

**BS 5864:2010**



**BSI Standards Publication**

# **Installation and maintenance of gas-fired ducted air heaters of rated heat input not exceeding 70 kW net (2nd and 3rd family gases) – Specification**

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## Foreword

### Publishing information

This British Standard is published by BSI and came into effect on 31 October 2010. It was prepared by Subcommittee GSE/30/7, *Ducted air heaters of rated input not exceeding 70 kW*, under the authority of 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This British Standard supersedes BS 5864:2004, which is withdrawn.

### Information about this document

This is a full revision of the standard, and introduces the following principal changes:

- Annex A gives information about the legal requirements which relate to the competence of approved operatives.
- Annex C gives information on the procedure for inspecting a heat exchanger.
- Annex D gives information on the procedure for setting up the fan assisted provision of combustion air from CORGI's *The Warm Air Heating System Design Guide* [1].

### Use of this document

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

### 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.

In particular, attention is drawn to the following statutory regulations:

The Gas Safety (Installation and Use) Regulations 1998 [2]

The Gas Safety (Installation and Use) Regulations (Northern Ireland) 2004 [3]

The Gas Appliance (Safety) Regulations 1995 [4]

The Asbestos (Prohibitions) Regulations 2003 [5]

The Building (Amendment) Regulations 2009, as amended [6]

The Building (Scotland) Amendment Regulations 2007, as amended [7]

The Building (Northern Ireland) Amendment Regulations 2009 [8]

The Building Control Act (Isle of Man) 1991 [9]

The Building (Isle of Man) Regulations 2007 [10]

The Gas Safety (Application) (Isle of Man) Order 1996 [11]

The Water Supply (Water Fittings) Regulations 1999, as amended [12]

# 1 Scope

This British Standard specifies requirements for the selection, installation and maintenance (see Note 1) of flued, gas-fired, ducted-air heaters of rated heat input not exceeding 70 kW, based on net calorific value, burning 2nd or 3rd family gases to heat one or more rooms or internal spaces in either domestic premises (see Note 2) or commercial premises.

It is applicable to warm air heaters that incorporate a fan to circulate the warm air.

It is also applicable to combined air heater/circulator installations and to the servicing and maintenance of heaters that distribute warm air by natural convection (see Annex B).

It is not applicable to gas installations in towed or motorized leisure accommodation vehicles.

*NOTE 1 For the purposes of this standard, installation includes design, inspection and commissioning. It is recognized that each of these tasks can be performed by the same person.*

*NOTE 2 As well as normally constructed dwellings, domestic premises include any permanently sited leisure accommodation vehicles, residential park homes and permanently moored boats.*

*NOTE 3 For the purposes of this standard, heat input is expressed in terms of the 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 4 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 the competence of approved operatives.*

# 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 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 5440-2:2009, *Flueing and ventilation for gas appliances of rated input not exceeding 70 kW net (1st, 2nd and 3rd family gases) – Part 2: Specification for the installation and maintenance of ventilation provision for gas appliances*

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, *Domestic butane- and propane-gas-burning installations – Part 2: Installations in caravans and non-permanent dwellings*

BS 5546, *Specification for installation and maintenance of gas-fired water-heating appliances of rated input not exceeding 70 kW net*

BS 5871-3, *Specification for the installation and maintenance of gas fires, convector heaters, fire/back boilers and decorative fuel effect gas appliances – Part 3: Decorative fuel effect gas appliances of heat input not exceeding 20 kW (2nd and 3rd family gases)*

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

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

BS EN 1949, *Specification for the installation of LPG systems for habitation purposes in leisure accommodation vehicles and in other vehicles*

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*

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

BS EN ISO 10239, *Small craft – Liquefied petroleum gas (LPG) systems*

IGEM/UP/1, Edition 2, *Strength testing, tightness testing and direct purging of industrial and commercial gas installations*<sup>1)</sup>

IGEM/UP/1A, Edition 2, *Strength and tightness testing and direct purging of small low pressure industrial and commercial Natural Gas installations*<sup>2)</sup>

