

Safety of domestic gas appliances —

Part 9: Specification for combined appliances: fanned-circulation ducted-air heaters/circulators

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Committees responsible for this British Standard

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- 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 (Building Research Establishment)
- Department of Trade and Industry (Consumer Market Division)
- 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

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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 combined gas-fired fanned-circulation ducted-air heaters and circulators burning 1st, 2nd and 3rd family gases.

In common with other Parts of BS 5258 currently being revised and prepared, this Part can be applied to all production appliances through a recognized scheme of quality assurance, whereas earlier 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. Furthermore, it should be possible for such servicing as may be necessary to maintain the appliance in a safe condition to be carried out by a competent fitter without difficulty.

This Part of BS 5258 has been prepared for this type of combined appliance by taking into account the requirements of Parts 1 and 4 (see the list below), as 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 future negotiations of a European Standard.

The codes of practice relevant to this Part of BS 5258 are BS 5440-1 and BS 5440-2, BS 5482-1, BS 5482-2 and BS 5482-3, BS 5546 and BS 5864.

Attention is drawn to the requirements of the Gas Safety (Installation and Use) Regulations, Electrical Equipment Safety Regulations, the Model Water Byelaws and of the various Building Regulations.

The following Parts of BS 5258 are already published or are, as indicated by an asterisk, in preparation:

- *Part 1: Central heating boilers and circulators;*
- *Part 2: Cooking appliances;*
- *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 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;*
- *Part 13: Specification for convector heaters;*
- *Part 14: Specification for barbecues (3rd family gas);*
- *Part 15: Specification for combination boilers*.*

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 36, 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 combined appliances consisting of a fanned-circulation ducted-air heater together with a circulator. The combined appliance is usually of integral construction, the circulator being fitted inside the air heater casing.

It also covers fanned-circulation ducted-air heaters which are designed to be fitted with circulators, as a purchaser's option.

This Part of this standard only applies to circulators intended for use as an integral part of the combined appliance. Circulators intended for independent use are covered by BS 5258-1.

It covers appliances in which the rated heat input of the air heater does not exceed 60 kW¹⁾ and that of the circulator does not exceed 8 kW¹⁾.

This Part of BS 5258 is not applicable to:

- a) flueless appliances;
- b) type C appliances burning 3rd family gas;
- c) appliances incorporating full sequence automatic control systems;
- d) appliances with premixed gas and air burners;
- e) appliances designed to make use of the latent heat of condensation of the water vapour in the combustion products.

It does not include the special requirements for appliances for outdoor installation or for appliances with fan-powered combustion circuits or fan-assisted flues.

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 in 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 with established practice, no reference to the installation procedure is deemed necessary in this Part of BS 5258.

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.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

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

2.1

adjustment pressure

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

2.2

fan control

a temperature activated control that causes the fan to operate when the minimum circulation air temperature is achieved and that stops the operation of the fan when the circulation air temperature is below this minimum

2.3

fanned-circulation ducted-air heater

a ducted-air heater incorporating a fan to move the heated air through the ducting

¹⁾ Based on gross calorific value.

2.4

circulator

an appliance with a rated input not exceeding 8 kW designed primarily for the supply of domestic hot water in conjunction with a separate storage vessel and for operation by gravity circulation

2.5

limit control

a temperature-actuated control intended to prevent the air discharge temperature from exceeding a specified limit

2.6

limit thermostat

the temperature sensing device which actuates a limit control

2.7

minimum operational rate

70 % of the minimum rate of the control system

2.8

overheat cut-off device

a temperature-actuated, pre-set, non-adjustable device designed to protect an appliance and its surroundings in the event of failure of the limit thermostat

2.9

rated heat input

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

2.10

setting pressure

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

2.11

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

2.12

range-rated appliance

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

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. 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:

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

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

Categories III, III_{TNL/B}, 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 the combustion air.

- a) *Type A: flueless appliances.*
- b) *Type B: open-flued appliances.*

c) *Type C: room-sealed appliances*. These comprise the following:

- 1) Type C₁: balanced-flue appliances.
- 2) Type C₂: Se-duct appliances.

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

NOTE 2 The relevant definitions of these types of appliances are given 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.

