Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

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

bsi.

...making excellence a habit.™

Publishing and copyright information
The BSI copyright notice displayed in this document indicates when the document was last issued.

© BSI 2010

ISBN 978 0 580 68284 1

ICS 97.100.20

The following BSI references relate to the work on this standard:
Committee reference GSE/30
Draft for comment 09/30205734 DC

Publication history
First published June 1980
Second edition September 1989
Third edition December 2004
Fourth (present) edition October 2010

Amendments issued since publication

Date	Text affected

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Contents

Summary of pages
This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 40, an inside back cover and a back cover.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013 Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

This page deliberately left blank

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This British Standard supersedes BS 5864:2004, which is withdrawn.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]

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

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]

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

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*

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013
Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

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*

IGE/UP/1, Edition 2, *Strength testing, tightness testing and direct purging of industrial and commercial gas installations* [1)]

IGE/UP/1A, Edition 2, *Strength and tightness testing and direct purging of small low pressure industrial and commercial Natural Gas installations* [2)]

IGE/UP/1B, Edition 2, *Tightness testing and direct purging of small Natural Gas installations* [3)]

IGEM/UP/2, Edition 2, *Installation pipework on industrial and commercial premises* [4)]

IGEM/UP/7, Edition 2, *Gas installations in timber framed and light steel framed buildings* [5)]

UKLPG UIS 014, *Gas Soundness Testing of LPG Service Pipework, Installation Pipework and Appliances in Holiday Homes, Caravans and Motor Homes* [6)]

---

1) 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.

2) 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.

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

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

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

6) 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/).

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

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.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013
Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

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_2 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_2), (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_4) to one limb and the flue duct to the other.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013
Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

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 [7)];

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 [8)];

h) the size, height, type, support and route of the chimney and the position of termination, including the possible consequences of any pluming [9)];

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]). [10)]

---

7) 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].

8) 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].

9) 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.

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

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

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].* [11)]

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].*

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

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

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.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

*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.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013
Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

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.*

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

- *The plume could affect the performance of external temperature sensors associated with energy management control systems.*
- *The chimney outlet or plume should not obscure security camera field of vision.*
- *The chimney outlet guards should be able to resist corrosive properties of the condensate.*
- *The need for a plume management kit when provided or specified by the appliance manufacturer.*
- *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 **4.4.4.1**).*

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 *[26].*

4.4.3 The choice of condensate drainage pipe

4.4.3.1 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).

4.4.3.2 Condensate removal by gravity

The condensate drainage pipe connected to the condensate drain outlet on the heater 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 heaters have a siphon fitted as part of the condensate trap arrangement. This significantly reduces 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 heater 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.

Where external run condensate drainage pipe requires insulation, waterproof pipe insulation shall be used.

*COMMENTARY AND RECOMMENDATIONS ON **4.4.3.2***
When a heater 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.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

4.4.3.3 Condensate removal by pump

A condensate removal pump shall be used when the condensate cannot be removed by gravity to achieve the condensate drainage arrangements in **4.4.4**. Where a condensate removal pump is required, the heater manufacturer shall be consulted for suitable options.

*COMMENTARY AND RECOMMENDATIONS ON **4.4.3.3***
Examples of where a condensate pump can provide a solution are where a heater is to be installed in a basement or below ground level, or conversely on an internal wall or in an airing cupboard. Manufacturers of condensate pumps can also provide detailed suggestions for the optimum disposal routes.

4.4.4 The positioning and termination of the condensate drainage pipe

4.4.4.1 General

The condensate drainage pipe shall be positioned and terminated such that it discharges the condensate safely away from the building.

All condensate drainage pipes and connecting pipework operating under gravity shall have a fall of at least 2.5° to the horizontal or approximately 45 mm per metre of condensate drainage pipe run. The number of bends and fittings shall be kept to a minimum in order to reduce the risk of condensate being trapped.

*NOTE 1 Where condensate cannot be removed under gravity, see **4.4.3.3** for guidance on condensate removal pumps.*

Suitable condensate discharge arrangements shall be by connection to:

a) a soil and vent stack (internal or external) (see **4.4.4.2**);

b) an internal waste pipe (see **4.4.4.3**);

c) an external drain, rainwater downpipe, or gully, which discharges into a foul water system and does not discharge into a surface water or storm drain (see **4.4.4.4**);

d) a rainwater hopper that is part of a combined system, i.e. a sewer that carries both foul water and rainwater (see **4.4.4.4**);

NOTE 2 For further information on the identification of a combined system, refer to the local water undertaker.

e) a purpose-made soakaway (see **4.4.4.5**).

