

Specification for

Safety of domestic gas appliances —

**Part 8: Combined appliances: gas
fire/back boiler**

UDC 662.76:697.326.3:614.8

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

BSI
Documents

AVA

Document Sharing Hub

Cooperating organizations

The Gas Standards Committee, under whose direction this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

British Combustion Equipment Manufacturers' Association
British Gas Corporation*
Chartered Institution of Building Services
Department of Energy (Gas Standards Branch)*
Department of the Environment (Housing and Construction)
Department of the Environment (PSA)
Heating and Ventilating Contractors' Association
Institution of Gas Engineers*
Liquefied Petroleum Gas Industry Technical Association (UK)*
National Association of Plumbing, Heating and Mechanical Services Contractors
Society of British Gas Industries*
Water-tube Boilermakers' Association

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

Association of Control Manufacturers
British Non-ferrous Metals Federation
Consumer Standards Advisory Committee of BSI
Department of the Environment
HEVAC Association
Institution of Fire Engineers
National Brassfoundry Association
National Water Council
Royal Society for the Prevention of Accidents

This British Standard, having been prepared under the direction of the Gas Standards Committee, was published under the authority of the Executive Board and comes into effect on 31 October 1980

© BSI 07-1999

The following BSI references relate to the work on this standard:
Committee reference GSE/17
Draft for comment 76/74664 DC

ISBN 0 580 10812 0

Amendments issued since publication

Amd. No.	Date of issue	Comments

Contents

	Page
Cooperating organizations	Inside front cover
Foreword	ii
0 Introduction	1
Section 1. General	
1 Scope	1
2 References	1
3 Definitions	1
4 Classification of appliances	2
5 General requirements	2
6 General conditions of test	3
Section 2. Safety requirements and associated methods of test	
7 General design and construction	4
8 Soundness	5
9 Heat input	5
10 Combustion	6
11 Ignition	6
12 Ignition system	8
13 Flame stability	9
14 Sooting	10
15 Flue system	11
16 Fire hazard and limiting temperatures	12
17 Prolonged performance test	13
18 Automatic controls	14
19 Manual controls	17
20 Electrical safety	18
21 User's instructions	18
22 Installation and servicing	18
Figure 1 — Test box and flue	21
Figure 2 — Waterside test rig	22
Figure 3 — Bubble leak indicator	23
Figure 4 — Spillage detector	24
Figure 5 — Apparatus for measuring floor and wall temperatures	24
Publications referred to	27

Foreword

BS 5258 has been prepared, under the direction of the Gas Standards Committee, to meet the need for a standard specifying the safety requirements and associated methods of test for domestic gas appliances burning 1st, 2nd and 3rd family gases.

BS 1250 has specified safety and performance requirements for a range of domestic appliances burning 1st family gas while BS 2491, BS 2773 and BS 2883 have similarly covered a limited range of appliances burning 3rd family gas. The increased distribution of 2nd family gas and the development of a new generation of appliances, often designed to burn more than one family of gas, have necessitated the publication of new British Standards which relate to appliances burning 1st, 2nd and 3rd family gases and in which the requirements and methods of test for the three gas families have been, where technically appropriate, harmonized. BS 5258 specifies safety requirements and associated methods of test and therefore supersedes, in part, BS 1250, BS 2491, BS 2773 and BS 2883. Other, non-safety aspects of appliances will be the subject of another British Standard now in course of preparation.

BS 5258 is being prepared in a number of Parts, each of which will apply to one particular type of appliance. In each Part, the sequence of the clauses and their subject matter are being arranged so that, as far as possible, a particular main clause number refers to the same aspect of the specification in all Parts. The following Parts are already published or are, as indicated by an asterisk, in course of preparation:

- *Part 1: Central heating boilers and circulators;*
- *Part 2: Cooking appliances;*
- *Part 3: Drying cabinets;*
- *Part 4: Fanned-circulation ducted-air heaters;*
- *Part 5: Gas fires;*
- *Part 6: Refrigerators and food freezers;*
- *Part 7: Storage water heaters;*
- *Part 8: Combined appliances: gas fire/back boiler;*
- *Part 9: Combined appliances: air heater/circulator*;*
- *Part 10: Flueless space heaters (excluding catalytic combustion heaters) (3rd family gases);*
- *Part 11: Flueless catalytic combustion heaters (3rd family gases);*
- *Part 12: Decorative gas log and other fuel effect appliances.*

Some of the provisions of this standard are set deliberately high to make allowance for manufacturing tolerances and variations in the supply of fuel gases. Some of the tests are destructive and it follows that it is not practicable to check each appliance made against all the provisions of the standard. However, the intention of the standard is that, if all its requirements are complied with when applied to a sample representing the average of production, this will ensure:

- that all appliances claimed to be designed to it are safe in normal use when installed and maintained in accordance with the relevant British Standard codes of practice and with the manufacturer's instructions; and
- that such servicing as may be necessary to maintain the appliance in a safe condition can be carried out by a competent fitter without difficulty.

