designed to give a water heating output level of at least 2.3 kW but less than 3.5 kW at the target burning rate.

1.2.5 high output boiler

A boiler designed to give a water heating output level of at least 3.5 kW at the target burning rate.

1.2.6 target burning rate

A designated rate of fuel consumption (on a dry basis), depending upon the nominal width and category of the appliance under specified test conditions.

1.2.7 ash shedding area

The area *Z* within the frame of the bottomgrate, as shown in figure 1(a) or 1(b), comprising the projected area of the firebars and the spaces between the firebars in the plane of the bottomgrate (see A.6.5).

1.2.8 firefront

The structure that forms the front of the appliance and which may also be decorative.

1.2.9 ash collection area

The maximum area *X* of the ashpan capable of collecting ash, unless ash deflectors or similar design features are fitted. In this case, the ash collection area *X* includes the projected area of those parts of the deflectors, etc., that do not overlap the ashpan when it is in place (see A.6.5).

1.3 Classification

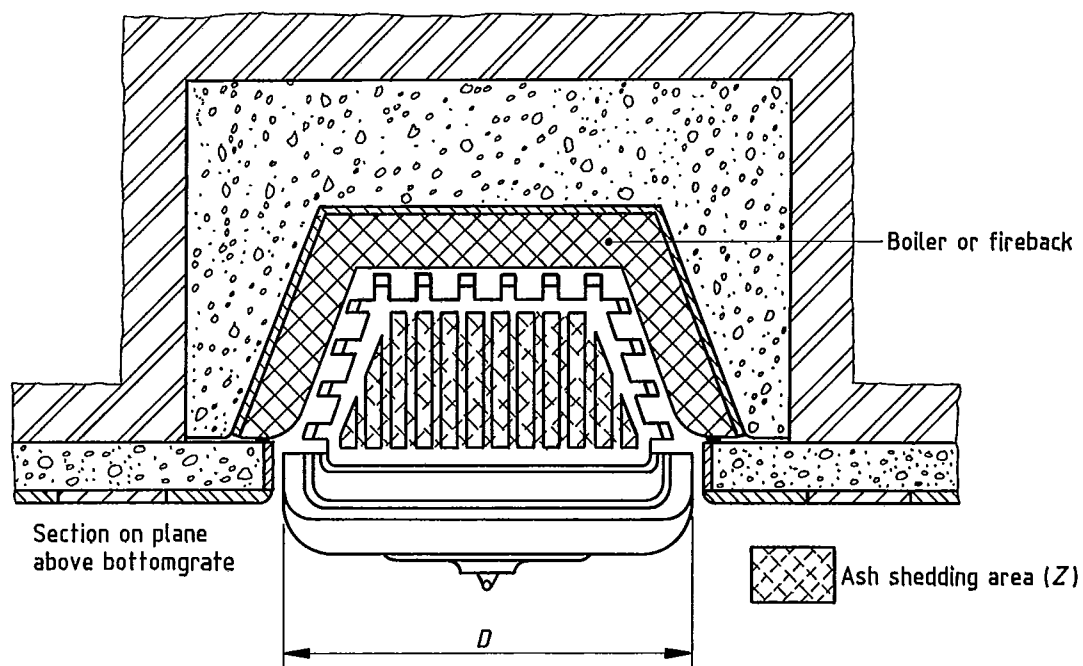
For the purposes of this standard, appliances are categorized as follows.

(a) Appliances with a tapered bottomgrate (see figure 1(a)):

