

Specification for

Non-domestic space heaters —

Burning liquefied petroleum gases

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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:

- Gas Council*
- Heating and Ventilating Contractors' Association
- Institution of Gas Engineers*
- Liquefied Petroleum Gas Industry Technical Committee*
- 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:

- Chief Fire Officers' Association
- Fire Officers' Committee
- Home Office
- Institution of Heating and Ventilating Engineers
- Ministry of Labour (H.M. Factory Inspectorate)
- National Federation of Building Trades Employers
- National Institute of Agricultural Engineering

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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 arrangement of switchgear busbars, main connections and small wiring.*
- BS 170, *The electrical performance of fractional horse-power electric motors and generators.*
- BS 192, *Open-ended spanners (not including B.A. sizes).*
- 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 — Part 1: Hot-dip galvanized coatings.*
- BS 731-1, *Flexible steel conduit and adaptors for the protection of electric cable.*
- BS 822, *Terminal markings for electrical machinery and apparatus — Part 5: Terminal markings for input terminals of composite apparatus.*
- BS 835, *Asbestos cement flue pipes and fittings, heavy quality.*
- BS 848, *Methods of testing fans for general purposes, including mine fans. Part 1: Performance.*
- BS 864, *Capillary and compression fittings of copper and copper alloy for use with copper tube complying with BS 659 and BS 1386.*
- BS 894, *Ubbelohde apparatus for flow and drop points.*
- BS 903, *Method of testing vulcanized rubber — Part A19: Accelerated ageing tests.*
- BS 1041, *Code for temperature measurement.*
- BS 1042, *Code for flow measurement.*
- BS 1179, *Glossary of terms used in the gas industry.*
- BS 1224:1965, *Electroplated coatings of nickel and chromium.*
- BS 1250, *Domestic appliances burning town gas — Part 4: Space heating appliances.*
- BS 1344, *Methods of testing vitreous enamel finishes — Part 3: Resistance to products of combustion — Part 7: Resistance to heat.*
- BS 1344:1947, *Methods of testing vitreous enamel finishes.*
- BS 1706, *Electroplated coatings of cadmium and zinc on iron and steel.*
- BS 1756, *Methods for the sampling and analysis of flue gases.*
- BS 1842, *Double-ended open-jawed spanners for B.A. hexagon sizes.*
- 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 2051, *Tube and pipe fittings for engineering purposes — Part 1: Copper and copper alloy capillary and compression tube fittings (for use with fractional o.d. sizes of tubes) — Part 2: Olive, soldered nipple and flared types of copper and copper alloy tube fittings (for use with fractional o.d. sizes of tubes).*
- BS 2558, *Tubular box spanners.*
- BS 2569, *Sprayed metal coatings.*
- BS 2613, *The electrical performance of rotating electrical machinery.*
- BS 2706, *Non-ferrous conduit and conduit fittings (aluminium and zinc alloy).*

BS 2989, *Hot-dip galvanized plain steel sheet and coil.*

BS 3016, *Pressure regulators for use with butane/propane gases — Part 1: Low pressure regulators for use with butane gas — Part 2: Low pressure regulators for use with propane gas — Part 3: Variable high pressure regulators.*

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

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

BS 3212, *Flexible tubing or hose (including connections where fitted) for use in butane/propane gas installations.*

BS 3245, *Jointing compounds for use in liquefied petroleum gas appliances and installations.*

BS 3535, *Safety isolating transformers for industrial and domestic purposes.*

BS 3804, *Methods for the determination of the calorific value of fuel gases.*

BS 4201, *Thermostats for gas burning appliances.*

BS 4161, *Gas meters.*

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 distributors and of heating engineers concerned with the installation, maintenance and servicing of appliances should be sought when these are being selected.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 39 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 General

1.1 Scope

1.1.1 This British Standard specifies the construction, operation, performance and safety requirements of non-domestic space heaters designed for use with either commercial butane or commercial propane or both, but not their installation. This standard does not cover catalytic heaters and appliances for installation where special fire hazards are present, e.g. in garages or paint spray booths.

