

Automatic gas burners —

Part 1: Specification for burners with input rating 60 kW and above

ICS 27.060.20

Confirmed February 2010

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The preparation of this British Standard was entrusted by the Gas Standards Committee (GSE/-) to Technical Committee GSE/27, upon which the following bodies were represented:

- British Coal Corporation
- British Combustion Equipment Manufacturers' Association
- British Gas plc
- Chief and Assistant Chief Fire Officers' Association
- Department of the Environment (Property Services Agency)
- Electricity Supply Industry in England and Wales
- Fire Offices Committee
- Health and Safety Executive
- Society of British Gas Industries
- Water-tube Boilermakers' Association

This British Standard, having been prepared under the direction of the Gas Standards Committee, was published under the authority of the Board of BSI and comes into effect on 31 August 1988

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The following BSI references relate to the work on this standard:
Committee reference GSE/27
Draft for comment 86/73991 DC

ISBN 0 580 16691 0

Amendments issued since publication

Amd. No.	Date of issue	Comments
6631	December 1990	
9260	July 1997	Indicated by a sideline in the margin

Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
1 Scope	1
2 Definitions	1
3 Verification	3
4 Gas flow pipework and controls	4
4.1 Filters and strainers	4
4.2 Pipework and flow components	4
4.3 Gas flow in pipework	6
4.4 Vents on safety shut-off systems	6
4.5 Gas supply	6
4.6 Safety shut-off systems	8
5 Combustion air, pre-purge and post-purge	11
5.1 Combustion air	11
5.2 Pre-purge and post-purge	12
6 Electrical supply and ancillary equipment	12
6.1 Electricity supply	12
6.2 Electrical equipment	13
6.3 Instrument and control fluid supplies	14
7 Flame safeguard system	14
7.1 Flame detection	14
7.2 Start-gas flame establishment	15
7.3 Main flame establishment	15
8 Control system requirements	16
9 Fuel/air ratio control	16
10 Materials	17
10.1 General	17
10.2 Metallic materials	17
10.3 Non-metallic materials	17
10.4 Glands and spindle packings	17
10.5 Jointing materials	17
10.6 Flexible pipes and pipe connections	17
11 Constructional requirements	18
11.1 Burner construction	18
11.2 Fixing	18
12 Manufacturer's literature	19
13 Marking	19
14 Commissioning instructions	19
Appendix A Dual fuel burners	21
Appendix B Over-pressure protection	21
Table 1 — Test gases	3
Table 2 — Wall thickness of pipes complying with BS 3601	4
Table 3 — Connections for valves and pipework	4
Table 4 — Inlet pressure ranges	7
Table 5 — Main gas safety shut-off valve system requirements	9
Table 6 — Flame safeguard drop-out times	14
Table 7 — Summary of materials	18
Publications referred to	23

Foreword

This Part of BS 5885 has been prepared under the direction of the Gas Standards Committee and applies primarily to single gas-fired automatic burners. It is a revision of BS 5885:1980, which is withdrawn.

In general, each requirement in this Part is accompanied by an appropriate means of verification, such means being by inspection, by measurement or by specified test.

In those cases where verification is to be achieved by measurement, no test method is given since the method of measurement is considered to be self-evident.

Verification of compliance with requirements which invoke other British Standards is to be demonstrated by means of a declaration from the burner manufacturer and, where third party certification is required, may necessitate the production of documentary proof.

Certain requirements are only capable of being verified when the burner is installed in its associated appliance. In these cases no verification procedure is specified as it is anticipated that the relevant appliance standard will incorporate the appropriate method of verification. For large or special plant, commissioning procedures will also need to take this into account. Requirements which also relate to burners employing induced draught fans can only be tested in situ.

It should also be appreciated that this Part of BS 5885 may not contain all the requirements for a particular application and therefore the burner may require additional features.

Much of this Part of BS 5885 is applicable to dual fuel burners. However, it should not be assumed that compliance with this Part (or with standards dealing with burners using oil fuel, e.g. BS 799 and BS 5410) will necessarily satisfy all the safety requirements of dual fuel burners. For guidance, see Appendix A.