For this Part the relevant codes of practice are: CP 332-1, CP 333-1, BS 5376-2, BS 5440-1 and BS 5440-2, BS 5449-1 and BS 5482-1 and BS 5482-2.

Furthermore, attention is drawn to the requirements of the Gas Safety Regulations, of the Building Regulations and of the Model Water Byelaws issued by the Department of the Environment and of the Building Standards (Scotland) (Consolidation) Regulations issued by the Scottish Development Department.

Certification. Attention is drawn to 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 to iv, pages 1 to 28, 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.

0 Introduction

This Part of BS 5258 has been prepared for combined appliances taking into account the requirements of Parts 1 and 5, where appropriate, for the individual appliances and adding those requirements pertinent to the combined appliance. While the requirements and methods of test follow existing United Kingdom practice, they are in no way intended to prejudice any future negotiations of a European Standard.

Section 1. General

1 Scope

This Part of BS 5258 specifies safety requirements and associated methods of test for combined appliances designed to be fitted into or against a fireplace recess and consisting of a boiler or circulator together with a gas fire. The combined appliance may be of integral construction or consist of substantially independent boiler (or circulator) and gas fire units.

This Part of BS 5258 also covers boilers and circulators designed to be fitted in a fireplace recess behind a decorative closure unit.

It includes appliances for use on both open and sealed water systems but does not cover the special requirements necessary for appliances with fan-powered combustion circuits.

In specifying requirements for appliances burning 2nd family gases it is assumed that a meter governor will be fitted, and for appliances burning 3rd family gases it is assumed that the gas supply from the container will be governed by a pressure regulator complying with the requirements of BS 3016.

There are circumstances, particularly with regard to central heating, where means of control may be provided either on the heating appliance or as part of the installation; where this option exists it is stated. Where the control forms part of the installation and its application conforms to established practice, no reference is deemed necessary, in this standard, to the installation procedure.

Requirements for controls, given herein, relate to controls fitted as part of, or supplied with, particular appliances; they do not necessarily provide a complete specification for controls intended for general use.

This standard does not take into account the special hazards that exist in nurseries and other places where there are young children or aged or infirm persons without supervision; in such cases additional requirements may be necessary.

2 References

The titles of the standards publications referred to in this standard are listed on pages 27 and 28.

3 Definitions

For the purposes of this Part of this British Standard, the following definitions, together with those in BS 1179 and in the relevant British Standard codes of practice, apply.

3.1 adjustment pressure

the pressure(s), measured at the test point(s), that is (are) required to obtain the rated heat input of each unit of the combined appliance using the reference test gas

3.2 back boiler

a water heating unit designed to fit into a fireplace recess to provide central heating or domestic hot water or both

3.3 closed fronted fire

a gas fire in which the glowing area is substantially covered by means of a transparent or translucent screen while air for combustion is drawn from the room

3.4 cold condition

a condition of the appliance required for some tests and obtained by allowing the unlit appliance to attain equilibrium at room temperature

3.5 dual shut-off system

a system having two gas valves in the main gas supply, actuated by more than one sensor, and arranged to maintain safe conditions in the event of failure of a valve, sensor or control circuit. A gas valve actuated only by a flame sensor as part of a flame failure device is not considered to be part of the dual shut-off system

3.6 fireplace recess

a space formed in a wall or chimney breast, up to the load-bearing lintel, into which an appliance may be placed and from which a flue leads

3.7 hot condition

a condition of the appliance required for some tests and obtained by heating to thermal equilibrium at the adjustment pressure, any thermostat on the gas fire unit remaining fully open and any water control thermostat being at the maximum setting

3.8**minimum operational rate**

the lowest rate obtainable in normal use with the appliance adjusted in accordance with the manufacturer's installation instructions. However, for manually controlled gas fire burners:

- a) that are subdivided into sections under control of a tap (e.g. duplex burners), the minimum operational rate applied for test purposes to any section is not less than 30 % of the normal rate of that section;
- b) that are not subdivided into sections (i.e. simplex burners), the minimum operational rate applied for test purposes is not less than 20 % of the normal rate.

