

Specification for

Non-domestic space heaters burning town gas

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Co-operating organizations

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

- Association of Heating, Ventilating and Domestic Engineering Employers
- Gas Council*
- Institution of Gas Engineers*
- Ministry of Power
- Society of British Gas Industries*

The scientific and industrial 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:

- Fire Offices Committee
- Institution of Heating and Ventilating Engineers
- Ministry of Labour (Factory Inspectorate)

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Foreword

This standard makes reference to the following British Standards:

BS 7, *Rubber-insulated cables and flexible cords for electric power and lighting (for working voltages up to and including 11 kV).*

BS 21, *Pipe threads.*

BS 31, *Steel conduits and fittings for electrical wiring.*

BS 158, *Marking and arrangements of switchgear bus-bars, main connections and small wiring.*

BS 170, *Electrical performance of fractional horse-power motors and generators with class A insulation.*

BS 192, *Open-ended spanners (not including B.A. sizes).*

BS 249, *Leaded brass (58 per cent copper, 3 per cent lead) rods and sections (other than forging stock).*

BS 265, *Cold rolled brass sheet, strip and foil. Common brass.*

BS 567, *Asbestos cement flue pipes and fittings, light quality.*

BS 715, *Sheet metal flue pipes and accessories for gas-fired appliances.*

BS 729, *Zinc coatings on iron and steel articles.*

BS 731-1, *Flexible steel conduits and adaptors for the protection of electric cable.*

BS 794, *Transformers for low-voltage lighting below 1 kVA rating (excluding transformers for use in mines).*

BS 822, *Terminal markings for electrical machinery and apparatus.*

BS 822-5, *Terminal markings for input terminals of composite apparatus.*

BS 831, *Transformers for use with electrically-operated toys.*

BS 832, *Bell transformers (excluding transformers for use in mines).*

BS 835, *Asbestos cement flue pipes and fittings, heavy quality.*

BS 1041, *Code for temperature measurement.*

BS 1042, *Code for flow measurement.*

BS 1133, *Packaging code.*

BS 1179, *Glossary of terms used in the gas industry.*

BS 1224, *Electroplated coatings of nickel and chromium.*

BS 1250, *Domestic appliances burning town gas.*

BS 1250-1, *General requirements.*

BS 1250-3, *Water-heating appliances.*

BS 1250-4, *Space-heating appliances.*

BS 1344, *Methods of testing vitreous enamel finishes.*

BS 1400, *Schedule of copper alloy ingots and copper and copper alloy castings.*

BS 1552, *Control plug cocks for low pressure gas.*

BS 1756, *Methods for the sampling and analysis of flue gases.*

BS 1963, *Pressure-operated relay valves for use with town gas.*

BS 2004, *PVC-insulated cables and flexible cords for electric power and lighting.*

BS 2035, *Cast-iron flanged pipes and flanged fittings.*

BS 2706, *Non-ferrous conduit and conduit fittings (aluminium and zinc alloy).*

BS 2872, *Copper and copper alloys forging stock and forgings.*

BS 3042, *Standard test fingers for protection against electric shock and mechanical hazard.*

BS 3156, *Methods for the sampling and analysis of fuel gases.*

BS 3554, *Independent low pressure governors for appliances burning town gas.*

BS 3804, *Determination of the calorific value of fuel gases.*

This British Standard will help to ensure that the appliances covered by it are safe and will give good service, but it is necessary to point out that compliance with the standard does not of itself guarantee that satisfactory service will be obtained. Conditions of use vary greatly and it is necessary to relate the standards of performance to the actual use to which appliances will be subjected. There are also local preferences and customs which should be taken into account. For these reasons the co-operation of the local gas undertaking and of heating engineers concerned with the installation, maintenance and servicing of appliances should be sought when these are being selected.

NOTE The figures specified in British units are to be regarded as the standard. Approximate metric conversions may be made using the factors in Appendix S. More accurate conversions should be based on the tables in BS 350, "*Conversion factors and tables*".