IGEM/UP/1B, Edition 2, *Tightness testing and direct purging of small Natural Gas installations*<sup>3)</sup>

IGEM/UP/2, Edition 2, *Installation pipework on industrial and commercial premises*<sup>4)</sup>

IGEM/UP/7, Edition 2, *Gas installations in timber framed and light steel framed buildings*<sup>5)</sup>

UKLPG UIS 014, *Gas Soundness Testing of LPG Service Pipework, Installation Pipework and Appliances in Holiday Homes, Caravans and Motor Homes*<sup>6)</sup>

<sup>1)</sup> INSTITUTION OF GAS ENGINEERS AND MANAGERS (IGEM). *Strength testing, tightness testing and direct purging of industrial and commercial gas installations*, Edition 2. Derbyshire: IGEM, 2005.

<sup>2)</sup> INSTITUTION OF GAS ENGINEERS AND MANAGERS (IGEM). *Strength and tightness testing and direct purging of small low pressure industrial and commercial Natural Gas installations*, Edition 2. Derbyshire: IGEM, 2005.

<sup>3)</sup> INSTITUTION OF GAS ENGINEERS AND MANAGERS (IGEM). *Tightness testing and direct purging of small Natural Gas installations*, Edition 2. Derbyshire: IGEM, 2006.

<sup>4)</sup> INSTITUTION OF GAS ENGINEERS AND MANAGERS (IGEM). *Installation pipework on industrial and commercial premises*, Edition 2. Derbyshire: IGEM, 2008.

<sup>5)</sup> INSTITUTION OF GAS ENGINEERS AND MANAGERS (IGEM). *Gas installations in timber framed and light steel framed buildings*, Edition 2. Derbyshire: IGEM, 2006.

<sup>6)</sup> The UKLPG User Information Sheet (UIS) 014. *Gas Soundness Testing of LPG Service Pipework, Installation Pipework and Appliances in Holiday Homes, Caravans and Motor Homes*. UKLPG, 2005 (available from <http://www.uklpg.org/>).

### 3 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

#### 3.1 air heater

appliance for heating air to be used for space heating

*NOTE Hereinafter referred to as "heater".*

#### 3.2 air vent

non-adjustable, purpose-provided unit/assembly designed to allow permanent ventilation

#### 3.3 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). It can be either an open flue chimney for use with an open-flued appliance or a room-sealed chimney configuration for use with a room-sealed appliance.*

#### 3.4 compartment

enclosure specifically designed or adapted to house one or more gas appliances

*NOTE Such an enclosure is a non-habitable space.*

#### 3.5 ducted-air heater

air heater using ducting to distribute the heating air

*NOTE In domestic premises this term is only used for flued heaters.*

#### 3.6 flue

passage for conveying products of combustion to the outside air

#### 3.7 flue pipe

pipe enclosing a flue

*NOTE For a double-walled flue system or factory-made insulated flue system it is the inner pipe.*

#### 3.8 installation instructions

instructions prepared by a gas appliance manufacturer, giving detailed information and requirements on how the appliance should be installed and maintained

*NOTE Such instructions should not be confused with other documents supplied by the appliance manufacturer, e.g. sales literature. These instructions are approved by the notified body as part of the CE marking process.*

#### 3.9 internal space

interior space which is not a room

*NOTE An internal space can be a hall, passageway, stairway or landing.*

#### 3.10 intumescent air vent

assembly for preventing the spread of fire, consisting of a metal Louvre or grille with an intumescent block secured behind it, which incorporates a latticework of holes to provide continuous ventilation but which expands and closes in the event of extreme heat build up as occurs in a fire

*NOTE When fitted to a door, the assembly usually has a Louvre or grille on both sides.*