It is recognized that for specialist heating processes it is permissible to use designs and test methods which differ from those specifically defined in this Part of BS 5885 but which nevertheless comply with the intent of this standard.

Similarly, new systems or procedures resulting from advances in technology may be applied to give equal or improved safety. It is not intended that this Part of BS 5885 should prohibit the development or use of such systems, but any departure from the specific requirements of this standard should be made only on the basis of sound engineering judgement and experience.

It has been assumed in the drafting of this British Standard that the execution of its provisions is entrusted to appropriately qualified and experienced people.

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 24, 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 BS 5885 specifies minimum requirements for automatic gas burners employing forced or mechanically induced draught and having a heat input rating of 60 kW and above. Such burners may be of packaged or non-packaged types, and may be designed for use with 1st, 2nd or 3rd family gases.

BS 5885 applies to burners intended for use in industrial processes. It does not cover burners intended for use in heating appliances, e.g. boilers, which are covered by BS EN 676, *Automatic forced draught burners for gaseous fuels*.

It covers single burners and dual fuel burners when operating only on gas. It does not cover multi-burners. Guidance on dual fuel burners is given in Appendix A.

This Part of BS 5885 specifies requirements primarily for the safety aspects of automatic control and operation. It does not constitute a complete specification for automatic burners and their ancillary equipment.

NOTE 1 The use of gases which are dirty, wet, of variable composition or high dewpoint may cause difficulties which are not covered in detail by this Part of BS 5885. In such cases, suppliers and users of equipment will need to take additional measures to comply with the requirements of this standard.

NOTE 2 Burners complying with this Part of BS 5885 meet the statutory requirements for the protection against flow of air into piped gas supplies in the following circumstances:

- a) where the maximum combustion air pressure is not greater than 50 mbar¹⁾;
- b) where the maximum combustion air pressure is not greater than 75 mbar, and where the start-gas and main gas supplies are each under the control of at least one class 1 safety shut-off valve of size not greater than 50 mm;
- c) where the start-gas and main gas supplies are each under the control of at least one safety shut-off valve with a proved capability of withstanding a reverse flow pressure differential of at least twice the maximum combustion air pressure.

In other circumstances burners complying with this Part of BS 5885 may require additional protection, e.g. non-return valves, and in such cases reference should be made to the fuel supplier.

NOTE 3 The titles of the publications referred to in this standard are listed on pages 23, 24 and on the inside back cover.

2 Definitions

For the purposes of this Part of BS 5885 the definitions given in BS 1179-6 apply together with the following.

NOTE Where a term is defined in both this Part of BS 5885 and BS 1179-6, the definition given in this Part only applies.

2.1

automatic burner

a burner in which, on starting from the completely shut-down condition, the start-gas flame is established and the main gas valves are actuated by the control without manual intervention

2.2

burner rating

the maximum burner thermal input expressed in terms of gross calorific value

2.3

closed position indicator switch

a switch fitted to a safety shut-off valve which indicates when the valve is in the nominally closed position

2.4

combustion chamber

that part of the plant in which the main combustion takes place

2.5

flame detector

that part of the flame safeguard that is responsive to flame properties and signals the presence of flame

2.6

flame failure

the loss of the flame from the normally detected position by any cause other than the action of de-energizing the safety shut-off valves

2.7

flame safeguard

a control responsive to flame properties, detecting the presence of a nominated flame and, in the event of ignition failure or subsequent flame failure, causing safety shut-down or lock-out

2.8

flame simulation

a condition where the flame detector erroneously signals the presence of a flame

2.9

flow rate metering (proportioning control)

a fuel/air ratio control system which measures fuel and air flows and adjusts them to a predetermined ratio

2.10

forced draught burner

a burner in which the combustion air is provided under pressure, usually from a fan

2.11

governor creep

the tendency of a governor outlet pressure at zero flow to rise gradually to the inlet pressure due to seat leakage

¹⁾ 1 mbar = 100 N/m² = 100 Pa.

