

BS 6798:2009



BSI Standards Publication

Specification for installation and maintenance of gas-fired boilers of rated input not exceeding 70 kW net

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Foreword

Publishing information

This British Standard is published by BSI and came into effect on 31 January 2009. It was prepared by Technical Committee GSE/30, *Gas installations (1st, 2nd and 3rd family gases)*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This British Standard supersedes BS 6798:2000, which is withdrawn.

Information about this document

The structure follows the approach used in other gas installation standards. Requirements, with corresponding commentary and recommendations, cover equipment selection and pre-installation, installation and post-installation, to which maintenance has been added as a specific detail.

In line with BS 5440-1, this revision has acknowledged that European work on chimney standards has brought about the need in British Standards to redefine chimney concepts and adopt common terminology consistent with the range of products used across the whole European community (the general requirements for which are given in BS EN 1443) where a chimney is treated as a structure containing a flue (the passageway) and might include a liner (inner wall), insulation and an outer wall. The common terminology in UK industry, which has regarded a chimney as a masonry structure generally associated with solid fuel appliances, has been superseded.

The requirements of this specification are supported by recommendations. To comply with this specification, it is necessary to comply with all its requirements. The operative may depart from recommendations, but would be expected to have good reasons for doing so.

This standard allows manufacturers' instructions to specify a method of installation, testing, commissioning or maintenance which differs in points of detail from this standard. This reference to manufacturers' instructions is allowed only where it will result in at least an equivalent level of safety. In such circumstances, it is important that the manufacturer's instructions are followed.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

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 cannot confer immunity from legal obligations.

Attention is drawn to the following statutory regulations:

- The Gas Safety (Installation and Use) Regulations 1998 [1];
- The Building Regulations 2000 (for England and Wales) [2];
- The Building (Amendment) Regulations (Northern Ireland) 2006 [3];
- The Building (Scotland) Amendment Regulations 2007 [4];
- The Building Regulations 2007 (for the Isle of Man) [5];
- The Water Supply (Water Fittings) Regulations 1999 [6].

1 Scope

This British Standard specifies requirements for the selection, installation, inspection, commissioning and maintenance of gas-fired boilers for central heating and other purposes, which have a total rated heat input not exceeding 70 kW, based on net calorific value. This includes cookers with integral boilers used to provide central heating.

It applies to boilers utilizing 1st, 2nd or 3rd family gases designed to operate in the condensing or non-condensing mode for the heating of domestic dwellings or domestic dwellings in commercial premises by the circulation of heated water in open or closed systems.

This standard does not apply to:

- boilers with a rated input of over 70 kW;
- groups of boilers with individual ratings of 70 kW or less but with aggregate inputs of over 70 kW as specified in BS 6644.

NOTE 1 Groups of boilers with individual ratings of 70 kW or less but with aggregate inputs of less than 70 kW may be installed to this standard but specialist advice on the system design, installation and control needs to be sought from the appliance manufacturer.

It does not cover the detailed design and installation of the whole heating system, which is specified in BS 5449.

NOTE 2 With the publication of EN 12828, EN 12831 and EN 14336 it is necessary for BS 5449 to be declared obsolescent and to be withdrawn within two years. These European Standards, which have now been adopted as British Standards, are not aligned to UK design and installation practices; they cover commercial as well as domestic heating systems and exclude hot water. Consequently, they are being amended to include national annexes covering all the relevant material from BS 5449.

NOTE 3 The installation of boilers with a rated input greater than 70 kW is covered by BS 6644. Additional requirements for the installation of back boiler units are specified in BS 5871-1 and BS 5871-2.

This standard applies to boilers which carry a CE mark and also to previously used boilers which do not carry the CE mark (see 4.2.1).

NOTE 4 In this standard, heat input is expressed in terms of net calorific values (CV), unless stated otherwise. The ratio of gross to net heat input is approximately 1.11:1 for natural gas, 1.09:1 for propane, and 1.08:1 for butane.

NOTE 5 It is essential that persons carrying out the installation of any gas appliance be competent to do so. Annex A gives information about the legal requirements which relate to approved operatives and gas appliances.

NOTE 6 Some parts of this standard might be appropriate for the installation of pool and spa heaters. The manufacturer's instructions may advise which parts are not appropriate. For example, for direct spa and pool heaters, no corrosion inhibitors or chemical cleaning are permitted.

