

Specification for safety and rational use of energy of domestic gas appliances —

Part 2: Combined appliances: Gas fire/back boiler

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- Electricity Association
- Royal Society for the Prevention of Accidents
- Society of British Gas Industries

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Foreword

This standard has been prepared under the direction of the Engineering Section Board, E/-, and is a revision of BS 5258-8:1989 and BS 6332-3:1984, all of which will be withdrawn, on publication of this standard.

Matters related to quality assurance systems, tests during production and to certificates of conformity of auxiliary devices are not dealt with.

The test gases, test pressures and appliance categories specified in this standard are in accordance with those specified in BS EN 437.

A Guide to the clauses of this British Standard addressing the Essential Requirements of the Gas Appliance Directive (GAD) is given in Annex C.

In particular attention is drawn to the following:

The Gas Appliances (Safety) Regulations 1995 SI No. 1629[1].

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its 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 74, an inside back cover and a back cover.

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1 Scope

This standard specifies the requirements and methods of test for the construction, safety, performance, classification and marking of gas-fired appliances consisting of a back boiler and a gas fire. These appliances are intended for installation with a governed or regulated gas supply.

This standard applies to open flued appliances using 2nd and/or 3rd family gases only.

This standard does not apply to:

- back circulators;
- catalytic combustion appliances;
- appliances in which the supply of combustion air, or the movement of convected air, is achieved by mechanical means;
- appliances intended for direct heating of sanitary water;
- gas fires with a range-rating capability.

This standard only covers type testing.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 1179:1967, *Glossary of terms used in the gas industry.*

BS 5258-8:1980, *Safety of domestic gas appliances — Combined appliances: Gas fire/back boiler.*

BS EN 88:1991, *Pressure governors for gas appliances.*

BS EN 125:1991, *Specification for flame supervision devices for gas-burning appliances — Thermoelectric types.*

BS EN 126:1995, *Multifunctional controls for gas burning appliances.*

BS EN 161:1991, *Automatic shut-off valves for gas burners and gas appliances.*

BS EN 257:1995, *Mechanical thermostats for gas burning appliances.*

BS EN 298:1994, *Automatic gas burner control systems for gas burners and gas-burning appliances with or without fans.*

BS EN 437:1997, *Specification for test gases, test pressures and categories of appliances, for gas appliances.*

BS EN 484:1998, *Specification for dedicated liquefied petroleum gas appliances — Independent hotplates, including those incorporating a grill for outdoor use.*

BS EN 50165:1997, *Electrical equipment of non-electric appliances for household and similar purposes — Safety requirements.*

BS EN 60730-2-9:2002, *Specification for automatic electrical controls for household and similar use — Particular requirements — Particular requirements for temperature sensing controls.*

IEC 817:1984, *Spring operated impact test apparatus and its calibration.*

ISO 7-1:1995, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation.*

ISO 228-1:2000, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation.*

ISO 228-2:1987, *Pipe threads where pressure-tight joints are not made on the threads — Part 2: Verification by means of limit gauges.*

ISO 274:1975, *Copper tubes of circulation section — Dimensions.*

ISO 7005-1:1992, *Metallic flanges — Part 1: Steel flanges.*

ISO 7005-2:1998, *Metallic flanges — Part 2: Cast iron flanges.*

ISO 7005-3:1998, *Metallic flanges — Part 3: Copper alloy and composite flanges.*

3 Terms and Definitions

For the purposes of this standard the following definitions together with those of BS 1179, apply.

3.1 Appliance and parts

3.1.1

appliance

a combination of a back boiler and a gas fire

3.1.2

back boiler

a water heating unit designed to fit into a builders opening to provide central heating or central heating and domestic hot water

3.1.3

gas fire

that part of the appliance that has a function similar to those within the scope of BS EN 509:2000 or BS 7977-1:2002

3.1.4

closed fronted gas fire

a gas fire which does not have exposed flames or exposed incandescent areas

3.1.5

live fuel effect fire (LFE)

gas fired appliance designed to heat a room mainly by the emission of air heated by convection. Such an appliance also contains radiant elements designed to simulate a solid fuel fire bed. It is designed to be mounted on a hearth, floor or wall

3.1.6

back circulator¹⁾

a water heater unit designed to fit into a fireplace recess intended primarily for the supply of domestic hot water in conjunction with a separate storage vessel and for operation by gravity circulation with a rated heat input not exceeding 7.2 kW net

3.2 Parts of the appliance conveying gas to the burners

3.2.1

gas circuit

the parts of the appliance conveying gas to the burners

3.2.2

inlet connection

the part of the appliance intended to be connected to the gas supply

3.2.3

mechanical joint (mechanical means of obtaining soundness)

a means of assuring the soundness of an assembly of several (generally metallic) parts without the use of liquids, pastes, tapes, etc. There are, for example:

- metal to metal joints;
- conical joints;
- toroidal sealing rings;
- flat joints

3.2.4

restrictor

device with an orifice, which is placed in the gas circuit so as to create a pressure drop and thus reduce the gas pressure at the burner to a predetermined value for a given supply pressure and rate

¹⁾ Back circulators are not covered by this standard.