Appliances 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 the appliance

5.2.1 All appliances. The appliance shall be set up 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.

Family	Test gas	Inlet pressure
		mbar ^a
1st	TGA	17.5
2nd	NGA	20
3rd	LPGA	28
	LPGC	37
^a 1 mbar = 100 N/m ² = 100 Pa.		

Except where otherwise specified in section 2, an appliance requiring an electrical supply shall be connected to a 240 V 50 Hz 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.

5.2.2 Type B appliances. Except where otherwise specified in section 2, an appliance with a vertical flue outlet shall be tested with 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; 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.

5.2.3 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 in accordance with the manufacturer's instructions. Due account shall be taken of variations in duct and/or terminal lengths.

5.2.4 Type C₂ appliances. Except where otherwise specified in section 2, the appliance shall be tested in still air conditions with the connecting ducts assembled in accordance with the manufacturer's instructions, but not connected to a test duct. Due account shall be taken of variations in length of the ducts between the appliance and the Se-duct.

5.3 Test rig: water side

For the tests specified in clauses **10** and **16** and for other tests, if desired, the circulator 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 in section 2. 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 1, 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 circulator for preliminary setting of water flow rate and to allow spot checks to be made during tests.

5.4 Test conditions

5.4.1 The test conditions given in **5.4.2** to **5.4.7** shall apply except where otherwise specified in section 2.

5.4.2 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 **7.1** and **7.2**).

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

5.4.4 The air heater shall be operated to give a temperature rise of 50 ± 5 °C.

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

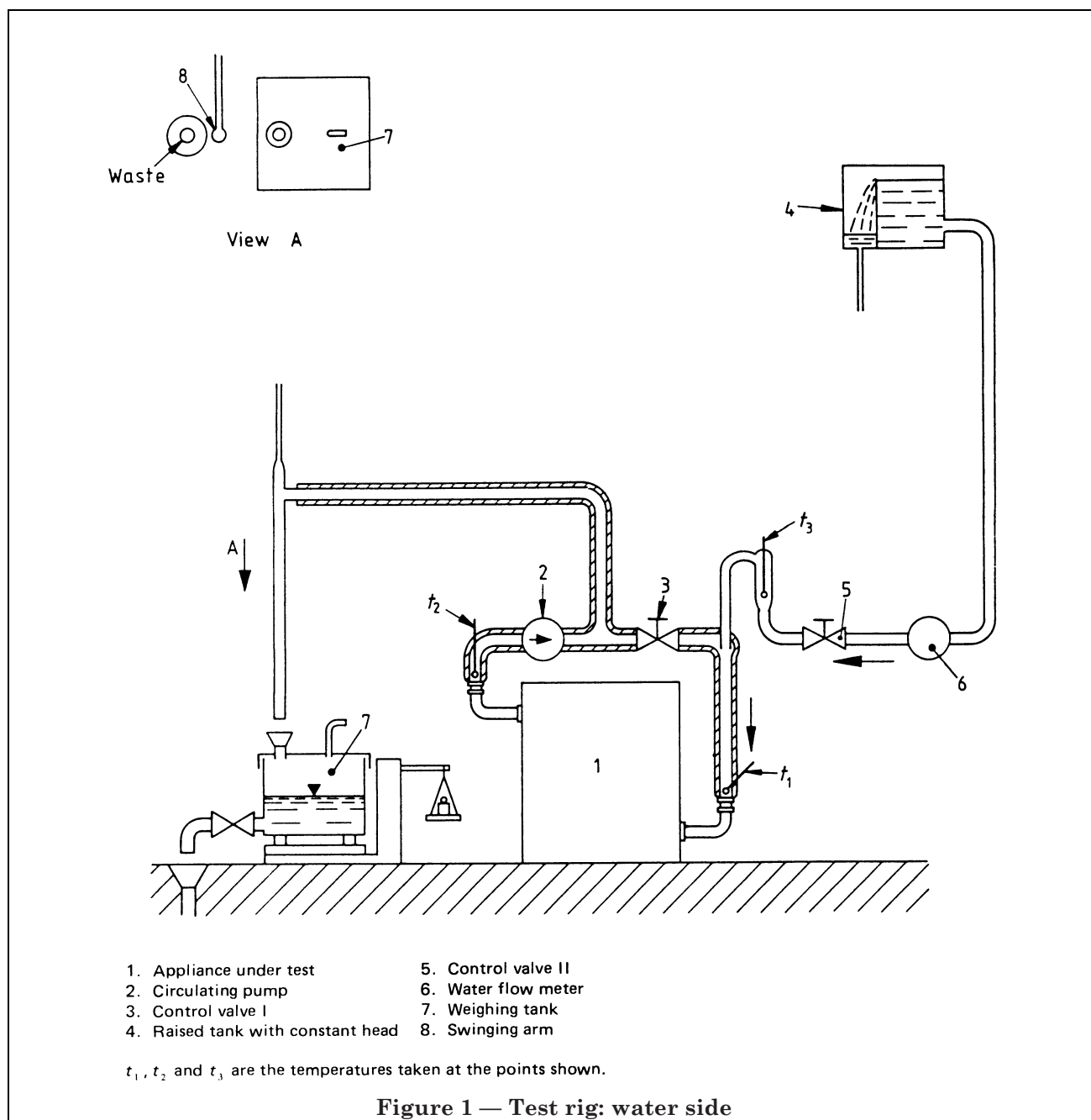
5.4.6 Precautions shall be taken to prevent thermostats or other variable controls from acting to interfere with the gas flow, except as necessitated by the test.