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 476-22, *Fire tests on building materials and structures – Part 22: Methods for determination of the fire resistance of non-loadbearing elements of construction*

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

BS 1179-6, *Glossary of terms used in the gas industry – Part 6: Combustion and utilization including installation at consumers' premises*

BS 5422:2001, *Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range –40 °C to +700 °C*

BS 5440-1:2008, *Flueing and ventilation for gas appliances of rated input not exceeding 70 kW net (1st, 2nd and 3rd family gases) – Part 1: Specification for installation of gas appliances to chimneys and for maintenance of chimneys*

BS 5440-2, *Installation and maintenance of flues and ventilation for gas appliances of rated input not exceeding 70 kW net (1st, 2nd and 3rd family gases) – Part 2: Specification for installation and maintenance of ventilation for gas appliances*

BS 5449, *Specification for forced circulation hot water central heating systems for domestic premises*

BS 5482-1, *Code of practice for domestic butane- and propane-gas-burning installations – Part 1: Installations at permanent dwellings, residential park homes and commercial premises, with installation pipework sizes not exceeding DN 25 for steel and DN 28 for corrugated stainless steel or copper*

BS 5482-2, *Code of practice for domestic butane- and propane-gas-burning installations – Part 2: Installations in caravans and non-permanent dwellings*

BS 5970, *Code of practice for thermal insulation of pipework and equipment in the temperature range of –100 °C to +870 °C*

BS 6700, *Design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages – Specification*

BS 6891, *Installation of low pressure gas pipework of up to 35 mm (R1¼) in domestic premises (2nd family gas) – Specification*

BS 7671, *Requirements for electrical installations – IEE Wiring Regulations – Seventeenth edition*

BS EN 1491, *Building valves – Expansion valves – Tests and requirements*

BS EN 13831, *Closed expansion vessels with built in diaphragm for installation in water*

BS EN 50379-3, *Specification for portable electrical apparatus designed to measure combustion flue gas parameters of heating appliances – Part 3: Performance requirements for apparatus used in non-statutory servicing of gas fired heating appliances*

NOTE BS EN 50379-3 has superseded BS 7927; see bibliography.

BS EN ISO 4126-1, *Safety devices for protection against excessive pressure – Part 1: Safety valves*

PD 5482-3, *Code of practice for domestic butane- and propane-gas-burning installations – Part 3: Installations in boats, yachts and other vessels*

IGEM/UP/2, *Edition 2, Installation pipework on industrial and commercial premises*¹⁾

LPGA, *Code of Practice 22 – LPG Piping System Design and Installation*²⁾

3 Terms and definitions

For the purposes of this British Standard, the terms and definitions given in BS 1179, BS 1179-6 and the following apply.

3.1 boiler compartment

enclosure specifically designed or adapted to house one or more gas boilers, and which is not a habitable space

3.2 combination boiler

boiler designed to provide domestic hot water and hot water for central heating without the need for additional secondary storage

NOTE A combination boiler may include primary or secondary storage.

3.3 condensing boiler

boiler designed to make use of the latent heat in the combustion products by condensing water vapour within the appliance

3.4 chimney

structure consisting of a wall or walls enclosing a flue or flues

NOTE This includes chimneys of all materials (e.g. metal, masonry, plastic, etc.) for use with either open-flued or room-sealed appliances.

3.5 domestic dwelling

self-contained unit designed to accommodate a single household

3.6 flue

passage for conveying combustion products to the outside air

3.7 flue duct

duct containing the flue of a chimney configuration

3.8 greywater

water originating from the mains water supply that has been used for bathing or washing, washing dishes or laundering clothes

3.9 hot water storage combination unit

either:

- a) hot-water storage vessel with a cold water feed cistern immediately above it, the two being fabricated together as a compact unit; or
- b) hot-water storage vessel with a cold water feed cistern beside it or inside it

¹⁾ INSTITUTION OF GAS ENGINEERS AND MANAGERS (IGEM). *Installation pipework on industrial and commercial premises*. IGEN/UP/2, Edition 2. Loughborough: IGEN, 2008.

²⁾ LP GAS ASSOCIATION (LPGA). *LPG Piping System Design and Installation*. Code of Practice 22. Ringwood: LPGA, 2002.