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 vi, pages 1 to 42 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard covers the construction and performance of non-domestic space heaters burning town gas, but not their installation.

This standard is divided into Parts as follows:

- *Part 1: General requirements;*
- *Part 2: Air heaters, fan-assisted;*
- *Part 3: Overhead heaters, radiant type;*
- *Part 4: Flued convector heaters, natural convection;*
- *Part 5: Room sealed heaters (requirements additional to Part 2 or Part 4).*

Where performance standards are laid down for controls, they relate only to controls fitted as part of, or supplied with, particular appliances; they do not necessarily provide a complete specification for controls when they are intended for general use and are tested separately.

No specific reference is made in this standard to central heating boilers for non-domestic purposes, but it is intended that these rated at over 150,000 Btu/h shall satisfy the relevant requirements of BS 1250, Parts 1 and 3¹⁾.

For testing purposes, appliances shall be adjusted and operated in accordance with Appendix A and Appendix B.

Notwithstanding the requirements specified in this standard, any new designs, materials and methods of assembly giving at least equivalent results to those specified in this standard are acceptable.

Every appliance intended to conform to this standard shall comply with the general requirements of Part 1 and the specific requirements of other relevant parts.

All gas pressures quoted in this standard, unless otherwise stated, are in inches water gauge (in w.g.).

2 Definitions

For the purpose of this British Standard the definitions in the relevant British Standard Codes of Practice apply. Other definitions are given in BS 1179²⁾.

3 Safety

Safety requirements and recommendations specific to individual types of appliances are included in Part 1 and other relevant parts of this standard.

The standard does not cover appliances for installation where special fire hazards are present e.g. in garages or paint spray booths.

¹⁾ BS 1250, "Domestic appliances burning town gas". Part 1, "General requirements". Part 3, "Water-heating appliances".

²⁾ BS 1179, "Glossary of terms used in the gas industry".

Part 1: General requirements

4 Gas soundness

a) *Components*. For appliances operating on low pressure gas supply, controls, except for taps and cocks, shall be sound at an internal air pressure of 12 in w.g. when tested as in Appendix C. All fittings and components except controls shall be sound at a pressure of 100 in w.g.

b) *Complete assembly*. A fully assembled gas appliance shall be sound at a pressure of 12 in w.g. when tested as in Appendix C³⁾.

5 Electrical requirements

a) *Wiring*. Cables and flexible cords which are not liable to exceed a temperature of 140 °F (60 °C) under working conditions shall conform to BS 7 or BS 2004⁴⁾. Other wiring which is likely to exceed 140 °F (60 °C) under working conditions shall be continuously insulated in a suitable manner, e.g. with an impregnated asbestos covering or a mineral insulated metal sheathed cable. Where mechanical protection is considered necessary, wiring shall be run in conduits suitable for the purpose. Flexible conduits shall comply with BS 731, Part 1⁵⁾; rigid conduits shall comply with BS 31 or BS 2706⁶⁾.

b) *Bushings for cables and cords*. Where cables and cords pass through metal, the holes through which they pass shall be suitably shaped or bushed to prevent damage to the insulating covering of the conductors.

c) *Electrical termination*. The materials, design and protection of all terminals shall be such that neither the terminals nor the conductors connected to them overheat in service.

The electrical input terminals of the appliance shall be clearly and permanently identified either

- i) by marking L, N and E to indicate “line”, “neutral” and “earth” respectively for single phase or L₁, L₂, L₃, N and E for three phase (see BS 822, Part 5⁷⁾), or

- ii) by colouring with red, black and green (green/yellow) for single phase or with red, yellow, blue, black and green (green/yellow) for three phase (see BS 158⁸⁾), or

- iii) by indicating the terminals by figures on an adjacent “as seen” wiring diagram [see Clause 23 c)].

Other terminals intended for connection to devices external to the appliance shall be suitably and permanently identified.