- 3.11 natural convection air heater**  
air heater designed for location within a centrally-sited convection chamber
- 3.12 open-flued (type B) heater**  
heater designed to be connected to an open-flued system, its combustion air being drawn from the room, space or compartment in which it is installed
- 3.13 plenum**  
box connected to a heater outlet that equalizes air pressure to the supply ducts
- 3.14 protected stairway**  
stairway, including an exit passageway leading to a final exit, enclosed with a fire-resistant construction, other than any part that is an external wall of a building
- 3.15 register**  
fitment equipped with a damper or movable Louvres that permits adjustment or closure of an opening from which air discharges
- 3.16 room-sealed (type C) heater**  
heater in which the combustion circuit (air supply, combustion chamber, heat exchanger and evacuation of the products of combustion) is sealed from the room in which the heater is installed
- 3.17 SE-duct**  
duct rising vertically through a building, open at its extremities, and serving to bring combustion air to, and to take products to the outside air from, Type C<sub>2</sub> room-sealed appliances
- 3.18 slot-fit heater**  
heater that is specifically designed and manufactured for installation in a purpose-built recess in such a way that only the front of the heater opens into a room or internal space  
*NOTE On open-flued heaters, combustion air and air for dilution passes through the front of the heater's panels.*
- 3.19 transfer grille**  
non-adjustable fitment for location within a wall, door or partition, to effect the transfer of air between adjacent rooms and/or spaces  
*NOTE These grilles can also provide the route for combustion air, so their size has to be calculated accordingly (see BS 5440-2).*
- 3.20 U-duct**  
duct in the form of a vertical "U", the ends being open and adjacent, one limb of which provides combustion air to the bottom of the "U", whilst room-sealed appliances, (Type C<sub>2</sub>), (both air supply duct and flue duct) are fitted to the other limb  
*NOTE A continental European arrangement fits the air supply duct of the appliance (Type C<sub>4</sub>) to one limb and the flue duct to the other.*

## 4 Selection of equipment and pre-installation

### 4.1 Exchange of information and planning

Persons who design the heating system or installation shall have a knowledge and understanding of the standards and regulations that apply to ensure that any completed plans produce a safe and satisfactory installation.

Persons concerned with the selection of the heater and the design of the system shall collaborate with the operative during the planning and the execution of the work.

#### COMMENTARY AND RECOMMENDATIONS ON 4.1

##### **Consultation between those carrying out the work**

*Liaison between the persons carrying out the work is essential for a safe and efficient heater installation.*

*The following matters should be considered when carrying out new or replacement installations:*

- a) *the number of storeys in the building, which determines the installation requirements (see 5.3.3);*
- b) *the type of building, its form of construction (for example timber framed) and its level of thermal insulation<sup>7)</sup>;*
- c) *the location, orientation and exposure of the building;*
- d) *the size, layout and purpose of rooms and working areas;*
- e) *the total heat requirements;*
- f) *the availability of adequate gas supplies;*
- g) *the best location of the heater<sup>8)</sup>;*
- h) *the size, height, type, support and route of the chimney and the position of termination, including the possible consequences of any plumbing<sup>9)</sup>;*
- i) *the availability of adequate air for combustion and ventilation;*
- j) *the electrical supplies available;*
- k) *the water supplies available (where applicable);*
- l) *the provisions of any local and water bylaws; and*
- m) *the external controls of the heating system (see the DCLG publication, Domestic Heating Compliance Guide [14]).<sup>10)</sup>*

<sup>7)</sup> Information on gas installations in timber framed and light steel framed buildings is given in IGEM/UP/7, Edition 2. Information on gas installations in flats and other multi-dwelling buildings is given in IGE/G/5, Edition 3 [13].

<sup>8)</sup> When the layout and disposition of the various areas to be heated are known, the size, type and location of the heater required should be determined. The path of the chimney system and the ventilation requirements might also affect the choice of the location of the heater. Whenever reasonably practicable, a room-sealed heater should be installed. The design of ductwork and ancillary equipment for the heating system is dealt with in CORGI's Warm Air Heating System Design Guide [1].