3.2.5**sgas rate adjuster**

component allowing the gas rate of the burner to be brought to a predetermined value according to the supply conditions.

the adjustment may be progressive (screw adjuster) or discontinuous (changing restrictors).

the adjuster of an adjustable governor is regarded as a gas rate adjuster.

if, after the manufacturer or installer has adjusted an adjuster it is immobilized in this position by some means such as a screw, etc., it is said that the adjuster is “set” in this position

3.2.6**sealing an adjuster**

procedure by which after setting an adjuster, material is added such that any attempt to alter the setting is apparent

factory sealed preset adjuster, other than the adjuster of a pressure governor, is considered to be non-existent.

a pressure governor is considered to be non-existent if it has been factory sealed such that it cannot function as a pressure governor.

3.2.7**putting an adjuster or a control out of service**

adjuster or a control (of temperature, pressure, etc.) is said to be “put out of action” if it is sealed in a position such that the appliance then functions as if the device had been removed

3.2.8**gas rate control²⁾**

component allowing the user to open, close or adjust the gas supply to one or more burners

3.2.9**range-rating device**

component on the appliance intended to be used by the installer to adjust the nominal heat input of the appliance, within the range of maximum and minimum heat inputs stated by the manufacturer, to suit the actual heat requirements of the installation

3.2.10**injector**

component that admits the gas into a burner

3.3 The burner**3.3.1****main burner**

burner that is intended to assure the thermal function of the appliance and is generally called the burner

3.3.2**fuel effect burner**

burner that simulates a solid fuel flame. The flames pass through a simulated solid fuel bed

3.3.3**ignition device**

any means (flame, electrical ignition device or other device) used to ignite the gas at an ignition burner or main burner

3.3.4**ignition burner**

a small burner whose flame is intended to ignite a main burner

²⁾ This device may be a “Tap”.

3.3.5

ignition safety time

time that elapses between the order to open the gas supply to the burner and the gas supply being shut off in the event that no flame has been detected

3.3.6

extinction safety time

time that elapses between extinction of the supervised flame and the order to shut off the gas supply to the burner

3.3.7

fixed primary aeration restrictor

device containing a restriction of fixed cross-section which limits the supply of air to a burner

3.3.8

non-volatile lockout

shutdown condition such that a start can only be accomplished by a manual reset

3.3.9

volatile lockout

shutdown condition such that a start can only be accomplished by restoration of the electrical supply after its loss

3.3.10

de-energized to trip principle

principle according to which neither auxiliary energy nor external action is required to activate a safety device

3.4 Burner control systems

3.4.1

manually operated burner control system

control system for an appliance in which manual intervention by the user is necessary to turn on the appliance; to ignite the ignition burner, if any, and the main burner; to vary the heat input of the main burner and to shut off the appliance

3.4.2

semi-automatic burner control system

control system for an appliance in which manual intervention by the user is necessary to turn and ignite a permanent ignition burner. Ignition, from this ignition burner, control and extinction of the main burner is carried out automatically without the need for manual intervention

3.4.3

automatic control system

system comprising at least a programming unit and all the elements of a flame detector device. The various functions of an automatic burner control system may be in one or more housings

3.4.4

programming unit

device which reacts to signals from control and safety devices; gives control commands; controls the start-up sequence, and supervises the burner shut-down and lock-out. It follows a predetermined sequence of actions and always operates in conjunction with a flame detector device

3.5 Construction

3.5.1

builders opening

enclosure constructed by the builder to accommodate fireplace components

3.5.2

draught diverter

device placed in the combustion products circuit to reduce the influence of flue-pull and down-draught on the burner performance and combustion

3.5.3**working surfaces**

those parts of an appliance whose main function is to contribute to the heating of the room and which are therefore at a high temperature, for example refractories and radiants. Also those parts which due to their function or position are at high temperature, for example dress guards and outlet grilles

NOTE 1 Any point within 15 mm of a working surface should be considered part of that working surface.

NOTE 2 Surfaces within 15 mm of parts that have to be manipulated during normal operation of the appliance cannot be considered as working surfaces.

3.6 Auxiliary equipment**3.6.1****pressure governor**

device which maintains the downstream pressure constant to within fixed limits independent of variations, within a given range, of the upstream pressure and the gas rate

3.6.2**flame supervision device**

device that, in response to a signal from the flame detector, keeps the gas supply open and closes it in the absence of the supervised flame

3.6.3**control knob**

component designed to be moved by hand to operate an appliance control (tap, thermostat, etc.)

