

Methods for

Thermal testing of domestic solid mineral fuel burning appliances with convection —

Part 1: Flue loss method

Committees responsible for this British Standard

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- Association of British Solid Fuel Appliance Manufacturers
- British Coal Corporation
- British Flue and Chimney Manufacturers' Association
- Consumer Policy Committee of BSI
- Department of Energy
- Department of the Environment
- HETAS Ltd.
- Incorporated Association of Architects and Surveyors
- Low Temperature Coal Distillers Association of Great Britain Ltd.
- METCOM
- National Fireplace Council Manufacturers' Association
- Solid Fuel Advisory Service
- Solid Smokeless Fuels Federation
- Waterheater Manufacturers' Association

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Foreword

This Part of BS 3250 has been prepared under the direction of the Refrigerating, Heating and Air Conditioning Standards Policy Committee, RHE/-. It supersedes BS 3250-1:1973, which is withdrawn.

BS 3250 describes two methods of test for determining the efficiency of appliances which produce part of their useful heat output as convection. Part 1 deals with the flue loss method, in which the total efficiency is obtained by determining the percentage heat content of the flue gases and deducting it from 100 %, making a correction for the undergrate combustible loss. Part 2 deals with the hood method, in which the total efficiency is obtained by adding together the directly measured radiation efficiency, convection efficiency and, for appliances with a boiler, water heating efficiency. The choice of test method depends largely on the laboratory facilities available.

The main technical changes from BS 3250-1:1973 are as follows:

- a) restriction to solid mineral fuels;
- b) inclusion of an additional larger, 150 mm internal diameter flue and measurement section for the testing of smoke-reducing coal-burning roomheaters and all open fires with convection;
- c) option of installing open fires with convection for test on platform scales or on a fixed hearth and determining the burning rate by the datum level method;
- d) modifications to thermal performance test corresponding to changes in test requirements in BS 3378:1986 for roomheaters and BS 3376:1991 for open fires with convection, including:
 - 1) test at normal and high draught for roomheaters;
 - 2) extended range of target burning rates for open fires with convection, to cover appliances with rectangular bottomgrate and up to 550 mm nominal width;
 - 3) variations in method of de-ashing open fires with convection, according to test fuel;
- e) minor modifications to design and operation of four component gravimetric train for flue gas analysis;
- f) guidelines for flue gas analysis using alternative methods to the gravimetric train;
- g) formulae for calculating flue gas losses and thermal efficiencies on net or gross calorific value basis;
- h) simplified formulae for calculating flue gas losses when using test fuel A.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 52, 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 Part of this BS 3250 describes a method for thermal testing of solid mineral fuel burning domestic heating appliances which incorporate as a design feature the production of convected heat. The method is used for roomheaters and open fires with convection in accordance with BS 3378:1986 and BS 3376:1991 respectively, to establish whether the requirements specified in those standards are met.

2 References

2.1 Normative references

This Part of BS 3250 incorporates, by reference, provisions from specific editions of other publications. These normative references are cited at the appropriate points in the text and the publications are listed on the inside back cover. Subsequent amendments to, or revisions of, any of these publications apply to this Part of BS 3250 only when incorporated in it by updating or revision.

2.2 Informative references

This Part of BS 3250 refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

3 Principle

The method is based essentially on the determination of the heat lost in the flue gases from the appliance under standard test conditions. The flue loss is calculated as a percentage of the heat input of the fuel burned, from a knowledge of the temperature, composition and volume of the flue gases. After allowing for a small undergrate combustible loss, the percentage of heat input remaining after deduction of the flue loss is taken to represent the total efficiency of the appliance. For appliances incorporating a boiler, the water heating efficiency component is determined directly and the direct room heating efficiency component is calculated by subtracting the water heating efficiency from the total efficiency.

4 Definitions

For the purposes of this Part of BS 3250, the definitions given in BS 1846-1:1968, BS 3323:1992, BS 3378:1986 and BS 6100-1.5.1:1984 apply, together with the following.

NOTE A list of the symbols and their units used throughout the standard for the flue loss and other calculations is given in Annex A.

4.1

coal rank code number

a numerical classification index defining a grouping of coals according to rank and caking properties

NOTE See Annex E for the British Coal Corporation classification system for United Kingdom Coals.

4.2

rank

the position of a coal relative to other coals in the coalification series from brown coal (low rank) to anthracite (high rank), indicating maturity in terms of general chemical and physical properties

NOTE Higher ranking is characterized by the increasing proportion of the carbon content and decreasing proportion of volatile matter on a dry-mineral-matter free basis.

5 Selection of test procedure

The flue loss test method described in this Part of BS 3250 is applicable to both roomheaters and open fires with convection, burning various test fuels. Although the test method is basically the same in all cases, there are differences in detail in the test equipment, flue gas analysis, installation, firing procedure and calculations depending on the particular application. Table 1 details the selection of test procedure and equipment related to appliance type and test fuel, with cross-reference to the appropriate clauses in the standard.

6 Test equipment

6.1 General design of test installation

For test purposes, the appliance is installed in a test setting and the flue outlet is connected to a section of flue pipe called the measurement section. This measurement section is provided with means for determining the flue gas temperature and composition. There are two designs of measurement section of different overall dimensions, called the small diameter and large diameter measurement sections respectively, whose test applications are given in Table 1. The flue gases are extracted from the top of the measurement section by a fan with means of adjustment in the intake to maintain a constant applied flue draught in the measurement section.

For roomheaters the appliance, setting and measurement section are mounted on platform scales. For open fires with convection either the test installation is mounted on scales, as for roomheaters, or alternatively the appliance is installed on a fixed hearth.

The assembly and use of the two measurement sections and their ancillary equipment are described in 6.2 and 6.3. The remaining test equipment is described in 6.4 to 6.6.

6.2 Small diameter measurement section

NOTE Figure 1 shows a schematic arrangement of an installation incorporating the apparatus.

6.2.1 Fan

A fan is required, sited at a height of not less than 4 m from the floor, capable of extracting 300 m³/h of flue gases at temperatures up to 150 °C and at the same time overcoming a pressure difference of 6.5 mbar¹⁾.

The inlet side of the fan is fitted with ducting, incorporating a gather that can be moved up and down and an adjustable spoil draught as a means of controlling the flue draught in the measurement section (see Figure 1). The fan discharges to the outside atmosphere.

6.2.2 Measurement section

A measurement section is required, in accordance with Figure 2, of overall dimensions 1 275 mm long × 75 mm internal diameter. The section is lagged with three layers of mineral wool rope of 6 mm diameter, or with other non-asbestos material of a similar insulation value. The insulation is covered with a single layer of aluminium foil, which is kept bright.