The technical requirements of this standard are grouped into five sections, as follows:

- 2 General requirements
- 3 Air heaters, fan assisted
- 4 Radiant heaters
- 5 Convector heaters, natural convection
- 6 Room sealed heaters (requirements additional to Section 3 or 5).

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.

For testing purposes, appliances shall be adjusted and operated in accordance with Appendix A, using test gases as specified in Appendix B.

For low pressure operation, the standard pressure for commercial butane shall be 11 in (28 cm) water gauge (w.g.) and for commercial propane shall be 14 in (36 cm) w.g. For high pressure operation above 14 in w.g., the maximum working pressure shall be 30 lbf/in² (2.1 kgf/cm²).

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

Every appliance intended to conform to this standard shall comply with the general requirements of Section 2 and the specific requirements of other relevant sections.

1.2 Definitions

1.2.1 For the purposes of this British Standard the definitions in BS 1179¹⁾ or in the relevant British Standard Code of Practice apply.

1.3 Underload and overload conditions

1.3.1 For fixed pressure appliances, underload and overload conditions shall be those of an inlet gas pressure 30 % below and above the normal operating pressure. For appliances with variable pressure regulation, they shall be 10 % below the minimum and 10 % above the maximum operating pressures.

1.4 Instructions

1.4.1 Instructions for fitting, safe use and consumer maintenance shall be supplied with each appliance. Each instruction card, sheet or leaflet shall clearly state the gas or gases for which the appliance is designed, the working pressures and the corresponding rated inputs in Btu/h. In addition, the instruction leaflet accompanying each appliance shall contain a statement that the appliance has been designed to comply with this British Standard.

1.5 Marking

1.5.1 The appliance shall be clearly and permanently marked with:

- 1) the manufacturer's name or trade mark and model name or number.
- 2) an indication of the gas or gases and the supply pressure for which the appliance is designed, together with the rated input in Btu/h. Where variable pressure regulation applies, the minimum and maximum pressures shall be indicated.
- 3) the operating voltage, nature of supply and amperage, where electrical equipment is incorporated.
- 4) any special instructions necessary for the safe use of the appliance, e.g. the provision of a guard on an appliance operating less than 7 ft 6 in from the ground.

NOTE The mark BS 4096 on or in relation to the product is a claim by the manufacturer that it complies with the requirements of the standard.

The British Standards Institution is the owner of a registered certification trade mark. This is shown below, enclosed in the words "Approved to British Standard". This mark can be used only by manufacturers licensed under the certification mark scheme operated by the BSI. The presence of this mark on or in relation to a product is an assurance that the goods have been produced to comply with the requirements of the British Standard under a system of supervision, control and testing operated during manufacture and including periodical inspection at the manufacturer's works in accordance with the certification mark scheme of the BSI.



¹⁾ BS 1179, "Glossary of terms used in the gas industry".

2 General requirements

2.1 Workmanship

2.1.1 The appliance, including all the component parts, shall be soundly constructed and of a high standard of workmanship and finish.

2.2 Fittings and materials

2.2.1 Suitable fittings and materials are covered by appropriate British Standards, but other types of fittings and materials may be used provided that the standards of performance, durability and safety of the appliance are not thereby lowered.

2.3 Design for maintenance

2.3.1 The appliance, including all the component parts, shall be easy to clean and to maintain in good working order. There shall be easy access to accessories and controls for maintenance and adjustment.

Burners and parts of burners (other than jets) of different capacity shall only be interchangeable if the performance is not affected.

Parts which are intended to be removable by the user shall be easy to replace correctly and difficult to assemble incorrectly.

All nuts, bolts and fittings having spanner flats should be capable of being moved by spanners complying with BS 192, BS 1842 or BS 2558²⁾, or should be readily accessible to an adjustable spanner.

2.4 Finishes

2.4.1 General. The finishes shall, on visual examination, show no defects (such as pinholes, blisters, roughness or exposed areas of metal) which might give rise to unduly rapid deterioration in use.