NOTE 3 Where the condensate is, by design, discharged with the combustion products from the flue terminal, the manufacturer's instructions will contain advice regarding the siting of the chimney outlet to ensure safe disposal of the condensate.

*COMMENTARY AND RECOMMENDATIONS ON **4.4.4.1***
Internal drainage points are preferred as they are less likely to become blocked (for example, by leaves or by frozen condensate).

It should be noted that the connection of a condensate drainage pipe to a drain might be subject to local building controls.

The condensate drainage pipe should be supported at a maximum spacing of 0.5 m for near horizontal sections and 1.0 m for vertical sections.

In some circumstances it is permissible to connect the condensate drain to either a package treatment plant (i.e. a digester), a septic tank or a cesspit; however, this should not be undertaken unless the person responsible

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

for the sewerage system has agreed that it will not adversely impact on the system. To make this assessment, the person responsible will need to know the typical condensate discharge conditions, e.g. the amount of acidulated condensate produced per day, the pH of the condensate and the proportion that the condensate is of the total flow going to the package treatment plant, septic tank or cesspit.

4.4.4.2 Connection to a soil and vent stack system (Figure 1)

4.4.4.2.1 Connection to an internal soil and vent stack system

NOTE 1 Provided that the condensate drainage pipe meets the requirements in 4.4.3 and 4.4.4, there is no length restriction.

The condensate drainage pipe shall incorporate a trap with a minimum condensate seal of 75 mm. Many condensing heaters will incorporate a condensate trap within the heater; if this condensate trap has a condensate seal of less than 75 mm, then an additional trap of 75 mm shall be fitted with a visible air break between the heater and the additional trap.

The condensate drainage pipe shall not discharge into the internal soil and vent stack lower than 450 mm above the invert of the tail of the bend at the foot of the stack for single dwellings of up to three storeys. If this is not visible then the height shall be measured from the lowest straight section of the stack that is visible.

For multi-storey buildings this distance shall be increased as follows:

a) for up to and including five storeys, the condensate drainage pipe shall not discharge into the internal soil and vent stack less than 750 mm above the invert of the tail of the bend at the foot of the stack;

b) for more than five storeys but not more than 20 storeys, ground-floor appliances shall discharge into their own internal soil and vent stack or discharge directly to an external drain, gully or rainwater hopper;

c) for more than 20 storeys, the ground-floor and first-floor appliances shall discharge into their own internal soil and vent stack or directly to an external drain, gully or rainwater hopper.

d) The connection to the internal soil and vent stack shall not be made in a way that could cause cross flow into any other branch pipe or from that branch pipe into the condensate drainage pipe.

NOTE 2 This can be achieved by maintaining an offset between branch pipes of at least 110 mm on a 100 mm diameter stack and 250 mm on a 150 mm diameter stack.

When connecting into a cast iron internal soil and vent stack, connection shall not be above the highest point of any existing wastewater or into any branch not used for wastewater disposal.

Any parts of the cast iron stack likely to be exposed to the condensate shall either be in a vertical plain, or be of reasonably short length with significant fall to limit the likelihood of concentrations of condensate at any point.

*COMMENTARY AND RECOMMENDATIONS ON **4.4.4.2.1***
A redundant branch where original sanitary appliances have been disconnected is an example of a branch not used for wastewater disposal.

Care should be exercized if any connection to the cast iron waste system involves drilling or cutting the cast iron as older existing cast iron installations can be brittle and prone to shatter.