<sup>9)</sup> Particular notice is drawn to the advice given in BS 5440-1:2008, Clause 12, on the connection to SE-duct, U-duct and shared chimneys. Attention is drawn to the Gas Safety (Installation and Use) Regulations [2] with respect to the need for inspection throughout the length of the chimney system.

<sup>10)</sup> The Domestic Heating Compliance Guide [14] will be replaced by the Domestic Building Services Compliance Guide in October 2010.

**Consultation with official bodies**

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

- 1) *The local authority, with regard to building regulations and planning application requirements.*
- 2) *The fire authority, with regard to 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), with regard to 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) [12] or relevant bylaws.*

**4.2 Selection of heater****4.2.1 General**

The installer shall ensure that a new heater carries a CE mark.

The heater used shall be one that has been marked by the manufacturer as being suitable for the gas with which it is to be supplied.

A previously used heater shall not be installed if the manufacturer's instructions are not available to the installer.

A heater shall only be installed if it has a readable data plate.

**COMMENTARY AND RECOMMENDATIONS ON CLAUSE 4.2.1**

*The efficiency of the heater should be taken into account during selection. The heater manufacturer's literature might indicate the claimed efficiency when measured in accordance with BS EN 778 for an open-flued heater or BS EN 1319 for a fanned-flued heater.*

*Attention is drawn to the Building Regulations for England and Wales, Part L and to Approved Documents L1A for new dwellings [15], L1B for existing dwellings [16], L2A for new buildings other than dwellings [17], and L2B for existing buildings other than dwellings [18]. For selection of a heater in England and Wales attention is drawn to:*

- a) *the DCLG publication, Domestic Heating Compliance Guide – Compliance with Approved Document L1A: New dwellings and L1B: Existing dwellings [14]; and*
- b) *the DCLG publication, Non-Domestic Heating, Cooling and Ventilation Compliance Guide – Compliance with Approved Document L2A, New buildings other than dwellings and L2B, Existing buildings other than dwellings [18].<sup>11)</sup>*

*Attention is drawn to the HSE Approved Code of Practice and Guidance L56, Safety in the installation and use of gas systems and appliances [20].*

*For selection of a heater in Scotland attention is drawn to the Scottish Building Standards Agency Domestic Technical Handbook [21] and Non-domestic Technical Handbook [22].*

<sup>11)</sup> The Non-Domestic Heating, Cooling and Ventilation Compliance Guide [19] will be replaced by the Non-Domestic Building Services Compliance Guide in October 2010.

### **New heaters**

*Of the heaters covered by this standard, new heaters fall within the scope of the European Gas Appliances Directive [23], implemented in the UK by the Gas Appliances (Safety) Regulations [4], which require new heaters to be CE marked.*

*The installer should check that the packaging and the heater's data plate are marked with at least the following information.*

- a) *The letters "GB".*
- b) *The type of gas and appliance inlet pressure as follows:*
  - 1) *for a heater adjusted for natural gas, "G20 and/or natural gas 20 mbar" plus the designation I2H;*
  - 2) *for a heater adjusted for butane, "G30 and/or butane 29 mbar" plus the designation I3B;*
  - 3) *for a heater adjusted for propane, "G31 and/or propane 37 mbar" plus the designation I3P;*
  - 4) *for a heater that is designed to burn either butane or propane gas at the correct pressure, "G30/G31 and/or butane/propane 29/37 mbar" plus the designation I3+.*

*Where a heater's data plate carries the letters CAT I or CAT II followed by the gas type designations (i.e.  $2H$ ,  $2P$ ,  $2B$ ), then the heater may be used for different types of gases when adjusted to do so. In such a case, the installer should ensure that the heater is correctly adjusted.*

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

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

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

### **Previously used heaters**

*It is recommended that a previously used heater is not installed. However, where such a heater is to be installed and the original packaging is not available, the installer should, by referring to the data plate and/or other means, ensure that the heater is suitable for the pressure and type of gas to be burnt. If there is any doubt, the heater should not be installed. Where the heater manufacturer's instructions are not available, these should be obtained from the manufacturer or his agent before installation of the heater begins.*

