BRITISH STANDARD

BS 3300:1985

Incorporating Amendment No. 1

Specification for

Paraffin unflued space heating and cooking appliances for domestic use

Confirmed January 2011

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Furniture and Household Equipment Standards Committee (FHM/-) to Technical Committee FHM/31, upon which the following bodies were represented:

British Steel Industry
Chief and Assistant Chief Fire Officers' Association
Consumer Standards Advisory Committee of BSI
Department of Trade and Industry (Consumer Safety Unit, CCS Division)
Engineering Equipment and Materials Users' Association
Home Office
Oil Appliances Manufacturers' Association
Royal Society for the Prevention of Accidents
Coopted member

This British Standard, having been prepared under the direction of the Furniture and Household Equipment Standards Committee, was published under the authority of the Board of BSI on 28 February 1985 and comes into effect on a date to be announced (see foreword)

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Second revision July 1963
Third revision September 1974
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The following BSI references relate to the work on this standard:
Committee reference FHM/31
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Amendments issued since publication

Amd. No.	Date of issue	Comments
6251	July 1989	Indicated by a sideline in the margin

Contents

Foreword

This revision of BS 3300 has been prepared under the direction of the Furniture and Household Equipment Standards Committee. It is a revision of BS 3300:1974 but it will become effective only when the Oil Heaters (Safety) Regulations are revoked and replaced by new Regulations made under the Consumer Safety Act 1978. Withdrawal of BS 3300:1974 will be announced at the appropriate time.

NOTE Upon publication of this revision BSI Sales Department will respond to purchase orders for BS 3300 by supplying copies of the 1985 edition. Copies of the 1974 edition may be obtained by quoting this number "BS 3300-74".

The 1960 edition of the standard was a revision of BS 2049-1:1953 and embodied many advances in safety requirements as compared with the original standard.

The standard was revised in 1963 when the main changes were strengthening of safety requirements for the spillage test for barometric feed space heating appliances, and for operation under out-of-level conditions. The standard was later amended to specify that all heating appliances should extinguish themselves if overturned when alight.

The standard was revised again in 1974 to metricate it and to take account of the requirements for fireguards in BS 1945.

This revision has been undertaken to make the standard suitable for use as the basis of a revision of the Oil Heaters (Safety) Regulations 1977, to clarify certain of the requirements and test methods and to take into account technical advances.

The fuel used in the appliances covered by this standard, C1 burner fuel in accordance with BS 2869-2, is now more correctly termed paraffin and all previous references to kerosine have been amended accordingly where C1 burner fuel is intended.

Users of this standard may wish to note that all unflued domestic paraffin heating appliances offered for sale in Great Britain are required to comply with the Oil Heaters (Safety) Regulations 1977, which are to be remade under the Consumer Safety Act 1978. These remade regulations will be based on BS 3300 and will be consistent with it.

Certification. It is strongly recommended that in view of the nature of this specification, manufacturers and purchasers should make use of the certification facilities described on the inside back cover of this standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their 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 and ii, pages 1 to 26, an inside back cover and a back cover.

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

1 Scope

This British Standard specifies construction and performance requirements for unflued space heating and cooking appliances intended by the manufacturer for domestic use and using paraffin as the fuel.

NOTE The titles of the publications referred to in this standard are listed on the 26.

2 Definitions

NOTE Terms used to describe the basic component parts of appliances covered by this British Standard are given in, and illustrated by, Figure 1 to Figure 7.

For the purposes of this British Standard the following definitions apply.

2.1
kindler type burner

a burner in which the fuel feeding device consists of a trough in which there is a kindler for lighting purposes

2.2
long drum burner

a burner fitted with a flue or chimney to induce a flow of air for combustion

2.3
pressure burner

a burner consisting of a burner head with a cavity, in which the paraffin is vaporized by the heat of the flame or by a separate heat supply. The vapour emerges from a nipple or injector in such a manner that the kinetic energy is utilized to entrain and mix the primary combustion air with the vapour. The pressure is usually generated by a hand-operated air pump but some automatic method or a gravity head may be used

2.4
short drum burner

a burner consisting of one or more pairs of perforated sleeves or plates mounted above a fuel feeding device. Paraffin vapour is burned mostly in the space between the sleeves and partly above them, producing a non-luminous blue flame. The long drum that forms an essential feature of **2.2** is not required

2.5
full fuel level

the level marked or indicated on the appliance as the maximum to which it may be properly filled with fuel or, where no such level is marked or indicated, the highest level to which the appliance can be filled with fuel without overflowing when it is standing on a rigid flat surface which is accurate to within 2° of the horizontal plane

2.6
self-extinguishing facility

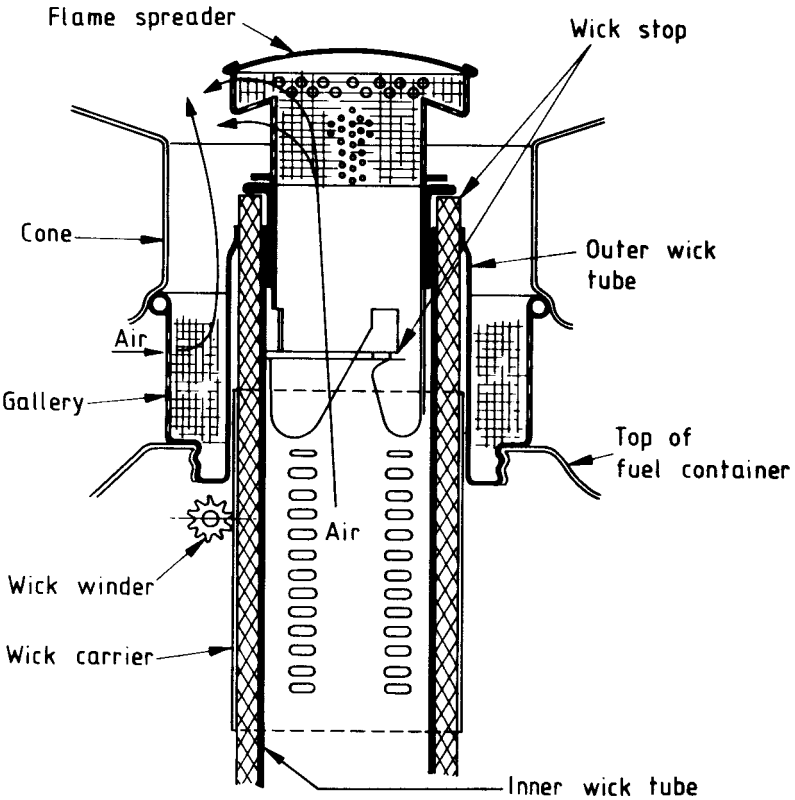
a mechanism or other provision incorporated in the design of a space heating or cooking appliance to extinguish the flame of the appliance if it is overturned when alight

2.7
unflued appliance

an appliance designed to emit combustion products into the room (space) occupied by the appliance

2.8
working surface

a surface of an appliance necessarily at a high temperature to permit efficient functioning, including that part of the casing which acts as a screen round a short drum burner, the outlet grill of a convector heater and the chimney and hotplate of a cooking appliance



NOTE Figure 1 to Figure 7 are intended to be illustrative of typical burner types but do not otherwise form part of the standard.