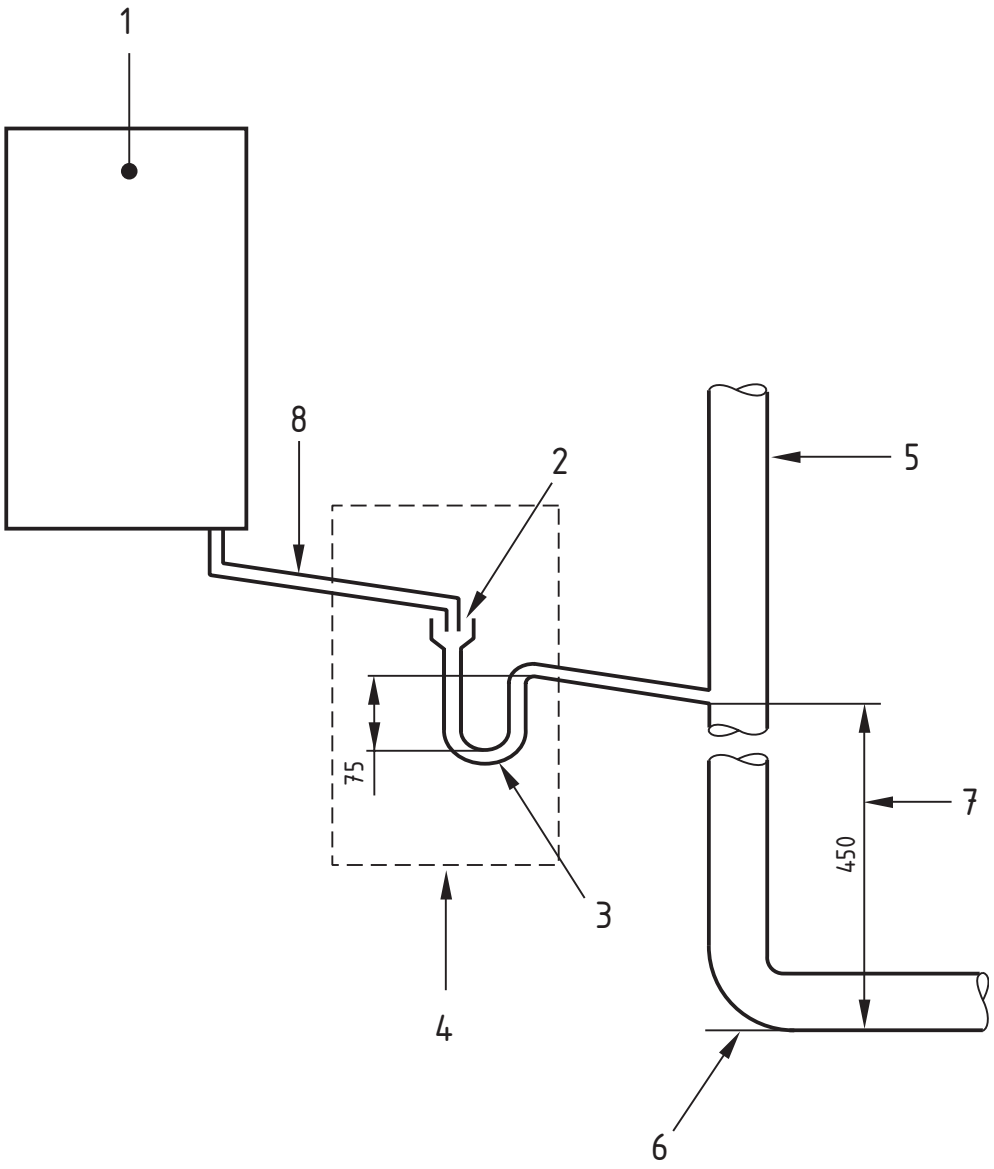
Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013
Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

4.4.4.2.2 Connection to an external soil and vent stack system

If the termination is to be to an external soil and vent stack, the connection shall conform to **4.4.4.2.1**; however, extra care is necessary in order to reduce the risk of the condensate drainage pipe becoming blocked due to the condensate freezing.

*NOTE For general requirements on external condensate drainage pipes see **4.4.3.2**.*

Figure 1 **Connection of condensate drainage pipe to soil and vent stack**



Key

1 Warm air
2 Visible break
3 75 mm trap
4 Visible air break and trap not required if there is a trap with a minimum condensate seal of 75 mm incorporated into the heater.
5 Soil and vent stack
6 Invert
7 450 mm minimum up to three storeys
8 Nominal diameter 22 mm

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

4.4.4.3 Connection to an internal waste pipe (Figure 2)

*NOTE 1 Provided that the condensate drainage pipe meets the requirements of **4.4.3** and **4.4.4**, there is no length restriction.*

The connection shall be made to the internal waste pipe from a sink, washing machine, dishwasher, basin, bath or shower, either downstream [Figure 2a)] or upstream [Figure 2b)] of the waste trap.

NOTE 2 If practical, the connection should be made to the upper part of the pipe wall.

If the connection is downstream of the waste trap and the heater does not have an integral condensate trap with a depth of seal of at least 75 mm then an additional trap of at least 75 mm shall be fitted.

