



BS 4433: Part 1: 1973

UDC 644.627 : 696.42 : 662.932.2

Specification for
**Solid smokeless fuel
boilers with rated
outputs up to 45 kW**

**Part 1. Boilers with undergrate
ash removal**

Gr 7

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*British Ironfounders' Association
*British Steel Industry
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Boiler and Radiator Manufacturers' Association
British Ceramic Tile Council
Copper Cylinder and Boiler Manufacturers
Institution of Municipal Engineers
National Fireplace Manufacturers' Association

Range Boiler Makers' Association Ltd.
Solid Smokeless Fuels Federation
Vitrous Enamel Development Council
Women's Advisory Committee of BSI

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Solid smokeless fuel boilers with rated outputs up to 45 kW

Part 1. Boilers with undergrate ash removal.

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British Standards Institution · 2 Park Street · London W1A 2BS

Telephone 01-629 9000

Telex 266933

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Foreword

This British Standard covers the constructional requirements and testing of boilers with rated outputs up to 45 kW including independent solid fuel boilers primarily designed for domestic hot water production, previously specified in BS 758: Parts 1 and 2.

The standard is divided into parts, each of which gives minimum requirements for a particular class of boiler. Part 1 (this part) deals with boilers fitted with bottomgrates, in which the ash is removed from under the firebars and which burn hard coke, gas coke, specially reactive solid smokeless fuels and other smokeless fuels such as anthracite, carbonized briquettes and dry steam coal.

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, or for domestic hot water supply only. Installation should be carried out in accordance with the recommendations of the relevant Codes of Practice.

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Introduction

A boiler which meets the requirements of this Part of the standard will have been type tested with a standard coke and will be deemed to give a satisfactory performance when used with the fuels recommended for its use in the list of 'Approved domestic solid fuel appliances'*.

Compliance with the requirements of this specification will mean that the boiler should:

- (1) give not less than the rated output claimed and the efficiency specified under the prescribed test conditions,
- (2) operate at and recover from low output satisfactorily,
- (3) not need to be refuelled or de-ashed with undue frequency,
- (4) not suffer damage if accidentally over-run for short periods above rated output,
- (5) have a satisfactory thermostatic control, if fitted,
- (6) be safe in use when properly installed, operated and maintained in accordance with the manufacturer's instructions.

*'Approved domestic solid fuel appliances', published by the Coal Utilisation Council and Solid Smokeless Fuels Federation.

British Standard Specification for

Solid smokeless fuel boilers with rated outputs up to 45 kW

Part 1. Boilers with undergrate ash removal

1. General

1.1 Scope

1.1.1 This Part of this British Standard deals with the constructional requirements and testing of cast iron and steel hot water heating boilers, with rated outputs up to 45 kW, designed for burning solid smokeless fuels.

1.1.2 The boilers covered by this Part of the standard have the fire supported on a grate and the ash removed below this grate.

1.1.3 Requirements for certain constructional features are given. Tests are described for checking the boiler for:

- (1) controllability,
- (2) performance at rated output and low load,
- (3) ability to withstand accidental over-run.

1.2 Definitions

For the purposes of this British Standard the following definitions apply (see also BS 1846):

- (1) *Boiler efficiency*. The total heat transferred to the water expressed as a percentage of the total heat content of the fuel consumed.
- (2) *Firebox*. That part of the appliance in which the fuel is burned.
- (3) *Integral fuel hopper*. A fuel store within the boiler from which fuel is fed to the firebox.
- (4) *Bottomgrate*. A grating on which the fuelbed rests.
- (5) *Boiler shell*. That part of the boiler which contains the water.
- (6) *Flow*. The water leaving the boiler after passing through the boiler shell.
- (7) *Return*. The water entering the boiler.
- (8) *Rated output*. The total heat transferred to the water leaving the boiler during the test period, expressed as an average in kW.
- (9) *Flue outlet*. The designed opening in the appliance through which the products of combustion are discharged to the flue.
- (10) *Front firebars*. Removable metal bars or grating fitted to the front of a firebox opening to prevent spillage of fuel or to increase fuel capacity, or both.
- (11) *Open fire boiler*. A boiler with an openable front above the level of the top of the bottomgrate, to give open fire facilities.

1.3 Rated output

The rated output of the boiler shall be stated by the manufacturer and shall be capable of being maintained under the prescribed test conditions.