Electrical connections on the permanent wiring of the heater shall be made by suitable screwed terminal arrangements of rigid construction or, if the connection is to be made under the head of a screw or bolt, a cup-shaped washer or equivalent device suitable for repeated use shall be provided. Any electrical plugs and sockets incorporated to facilitate servicing shall be of the safety type and it shall not be possible for reconnection to be made incorrectly.

Where necessary, provision shall be made to facilitate the conduit connection. Where connection to the supply is intended to be made by a flexible cord a suitable cord grip and bush shall be provided.

d) *Earthing*. The earthing terminal shall be connected by an earth continuity conductor to all exposed metal parts which might become live in the event of electrical breakdown. These parts include casings of electromagnetic gas valves, motors, thermostats and the heater frame and casing. The sheath of flexible metal conduit shall not be regarded as providing adequate earthing. The resistance shall not exceed 0.1 ohm between any metal part of the heater intended to be earthed and the earthing terminal with a current of 10 amp, or a current approximately equal to the full load current of the heater, whichever is the greater, in a d.c. circuit of voltage not exceeding 6 volts or $0.2 \times$ (full load current in amperes), whichever is the greater.

³⁾ Where the specified test is impracticable, a solution of soap in water may be used instead of the bubble leak indicator to detect leaks at joints. Particular attention should be paid to the assembly of all connectors and compression joints and to the proper fitting of non-aerated jets.

⁴⁾ BS 7, “Rubber-insulated cables and flexible cords for electric power and lighting”.
BS 2004, “PVC-insulated cables and flexible cords for electric power and lighting”.

⁵⁾ BS 731-1, “Flexible steel conduits and adaptors for the protection of electric cable”.

⁶⁾ BS 31, “Steel conduits and fittings for electrical wiring”.

BS 2706, “Non-ferrous conduit and conduit fittings (aluminium and zinc alloy)”.

⁷⁾ BS 822, “Terminal markings for electrical machinery and apparatus”. Part 5, “Terminal markings for input terminals of composite apparatus”.

⁸⁾ BS 158, “Markings and arrangements of switchgear bus-bars, main connections and small wiring”.

e) *Insulation resistance.* The insulation resistance between the electrical circuit and the frame of the heater, when measured at normal room temperature with a voltage of not less than 500 v d.c., shall not be less than the following:

- i) Heaters incorporating an electric motor or a winding of some form such as the winding of a transformer or control coil: 1 megohm.
- ii) Heaters which do not incorporate either an electric motor or a winding of any type: 100 megohms.

f) *Protection of live parts.* Live components of the heater shall be so protected by suitable guards, shields or screens of adequate size, strength and durability that they are not liable to be touched accidentally. Compliance may be checked by applying the test finger specified in BS 3042⁹⁾.

g) *Thermostats and switches.* Thermostats and single pole switches, where used, shall be connected between the "Line" terminal and the power consuming components.

h) *Electrical rating of thermostats.* Thermostats designed for operating on main circuits shall be suitable for 20 to 60 c/s a.c. up to 250 volts r.m.s. (or 440 volts r.m.s. for three phase) and shall be capable of interrupting repeatedly a current at least equal to the fuse rated current for the circuit in which the thermostat is placed.

j) *Transformers.*

- i) Transformers should be suitable for use from a maximum supply voltage of 250 volts, single phase, at a rated frequency of 50 c/s.
- ii) Any transformer supplying a secondary circuit to which the user of the appliance has easy access, or which by nature of the situation of the components in the secondary circuit, the presence of water, or any other circumstances might present an unusually great shock hazard to the user, shall be of the double wound type having separate input and output windings and an output not exceeding 55 volts.

iii) All double wound transformers shall be suitably earthed at some point of the secondary circuit if the output is less than 25 volts or shall be earthed at the mid point of the secondary winding if the output is 25 volts or over. They shall comply with the requirements of BS 794, BS 831 or BS 832¹⁰⁾ as appropriate if the output does not exceed 55 volts.

iv) The secondary circuit(s) of all transformers shall be suitably fused, but fuses integral with the transformer are not essential.

v) The metallic transformer core, interwinding earthing screen, and metallic case, if fitted, shall be earthed.

vi) The transformer shall be mounted rigidly and in such a position that in operation the ambient temperature does not exceed 105 °F (40 °C), unless specifically designed for higher temperatures.

vii) The transformer shall be fitted with suitable input and output terminals, or other means of connection, and these terminals shall have indelible markings indicating the respective windings and the appropriate rated voltages including tappings.

