

Safety of domestic gas appliances —

Part 15: Specification for combination boilers

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Gas Standards Policy Committee (GSE/-) to Technical Committee GSE/17, upon which the following bodies were represented:

- Association for Consumer Research (ACRE)
- British Gas plc
- British Non-ferrous Metals Federation
- Consumer Policy Committee of BSI
- Department of Energy (Energy Efficiency Office)
- Department of the Environment (Construction Directorate)
- Department of Trade and Industry (Consumer Safety Unit, CA Division)
- Gas Consumers' Council
- Institution of Gas Engineers
- Liquefied Petroleum Gas Industry Technical Association (UK)
- National Caravan Council Ltd.
- Royal Society for the Prevention of Accidents
- Society of British Gas Industries

The following was also represented in the drafting of the standard, through subcommittees and panels:

- Coopted member

This British Standard having been prepared under the direction of the Gas Standards Policy Committee was published under the authority of the Board of BSI and comes into effect on 30 November 1990

© BSI 06-1999

The following BSI references relate to the work on this standard:
Committee reference GSE/17
Draft for comment 87/75710 DC

ISBN 0 580 18897 3

Amendments issued since publication

Amd. No.	Date	Comments

Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
Section 1. General	
1 Scope	1
2 Definitions	1
3 Classification of appliances	3
4 General requirements	3
5 General conditions of test	3
Section 2. Safety requirements and associated methods of test	
6 General design and construction	9
7 Soundness	10
8 Heat input	13
9 Combustion	14
10 Ignition	17
11 Ignition system	19
12 Flame stability	20
13 Sooting	22
14 Flue system	22
15 Fire hazard and limiting temperatures	23
16 Manual controls	26
17 Automatic controls	26
18 Full sequence automatic control systems	30
19 Electrical safety	31
20 User's instructions	32
21 Installation and servicing	32
Appendix A Calculation of flue draught	35
Appendix B Method of test for resistance to airborne lint	35
Appendix C Recommended method for determination of soundness of the combustion system of fan-powered appliances	37
Appendix D Apparatus and conditions for combustion tests on type C ₁ appliances	40
Appendix E Apparatus for combustion tests on type C ₂ appliances	42
Appendix F Information to be supplied by the manufacturer	45
Figure 1 — Fan-powered type B appliances with draught diverter	5
Figure 2 — Fan-powered type B appliances without draught diverter	6
Figure 3 — Type B appliances with integral fan in the secondary flue	7
Figure 4 — Fan-powered type C ₁ appliances	7
Figure 5 — Test rig	8
Figure 6 — Pressure differentials for lint resistance test	12
Figure 7 — Apparatus for measuring floor and wall temperatures	25
Figure 8 — Position of baffle with respect to lint generator outlet duct	38
Figure 9 — Lint generator	39
Figure 10 — Lint filter	40
Figure 11 — Test installations for combustion system of fan-powered appliances	41
Figure 12 — Typical apparatus for testing type C ₁ appliances	43
Figure 13 — Apparatus for testing type C ₂ appliances	44
Publication(s) referred to	48

Foreword

This Part of BS 5258 has been prepared under the direction of the Gas Standards Policy Committee to meet the need for a standard specifying the safety requirements and associated methods of test for combination boiler/water heating appliances burning 1st, 2nd and 3rd family gases.

In common with those Parts of BS 5258 currently being revised, this Part can be applied to all production appliances through a recognized scheme of quality assurance, whereas originally the Parts were written with type approval in mind. The intention is that all appliances manufactured in accordance with this standard will be safe in normal use when installed and maintained in accordance with the relevant British Standard codes of practice and with the manufacturer's instructions.

This Part of BS 5258 has been prepared for this type of combined appliance by taking into account the requirements of BS 5258-1 and BS 5386-1, where appropriate, for the individual units and adding those requirements relevant to the combined appliance. While the requirements and methods of test follow existing UK practice, they are in no way intended to prejudice any further negotiations of a European Standard.

Throughout the standard there are numerous references to information that the manufacturer has to include on labels attached to the appliance and in the various forms of manufacturer's literature. Appendix F contains a list of those items of information and indicates the form in which each item has to be supplied.

The codes of practice and installation specifications relevant to this Part of BS 5258 are BS 5440-1 and BS 5440-2, BS 5449-1, BS 5482-1, BS 5482-2 and BS 5482-3, BS 5546, BS 6700 and BS 6798.

Attention is drawn to the requirements of the Gas Safety (Installation and Use) Regulations, Low Voltage Electrical Equipment (Safety) Regulations, Byelaws of the local Water Undertaking and of the various Building Regulations, particularly in respect of unvented water systems.

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 48, 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.

Section 1. General

1 Scope

This Part of BS 5258 specifies safety requirements and describes associated methods of test, for gas-fired combination boilers, being combination boiler/water heater appliances with rated heat inputs up to and including 60 kW¹⁾ including appliances that have integral storage. The appliance is capable of operating either in its central heating or its domestic water mode; additionally, it may be capable of operating in both modes simultaneously.

It includes requirements for natural draught and fan-powered appliances for use on open and sealed water systems.

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 BS 3016.

This Part of BS 5258 is not applicable to:

- a) appliances which, when operating in both modes simultaneously, have an input rating in excess of the greater of the two modal ratings;
- b) flueless appliances;
- c) type C₂ appliances burning 3rd family gases, since they are not currently manufactured;
- d) appliances designed to make use of the latent heat of condensation of the water vapour in the combustion products;
- e) appliances with a hot water storage system of storage capacity greater than 15 L which neither incorporates nor facilitates the connection of a vent pipe to atmosphere;
- f) appliances for installation out of doors;
- g) appliances with pre-mixed gas and air burners;
- h) independent fan units designed to be fitted to the secondary flue of a normal open-flued appliance.

The requirements for controls 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 Part of BS 5258 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.

NOTE The titles of the publications referred to in this standard are listed on page 48.

2 Definitions

For the purposes of this Part of BS 5258 the definitions given in BS 1179:1967 and BS 1179-6 apply, together with the following.

