

Domestic solid mineral fuel fired boilers with rated output up to 45 kW —

**Part 2: Specification for gravity feed
boilers designed to burn small
anthracite**

ICS 91.140.010

Committees responsible for this British Standard

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- Association of British Solid Fuel Appliances Manufacturers
- British Ceramic Tile Council
- British Coal Corporation
- British Flue and Chimney Manufacturers' Association
- Consumer Policy Committee of BSI
- Department of the Environment
- Department of Trade and Industry (Energy Efficiency Office)
- HETAS Ltd.
- Incorporated Association of Architects and Surveyors
- Low Temperature Coal Distillers Association of Great Britain Ltd.
- METCOM
- National Fireplace Manufacturers' Association
- National Society for Clean Air
- Real Fire Association
- Solid Smokeless Fuels Federation
- Waterheater Manufacturers' Association

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Foreword

This Part of BS 4433 has been prepared under the direction of the Refrigeration, Heating and Air Conditioning Standards Policy Committee. It supersedes BS 4433-2:1969, which is withdrawn.

BS 4433 is divided into two Parts. It covers the requirements and testing of independent boilers with rated outputs up to 45 kW and operating at pressures below 2 bar. Part 1 deals with boilers fitted with bottomgrates in which the ashes are removed from below this grate. Part 2 deals specifically with gravity feed boilers designed to burn small anthracite.

Boilers covered by these specifications are used for heating water for central heating, commonly in conjunction with domestic hot water supply.

The main technical changes from the previous edition of Part 2 are as follows:

- a) introduction of requirements for the width of boiler flueways;
- b) introduction of requirements for the width of boiler waterways;
- c) changes in requirements for the thickness of mild steel used in boiler shell construction;
- d) changes in requirements for tapping dimensions;
- e) introduction of requirements for the thickness of mild steel used for non-water-backed surfaces;
- f) exclusion of asbestos products in construction;
- g) introduction of requirement for a fan cut-out device that switches off the primary air fan in the event of flue blockage;
- h) introduction of requirement for minimum depth of flue socket;
- i) deletion of the boiler response test.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 25 and a back cover.

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Section 1. General

1.1 Scope

This Part of BS 4433 specifies the general constructional, dimensional and performance requirements for thermostatically controlled cast iron and mild steel gravity feed central heating boilers with rated outputs up to 45 kW, and less than 2 bar¹⁾ operating pressure designed for burning small anthracite.

Methods of test for the boilers specified in this Part of BS 4433 are given in Annex A.

Central heating boilers with a working pressure greater than or equal to 2 bar, and central heating boilers with a working pressure less than 2 bar which do not give heat to the room in which they are installed, are excluded from this standard. These central heating boilers are now covered by BS EN 303-5:1999.

The boilers covered by this Part of BS 4433 have an integral fuel storage hopper and the fuel feeds by gravity from the hopper to the fuelbed. Ashes are normally removed as clinker. The boilers are designed for installation in accordance with BS 8303:1986.

1.2 Normative references

This Part of BS 4433 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 page 24. Subsequent amendments to, or revisions of, any of these publications apply to this Part of BS 4433 only when incorporated in it by updating or revision.

1.3 Definitions

For the purposes of this Part of BS 4433, the definitions given in BS 1846-1:1968, BS 3250-1:1993 and BS 6100-1.5.1:1984 apply, together with the following.

1.3.1

flow

the water leaving the boiler after passing through the boiler shell

1.3.2

return

the water entering the boiler

1.3.3

rated water heating output

the manufacturer's declared mean rate of water heating output for the appliance

1.4 Symbols

For the purposes of this Part of BS 4433, the symbols given in Table 1 apply.

1.5 Rated output data

The rated heat output of the boiler shall be stated by the manufacturer and shall be capable of being maintained under the prescribed test conditions. The refuelling and declinking intervals at rated output shall also be stated by the manufacturer; both shall be at least 10 h.