Figure 1 — Long drum burner: white flame type

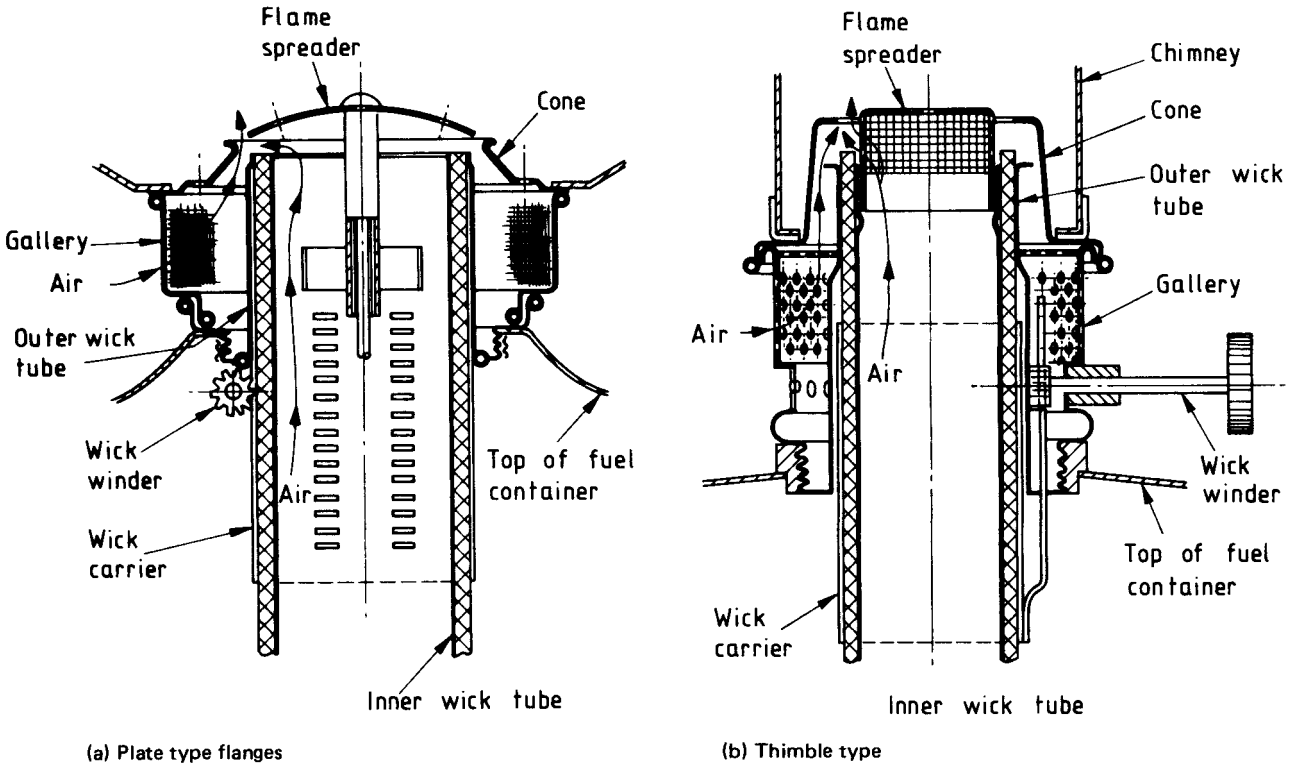


Figure 2 — Long drum burner: blue flame type

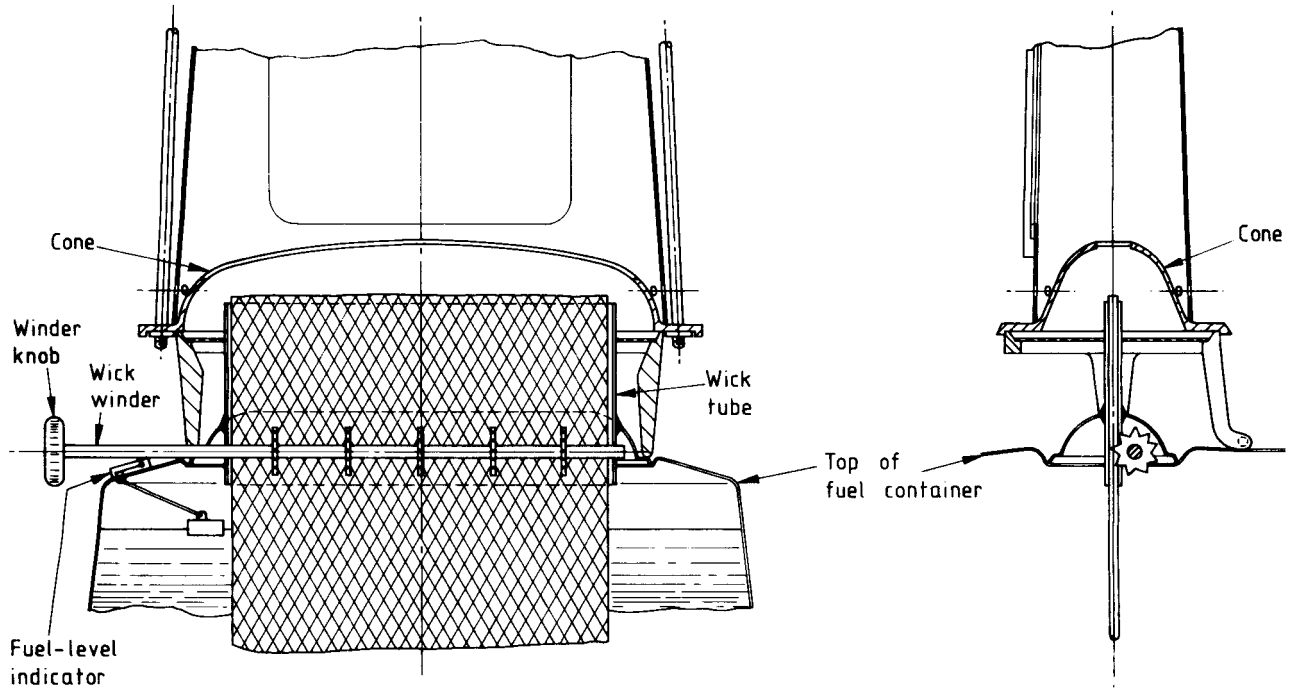


Figure 3 — Long drum burner with single flat wick

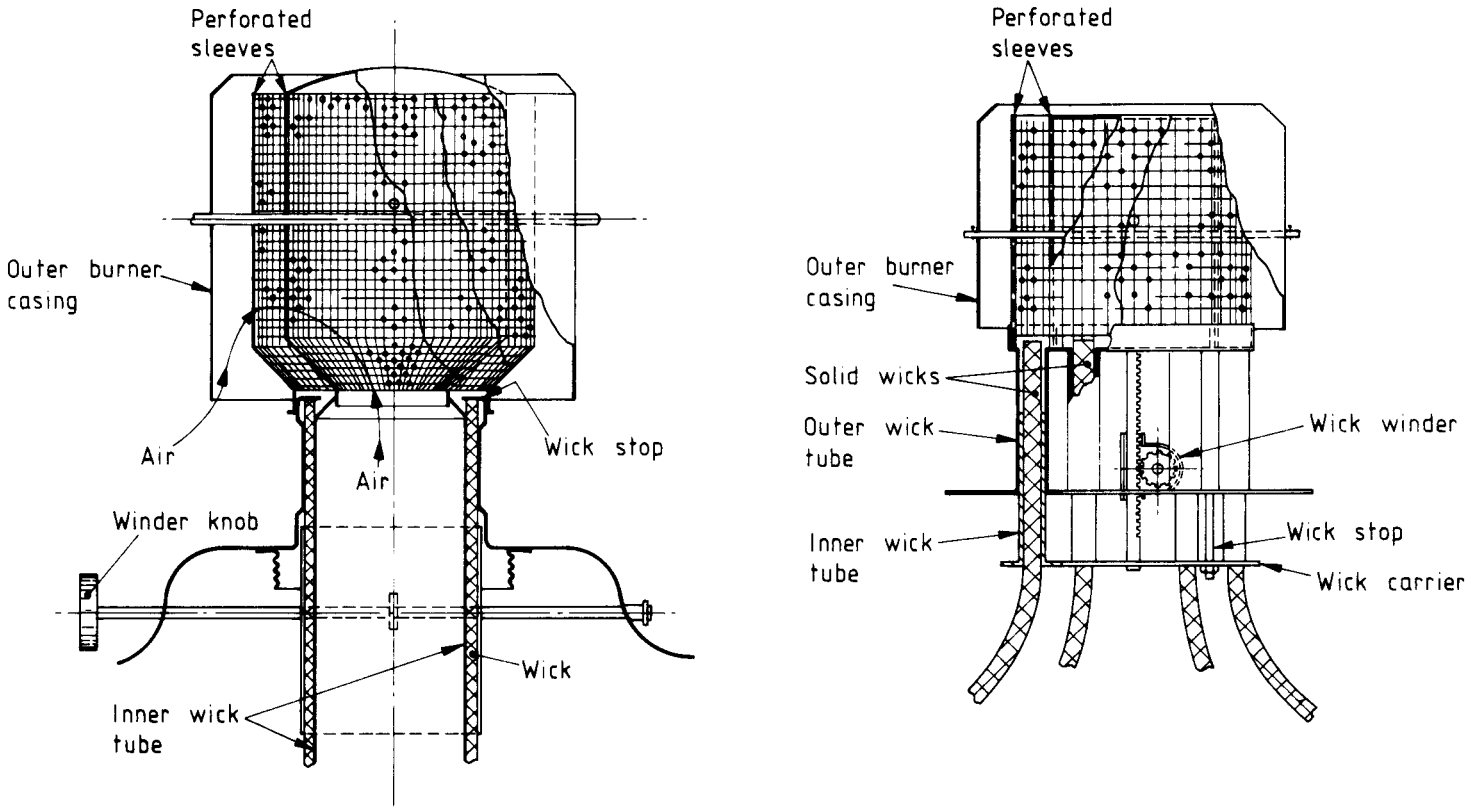


Figure 4 — Short drum burner: wick-fed type

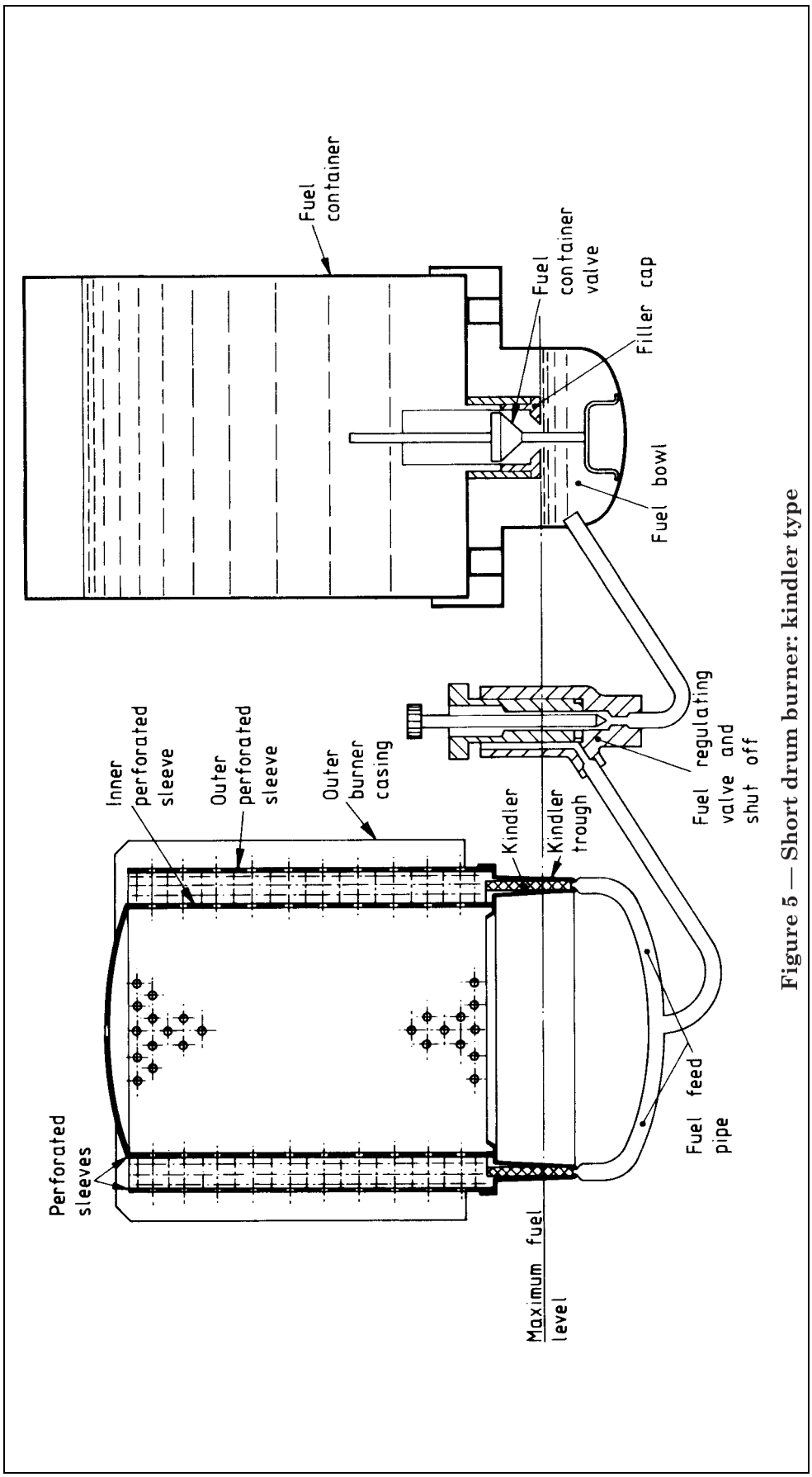


Figure 5 — Short drum burner: kindler type

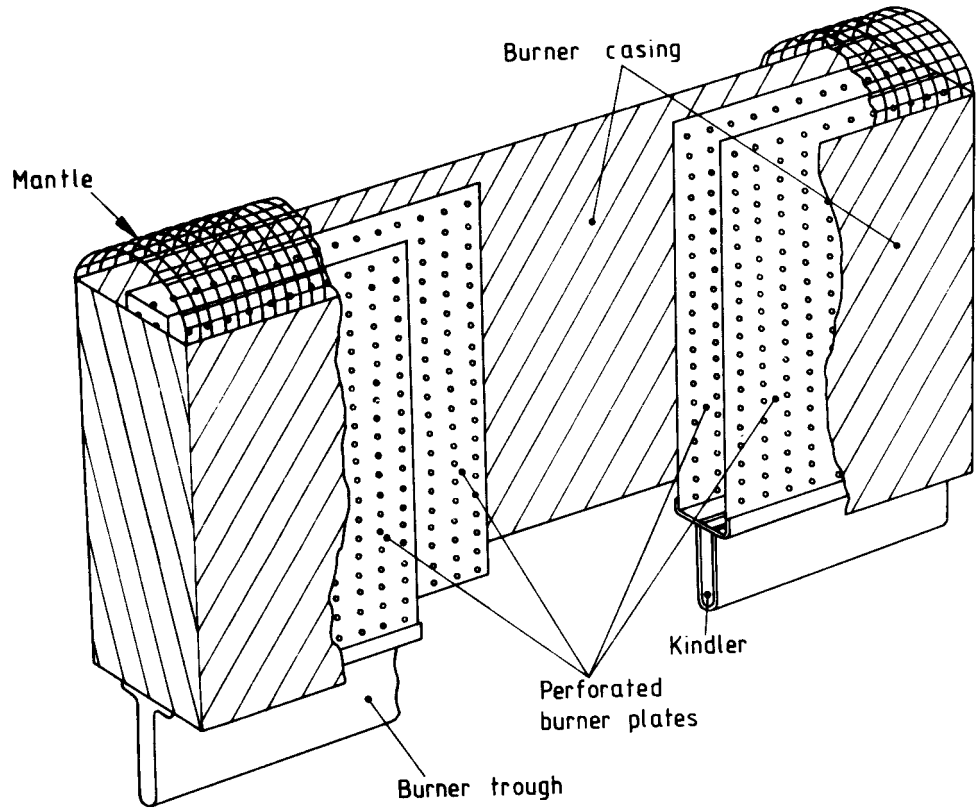


Figure 6 — Short drum burner: plate or rail type

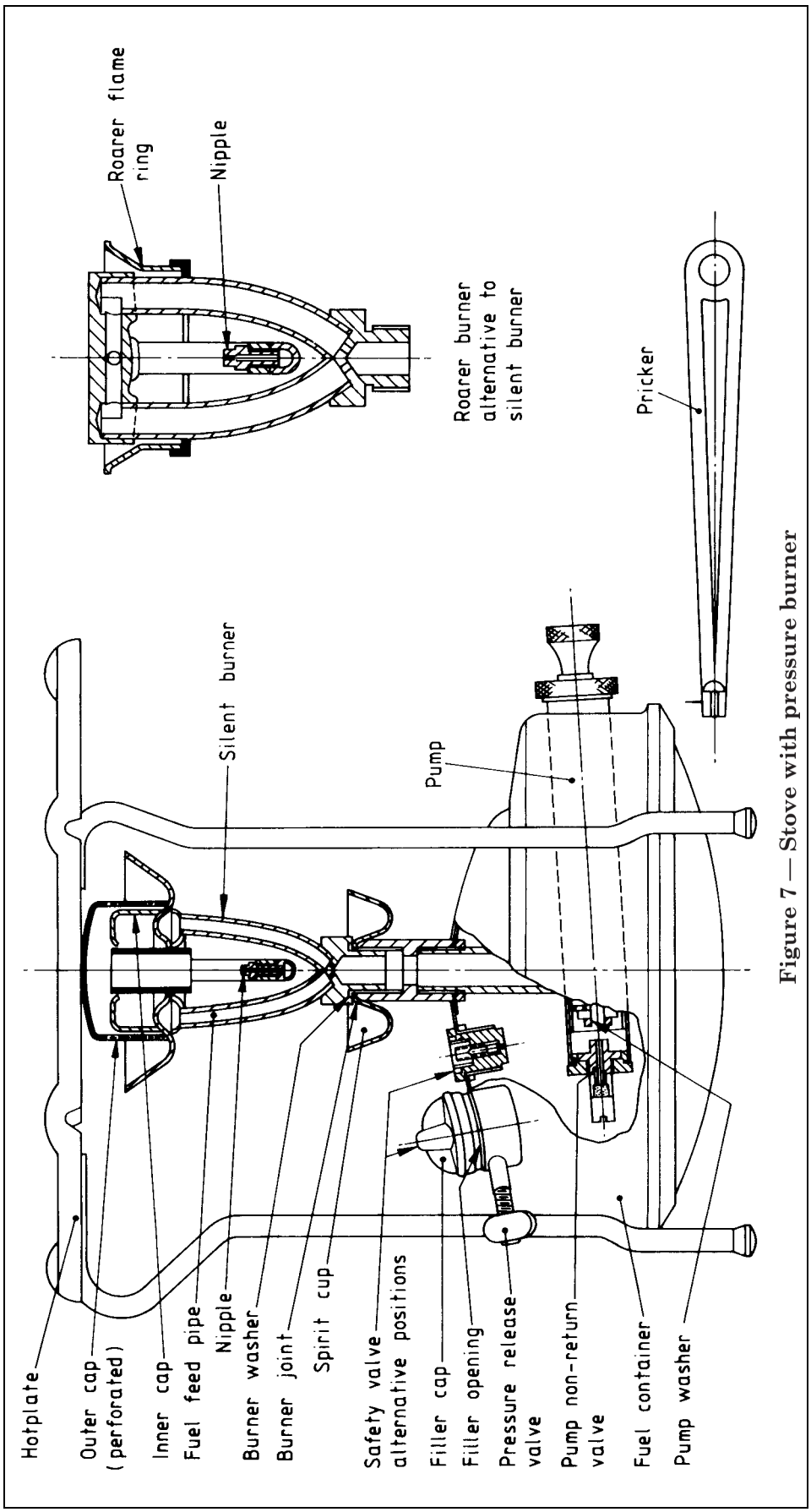


Figure 7 — Stove with pressure burner

3 Materials, design and construction

3.1 General

The construction and the strength of materials shall be such that no breakage or distortion can take place under the conditions of use required by **5.9** and **5.16** leading to the discharge of fuel or vapour or which may otherwise affect safe operation.

Provision shall be made for levelling the appliance if this is necessary for its safe and proper operation.

Radiant and convector heaters shall have no outlets in any upper horizontal surface.

All corrosive materials used in manufacture shall be removed or otherwise made harmless.

Deep-drawn brass parts shall be heat-treated to prevent season cracking. When tested by the mercurous nitrate test described in BS 2871-2, deep-drawn brass parts shall exhibit no sign of season cracking.

3.2 Fuel container

3.2.1 *General*. All joints below full fuel level shall be air-tight and fuel-tight. Each fuel container shall be tested for this by the manufacturer by applying 20 kPa air pressure internally whilst the fuel container is totally immersed in water.

The container and any internal coating materials shall not suffer any thermal or mechanical damage arising from use and operation of the appliance as required by **5.9** and **5.16**.

3.2.2 *Resistance to corrosion*. The fuel container shall be made of, or shall be coated internally with, a material that is resistant to corrosion by ionizable corrosive compounds in any water present in the fuel container, and that shall not be liable to soften or otherwise deteriorate through exposure to paraffin.

Fuel containers shall be tested for internal corrosion resistance in the following manner.

Remove the filler cap and burner from the fuel container and score the bottom inner surface of the container. Fill the container to the full fuel level with distilled water and leave to stand for a period of 48 h at a temperature of 18 ± 5 °C. Empty the container and examine the inner surfaces and all joints below full fuel level, for evidence of corrosion. Corrosion at the score marks only will give a measure of the efficiency of a corrosion resistant internal coating.