2.1 adjustment pressure²⁾

the pressure, measured at the pressure test point, that is required to obtain the rated heat input using the appropriate reference test gas

2.2 combination boiler

an appliance designed to provide central heating hot water and domestic hot water by means of a single gas supply and a single flue and without the need for additional domestic hot water storage

2.3 continuous pilot

a constantly burning and supervised pilot flame throughout the time a burner or heating equipment is in service, whether the main flame is on or off

NOTE The pilot may be turned on or off by the action of a switch or clock.

2.4 control thermostat

a thermostat intended to control water flow temperature of a water heating appliance when in normal operation

NOTE The temperature setting is usually but not, necessarily adjustable by the user.

2.5 direct burner ignition

ignition and flame supervision are applied directly to the main burner, without the use of a separate pilot burner

2.6 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

NOTE A gas valve actuated only by a flame sensor is not considered to form part of the dual shut-off system.

2.7 equivalent length

the length of straight flue whose resistance to flow of products of combustion is equal to that of the actual flue

¹⁾ Based on gross calorific value.

²⁾ This definition is identical with that given in BS 1179-6.

**2.8
expanding pilot**

a form of continuous pilot in which the flame size is increased when required to ignite the main flame and reduced immediately after ignition or after the main flame is shut off

**2.9
full sequence automatic control system**

a control system that brings an appliance into operation from a completely shut-down condition in response to an external demand without manual intervention, and thereafter monitors the flame

**2.10
hazardous condition**

an abnormal condition involving risk to person or property

**2.11
ignition period**

the period in which the ignition source may remain energized and during which the safety shut-off system is permitted to be open before the flame detector is required to supervise the flame

**2.12
limits of tolerance of the supply voltage**

0.90 times the minimum rated voltage and 1.10 times the maximum rated voltage of the appliance

**2.13
low rate start**

a form of direct burner ignition in which ignition and initial supervision of the main burner occur at low gas rate

**2.14
minimum operational rate**

70 % of the lowest heat input at which the appliance is intended to be operated

**2.15
open water system³⁾**

a central heating system incorporating a water circuit that is open to the atmosphere through a feed cistern and a vent pipe

**2.16
overheat cut-off device**

a temperature-activated device, not adjustable by the user, designed to protect an appliance and its surroundings in the event of failure of the normal means of temperature control

**2.17
purge time**

a period during which potentially hazardous mixtures are purged naturally or mechanically from the combustion zone and flueways and during which no gas is admitted

**2.18
range-rated appliance**

an appliance whose rated heat input is adjustable within a specified range

**2.19
rated heat input³⁾**

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

**2.20
rated voltage (range)**

the voltage (range) assigned by the manufacturer

**2.21
safety time**

a period during which gas is safely admitted to the combustion chamber without the presence of flame being proved

**2.22
safety time at starting up**

the period beginning the instant the signal to admit gas is given and ending with the signal to shut off gas, when there is no ignition

**2.23
sealed water system³⁾**

a central heating system incorporating a water circuit that is not open to the atmosphere but that incorporates an expansion vessel

**2.24
setting pressure³⁾**

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

**2.25
shut-down safety time**

the period beginning the instant when the flame disappears and ending with the shut off of the gas, when there is an irregularity in operation

³⁾ This definition is identical with that given in BS 1179-6.

3 Classification of appliances

3.1 Classification by category

The category system of appliance classification is described in A.1.3 of BS 4947:1984 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 of BS 5258, the following categories of appliances are permitted.

- a) Categories I_T, I_N, I_L, I_L B and I_L P.
- b) Categories II_{TN}, II_{NL}, II_{NL} B and II_{NL} P.
- c) Categories III, III_{TNL} B and III_{TNL} P.

3.2 Classification by flue type

For the purposes of this Part of BS 5258, appliances are also classified into the following types according to the flue system for which they are designed and the source of combustion air.

- a) *Type A: flueless appliances*
- b) *Type B: open-flued appliances.* These comprise the following:
 - 1) Natural draught appliances
 - 2) Fan-powered appliances with draught diverter. These appliances use a fan to move air for combustion and products of combustion through the combustion chamber and heat exchanger. The draught diverter is connected to a secondary flue in accordance with relevant codes of practice for construction and termination. Examples are shown in Figure 1(a) and Figure 1(b).
 - 3) Fan-powered appliances without draught diverter or equivalent device. These appliances use a fan to move air for combustion and products of combustion through the combustion chamber, heat exchanger and the flue system. Examples are shown in Figure 2(a) and Figure 2(b).
 - 4) Fan-powered appliances with integral fan in the secondary flue. The flow of air for combustion and of products of combustion through the appliance is produced by natural convection. The appliance is fitted with a draught diverter or suitable flue break and a fan in the secondary flue is used to evacuate the products of combustion through the flue. Examples are shown in Figure 3(a) and Figure 3(b).
- c) *Type C: room-sealed appliances.* These comprise the following:
 - 1) Type C₁: balanced-flued appliances, which may be either natural draught or fan-powered.

Fan-powered type C₁ appliances will usually be as shown in Figure 4(a) and Figure 4(b). Alternative arrangements of air intake and products outlet ducts to those shown will occur in practice.

- 2) Type C₂: Se-duct appliances, which may be either natural draught or fan-powered.

NOTE 1 This Part of BS 5258 does not cover type A appliances or type C₂ appliances using 3rd family gases.

NOTE 2 These types of appliances are defined in BS 1179-6.

4 General requirements

The appliance shall comply with this Part of BS 5258 when tested using the specified test gases of the appropriate gas family. Full details of the test gases are given in BS 4947.

NOTE For purposes of quality assurance, line gas may be used instead of reference test gas but the latter has to be used in cases of dispute.

An appliance designed to burn 1st family gases shall be suitable for gas groups G4 and G5 with or without a change of injectors or jets.

5 General conditions of test

5.1 Test room

The room shall be adequately ventilated but free from draughts 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.

5.2 Preparation of appliance

The appliance shall be set up on or against a wall taking due account of the manufacturer's instructions, with particular reference to minimum clearances around the appliance. It shall then be adjusted in accordance with the manufacturer's instructions, using the appropriate reference test gas at the following inlet pressure.

The appliance shall be connected to the appropriate flue as specified in 5.3.

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

^a 1 mbar = 100 N/m² = 100 Pa.

Except where otherwise specified in section 2, an appliance requiring an electrical supply shall be connected to a 240 V electrical supply.