The measurement section is installed by the method described in 7.3.3.2.

6.2.3 Suction pyrometer

A suction pyrometer is required, located in the measurement section as shown in Figure 1 and constructed in accordance with Figure 2. The hot junction of a nickel-chromium/nickel-aluminium thermocouple (see BS 4937-4) of 0.6 mm to 1.2 mm diameter wire, is inserted into the fitting shown in Figure 2 from the right-hand end, with the junction 6 mm short of the end of the glass or silica tube and mounted so as not to touch the sides of the tube. Each wire is covered for a distance of 125 mm to 130 mm from the junction with suitable high temperature insulating tubing. A gas-tight seal is made where the wires enter the tube. To serve as a radiation shield a strip of bright aluminium foil, 20 mm wide, is wrapped round the outside of the glass/silica tube and is fixed in position with high temperature adhesive. The assembled pyrometer is inserted into the flue of the measurement section and a suitable fitting is provided to give a gas-tight seal between the pyrometer and measurement section. The vertical outlet tube of the assembly is connected to a vacuum pump via a cooling coil, flowmeter and flow control valve.

In order that the suction pyrometer measures the difference between flue gas and ambient temperatures, the cold junction of the thermocouple is placed behind the plane of the front opening of the appliance at a position 0.5 m from the ground and 1.2 m from the centre of the measurement section. The cold junction is protected from radiation by a cylindrical metal screen, with open ends and made of polished aluminium or material of equivalent reflectivity, approximately 40 mm in diameter and 150 mm long.

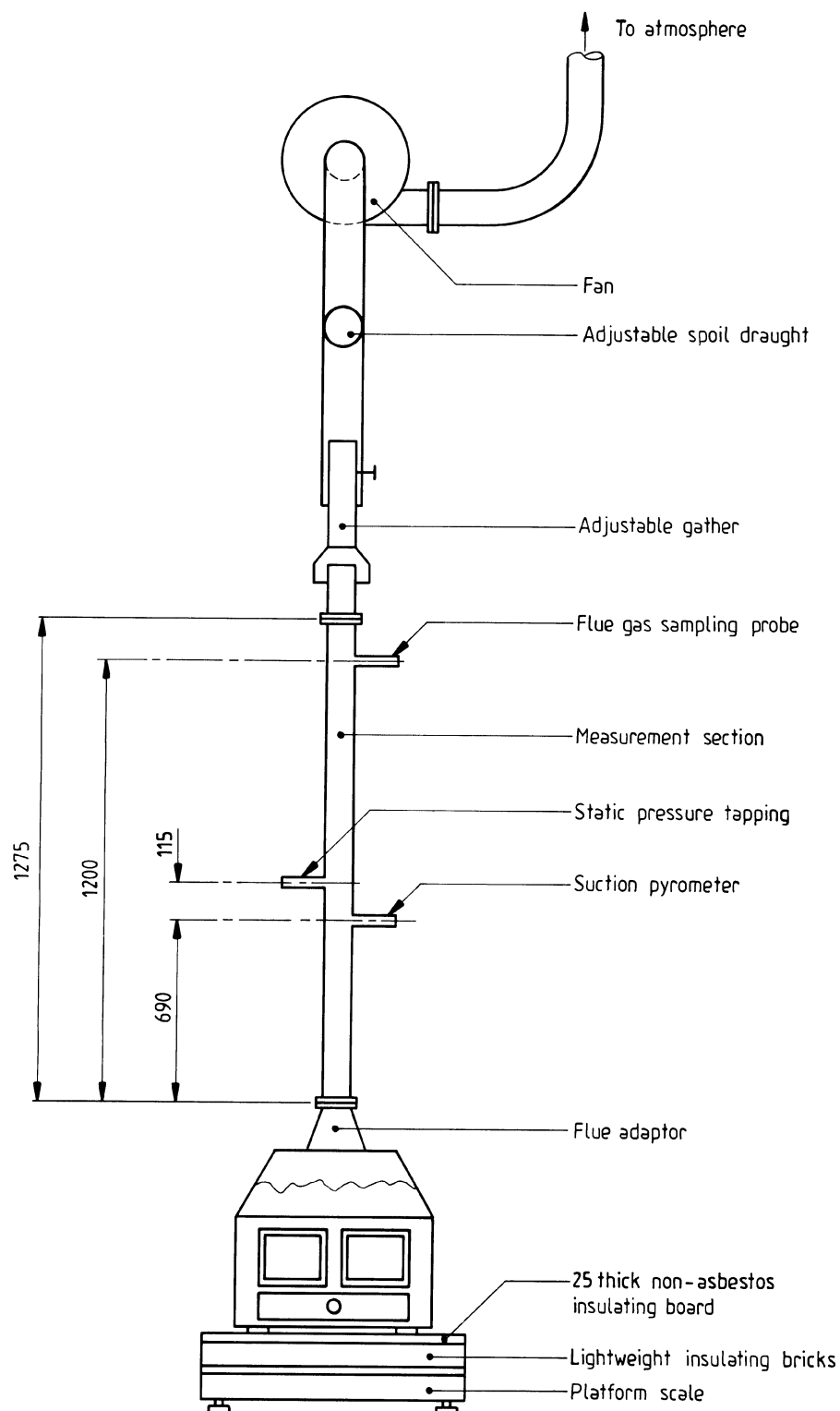
For measurement of the ambient temperature, a separate thermocouple or other temperature measuring device is placed inside the metal screen.

The thermocouples for the suction pyrometer and for the measurement of ambient temperature shall have calibrations traceable to national standards.

¹⁾ 1 mbar = 100 N/m² = 100 Pa.