2.4.2 Accessories. The corrosion resistance of screws, nuts, bolts, washers and springs shall be appropriate to the conditions of use.

2.4.3 Vitreous enamel

2.4.3.1 Where the component is subject to attack by products of combustion, it shall be tested by the method given in BS 1344, Part 3³⁾ and shall meet the requirements for Class SA.

2.4.3.2 Where the component is subject to high temperature, it shall pass the test given in BS 1344, Part 7³⁾.

2.4.4 Plated finishes. Nickel and chromium plated metal parts shall have a standard of adhesion and resistance to corrosion equal to the requirements of BS 1224:1965, Service Grade No. 4S or 4C⁴⁾. The acetic salt test, Appendix H of BS 1224:1965, shall be applied for a period of eight hours. Other plated finishes shall comply with the appropriate British Standard, e.g. BS 1706⁵⁾.

2.4.5 Paint and similar finishes. Surfaces finished in stoved paint or similar material shall comply with the following requirements:

1) **RESISTANCE TO HEATING.** When the appliance is operated at the overload pressure for a period of 200 hours, there shall be no appreciable change of colour on any part of the appliance and the finish shall not become tacky or show other signs of deterioration. This does not apply to parts such as burners or other parts which come into direct contact with the flame.

After the initial burning-off period there shall be no odour from the paint when the appliance is operated normally.

2) **RESISTANCE TO SCRATCHING.** The resistance to scratching shall be such that it shall not fail the test described in Appendix C.

2.4.6 Metallized finishes. Galvanized parts shall comply with BS 729, Part 1⁶⁾, or BS 2989⁷⁾, as appropriate, and sprayed metal coatings shall comply with BS 2569⁸⁾.

²⁾ BS 192, "Open-ended spanners (not including B.A. sizes)."
BS 1842, "Double-ended open-jawed spanners for B.S. hexagon sizes."
BS 2558, "Tubular box spanners."

³⁾ BS 1344, "Methods of testing vitreous enamel finishes".
Part 3, "Resistance to products of combustion"
Part 7, "Resistance to heat".

⁴⁾ BS 1224:1965, "Electroplated coatings of nickel and chromium."

⁵⁾ BS 1706, "Electroplated coatings of cadmium and zinc on iron and steel."

⁶⁾ BS 729, "Zinc coatings on iron and steel articles", Part 1, "Hot-dip galvanized coatings".

⁷⁾ BS 2989, "Hot-dip galvanized plain steel sheet and coil".

⁸⁾ BS 2569, "Sprayed metal coatings".

2.5 Tap and valve construction

2.5.1 Tapered plug type taps. Taps shall be so made that in normal use and with reasonable application of lubricant the gas passages do not become blocked. They shall have dimensions not less than those shown on Figure 2.

Each taper plug shall be spring-loaded to maintain a gastight fit. If a coil spring is used, its ends shall be flattened. It shall not be possible to cause a gas leak during manual operation of the tap.

A gas tap shall be designed, marked or positioned to avoid inadvertent operation, but shall be easy to operate when required. It shall be so designed that in operation the "ON" and "OFF" positions are readily distinguishable. Handles should turn off clockwise or from left to right.

A gas tap used for the purpose of ON-OFF operation shall be provided with positioned stops at the ON and OFF position except that special purpose taps may have movement beyond the FULL ON position.

The means of igniting adopted shall be sufficiently robust to avoid distortion or damage in normal use. It should be impossible for a tap to be opened inadvertently. The taps shall be so situated that they can be operated without the hand being likely to touch hot parts and the body of the tap should preferably not become hotter than 120 °F (49 °C) on full operation of the appliance.

2.5.2 Needle valves. Needle valves shall be so designed that it is impossible to withdraw the valve stem completely in the normal operation of the valve. It shall be impossible for any valve to be opened inadvertently.

The valves shall be so situated that they can be operated without the hand being likely to touch hot parts.