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.

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

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 test gas is LPGA; for appliances designed to burn propane, but not butane, the 3rd family reference test gas is LPGC.



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. The appliance shall be free from sharp edges that are liable to damage clothing or cause injuries.

Asbestos-containing materials shall not be used.

6.2 Component location

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.

Mechanical means shall be provided to secure the circulator firmly to the air heater.

The burners shall be positively located and so arranged that they cannot be misaligned.

It shall not be possible to loosen complete burner assemblies, jets or injectors without the use of tools.

For an appliance where the fitting of a circulator is optional, it shall be possible to fit the circulator and its flueways to the air heater without having to remove the latter from the installed position and without having to carry out any alteration work on the air heater, other than punching through knock-outs etc. in the casing and any alterations necessary to connect the gas supply to the circulator.

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 Bolts and screws

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

Where self-tapping screws are used to secure components that are removed during servicing, they shall engage into spring steel fasteners.

6.5 Aeration adjustment

There shall be no means of adjusting the primary aeration of Category I_T or Category I_N appliances. For other categories, the means of adjusting the primary aeration shall be preset and locked by the manufacturer.

6.6 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.

6.7 Deposits from appliance

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

6.8 Fans

The direction of rotation of fans shall be clearly marked.

Any belt drive in normal operation shall present no hazard. Means shall be provided to adjust belt tension.

Products of combustion shall not be drawn into the air distribution system under normal operating conditions or when user access panels are removed.

If it is necessary to remove a panel in order to light the pilot, the removal of the panel shall not provide access to the compartment housing the air-circulating fan.

Access to the compartment housing the air-circulating fan for maintenance shall not be possible without the use of tools.

All tests for temperature rise as required by BS 3456-101 shall be carried out with the appliance at thermal equilibrium when operated at rated heat input on reference test gas and also immediately after the appliance has been switched off.

6.9 Air filters

Provision shall be made for the fitting of an air filter. The filter shall be of either the cleanable or renewable type and shall be capable of easy and safe removal and replacement.

Air filter material shall possess ignitability characteristics designated P tested in accordance with BS 476-5.

6.10 Lint resistance of type B appliances

6.10.1 General. An appliance fitted with aerated burners and/or aerated pilots shall comply with **6.10.2** to **6.10.5**. 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 inlets.** Any opening(s) in the appliance casing for the supply of combustion air.

6.10.2 Ignition. After the appliance has been tested in accordance with **6.10.3** and Appendix A, the appliance shall comply with **10.2.1**.

6.10.3 Combustion

6.10.3.1 For type approval purposes, when the appliance is tested as described in Appendix A 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 shall be supplied 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 2 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 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 2 for the appropriate height of the air inlet above the floor, the CO/CO₂ ratio shall not exceed 0.02.

6.10.3.4 For the purposes of **6.10.3.2** and **6.10.3.3**, the height of the air inlet above the floor shall be as measured from the lowest edge of the air inlet to the floor. For wall mounted appliances, the measurement shall be that when the appliance is fitted at the minimum height permitted by the installation instructions.