When ferrous sheet metal other than stainless steel is used in the construction of a fuel container, the sheet metal shall be not less than 0.7 mm thick; in the fabricated container the thickness shall in no place be less than 0.5 mm.

NOTE 1 The following coating materials, quoted as examples, are known to provide adequate resistance to corrosion:

a) electrodeposited zinc, 0.003 mm thick, but preferably 0.008 mm thick;

b) terne alloy, with 8 % to 15 % tin, at an average coating mass of not less than 120 g/m^2 of sheet, preferably covered with a paraffin resistant lacquer, provided that adhesion is good and that fabrication processes and handling do not adversely affect the coating;

c) stoved epoxy resin, provided that its application and stoving are correctly carried out;

d) paraffin resistant paint or lacquer, used in some instances in conjunction with non-ferrous or phosphate coatings, provided that adhesion is good.

NOTE 2 Paraffin as such is non-corrosive. Corrosion can occur, however, through the presence of water which may be introduced accidentally or may be condensed from the atmosphere. In such circumstances, the water may be expected to contain the ionizable corrosion promoting compounds that occur normally in natural waters, or as atmospheric pollution.

3.2.3 *Barometric feed appliances*. The fuel container of a barometric feed appliance shall have no soft solder joints and shall not allow the discharge of fuel or vapour due to distortion under the conditions of use required by **5.9**. When ferrous sheet metal other than stainless steel is used in the construction of the fuel container, its thickness shall be not less than 0.7 mm. Where the container is fabricated, the thickness shall be at no place less than 0.5 mm.

3.3 Fuel supply system

If the burner is not mounted immediately on top of the fuel container, any join in the fuel supply system, which may in normal use be exposed at the same time to both fuel and air, shall be fuel-tight when tested by applying 20 kPa internally whilst the fuel supply system is totally immersed in water.

NOTE Any join in the fuel supply system should be appropriate to the operational conditions of normal use.

3.4 Stability

The appliance, both when full of fuel and when empty, shall remain stable in all directions when standing on a platform inclined at 15° to the horizontal.

3.5 Provision for fixing

Space heating appliances shall have screw-holes, a hook and chain or other means conveniently placed and sufficient for securing them so as to prevent their being overturned.

3.6 Self-extinguishing facility and fuel spillage

A space heating appliance other than one designed to operate only when fixed to a rigid support shall incorporate a self-extinguishing facility which will extinguish the flame of the appliance if it is overturned.