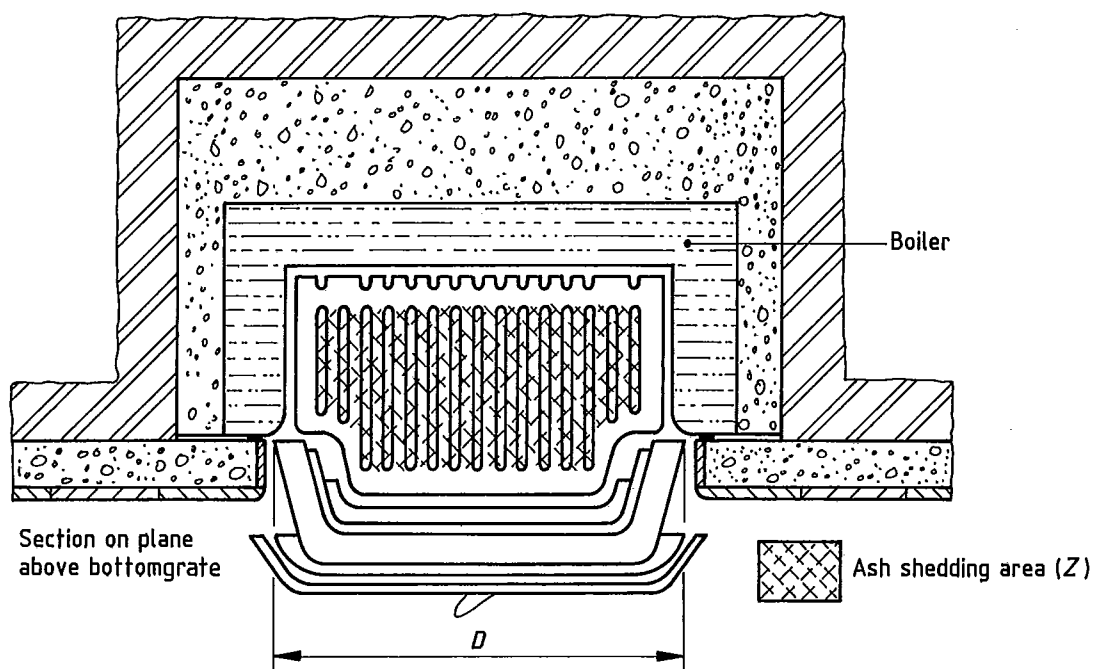
- (1) without a boiler;
- (2) with a boiler designed for normal output;
- (3) with a boiler designed for high output (see note).

(b) Appliances of minimum nominal width 400 mm (see note), with a rectangular bottomgrate (see figure 1(b)), with a boiler designed for high output. This category includes appliances designated as capable of burning bituminous coal at enhanced efficiency. This category excludes intermittent appliances.

NOTE. Appliances with a rectangular bottomgrate which do not comply with the dimensions given in tables 2 and 3 are treated as category (a)(3) appliances.



(a) Tapered bottomgrate



(b) Rectangular bottomgrate

Figure 1. Typical inset open fire showing ash shedding area

Section 2. Construction

2.1 General

The components of the appliance shall be made from the material indicated in table 1. Component parts which require periodic replacement shall be either designed or marked to ensure correct fitting (see section 4).

NOTE. Such parts should be easily replaceable.

2.2 Minimum dimensions for category (b) appliances

Category (b) appliances shall comply with the minimum dimensions given in table 2, determined in accordance with A.6.3 and A.6.5.2.

NOTE. Appliances with a rectangular bottomgrate that do not comply with table 2 are considered to be category (a)(3) appliances (see 1.3).

2.3 Firefront

Means shall be provided for rigidly fixing the firefront either directly or indirectly to either the back hearth or the boiler.

The width of that part of the firefront designed to fit within the tiled surround (dimension *D* in figure 1) shall be the nominal width of the appliance $+0, -3$ mm.

2.4 Bottomgrate

2.4.1 General

The bottomgrate shall be designed to fit either a fireback complying with BS 1251 or a purpose-made fireback or boiler. It shall be capable of being removed and shall be either designed or marked to ensure correct fitting. The bottomgrate shall consist of a series of firebars and the width of the space between the bars shall be 13 ± 2 mm.

NOTE. The bottomgrate should be supported in such a way as to offer minimum obstruction to the removal of ash.

2.4.2 Assembly

If the appliance is supplied with its own fireback or boiler, assemble it in accordance with the manufacturer's instructions. Otherwise assemble and install it in a model fireback (e.g. constructed from wood) complying with the mean dimensions specified in BS 1251 with a tolerance of ± 1 mm.

NOTE. If adjustable, the bottomgrate may be trimmed to the most appropriate dimensions, in accordance with the manufacturer's instructions.