NOTE In the case of a transformer having a single primary winding and a single secondary winding (i.e. no tappings whatever), it is permissible to indicate only the primary and secondary sides of the transformer.

k) *Motors.* Any electric motor fitted to an appliance shall comply with BS 170¹¹⁾.

6 Gas connections

Gas inlet connections shall be suitable for connection either to tapered thread installation pipes to BS 21¹²⁾ (i.e. internal threads may be either tapered or parallel, but external threads shall be tapered), or to flanged pipes and fittings to BS 2035¹³⁾. They shall also be easily accessible for connecting and disconnecting the appliance.

⁹⁾ BS 3042, "Standard test fingers for protection against electric shock and mechanical hazard".

¹⁰⁾ BS 794, "Transformers for low-voltage lighting below 1 kVA rating".

BS 831, "Transformers for use with electrically-operated toys".

BS 832, "Bell transformers".

¹¹⁾ BS 170, "Electrical performance of fractional horse-power motors and generators with class A insulation".

¹²⁾ BS 21, "Pipe threads".

¹³⁾ BS 2035, "Cast iron flanged pipes and flanged fittings".

7 Fittings and materials

Suitable fittings and materials are covered by appropriate British Standards, but other types of fittings or materials may be used provided that the standards of performance, durability and safety of the appliance are not thereby lowered. Relevant British Standards are listed in Appendix R and the manufacturer should state to the testing authority where these standards have been adopted.

8 Heat input

All appliances shall be fitted with a governor (see Clause 17) and if the burners are aerated they shall be fitted with fixed injectors. The heat input of the burner or combination of burners intended for independent use, up to and including the total number of burners fitted, shall be within ± 5 per cent of the heat input stated by the manufacturer for such a burner or combination, when the appliance is tested with the governor removed or put out of action and at the setting pressure stated by the manufacturer. The heat input shall be checked at the mean Wobbe number (see Appendix A) of one group, and where practicable of each group, with the manufacturer's recommended injector or jet sizes and in accordance with the method laid down in Appendix B.

With all the controls on the appliance and the governor at their maximum setting and the appliance fully heated, the heat input shall be not more than 30 per cent above the manufacturer's rating at a gas inlet pressure of 4 in w.g.

9 Ignition

There shall be easy access for lighting and ignition of the main burner shall be smooth on all test gases (see Appendix A) by the means of ignition intended. Under the working conditions, as defined in the relevant part of this standard, the burner flame shall light across to all ports or jets on the same burner and each independent burner to which the gas supply is opened shall light either from the common pilot, or from an independent pilot, or from another independent burner already alight. Where practicable, the flames should be visible, either directly or by reflection, when the appliance is working.

When the appliance has been adjusted according to the manufacturer's recommendation at 3 in w.g. inlet pressure, lighting across of the burner shall take place quietly at this inlet pressure and also when the inlet pressure is reduced to 2 in w.g. An appliance with a manual low rate control shall give satisfactory ignition when the inlet pressure is reduced to give 50 per cent of the normal rating. Tests shall be made under both cold and heated-up conditions; these tests are of special importance with appliances having flash tube ignition, when the flash tube must function satisfactorily on all test gases in both hot and cold conditions.

Where the main burner is to be ignited from a pilot flame, it shall not be possible for gas to emerge from the main burner without being smoothly ignited by the pilot flame.

When extra low voltage filament ignition is employed, satisfactory ignition shall occur at all inlet gas pressures between 2 and 10 in w.g. when the supply voltage to the appliance is at the nominal value for which the appliance is intended or at any value down to 15 per cent less than this nominal.