If a cooking appliance incorporates such a facility, the facility shall also extinguish the flame of the appliance if it is overturned.

In the case of space heating and cooking appliances other than those designed to operate only when fixed to a rigid support, the amount of fuel that is spilled when the appliance is overturned shall be limited in accordance with **5.16.3**.

3.7 Wick tubes

Inner and outer wick tubes shall exhibit no distortion that could affect the safe operation of the appliance and no fuel leakage under the conditions of use required by **5.9**.

3.8 Flame regulator

The flame regulator of the appliance shall be readily accessible and easily adjustable when the appliance is alight and shall adjust the flame evenly.

The flame regulator shall exhibit no fuel leakage that may affect the safe operation of the appliance, under the conditions of use required by **5.9**.

3.9 Removable parts

Any part of an appliance that is intended to be removed in the course of filling, cleaning, or the replacing or trimming of the wick shall be so constructed that it cannot reasonably be fitted incorrectly or, where size and materials permit, an indication of its correct position in the appliance shall be clearly marked on it or shall be clearly marked on another part of the appliance near that position and in such a manner that the marking may be easily seen when the part is being replaced.

If it is not possible to mark the part or the appliance, for reasons of size or materials only, the correct position of any removable part shall be clearly given in a diagram accompanying the appliance.

If the design of the appliance is such that special tools are required for removable parts, such tools shall be supplied with the appliance.

3.10 Replacement parts

Replacement burners, wicks, kindlers and catalogued parts shall be clearly identified as to model number.

NOTE These should not cause the appliance to fail to comply with any safety requirements specified in this standard.

If the design of the appliance is such that special tools are required to fit replacement parts normally supplied to the general public, such tools shall be supplied with the appliance.

3.11 Lighting

Lighting shall be possible with a wooden match of length 40 ± 4 mm without inconvenience or difficulty.

3.12 Guards

Paraffin space heating appliances having exposed flames or radiants shall be provided with guards complying with the requirements of BS 1945.

NOTE Attention is drawn to the Heating Appliance (Fireguards) Regulations 1973.

4 Additional construction requirements for appliances with pressure burners

4.1 Fuel container

When standing on a level surface filled to the full fuel level and with any safety valve omitted and blanked off, the fuel container shall be leak-proof when tested at the highest of the following pressures:

a) an internal pressure of 210 kPa;

b) the internal pressure reached by operating the pump connected to the container through 60 complete strokes in 1 min;

c) the lesser of the two pressures, p_1 and p_2 (in kPa) defined as follows:

$$p_1 = \frac{133\,000 \times \text{mechanical advantage}}{\text{internal cross-sectional area of pump (in mm}^2\text{)}}$$

$p_2 = 103 \times$ compression ratio of the pump.

NOTE The mechanical advantage is the factor by which the force applied to the pump handle is multiplied between this point and the pump piston.

4.2 Burner and vaporizing unit

Burners and vaporizing units with all outlets blanked off shall be leak-proof when tested at the highest of the following pressures:

a) an internal pressure of 420 kPa;

b) the internal pressure reached by the pump of the fuel container to which the burner is attached in normal use. The pump shall be operated as described in **4.1** b);

c) the pressure defined in **4.1** c).

4.3 Burner assembly

All permanent metal-to-metal burner joints shall be soundly brazed or continuously welded with high melting point metal.

4.4 Nipple

A removable nipple, where provided, shall be shaped to enable a spanner or key to be fitted for unscrewing, and shall be so situated that it is accessible for pricking.

4.5 Pump

The pump shall be fitted with a non-return valve, leak-proof up to the maximum test pressure of the fuel container (see **4.1**).

The non-return valve and the pump washer shall be removable.

4.6 Pressure release valve

The fuel container shall be fitted with a valve which shall be readily operable, for releasing quickly and safely the pressure in the fuel container.

4.7 Filler opening

The filler opening shall be so located and designed that the fuel container, when level, cannot be filled to more than 94 % of its total volume, measured to the base of the burner stem.

4.8 Filler cap assembly

The filler cap assembly shall be leak-proof up to the maximum test pressure of the container (see **4.1**). The washer shall exhibit no damage due to fuel and heat conditions under the conditions of use required by **5.9**.

5 Performance

5.1 General

Test fuels used shall be in accordance with Appendix A.

All performance tests, except that specified in **5.13**, shall be carried out under the conditions specified in Appendix B.

5.2 Fuel consumption and thermal output

The fuel consumption and, if required, the thermal output, obtained at the manufacturer's stated maximum flame setting, shall be determined as specified in Appendix C.

5.3 Combustion gas

The CO/CO_2 ratio shall not exceed 0.02 at rates of burning between the manufacturer's stated maximum flame setting and one half of this rate, or if it is less, the manufacturer's stated minimum flame setting. At settings other than those specified above, from the minimum to the maximum that can be obtained without the production of visible smoke, the absolute rate of evolution of carbon monoxide shall be not greater than that permitted at the manufacturer's stated maximum flame setting. The appliance shall be tested as described in Appendix D.

5.4 Flame stability

When operated at the manufacturer's recommended minimum flame setting for a minimum of 30 min and then suddenly turned to the fully open position, appliances fitted with short drum burners and non-adjustable wicks or kindlers shall not, after a period of 5 min has elapsed, cause a flame outside the sides of the perforated sleeves or plates, and after the same period shall withstand the flannelette test specified in BS 1945.

5.5 Fuel creep

There shall be no spreading of fuel over any external part of the appliance during a period of 4 h following its final adjustment, when operated at the manufacturer's stated maximum flame setting.

5.6 Flame creep

The flame shall not increase in size during a period of 4 h following its final adjustment to the manufacturer's stated maximum flame setting.

5.7 Smoke

At no time over the period required to burn 90 % of the fuel in the fuel container shall the flame of the burner emit smoke, following final adjustment of the flame to the manufacturer's maximum flame setting.

5.8 Surface temperature

The surface temperature of any part of an appliance that it may be necessary to touch during operation shall not exceed 58 °C in the case of parts made of metal, or of a material of a thermal conductivity not lower than that of steel and not higher than that of aluminium, or 80 °C in the case of other materials. No portion of the surface of an appliance (other than a working surface) likely to be accidentally touched, shall exceed 105 °C. The appliance shall be tested as described in Appendix E with any upper horizontal surface of a space heating appliance not regarded as a working surface.

NOTE The temperatures given in **5.8** have been selected with due regard to BS 4086 and PD 6504; they may be the subject of amendment when results of the research into safe surface temperatures become available.

5.9 Temperature rise of floor and walls

Appliances giving principally unidirectional radiation shall not give floor and wall temperatures exceeding 65 °C and other appliances shall not give floor and wall temperatures exceeding 100 °C, when tested as described in Appendix F.

After the test has been repeated the appliance shall exhibit no distortion, fracture or breakage of any part that would cause the appliance to become unsafe and deep-drawn brass parts shall continue to satisfy the requirements for season cracking given in **3.1**.

5.10 Fuel temperature

For appliances other than those with pressure burners with sealed containers, the temperature of the top 5 mm of the fuel surface in the fuel container or fuel bowl, or the mixed fuel temperature in the case of an inverted fuel container, shall not exceed 38 °C, based on a room temperature of 16 °C, when the appliance is filled to the full fuel level and run until 95 % of the contents of the fuel container has been consumed, at any rate between the manufacturer's stated maximum and minimum flame settings.

5.11 Operation of space heating appliances under out-of-level conditions

At no time shall fuel leak from the valve, or from any other part of a space heating appliance, when any part of the periphery of the base in contact with the floor or, if feet are provided, any one of its feet, is lifted out of level by 3° following operation in a level condition at the manufacturer's stated maximum flame setting.

A space heating appliance shall also withstand the flannelette test specified in BS 1945 after a period of 5 min in the out-of-level condition has elapsed.

5.12 Simmering performance of cooking appliances

The test applies to multiple burner cooking appliances with burners of the long drum and short drum types. At least one burner of such a multiple burner cooking appliance shall be capable of complying with the following requirement.

During a 30 min period the burner shall not flare, smoke or go out in a current of air with a velocity of 1 m/s when tested as described in Appendix G.

5.13 Operation of space heating appliances in a steady draught

A space heating appliance, when operated at the manufacturer's maximum recommended flame setting shall be capable of operating safely, i.e. in each test period not more than 10 flashes of flame, each of less than 1 s duration and of not more than 50 mm in length, shall appear outside the heating appliance, in a steady frontal horizontal, or worst orientation, draught at any velocity in the range 0 m/s to 8 m/s. The test period shall be 5 min or until the burner is extinguished, whichever is the shorter period.

NOTE A suitable design of wind tunnel for creating the draught is described in Appendix H.

If the burner is extinguished during the test period, the draught shall be discontinued immediately, and the heating appliance kept under observation for 15 min. If the burner relights, safe operation shall continue.

In the case of short drum kindler type burners, if the flame is displaced so that it burns at the base within the test period of 5 min, a further test of 30 min shall be undertaken; during this further period, no flame shall appear outside the heating appliance.

After each test, burning shall be continued for a period of 15 min without the draught; during this period, no flame shall appear outside the heating appliance.

5.14 Flame flash-back

For all wick-fed burners, it shall not be possible to cause the flame to flash back from the burner into the fuel container by turning the wick down as far as it will go during operation in accordance with Appendix C.

The test shall be carried out with the wick reduced to the lowest height at which the burner is capable of operation with a normal flame.

5.15 Paraffin feed control

There shall be no increase in the flow of paraffin, if, for any reason, the feed control unit fails to operate.

5.16 Safety on overturning

5.16.1 It shall not be possible to light an appliance if the self-extinguishing facility is not in an operating condition.

5.16.2 The flame shall be extinguished within 15 s of overturning and no flame shall appear outside the casing or guard of the appliance when the appliance is tested in accordance with **J.3**, both following repeated operation of the self-extinguishing facility as described in **J.1** and following corrosion testing as described in **J.2**.

5.16.3 The fuel spillage during the first 15 s after overturning shall not exceed 55 mL per burner when tested in accordance with **J.4**.

The spillage shall not exceed a further 55 mL per burner in the immediately following 15 s when the appliance has been quickly returned to an upright position.

5.16.4 There shall be no distortion, fracture or breakage of any part that would cause the appliance to become unsafe when the appliance is subjected to the unarrested free falls described in **J.4**.