2.4.3 Appliances without underfloor air supply

When assembled as described in 2.4.2, the appliance shall comply with the following.

- (a) The side-to-side movement of the bottomgrate within its support shall not exceed 5 mm.
- (b) It shall not be possible to pass a $20 +0, -1$ mm diameter sphere from above the bottomgrate into the ashpit at any point other than a corner.

(c) It shall not be possible to pass a $30 +0, -1$ mm diameter sphere from above the bottomgrate into the ashpit at a corner.

(d) There shall be a clearance of not less than 6 mm in the plane of the bottomgrate at all points between the bottomgrate and adjacent components.

2.4.4 Appliances with underfloor air supply

When assembled as described in 2.4.2, the appliance shall comply with the following.

(a) It shall not be possible to pass a $20 +0, -1$ mm diameter sphere from above the bottomgrate into the ashpit at any point other than a corner.

(b) It shall not be possible to pass a $30 +0, -1$ mm diameter sphere from above the bottomgrate into the ashpit at a corner.

(c) There shall be a clearance of not less than 3 mm in the plane of the bottomgrate surface at all points between the bottomgrate and adjacent components.

2.5 Combustion air control

The appliance shall be designed so that, when it is installed according to the manufacturer's instructions, the primary air shall enter the ashpit only through the designated air inlet(s).

NOTE 1. The primary air may be fan assisted.

If for an overnight burning appliance the hearth forms the base of the ashpit, a means of sealing the firefront to the hearth and to either the fireback or boiler shall be provided and be detailed in the manufacturer's instructions.

The air control shall be capable of maintaining any position in which it is intended to be set. It shall be capable of adjustment to at least three intermediate positions between the fully closed and fully open positions. Two of these positions shall be between the fully closed position and 30 % of the fully open position, measured in terms of the area of the primary air opening.

NOTE 2. A further means of fine air control in the nearly closed position should be provided.

NOTE 3. The design of the fire should be such that spillage of fuel or ash should not prevent complete closure of the air control.

Table 1. Materials for construction of appliance components

Component	Material		
	Cast iron	Low carbon steel	Other
Ashpit cover	●	●	Cast aluminium
Bottomgrate	●	Not suitable	Chrome iron
Front firebars ¹⁾	●	Not suitable	Chrome iron
Ashpan	Not suitable	●	Stainless steel
Deepening bar ¹⁾	●	●	Chrome iron
Deepening plate ¹⁾	●	●	Chrome iron
Main body	●	●	Stainless steel
Throat restrictor ¹⁾	●	●	—
Boiler ¹⁾	As specified in BS 3377		
Convection chamber	As specified in 2.15		

NOTE. Decorative parts of the firefront should be made from any material that does not distort or visibly deteriorate during the performance tests described in appendix A. Such parts should be capable of being easily cleaned.

¹⁾ If fitted.

Table 2. Minimum dimensions for category (b) appliances

Nominal width	Firebox capacity	Effective grate area, Y
mm	dm ³	dm ²
400	16	7.4
450	19	8.7
500	22	10.2
550	25	11.5

Table 3. Minimum ashpan capacity

Bottomgrate	Nominal width	Minimum capacity
Tapered	mm	dm ³
	350	1.8
	400	2.1
	450	2.5
	500	2.9
	550	3.3
Rectangular	400	2.5
	450	2.9
	500	3.4
	550	3.9

2.6 Ashpan

An ashpan shall be provided, constructed of low carbon steel or stainless steel (see table 1) of minimum thickness 0.91 mm.

The minimum ashpan capacity shall be not less than the value given in table 3.

The capacity shall be determined geometrically. If the ashpan is open at the rear, an angle of repose for the ash of 45° shall be assumed at the rear end.

The ashpan shall be so designed that the ash collection area *X* shall be not less than the ash shedding area *Z* when calculated in accordance with A.6.5.

NOTE. The ashpan should be designed and constructed to ensure the following:

- (a) that it locates in the ashpit in such a way that it allows the free passage of primary air and does not obstruct any primary air control;
- (b) that it can be easily and safely withdrawn, carried and emptied when hot, using the tool(s) provided, without undue spillage of ash (see 2.16);
- (c) that it does not distort to an extent that makes it unsuitable for use.