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.

5.3 Installation on test flue

5.3.1 Type B appliances

5.3.1.1 Natural draught and fan-powered with draught diverter

Except where otherwise specified in section 2, an appliance with a vertical flue outlet shall be connected to a 1 m vertical secondary flue of the same nominal diameter as the flue outlet. The vertical flue shall be made from uninsulated aluminium having a metal thickness less than 1 mm.

An appliance with a horizontal flue outlet shall be fitted in accordance with the manufacturer's instructions and thereafter the vertical flue shall be fitted. The manufacturer's instructions shall include the maximum length of horizontal run and the method of adaptation to a vertical flue.

5.3.1.2 Fan-powered without draught diverter

Except where otherwise specified in section 2:

- a) an appliance intended to be used with a flue having a wall termination shall be connected to a flue having the same diameter as the flue outlet and a length appropriate to installation on a wall 300 mm thick;
- b) an appliance intended to be used with a vertical flue having a termination above roof level shall be connected to a 1 m vertical flue having the same diameter as the flue outlet.

Where a flue of maximum height is specified in section 2, it may be more convenient to use a fan to apply an equivalent suction. The equivalent suction shall be calculated using the formulae given in Appendix A and shall be measured at the outlet of the appliance.

5.3.1.3 Fan-powered with integral fan in secondary flue

Except where otherwise specified in section 2, the appliance shall be connected to a 1 m secondary flue.

5.3.2 Type C₁ appliances

Except where otherwise specified in section 2, the appliance shall be tested in still air conditions with the flue/air ducts and terminal assembled as for installation on a wall 300 mm thick.

5.3.3 Type C₂ appliances

Except where otherwise specified in section 2, the appliance shall be tested in still air conditions with the connecting ducts assembled as for installation with a distance of 100 mm between the appliance and the internal surfaces of the Se-duct.

5.4 Test rig: water side

5.4.1 Central heating mode

The appliance shall be connected to a test rig capable of allowing it to be operated at the rated heat input(s) specified in 5.5.7, unless otherwise specified in section 2, and with the flow and return water temperatures specified in this subclause relevant to its operation in the central heating mode. Means shall be provided for measuring the flow and return temperatures and the inlet water temperature to within 0.5 °C.

NOTE A suitable test rig is shown in Figure 5, but any other arrangements having the same capability may be used. It is advisable to fit a water flow meter (6) into the cold feed to the appliance for preliminary setting of water flow rate.

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 take-off.

The water flow rate corresponding to the required flow temperature at the pre-set 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).

The test rig shall be adjusted to give a flow temperature, t_2 , of 80 ± 2 °C and a return temperature, t_1 , of 60 ± 2 °C. If this temperature difference is not suitable to the appliance, the flow temperature shall be set at the prescribed value and the return temperature set as near the prescribed value as the manufacturer's instructions permit. If an 80 °C flow temperature is not suitable, the flow temperature shall be set at the manufacturer's stated maximum operating temperature and the return temperature adjusted to be 20 ± 2 °C below this value.

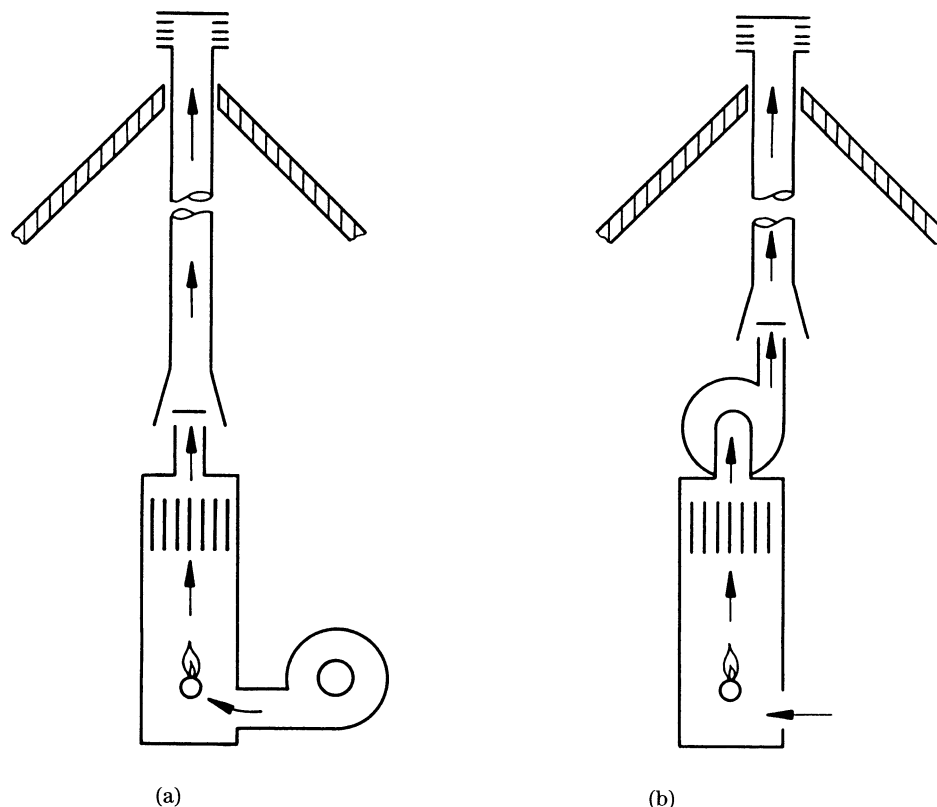


Figure 1 — Fan-powered type B appliances with draught diverter

5.4.2 Domestic water mode

The appliance is connected to a water supply (7) capable of being controlled to give the required supply pressures to within $\pm 4\%$. Where the outlet water temperatures (t_5) are required to be measured, the inlet temperature (t_4) shall not vary by more than $\pm 0.5\text{ }^\circ\text{C}$ during the test concerned. Inlet temperatures are measured immediately upstream of the inlet water connection; except where otherwise stated outlet temperatures are measured immediately downstream of the outlet water connection (9).

NOTE It is advisable to fit a water flow meter (11) into the cold feed to the appliance for preliminary setting of water flow rate (see Figure 5).