6 Marking and instructions

6.1 Marking

The following information shall be legibly and permanently marked on the body of the appliance:

a) the name, trade mark or other means of identification of the UK manufacturer, distributor or supplier;

b) the manufacturer's model name and/or type number followed by:

1) in the case of a space heating appliance, the words "SPACE HEATER";

2) in the case of a cooking appliance, the word "COOKER";

c) the number and date of this British Standard, i.e. BS 3300:1985[1)].

6.2 Warnings

The appliance shall bear the following permanent warnings which shall be distinguished by the word "WARNING":

a) "Use only paraffin, BS 2869:C1 "positioned as closely as", is practicable to the filling aperture;

[1)] Marking BS 3300:1985 on or in relation to a product is a claim by the manufacturer, distributor or supplier that the product has been manufactured to the requirements of the standard. The accuracy of such a claim is therefore solely the responsibility of the manufacturer, distributor or supplier. Enquiries as to the availability of third party certification to support such claims should be addressed to the Director, Quality Assurance Division, BSI, PO Box 375, Milton Keynes MK14 6LO for certification marks administered by BSI or to the appropriate authority for other certification marks.

b) "Do not fill or carry when alight";

c) "Do not use in an unventilated place or where exposed to draughts";

d) in the case of a cooking appliance: "Do not use as a space heater";

e) in the case of a heating appliance: "Do not use as a cooker";

f) in the case of a cooking appliance not having a self-extinguishing facility: "Do not place this appliance where it can be knocked over";

g) in the case of a self-extinguishing appliance, instructions about any necessary attention needed to maintain or restore its self-extinguishing capability.

NOTE Indestructible labels with a permanent and paraffin-resistant adhesive are permitted for the requirements of **6.1** and **6.2**.

6.3 Instructions

The manufacturer shall supply written instructions with the appliance concerning its safe use and operation.

The manufacturer's instructions shall contain the following:

a) a statement that the appliance is to be used only with paraffin, class C1 burner fuel in accordance with BS 2869-2 and identified by the device shown in that standard;

b) the device shown in BS 2869-2, reproduced in Figure 8;

c) manufacturer's maximum and minimum flame settings;

d) approximate maximum fuel consumption, as determined from Appendix C, and, if required, the thermal output as determined fromAppendix C.

e) warnings against the following:

1) use of fuels other than paraffin;

2) accidental introduction of water into fuel containers;

3) use of containers that have previously held petroleum or methylated spirit;

4) use of the appliance in inadequately ventilated areas which could prevent satisfactory dispersal of the products of combustion;

f) information on requirements for adequate ventilation, including the minimum area of openings to the room in which the appliance is used, to ensure satisfactory dispersal of the products of combustion and to allow the entry of replacement air, which shall be included with item e) 4);

g) any special precautions necessary for the safe handling, use, operation and extinguishing of the appliance, including any instructions necessary for the proper operation of adjustable wick stops and identification of surfaces likely to become heated in normal use;

h) any positioning and/or fixing instructions.

NOTE This figure is reproduced from BS 2869-2.

Figure 8 — Symbol for class C1 burner fuel

Appendix A Test fuels

A.1 Tests for fuel consumption and heat output

The fuel used for these tests shall comply with the requirements of BS 2869, class C1.

A.2 All other tests

The characteristics of the test fuel shall be in accordance with Table 1, when tested by the appropriate British Standard or Institute of Petroleum method given in Table 1.

NOTE This specification represents a test fuel only; it has been prepared in order to reveal various characteristics of the appliances under test.

A.3 Net specific energy

When determined by the method described in BS 2000-12 (IP 12) and BS 526 or by calculation from the density, the net specific energy of the test fuel shall be 43.5 MJ/kg approximately.

NOTE 1 BS 2000-12 (IP 12) allows the determination of the gross specific energy of the fuel which can be converted to the net specific energy using the equations given in BS 526.

When calculating the net specific energy (in MJ/kg) from the density, the following equation shall be used:

$$\text{Net specific energy} = 46.423 - 8.792\,\rho^2 + 3.170\,\rho$$

where ρ is the density at 15 °C (in g/m L).

NOTE 2 Any small corrections for sulphur, water and incombustibles (ash) that may be present are ignored.

Appendix B Test conditions and preparation of the appliance

B.1 General

The appliance shall be tested in a test room. The air of the test room shall contain not more than 0.2 % of carbon dioxide and not more than 0.002 % of carbon monoxide and shall be free from draughts likely to affect the performance of the burner; the temperature of the air in the test room shall lie between 13 °C and 23 °C during the test.

The temperature of the test fuel used to fill the fuel container of an appliance under test shall be between 13 °C and 23 °C.

B.2 Preparation of the appliance

Prior to the performance tests, the appliance shall be checked and examined to ensure that all components are undamaged and are properly assembled and positioned according to the manufacturer's operating instructions. The appliance shall then be operated at the maker's stated maximum flame setting for two periods of approximately 8 h, after which, in the case of wick-fed burners, the wick burning surface shall be carefully and uniformly smoothed and loose char removed, using the wick cleaner if provided with the appliance. Any protruding strands shall also be removed.

Table 1 — Characteristics of test fuel

Characteristic	Requirement	Test method[a] British Standard	Identical Institute of Petroleum method
Smoke point, mm	25 min. 30 max.	BS 2000-57	IP 57
Char value, mg/kg	10 min. 20 max.	BS 2000-10	IP 10
Distillation Recovery at 200 °C % by volume	40 min. 60 max.	BS 2000-123	IP 123
Final boiling point, °C	240 min. 260 max.	BS 2000-123	IP 123
Residue, % by volume	1.5 max.	BS 2000-123	IP 123
Sulphur content, % by mass	0.15 max.	BS 2000-107	IP 107
Flash point closed Abel, °C	38 min.	BS 2000-170	IP 170
Colour	undyed		

[a] The British Standard methods are identical with the methods published by the Institute of Petroleum. Their corresponding Institute of Petroleum methods are also given.

Appendix C Determination of fuel consumption and thermal output

The test is applicable to both long drum and short drum burners.

Fill the fuel container to the full fuel level and light the burner. Adjust the flame as soon as possible to the manufacturer's stated maximum flame setting and readjust as necessary during the first 30 min from lighting up. After a period not exceeding 30 min from lighting up, make no further adjustment to the flame for the duration of the test.

If a wick stop is fitted, fill the fuel container to the full fuel level and light the burner. Turn up the wick to the maximum height permitted by the wick stop, and thereafter make no further adjustment.

After the final adjustment to the flame, determine the fuel consumption over the next 4 h running. Express the fuel consumption in L/h.

If the thermal output rating is required, calculate this from the fuel consumption determined in this appendix. Take the net specific energy of paraffin as 43.5 MJ/kg and the density as 0.8 g/mL.

Appendix D Determination of carbon dioxide and carbon monoxide content of combustion products

D.1 Adjustment of appliance

D.1.1 *Appliances with long drum and short drum burners*. Fill the fuel container to the full fuel level and light the appliance. Adjust the flame as soon as possible to give the rate of burning at which the combustion test is to be carried out. Adjust the flame as necessary during the first 30 min from lighting up. After a period not exceeding 30 min from lighting up, make no further adjustment to the flame for the duration of the test.

If a wick stop is fitted, adjust the flame as soon as possible to the maximum height permitted by the wick stop and thereafter make no further adjustment.

D.1.2 *Appliances with pressure burners*. Fill the fuel container to the full fuel level and light the appliance. Adjust the pressure as soon as possible to give the rate of burning at which the combustion test is to be carried out. Adjust the pressure as necessary during the first 30 min from lighting up. After a period not exceeding 30 min from lighting up, make no further adjustment to the pressure for the duration of the test.

If a safety valve is fitted as a part of the appliance, carry out the test with the safety valve omitted and blanked-off.

D.2 Procedure

D.2.1 *Frequency of sampling*. After the final adjustment of the flame, sample the products of combustion a sufficient number of times to reflect the performance of the appliance during the period of test.

D.2.2 *Sampling provisions for certain classes of appliances*. Methods and apparatus used for sampling shall not affect combustion and shall ensure the collection of a representative sample with as little dilution as possible. The sampling methods and apparatus given below are based on experience.

a) *Cooking appliance burners*. The sampling apparatus consists of a hood as shown inFigure 9. Place a vessel of the specified dimensions, containing water, centrally over the burner. Set the damper provided on the hood, or additional flue if added, so that spillage of the flue gases is just prevented.

NOTE The homogeneity of the flue gas stream may be tested by taking a traverse across the flue at the sampling level.

b) *Whole hotplate test for cooking appliances*. Place a large oval vessel, approximately 280 mm by 355 mm over two burners and place vessels approximately 190 mm in diameter over the remaining burners. Light all burners, including the grill burner, and place a large hood, as shown in Figure 10, over the whole.

c) *Cooking appliance ovens*. Fit a short length of pipe to the appliance outlet. Offer the sampling probe parallel to the axis of this pipe. The sampling point shall be in the plane of the appliance outlet and in the case of circular outlets shall be one-third of a radius from the centre.

d) *Space heating appliances*. Draw the sample through a head; a suitable design is shown in Figure 11.

D.2.3 *Methods of sampling*. Draw two samples simultaneously in parallel, one for the determination of carbon dioxide and one for the determination of carbon monoxide.