2.7 Ashpit and ashpit cover

The height from the bottom of the inside of the ashpan to the underside of the bottomgrate bars shall be not less than 75 mm at any point.

NOTE. The ashpit cover should be designed to ensure the following:

- (a) that its closure is not easily prevented by spilled undergrate material;
- (b) that it is difficult to accidentally dislodge it from the set position;
- (c) that when hot, it can be handled easily and safely with the tool(s) provided (see 2.16).

2.8 Fallplate and front firebars

2.8.1 Fallplate

If a fallplate is fitted, the design of the fallplate shall be such that, when in the closed position, it will not open without using the tool(s) provided (see 2.16).

If a fallplate is fitted then front firebars shall also be fitted. The upper edge of the fallplate shall not project above the upper edge of the topmost firebar.

2.8.2 Front firebars

If front firebars are fitted (see 2.8.1) they shall be removable and either horizontal across the front of the fire or vertical.

They shall not be capable of being fitted incorrectly.

In the case of horizontal front firebars, the spaces between adjacent bars and between bottom bar and the firefront shall be such that a 20 +0, -1 mm diameter rod cannot be inserted horizontally between them.

In the case of vertical front firebars, the distances between adjacent bars shall not exceed 15 mm.

Horizontal front firebars shall be designed so that when in position they slope downwards towards the back of the fire.

2.9 Deepening bar

If a deepening bar is provided it shall be horizontal across the front of the fire and shall slope downwards to the back of the fire. The lower edge of the bar shall be not more than 25 mm above the top of the firefront at any point.

The deepening bar when in position for use, shall be positively located and shall be capable of manipulation with the tool(s) provided (see 2.16).

2.10 Deepening plate

If provided, the deepening plate, when in position for use, shall be positively located and shall be capable of manipulation with the tool(s) provided (see 2.16).

2.11 Gas ignition burner

2.11.1 General

If provided, the gas ignition burner shall comply with 2.11.2 or 2.11.3 as appropriate.

The burner bar and handle tube shall be made of low carbon steel or alloy steel or other equally durable metal. The dimensions, tolerances and masses of steel tubes shall comply with those specified for 8 mm bore medium tube in BS 1387.

The burner shall be supplied with an aeration device (see figure 2) and the relationship between the number of gas ports and the number of air ports shall be as shown in table 4. The aeration device shall be marked with an arrow showing the direction of flow.

The burner shall be positioned under the bottomgrate bars, approximately midway between front and back of the bottomgrate, so that misalignment during fixing is not possible and shall be located so that the flames pass between the bars. With the flameports sealed and the burner connected to an air supply at a pressure of 40 mbar¹⁾, no leakage shall be observed within 10 s, as shown by a bubble leak detector or by immersing the burner in water.

2.11.2 Integral gas ignition burner

The threads of the gas supply connection shall comply with R $\frac{1}{4}$ or type R_C $\frac{1}{4}$ threads in accordance with BS 21.