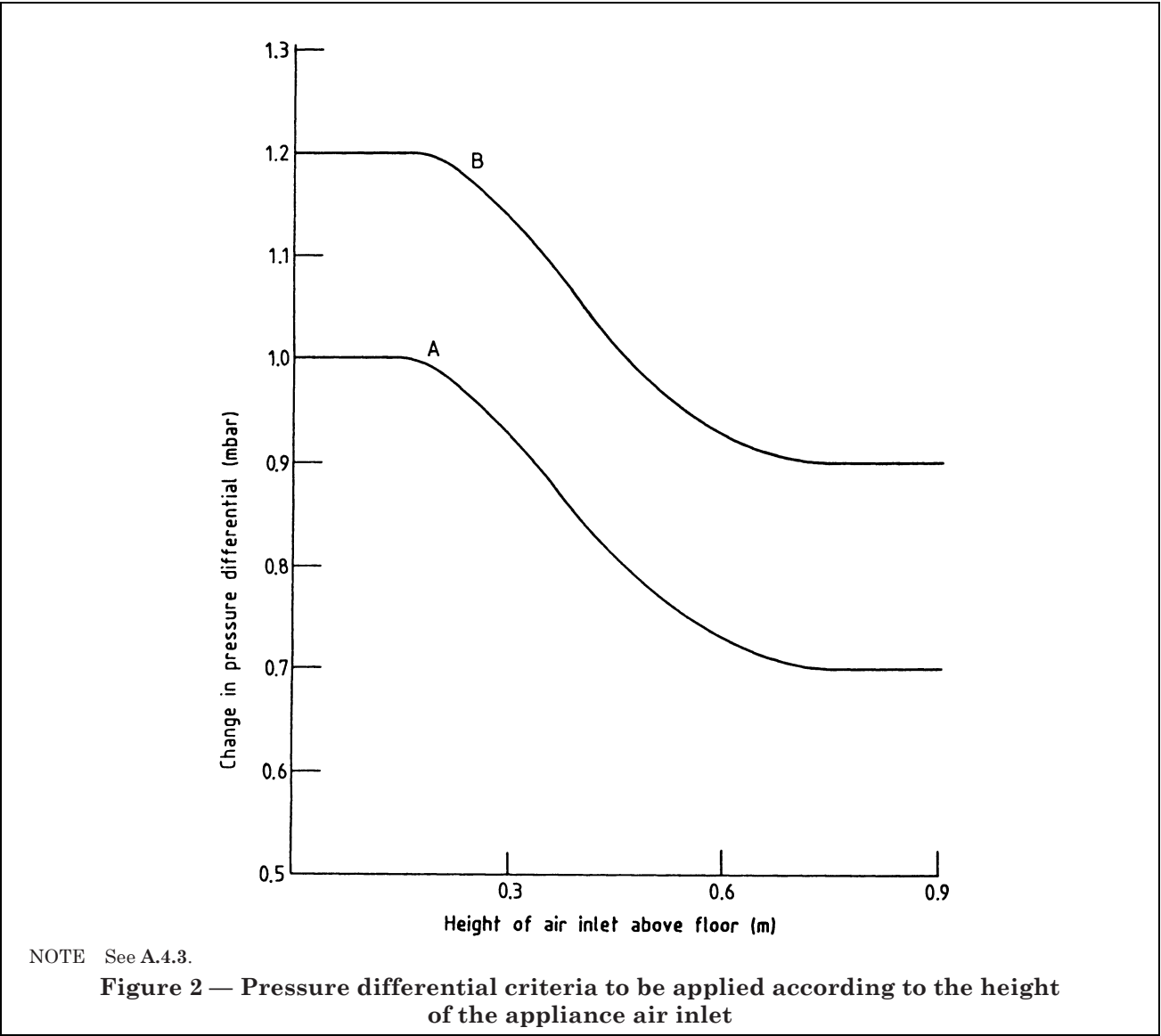
6.10.4 Cleanability

6.10.4.1 The manufacturer shall provide instructions for the cleaning of the complete 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 **A.4.9**, 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 not exhibit any appreciable accumulation of lint, on examination in accordance with **A.4.9**.

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



7 Soundness

7.1 Gas soundness

7.1.1 *General.* All gas-carrying parts of the combined 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

Where the appliance is for use on more than one gas family, one of which is 3rd family, the test pressure shall be 150 mbar.

This requirement shall be deemed to be met if the leakage rate does not exceed $130 \text{ cm}^3/\text{h}$ over a period of 1 min.