2.12**hazardous condition**

an abnormal condition involving risk to persons or property

2.13**high/low burner**

a burner in which, under the operation of the process control, the firing rate is either full on or at low fire

2.14**induced draught burner**

a burner into which the combustion air is introduced by providing a suction in the combustion chamber by mechanical means, usually a fan

2.15**liquefied petroleum gas (LPG)**

commercial butane or commercial propane complying with BS 4250-1

2.16**lock-out**

a safety shut-down condition of a control system such that restart cannot be accomplished without manual intervention

2.17**main flame**

a flame, other than the start-gas flame, on the main burner

2.18**main flame establishment period**

a period during which the main gas safety shut-off valve(s) is permitted to be open before the pilot flame is extinguished and before the flame safeguard is required to supervise the main flame alone

2.19**main gas supply**

gas that is supplied to establish and maintain the main flame

2.20**modulating burner**

a burner in which, under the operation of the process control, the firing rate is variable between the full on and low fire rates

2.21**natural gas**

a 2nd family gas whose main constituent is methane

2.22**operational specification**

a full description of the control system together with an explanation of the operation of the control system during each stage of the operating sequence. It also includes an explanation of the system behaviour in the event that any signals from any external devices are incorrect (by failure to ignite, flame failure, airflow failure, etc.)

2.23**pilot flame**

a flame, established at a separate pilot burner, that is used to ignite the main flame

2.24**post-purge**

a purge that follows shut-down

2.25**pre-purge**

a purge that precedes any ignition attempt

2.26**proof of closure switch**

a switch fitted to a safety shut-off valve with mechanical overtravel which proves the valve to be in the closed position

2.27**prove**

to sense a system parameter (for example, gas pressure) in order to ascertain either directly or indirectly whether it is within a prescribed range

2.28**proving system**

a system to check the effective closure of the start-gas or main gas safety shut-off valves, which is more sophisticated than a system check and which is capable of either:

- a) detecting small leakage rates, e.g. a pressure proving system; or
- b) safely venting small leakage rates, e.g. two safety shut-off valves in series each fitted with a proof of closure switch and a vent valve fitted with a proof of open switch.

2.29**purge**

the introduction of air into the combustion chamber and flue passages so as to displace any remaining fuel/air mixture

2.30**safety shut-down**

the action of shutting off gas and ignition energy by means of a safety control such that restart takes place only after manual intervention or automatic recycling

NOTE Safety shut-down may include triggering an alarm.

2.31**safety shut-off system**

a system of safety shut-off valves with associated control circuits that enables the supply of gas to the burner to be admitted or shut-off

2.32**safety shut-off valve**

a valve designed to open when energized and close automatically when de-energized, activated by the safety controls of a burner system

2.33**self-checking flame safeguard system**

a flame safeguard system having a device which automatically checks the functioning of the flame safeguard periodically

2.34**start-gas flame**

a flame established at the start-gas rate either at the main burner or at a separate pilot burner

2.35**start-gas flame establishment**

the establishment of a proved and supervised start-gas flame

2.36**start-gas flame ignition period**

the period during which the start-gas safety shut-off valve(s) is permitted to be open, before the flame safeguard is required to supervise the start-gas flame

2.37**start-gas flame proving period**

the period during which the start-gas flame is supervised by a flame safeguard system following the cessation of the ignition period and before the opening of the main gas safety shut-off valve(s)

2.38**start-gas rate**

the restricted gas flow rate admitted either to a separate pilot burner or to the main burner during the start-gas flame establishment period

2.39**start-gas supply**

gas that is supplied at the start-gas rate to establish the start-gas flame

2.40**stoichiometric gas rate**

that gas rate at which, if reacted completely with the combustion air flow, the gas would just consume all the oxygen in the air

2.41**system check**

for safety shut-off valves, a system to check the effective closure of the main gas safety shut-off valves prior to start-up, e.g. two safety shut-off valves fitted with closed position indicator switches

2.42**town gas**

a 1st family gas, also commonly known as manufactured gas

2.43**type test**

a test carried out as part of a programme to approve to a particular specification a device which is representative of production

2.44**vent valve**

a normally open automatic valve fitted between two safety shut-off valves intended to vent any small leakages

3 Verification

3.1 Verification tests specified in this Part of BS 5885 shall be type tests.

3.2 For the purposes of verifying compliance with this Part of BS 5885 the burner shall be mounted on a test bed so that it may be fired in free air, connected to appropriate services and commissioned according to the manufacturer's instructions.