3.6.4**control thermostat**

device enabling a temperature to be kept automatically, within a range, at a predetermined value

3.6.5**adjustable control thermostat**

control thermostat that permits the user to obtain setting temperatures between a minimum and a maximum value

3.6.6**safety temperature limiter**

device that causes safety shutdown and non-volatile lockout so as to prevent the water temperature exceeding a preset limit

3.6.7**temperature sensing element**

component that detects the temperature of the environment to be supervised or controlled

3.6.8**overheat cut-off device**

device that causes safety shutdown and non-volatile lockout before the appliance is damaged and/or before safety is compromised

3.7 Gases**3.7.1****net calorific value (net C.V.)**

quantity of heat produced by the complete combustion, at a constant pressure of 1 013.25 mbar³⁾, of unit volume or mass of gas, the constituents of the combustible mixture being initially at 15 °C, 1 013.25 mbar, the products of combustion being brought back to the same conditions and the water produced by combustion being assumed to be retained in the vapour state

Practical units: MJ/m³, MJ/kg Symbol: H_i

³⁾ 1 bar = 10⁵ Pa

3.7.2**gross calorific value (gross C.V.)**

quantity of heat produced by the combustion, at a constant pressure, of unit volume or mass of the gas considered, the combustion water being condensed, under standard reference conditions of 15 °C, 1,013 bar

Practical units: MJ/m³, MJ/kg

Symbol: H_g

3.7.3**relative density**

ratio of the masses of equal volumes of dry gas and dry air at the same conditions of temperature and pressure

Symbol: d

3.7.4 Wobbe index**3.7.4.1****net wobbe index**

ratio of the net calorific value of a gas per unit volume and the square root of its relative density under the same reference conditions

$$\frac{H_i}{\sqrt{d}}$$

Unit: MJ/m³

Symbol: W_i

3.7.4.2**gross wobbe index**

ratio of the gross calorific value of a gas per unit volume and the square root of its relative density under the same reference conditions

$$\frac{H_g}{\sqrt{d}}$$

Unit: MJ/m³

Symbol: W_g

3.7.5**gas pressures**

all the pressures are static pressures of the moving gas, relative to the atmospheric pressure, measured at right angles to the direction of flow of the gas

Units: millibar (mbar)

3.7.6**test pressures**

gas pressures used to check the operational characteristics of appliances using combustible gases. They comprise normal and limit pressures

Units: millibar (mbar)

3.7.7**normal pressure**

pressure under which appliances operate under nominal conditions when supplied with the corresponding reference gas (see Table 6)

Symbol p_n

3.7.8**limit pressures**

pressures representative of the extreme variations in the appliance supply condition

3.7.9**setting pressure**

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

3.8 Appliance performance

3.8.1 Gas rates

3.8.1.1

volumetric flow rate

volume of gas consumed by the appliance in unit time during continuous operation

Unit: m³/h

3.8.1.2

mass flow rate

mass of gas consumed by the appliance in unit time during continuous operation

Units: kg/h and, if necessary, g/h

3.8.1.3

thermal equilibrium

state of thermal equilibrium is the operating state of the appliance corresponding to a particular setting of the input, in which the measured value of the flue gas temperature remains steady within a tolerance of $\pm 2\%$ over a period of 10 minutes

3.8.2 Input

3.8.2.1

heat input

quantity of energy used in unit time corresponding to the volumetric rate or the mass rates, the calorific value used being net and expressed in kilowatts⁴⁾

Unit: kW

3.8.2.2

nominal heat input⁵⁾

the value of the net heat input stated by the manufacturer (see 8.1)

Unit: kW

3.8.2.3

minimum operational rate

3.8.2.3.1

boiler

lowest heat input at which the boiler is intended to operate

3.8.2.3.2

gas fire

- a) for any burner or section of a burner which is controlled by a thermostat, the bypass rate;
- b) for any burner which is manually controlled and which is subdivided into sections under control of a tap (e.g. duplex burners), 30 % of the full-on rate of each individual section;
- c) for any burner which is manually controlled but which is not subdivided into sections (i.e. simplex burners), 20 % of the full-on rate;
- d) for any burner where it is only possible to obtain certain predetermined fixed settings, the lowest fixed setting.

⁴⁾ The heat input on gross calorific value is related to the net value for the reference gases as follows:

G 20 gross value = $1.111 \times$ net value

G 31 gross value = $1.087 \times$ net value.

⁵⁾ Appliances fitted with a range-rating device operate at a nominal heat input between the maximum and minimum adjustable heat inputs. Modulating appliances operate between the nominal heat input and the minimum controlled heat input.

3.8.3

nominal output

heat output obtained with the reference gas at nominal heat input. This output is declared by the manufacturer for both the back boiler and the gas fire

Unit: kW

3.8.4 Efficiency

3.8.4.1

boiler efficiency

ratio of the useful boiler output to the heat input measured with the boiler only alight, expressed as a percentage

3.8.4.2

fire efficiency

ratio of the useful fire output to the heat input measured with the fire only alight, expressed as a percentage

3.9 Gas combustion

3.9.1

flame stability

the state of the flames resting in a stable manner, on the burner ports or the flame contact area provided by the design, with no flame lift or light-back

3.9.2

flame lift

phenomenon characterized by the total or partial lifting of the base of the flame from the burner port or the flame contact area provided by the design

3.9.3

light-back

phenomenon characterized by the entry of a flame into the body of a burner

3.9.4

light-back at the injector

phenomenon characterized by ignition of the gas at the injector either, as a result of the flame entering the burner or, by the propagation of a flame around the outside of the burner

3.9.5

sooting

phenomenon characterized by deposits of soot on the surfaces of parts of the appliance in contact with the products of combustion or with the flame

3.9.6

yellow tipping

phenomenon characterized by the appearance of yellow colouring at the tip of a blue flame

3.9.7

start gas rate

fixed, restricted gas flow rate admitted either to a separate ignition burner or to the main burner during safety time

3.9.8

start gas flame

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

3.9.9

main gas rate

gas flow obtained with the burner controls in their fully open position

3.10 lint assessment

for the purposes of lint assessment the following definitions apply:

- a) aerated burner. A burner in which the gas flowing through a gas injector induces the primary air for subsequent combustion;
- b) non-aerated burner. A burner in which the gas is burned without previous mixture with air;
- c) air inlet. Any opening(s) in the boiler casing for the supply of air.

