

Specification for

Non-domestic gas-fired overhead radiant tube heaters

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- British Combustion Equipment Manufacturers' Association
- British Gas plc
- Chartered Institution of Building Services Engineers
- Chief and Assistant Chief Fire Officers' Association
- Fire Offices Committee
- Health and Safety Executive
- Home Office
- Institution of Gas Engineers
- Liquefied Petroleum Gas Industry Technical Association (UK)
- Society of British Gas Industries
- Coopted members

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Foreword

This British Standard has been prepared under the direction of the Gas Standards Policy Committee to meet the need for a standard specifying the safety of, and associated methods of test for, non-domestic gas-fired overhead radiant tube heaters.

A radiant efficiency test method is being actively pursued in the UK and other EEC countries. When a suitable and generally acceptable method is agreed, appropriate requirements and methods of test will be incorporated in this standard.

This standard is therefore published initially as a safety and construction document but radiant efficiency requirements and methods of test will be added as a separate Section at the earliest possible time.

This standard partially supersedes BS 3561 and BS 4096, in respect of the appliances described in the scope.

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 20, 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 British Standard specifies the safety of, and associated methods of test for, non-domestic gas-fired overhead radiant tube heaters incorporating a single mechanically induced or forced draught burner under the control of a full sequence automatic control system, and having heat inputs not exceeding 60 kW¹⁾.

This standard applies to appliances designed for use on normal low pressure district supplies of 2nd and 3rd family gases and is only applicable to type A: flueless appliances and type B: open-flued appliances.

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. Where the control forms part of the installation and its application conforms with established practice, no reference is deemed necessary in this standard to the installation procedure.

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 page 20.

2 Definitions

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

2.1

cold condition

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

2.2

equivalent resistance

the resistance to flow in millibars, measured at the outlet of the appliance, which is equivalent to that of the actual flue

2.3

full sequence automatic control system

a control system which brings an appliance into operation from a completely shut down condition in response to an external demand without manual intervention

2.4

hot condition

a condition of the appliance required for some tests and obtained by heating to thermal equilibrium at the adjustment pressure, any thermostat remaining fully open

2.5

main gas flame ignition period

the period during which the spark may remain on and during which the main gas safety shut-off system is permitted to be open, before the flame safeguard system is required to supervise the main gas flame

2.6

minimum operational rate (2nd and 3rd family gases)

the heat input obtained when the appliance is adjusted to the minimum heat input and supplied with the appropriate reference gas at the following inlet pressures:

- | | |
|---------|------------|
| a) NGA | 12.5 mbar; |
| b) LPGA | 18 mbar; |
| c) LPGC | 23.5 mbar. |

2.7

overhead radiant tube heater

a gas fired appliance intended for installation above head level which is designed to heat the space beneath by radiation by means of a tube or tubes, heated by the internal passage of combustion products

2.8

single burner systems

those radiant tube heaters which employ a single combustion system incorporating independent flame monitoring and combustion air fan

2.9

start-gas flame

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

2.10

start-gas flame ignition period

the period during which the spark may remain on and during which the start-gas safety system is permitted to be open, before the flame safeguard system is required to supervise the start-gas flame

¹⁾ Consideration will be given to the inclusion in the near future of radiant efficiency requirements as a separate Section.

2.11
volatile lock-out

a safety shut-down condition of the control system such that restart takes place only after either manual intervention or an interruption of the electrical supply to the control of at least 50 ms duration and its subsequent restoration

2.12
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

2.13
adjustment pressure

the pressure, measured at the pressure test point, that is required to obtain the rated heat input, within a tolerance of $\pm 2\%$, using the appropriate reference test gas

3 Classification of appliances

3.1 General

Appliances are classified by category and by flue type.

3.2 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, these families being identified by subscripts, T, N and L for the 1st, 2nd and 3rd families respectively.

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

- a) Category $I_N, I_L, I_{L/B}, I_{L/P}$;
- b) Category $II_{NL}, II_{NL/B}, II_{NL/P}$.

3.3 Flue type

Appliances are classified according to the flue system for which they are designed (see Figure 1 to Figure 3):

- a) type A : flueless appliances
- b) type B : open-flued appliances
- c) type C : room-sealed appliance
 - 1) type C1 : balanced flue appliance
 - 2) type C2 : room-sealed appliance for connection to a Se-duct or a U-duct

Only types A and B are dealt with in this standard.

4 General requirements

Appliances 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.

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 can be influenced by the temperature of the ambient air, the room temperature shall be maintained at $20 \pm 50^\circ\text{C}$.

5.2 Preparation of appliance for testing

5.2.1 *General.* The appliance shall be set up in accordance with the manufacturer's instructions, with particular reference to minimum declared clearances round the appliance.

It shall then be adjusted in accordance with the manufacturer's instructions using the appropriate reference test gas at the inlet pressure specified in the following table.

NOTE For the convenience of carrying out tests, the appliance may be installed at a height above the floor which is other than that specified in the manufacturer's instructions, provided that this does not affect the performance of the heater.

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

^a 1 mbar = 100 N/m² = 100 Pa.

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 which might interfere with observations.

5.2.2 *Type A appliances.* When an appliance can optionally be fitted with a flue it shall also be tested according to the appropriate flue arrangement(s) specified as a type B appliance.