3.3 The test gases used in the verification tests shall be:

a) as specified in Table 1 for 1st, 2nd and 3rd families;

or

b) their equivalents as specified in BS 4947; or

c) other gases appropriate to the application of the burner.

NOTE Where option (c) is required the test gas to be used should be agreed between the contracting parties.

Table 1 — Test gases

Family	Test gas
1st	TGA – 4
2nd	NGA (G 20)
3rd: Butane	LPGA (G 30)
Propane	LPGC (G 31)

4 Gas flow pipework and controls

4.1 Filters and strainers

4.1.1 A strainer shall be fitted at the inlet of the safety shut-off valve system to prevent the ingress of foreign matter.

NOTE 1 Except for valves incorporating a self-cleaning or shearing action or for valves with connection size not greater than DN 15, the strainer may be integral with the upstream safety shut-off valve(s).

NOTE 2 In multiple valve safety shut-off systems only one strainer need be fitted, provided that it gives adequate protection to all valves.

Compliance shall be checked by inspection.

4.1.2 The maximum strainer hole dimension shall be not greater than 1.5 mm and the mesh shall not pass a 1 mm pin gauge.

Compliance shall be checked by measurement.

4.1.3 In the special case where dust could interfere with burner operation or could cause erosion at high velocities, the gas supply to the burner shall be filtered to remove particles of a size greater than 250 µm.

NOTE Pressure test points should be fitted to the inlet and outlet of each filter to enable checks to be made on its performance.

Compliance shall be declared by the manufacturer.

4.1.4 Where pneumatic controls are applied an air filter(s) shall be fitted to protect controls, actuators and instrumentation [see also clause 12 f)].

Compliance shall be checked by inspection.

4.2 Pipework and flow components

4.2.1 Thickness and size. Gas pipework shall comply with BS 1387 (medium or heavy thickness) or BS 3601 or BS 2871-1, as appropriate.

Compliance shall be declared by the manufacturer.

Where pipe complying with BS 3601 is used it shall have a wall thickness not less than that given in Table 2.

Compliance shall be declared by the manufacturer.

Copper pipe shall not be used in sizes above 28 mm.

Compliance shall be checked by inspection.

4.2.2 Connections. Gas pipework connections shall be of the screwed, compression, flanged, brazed or welded types. Screwed, flanged, brazed and welded connections shall be applied according to pressure and size as shown in Table 3.

Screwed connection threads shall comply with BS 21.

Compliance shall be checked by inspection (with respect to the pipework connections) and by manufacturer's declaration.

4.2.3 Screwed and compression fittings. Screwed fittings shall comply with BS 1740-1 or BS 143 & BS 1256.

Compression fittings shall comply with BS 864-2 or BS 2051-1 or BS 2051-2 for use on copper pipe, or BS 4368 for use with steel pipe.

Compression fittings shall not be used on pipework larger than 42 mm diameter and shall employ metal olives.

Table 2 — Wall thickness of pipes complying with BS 3601

Nominal pipe size	Minimum wall thickness
mm	mm
15 (R½)	2.6
20 (R¾)	2.6
25 (R1)	3.2
32 (R1¼)	3.2
40 (R1½)	3.2
50 (R2)	3.6
80 (R3)	4.0
100 (R4)	4.5
150 (R6)	5.0
200 (R8)	5.4
250 (R10)	5.4
300 (R12)	5.6
400 (R16)	6.3

Table 3 — Connections for valves and pipework

Size	Pressure		
	0 mbar to 50 mbar	Above 50 mbar to 2 bar	Above 2 bar to 7 bar
Up to 25 mm	Flanged, screwed, welded or brazed	Flanged, screwed, welded or brazed	Flanged, screwed, welded or brazed
Above 25 mm to 80 mm			Brazed or welded flanges
Above 80 mm		Brazed or welded flanges	

Compliance shall be by manufacturer's declaration and by inspection (with respect to pipework connections).