4 Classification of appliances

4.1 Classification according to the nature of the gases used (categories)

4.1.1 General

For the purposes of this standard, gases shall be classified in accordance with BS EN 437:1999.

4.1.2 Families of gases

Gases are classified into families, possibly divided into groups according to the value of the Wobbe index. Table 1 specifies the families and groups of gas used in this standard.

Table 1 — Classification of gases

Gas families and groups	Gross Wobbe index at 15 °C and 1 013.25 mbar (dry)	
	Minimum	Maximum
Second family		
Group H	45.7	54.7
Third family		
Group P	72.9	76.8

4.1.3 Categories of appliance

NOTE Appliances are classified in categories according to the gases that they are designed to use.

4.1.3.1 Categories I

These categories relate to appliances designed exclusively to use gases of a single family and possibly only gases of a single group:

- a) appliances designed for use with second family gases,
category I_{2H}. An appliance for use with gases in group H of the 2nd family only;
- b) appliances designed for use with third family gases,
category I_{3P}. An appliance for use with gases in group P of the 3rd family only (propane).

4.1.3.2 Categories II

This category relates to appliances designed for use with 2nd and 3rd family gases.

— Category II_{2H3P}. An appliance capable of using gases of group H of the second family and gases of group P of the third family. The second family gases are used under the same conditions as for category I_{2H}. The third family gases are used under the same conditions as for category I_{3P}.

4.2 Conversion to different gases

When converting from one gas to another, the manufacturer's instructions shall be followed.

5 Construction

5.1 Materials and method of construction

5.1.1 *General*

The quality and thickness of the materials used in the construction of the appliances, and the method of assembling the various parts, shall be such that the constructional and performance characteristic are not significantly altered during a reasonable life and under normal conditions of installation and use.

In particular, all the appliance components shall withstand the mechanical, chemical and thermal conditions to which they may be subjected when the appliance is normally used.

Materials downstream of the heat exchanger shall be corrosion-resistant or be protected against corrosion.

5.1.2 *Materials*

Asbestos or asbestos containing materials shall not be used.

Cadmium shall not be used in high melting point solders.

Copper shall not be used for those parts of the gas circuit which exceed 100 °C when the appliance is in normal use.

Thermal or acoustic insulation shall be non-combustible, securely located and protected against mechanical damage and condensate.

5.2 Accessibility for maintenance and use

Any control placed in the gas circuit shall be so arranged that any adjustment, maintenance or exchange is easy.

User removable parts shall be so designed or marked that they are easy to reassemble correctly and difficult to reassemble incorrectly.

In particular, it shall be possible to complete all the operations of removal and reassembly of parts which the user has to carry out in the course of routine maintenance, as explained in the user instructions, without the aid of a tool.

Removable parts shall be dismantable for maintenance by a service engineer using ordinary tools.

Parts that are not intended to be removed or adjusted by the user and that on removal, or adjustment, may result in a hazard, e.g. injector jets, shall require the use of tools for their removal.

5.3 Connections to the gas and water pipes

5.3.1 *General*

The appliance connections shall be easily accessible. They shall be clearly identified in the installation instructions and possibly on the appliance.

The clearance around the connections, after removing the case if necessary, shall be adequate to allow easy use of the tools required to make the connection. It shall be possible to make all the connections without special tools.

5.3.2 *Connection to the gas pipe*

It shall be possible to connect the appliance by rigid metallic means to the gas supply pipe.

If the appliance has a threaded connection, this thread shall conform to ISO 228-1:1995 or ISO 7:1995. In the first case, the end of the appliance inlet connection shall offer a sufficiently flat annular surface to allow the use of a sealing washer.

If flanges are used, they shall conform to ISO 7005:1988 and the manufacturer shall provide the counter-flanges and sealing gaskets.

5.3.3 *Water connections*

Threaded connections shall conform to ISO 228-1:2000 or ISO 7-1:1995.

If tubular copper connections are used, the connecting end of the tube shall conform to ISO 274:1975.

Non-metallic materials shall only be used if it is evident that such materials are fit for purpose.

5.3.4 *Drainage*

If it is not possible to drain the boiler by means of the water connections, the boiler shall have a device to enable it to be drained, which can be operated by means of a tool such as a spanner or screwdriver.

Directions for drainage shall be included in the instructions.