The appliance shall be supplied with water at a temperature between $5\text{ }^\circ\text{C}$ and $10\text{ }^\circ\text{C}$ and at a rate to obtain a $40\text{ }^\circ\text{C}$ temperature rise. Where this temperature rise is not obtainable, the water rate shall be that which gives the highest temperature rise when the appliance is operated at the (relevant) rated heat input.

5.5 Test conditions

5.5.1 The test conditions given in 5.5.2 to 5.5.7 shall apply except where otherwise specified in section 2.

5.5.2 The test rig and appliance shall be examined for gas and water soundness both before and after the tests. The test results are deemed invalid unless the system is sound (see 7.1 and 7.3).

5.5.3 The appliance shall be at room temperature at the start of each test.

5.5.4 During testing the initial adjustment of the appliance shall not be altered.

5.5.5 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.

NOTE 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.

5.5.6 Test pressures shall be measured correct to 0.2 mbar and the variation in test pressure shall not exceed $\pm 0.2\text{ mbar}$.

5.5.7 Except where otherwise specified in section 2, tests shall be made at both the maximum rated heat input in the central heating mode and at the maximum rated heat input in the domestic water mode (or their equivalent adjustment pressures).

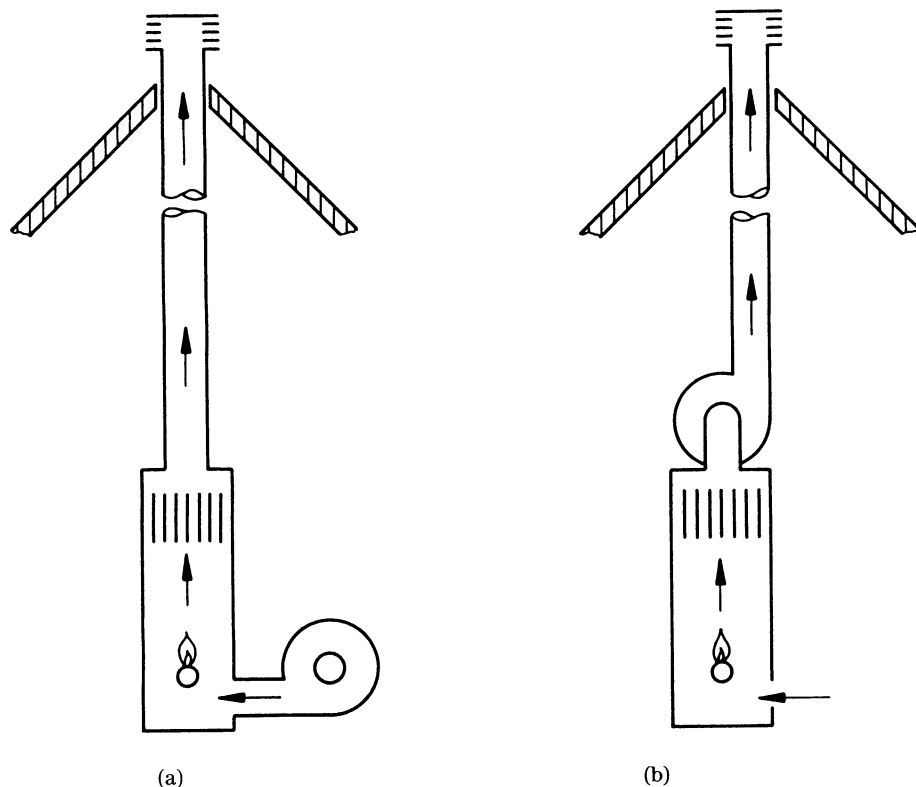


Figure 2 — Fan-powered type B appliances without draught diverter

Where the maximum rated heat inputs in the central heating and domestic water modes are the same then the requirements of section 2 shall be met with the appliance in the central heating mode, unless otherwise stated in the test method. The tests described in 10.3.1.2 and 14.1.2.2 shall, however, be carried out in both modes.

For fan-powered appliances where the heat input is a function of the fan speed, tests shall be made at the maximum rated heat input for each fan speed.

NOTE 1 BS 4947 gives guidance on the measurement of heat input rate.

NOTE 2 The test gases (and, where appropriate, their conditions of application) to be used are specified in relevant clauses of section 2. For 3rd family appliances, test gases LPGA and LPGB are used with the appliance adjusted for butane and test gases LPGC and LPGE with the appliance adjusted for propane. For appliances designed to burn butane, the 3rd family reference gas is LPGA; for appliances designed to burn propane, but not butane, the 3rd family reference test gas is LPGC.