The material of valve seats and O-rings shall have a good resistance to commercial butane and propane. After immersion in pentane for 72 hours it shall not show a weight or volume change greater than 10 %. The material shall not show appreciable evidence of deterioration when subjected to the accelerated ageing test described in BS 903, Part A19, Method B⁹⁾.

2.5.3 Diaphragm valves (mainly for on/off control). Diaphragm valves shall be of such a construction that it is impossible to withdraw the operating knob and spindle completely during normal operation. A visual means of indication shall be given for the direction of opening and closing.

The valve seating shall be of good smooth finish so that a fully closed position can be obtained with normal hand pressure.

The diaphragm material shall be as specified in 2.5.2 for seats and O-rings.

Valves should preferably be provided with a device which prevents leakage past the spindle should the diaphragm rupture.

Valve bodies shall not leak when tested hydraulically to 300 lbf/in² (21 kgf/cm²) with the valve opened and the end blanked off. If valves are painted, this test shall be carried out before painting. The valves shall be gas tight when tested under water with air or nitrogen at a pressure of 200 lbf/in² (14 kgf/cm²).

A code shall be stamped on the valve to indicate that it is suitable for commercial butane and propane.

2.5.4 Lubricants. Lubricants for taps shall be resistant to the gas and shall have a drop point as determined in BS 894¹⁰⁾ in excess of the maximum working temperature of the tap or valve.

2.6 Gas soundness

2.6.1 General. All gas carrying parts of an appliance shall be sound and these parts when connected shall form a complete assembly which is sound. The basic test shall be carried out on the complete assembly but additional and more stringent tests are necessary for certain components to ensure an adequate margin of safety.

2.6.2 Components. Gas cocks and valves which form part of the assembly and castings which are intended to carry gas under pressure shall be sound at an internal air pressure of 5 lbf/in² (0.35 kgf/cm²), for low pressure appliances, or three times the maximum working pressure for high pressure appliances, whichever is the greater.

2.6.3 Complete assembly. The fully assembled appliance shall be sound at an internal air pressure of 2 lbf/in² (0.14 kgf/cm²), for low pressure appliances, or three times the maximum working pressure, for high pressure appliances, when connected to an air supply which maintains a constant pressure and which embodies a suitable meter for measuring air flow.

The duration of the test shall be at least 1 minute and the assembly shall be deemed sound if the leakage rate does not exceed 0.003 ft³/h (85 cm³/h) in each of the following conditions:

- 1) With all gas taps closed.
- 2) With each control (other than a thermostat) in turn closed but all other taps and controls open.

⁹⁾ BS 903, "Methods of testing vulcanized rubber", Part A19, "Accelerated ageing tests".

¹⁰⁾ BS 894, "Ubbelohde apparatus for flow and drop points".

- 3) With the jets sealed and all taps and controls open.

When the flame failure device is closed, the total gas passing, other than to the pilot, shall not exceed 0.1 ft³/h (2 832 cm³/h) with an inlet pressure of 14 in (36 cm) w.g.

2.7 Thermostats

2.7.1 General requirements

2.7.1.1 BRITISH STANDARD FOR THERMOSTATS. Thermostats shall comply with the relevant appropriate requirements of BS 4201¹¹⁾.

2.7.1.2 SETTING MARKS. The settings shall be indicated by easily distinguishable durable markings.

2.7.1.3 SEALING. A sealing or locking device shall be provided to prevent interference with calibration.

2.7.1.4 ROOM THERMOSTAT. The instructions issued with the appliance shall recommend a suitable type of thermostat, if required, and its method of installation and use.

The design of the thermostat and the materials and the finishes used in its construction shall be such as to provide many years' normal use without any deterioration which would impair its function or the safety of the operator.

Materials liable to shrinkage under normal conditions of use shall not be used where such shrinkage would lead to unsound electrical connections.

The thermostat shall be provided with a means of adjustment such that the operating temperature can be varied smoothly and progressively over the range declared by the manufacturer.

2.7.1.5 TESTING. Performance tests on thermostats for the various classes of appliance are described in the relevant parts of BS 4201¹¹⁾.