3.9**open system**

a central heating system that is open to the atmosphere through a cold feed and expansion cistern and an open vent pipe

3.10**overheat cut-off device**

a non-adjustable device fitted in an appliance to guard against failure of the normal means of temperature control

3.11**rated heat input**

the manufacturer's declared heat input for the appropriate reference test gas

3.12**sealed system**

a system in which the water-carrying parts constitute a completely closed circuit, the expansion of the water being accommodated within the system

3.13**setting pressure**

the pressure(s), measured at the test point(s), that is (are) specified by the manufacturer for the purpose of adjusting the appliance heat input

3.14**water control thermostat**

a thermostat intended to control the water flow temperature of a water heating appliance when in normal operation. The temperature setting is usually, but not necessarily, adjustable by the user

4 Classification of appliances

4.1 By category. BS 4947 describes the category system of appliance classification by which an appliance is denoted by a category number, I, II or III, according to the number of gas families that it is designed to burn and the families are identified by subscripts T, N and L for the 1st, 2nd and 3rd gas families respectively.

For the purposes of this Part, the following categories of appliances are permitted:

Category I_T, I_N, I_L, I_{L/B}, I_{L/P}

Category II_{TN}, II_{NL}, II_{NL/B}, II_{NL/P}

Category III, III_{TNL/B}, III_{TNL/P}

4.2 By flue type. For the purposes of this standard, appliances are also classified into the following types according to the flue system for which they are designed and the source of the combustion air:

- type A: flueless appliances
- type B: open flued appliances
- type C: room-sealed appliances
- type C₁: balanced flue appliances
- type C₂: Se-duct appliances

The relevant definitions of these types of appliance are given in BS 1179.

This Part covers type B appliances only.

5 General requirements

The appliance shall comply with the requirements of this standard when tested using the specified test gases of the appropriate gas family. Full details of the test gases are given in BS 4947.

Central heating boilers and circulators designed to be fitted behind a decorative closure unit shall comply with the relevant requirements.

Appliances designed to burn 1st family gases shall be suitable for gas groups G4 and G5 by a change of injectors, jets or pressures.

Notwithstanding the requirements specified in this standard, any new designs, materials and methods of assembly are permissible provided that at least equivalent results are achieved.

Any new features incorporated in an appliance for which no provision for testing is made in this standard shall be examined in the light of the manufacturer's claims and instructions. The claims shall be checked against the instructions and shall be valid.

6 General conditions of test

6.1 Test room. The room shall be adequately ventilated but free from draughts that are likely to affect the performance of the appliance. If the test results are influenced by the temperature of the ambient air, the room temperature shall be maintained at 20 ± 5 °C.

6.2 Preparation of appliance

6.2.1 All appliances. The appliance shall be fitted to the test box specified in **6.3** in accordance with the manufacturer's instructions. It shall then be adjusted in accordance with the manufacturer's instructions, using the appropriate reference test gas at the following inlet pressure.

Family	Test gas	Inlet pressure
1st	TGA	mbar ^a 17.5
2nd	NGA	20
3rd	LPGA	28
	LPGC	37

^a 1 mbar = 0.1 kPa = 10^2 N/m².

Before any tests are made the appliance shall be operated at its full working temperature for a period sufficient to dry any insulation and remove any temporary finish that might interfere with observations.

6.3 Test box

6.3.1 Design. The test box and surrounds, which shall be supplied to the test authority by the manufacturer, shall be of metal and they shall simulate the type of construction specified in the manufacturer's installation instructions. The test box shall represent the minimum size of fireplace recess into or against which the appliance is designed to be fitted, i.e. the test box shall have the minimum dimensions for the fireplace depth, width and height and the maximum dimension for the associated lintel, which shall be assumed to be of rectangular section. The wall face extension shall be a minimum of 150 mm on each side of the appliance. The box shall be provided with two removable fireplace surrounds, each not less than 1 m long and 1 m high and having an opening of the appropriate minimum dimensions given in BS 1251. The surrounds shall be of the maximum and minimum thicknesses, respectively, stated in the manufacturer's installation instructions. All tests involving operation of the appliance shall be carried out with the box fitted with the surround of minimum thickness. The tests carried out under downdraught conditions shall be repeated using the surround of maximum thickness.

There shall be adequate provision for the fitting of test probes and for access to the appliance during testing.

A test box of typical dimensions is illustrated in Figure 1.