A visible air break shall be included between the trap in the heater and the additional trap, as shown in Figure 2a).

If the connection is upstream of the waste trap, then a visible air break is necessary between the waste trap and the condensate trap but, in the case of a sink, basin or bath, this is provided by the sink, basin or bath waste pipe itself as long as the sink, basin or bath has an integral overflow, as shown in Figure 2b).

In order to prevent waste from the sink, washing machine, dishwasher, basin, bath or shower entering the condensate trap, there shall be a minimum of 100 mm between the visible air break at the lowest condensate trap and the top of the sink, basin, bath or shower tray or visible air break serving the washing machine or dishwasher.

*COMMENTARY AND RECOMMENDATIONS ON **4.4.4.3***
It is preferable to connect to a washing machine drain rather than a kitchen sink; this reduces the likelihood of solid waste and fats blocking or restricting the drainage of condensate.

4.4.4.4 Connection to an external drain, gully or rainwater hopper (Figure 3)

The open end of the condensate drainage pipe shall be directed into a rainwater hopper or gully below the grating and above the water level. Unless the heater includes a trap of at least 38 mm depth, a trap of at least 38 mm shall be installed between the heater and the discharge point, with a visible air break between the heater and the trap.

*NOTE 1 For general guidance on external condensate drainage pipes, see **4.4.3.2**.*

NOTE 2 When connecting the condensate pipe into a rainwater downpipe, an appropriate fitting should be used i.e. the pipe should not be pushed directly into the downpipe as this could cause blockage.

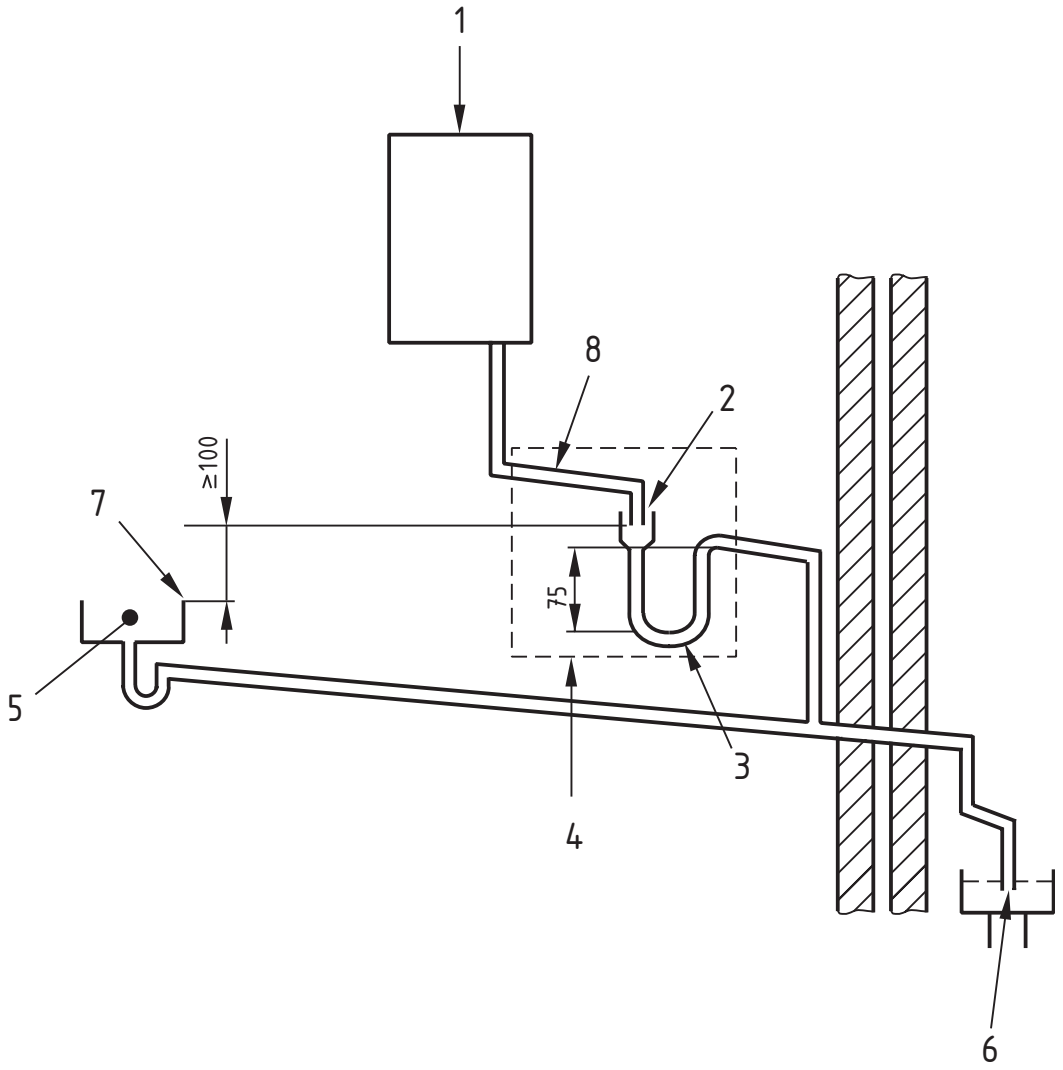
The rainwater hopper shall be part of a combined system [see **4.4.4.1**d)].