5.3.5 *Pressure test points*

Pressure test points shall be provided on the appliance for measurement of the manufacturer's stated operating pressures. The pressure test nipples shall have an external diameter of $9_{-0.5}^0$ mm, and a useful length of at least 10 mm for connection to tubing. The diameter of the hole in the test point shall be not greater than 1 mm at its narrowest point.

If either the fire or back boiler is fitted with a governor or continuous action gas rate adjuster which, in accordance with the manufacturer's instructions, may require adjustment, upon installation of the appliance, or during its conversion, then the fire or boiler concerned shall be fitted with two pressure test points. One to measure the pressure upstream of any governor or adjuster⁶⁾ and the other to measure the pressure after the governor or adjuster, upstream of the burner.

5.4 *Flue system*

The appliance shall be capable of:

- a) direct connection to a round flue pipe or to a flexible metallic liner; and/or
- b) connection to a specified design of pre-cast flue system.

The appliance shall be provided with a flue outlet socket form having a minimum depth of 25 mm. It shall be easily possible, during installation in accordance with the manufacturer's instructions, to make and seal the flue connection from the front of, and inside, the fireplace recess.

5.5 *Soundness*

5.5.1 *Soundness of the gas circuit*

Holes for screws, studs, etc., intended for the assembly of components shall not open into the gasways⁷⁾. The residual wall thickness shall be at least 1 mm.

Brackets for supporting components shall not interpose into any gas-carrying joints.

The soundness of components and assemblies connected to the gas circuit and likely to be dismantled for routine maintenance at the consumer's premises with the exception of gas taps and cocks, shall be assured by means of mechanical joints, e.g. metal to metal joints, O-ring joints or packing, i.e. excluding the use of any sealing compound such as tape, mastic or paste. The soundness shall be maintained after dismantling and reassembly.

Sealing compounds may be used for permanently threaded assemblies and grease may be used for taps and cocks. The sealing material shall remain effective under normal conditions of appliance use.

Where parts of the gas circuit are assembled without threads, soundness shall not be achieved by means of soft solder for which the lowest temperature of the melting range, after application, is less than 450 °C neither shall adhesives be used.

⁶⁾ This pressure test point may serve both the fire and the boiler.

⁷⁾ A niting plate is not considered to be a gas-carrying joint.

5.5.2 Soundness of the combustion circuit

The appliance shall be constructed so that it conforms to 7.1.2.

Any means used to achieve soundness of the combustion circuit shall be such that it remains effective under normal conditions of use and servicing.

In particular, the soundness of parts likely to be removed during routine servicing shall be achieved by mechanical means, excluding pastes, liquids and tapes. The replacement of seals in accordance with the manufacturer's instructions is permitted.

5.6 Supply of combustion air and evacuation of the combustion products

All appliances shall be designed so that there is an adequate supply of combustion air during ignition and over the whole range of possible heat inputs stated by the manufacturer.

Connection to the flue shall be made by means of a flue outlet preceded by a draught diverter. This device is part of the appliance.

5.7 Assembly

Mechanical means shall be provided to secure the boiler base firmly to the fireplace hearth.

Where screws are used for the assembly of any part of the appliance casing which is removable for routine servicing, they shall be fitted with spring steel fasteners or have at least 2½ threads engagement.

5.8 Electrical equipment

The electrical equipment of the appliance shall conform to the relevant requirements of BS EN 50165:1999.

5.9 Operational safety in the event of fluctuation, interruption and restoration of the auxiliary energy

Interruption and subsequent restoration of the mains voltage supply to the appliance at any time during the start up or operation of the appliance shall result in continued safe operation, or:

- a) for appliances not fitted with an automatic burner control system, shut down of the burner such that manual re-ignition of the burner is required, or
- b) for appliances with an automatic burner control system, at least safety shut down.

Interruption and subsequent restoration of the mains voltage supply shall not override any non-volatile lockout condition.

Requirements and methods of test covering the safety and continued operation of the appliance in the event of normal and abnormal fluctuation of the auxiliary energy are specified in 7.7.1.1 and 7.7.1.2.5.

5.10 Confirmation of operation

The ignition and operation of the burners and also the length of the flame(s) of any ignition burner(s) shall be visible to the installer.

NOTE This may entail the opening of a door or the removal of a case.

Mirrors, sight glasses, etc., shall continue to retain their optical properties.

An indirect means of indication (e.g. an indicator light) may be used, provided that the indicator checks only for flame presence or a fault in the means of checking the flame itself which results in an indication that there is no flame.

It shall be possible for the user, perhaps after opening a door, to check at any time that the boiler is operating.

5.11 Requirements for adjusting, control and safety devices

5.11.1 General

Safety systems shall be so designed that de-energization does not create a hazard.

The operation of safety devices shall not be overruled by adjusting and control devices.

All of the devices and/or any multifunctional control shall be removable or exchangeable if necessary for cleaning or replacement of the device. Adjusters for devices shall not be interchangeable if this could result in confusion.

When there are several control knobs (taps, thermostats, etc.), their function shall be clearly indicated and they shall not be interchangeable if this could lead to confusion.

5.11.2 Gas rate adjusters and range-rating devices (boiler only)

5.11.2.1 General

Any parts which are not intended to be altered by the user or the installer shall be sealed such that any unauthorized interference is evident. Paint may be used for this purpose provided that it withstands the temperature to which it is subjected during normal operation of the boiler.