¹⁾ 1 bar = 10⁵ N/m² = 100 kPa.

Table 1 — List of symbols, their definitions and units

Symbol	Definition	Unit
C_p	Mean specific heat of water, 4.187 kJ/(kg · K)	kJ/(kg · K)
E_b	Water heating efficiency	%
m	Total moisture content of the test fuel	% (m/m)
M	Mean water flow rate through the boiler	kg/h
N	Mean water temperature rise	K
O_b	Total water heating output	kJ
O_m	Mean water heating output	kW
Q	Gross calorific value of the test fuel, dry basis	kJ/kg
t	Duration of test period	h
u	Ashpit loss	kg
W_c	Mass of fuel charged during the test period, as charged basis	kg
W	Mass of dry fuel consumed over the test period	kg

Section 2. Construction

2.1 General

The body of the appliance shall be constructed of cast iron or mild steel.

No part of the boiler, fittings or accessories shall comprise, or contain, asbestos.

Provision shall be made for parts which form a seal to be located securely.

Joints between metal surfaces in the firebox or flue gas passageway shall be airtight and shall be welded, seam welded, riveted, or bolted.

NOTE 1 Where a seal is to be made with fire cement, the gaps between components should be small and the cement should be well supported by the adjacent metal surfaces.

Component parts which require periodic replacement shall be either designed or marked to ensure correct fitting.

NOTE 2 Component parts which require periodic replacement should be easy to remove and replace.

2.2 Material and design

2.2.1 Cast iron

Cast iron used in the manufacture of the boiler shall conform to BS 1452:1990, minimum grade 180.

The minimum wall thickness shall conform to BS 3377:1985 as amended by 2.2.6.1.

2.2.2 Steel

Steel plate used in the manufacture of the boiler shell shall conform to one of the following:

BS 1449-1.2:1991

Grade HR15 and HR4

BS 4360:1990

Grade 40A

BS EN 10028-2:1993

161 Grade 400

The welding of mild steel boilers shall be carried out in accordance with BS 5135:1984, BS 2640:1982 and BS 2971:1991, in so far as they apply.

The thickness of the materials shall be not less than 5 mm (nominal) for water-backed surfaces in contact with the fuelbed or with combustion products in the primary flueway and, except for tappings, not less than 3 mm (nominal) elsewhere.

The material and construction of any steel water and boiler tubes shall conform to BS 1387:1985, BS 3377:1985 and BS 3601:1987. The minimum water and boiler tube wall thickness shall be 4 mm (nominal). A certificate confirming the materials used shall be supplied to the test station by the manufacturer.

2.2.3 Strength of boiler shells

2.2.3.1 General

At least one boiler shell of each type and series and of the same design and material shall be subjected to the type test (see 2.2.3.2), and each boiler shell shall be subjected to the routine test (see 2.2.3.3), before leaving the manufacturer's works. The pressure test conditions shall be stated on the boiler test certificate, which shall be supplied to the test station by the manufacturer.

In no case shall the working pressure, i.e. the maximum static head at which the appliance is intended to operate, be less than 1.4 bar.

2.2.3.2 Type test

The boiler shell shall not fail²⁾ when tested hydraulically for 15 min at a sustained pressure of $2 \times$ working pressure.

²⁾ The term "shall not fail" is deemed to imply that the boiler, while under test, shall not show signs of leakage or weakness; furthermore, there shall not be significant permanent deformation after the test.

2.2.3.3 Routine test

The boiler shell shall not fail²⁾ when tested hydraulically for 5 min or, in the case of a mild steel boiler shell, pneumatically for 2 min at a sustained pressure of $1.5 \times$ working pressure.

In no case shall the working pressure be less than 1.4 bar.

2.2.4 Thickness of non-water-backed surfaces

Materials for construction of non-water-backed surfaces in contact with the firebed or flue gases shall conform to the minimum thickness requirements given in Table 2.