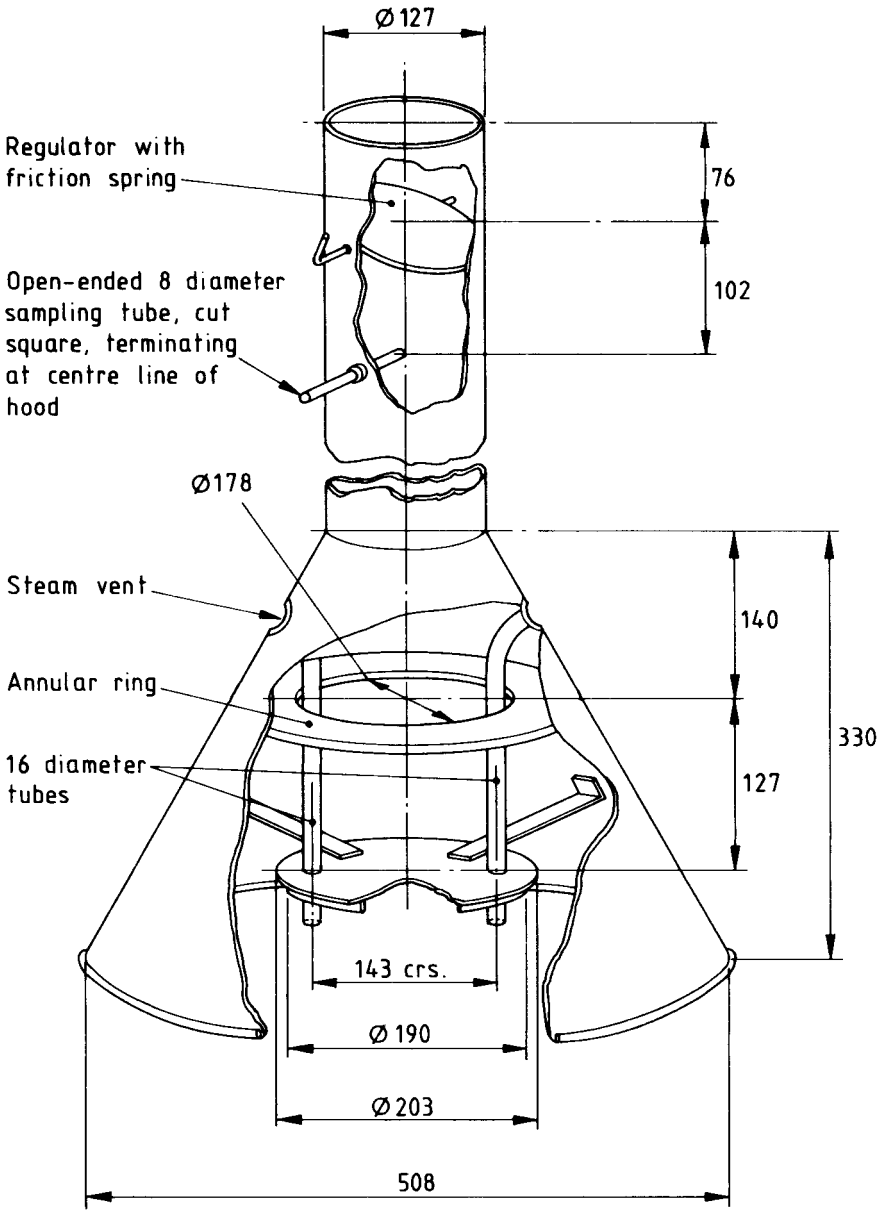
NOTE The methods of drawing and storing samples are dependent on the method of analysis; details are given in BS 1756-1, for the methods described in BS 1756-2 to BS 1756-5.

Commence sampling as soon as thermal equilibrium is established, and in any case 30 min after lighting-up.

D.2.4 *Analysis of samples.* Determine the carbon dioxide and carbon monoxide content of the products of combustion from the appliance by methods capable respectively of an accuracy of 0.1 % and 0.002 % of the volume of the sample.

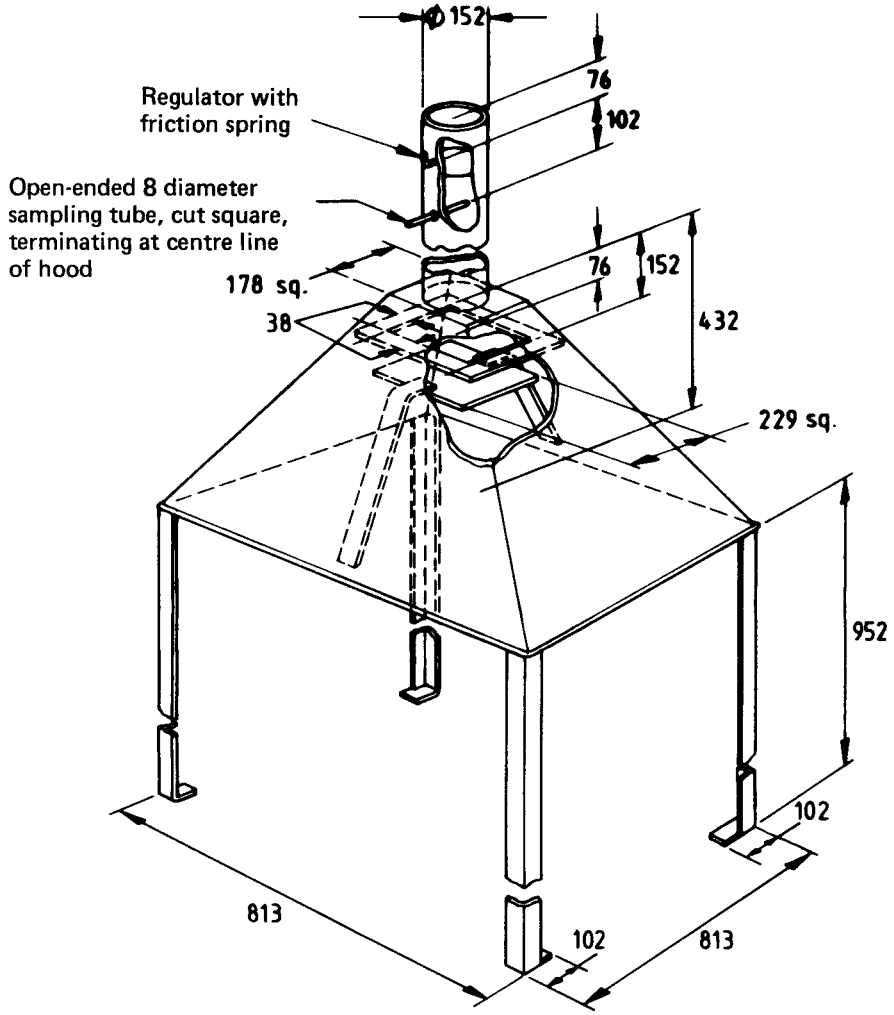
NOTE Reference methods of analysis are described in BS 1756-2 to BS 1756-5. Alternative methods of analysis may be employed provided they are capable of the accuracy required.

D.2.5 *Number of tests required.* Repeat the test at a sufficient number of rates of burning to determine the combustion performance over the whole of the appropriate range of rates (see **5.3**). If this is done by plotting a curve of CO/CO_2 ratio against rate, make no extrapolation.



All dimensions are in millimetres.

Figure 9 — Sampling apparatus for cooking appliance burners



All dimensions are in millimetres.

Figure 10 — Sampling apparatus for whole hotplate

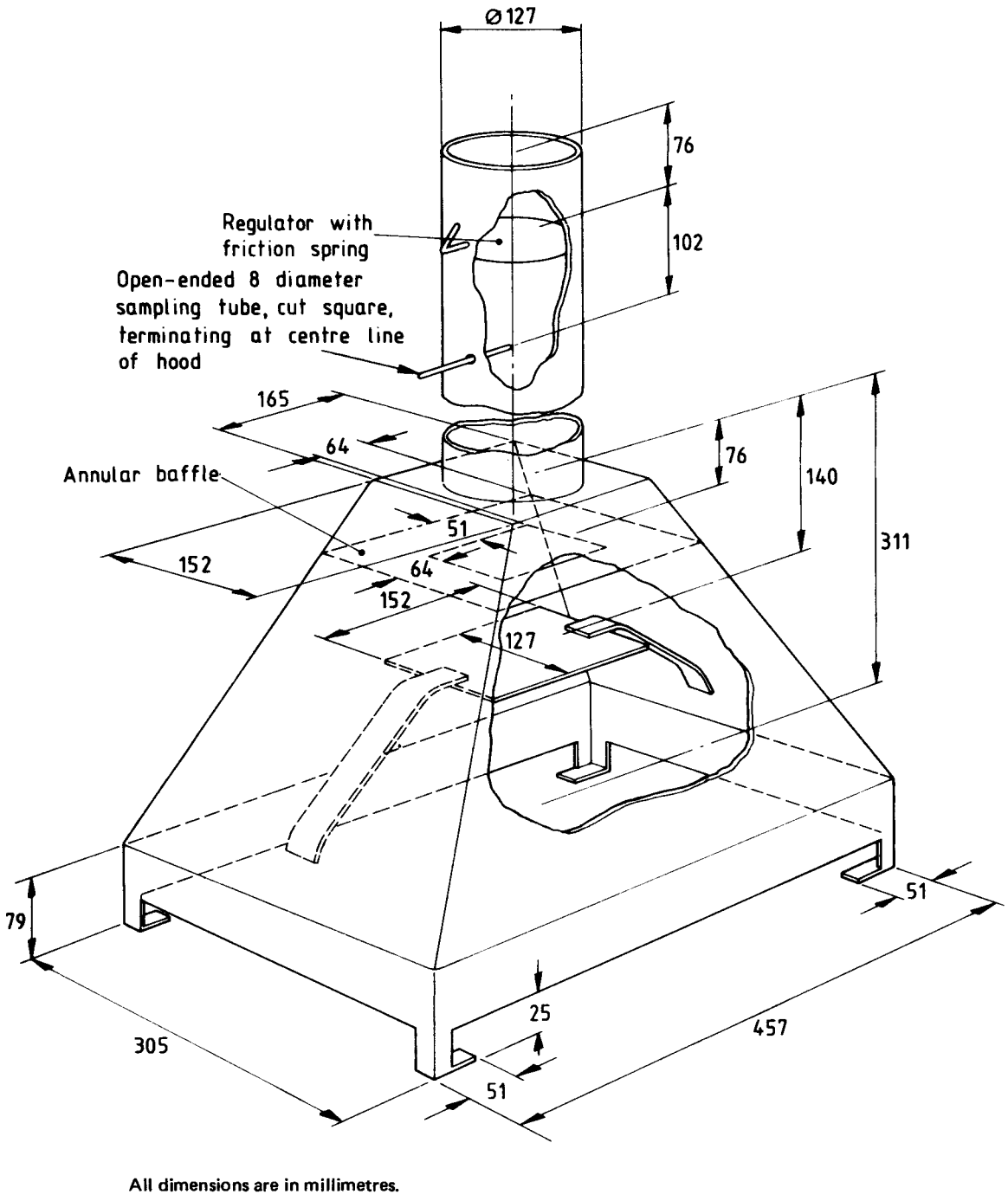


Figure 11 — Sampling apparatus for space heating appliance

Appendix E Determination of surface temperature

Operate the burner as described in Appendix C. Measure the temperature of all parts of the burner and appliance which have to be touched to extinguish the appliance, to adjust the flame or to move a portable space heating appliance. Measure the temperature of all parts of the burner and appliance likely to be touched accidentally. Determine these surface temperatures every 30 min, using a surface pyrometer, until equilibrium is reached.

Correct the surface temperature to a standard room temperature of 16 °C as follows:

Corrected surface temperature(in °C) = $Y - (X - 16)$

where

Y is the measured surface temperature (in °C).