1.4 Fuel capacity

1.4.1 The fuel capacity shall be determined by filling the boiler by means of a hod or shovel with the singles size of the standard test coke (see 3.2) and shall be expressed in cubic metres. The determination of bulk density of the coke shall be as described in BS 1016: Part 13.

For boilers charged from the top, capacity shall be determined by charging to that datum which gives the maximum capacity which is suited practically to the appliance. Placing of the coke in those regions not normally accessible shall not be carried out, but final levelling of the fuelbed is permissible.

For boilers charged from the front, the fuel capacity shall be determined by charging to full capacity without exceeding a natural angle of repose at the door opening. It should be possible to open and close the charging door when the appliance is fully charged without any of the charge falling out.

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With the exception of hopper-fed boilers, the fuel shall nowhere be above the lowest part of the flue outlet.

The capacity of any integral fuel hopper shall be included in the fuel capacity but shall be reported separately.

1.4.2 The fuel capacity shall not be less than 0.017 m^3 .

1.5 Bottomgrate

The bottomgrate shall be of the mechanical de-ashing type and shall provide satisfactory clearance of the ash without the use of strenuous effort. The bottomgrate shall be capable of being removed and shall be designed or suitably marked to ensure correct assembly. Where no clinker door is fitted, a dumping grate or other integral means of removing clinker and shale shall be provided.

1.6 Combustion controls

1.6.1 **Air supply.** The supply of combustion air may be by natural draught or may be fan assisted. A manually adjustable thermostat bypass capable of being completely closed is advisable for thermostatically-controlled boilers. Electrical motors should conform to the requirements of BS 170.

1.6.2 **Primary air supply.** Thermostat air control shall be fitted to all boilers except those rated below 7.5 kW with natural draught air supply. For such boilers, thermostat control is recommended but manual primary air control is permitted.

1.6.3 **Thermostat air control (when provided).** Thermostats shall be variable, of the immersion type, and the sensor shall be located to its full depth in a pocket in the waterway without interfering with the flow from the boiler. Full details for checking shall be given, either in the installation instructions or plainly marked on or near the thermostat assembly, and shall be legible without undue dismantling of the boiler casing. Where adjustment on site is intended, instructions shall be similarly provided. The thermostat shall be convenient to operate, with the dial suitably marked and easy to read.

1.6.4 **Manual primary air control.** When fitted, the control shall be capable of fine adjustment, particularly in the range of openings of the control from 650 mm^2 to the closed position.

1.6.5 **Ash, clinker and fire doors.** Doors and covers used for closing the front of the ashpit or combustion chamber shall be close fitting, which in general implies that any clearance shall not exceed 0.15 mm on average and shall nowhere exceed 0.4 mm. The clearance shall be measured at 8 points equally round the door or, if it is rectangular, at the 4 corners and the 4 mid-points of the sides.

1.6.6 **Flue control.** Preferably a damper should not be fitted to the boiler because of the possibility of debris from the chimney falling on to the damper and blocking the flue pipe. A flue stabiliser or breakdraught is unlikely to be so blocked and is therefore recommended.

If it is deemed essential to fit a flue damper, one of the butterfly type and not the sliding type shall be used (see 1.20.1). A flue damper shall not be fitted to a fan assisted boiler.

1.6.7 **Admission of air above the fuelbed.** Provision shall be made for the admission of air above the fuelbed to minimize the risk of condensation and the accumulation of combustible gases. The means of entry shall be so designed that the admission of secondary air is not reduced when the firebox is filled to capacity.

1.7 Chimney

The manufacturer shall indicate in the operating and installation instructions any special chimney requirements necessary for satisfactory operation of the boiler.

1.8 Ashpan and ashpit

The capacity of the ashpan shall not be less than 20 % of the fuel capacity of the boiler or 20 % of the volume occupied by the test fuel consumed in 10 h at rated output, whichever is the smaller. With the ashpan removed, the height of the ashpit to the underside of the bottomgrate shall be nowhere less than 100 mm. An ashpan shall be provided, of minimum thickness 1.2 mm, if of mild steel, or designed to give equivalent durability if of other material.

1.9 Operating tools

Tools shall be provided to perform any operation which would otherwise require the touching of a hot surface by hand. Suitable boiler cleaning and stoking tools shall also be available.

1.10 Flue outlet

The boiler shall be supplied with a socket outlet suitable for a flue pipe of adequate bore complying with the requirements of BS 41.