*Where a used heater carries the "CE" mark, its data plate is likely to carry the information on type of gas and appliance inlet pressure. In such a case, the installation should proceed in accordance with the manufacturer's instructions.*

*Where the heater does not carry a "CE" mark, other criteria could apply, such as surface temperatures, heater stability, ventilation, etc., and these need to be taken into account in deciding the method of installation. The installer should satisfy himself that the heater is safe in construction and condition, and can be used without constituting a danger.*

## **4.2.2 Sizing the heater**

The heater shall have a rated output sufficient to satisfy the heat requirements of the building as agreed between the installer or designer and the owner/occupier of the premises in which the heater is to be installed, taking into account any losses from the warm air ducting.

**COMMENTARY ON 4.2.2**

*Information on the methods for determining heat requirements and fan requirements is given in the Warm Air Heating System Design Guide [1]. Further information, particularly on heat losses and sizing, can also be found in CIBSE Guide B3: Ductwork [24].*

**4.2.3 Types of heater**

The heater shall be selected to suit the operating characteristics required by the heating system's design.

**COMMENTARY ON 4.2.3**

*There are three types of heater which are categorised according to the direction of air flow through the heater:*

- a) upflow;*
- b) downflow; and*
- c) horizontal flow.*

*Some of these can be combined with an integral water heater.*

*Condensing appliances are also available.*

**4.3 Location of heaters**

The location of a heater shall be in accordance with the manufacturer's instructions and the chosen location shall ensure that the requirements of 5.1 to 5.7 are met.

**COMMENTARY ON 4.3**

*The Gas Safety (Installation and Use) Regulations 1998 [2] require that:*

- a) a heater installed in a room or internal space containing or intended to contain a bath or shower has to be room-sealed;*
- b) a heater of greater than 12.7 kW net (14 kW gross) heat input installed in a room used or intended to be used as sleeping accommodation has to be room-sealed;*
- c) a heater of not greater than 12.7 kW net (14 kW gross) heat input installed in a room used or intended to be used as sleeping accommodation has to be room-sealed or has to incorporate a safety control designed to shut down the heater before there is a build up of a dangerous quantity of combustion products in the room concerned; and*
- d) a heater for use with 3rd family gases, which uses automatic-ignition or a pilot light, shall not be installed in a room or internal space below ground level, e.g. a basement.*

*The regulations do not preclude the installation of such appliances in rooms or internal spaces which are basements with respect to one side of the building but which are open to ground level on the opposite side.*

*A previously used, non room-sealed gas heater should not be installed in a room used or intended for use as sleeping accommodation because the device for shutting down the heater in the event of a build up of combustion products might not be present or acceptable. Where there is any doubt as to whether the heater is fitted with an acceptable device it should not be installed in sleeping accommodation.*

*A room-sealed heater may be installed in any room or space. Installation of a gas heater in a bathroom, shower room or bedroom should be considered only if there is no alternative location and the manufacturer's instructions state that the heater is suitable for installation in a bathroom, shower room or bedroom.*

*Any type of heater may be installed in a private garage unless the manufacturer's instructions for a particular heater state that it is unsuitable for use in such a location. A heater should not be installed in any premises where concentrations of flammable vapour could accumulate, e.g. commercial garages and workshops. Reference should be made to the British Gas publication, IM/28: Gas appliances in garage workshops [25].*

## 4.4 Condensing heaters

### 4.4.1 General

Heaters 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 4.4.2, 4.4.3, 4.4.4, 4.4.5 and 4.4.6 shall be followed.

#### COMMENTARY AND RECOMMENDATIONS ON 4.4.1

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

### 4.4.2 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 heater 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 4.4.2

*Condensing heaters 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 free passage of air is needed to aid plume dispersal.*
- *The flue terminal should not be sited under a carport.*
- *In cold weather, the plume could cause a safety hazard if it freezes on pathways, or if it results in frost damage to surfaces.*
- *The plume could trigger infra-red security lighting if sited in the wrong place.*