NOTE Where copper pipework is used it should be so arranged as to be protected against accidental damage.

Copper compression fittings shall only be used on start-gas supply pipework.

Compliance shall be checked by inspection.

4.2.4 Pipework design. The design of pipework shall be such as to avoid tensile loading of the joints.

Compliance shall be checked by inspection.

4.2.5 Flanges. Flanges shall either:

- a) comply with BS 4504-1 or BS 4504-2 or BS 1560-2; or
- b) be flat-faced flanges complying in all other respects with BS 4504-1 or BS 4504-2.

NOTE The number of flanged joints should be kept to a minimum.

Compliance shall be declared by the manufacturer.

4.2.6 Welding. Welding shall be applied according to pressure and size as given in Table 3 and shall comply with the following standards:

- a) *pressures up to 2 bar*:
 - 1) pipework up to 100 mm nominal bore: BS 2971, or BS 2640 with inspection and testing in accordance with BS 2971;
 - 2) pipework above 100 mm nominal bore: BS 2971;
- b) *pressures from 2 bar to 7 bar*: BS 2971, with 10 % radiography or ultrasonic testing in accordance with BS 2633.

Compliance shall be declared by the manufacturer.

4.2.7 Brazing. Brazing shall comply with BS 1723-1.

Compliance shall be declared by the manufacturer.

4.2.8 Pressure test points. Pressure test points shall be in the form of a nipple for the temporary connection of a pressure gauge.

NOTE Pressure test points should be positioned so as to minimize the risk of accidental damage and should be easily accessible.

Compliance shall be checked by inspection.

Threads shall either:

- a) comply with BS 21; or
- b) be suitable for the design pressure.

Compliance shall be declared by the manufacturer.

4.2.9 Debris. All pipework shall be free of debris such as dust, welding slag, etc.

Compliance shall be checked by inspection.

4.2.10 Leakage test

4.2.10.1 Requirements. The gas pipework on the complete burner assembly up to the last downstream means of isolation shall be subjected to a leakage test under an air or inert gas pressure of at least 1.5 times the maximum stated working pressure, or 40 mbar, whichever is the greater. The leakage rate shall not exceed 25 mm³/s of air equivalent under metric standard reference conditions²⁾ for a burner of up to 300 kW heat input. For burners above 300 kW heat input, the leakage rate shall not exceed 25 mm³/s plus 1 mm³/s for every 20 kW heat input above 300 kW.

Compliance shall be checked by the test specified in 4.2.10.2.

4.2.10.2 Method. Connect an air or gas supply, incorporating a governor for the control of pressure and a meter for flow measurement, to the burner inlet.

Maintain the safety shut-off valve(s) in the open position.

Adjust the inlet pressure to the specified value and subject all gas-carrying parts to this pressure with all gas valves, except the last downstream means of isolation, in the open position.

4.2.11 Flexible pipes. Flexible pipes shall comply with BS 6501-1 or BS 6501-2 and shall withstand at least three times the working pressure with a minimum of 3.5 bar at both maximum and minimum service temperatures.

NOTE BS 6501-1 and BS 6501-2 also give guidance on the correct selection and use of flexible pipes.

Compliance shall be declared by the manufacturer.

4.2.12 Manual valves. Burners shall be provided with such manual valves as are essential for their commissioning and normal operation. In addition a quick acting manual valve shall be provided upstream of all controls to isolate the burner.

NOTE 1 The quick acting manual valve need not be provided by the burner manufacturer. Guidance on the selection of manual valves may be obtained from IM/15 "Manual Valves. A Guide to Selection for Industrial and Commercial Gas Installations" published by British Gas plc.

There shall be a manual isolating valve in a readily accessible position upstream of the inlet of any section of flexible pipe.

NOTE 2 Reference should also be made to the British Gas Publication IM/16 "Guidance Notes on the Installation of Gas Pipework, Boosters and Compressors in Customers' Premises".

Compliance shall be checked by inspection.

²⁾ Standard reference conditions are 15 °C, 1013.25 mbar, dry.