X is the test room temperature (in °C);

Appendix F Determination of temperature rise of floor and walls

F.1 General

The test is applicable to both space heating and cooking appliances and is designed to ensure that under normal working conditions the maximum temperature attained by a wooden floor beneath the appliance, or by a wooden wall against which the appliance may be fixed, is such that the possibility of fire is eliminated.

F.2 Apparatus

F.2.1 *A wooden floor with detachable side and back walls*. (See Figure 12.) The floor is approximately 50 mm thick and consists of a 25 mm layer of pine below a 25 mm layer of oak or equivalent material with a thickness of building paper between them. The oak is finished in clear varnish. The side and back walls are both 25 mm pine and are painted dull black. Thermocouples are embedded in each wall at 152 mm centres. The thermocouples enter the wall from the side remote from the appliance, the junctions being fixed 1.6 mm from the surface of the wood nearest to the appliance.

F.3 Procedure

The woodwork shall have been thoroughly dried out, either as a result of previous tests or by heating for 24 h with an appliance in position and operating at maximum rate.

Arrange the appliance to be tested so that it is as close as possible to the back and side walls, and, in the case of cooking appliances, with an approximately 190 mm diameter pan containing water in position. Place appliances
provided with a radiant element giving principally unidirectional radiation on the test apparatus so that in plan view the main beam of radiation is at 45° to each wall pointing outwards. Light the appliance and run for 4 h at full output. The thermostat, if any, should be at its maximum setting.

Take readings of the temperatures at the junctions most affected by the heat of the appliance. Correct the temperatures to a standard room temperature of 16 °C by the method given in Appendix E.

Appendix G Simmering test

G.1 Apparatus

G.1.1 *A flat bottomed test vessel* made of approximately 0.7 mm thick Monel metal, stainless steel or copper, and approximately 190 mm diameter and 127 mm high with a lid and stirrer. The general form recommended is shown in Figure 13. The centre of a – 10 °C to + 110 °C thermometer bulb is situated about 90 mm below the top of the lid, with the 10 °C graduation visible. The mass of the vessel (including lid and stirrer) is 1 250 ± 25 g. The exterior of the sides and lid are highly polished to reduce radiation losses and the base is clean but not polished.

G.2 Procedure

Heat 1 kg of water in the test vessel (**G.1.1**) to approximately 82 °C in a current of air of velocity 1 m/s measured at burner level. Adjust the burner so that the water temperature is maintained at 82 ± 3 °C for 30 min without need for further adjustment. Movement of the vessel is allowed, if necessary, up to a maximum of 75 mm in any direction.

NOTE A flame resistant mat may be used to ensure that only the base of the test vessel is heated directly.

Stir the water intermittently during the test period and immediately before taking the temperature. During the test period observe the burner and note whether the flame flares, smokes or goes out.

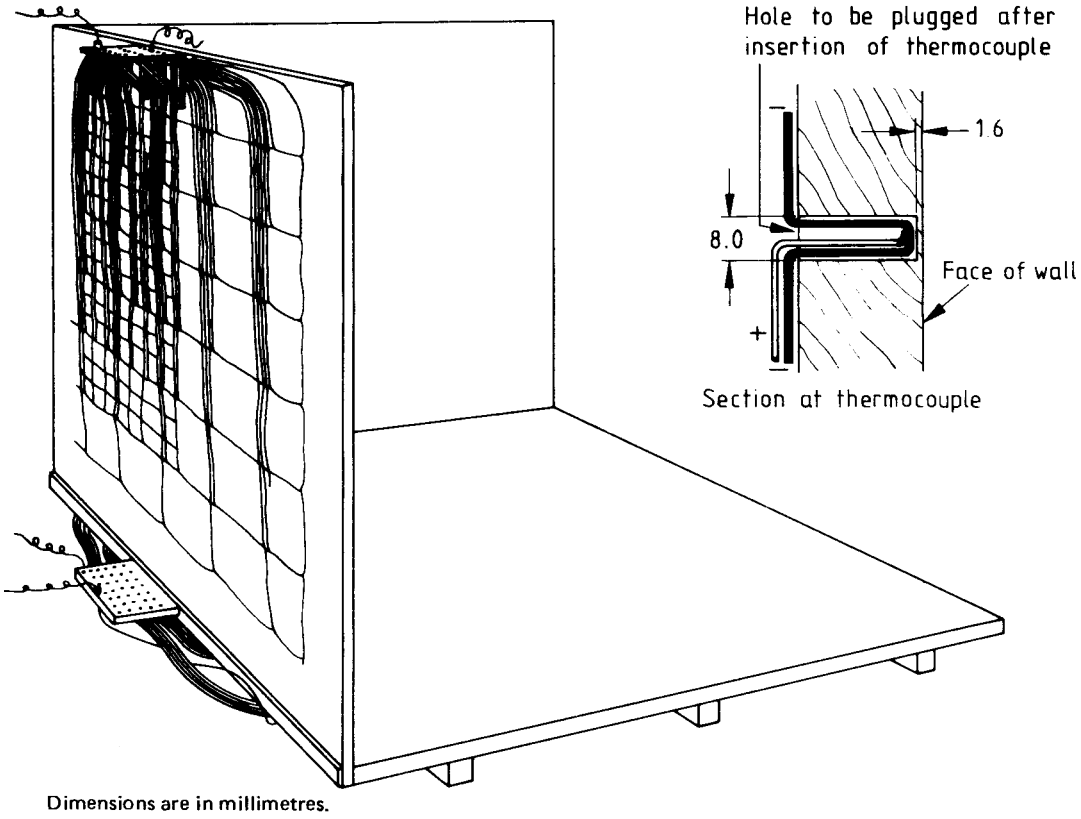


Figure 12 — Apparatus for measuring temperature rise of floor and walls

Appendix H Design of wind tunnel for the steady draught test

H.1 General

This appendix summarizes principles for the design of a wind tunnel to provide a reasonably uniform wind speed for testing space heating appliances in a steady draught, as required by **5.13**.

H.2 Direction of air flow

It is essential that the wind speed in the working section of the tunnel is substantially uniform. This is most readily achieved by drawing air through the tunnel when a reasonably uniform velocity profile is obtained without recourse to "straightening" grids, or long entry sections.

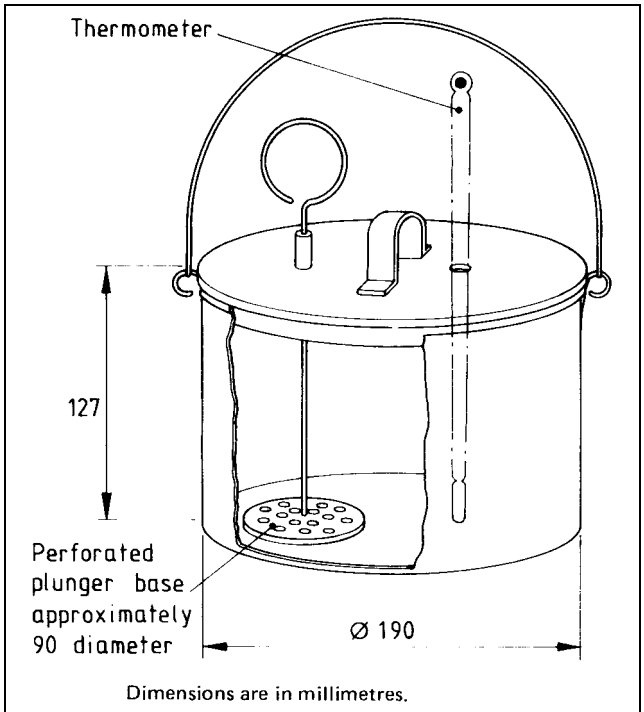


Figure 13 — Test vessel for simmering test

H.3 Dimensions of the tunnel

The working section of the tunnel (see Figure 14) should be such that there is at least 300 mm between the sides and top of the heating appliance to be tested and the sides and top of the tunnel respectively. The heating appliance should not occupy more than 40 % of the section area. This may be simply achieved with a rectangular working section. The length of the working section should be such as to allow at least 900 mm clear in front of and behind the heating appliance under test.

The dimensions of the entry and final sections of the tunnel will depend on the site of the tunnel and the diameter of the fan respectively. If the tunnel is operated in a space free from draughts, the entry section, which should taper at about 10° to the axis, could possibly be dispensed with but it should not in any case need to exceed 1.8 m in length. The final section should also taper at an angle of about 10° to dimensions similar to the diameter of the fan. It need not be faired to a circular section.

The floor of the tunnel should be smooth with no sudden changes in level and should not deviate from the true surface by more than 3 mm.

H.4 Fan and speed control

The fan should be of such diameter and rating as to give 10 % greater free air flow than the maximum test requirement. Control of the air speed may be obtained by a variable speed fan, or by shutters. The shutters should always present a symmetrical opening to the tunnel. A suggested form is shown in Figure 14.

H.5 Air speed measurement

The air speed in the tunnel may be measured with vane or cup anemometers, or a suitable velocity meter or pitot tube. The air speed in any position in the section of the tunnel occupied by the heating appliance, at a distance greater than 150 mm from the walls of the tunnel, should not vary by more than 10 % from the mean value.

The measurement of air speed during tests on a heating appliance should be made at least 900 mm in front of the heating appliance and in line with the burner.

Appendix J Determination of safety on overturning

J.1 Test for mechanical reliability of self-extinguishing facility

Operate any moving parts of the self-extinguishing facility 2 000 times and then subject the appliance to the test described in **J.3** to ensure that it continues to function correctly.

J.2 Test for corrosion resistance of self-extinguishing facility

J.2.1 *General*. Expose the complete appliance to the acetic acid salt spray test described in **J.2.2** to **J.2.5** and then subject the appliance to the test described in **J.3** to ensure that the self-extinguishing facility continues to function correctly.

J.2.2 *Spraying liquid*. Dissolve 50 ± 5 g of sodium chloride (NaCl) in water containing less than 100 mg/L of total solids or having a conductivity of less than 0.002 S/m and dilute to 1 L.

Add glacial acetic acid to adjust the pH to 3.2 ± 0.1.

J.2.3 ***Apparatus***

J.2.3.1 *A fog cabinet* or room lined with materials resistant to the corrosive medium employed in the test (glass, rubber or certain plastics materials are suitable), with specimen supports meeting the same requirements and baffles to prevent direct impingement of the spray on the appliance being tested.

NOTE The use of adjustable baffles will be found of assistance in obtaining a uniform collection rate throughout the cabinet.

J.2.3.2 *A supply of clean air* of controlled pressure and humidity.

J.2.3.3 *One or more spray nozzles*

J.2.3.4 *A means of heating* the apparatus and maintaining the test temperature.