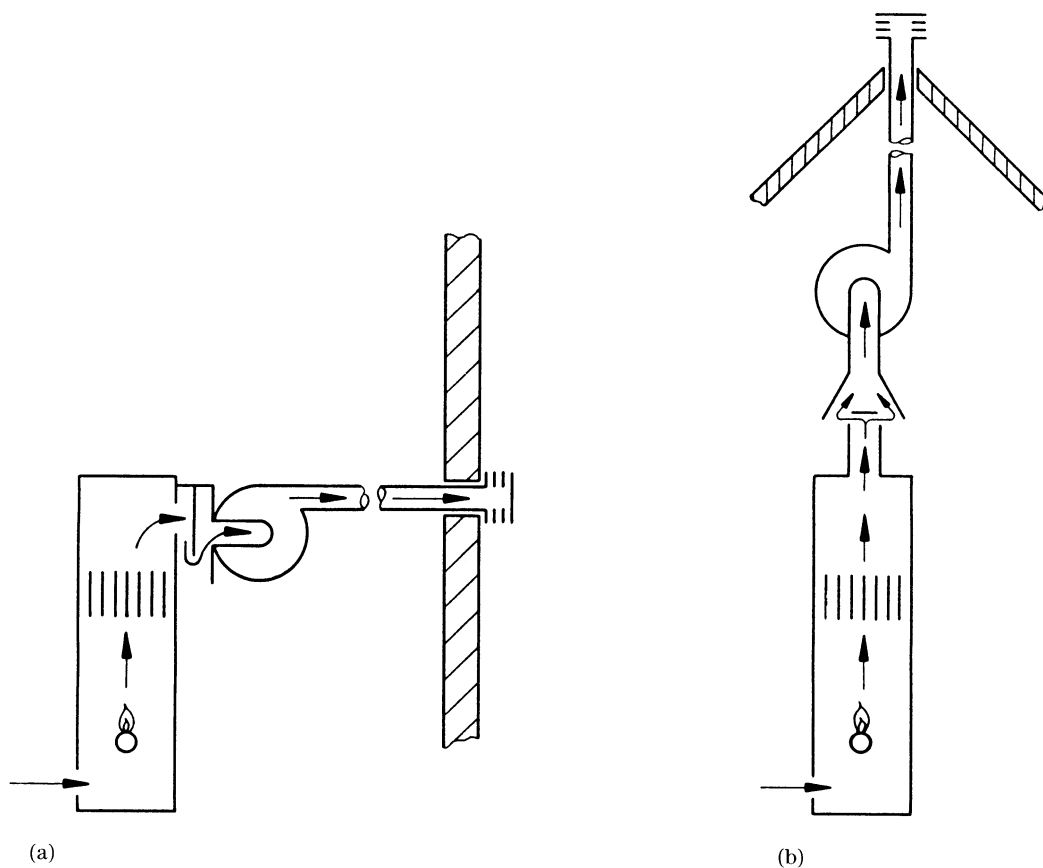


Figure 3 — Type B appliances with integral fan in the secondary flue

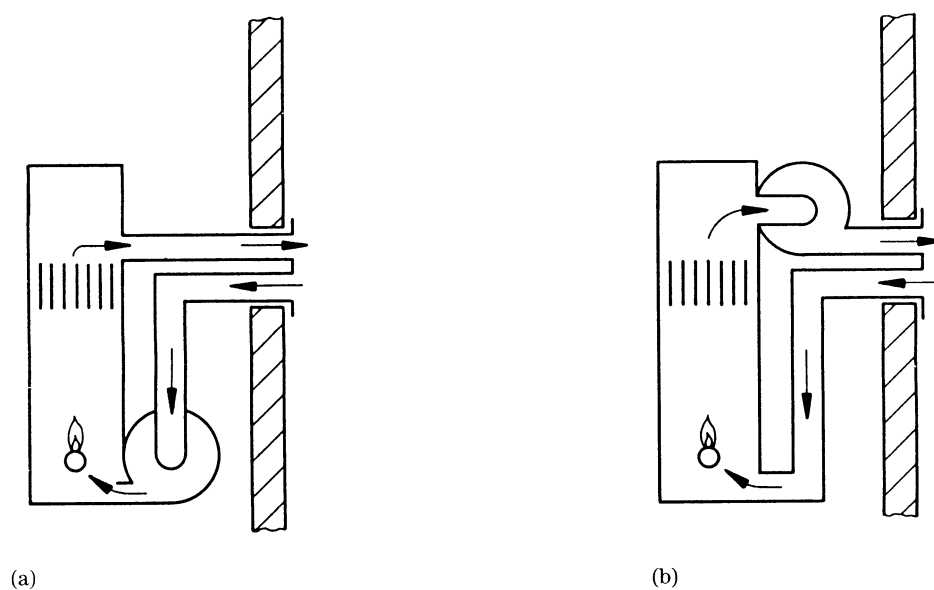
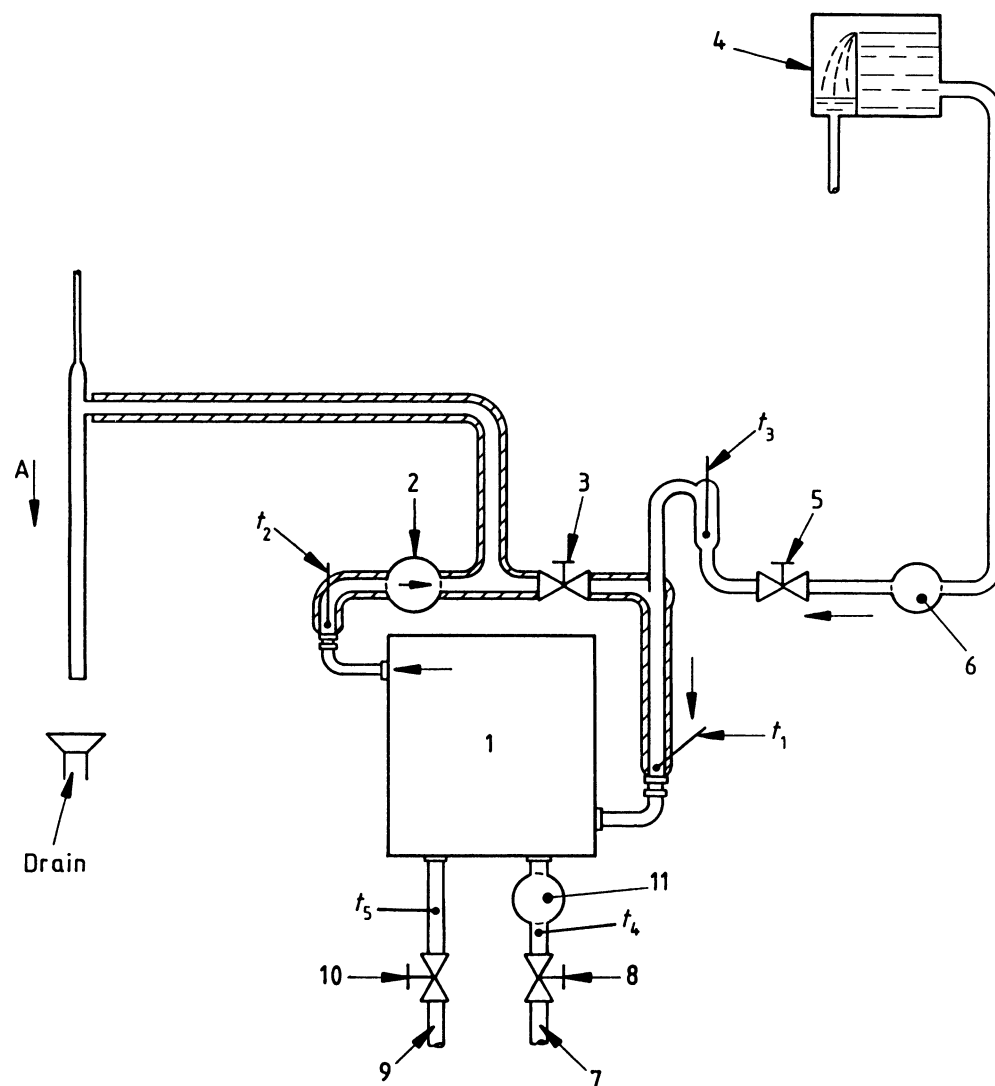