If the gas flow to the main burner is controlled by an electrical device such as a solenoid valve in combination with the filament and there is not a flame safety device, ignition shall take place, if the gas is allowed to pass, down to 20 per cent less than the nominal supply voltage for which the appliance is intended. Ignition should preferably take place at the lowest supply voltage at which the device will allow gas to pass.

If a system relies on filament breakage to cause an interruption of supply to an electrically controlled gas valve, the filament shall be positioned and the conductors to the filament insulated to ensure proper operation of the device.

10 Pilot

A pilot filter should preferably be provided and shall be easily replaceable if fitted. Pilots and pilot tubes shall be positively located and should be placed to eliminate as far as possible blockage due to gas cracking or deposits.

Pilot jets should be of a suitable ceramic or other non-corrodible material.

It is desirable that pilots should be governed separately from the main burners, especially on the larger heaters.

11 Flame failure device

A flame failure device, initially at room temperature, shall open fully in not more than 120 seconds and shall close from the fully-heated condition within 90 seconds when tested as specified in Appendix D, except that a time greater than 90 seconds is permitted if this involves no significant sacrifice of safety. A protective device shall be designed, in case of breakdown, to cut off the gas supply.

Where the pilot flame of a flame failure device is also used to ignite the main burner, the device shall shut down before the pilot flame becomes short enough to fail to ignite the main burner.

12 Combustion performance

a) *Combustion standard.* The combustion standard is that the CO/CO₂ ratio (see note below) shall not exceed 0.02 when the appliance is tested as prescribed; any additional requirements in the relevant parts of this standard shall also be satisfied.

Tests shall be made at a sufficient number of heat input rates to determine the combustion performance over the operational range of the heater and up to 20 per cent above normal rate. No extrapolation of the curve obtained by plotting CO/CO₂ against heat input shall be made.

Sampling points shall be selected as specified in Appendix B. The method of sampling and the analysis of the gases is described in BS 1756¹⁴⁾.

NOTE When carbon compounds burn without the formation of free carbon, the relative proportion of carbon monoxide and carbon dioxide in the combustion products provides a substantially accurate basis for assessment of the completeness of combustion. Moreover, this proportion, expressed as a ratio of the concentration of the two gases, is a reliable indication of the stage at which combustion deteriorates rapidly. The concentrations of the two gases can be determined conveniently with adequate accuracy by a variety of methods (see BS 1756) and the ratio is not appreciably affected by dilution of the products of combustion during sampling. It is therefore adopted as the criterion of the combustion performance. For the present purposes, the method used for the determination of carbon monoxide shall be accurate to ± 10 per cent at concentrations of 0.01 per cent of carbon monoxide and over, while that used for carbon dioxide shall be accurate to ± 5 per cent at concentrations of 1 per cent of carbon dioxide and over; the carbon dioxide concentration shall not be less than 1 per cent in a sample used for the determination of CO/CO₂ ratio. The methods of sampling and analysis may require modification to suit particular appliances.

b) *Sooting.* A non-aerated appliance having restricted combustion space shall not show an internal accumulation of soot likely to interfere with proper operation of the appliance, when fitted up as in Figure 2, operated from cold at the normal rating with test gas TGE (see Appendix A) and turned off after 30 minutes.

NOTE Repeated inhalation of benzene vapour, even to a modest degree, can, over a period of several months, result in fatal toxic effects. Any benzene process should be enclosed or carried out in a fume cupboard if practicable.

13 Flame stability

The appliance shall satisfy the tests for flame stability described below, any variation of conditions of test or additional tests being specified in the appropriate parts of this standard.

a) *In still air.*

i) *Burners.* The flame of an aerated burner appliance, adjusted to full rate according to the manufacturer's instructions on test gas TGA, shall not light back when the gas is changed to test gas TGC.