J.2.3.5 *Two or more collector vessels*

J.2.3.6 *A swab and light magnesium oxide slurry*

J.2.4 *Test conditions*. The test is carried out in a suitable fog cabinet (**J.2.3.1**).

The operating temperature inside the cabinet is 35 ± 2 °C.

The spray collection rate is 1.5 ± 0.5 mL/h over an 8 000 mm^2 horizontal area, averaged over at least 8 h.

J.2.5 *Procedure*. Clean the self-extinguishing facility with a slurry of light magnesium oxide on a swab (**J.2.3.6**) and rinse the area in clean running water so that it is free from water breaks. Place the appliance in the cabinet so that as far as possible the most significant surface is at an angle of 15° to 30° to the vertical.

Place at least two collector vessels (**J.2.3.5**) in the zone of the appliance, taking care that only fog and no liquid falls from the appliance and that it is all collected.

Adjust the cabinet to the required temperature and commence the test.

The collected spray should consist of a solution containing 50 ± 10 g of sodium chloride per litre and having a pH of 3.2 ± 0.1 and is not recirculated.

Operate the test continuously for a period of 24 h except for short periods of inspection and to replenish the solution reservoir.

When the test is complete rinse the appliance to remove any deposits of salt and dry.

Examine the appliance for any deterioration in appearance and operate the self-extinguishing facility 20 times.

J.3 Self-extinguishing test

J.3.1 ***Apparatus***

J.3.1.1 *Metal tray* large enough to allow the appliance to fall freely onto it and with a piece of winceyette laid flat in the bottom of it.

J.3.2 *Preparation*. Place the appliance on the metal tray (**J.3.1.1**). Light the appliance and allow it to warm up until the wick tube of a wick-fed appliance or the outer casing of the burner of a barometric feed appliance has attained a temperature of at least 95 % of the maximum.

NOTE This temperature will normally be attained from cold within 30 min at the recommended high flame rate. After heating appliances have been extinguished for about 5 min, such temperatures are likely to be regained within 10 min at the recommended high or low flame rate.

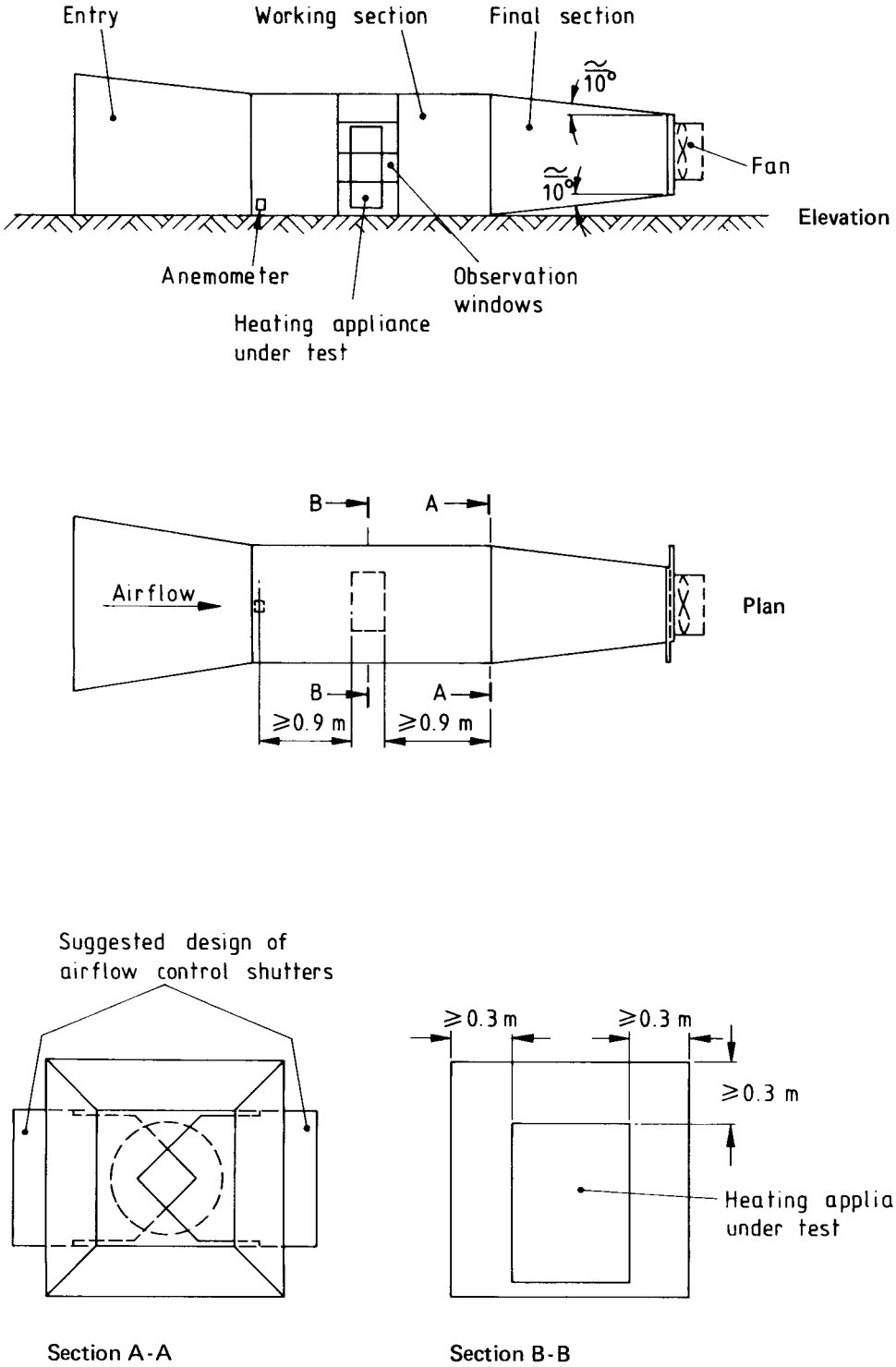


Figure 14 — Small wind tunnel for steady draught test

J.3.3 *Procedure*. Push the top of the lighted appliance in one movement beyond its point of balance and allow it to fall freely until it is about to impact the tray, when it is arrested so as to avoid damage to the appliance and so that it comes to rest on its back, on its front or on one of its sides. Carry out this procedure twice for each direction, followed by a third unarrested free fall in each direction to simulate the appliance being knocked over more violently; the heating appliance is overturned a total of nine times. Carry out any two of the tests in each direction at the full flame rate and the remaining one at the lowest recommended flame rate. Before each overturning operation, any spilled paraffin from previous tests is carefully removed and the heater pre-burned for a sufficient time to remove traces of fuel from crevices in the burner; 10 min between tests should be sufficient for this.

J.3.4 *Expression of results*. Note whether or not the flame is extinguished within 15 s each time the appliance is overturned, whether flames appear outside the casing or guard of the appliance during the tests, whether the winceyette catches fire and if the appliance re-ignites spontaneously.

J.4 Spillage test

J.4.1 ***Apparatus***

J.4.1.1 *Metal tray* of known mass and large enough to allow the appliance to fall freely on it.

J.4.2 *General*. If desired, this test may be carried out concurrently with the test described in **J.3**. If carried out separately, the appliance may be unlighted but shall have its burner set at the flame size found by previous experimentation to be the most severe for the test.

J.4.3 *Procedure*. Fill the fuel container to the full fuel level and stand the appliance on a metal tray (**J.4.1.1**). Push the top of the appliance in one movement beyond its point of balance and allow it to fall freely until it is about to impact the tray, when it is arrested so as to avoid damage to the appliance and so that it comes to rest on its back, on its front or on one of its sides. Carry out this procedure twice for each direction, followed by a third unarrested free fall in each of the same three directions; the heating appliance is overturned a total of nine times.

After each fall, allow the appliance to remain at rest for 15 s. At the end of this time measure the amount of any fuel spilled in the 15 s, return the appliance quickly to an upright position where it shall remain for a further 15 s, at the end of this time measure the amount of any additional fuel spilled.

Between each test remove any spilled fuel from the tray and appliance surfaces

J.4.4 *Expression of results*. Calculate and report the volume of fuel spilled (in millilitres) by subtracting the original mass of the tray (in grams) from the final mass of the tray and spilled fuel (in grams); convert this mass to volume units by estimating the density of the fuel to be 0.8 g/mL.

Report any distortion, fracture or breakage occurring in the unarrested falls which would render the appliance unsafe for further use.

If desired, the measurement of the two separate amounts of spilled fuel may be replaced by the measurement of the total spillage at the end of each 30 s cycle. Such a method of measurement will be valid only if it is found that the total spillage does not exceed 55 mL for each burner.

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Publications referred to

BS 526, *Definitions of the calorific values of fuels.*
BS 1756, *Methods for the sampling and analysis of flue gases.*
BS 1756-1, *Methods of sampling.*
BS 1756-2, *Analysis by the Orsat apparatus.*
BS 1756-3, *Analysis by the Haldane apparatus.*
BS 1756-4, *Miscellaneous analyses.*
BS 1756-5, *Semi-routine analyses.*
BS 1945, *Fireguards for heating appliances (gas, electric and oil-burning).*
BS 2000, *Methods of test for petroleum and its products.*
BS 2000-10, *Burning test (24-hour) for kerosine.*
BS 2000-12, *Heat of combustion of liquid hydrocarbon fuels.*
BS 2000-57, *Smoke point of kerosine.*
BS 2000-107, *Sulphur in petroleum products (lamp method).*
BS 2000-123, *Distillation of petroleum products.*
BS 2000-170, *Flash point by the Abel apparatus (non-statutory method).*
BS 2869, *Fuel oils for non-marine use.*
BS 2869-2, *Specification for fuel oil for agricultural and industrial engines and burners (classes A2, C1, C2, D, E, F, G and H).*
BS 2871, *Copper and copper alloys. Tubes.*
BS 2871-2, *Tubes for general purposes.*
BS 4086, *Recommendations for maximum surface temperatures of heated domestic equipment.*
PD 6504, *Medical information on human reaction to skin contact with hot surfaces.*
IP 10, *Burning test — 24-hour*[2)].
IP 12, *Heat of combustion of liquid hydrocarbon fuels*[2)].
IP 57, *Smoke point*[2)].
IP 107, *Method of test for sulphur in petroleum products (lamp method)*[2)].
IP 123, *Method of test for distillation of petroleum products*[2)].
IP 170, *Flash point by the Abel apparatus*[2)].

[2)] Available from the Institute of Petroleum, 61 New Cavendish Street, London, W1.

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