Adjusting screws shall be designed in such a way that they cannot fall into the gasways.

Adjustment of the adjuster and/or of the range-rating device may be continuous (e.g. use of an adjusting screw) or discrete (e.g. change of restrictors).

5.11.2.2 Adjuster

Any adjuster(s) shall be adjusted and sealed by the manufacturer or the installer.

5.11.2.3 Range-rating devices

If this device and the gas rate adjuster are one and the same, the manufacturer shall give instructions for the use of the adjuster in installation instructions.

5.11.3 Aeration adjusters

Aeration shall not be adjustable on the boiler.

If the fire is provided with aeration adjustment, this adjustment shall be limited in accordance with 7.7.3.1.

5.11.4 Manual controls

The appliance shall be provided with gas taps, thermostats or electric switches essential for normal operation of the appliance by the user.

Any gas tap shall conform to the parameters specified by the tap manufacturer.

Any gas cock or tap shall be designed, identified or positioned to avoid inadvertent operation but shall be easy to operate when required. It shall be so designed that the "OFF" and "ON" positions are readily distinguishable.

Any gas cock or tap shall be provided with positive stops at the "OFF" and full "ON" positions. The gas shall not be shut off in any position of the tap except between the "OFF" stop and the end of the circumferential seal. For the purpose of this standard any operating mechanism between the control and the tap handle shall be deemed part of the control.

A multi-position tap shall be clearly marked at the ignition position. A halt at the ignition position shall be provided unless the control incorporates another device, to avoid a hazard arising, e.g. flame supervision device or ignition cut out.

5.11.5 Gas governors

The use of a gas governor is optional. Gas governors shall conform to BS EN 88:1991.

The design and accessibility of any governor shall be such that it can be easily adjusted and put out of operation when another gas is supplied, but precautions shall be taken to make unauthorized interference with the adjuster difficult.

5.11.6 Flame supervision devices

5.11.6.1 General

The backboiler and fire shall each be protected by a flame supervision device conforming to BS EN 125:1996 or BS EN 298:1998 as appropriate.

5.11.6.2 Flame detection

The presence of a flame shall be detected as follows:

- either by a thermoelectric flame supervision device; or
- by the flame detector of an automatic burner control system.

Where the main burner is ignited by an ignition burner, the presence of the ignition burner flame shall be detected before gas is admitted to the main burner.

5.11.6.3 Thermoelectric flame supervision device

The device shall cause non-volatile lockout of the unit of the appliance in the event of flame failure and in the event of damage to the sensing element or to the connection between the sensing element and the shut-off valve.

5.11.7 Multifunctional controls

Multifunctional controls shall conform to BS EN 126:1995.

5.11.8 Automatic shut-off valves

Any electrically operated automatic shut-off valve shall conform to the requirements of EN 161:1998.

The valve classes specified in this standard are the minimum requirements and do not prevent the use of valves of a superior performance. The valve classes are A, B, C and J with A having the greatest closing force and J the lowest. Examples of gas valve arrangements for automatic controls are given in Annex B (see Figure B.1, Figure B.2 and Figure B.3).

No markings are required where a single push button operates a safety device that controls both the burner and the ignition burner, provided that incorrect operation is not possible.

5.11.9 Burner control systems

5.11.9.1 General

The fire control system shall be so designed that ignition is possible only when the user is in sight of the fire. Further, it shall not incorporate any means of facilitating ignition under other circumstances.

The fire shall have:

- either a manually operated burner control system;
- or a semi-automatic control system;
- or an automatic burner control system providing that this system is so designed that ignition is only possible when the user is in sight of the appliance.

The back boiler shall have:

- either a semi-automatic burner control system;
- or an automatic control system.

5.11.9.2 Manually operated burner control system

The control system shall have one or more manually operated controls (e.g. tap or cock) enabling the user:

- to turn on and ignite the ignition burner, if any, and the main burner
- to control the heat input of the main burner, and
- to shut off the main burner and any pilot.

The control system shall incorporate a flame supervision device conforming to BS EN 125:1996. In the event of flame failure, this device shall shut off the gas supply to the main burner. Re-ignition of the appliance shall only be possible after manual intervention.

5.11.9.3 Semi-automatic burner control systems

5.11.9.3.1 General

The control system shall be provided with a user control enabling the user to turn on and ignite the ignition burner.

The control system shall incorporate a means of preventing the supply of gas to the main burner until the ignition burner flame has been detected.

The control system shall incorporate a flame supervision device conforming to BS EN 125:1996. In the event of flame failure, this device shall shut off the gas supply to the main burner and any ignition burner. Re-ignition of the appliance shall only be possible after manual intervention.

In addition, where the boiler incorporates such a control system, it shall conform to either of the following requirements.

- a) The control system shall incorporate a re-start interlock; or
- b) The manufacturer shall include a statement in the user's instructions, warning the user to wait a specific period of time before attempting to light the appliance in any circumstances where this could be hazardous.