3.10 open-flued chimney

chimney that evacuates the products of combustion to the outside air, the combustion air being drawn directly from the room, space or enclosure containing the boiler

3.11 open-flued boiler

boiler designed to be connected to an open-flue chimney

NOTE 1 These appliances are sometimes referred to as non-room sealed appliances in European installation standards.

NOTE 2 These appliances are classified in PD CEN/TR 1749 as Type B appliances.

3.12 open system

heating system which is open to the atmosphere and incorporates a feed and expansion cistern

3.13 operative

person who installs, commissions, services or maintains a gas-fired central heating boiler

3.14 plumbing

visible cloud formed when products of combustion exit from a chimney and are cooled below the dew point by mixing with external air

3.15 plume management kit

chimney component designed to manage the discharge of the products of combustion such that any plume will not cause a nuisance

3.16 pressure relief valve

pressure actuated valve which opens automatically at a specified set pressure to discharge fluid

3.17 rated output

useful output stated by the manufacturer

3.18 room-sealed boiler

boiler whose combustion system is sealed from the room in which the boiler is located and which obtains air for combustion from a ventilated uninhabited space within the premises, or from the open air outside the premises and which vents the products of combustion directly to open air outside the premises

NOTE This type of boiler is designated as Type C in PD CEN/TR 1749.

3.19 sealed system

central heating system incorporating a water circuit that is not open to the atmosphere

3.20 terminal

fitting installed at the outlet of a chimney

NOTE These are fitted to assist products of combustion to escape, minimize downdraught and prevent entry of material which might block the flue.

4 Selection of equipment and pre-installation

4.1 Exchange of information and planning

Those concerned with the selection of the boiler and the design of the system shall collaborate with the operative, both at the planning stage and during the execution of the work.

COMMENTARY AND RECOMMENDATIONS ON 4.1

Liaison between the various trades carrying out the work is essential for a safe and efficient gas boiler installation.

Particular matters that should be considered when carrying out new or replacement installations are:

- a) the availability and suitability of gas, electrical and water supplies;*
- b) the heat requirements (see 4.5);*
- c) the compatibility of heat emitters with current needs;*
- d) the physical size, design and position of the boiler, and its relationship to structural support and to combustible materials;*

NOTE Some installations will involve preliminary structural work which needs to be completed at the building carcass stage. Suitable bases will be required for floor-standing boilers.

- e) the type of building, form of construction (e.g. timber framed), and the probable position of fixtures, furniture and curtains;*

NOTE 1 Information on gas installations in timber-framed and light steel framed buildings is given in IGE/UP/7, Edition 2 [7].

NOTE 2 Information on gas installations in flats and other multi-dwelling buildings is given in IGE/G/5 [8].

- f) the size, height, type, support and route of the chimney and the position of termination, including the possible consequences of any plumbing;*

NOTE 1 Particular notice is drawn to the advice in BS 5440-1:2008, Clause 12, on the connection to SE-duct, U-duct and shared chimneys.

NOTE 2 Many modern room-sealed fanned draught boilers are designed for long flue ducts which enable builders to site boilers away from external walls and conceal the flue ducts and air-supply ducts within voids. Attention is drawn to the Gas Safety (Installation and Use) Regulations [1] concerning the need for inspection throughout the length of the flue duct. Detailed information is given in CORGI Technical Bulletin 200 [9].

- g) the provision of adequate air for combustion and ventilation;*
- h) the position of any drains for condensate or pressure/temperature relief valve discharge;*
- i) the manufacturer's instruction regarding water hardness. Unless the manufacturer's instructions say otherwise, where the mains water total hardness (as CaCO₃) exceeds 200 ppm, provisions should be made to treat the feed water to the hot water circuit of combination boilers to reduce the rate of accumulation of limescale;*
- j) the compatibility of the boiler with any system controls;*
- k) the system controls for energy conservation and comfort, in particular to avoid unnecessary cycling of the boiler and to comply with building regulations (see Foreword);*

- l) *whether the pump is adequate for the new boiler and is located so as to avoid entrainment of air or discharge of water from the system;*
- m) *whether the system pipework is adequately sized;*
- n) *the need for the central heating system to be thoroughly cleansed and flushed out before installing a new boiler (see 5.7.4.1).*

Consultation with official bodies

The following official bodies might need to be consulted for the reasons given.