2.7.2 Gas operated thermostats

2.7.2.1 CLEANABLE VALVE. The thermostat shall be so designed that the valve can be withdrawn from the body and, after cleaning, replaced without the temperature calibration being altered. This operation shall be possible without the necessity of first removing the complete thermostat from the appliance.

2.7.2.2 BYPASS. The bypass orifice shall be readily accessible for cleaning and shall be non-adjustable. Thermostats for use with relay valves shall have no bypass.

2.7.3 Electrically operated thermostats. Electrically operated thermostats shall comply with the relevant subclauses of 2.9.

2.8 Relay valves

2.8.1 Relay valves shall comply with the relevant requirements of BS 1963¹²⁾.

2.9 Electrical components

2.9.1 Operation. The electrical components should be designed to operate on an a.c. supply having a frequency of 50 cycles per second, unless otherwise specified.

Devices shall operate when the supply voltage is 10 % below the lowest voltage for which they are intended. On voltages below this, they shall either operate correctly or fail to safety.

2.9.2 Constructional methods and workmanship

2.9.2.1 GENERAL. Electrical components shall be soundly constructed and of a high standard of workmanship and finish. Their individual parts shall be securely fixed and shall not work loose as a result of normal operation.

2.9.2.2 INSULATION. The insulation shall be such as to give the user of the device adequate protection against shock and shall be sufficiently strong to resist mechanical damage under normal service conditions.

2.9.2.3 COVERS AND CASINGS. Covers and casings of sheet metal adjacent to live parts shall be so constructed that they cannot readily be deformed and brought into contact with or allow access to live parts.

2.9.2.4 ROUGH EDGES AND BURRS. Edges of sheet metal and other materials, including in particular all wireways, shall be smooth and free from burrs, to avoid risk of injury to the insulation on conductors or to the user of the device.

2.9.2.5 CASE OR PROTECTIVE COVER. Any case or protective cover shall be substantial, sufficiently rigid and so disposed as to avoid risk of deformation under conditions likely to be encountered in use; it shall afford adequate protection to all current carrying parts enclosed by it.

¹¹⁾ BS 4201, "Thermostats for gas burning appliances".

¹²⁾ BS 1963, "Pressure operated relay valves for use with town gas".

2.9.3 Wiring. Cables and flexible cords which are so positioned that the combination of ambient temperature and temperature rise due to load results in a continuous conductor temperature not exceeding 140 °F (60 °C) under working conditions shall conform to BS 7¹³⁾ or BS 2004¹⁴⁾. Cables positioned where the combination of ambient temperature and temperature rise due to load results in a continuous conductor temperature which is likely to exceed 140 °F (60 °C) under working conditions shall be continuously thermally insulated in a suitable manner, e.g., with an impregnated abestos covering on a mineral insulated metal sheathed cable. Where mechanical protection is considered necessary, wiring should be run in conduits suitable for the purpose. Flexible conduits shall comply with BS 731, Part 1¹⁵⁾, rigid conduits shall comply with BS 31¹⁶⁾ or BS 2706¹⁷⁾.

2.9.4 Bushes. Where external leads, including flexible cords, pass through metal, the holes through which they pass shall be suitably shaped or bushed to prevent damage to the insulating cover of the leads. Bushes shall be of such a type, or so secured, that they will not easily become detached in normal usage of the appliance. The cord shall be reinforced in the neighbourhood of the bush if, in normal use of the appliance, there is severe flexing at this point. Metal springs are not regarded as suitable reinforcement.

2.9.5 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 by one of the following methods:

- 1) By marking "L" "N" and "E" to indicate "LIVE" "NEUTRAL" and "EARTH" respectively for single phase or L₁, L₂, L₃, N and E for three phase (in accordance with BS 822-5¹⁸⁾).
- 2) 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 in accordance with BS 158¹⁹⁾.
- 3) By indicating the terminals by figures or letters on an adjacent wiring diagram.