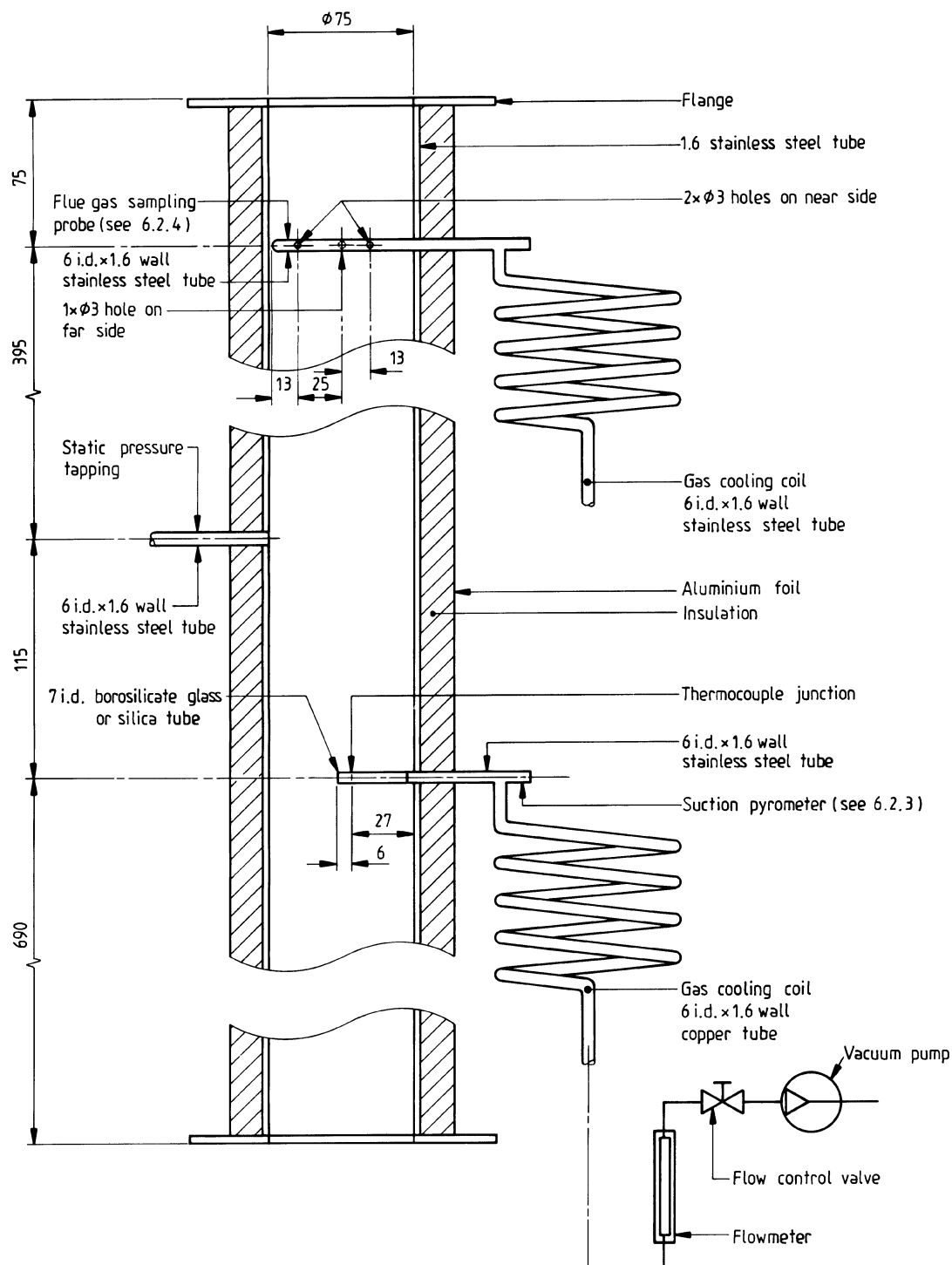
Table 1 — Selection of test procedure

Appliance type	Room heater			Open fire with convection	
Test fuel	Test fuel B [See C.1.2a), C.2b), C.3 and C.4]	Test anthracite [See C.1.2b), C.2c), C.3 and C.4]	Test bituminous coal [See C.1.2c), C.2d), C.3 and C.4]	Test fuel A [See C.1.1a), C.2a), C.3 and C.4]	Test fuel B [See C.1.1b), C.2b), C.3 and C.4]
<i>Test installation</i>					
Measurement section	Small diameter (See 6.2)	Small diameter (See 6.2)	Large diameter (See 6.3)	Large diameter (See 6.3)	Large diameter (See 6.3)
Mounting of appliance	Platform scale (See 7.3.1 and 7.3.2)	Platform scale (See 7.3.1 and 7.3.2)	Platform scale (See 7.3.1 and 7.3.2)	Platform scale or fixed hearth (See 8.3.1 and 8.3.2)	Platform scale fixed hearth (See 8.3.1 and 8.3.2)
Test setting					
a) inset appliance	Simulated fireplace recess (See 7.3.3)	Simulated fireplace recess (See 7.3.3)	Simulated fireplace recess (See 7.3.3)	Simulated fireplace recess (See 8.3.3)	Simulated fireplace recess (See 8.3.3)
b) freestanding appliance	Freestanding (See 7.3.4)	Freestanding (See 7.3.4)	Freestanding (See 7.3.4)	Freestanding (See 8.3.4)	Freestanding (See 8.3.4)
<i>Thermal performance test</i>					
Range of tests	Normal and high draught. HRO and HBO where applicable (See 7.4.3.1 and 7.4.3.2)	Normal and high draught. HRO and HBO where applicable (See 7.4.3.1 and 7.4.3.2)	Normal and high draught. HRO and HBO where applicable (See 7.4.3.1 and 7.4.3.2)	One draught setting only. HRO and HBO for boiler units (See 8.4.3.1, 8.4.5 and 8.4.6)	One draught setting only. HRO and HBO for boiler units (See 8.4.3.1, 8.4.5 and 8.4.6)
Firing test	Single 4 h refuel (See 7.4.3.1 and 7.4.3.3)	Single 6 h refuel (See 7.4.3.1 and 7.4.3.3)	Single 4 h refuel (See 7.4.3.1 and 7.4.3.3)	4 × 1½ h refuels (See 8.4.3.4)	4 × 1½ h refuels (See 8.4.3.4)
Measurement of fuel consumption	Platform scale (See 7.4.3.3)	Platform scale (See 7.4.3.3)	Platform scale (See 7.4.3.3)	Platform scale or datum level method (See 8.4.3.4)	Platform scale or datum level method (See 8.4.3.4)
<i>Measurement of thermal performance</i>					
Flue gas analysis:					
Constituents measured	CO ₂ , CO	CO ₂ , CO, CH ₄ , H ₂	CO ₂ , CO, CH ₄ , H ₂	CO, CO, CH ₄ , H ₂	CO ₂ , CO
a) method 1	Gravimetric (2 component) (See B.2)	Gravimetric (4 component) (See B.3)	Gravimetric (4 component) (See B.3)	Gravimetric (4 component) (See B.3)	Gravimetric (2 component) (See B.2)
b) method 2	Sample storage/ chromatograph or infra-red (See B.4)	Sample storage/ chromatograph (See B.4)	Sample storage/ chromatograph (See B.4)	Sample storage/ chromatograph (See B.4)	Sample storage/ chromatograph or infra-red (See B.4)
c) method 3	On-line infra-red (See B.5)	—	—	—	On-line infra-red (See B.5)
Flue loss	Flue gas analysis and temperature (See 7.5)	Flue gas analysis and temperature (See 7.5)	Flue gas analysis and temperature (See 7.5)	Flue gas analysis and temperature (See 8.5)	Flue gas analysis and temperature (See 8.5)
Undergrate combustible loss	Sieve undergrate material (See 7.8.1)	Sieve undergrate material (See 7.8.1)	Analysis of undergrate material (See 7.8.2)	Sieve undergrate material (See 8.8)	Sieve undergrate material (See 8.8)
Water heating output	Water flow and temperature rise (See 7.2 and 7.6)	Water flow and temperature rise (See 7.2 and 7.6)	Water flow and temperature rise (See 7.2 and 7.6)	Water flow and temperature rise (See 8.2 and 8.6)	Water flow and temperature rise (See 8.2 and 8.6)
Radiation heat output	Radiometer cage (optional) (See 6.6 and 7.7)	Radiometer cage (optional) (See 6.6 and 7.7)	Radiometer cage (optional) (See 6.6 and 7.7)	Radiometer cage (See 6.6 and 8.7)	Radiometer cage (See 6.6 and 8.7)
<i>Calculations</i>					
Fuel consumption	Dry basis (See 8.2.1)	Dry basis (See 8.2.1)	As charged basis (See 8.2.1)	Dry basis, less undergrate combustibles (See 8.2.2)	Dry basis, less undergrate combustibles (See 8.2.2)
Flue gas and combustible losses	Simplified formulae (See 9.3.2)	Simplified formulae (See 9.3.3)	Full carbon balance (See D.4 or 9.3.4 or D.3)	Simplified formulae (See 9.3.1)	Simplified formulae (See 9.3.2)
Total efficiency	100 % minus flue and undergrate combustible losses (See 9.4.1)	100 % minus flue and undergrate combustible losses (See 9.4.1)	100 % minus flue and undergrate combustible losses (See 9.4.1)	100 % minus flue losses (See 9.4.2)	100 % minus flue losses (See 9.4.2)
Water heating and radiation efficiencies	Output/fuel consumption (See 9.5.2 and 9.6.2)	Output/fuel consumption (See 9.5.2 and 9.6.2)	Output/fuel consumption (See 9.5.2 and 9.6.2)	Output/fuel consumption (See 9.5.2 and 9.6.2)	Output/fuel consumption (See 9.5.2 and 9.6.2)
Direct room heating and convection efficiencies	By difference (See 9.7 and 9.8)	By difference (See 9.7 and 9.8)	By difference (See 9.7 and 9.8)	By difference (See 9.7 and 9.8)	By difference (See 9.7 and 9.8)