On an appliance with a non-aerated burner adjusted on test gas TGD to normal rating, the flame shall not be extinguished by blowing off in either the hot or cold conditions. At normal rating the appliance shall be free from roar when fully heated on test gas TGA.

ii) *Pilots (non-aerated).* Ensure that any pilot filter is correctly fitted before making these tests. Set the pilot to give a flame of the length specified by the manufacturer at an inlet pressure to the appliance of 2.5 in w.g. with test gas TGD. The pilot flame shall not be extinguished when the inlet pressure is increased to 5 in w.g.

The test is made with the pilot only on and repeated with the pilot and main burner on.

b) *In draughty conditions.* When subjected to a draught of 7.5 ft/s, the flame of an aerated burner appliance, set to the manufacturer's instructions on test gas TGA and at full gas rate, shall not light back or be extinguished.

When subjected to this same draught, the flame of a non-aerated appliance, set on test gas TGA and at full gas rate, shall not be extinguished when the appliance is lit from cold, nor when it is fully heated.

To apply the draught test, a portable axial flow type fan of at least 12 in (30 cm) diameter is used and the distance from it at which the wind speed is 7.5 ft/s is found using a vane anemometer.

¹⁴⁾ BS 1756, "Methods for the sampling and analysis of flue gases".

The fan is then placed at this distance from the heater and the air stream directed at the heater. A shield is placed between fan and heater and, immediately the appliance is lit, this shield is removed for periods of 3 seconds so that gusting is experienced. This test is repeated at steps of 30° round the heater in a horizontal plane.

14 External temperatures

a) *Surface temperatures.* When tested as stipulated in Appendix E.1 no portion of the surface of an appliance (other than the working surface) likely to be accidentally touched shall exceed 250 °F (121 °C) or preferably 200 °F (93 °C). The term “working surface” includes such surfaces as the radiating surfaces of a radiant heater and the outlet grilles of a convector heater.

The temperature of surfaces which have to be touched while the gas is alight shall not exceed 140 °F (60 °C) in the case of good thermal conductors or 150 °F (66 °C) in the case of poor thermal conductors and shall preferably not exceed 120 °F (49 °C) in either case.

The temperature of non-metallic flexible diaphragms in gas carrying components shall not exceed 140 °F (60 °C).

NOTE Special consideration should be given to surface temperatures of appliances for schools and public buildings and to the requirements of local regulations. It may be necessary to fit protective guards to prevent touching of the hot surfaces of appliances.

b) *Floor and wall temperatures.* An appliance shall not give rise to wall temperatures above 150 °F (66 °C) and, other than one intended to be fitted on a protective base, shall not give rise to floor temperatures above 150 °F (66 °C), when tested as described in Appendix E.2.

It is strongly recommended that appliances should be designed for siting and fitting in any position, without the necessity of special precautions being taken to obviate the occurrence of excessive surface temperatures. Also, especially where high temperatures are likely to arise, instructions should be provided on the siting of appliances and the precautions which it may be necessary to take in special circumstances. Where such precautions are required it is also recommended that protective shields, e.g. a concrete base, should be supplied with the appliance.

c) *Ceiling temperature.* An appliance intended to be fitted, or which may be fitted, under a combustible or plaster ceiling shall not give rise to a ceiling temperature greater than 150 °F (66 °C) when tested as described in Appendix E.3. A minimum distance which satisfies this requirement shall be stated on the fixing instructions supplied with the heater and the reference point on the heater from which this distance is measured shall be clearly stated.

d) *Convected air temperature.* The convected air temperature shall be limited as indicated in the various parts. Unless otherwise stated the inlet air temperature is assumed to be 60 °F (15.5 °C). Measurements should be made with a base metal thermocouple of 22 S.W.G. (0.028 in, 0.71 mm) wire in conjunction with an indicator capable of giving an accuracy of ± 1 degF (± 0.5 degC).

15 Thermal efficiency

The thermal efficiency, based on the gross calorific value of the gas, shall be to the standard required in the appropriate part. Measurements and calculations shall be carried out as described in Appendix F.