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. Terminals to which flexible conductors are to be connected shall be designed to retain the strands of the conductor. 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. Terminals shall be so fixed that they will not work loose when conductor clamping screws are tightened or loosened. Any electrical plugs and sockets incorporated to facilitate servicing shall be of the safety type and it shall not be possible for re-connection 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.

The flexible cord (of the type normally supplied for use with the device), when correctly fixed in the device as in service except that the conductors shall not be connected to the terminals, shall withstand a direct pull of at least 10 lbf (4.5 kgf) applied gradually, with the appliance held stationary, without moving noticeably in the cord grip.

The insulation at the ends of each conductor shall not be excessively removed, shall not fray and if necessary shall be protected against fraying or mechanical damage by sleeving.

Connections shall not loosen under normal conditions of use when they are wired with conductors of the rating appropriate to the device, as stated in the Regulations for the Electrical Equipment of Buildings, issued by the Institution of Electrical Engineers. Terminal screws shall engage at least two full threads.

In pillar-type terminals the screws shall be of sufficient length to extend to the far side of the terminal hole and shall be of a diameter approximately equal to that of the hole. The ends of the screws shall be rounded or chamfered to prevent damage to the conductors and the side of the hole against which the screw bears shall be smooth and unbroken.

¹³⁾ BS 7, "Rubber-insulated cables and flexible cords for electric power and lighting".

¹⁴⁾ BS 2004, "PVC-insulated cables and flexible cords for electric power and lighting".

¹⁵⁾ BS 731, Part 1, "Flexible steel conduit and adaptors for the protection of electric cable".

¹⁶⁾ BS 31, "Steel conduits and fittings for electrical wiring".

¹⁷⁾ BS 2706, "Non-ferrous conduit and conduit fittings".

¹⁸⁾ BS 822, "Terminal markings for electrical machinery and apparatus", Part 5, "Terminal markings for input terminals of composite apparatus".

¹⁹⁾ BS 158, "Marking and arrangement of switchgear busbars, main connections and small wiring".

Where it is impossible to avoid damp conditions, terminals shall be housed within a weatherproof enclosure which shall be moisture resisting.

Terminal or connection boxes shall be of sufficient size to accommodate wiring joints or terminal blocks without crowding, and each box shall have a removable inspection plate.

Screw threads shall be in accordance with one of the appropriate British Standards. A self tapping screw shall not be used for any form of electrical connection.

2.9.6 Earthing

2.9.6.1 All devices having exposed non-current carrying metal parts other than those referred to in **2.9.6.3** below shall be provided with a substantial terminal having contact surfaces which do not readily oxidize or corrode in air, or other equally effective means for the attachment of an earth continuity conductor; this terminal or other means shall be in effective electrical contact with all such exposed metal.

2.9.6.2 If an appliance which, according to **2.9.6.1**, requires an earthing terminal is supplied complete with flexible cord, that cord shall contain a third conductor which shall be coloured green and which shall be connected to the earth terminal.

2.9.6.3 The following metal parts are excluded from the requirements of **2.9.6.1**:

Lamp caps.

Shades, reflectors and guards supported on holders or fittings of non-conducting material.

Metal parts on, or screwed in or through, non-conducting material and separated by such material from current-carrying parts and from earthed non-current-carrying parts in such a way that in normal usage they cannot become alive or come into contact with earthed parts.

Metal parts which are separated from all current-carrying parts by earthed metal in such a manner that no path which does not pass through earthed metal exists between the metal part and any current-carrying part.

2.9.6.4 Earthing terminals and the like shall be made of non-rusting metal; the contact surfaces shall be bare metal and they shall be positively locked so that it is not possible for them to loosen during transit and normal use.

2.9.6.5 A main marked earthed terminal shall be fitted to an appliance for use by an installing electrician as required and shall be electrically bonded to the appliance earth continuity conductor. It shall not require removal during replacement or adjustment of the gas carrying components of the appliance.