All dimensions are in millimetres. Tolerance on all dimensions is ± 1 mm.

Figure 1 — Test installation with small diameter measurement section



All dimensions are in millimetres. Tolerance on all dimensions is ± 1 mm.

Figure 2 — Details of sampling probes for small diameter measurement section

6.2.4 Flue gas sampling

A sampling probe is required, located in the measurement section as shown in Figure 1 with the sealed end touching the opposite wall of the flue and constructed in accordance with Figure 2. A suitable fitting shall be provided to give a gas-tight seal between the probe and the wall of the measurement section.

The vertical outlet of the sampling probe is connected via a stainless steel cooling coil to a flue gas analysis system suitable for the appliance under test (see 6.5 and Annex B). Means of cleaning and drying the flue gas sample shall be incorporated in the sampling line, such as Midvale tubes packed with glass wool, for removal of particulate matter, and with magnesium perchlorate (anhydrous), for drying.

It is essential that there are no leaks in either the sampling probe connections or the gas sampling line and that the materials used for the sampling line are resistant to temperatures up to 110 °C and will not react with or allow diffusion of flue gases.

6.2.5 Static pressure measurement

For measurement of the static pressure resulting from the applied flue draught in the test equipment, a pressure indicator or recorder is required in the range 0 to – 2 mbar and accuracy of ± 0.005 mbar or better. The instrument is connected to the pressure tapping in the measurement section (see Figure 2). It is essential that where the tapping is connected to the measurement section, the end of the tubing is sealed flush with the inner wall of the measurement section.

6.3 Large diameter measurement section

NOTE Figure 3 shows a schematic arrangement of a test installation incorporating the apparatus.

6.3.1 Fan

A fan is required, sited at a height of not less than 7 m from the floor, capable of extracting 1 200 m³/h of flue gases at temperatures up to 150 °C and at the same time overcoming a pressure difference of 2.5 mbar. The fan shall discharge to the outside atmosphere.

Suitable means for adjusting the applied draught to the measurement section shall be provided, similar to that described for the small diameter measurement section (see 6.2.1).

6.3.2 Test flue and measurement section

A test flue is required, 4 m high $\times$ 150 mm internal diameter, as shown in Figure 3.

The lower 1.5 m high section (as detailed in Figure 4) corresponds to the small diameter measurement section described in 6.2.2. It is made of 1.6 mm nominal (16 gauge) stainless steel, lagged with a 15 mm to 18 mm thick layer of mineral wool or with other non-asbestos material of similar insulation value, and has an outer casing of polished aluminium, which is kept bright.

The 2.5 m upper section is a 150 mm internal diameter insulated metal chimney conforming to the requirements of BS 4543-2:1990. A seal is required between the upper and lower sections and, where the test installation is supported on scales, it shall be a hydraulic seal as shown in Figure 3.

The test flue is installed by the appropriate method described in 7.3.3.2 or 8.3.3.2.

6.3.3 Suction pyrometer

A suction pyrometer is required, located in the measurement section as shown in Figure 3 and constructed in accordance with Figure 4. The hot junction of a nickel-chromium/nickel-aluminium thermocouple (see BS 4937-4) of 0.6 mm to 1.2 mm diameter wire, is inserted into the fitting with the junction 5 mm above the centre of the cross-shaped sampling section and mounted so as not to touch the sides of the arm. Each wire is covered for a distance of 125 mm to 130 mm from the junction with high temperature insulating tubing. A gas-tight seal is made where the wires enter the tube. The assembled pyrometer is inserted into the flue and a suitable fitting shall be provided to give a gas-tight seal between the pyrometer and measurement section. The vertical outlet tube of the assembly is connected to a vacuum pump via a cooling coil, flowmeter and flow control valve.

The cold junction is placed in the same position and with the same arrangements for screening radiation, as those described in 6.2.3. Also, the same arrangements as those described in 6.2.3 are made for measuring the ambient temperature and for the prior calibration of the thermocouples.