Figure 4 — Fan-powered type C₁ appliances



- | | |
|-----------------------------------|-----------------------------------|
| 1. Appliance under test | 7. Domestic cold water inlet pipe |
| 2. Circulating pump | 8. Domestic cold water inlet cock |
| 3. Control valve I | 9. Domestic hot water pipe |
| 4. Raised tank with constant head | 10. Domestic hot water cock |
| 5. Control valve II | 11. Water flow meter |
| 6. Water flow meter | |

t_1 , t_2 , t_3 , t_4 and t_5 are the temperatures taken at the points shown.

t_4 is the domestic cold water inlet temperature

t_5 is the domestic hot water outlet temperature

Figure 5 — Test rig

Section 2. Safety requirements and associated methods of test

6 General design and construction

6.1 Materials, fittings and finishes

Materials, fittings and finishes, the failure of which may affect the safe operation of the appliance, shall comply with the 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.

Asbestos-containing materials shall not be used.

6.2 Component location

The burner shall be positively secured by mechanical means and its location so arranged that it cannot be misaligned from its correct position.

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 and shall be easy to assemble correctly and difficult to assemble incorrectly.

6.3 Materials in contact with gas

6.3.1 Copper tubing

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

6.3.2 Jointing compounds

Jointing compounds shall comply with BS 5292.

6.3.3 Unions and flanges

Unions in gas lines shall be of the cone or spherical seated type. Flange joints shall include a gasket or O-ring seal resistant to the action of components of the gas and suitable for the temperature to which it is likely to be exposed.

6.4 Materials in contact with potable water

When used under the conditions for which they are designated, non-metallic products in contact with or likely to come into contact with potable water shall comply with the requirements of BS 6920-1:1988.

NOTE Non-metallic products for installation and use in the United Kingdom which are verified and listed under the UK Water Fittings Byelaws Scheme are deemed to satisfy the requirements of this clause. Details of the Scheme are obtainable from the Water Research Centre Byelaws Advisory Service, 660 Ajax Avenue, Slough SL1 4BG.

6.5 Bolts and screws

Drillings for bolts and screws shall not connect with fuel gasways or waterways. The minimum residual wall thickness shall be 1 mm.

Self-tapping screws that are removed during periodic servicing shall be fitted with spring steel or other appropriate fasteners.

6.6 Aeration adjustment

There shall be no means of adjusting the primary aeration.

6.7 Insulation

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

6.8 Deposits from appliance

An appliance that gives rise to either solid or liquid deposits shall be provided with effective means of collecting and retaining such deposits. Any deposits shall be easily removable.

6.9 Expansion vessel

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

6.10 Lint resistance of type B appliances

6.10.1 General

An appliance, which according to the manufacturer's instructions may be fitted less than 0.9 m above floor level and is fitted with aerated burners and/or aerated pilots, shall comply with 6.10.2 to 6.10.5. The requirements of 6.10.2 and 6.10.3 shall be met at the maximum rated heat input in the central heating mode.

For the purposes of 6.10.1 to 6.10.5 the following definitions apply.

- a) *Aerated burner*. A burner in which the gas flowing through a gas injector induces the primary air for subsequent combustion.
- b) *Non-aerated burner*. A burner in which the gas is burned without previous mixture with air.
- c) *Air-inlet*. Any openings in the appliance casing for supply of combustion air.

6.10.2 Ignition

After the appliance has been tested in accordance with 6.10.3 and Appendix B, the appliance shall comply with 10.3.1 or, for appliances that incorporate a full sequence automatic control system, with 10.3.1 as modified by 10.4.1.

6.10.3 Combustion

6.10.3.1 For type approval purposes, when the appliance is tested as described in Appendix B the CO/CO₂ ratios shall not exceed those specified in 6.10.3.2 and 6.10.3.3.

For a production appliance the requirements of 6.10.3.2 and 6.10.3.3 are deemed to be satisfied provided that the dimensions and/or specification of the lint arrester system are in accordance with drawings which the manufacturer shall supply to the test authority.

6.10.3.2 At a lint concentration where the measured change in pressure differential is that given by curve A in Figure 6 for the appropriate height of the air inlet above the floor, the CO/CO₂ ratio shall be not greater than the larger of the following:

- a) the CO/CO₂ ratio that would be obtained at 110 % rated heat input in the absence of lint;
- b) 0.004 plus the CO/CO₂ ratio at rated heat input in the absence of lint.

6.10.3.3 At a lint concentration where the measured change in pressure differential is that given by curve B in Figure 6 for the appropriate height of the air inlet above the floor, the CO/CO₂ ratio shall not exceed 0.02.

This requirement also applies when the appliance is operated at the maximum rated heat input in the domestic water mode.

6.10.4 Cleanability

6.10.4.1 The manufacturer shall provide instructions for the cleaning of the appliance.

6.10.4.2 Where box-type burners are employed that are not capable of being opened using standard tools, or are not otherwise accessible for internal cleaning, the combustion ratio at the end of the second linting test as described in **B.4.8** shall be not more than 0.004 above the combustion ratio obtained at the end of the first linting test, subject to a maximum permissible combustion ratio of 0.02.

6.10.4.3 A burner that is not capable of being opened shall on examination in accordance with **B.4.9** not exhibit any appreciable accumulation of lint.

6.10.5 Pilot performance

After the appliance has been tested in accordance with **6.10.3** and Appendix B, any aerated pilot shall comply with **11.2**.

6.11 Drainage

A shut-off valve shall be fitted to the cold inlet or supplied with the appliance to enable the domestic hot water circuit of the appliance to be shut-off.

It shall be possible to drain the domestic hot water circuit according to the manufacturer's instructions without affecting the electrical safety of the appliance.

7 Soundness

7.1 Gas soundness

7.1.1 General

All gas-carrying parts of the appliance shall be sound and, when connected, shall form a complete assembly that is sound.