2.9.7 Earthing continuity. The resistance shall not exceed 0.1 ohm between any metal part of the device intended to be earthed and

- 1) the earthing conductor, if the device is fitted with a flexible cord,
- 2) the earthing terminal, if the device is supplied without a flexible cord,
- 3) the shroud of the apparatus connector, if the device is fitted with a removable connector.

The test shall be made with a current of 10 amp, or a current approximately equal to the full load current of the device, whichever is the greater, in a d.c. circuit of a voltage not exceeding 6 volts or $0.2 \times$ full load current in amperes, whichever is the greater.

2.9.8 Insulation resistance. The insulation resistance between the live and neutral conductors and the frame of the device, when measured at normal room temperature with a voltage of not less than 500 volts d.c., shall be not less than the following:

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

2.9.9 High voltage

2.9.9.1 Every device shall be capable of withstanding a voltage of 1 000 volts r.m.s. applied for one minute between live parts and frame. The test voltage shall be alternating, of approximately sine wave form and of any convenient frequency between 25 and 100 cycles per second.

2.9.9.2 In addition to the foregoing test, devices included in **2.9.8** 1) and 2) shall satisfy the requirements of a test under the conditions of **2.9.9.1** immediately after the device has been on a circuit for one hour.

2.9.10 Protection of live parts. Live components of the heater shall be protected by suitable guards, shields or screens of adequate size, strength and durability such that they are not liable to be touched accidentally. Compliance may be checked by applying the test finger specified in BS 3042²⁰⁾.

²⁰⁾ BS 3042, "Standard test fingers for checking protection against electric shock and mechanical hazard".

It shall not be possible to contact any live parts with the test finger with the appliance in any position of use, including routine cleaning.

The method of application of the test finger shall be as indicated in BS 3042²¹⁾ and for the purpose of this test removable or interchangeable parts intended for removal by the user of the appliance during the course of normal operational use (including maintenance or repair) may be removed.

Panels may also be removed for the purpose of the test.

Exemption: Earthed extra low voltage circuits which are isolated from the electrical supply and the contacts of lampholders when the lamp is removed are exempted from this test.

2.9.11 Switches

2.9.11.1 A mains isolating switch need not be fitted on the appliance, but in the absence of such a switch the installation instructions shall draw attention to the necessity of providing means to interrupt the supply. The cover exposing conductors in the appliance shall carry a permanent label drawing attention to the necessity of isolating before removal of such a cover.

2.9.11.2 Either double or single pole switches may be fitted to the appliance, but if the latter are used the switch must be fitted to interrupt the live conductor.

2.9.11.3 Hand operated switches shall have permanent markings indicating their different positions including every OFF position. The switch and markings shall be fixed in relation to one another in such a manner that they cannot be misaligned.

2.9.11.4 Micro-gap switches are permissible provided that they are suited to the application and are suitably sited. They should have earthed metal actuators or actuators of durable insulating material.

2.9.11.5 When switches are mounted where they may come into contact with moisture, they shall be totally waterproofed to prevent ingress of moisture.

2.9.12 Transformers

2.9.12.1 Any transformer supplying a secondary circuit to which the user of the appliance has 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 a 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.

2.9.12.2 All double wound transformers shall be suitably earthed at one point in 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 appropriate requirements of BS 3535²²⁾ if the output does not exceed 110 volts.

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

2.9.12.4 The transformer shall be mounted rigidly and in such a position that in operation the ambient temperature shall not exceed 104 °F (40 °C), unless specifically designed for higher temperatures.

2.9.12.5 The input and output shall be clearly indicated (e.g. *primary* and *secondary*) and the input terminals shall be indelibly marked to indicate the various voltages where a selection is provided.

2.9.13 Motors. Any electric motor fitted to an appliance shall comply with BS 170²³⁾ or BS 2613²⁴⁾. If thermal overload devices are fitted, they shall be provided with a manual re-set.

²¹⁾ BS 3042, "Standard test fingers for checking protection against electric shock and mechanical hazard".

²²⁾ BS 3535, "Safety isolating transformers for industrial and domestic purposes".

²³⁾ BS 170, "The electrical performance of fractional horsepower electric motors and generators".