6.3.4 Flue gas sampling

A gas sampling probe is required, located in the measurement section as shown in Figure 3 and constructed in accordance with Figure 4. A suitable fitting shall be provided to give a gas-tight seal between the probe and the measurement section.

NOTE The sampling probe is of essentially the same design as that for the small diameter measurement section (see 6.2.4), both having the sampling ports at distances of $D/6$, $D/2$ and $2D/3$ from the closed end of the probe touching the flue wall, where D is the internal diameter of the measurement section.

The outlet of the sampling probe is connected to one of the alternative types of the flue gas analyser for the appliance under test (see 6.5 and Annex B).

The same precautions shall be taken as those stipulated in 6.2.4 to cool, clean and dry the flue gas sample and protect the sample line from leakage and the effects of high temperature.

6.3.5 Static pressure measurement

For measurement of the static pressure in the test equipment, a pressure indicator or recorder is required of the same specification as for the small diameter measurement section (see 6.2.5). The instrument is connected to the pressure tapping in the large diameter measurement section (see Figure 3). It is essential that where the tapping is connected to the measurement section, the end of the tubing is sealed flush with the inner wall of the measurement section.

6.4 Weighing apparatus

For measuring the mass of fuel charged, a balance is required with a capacity of at least 20 kg and an accuracy of up to ± 5 g. For measuring the mass of ash residue, a balance is required with a capacity of at least 2 kg and an accuracy of up to ± 1 g.

Except for open fires with convection installed on a fixed hearth, a platform scale is required for measuring the combined mass of the appliance, setting and measurement section. It shall have a capacity of at least 350 kg and an accuracy of up to ± 15 g, and the platform size shall be not less than 750 mm $\times$ 750 mm.

6.5 Analysis of the flue gases

A method of analysing the flue gases is required that will determine the concentrations of the component gases with the accuracies given in Table 2. For reference purposes a gas mixture shall be used of composition similar to the flue gas being analysed and which has its analysis traceable to national standards.

When the test fuel (see Annex C) is test fuel B, only the carbon dioxide and carbon monoxide content of the flue gases are measured. When the test fuel is bituminous coal (for smoke-reducing roomheaters), test fuel A or test anthracite, the methane and hydrogen content are measured in addition to the carbon dioxide and carbon monoxide content.

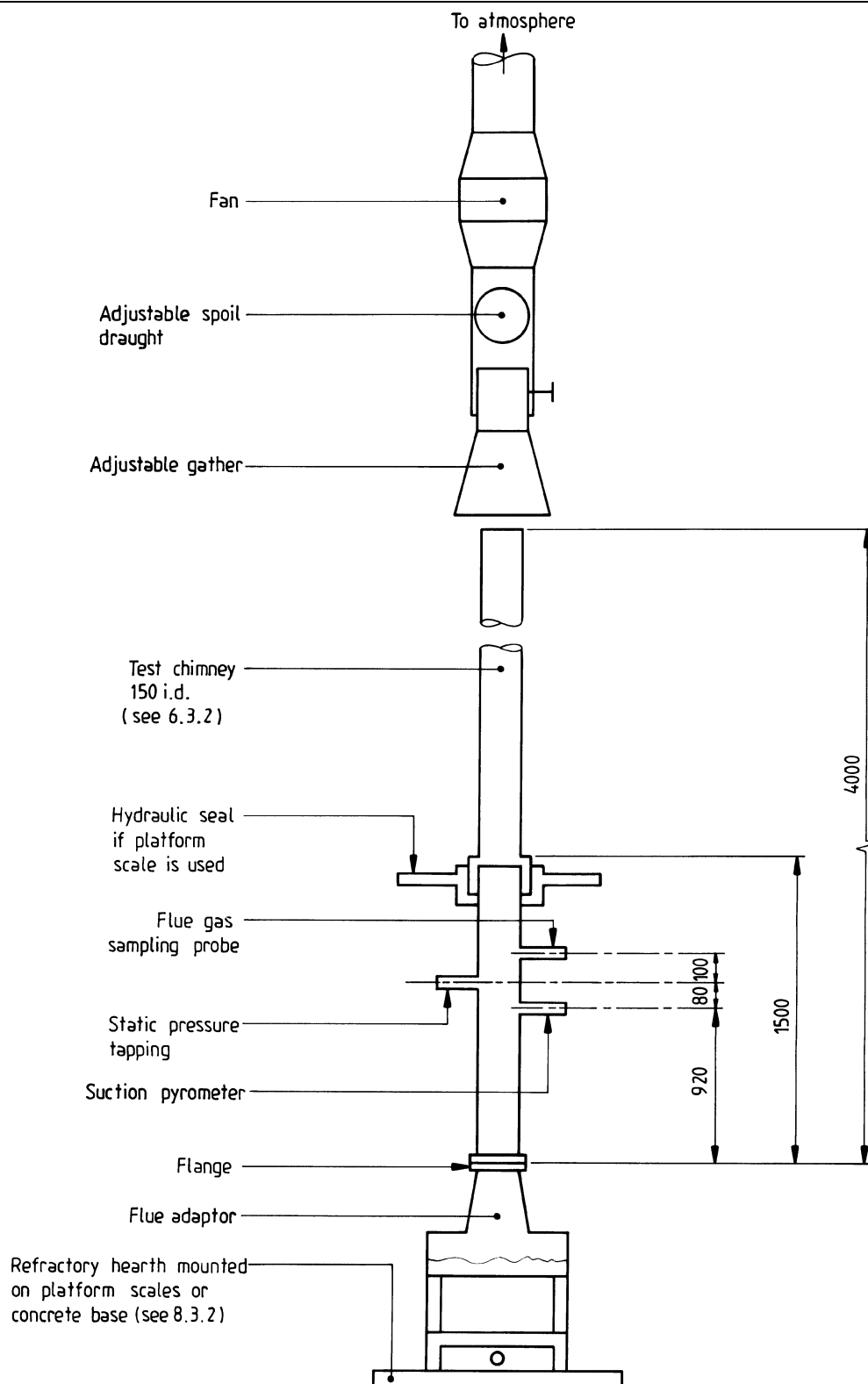
Various methods that have been found to give the required accuracy are described in Annex B.

6.6 Radiation measurement

For measurement of the radiation heat output, a BCURA (British Coal Utilization Research Association) quadrant cage radiometer²⁾ is required. The BCURA quadrant cage radiometer consists of the upper section of a hemispherical cage fitted with a matched set of radiometer elements. A calibration factor F , in kilowatts per millivolt, is initially provided by the supplier of the radiometer and shall be redetermined at intervals not exceeding 24 months.