NOTE Additional and more stringent tests may be required by other standards for certain components to ensure an adequate margin of safety.

7.1.2 Complete assembly

7.1.2.1 Requirement

When tested as described in **7.1.2.2** the fully assembled appliance shall be sound at the following internal air pressure.

Family	Air pressure
	mbar
1st	50
2nd	50
3rd	150

This requirement shall be deemed to be met if the leakage rate does not exceed 130 cm³/h over a period of 1 min.

7.1.2.2 Method

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:

- a) with all gas taps in the OFF position;
- b) with all gas taps turned to the ON position, the flame supervision device being maintained in the open position by suitable means, e.g. thermal or mechanical, compatible with its normal operation and all injectors and pilots capped off.

Where the design of the pilot is such that its gas outlet cannot be sealed, seal the gasway to the pilot at a convenient place. In addition, verify that there is no leakage from the pilot when it is operating at its normal working pressure.

7.2 Soundness of combustion system

7.2.1 General

The maximum permitted leakage rate shall be calculated separately according to **7.2.2** or **7.2.3**, as appropriate, for both the central heating and the domestic hot water functions using the corresponding values for rated heat input and CO/CO₂ ratio. The lower of the two rates shall apply. For an appliance which is range-rated for central heating purposes, the heat input to be used shall be the maximum of the rated range.

7.2.2 Type B appliances

7.2.2.1 Fan-powered with draught diverter

The leakage into the room from those parts of the appliance that contain products of combustion, when subjected to an internal air pressure equal to the normal operating pressure, shall not exceed:

- 0.085 m³/h per kilowatt of rated heat input if the CO/CO₂ ratio is less than 0.002;
- $\frac{1.7 \times 10^{-4}}{\text{CO/CO}_2 \text{ ratio}}$ m³/h per kilowatt of rated heat input if the CO/CO₂ ratio is between 0.002 and 0.01 (inclusive);
- 0.017 m³/h per kilowatt of rated heat input if the CO/CO₂ ratio is greater than 0.01;

where the CO/CO₂ ratio is that measured at rated heat input using the reference test gas under the voltage and flue conditions specified in 5.2 and 5.3 respectively.

NOTE The recommended method of test is described in Appendix C.

7.2.2.2 Fan-powered without draught diverter

The leakage into the room from those parts of the appliance that contain products of combustion, when subjected to an internal air pressure equal to the normal operating pressure, shall not exceed:

- 0.05 m³/h per kilowatt of rated heat input if the CO/CO₂ ratio is less than 0.002;
- $\frac{10^{-4}}{\text{CO/CO}_2 \text{ ratio}}$ m³/h per kilowatt of rated heat input if the CO/CO₂ ratio is between 0.002 and 0.01 (inclusive);
- 0.01 m³/h per kilowatt of rated heat input if the CO/CO₂ ratio is greater than 0.01;

where the CO/CO₂ ratio is that measured at rated heat input using the reference test gas under the voltage and flue conditions specified in 5.2 and 5.3, respectively.

NOTE The recommended method of test is described in Appendix C.

7.2.3 Type C appliances

7.2.3.1 Natural draught and fan-powered

7.2.3.1.1 Requirement

The leakage rate shall not exceed the value given in the following table when the appliance, together with any inlet and outlet ducts, is subjected to an air pressure of 1.25 mbar and tested by the method described in 7.2.3.1.2.

Rated heat input	Leakage rate
kW	m ³ /h
Less than 5	2
From 5 to 10	4
From 10 to 35	0.4 per kilowatt of rated heat input
Greater than 35	14

7.2.3.1.2 Method

Assemble the appliance according to the manufacturer's instructions.

Seal the terminal, close any lighting door and stop the gas inlet to the pilot and main burner. Pass air into the appliance and note the air flow rate when the pressure inside the appliance is steady at 1.25 mbar.

7.2.3.1.3 Appliance case

Where failure to locate the appliance case (or part of the case) correctly could result in leakage of combustion products into the room, the installation and servicing instructions shall emphasize the importance of correctly securing the case and shall give appropriate instructions on the procedure. In addition they shall indicate that where a case sealing strip is fitted, it shall be examined and, where necessary, replaced before the case is refitted. The user's instructions shall contain a prominent warning against disturbance of the case.

7.2.3.2 Fan-powered

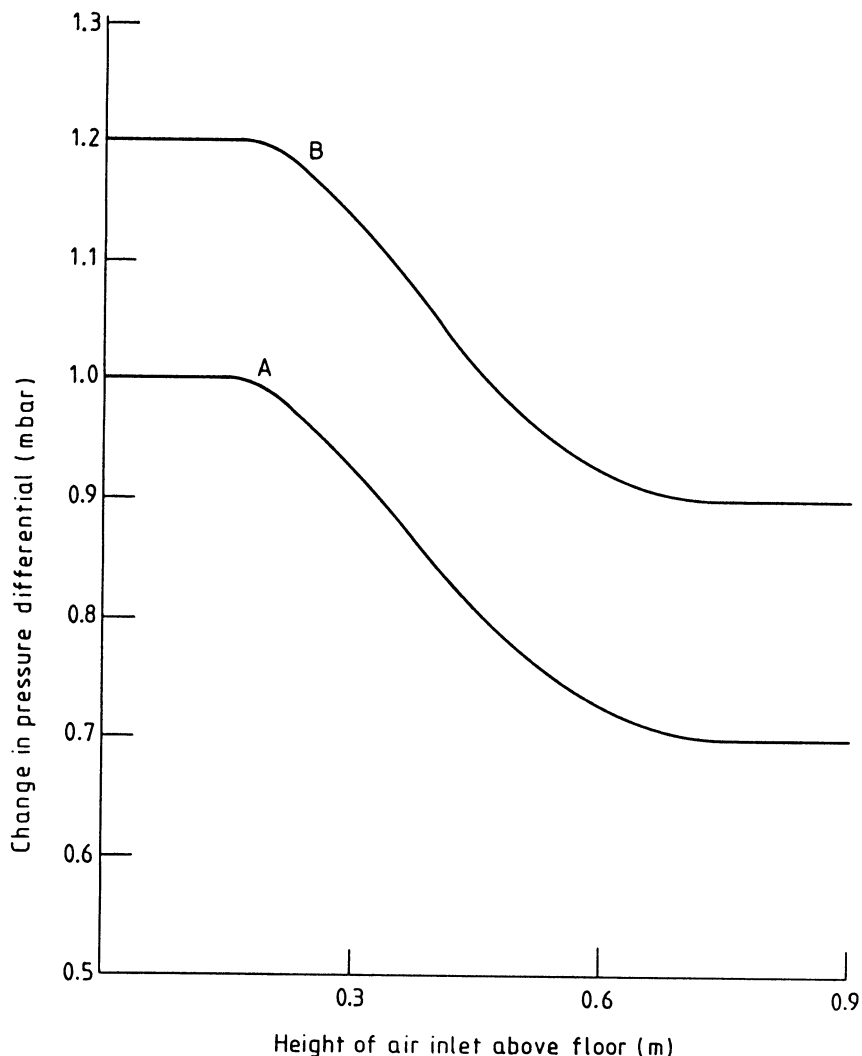
7.2.3.2.1 Fan-powered appliances shall comply with 7.2.3.2.2 and 7.2.3.2.3 in addition to 7.2.3.1.