5.11.9.3.2 Gas circuit valves

The gas circuit shall be fitted with at least the following automatic shut off valves

Specified in Table 2, or their given alternatives. Where two gas valves are required these shall be in series.

Table 2 — Gas valves for semi-automatic control systems

Main gas circuit		Ignition circuit	
1 st valve	2 nd valve	1 st valve	2 nd valve
C ^a	J	C ^{ab}	J ^c
^a A flame supervision device may be fitted as an alternative to this valve. ^b This valve may be the 1 st valve in the main burner circuit. ^c This valve is not required if the heat input of the ignition burner is less than 0.250 kW.			

5.11.9.4 Fully automatic burner control systems

5.11.9.4.1 General

Automatic burner control systems shall conform to the appropriate requirements of EN 298:1994 Systems not within the scope of EN 298:1994 shall conform to an appropriate standard for their application.

Operation push buttons, switches, etc. incorrectly set or out of sequence shall not adversely affect the safety of the automatic burner control system. In particular, when tested in accordance with 7.13.2.1.2.1, the rapid (on and off) operation of any start switch shall not set up a hazardous condition.

5.11.9.4.2 Particular conditions for the gas fire

Extinction of the main burner or start gas flame (where incorporated) due to operation of user controls, safety controls, or failure of gas or electricity supply shall result in non-volatile lock out.

5.11.9.4.3 Start-gas flame ignition

5.11.9.4.3.1 Design

For burners with this control system, a start-gas flame shall be established, either at the main burner or at a separate ignition burner. If the start-gas flame is established at the main burner, it shall be supplied at a fixed start-gas rate.

The manufacturer shall declare the maximum safety time (see 7.13.1.2.2).

If the start-gas flame has not been detected by the end of the safety time, volatile or non-volatile lockout shall result.

The control system shall be so designed and arranged that the signal to supply the main burner with gas at the main gas rate cannot be given until after the start-gas flame has been detected.

Where the start-gas supply is taken from between the two main gas valves or is supplied by the first stage of a two stage valve in the main system, the gas line shall conform to **7.4.6**.

Flame failure in the running condition shall result in the following:

- non-volatile lockout;
- volatile lockout; or
- spark restoration.

Where spark restoration is used, the re-ignition attempt shall begin within 1 second of loss of flame and end no later than the safety time. If the flame is not detected by the end of the safety time, non-volatile or volatile lockout shall result.

5.11.9.4.3.2 Gas circuit valves

The gas circuit shall be fitted with at least the automatic shut off valves shown in Table 3. Where two gas valves are required these shall be in series.

Table 3 — Gas valves for automatic control systems with start-gas ignition

Main gas circuit	Start –gas circuit ^a
1 class C and 1 class J ^c	1 class C ^b and 1 class J ^d
^a Where the start-gas rate is controlled by a two stage valve in the main gas circuit, these valves are the same as the main gas valves. ^b This valve may be the class C valve in the main gas circuit. ^c If a class J valve is used, a strainer that does not pass a 0.2 mm pin gauge shall be fitted upstream of the valve. ^d This valve is not required if the start gas rate ≤ 0.250 kW.	

5.11.9.4.4 Direct main flame ignition

5.11.9.4.4.1 Design

For burners with this control system, the main burner is ignited directly at the main gas rate or, for control systems incorporating a slow opening valve, at a lower rate, depending on when ignition occurs.

The ignition source shall not be energized before the flame simulation check has been carried out by the automatic burner control system and shall be de-energized at, or before, the end of the safety time. Where a hot surface ignition system is used, the ignition system shall be so energized that the ignition source is capable of igniting incoming gas before the main gas valves are opened.

The manufacturer shall declare the maximum safety time (see **7.13.1.2.2**).

If the flame has not been detected by the end of the safety time, non-volatile lockout shall result.

Flame failure in the running condition shall result in the following:

- non-volatile lockout;
- volatile lockout; or
- spark restoration.

Where spark restoration is used, the re-ignition attempt shall begin within 1 second of loss of flame and end no later than the safety time. If the flame is not detected by the end of the safety time, non-volatile or volatile lockout shall result.

5.11.9.4.4.2 Gas circuit valves

The main gas circuit shall be fitted with at least two gas valves in series. One of these shall be of at least class C and the other shall be at least class J.

Where a class J valve is used, a strainer shall be used such that it does not pass a 0.2 mm pin gauge. This strainer shall be fitted upstream of the valve.

5.11.10 Thermostats and water temperature limiting devices (boiler only)

5.11.10.1 General

Boilers shall be fitted with a control thermostat conforming to 5.11.9.4.

In normal operation, the maximum water flow temperature shall not exceed 95 °C.

Temperature limiting devices are not required when the boiler is designed to be installed exclusively with an open expansion vessel and a failure of the control thermostat does not cause a dangerous situation for the user or damage to the appliance. In all other situations a safety temperature limiter shall be fitted to prevent the water flow temperature exceeding 110 °C following failure of the control thermostat.

To avoid the water flow temperature exceeding 110 °C, following failure of the control thermostat, boilers shall be fitted with the additional temperature limiting devices specified as follows.