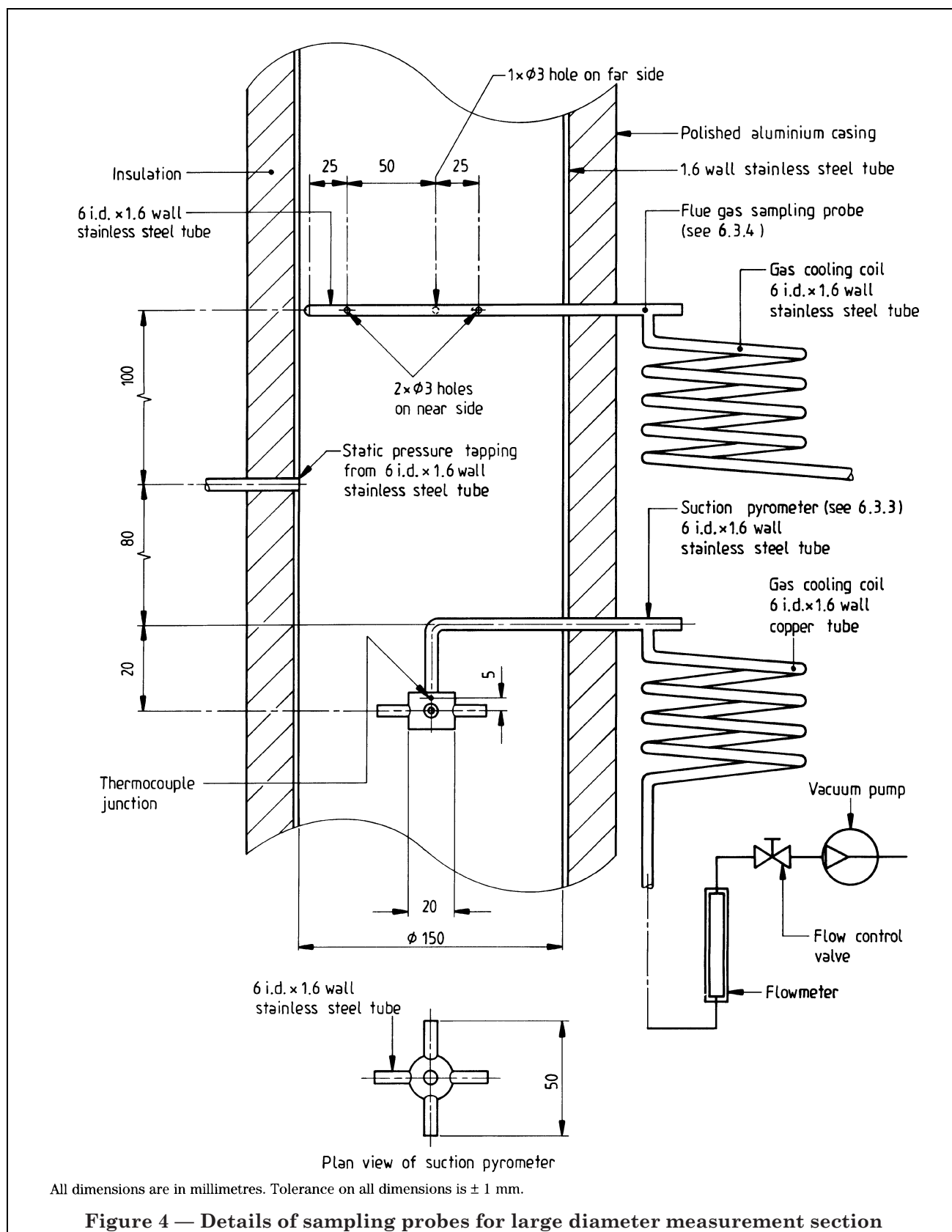
The radiometer is located at hearth level and placed on a sheet of polished aluminium, cut to the size and shape of the base of the cage, which serves as a reflecting hearth. When testing appliances installed on platform scales, the radiometer and reflecting hearth are mounted on a low platform of the same height as the test hearth on the scales (see 7.3.2 and 8.3.2).

²⁾ For information on the availability of BCURA radiometers and calibrated radiometer elements write to Customer Services, Information Services Group, BSI, Linford Wood, Milton Keynes MK14 6LE.



All dimensions are in millimetres. Tolerance on all dimensions is ± 1 mm.

Figure 3 — Test installation with large diameter measurement section



7 Test method for roomheaters

7.1 Appliance

The supplier of the appliance shall provide all the necessary parts for normal operation and these shall be accompanied by complete installation instructions and, for appliances requiring assembly on site, drawing(s) illustrating the method of assembly.

A constant primary air opening shall be used during testing. If the appliance has a thermostatic primary air control, replace it by a suitable manual air control.

NOTE Where the thermostat operation depends on a phial in contact with the boiler (if a water-temperature actuated thermostat) or with the appliance body (if a body thermostat) it is recommended that conversion from thermostatic to manual control should be achieved by removing the phial from the appliance and, after installation, siting the phial in a convenient position at room temperature where it is not exposed to direct radiation.

Table 2 — Repeatability of flue gas analysis
(Maximum deviations from values of reference gases)

Component	Carbon dioxide % (V/V)	Carbon monoxide % (V/V)	Methane ^a % (V/V)	Hydrogen ^a % (V/V)
Roomheater	± 0.2	± 0.04	± 0.04	± 0.04
Open fire with convection	± 0.05	± 0.01	± 0.01	± 0.01

^a Not measured for test fuel B.

7.2 Water circuit for appliances with boilers

If the appliance incorporates a boiler, connect the boiler to a constant water flow apparatus (see general arrangement in Figure 5 and layout for a typical inset roomheater installation in Figure 6). The water supply shall be from a constant head tank and means shall be provided for maintaining the temperature of the water supply within the limits specified in 7.6.3.

Construct the water circuit so that the vertical inlet and outlet pipes from the boiler join horizontal pipes leading to the supply and outflow for the circuit. Ensure that the horizontal pipe on the outlet side is clear of the top of the setting and that the horizontal pipe on the inlet side is below the outlet pipe. Locate the supply and outflow for the circuit clear of the test equipment. Ensure that none of the pipework obstructs free movement of the scales.

Fit thermometers, thermocouples or other temperature measuring devices at the top of the vertical inlet and outlet pipes from the boiler, to enable the inlet and outlet temperatures to be recorded. Insert the temperature measuring device vertically and coaxially to the flow to a depth of either not less than 150 mm or to that depth for which it is calibrated. Cover the outlet pipe with pre-formed polyurethane foam of thickness 9 mm ± 1 mm or equivalent non-asbestos insulation to a distance of at least 150 mm beyond the point at which the temperature is measured.