7.2.3.2.2 The leakage into the room from those parts of the appliance that contain products of combustion, when subjected to an internal air pressure equal to the normal operating pressure, shall not exceed:

- 0.5 m³/h if the CO/CO₂ ratio is less than 0.002;
- $\frac{10^{-3}}{\text{CO/CO}_2 \text{ ratio}}$ m³/h if the CO/CO₂ ratio is between 0.002 and 0.01 (inclusive);
- 0.1 m³/h if the CO/CO₂ ratio is greater than 0.01;

where the CO/CO₂ ratio is that measured at rated heat input using reference test gas under the voltage and flue conditions specified in 5.2 and 5.3 respectively.

NOTE The recommended method of test is described in Appendix C.



NOTE See B.4.3

Figure 6 — Pressure differentials for lint resistance test

7.2.3.2.3 In addition to the requirements specified in **7.2.3.1.3**, for appliances incorporating a fan system resulting in the case being under positive pressure, the following permanent labels shall be fitted.

- a) A label, drawing attention to the fact that for safety reasons the case has to be correctly secured and stating briefly the procedure for achieving this, shall be fitted to the appliance so as to be visible when the case (or its relevant part) is removed.
- b) A permanent label(s), drawing attention to the fact that the case has to be correctly secured, shall be fitted in a sufficiently prominent position to the screws or fixings, the removal of which would adversely affect the appliance seal.

At least one such label shall be clearly visible before adjustment of the screws or fixings when the appliance is installed in accordance with the manufacturer's minimum recommended clearances.

7.2.4 Production appliances

The requirements given in **7.2.2** and **7.2.3** are applicable to type approval appliances. Production appliances shall comply with the following.

Any seals, welds, joints, etc. on production appliances shall be inspected to ensure compliance with the quality of production established for the type approval sample. Where the design of the appliance is such that under normal operating conditions the combustion products are at positive pressure with respect to the air in the room in which the appliance is installed, and where failure of sealing arrangements on the appliance, other than those intended to be made by the installer, would result in leakage of combustion products into the room under normal operating conditions, then additional soundness tests on production appliances shall be carried out.

NOTE 1 These tests should be agreed between the manufacturer and the test authority.

NOTE 2 Where practicable the test for those parts of the appliance carrying products of combustion and surrounded by room air should be carried out with a test pressure equal to the normal operating pressure and should be based on 7.2.3.2. Tests on other parts of the appliance should be based on 7.2.3.1.1.

The maximum permitted leakage shall be as specified in 7.2.2.1, 7.2.2.2 or 7.2.3.2, as appropriate, when related to the CO/CO₂ ratio of the type approval appliance.

7.2.5 Joints

Joints that can affect the soundness of the combustion system and need to be broken for servicing or maintenance shall be designed to make an effective seal without the application of any sealing compound, e.g. glue or paste. Sealing compounds shall not be used except for fixed joints so designed that the compound remains permanently in place.

7.2.6 Lighting door

Any lighting door that affects the soundness of the combustion system shall be easy to close or replace to form a seal.

7.2.7 Externally mounted fans

For type C₁ appliances incorporating a fan system where the fan motor is mounted externally to the sealed chamber with the fan spindle entering the sealed chamber via an annulus, the requirements of 7.2.3.1.1 shall be met with the annulus sealed.

In addition, with the appliance installed in accordance with the manufacturer's instructions on the test apparatus described in Appendix D and with the appliance operating with the appropriate reference test gas at the adjustment pressure appropriate to the greater maximum rated heat input, with a head-on wind of 5 m/s there shall be no leakage of products from the annulus. Where the fan has more than one speed, this test shall be carried out under the conditions giving the lowest fan speed.

7.3 Water soundness

7.3.1 Pressure test

When tested over a 1 min period at a water pressure 50 % greater than the stated maximum pressure [see 21.5.1 k)], each water circuit within the appliance shall not leak or show any sign of permanent distortion.

The central heating circuit of an appliance intended for use in a sealed central heating system shall satisfy these requirements at a test pressure of 4.5 bar.

When an appliance includes a component incorporating more than one water service, each water service shall be tested independently at a pressure 50 % greater than the stated maximum with the other water service(s) at atmospheric pressure. There shall be no intermixing.

7.3.2 Intermixing

Where two or more services are incorporated in a common component and are connected by a spindle which moves during the normal operation of the appliance then the services shall be separated from each other by a vent to atmosphere. The total aperture area of a vent or vents shall be not less than 19 mm² and every vent aperture shall be capable of accepting a 4 mm diameter pin gauge.

8 Heat input

8.1 Definition and conditions of measurement

For the purposes of 8.1 to 8.4, the heat input is that which would be obtained using a reference gas of the following Wobbe number.

Family	Test gas	Wobbe number ^a
1st	TGA (4)	MJ/m ³ 27.6
	TGA (5)	25.2
2nd	NGA	50.8
3rd	LPGA	87.5
	LPGC	77.0
^a The reference conditions are 1013.25 mbar, 15 °C, and dry.		

The heat input shall be measured after the appliance has been in operation for 1 h.