²⁴⁾ BS 2613, "The electrical performance of rotating electrical machinery".

2.10 Gas connections

2.10.1 When threaded gas connections are provided they shall be suitable for connection either to tapered thread installation pipes to BS 21²⁵⁾ (i.e. internal threads may be either tapered or parallel, but external threads shall be tapered), or to flanged pipes and fittings to BS 2035²⁶⁾. They shall also be easily accessible for connecting and disconnecting the appliance. Compression fittings shall comply with BS 864²⁷⁾ or BS 2051, Parts 1 and 2²⁸⁾. Flexible hoses shall comply with BS 3212²⁹⁾. Jointing compounds shall comply with BS 3245³⁰⁾.

2.11 Aerated pilots

2.11.1 Aerated pilots and pilot tubes shall be positively located with respect to the main burner and shall be placed to eliminate as far as possible blockage due to gas cracking or deposit.

2.12 Flame failure device

2.12.1 The fitting of a flame failure device is desirable. A flame failure device shall be fitted to any appliance which has a burner rated above 20 000 Btu/h and which is mounted within a confined space or when the flames or the effect of flames (e.g. a glowing surface) cannot be seen readily.

2.12.2 The device shall be so designed that in the case of mechanical or electrical fault the gas supply to the main burner or burners shall be shut off.

2.12.3 Except where otherwise stated in Sections 3–6, a flame failure device when tested as specified in Appendix D shall open fully from cold in not more than 90 seconds and shall close from the fully heated condition within 90 seconds. Furthermore, no device shall require more than 40 seconds of sustained manual operation before opening. For this test low pressure flame failure valves shall be subjected to an inlet pressure of 11 in (28 cm) w.g. of test gas LPG A and high pressure flame failure valves shall be subjected to twice the design operating pressure of the appliance using test gas LPG C. Closure of the device shall be considered complete when the device is passing not more than 0.05 ft³/h (1 416 cm³/h) of test gas at the maximum operating pressure.

2.12.4 The arrangement of any flame failure device shall be such that, in the event of the pilot flame shortening, the valve in the device shall close the supply of gas to the main burner before ignition becomes violent.

2.12.5 Where ignition of the main burner is by a pilot flame other than the flame operating the flame failure device, these two flames shall cross light at all pressures down to the pressure at which the failure device operates and, having cross-lit, shall ignite the main burner within 5 seconds. Any intermediate cross lighting flames between these two pilot flames should be extinguished during this test and these tests should apply when the inlet pressure is reduced to give not more than 50 % of the normal rating.

2.13 Ignition and flame travel

2.13.1 There shall be easy access for lighting, and the ignition of the main burner shall be smooth on all test gases (see Appendix B) by the means of ignition intended. It shall be easy to see if the gas is ignited. 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 a common pilot, or from an independent pilot, or from another independent burner already alight. Where practicable, the flames shall be visible, either directly or by reflection, when the appliance is working.

When the appliance has been adjusted according to the manufacturer's recommendations, lighting across the burner shall take place quietly at underload and overload pressures on test gas LPG A or LPG C, as applicable.

Appliances designed for low rate control shall give satisfactory ignition when the inlet pressure is reduced to give 50 % of normal rating (this applies only to low pressure appliances). 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.

²⁵⁾ BS 21, "Pipe threads".

²⁶⁾ BS 2035, "Cast iron flanged pipes and flanged fittings".

²⁷⁾ BS 864, "Capillary and compression fittings of copper and copper alloy for use with copper tube complying with BS 659 and BS 1386".

²⁸⁾ BS 2051, "Tube and pipe fittings for engineering purposes", Part 1, "Copper and copper alloy capillary and compression tube fittings", Part 2, "Olive, soldered nipple and flared types of copper and copper alloy tube fittings".

²⁹⁾ BS 3212, "Flexible tubing or hose (including connections where fitted) for use in butane/propane gas installations".

³⁰⁾ BS 3245, "Jointing compounds for use in liquefied petroleum gas appliances and installations".