- 1) *The local authority, with regard to building regulations and planning application requirements.*
- 2) *The fire authority, to establish compliance with relevant fire precautionary requirements; and the fire insurers, for notification of any proposed changes in the means of heating.*
- 3) *The Health and Safety Executive (HSE), to establish compliance with health and safety requirements in commercial premises, particularly with regard to safety requirements which are not fulfilled as an integral part of the installation.*
- 4) *The water authority/company, with regard to the Water Supply (Water Fittings) Regulations (as amended) [6] or relevant byelaws.*

4.2 Selection of boiler

4.2.1 General

A new boiler selected for installation shall carry a CE mark.

A previously used boiler selected for installation shall either carry a CE mark, or shall conform to an appropriate British Standard.

The boiler shall only be connected to and supplied with the gas for which it was designed.

Conversion to another gas, if necessary, shall be carried out strictly in accordance with the boiler manufacturer's instructions, using the manufacturer's supplied kit of parts.

The boiler shall only be fitted with external control devices, e.g. flue dampers or economizers, as approved by the boiler manufacturer. The boiler selected shall be suitable for use with any existing control system to which it is fitted.

COMMENTARY AND RECOMMENDATIONS ON 4.2.1

Attention is drawn to the Building Regulations for England and Wales, Part L1 [10], which require that gas-fired boilers installed after 1 April 2005 are to be condensing boilers, whether they are replacements or new installations, with a few exceptions.

For selection of a boiler in England and Wales attention is drawn to:

- a) *the DCLG publication, Domestic Heating Compliance Guide – Compliance with Approved Documents L1A: New dwellings and L1B: Existing dwellings [11]; and*
- b) *the DCLG publication, Guide to the Condensing Boiler Installation Assessment Procedure for Dwellings [12].*

For selection of a boiler in Scotland attention is drawn to the Scottish Building Standards Agency Technical Handbook [13].

Similar requirements might apply in other areas of the UK.

The HSE publication, Safety in the installation and use of gas systems and appliances [14] should also be consulted.

For CE-marked boilers

The operative should ensure that boilers carry the CE mark on the data plate and that the boiler and the packaging are marked with at least the following information:

- a) *the letters "GB";*
- b) *the type of gas and the pressure of utilization indicated as follows:*
 - 1) *"G20 and/or natural gas 20 mbar" for a boiler adjusted for natural gas;*
 - 2) *"G31 and/or propane 37 mbar" for a boiler adjusted for propane;*
 - 3) *"G30 and/or butane 29 mbar" for a boiler adjusted for butane;*
 - 4) *"G30, G31 and/or butane/propane 29/37 mbar" for a boiler which will burn either butane or propane at the correct pressure.*

The data plate of a CE-marked boiler will carry the designation I2H, I3P, I3B, or I3+ respectively for items 1), 2), 3) or 4). Where a boiler data plate carries the letters "Cat II" or "II", followed by the gas type designations P, B, then the boiler can be used for propane or butane when adjusted and converted to do so.

Installation of previously used (e.g. second hand) boilers without a CE mark

If a previously used boiler which does not carry the CE mark is to be installed, the operative should be satisfied that the boiler is safe in construction and can be used without constituting a danger. The boiler should be fitted in accordance with the manufacturer's instructions. If these instructions are not available, the operative should contact the manufacturer and obtain a copy before fitting the boiler.

A previously used boiler conforming to BS 5258-1 or BS 5258-8 may be considered safe to install.

For all boilers

If there is any doubt as to the suitability of a boiler for a particular gas, the boiler manufacturer should be consulted.

The operative should check the data provided with the boiler to confirm that the boiler is appropriate for the installation, and should confirm the basis on which the heat input rating is quoted, i.e. gross or net. The ratio of gross to net heat input is approximately 1.11:1 for natural gas, 1.09:1 for propane and 1.08:1 for butane.

Further information on the labelling of gas appliances is given in DD 221:1997.

4.2.2 Boilers for sealed systems

Boilers intended to be used in a sealed system shall be selected from those specifically designated for this purpose by the manufacturer, or shall be modified by means of a kit supplied for this purpose by the manufacturer.

COMMENTARY AND RECOMMENDATIONS ON 4.2.2

Boilers used in sealed systems should incorporate appropriate protection devices.

4.3 Condensing boilers

4.3.1 General

Boilers designed to be used in the condensing mode shall be installed in accordance with the manufacturer's installation instructions, or, if there are no specific instructions, the requirements in 4.3.2, 4.3.3, 4.3.4, 4.3.5 and 4.3.6 shall be followed.