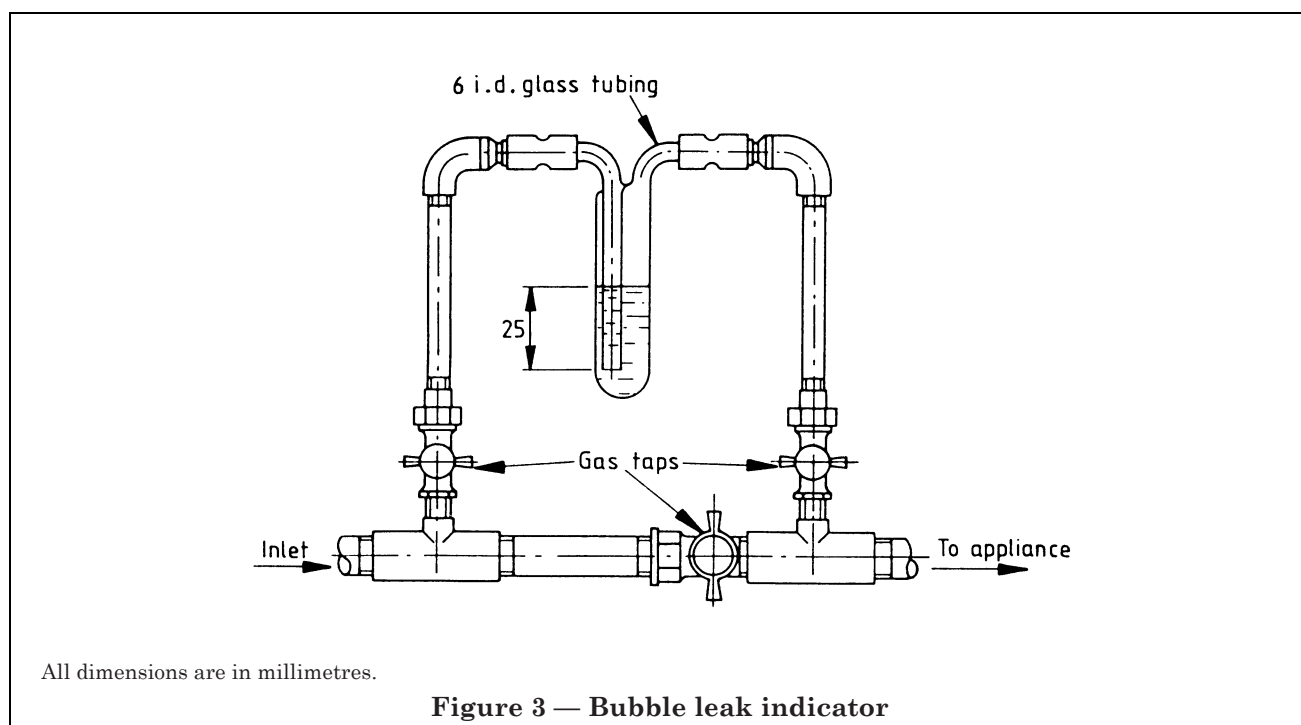
NOTE One convenient method of measuring the leakage rate is by the bubble leak indicator shown in Figure 3. A rate of nine bubbles per minute should be equivalent to $130 \text{ cm}^3/\text{h}$ but this should be checked before the indicator is used.

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:

- with all gas taps in the OFF position;
- with all gas taps turned to the ON position, the flame supervision device being maintained by suitable means in the open position and all injectors and pilots capped off;
- with all controls in the open position, except that control which in normal operation opens and closes the gas supply, and with pilots capped off.

Ensure that any means (e.g. thermal or mechanical) used to maintain the flame supervision device in the open position is compatible with the normal operation of the device.



7.2 Water soundness

The manufacturer shall state the maximum pressure to which the circulator can be subjected, together with the recommended range of working pressure.

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

7.3 Room sealing: type C appliances

NOTE All joints should be designed to make an effective seal without the use of any sealing compound.

7.3.1 Joints. Joints that need to be broken for servicing or maintenance shall be made without the use of a sealing compound, e.g. glues and pastes.

Where sealing compounds are required in fixed joints, the joint shall be such that the compound remains permanently in place.

7.3.2 Lighting door. Any lighting door shall be easy to close or replace to form a seal.