16 Cocks and taps

a) *Materials.* The bodies, plugs, washers and nuts of cocks and taps shall be made from copper-base alloys or other suitable materials. All other components covered by this clause shall be made from copper-base alloys, cast iron, aluminium alloys or other suitable materials.

Suitable materials are specified in the following British Standards, but others may be used provided that the standards of performance, durability and safety of the appliance are not thereby lowered:

	Material	Application
BS 2872	Copper and copper alloys forging stock and forgings CZ 122: Lead brass, 58 % copper, 2 % lead.	Hot pressed bodies, plugs and washers
BS 249	Lead brass (58 per cent copper, 3 per cent lead) rods and sections (other than forging stock).	Nuts, etc.
BS 265	Cold rolled brass sheet, strip and foil. Common brass.	Washers
BS 1400	Copper alloy ingots and castings B3-C: Brass castings LG2-C: Gunmetal castings	Bodies, plugs and washers

b) *Operation.* Cocks and taps shall be designed or positioned to avoid inadvertent operation but shall be easy to operate when required. They shall be so designed that in operation ON and OFF: positions are readily distinguishable. Handles should preferably turn off clockwise, or from left to right, or vertically downwards. Any pilot cock shall be clearly distinguishable and consideration should be given to interlocking the pilot and main cocks.

If the method of operation of the controls is not likely to be clear to the user, an instruction plate should be fitted in the vicinity of the appliance tap. If any main cock needs to be accessible for the operation of an appliance, this should be stated clearly in the fitting instructions.

Cocks and taps shall be easy to turn at the highest working temperature obtained on the appliance and they shall be gas tight at that temperature (see Appendix C for the method of test).

c) *Construction.* Cocks and taps used for the purpose of ON — OFF operation shall be provided with positive stops at the ON and OFF positions, except that special-purpose taps (e.g. for ignition or low rate combustion) may have a movement beyond the ON position.

Niting shall be by means of a niting washer *except* that pin niting shall be permitted provided that the pin is securely fixed and cannot be displaced or damaged in normal use.

Cocks and taps shall be fitted with a securely fixed key, unless there is a special reason for providing a removable key, in which case it shall be replaceable only in the correct position.

Where a plug type tap is used, it is preferable that the plug be recessed at the larger diameter into the body and the body recessed at the smaller diameter, to prevent the formation of a shoulder by wear in either the body or the plug. The seal for the bore between plug and body shall be adequate and even for the smallest tap shall not be less than $\frac{1}{8}$ in (3 mm).

d) *Manufacture and assembly.* The quality of work and the cleanliness of these components shall be in accordance with BS 1552¹⁵⁾, Clause 6.

The lubricant shall be non-corrosive and shall withstand the maximum working temperature to which the cock or tap is liable to be subjected.

17 Governors

Governors shall comply with BS 3554¹⁶⁾. A pressure governor shall maintain the outlet pressure to the appliance within ± 0.25 in w.g. of its nominal value over 100 to 30 per cent of the range of gas rates, when tested over a range of inlet pressures from 10 in w.g. down to 3.5 in w.g., or 0.5 in w.g. in excess of the nominal outlet pressure, whichever is the lower. The nominal outlet pressure should preferably be 2.5 in w.g.

When a spring-loaded governor is provided with an accessible adjustment, means shall be provided for limiting the maximum outlet pressure available as required in the relevant part of this standard.

Where a governor is used as a control for varying the gas rate in use, the outlet pressure giving the recommended G.4 setting pressure shall be taken as the nominal outlet pressure.

18 Relay valves

Relay valves shall comply with the appropriate requirements of BS 1963¹⁷⁾.

19 Thermostats

a) *General.*

1) *Setting marks.* The settings shall be indicated by easily distinguishable durable markings.

2) *Sealing.* A sealing or locking device shall be provided to prevent interference with calibration.

3) *Room thermostat.* The instructions issued with the appliance shall recommend a suitable type of room thermostat, if required, and its method of use.

b) *Gas-operated thermostats.*

i) *Cleanable valve.* The thermostat should be so designed that the valve can be withdrawn from the body and, after cleaning, replaced without the temperature calibration being altered. If this is the case, this operation shall be possible without the necessity of first removing the complete thermostat from the appliance.