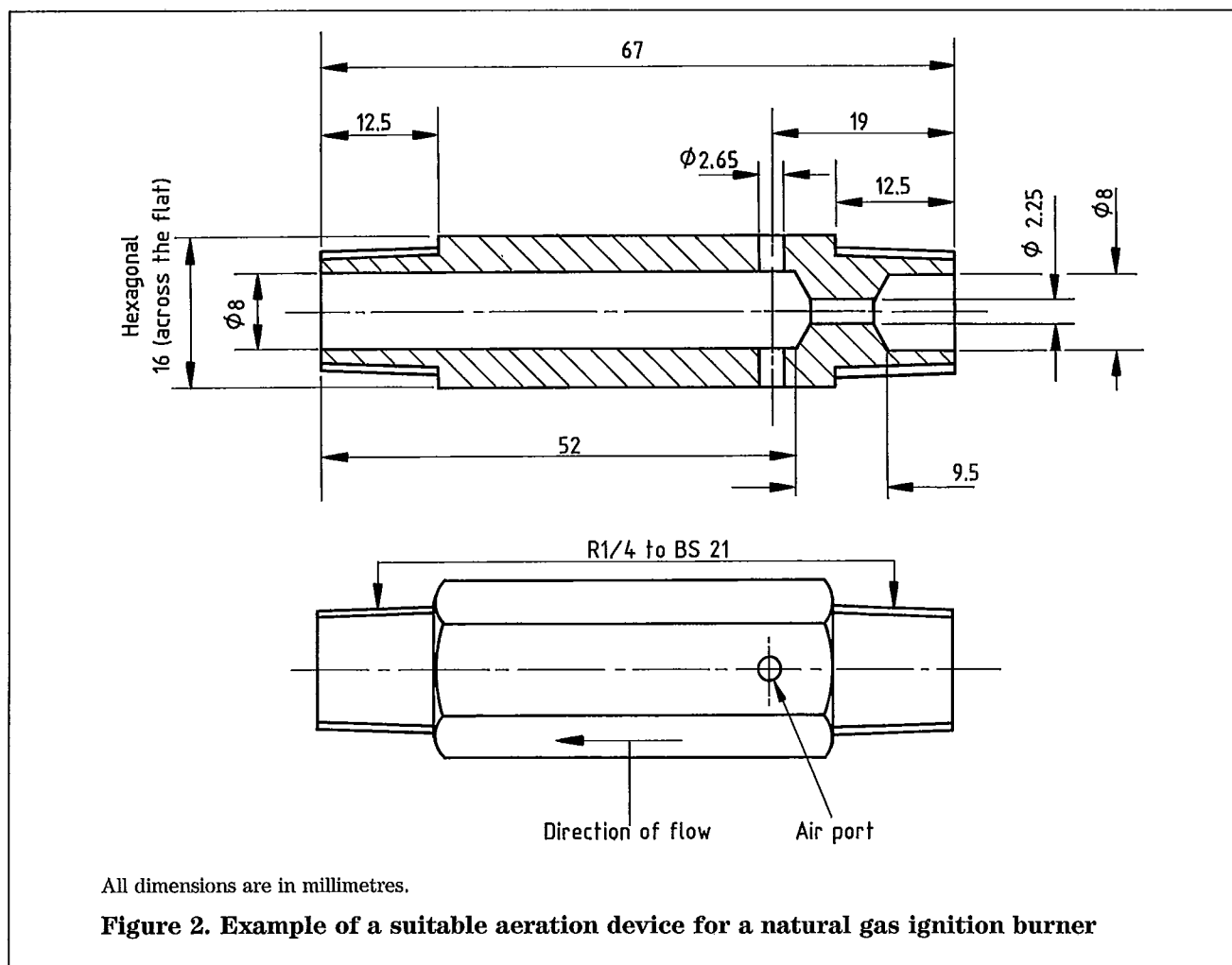
Unless the fire is supplied exclusively with a surround, the distance between the rear edge of the side of the fire surround and the centreline of the burner connection at the point where the burner or pipe leaves the firefront shall be not less than 64 mm.

NOTE. This is so that a satisfactory fixing is possible within a surround incorporating a 50 mm return at the fireplace opening.

Table 4. Relationship between gas ports and air ports

Number of gas ports	Number of air ports of diameter 2.65 mm
11	2
10	2
9	1
8	1

¹⁾ 1 mbar = 100 N/m² = 100 Pa.



2.11.3 Portable gas ignition burner

The threads of the gas supply connection shall comply with $R_C \frac{1}{8}$ type threads in accordance with BS 21.