6.3.2 Flue. Except where the test method specifically requires otherwise, the appliance, or the test box, as appropriate, shall be fitted with a vertical flue of the nominal diameter or equivalent area stated in the manufacturer's installation instructions and of such a length that the height from the floor of the test box to the top of the flue is 3 m.

There shall be no significant leakage from the top of the test box.

6.4 Test rig: water side. For the tests specified in clauses **10** and **16** and for other tests, if desired, the appliance shall be connected to a test rig capable of allowing it to be operated at the rated heat input(s) and at the flow and return temperatures specified. Means shall be provided for measuring the flow and return temperatures and the inlet water temperature to within 0.5 °C.

A suitable test rig is shown in Figure 2, but any other arrangements having the same capability may be used.

The flow and return of the appliance (1) are short circuited via a connecting pipe containing a circulating pump (2) and control valve I (3). Cold water at a temperature t_3 is fed into the return pipe after the control valve (3) from a raised tank (4) which ensures a static head on the system. An equivalent amount of water at the flow temperature t_2 flows out of the system via a ventilated offtake.

The water flow rate corresponding to the required flow temperature at the preset output is regulated by control valve II (5). The specified temperature difference $(t_2 - t_1)$ °C is set by means of control valve I (3).

It is advisable to fit a water flow meter (6) into the cold feed to the boiler for preliminary setting of water flow rate and to allow spot checks to be made during tests.

6.5 Test procedure. The test rig and appliance shall be examined for gas and water soundness both before and after the tests and the results are deemed invalid unless the system is sound. (See **8.1** and **8.2**.)

The appliance shall be at room temperature at the start of each test unless otherwise stated.

During testing, the initial adjustment of the appliance shall not be altered unless specifically required by the test method.

Precautions shall be taken to prevent thermostats or other variable controls from acting to interfere with the gas flow, except as necessitated by the test.

In general, except for tests involving governor performance, the appliance governor, if any, may be put out of operation and the specified test pressure obtained by adjustment of the gas pressure at the inlet to the appliance.

Test pressures shall be measured correct to 0.2 mbar and controlled so that the variation does not exceed ± 0.2 mbar.

BS 4947 gives guidance on the measurement of heat input rate.

Tables giving details of the test gases (and, where appropriate, their conditions of application) to be used for each of the gas families are inserted in relevant clauses. For 3rd family appliances, test gases LPGA and LPGB are used with appliances suitable for use with butane and test gases LPGC and LPGE with appliances suitable for use with propane.

Section 2. Safety requirements and associated methods of test

7 General design and construction

7.1 Materials, fittings and finishes. Materials, fittings and finishes, the failure of which may affect the safe operation of the appliance, shall comply with the requirements of relevant British Standards and shall be appropriate to the conditions arising in the part of the appliance in which they are used. The appliance shall be free from swarf, grit or other foreign matter that could affect the safety or operation of the appliance.

7.2 Removal and reassembly of parts by user. Parts that are intended to be removable by the user, e.g. for cleaning, shall be readily accessible, shall not require the use of tools for their removal, shall be easy to assemble correctly and difficult to assemble incorrectly.

Parts that are not intended to be removed by the user, e.g. injector jets, shall require the use of tools for their removal.

7.3 Materials in contact with gas

7.3.1 Copper tubing. Copper tubing shall not be used where it would be exposed to temperatures above 100 °C.

7.3.2 Non-metallic materials: 3rd family gases. Diaphragms shall comply with the requirements of 3.3 1) and 3.3 6) of BS 3016:1972.

Valve pads shall comply with the requirements of 3.4 1), 3.4 4) and 3.4 5) of BS 3016:1972.

All non-metallic materials shall show no marked deterioration when subjected to an accelerated ageing test for 7 days at a temperature of 20 °C in excess of the manufacturer's maximum recommended temperature.

NOTE The requirements of the above three paragraphs may not be complied with by materials made of some silicone rubbers although these rubbers are claimed to be satisfactory. Criteria for testing silicone rubber materials are still under consideration and, in the meantime, components and appliances containing such a material will be considered acceptable provided that the appropriate manufacturer can demonstrate that it has proved satisfactory in use.

Jointing compounds shall comply with the relevant requirements of BS 5292.

7.4 Component location. Mechanical means shall be provided to secure the boiler (or circulator) base firmly to the fireplace hearth.

The boiler (or circulator) burner shall be positively located and so arranged that it cannot be misaligned.