COMMENTARY AND RECOMMENDATIONS ON 4.3.1

The manufacturer's installation instructions should describe any particular requirements for the condensing boiler, e.g. a means for disposal of condensate, the air-gas ratio valve setting and the water temperature operating range.

4.3.2 The siting of the chimney outlet

NOTE Chimney outlet was originally referred to as flue terminal in UK standards.

Where it is considered that the plume from a chimney outlet might cause a nuisance to the user or their neighbours, reference shall be made to the boiler manufacturer's instructions for specialist advice on how to redirect the chimney outlet, for example by the:

- a) partial rotation of the chimney terminal;
- b) fitting of a deflector elbow;
- c) use of a kit that provides high level termination.

In particular, the potential for the plume to cross the following situations shall be avoided:

- 1) a public footpath;
- 2) a frequently used access route;
- 3) a frequently used area (such as a patio);
- 4) a neighbouring dwelling.

The terminal shall not be directed towards a window or door, or be sited close to a facing wall, boundary fence or neighbouring property.

COMMENTARY AND RECOMMENDATIONS ON 4.3.2

Condensing boilers will produce a visible plume of water vapour for a significant proportion of their operating time. At low level, this plume might cause nuisance.

Other aspects to consider when planning the chimney outlet position include the following.

- a) *A free passage of air is needed to aid plume dispersal.*
- b) *The section on flue terminal siting in the DCLG publication, Guide to the Condensing Boiler Installation Assessment Procedure for Dwellings [12] advises against the positioning of the flue termination of a condensing boiler under a carport.*
- c) *In cold weather, the plume could cause a safety hazard if it freezes on pathways, or if it results in frost damage to surfaces.*
- d) *The plume could trigger infra-red security lighting if sited in the wrong place.*
- e) *The plume could affect the performance of external temperature sensors associated with energy management control systems.*

- f) *The chimney outlet or plume should not obscure security camera field of vision.*
- g) *The chimney outlet guards should be able to resist corrosive properties of the condensate.*
- h) *The need for a plume management kit when provided or specified by the appliance manufacturer.*
- i) *Some appliances are designed to disperse condensate in a spray form within the combustion products discharge. With these types of appliance particular care is necessary when siting the terminal to ensure safe disposal of the condensate in accordance with the manufacturer's instructions (see 4.3.4.1).*

Further information on chimney outlet siting and plume management is provided in BS 5440-1. For guidance on how to reduce the possibility of nuisance to neighbouring buildings, refer to the section on flue terminal siting in the DCLG publication, Guide to the Condensing Boiler Installation Assessment Procedure for Dwellings [12].

4.3.3 The choice of condensate drainage pipe

4.3.3.1 Material

The condensate drainage pipe shall be run in a standard drainpipe material, e.g. poly(vinyl chloride) (PVC), unplasticized poly(vinyl chloride) (PVC-U), acrylonitrilebutadiene-styrene (ABS), polypropylene (PP) or chlorinated poly(vinyl chloride) (PVC-C).

4.3.3.2 Condensate removal by gravity

The condensate drainage pipe connected to the condensate drain outlet on the boiler shall have a nominal diameter of 22 mm OD, or as recommended by the appliance manufacturer, to promote the clearance of condensate.

Any trap in the condensate drainage pipe shall be fitted within the dwelling.

NOTE Many boilers have a siphon fitted as part of the condensate trap arrangement. This will significantly reduce the risk of condensate freezing where part of the condensate drainage pipe is run externally.

For externally run condensate drainage pipe, extra care is necessary in order to reduce the risk of the condensate drainage pipe becoming blocked due to the condensate freezing, so the length of condensate drainage pipe external to the dwelling shall be kept as short as possible and not more than 3 m, unless it is insulated.

If a boiler does not include a siphon then any external condensate drainage pipe shall be increased to a minimum of 32 mm nominal diameter to reduce the risk of freezing.

In external locations where the condensate drainage pipe is less than 32 mm nominal diameter, the pipe shall be protected with waterproof pipe insulation.

COMMENTARY AND RECOMMENDATIONS ON 4.3.3.2

When a boiler is to be installed in an unheated location, e.g. garage, all condensate drainage pipes downstream from the trap or siphon should be considered as external.