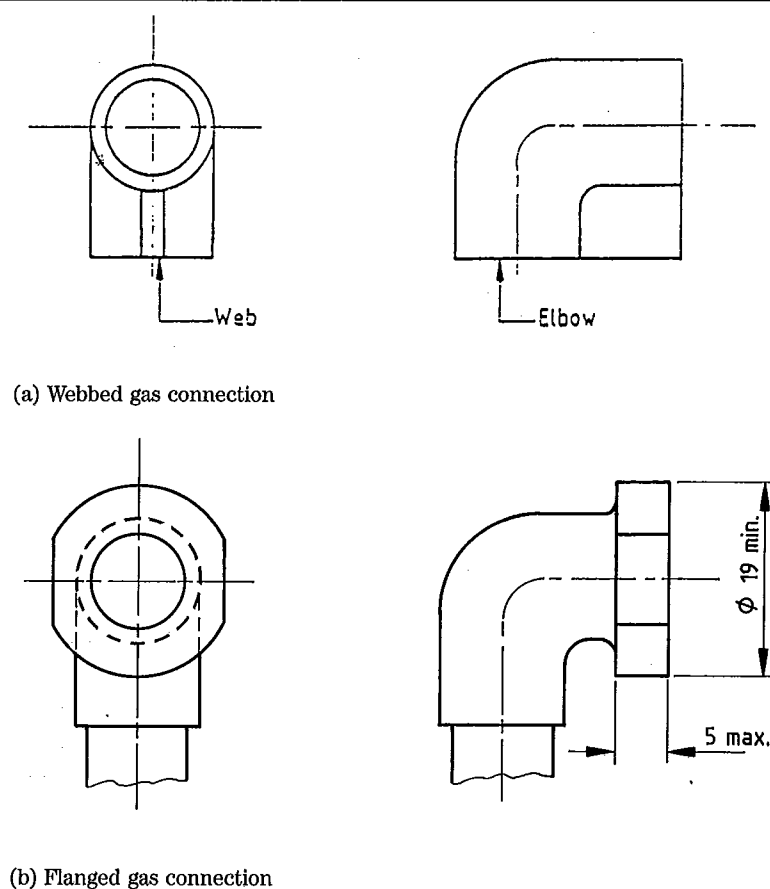
The handle shall afford an adequate grip and shall be made of non-combustible material.

NOTE. It should be secure so as to prevent slipping or twisting in use.

If the gas connection is in line with or at an angle to the handle tube, the diameter of the flange carrying the connection thread shall be not less than 19 mm and the flange shall not project more than 5 mm beyond the face of the handle. The distance between the centre of the gas connection and the superimposed hearth shall be not less than 25 mm.

If the connection is made by means of an elbow, this shall be either permanently webbed with a quadrant web as shown in figure 3(a) or provided with a flange as shown in figure 3(b).

In any case, the flange shall be provided with one or more pairs of flats to facilitate assembly and fitting of the gas connection.



All dimensions are in millimetres.

Figure 3. Gas connection elbows

2.12 Boiler

If fitted, the boiler shall comply with BS 3377.

2.13 Boiler flue

If incorporated, the boiler flue shall be accessible for cleaning with the tool(s) provided (see 2.16). Any flue access plate shall be removable and shall be designed or marked to ensure correct location.

If the angle α to the vertical of the boiler flue mouth is greater than 55° (see figure 4), the lowest edge A of the flue mouth entry shall be at least 25 mm above the uppermost surface of the adjacent bottomgrate, to reduce the risk of blockage of the flue mouth by ash.

If a boiler flue damper is fitted it shall be designed to ensure correct assembly and shall be capable of maintaining any position in which it is intended to be set.

NOTE 1. Any operations necessary for cleaning the boiler flue should be easy to carry out with the tools provided.

NOTE 2. The design and shape of the flue aperture when fully opened should be such that the risk of blockage is minimized.

2.14 Throat restrictor

2.14.1 General

If provided, the throat restrictor, which may be removable, shall be provided with an easily accessible and visible manual control for altering the available throat area. This control shall have two operating positions designated as the open position and the normal position. It shall be possible to alter the control easily from either position to the other when the fire is at high output. The control shall be so designed that it remains firmly in either position until deliberately altered.

To ensure satisfactory chimney sweeping, the unobstructed throat opening, with the throat restrictor either open or removed, shall measure not less than 100 mm in any direction.

2.14.2 Open position

For use in the open position during ignition or immediately after refuelling the fire, the throat area shall be at least 150 cm^2 for a fireplace opening of 850 cm^2 or less, and at least 200 cm^2 for a larger fireplace opening.