Means shall be provided to support the gas fire independently of its gas supply. When installed in accordance with the manufacturer's instructions, the gas fire shall be stable and, when a weight of 25 kg mass is placed at the top centre of the fire, no part of the supporting member shall deflect by more than 2 mm.

Where the gas fire burner is not an integral part of the gas fire, means shall be provided to secure positively the gas fire in its correct position relative to its burner.

7.5 Aeration adjustment. There shall be no means of adjusting the primary aeration.

7.6 Insulation. Thermal or acoustic insulation shall be non-combustible (see BS 476-4), shall be securely located and shall be protected against mechanical damage and the effects of condensate.

7.7 Expansion vessel. Where an expansion vessel is an integral part of, or supplied with, an appliance intended for use on a sealed water system, it shall comply with the constructional requirements of BS 4814.

7.8 Refractories. The bricks, radiants and burner of the gas fire shall be so located with respect to each other that, at the limit of movement allowed, the operational safety of the appliance shall be satisfactory.

7.9 Guards. The gas fire shall be provided with a guard in accordance with current regulations and complying with the requirements of BS 1945.

8 Soundness

8.1 Gas soundness

8.1.1 General. All gas-carrying parts of the combined appliance shall be sound and, when connected, shall form a complete assembly which is sound. The basic test of **8.1.2** shall be carried out on the complete assembly for an appliance of integral construction, and on each assembled unit for an appliance consisting of substantially independent boiler (or circulator) and gas fire units, but additional and more stringent tests may be required by other standards for certain components to ensure an adequate margin of safety.

8.1.2 Assembly. The fully assembled combined appliance or the assembled unit, as appropriate (see **8.1.1**), shall be sound at the internal air pressure given in the following table.

Family	Air pressure
	mbar
1st	30
2nd	40
3rd	150

This requirement shall be deemed to be complied with if the leakage rate (see note) does not exceed 85 cm³/h over a period of 1 min.

NOTE One convenient method of measuring the leakage rate is by the bubble leak indicator illustrated in Figure 3. A rate of six bubbles per minute should be equivalent to 85 cm³/h but this should be checked before the indicator is used.

The method of test is as follows.

Connect to the appliance inlet an air supply maintained constant at the appropriate pressure and embodying a suitable meter for measuring air flow.

Test the appliance under the following conditions:

- with all gas taps in the OFF position;
- with all gas taps turned to the ON position, the flame failure device being maintained by suitable means in the open position and all injectors and pilots capped off.

Care shall be taken to ensure that any means (e.g. thermal or mechanical) used to maintain the flame failure device in the open position is compatible with the normal operation of the device.

8.2 Water soundness. The manufacturer shall state the maximum pressure to which the boiler (or circulator) can be subjected, together with the recommended range of working pressure.

When tested over a 1 min period, the appliance shall not leak or show any sign of permanent distortion at a water pressure 50 % greater than the stated maximum pressure.

An appliance intended for use in a sealed water system shall satisfy these requirements at a water pressure of 4.5 bar. (See also **10.2**.)

9 Heat input

9.1 Definition and conditions of measurement.

For the purposes of this clause, the heat input is that which would be obtained with a reference gas of the Wobbe number given in the following table. The heat input shall be measured with the appliance at thermal equilibrium and in its normal operating condition. (See BS 4947 for guidance on the measurement of heat input.)

Family	Test gas	Wobbe number
		MJ/m ³
1st	TGA (4)	27.6
	TGA (5)	25.2
2nd	NGA	50.8
3rd	LPGA	87.5
	LPGC	77.0

9.2 Tolerance. The heat input of each unit of the appliance operating on its own shall be within $\pm 5\%$ of its rated heat input at the manufacturer's recommended setting pressure, with the following pressure applied to the inlet of the appliance.

Family	Test gas	Inlet pressure
		mbar
1st	TGA	17.5
2nd	NGA	20
3rd	LPGA	28
	LPGC	37

Under the same inlet pressure conditions it shall be possible to obtain the manufacturer's recommended setting pressure(s) when both units are operating in combination.

9.3 Adjustment. Any gas rate adjuster provided shall not be liable to inadvertent movement.

9.3.1 1st and 2nd family gases. Any means of adjustment of the appliance heat input shall be preset by the manufacturer. The provisions of **4.1** of BS 3554-1:1971 shall apply where appropriate.

Where a 1st family appliance is common for gas groups G4 and G5, i.e. it requires only a change of setting pressure, it shall be preset for TGA (4).

9.3.2 3rd family gases. Gas rate adjusters shall be set and sealed by the manufacturer in such a way that any subsequent interference is evident.