5.11.10.2 Boilers only intended for central heating systems with open expansion vessels

Appropriate information shall be given in the technical instructions.

Where an overheat device is required on an open vented system then it shall conform to the same control requirements as if it were fitted to a sealed expansion vessel.

5.11.10.3 Boilers intended for central heating systems with sealed expansion vessels

Boilers intended for central heating systems with sealed expansion vessels shall have a safety temperature limiter conforming to the requirements of 5.11.10.5.

5.11.10.4 Control thermostat

The control thermostat shall conform to BS EN 60730-2-9:1995 for type 1 devices

If the control thermostat is adjustable, the manufacturer shall state the maximum temperature in the instructions. The positions of the temperature selector shall be easy to establish and it shall be possible to ascertain in which direction the water temperature rises or falls. If numbers are used for this purpose, the highest number shall correspond to the highest temperature.

The thermostat shall have a position allowing the temperature of domestic hot water to be raised above 60 °C.

At its maximum setting, the thermostat shall cause at least controlled shut-down before the water flow temperature exceeds 95 °C.

5.11.10.5 Safety temperature limiter

A safety temperature limiter shall conform to BS EN 60730-2-9:1995 for type 2 devices.

The safety temperature limiter shall cause non-volatile lockout before the water flow temperature exceeds 110 °C.

This device shall cause non-volatile lockout before the boiler is damaged and/or a dangerous situation for the user occurs.

This device shall not be adjustable and normal operation of the boiler shall not give rise to a change in its set-point temperature.

Interruption of the link between the sensor and the device responding to its signal shall cause at least safety shutdown.

5.11.10.6 Mechanical thermostat

Mechanical thermostats shall conform to BS EN 257:1995.

5.11.10.7 Thermostat sensors

The failure of any sensor shall not give rise to a dangerous situation for the user, or damage to the appliance.

The sensors shall withstand the thermal overload resulting from any overheat condition specified in this document without the predetermined set point being affected.

5.11.10.8 Remote control

The boiler shall be designed so that it can be controlled remotely (for example by a room thermostat or a clock), except when the boiler operates without using electrical energy.

Connection of any remote controls recommended by the manufacturer shall be possible without disturbing the internal electrical connections except for purpose-designed removable links.

5.11.10.9 Expansion vessel and pressure gauge

For appliances specified for use with a sealed system, an expansion vessel shall be supplied or specified by the manufacturer.

The instructions shall give full details of the maximum permissible water capacities of the system and the maximum water-side operating pressure for expansion vessels supplied or specified and the water content of the appliance.

Such a boiler shall also be fitted with a pressure relief valve conforming to **5.11.10**.

5.11.11 Pressure relief valve (Boilers only)

A pressure relief valve shall include the following features:

- spring loading;
- a preset, non-adjustable lift pressure of 3 bar;
- a seating or valve face of non-resilient material;
- a test device;
- provision for connection to a drain pipe.

5.11.12 Spillage monitoring system

The appliance system shall be so constructed that in abnormal conditions there is no release of combustion products in a dangerous quantity into the room concerned.

Any safety device used for this purpose shall be as follows:

- not have any adjustment other than that made and sealed by the manufacturer;
- be so designed that it cannot be removed or dismantled without the use of a tool;
- have electrical insulation that will withstand the thermal and chemical stresses resulting from spillage of the combustion products;
- be so designed such that interruption of any link between the sensor and the device shall cause safety shut down, if necessary, after a waiting time.

5.11.13 Ignition devices

Ignition of the ignition burner(s) (or main burner for a fire without an ignition burner) shall be from a safe and easily accessible position.

Ignition burners, ignition devices and their mountings shall be so designed that they can only be located rigidly and correctly in relation to every component and burner with which they are to operate.

5.12 Burners

All burner and injectors shall be positively located and so arranged that misalignment is difficult and obvious.

The cross-section of the flame ports and also the terminal cross-section of burner and ignition burner injectors shall not be adjustable.

Every injector and removable restrictors shall carry an indelible means of identification prevent any confusion.

6 Test conditions

6.1 Test gases

6.1.1 Characteristics of test gases (reference and limit gases)

Appliances are intended for use with gases of various qualities.

In each family or group:

- the gas which in general corresponds to that most frequently distributed and for which the appliance is designed is called the reference gas;
- the gases which correspond to the extremes of a particular gas family or gas group are called "limit gases".

Table 4 and Table 5 gives the characteristics of the reference and limit gases.

6.1.2 Synthesis of test gases

Within the following tolerances, the composition of gases used for the tests are those specified in Table 4. For the constitution of the gases the following rules are observed:

- the Wobbe index of the gas used shall be within ± 2 % of the value in the Table 4 (this tolerance includes the errors of the measuring equipment);
- the gases used to constitute the mixtures shall have the following minimum degrees of purity:

nitrogen	N ₂	99%	
hydrogen	H ₂	99%	
methane	CH ₄	95%	} With a total content of H ₂ , CO and O ₂ below 1 %
propene	C ₃ H ₆	95%	
propane	C ₃ H ₈	95%	
butane	C ₄ H ₁₀	95%	} and a total content of N ₂ and CO ₂ below 2 %.