¹⁵⁾ BS 1552, "Control plug cocks for low-pressure gas".

¹⁶⁾ BS 3554, "Independent low-pressure governors for appliances burning town gas".

¹⁷⁾ BS 1963, "Pressure-operated relay valves for use with town gas".

ii) *By-pass*. The by-pass orifice shall be readily accessible for cleaning and should be non-adjustable. Thermostats for use with relay valves shall have no by-pass.

c) *Electrically operated thermostats*.

i) *Electrical requirements*. Electrically operated thermostats shall comply with the relevant paragraphs of Clause 5.

ii) *Tests*. Performance tests on thermostats for the various classes of appliance are described in the relevant parts of this standard.

20 Flue system

a) *Connections*. Connections for round flue pipes shall be such as to accommodate flue pipes complying with BS 567, BS 715 or BS 835¹⁸⁾, as appropriate.

b) *Natural draught*. A draught diverter shall be fitted to or included with an appliance intended to be ventilated to the outside air, except where the appliance is designed to work on a balanced flue principle, which is covered in Part 5. An appliance with draught diverter shall meet the following requirements:

i) When tested as described in Appendix T.1, all the products of combustion shall pass through the secondary flue.

ii) When tested as described in Appendix T.2, the CO/CO₂ ratio shall not exceed 0.02.

iii) When tested as described in Appendix T.3, the CO/CO₂ ratio shall not exceed 0.02; there shall be no appreciable distortion or disturbance of the flame and pilots shall remain stable; any thermal cutoff or flame failure device shall continue to function normally.

iv) When tested as described in Appendix T.4, the thermal efficiency shall not fall below 63 per cent.

c) *Fan assisted draught*. Where mechanical draught is applied in any form to assist the removal of products of combustion, a draught diverter or some form of draught stabilizer will generally be necessary to ensure satisfactory performance in accordance with the relevant combustion and flame stability requirements.

d) *Fan control*. When a fan is integral with the appliance to assist in the supply of combustion air, a control shall be provided to cut off the gas supply to the burner if the total flow through the appliance falls to the point where the CO/CO₂ ratio exceeds 0.2 at normal gas rate.

e) *Design and position*. The flue outlet shall be so designed and positioned that it is not liable to obstruction, e.g. by products of corrosion or air borne dirt, and that staining of the walls and ceiling is minimized.

21 Finish and accessories

a) *Concealed gas supplies*. Concealed tubes and fittings liable to be functionally damaged by heat or corrosion shall be suitably protected.

b) *Water supplies*. All water-carrying tubes and components shall be corrosion resistant under the conditions of use to which the appliance will normally be subjected and shall comply with the requirements of the British Waterworks Association.

c) *Painted surfaces*. Visible painted surfaces shall be tested for resistance to scratching as described in Appendix G. The hardness shall be such that a scratch completely through the film is not obtained. The scratch shall be free from jagged edges of width greater than 0.04 in (1 mm).

d) *Heat resistance*. When the appliance is tested as described in the relevant parts of this standard, including Clause 25, there shall be no appreciable change of colour on any part of the appliance sufficient to detract from the external appearance and the finish of parts shall not become tacky or show other signs of deterioration.

The material and finish shall be such that excessive smoke is not emitted from the appliance when first lit and that after 24 hours' use no detectable odour is produced when the appliance is operated normally.

e) *Unpainted surfaces*. Unpainted surfaces shall not, on visual examination, show any defects (e.g. pinholes, blisters, roughness or exposed areas of metal) which might cause undue deterioration in use. The external finish shall be easily cleanable.

¹⁸⁾ BS 567, "Asbestos cement flue pipes and fittings, light quality".
BS 715, "Sheet metal flue pipes and accessories for gas fired appliances".
BS 835, "Asbestos cement flue pipes and fittings, heavy quality".