5.2.3 Type B appliances

5.2.3.1 *Type B appliances with draught diverters.* Unless a test method specifically requires otherwise, appliances with a vertical flue outlet shall be tested with a 1 m vertical secondary flue of the same nominal diameter as the flue outlet.

Appliances with a horizontal flue outlet shall be fitted in accordance with the manufacturer's instructions; these shall include the maximum length of horizontal run and the method of adaption to a vertical flue; thereafter the vertical flue shall be fitted as above.

The vertical flue shall be made from sheet metal having a metal thickness less than 1 mm. Unless otherwise stated, the flue shall be uninsulated.

5.2.3.2 Type B appliances without draught diverters.

Unless a test method specifically requires otherwise, appliances intended to be fitted to a flue having a wall termination shall be tested with a flue having the same diameter as the flue outlet and of the manufacturer's maximum equivalent resistance.

Unless a test method specifically requires otherwise, appliances intended to be fitted to a vertical flue shall be tested as follows:

- a) appliances with a vertical flue outlet shall be fitted with 1 m of vertical flue having the same diameter as the flue outlet;
- b) appliances with a horizontal flue outlet shall be fitted in accordance with the manufacturer's instructions; these shall include the maximum length of horizontal run and the method of adaption to a vertical flue; thereafter the vertical flue shall be fitted as above.

The flue shall be made from sheet metal having a metal thickness less than 1 mm. Unless otherwise stated the flue shall be uninsulated.

NOTE The fitting of a ducted air inlet supply to a type B appliance without a draught diverter effectively creates a type C appliance. Requirements for type C appliances are not included in this standard.

5.3 Test procedure

The appliance shall be examined for gas soundness before and after the tests specified in this standard.

Unless otherwise stated, the appliance shall be connected to a 240 V electrical supply, be at room temperature at the start of each test and be set at the adjustment pressure.

For appliances that are designed to be range rated, all tests shall be carried out at their maximum and minimum heat inputs.

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

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

NOTE 1 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 adjusting 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.

NOTE 2 BS 4947 gives guidance on the measurement of heat input.

NOTE 3 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 the appliance adjusted for butane and test gases LPGC and LPGE with the appliance adjusted for propane.

Section 2. Safety requirements and associated methods of test

6 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 condition arising in the part of the appliance in which they are used.

The appliance and its components shall be free from swarf, grit or other foreign matter.

6.2 Component location

Parts that are intended to be removable for maintenance or cleaning shall be readily accessible, shall be easy to assemble correctly and difficult to assemble incorrectly. Such parts shall be impossible to assemble incorrectly where incorrect assembly would create a hazardous condition or result in damage to the appliance and its controls.

The burner(s) shall be positively located and so arranged that misalignment cannot occur.

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

6.3 Injectors and jets

Injector and jet shall be marked for identification and their surface areas shall be non-adjustable.

6.4 Gas rate adjusters

If any means of adjustment to the heat input of the burner(s) is provided, it shall be designed to discourage unauthorized interference with the adjusting mechanism and shall not be liable to inadvertent movement. In addition for 3rd family gases the maximum rated heat input shall be obtained at the maximum outlet pressure of the controls when supplied with gas at the nominal inlet pressure (28 mbar butane and 37 mbar propane).

NOTE Suitable means of sealing the adjusting mechanism include lock nuts, locking wire with seal, a cover screw with a screwdriver slot or any means that requires the use of tools to gain access to the adjusting mechanism.

6.5 Aeration adjustment

Any means of adjusting the primary aeration shall be pre-set and locked by the manufacturer.

6.6 Materials in contact with gas

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

6.6.2 Solder. Solder that has a melting point less than 450 °C after application shall not be used for gas-carrying parts.

6.6.3 Non-metallic materials. Non-metallic materials incorporated in controls shall comply with the requirements of the relevant control standards. Jointing compounds shall comply with BS 5292.

6.7 Fire properties

The appliance shall be constructed of materials that are non-combustible as defined in BS 476-4.

Any coating that may be applied to the outside surface of the appliance and its components shall have class I surface spread of flame characteristics when tested in accordance with BS 476-7.

6.8 Fan outlet

The fan or appliance outlet of a type A appliance shall be so designed and arranged that it is protected against inadvertent blockage.

6.9 Gas connection

The gas connection on the appliance shall:

- have a jointing thread specified in clause 4 of BS 21:1985; or
- be suitable for direct connection to copper tube complying with BS 2871-1; or
- be suitable for direct connection to copper capillary and compression fittings complying with BS 864-2 or BS 2051-1 or BS 2051-2.

The gas connection shall be so secured that connections to the gas supply can be made without disturbing any controls or gas-carrying components of the appliance.

6.10 Bolts and screws

Holes for screwed fasteners and pins, which are used for the assembly of parts and for mounting, shall not penetrate gas ways. The wall thickness between holes (including threads) and gas ways shall be not less than 1 mm.

NOTE 1 Thread cutting screws are not recommended but where they are used to secure components that are removed during installation or servicing, they should engage with spring steel fasteners.

NOTE 2 Thread forming screws may be used provided that the thread so formed has a depth equivalent to a standard full nut.

6.11 Confirmation of operation

Means shall be provided to allow observation of any pilot flame during commissioning and servicing. If the means of observation is a viewing port, it shall, when located in an area of high temperature, be covered with heat resistant glass or equivalent material and sealed with a suitable heat resistant sealant.