The temperature measuring devices shall have calibrations traceable to national standards.

NOTE If thermocouples are used, it is recommended that a pair of thermocouples be connected differentially to measure the rise in boiler water temperature between the inlet and outlet pipes for determination of the water heating output (see 7.6). A further thermocouple, with compensated zero reference, should be used to measure the boiler water inlet temperature to confirm that the temperature of the cold water supply meets the requirements of the test (see 7.6.3).

7.3 Test assembly

7.3.1 General

Mount the appliance on the platform scale described in 6.4, in a manner that enables the combined mass of the appliance, setting and measurement section to be measured. Use the same form of installation for both smokeless fuel and smoke-reducing roomheaters, except that the small diameter measurement section described in 6.2 is required for smokeless fuel roomheaters and the large diameter measurement section described in 6.3 is required for smoke-reducing roomheaters.

7.3.2 Hearth

Construct a test hearth in refractory brick, contained within an aluminium tray and covered by a non-asbestos insulation board, to the dimensions shown for items 2, 3 and 4 of Figure 6 in Table 3. Support the hearth on the platform scale as described in 6.4.

7.3.3 Installation of inset roomheaters

7.3.3.1 Types of installation

Inset roomheaters fall into two categories for their installation. The main category are those designed to be installed directly into a fireplace recess without a fireback. The second category are those designed to be installed in a fireback within the recess. In deciding the category, the manufacturer's installation instructions shall be followed.

7.3.3.2 Installation without a fireback

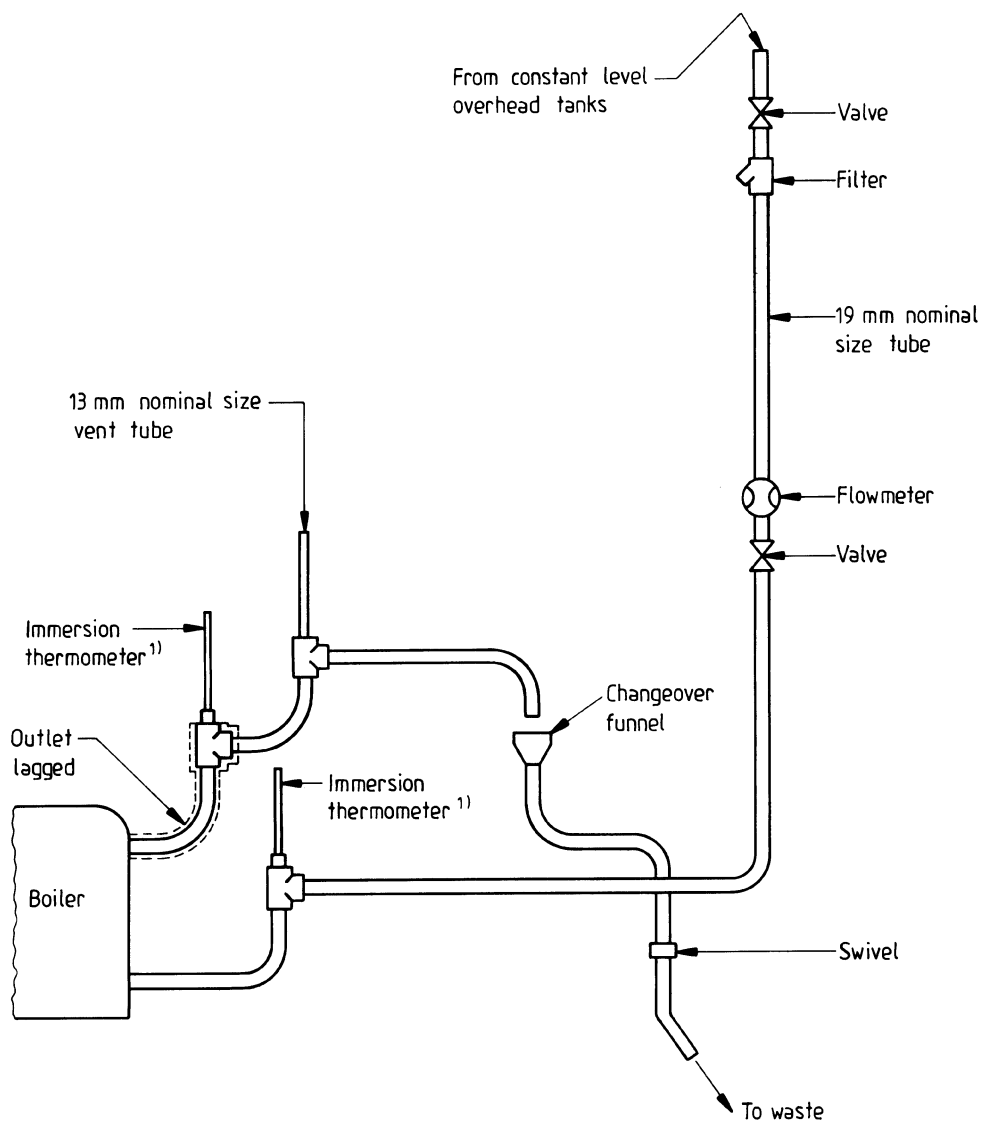
Install the appliance generally in accordance with Figure 6, which shows the test installation for a smokeless fuel roomheater. Construct a simulated fireplace recess and surround on the insulated hearth described in 7.3.2. Fabricate the recess in 2 mm thick aluminium sheet or other lightweight constructional material, to the dimensions given in items 7 and 8 of Figure 6. Cover the front of the recess with a 25 mm thick sheet of non-asbestos insulation board, with a fireplace opening of the size recommended for the appliance in the manufacturer's installation instructions. Install the appliance into the recess through the opening in the front surround. Connect the water circuit (see 7.2) if the appliance is a boiler model. Fill the space between the appliance and the sides of the recess with exfoliated vermiculite.

Connect the outlet of the appliance to the small diameter measurement section (see 6.2) for smokeless fuel roomheaters and the large diameter measurement section (see 6.3) for smoke-reducing roomheaters, using a flue adaptor, constructed in the following manner.

Fabricate a vertical flue adaptor, not more than 300 mm long, in mild steel plate and design it so that an airtight fit can be effected with the appliance outlet, using mineral wool rope and fire cement to ensure a good seal. At the top, make the internal diameter 75 mm or 150 mm, depending on whether the appliance is to be connected to the small or large diameter measurement section. Provide a matching flange to the flange at the base of the appropriate measurement section and make an airtight connection. Insulate the adaptor including the connecting flanges with three layers of mineral wool rope of 6 mm diameter, or equivalent non-asbestos insulation. Cover this insulation with a single layer of aluminium foil; keep the foil bright in use.