Table 2 — Minimum thickness of non-water-backed surfaces

Component	Nominal thickness mm
Firebox:	
without refractory lining	5
with refractory lining	3
Flueways	3

2.2.5 Flueways and waterways

The width of boiler flueways shall be not less than 15 mm.

For cleaning the boiler flueways, either:

- a) an integral mechanical cleaning device shall be incorporated; or
- b) access for manual cleaning shall be provided.

Where a boiler flueway is shaped such that cleaning by means of the tool provided (see 2.8) or a brush would not otherwise be achieved, then purpose designed access to the boiler flueway shall be incorporated, e.g. by provision of an access door, to permit necessary inspection and cleaning.

The design of the boiler shall be such as to minimize build up of sediment and sharp wedge-shaped waterways with the taper towards the bottom shall be avoided.

The width of waterways throughout the main body of the appliance shall be not less than 20 mm, except if waterways have to be locally reduced to facilitate manufacture, or are in areas not in direct contact with burning fuel, it shall be permissible to reduce the width of the waterways to 15 mm minimum.

The design shall be such as to ensure a free flow of water through areas of reduced width.

2.2.6 Tappings

2.2.6.1 Boiler shell

All boilers shall be provided with at least two flow tappings and two return tappings having a minimum size as given in Table 3.

Table 3 — Minimum size of flow and return tappings

Rated output kW	Minimum thread size designation R _C or R _P
Up to 22	1
22 to 35	1 ¼
35 to 45	1 ½
R _C = internal tapered thread R _P = internal parallel thread	

The threads for tappings shall conform to BS 21:1985 and shall be shaped as follows:

- a) for cast iron boilers, threads shall be tapered;
- b) for mild steel boilers, threads shall be tapered or parallel.

The position of flow tappings shall be such that air will not be retained in the boiler shell.

If boilers are supplied with bushes or reducers in the flow tappings, these shall be of eccentric pattern and fixed so that the outlet is in the uppermost position.

The minimum depth of tappings shall be as given in Table 4.

Table 4 — Minimum depth of tappings

Thread size designation R _C or R _P	Minimum depth of tappings mm
1 to 1 ¼	16
1 ½	19
R _C = internal tapered thread R _P = internal parallel thread	

2.2.6.2 Draining

Means shall be provided for draining the boiler and hot water circuits either at the base of the boiler shell or at the lowest part of the water circuits. Where the drain socket is in the boiler shell, the drain tapping size shall be as shown in Table 5.

Table 5 — Size for drain tappings

Rated output kW	Thread size designation R _C or R _P
Up to 22	½
over 22	¾
R _C = internal tapered thread R _P = internal parallel thread	

2.2.6.3 Combustion testing

There shall be one or more accessible plugged test tappings, of thread size designation R_P ¼ in the flue system to enable flue gas samples to be obtained when any necessary assessment of flue conditions are required. Where a draught stabilizer is incorporated, the test tapping shall be between the boiler and the draught stabilizer.

2.3 Combustion controls

2.3.1 Combustion air supply

Provision shall be made for the supply of both primary and secondary combustion air. The air supply shall be either fan assisted or by natural draught. In both cases a water temperature actuated air control thermostat (see 2.3.2) shall be used to control the combustion air supply.

NOTE A manually adjustable air bleed bypass of the air control thermostat, capable of being completely closed, is advisable for boilers with natural draught air supply.

2.3.2 Combustion air control thermostats

Combustion air control thermostats shall be variable and of the immersion or dry pocket type. Any thermostat shall be identified either by the thermostat manufacturer's name and model number or the appliance manufacturer's part number. The cold setting distance of any air control shall be either clearly marked or the method of adjustment described in the instructions (see 3.1).

2.3.3 Admission of air above the firebed

Provision shall be made for the admission of air above the firebed to minimize the risk of condensation and the accumulation of combustible gases.

The position of air entry shall be so designed that the passage of the air is not restricted when the firebox is filled to the manufacturer's recommended capacity.