Brace the small diameter measurement section, for smokeless fuel roomheaters, and the lower part of the large diameter measurement section, for smoke-reducing roomheaters, with struts attached to the sides and rear of the fireplace recess. Support the upper part of the large diameter measurement section separately from the rest of the test assembly and ensure that a hydraulic seal is made with the lower section (see 6.3.2).

Site the test assembly so that the top of the measurement section is immediately beneath the gather on the inlet ducting to the appropriate flue gas extraction fan (see 6.2.1 and 6.3.1 for the small and large diameter section fans respectively).



¹⁾ Other temperature measuring devices can be used.

NOTE If the appliance is mounted on scales an anti-splash funnel is required in the vertical feed pipe below the flowmeter and lower valve.

Figure 5 — Typical constant water flow apparatus

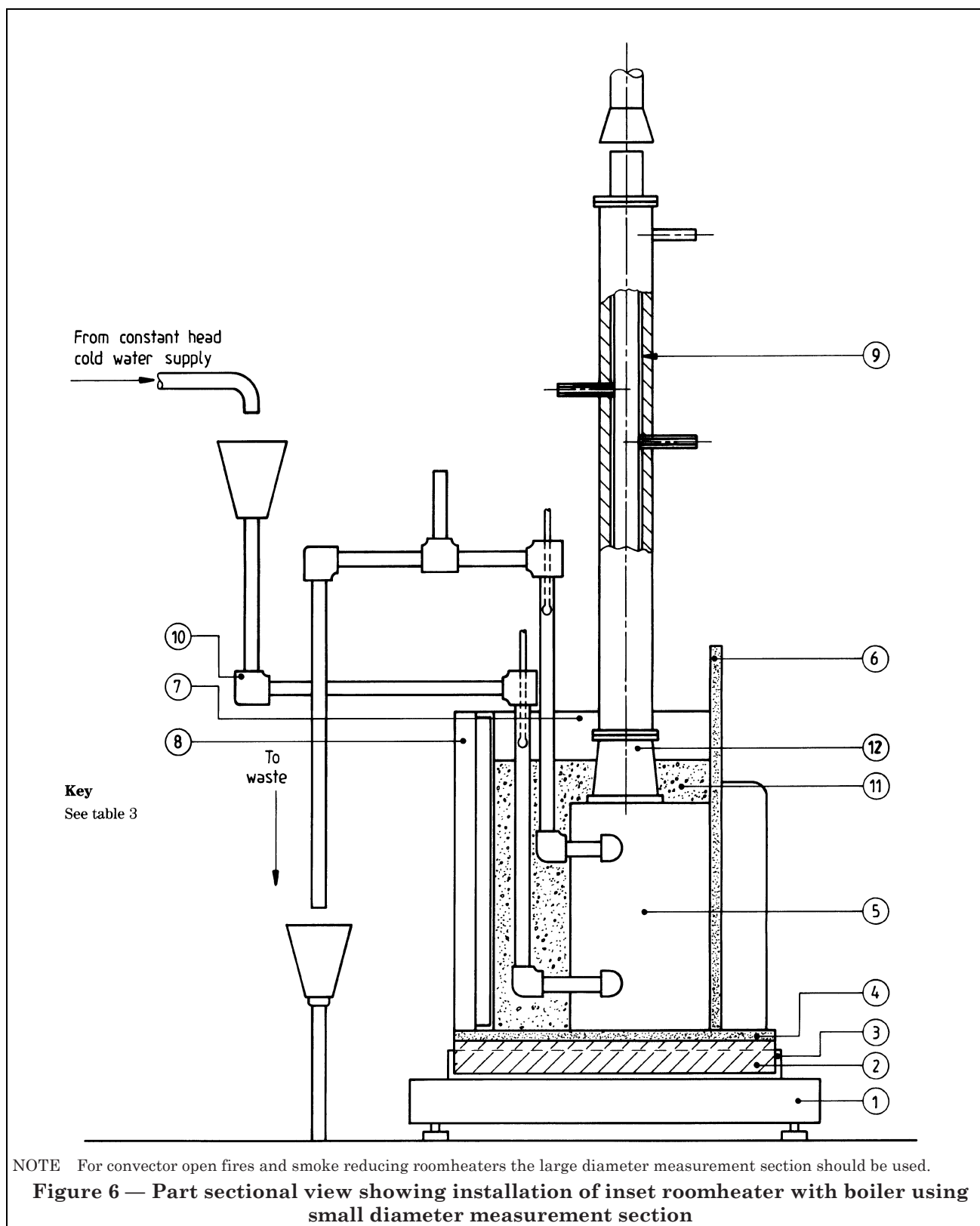


Table 3 — List of component parts for test installation of roomheater and open fire with convection

Item	Component	Material	Remarks (including recommended dimensions)
1	Platform scale: capacity 350 kg, accurate to ± 15 g		Platform area 750 mm wide $\times$ 750 mm long
2	Hearth bricks	Lightweight insulating bricks	
3	Tray	Aluminium sheet, 2 mm thick	For retaining item 2: 650 mm wide $\times$ 750 mm long $\times$ 50 mm high
4	Base	Non-asbestos insulation board	650 mm side $\times$ 750 mm long $\times$ 25 mm thick
5	Appliance and fittings		Figure 6: Inset roomheater with boiler Figure 7: Inset open fire with convection
6	Fireplace surround	Non-asbestos insulation board	900 mm wide $\times$ 900 mm high $\times$ 25 mm thick
7	Fireplace recess, sides	Aluminium sheet, 2 mm thick, or other lightweight constructional material	Formed in shape of tray: 600 mm wide $\times$ 750 mm high $\times$ 25 mm deep
8	Fireplace recess, back	Aluminium sheet, 2 mm thick, or other lightweight constructional material	Formed in shape of tray: 700 mm wide $\times$ 750 mm high $\times$ 25 mm deep
9	Measurement section with fittings		See Figure 2 and Figure 4 for detail of small and large diameter measurement sections
10	Pipes and fittings for test water circuit		1 in BSP. See also Figure 5
11	Exfoliated vermiculite		
12	Flue adaptor	Mild steel, 2 mm thick	Figure 6: Size adaptor to suit; Figure 7: See adaptors in Figure 8 (roomheaters) and Figure 9 (convector open fires)
13	Fireback	Refractory	Conforming to BS 1251:1987
14	Hydraulic seal		Required when installation mounted on platform scale
15	Upper section of test chimney		Insulated metal chimney conforming to BS 4543-2:1990, 150 mm i.d.