Condensate shall not be disposed of into a greywater recovery system that is intended for reuse.

NOTE 3 Further guidance on greywater recovery systems can be found in the Water Regulations Advisory Scheme (WRAS) publication, Reclaimed Water Systems*.* Information about Installing, Modifying or Maintaining Reclaimed Water Systems *(No. 9-02-04) [27].*

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013
Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Figure 2a) **Connection of a condensate drainage pipe downstream of a sink, basin, bath or shower waste trap**

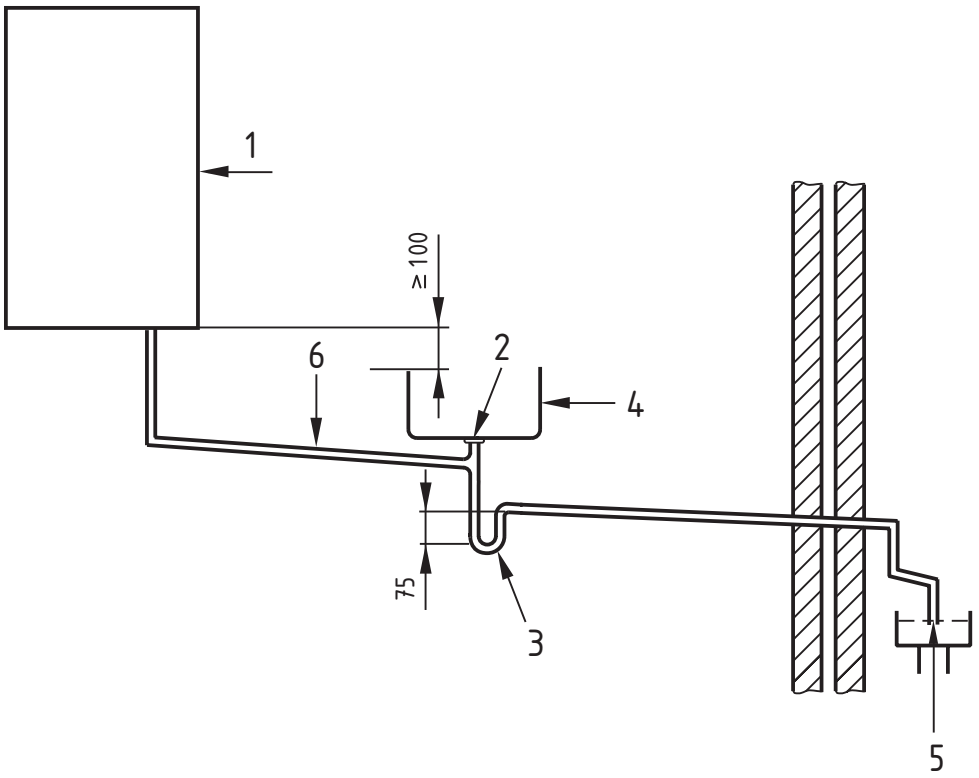


Key

1 Warm air
2 Visible air break
3 75 mm trap
4 Visible air break and trap not required if there is a trap with a minimum condensate seal of 75 mm incorporated into the heater. In this case the 100 mm is measured to the trap in the heater.
5 Sink, basin, bath or shower
6 Open end of condensate drainage pipe direct into gully below grating but above water level
7 Sink lip
8 Nominal diameter 22 mm

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Figure 2b) **Connection of a condensate drainage pipe upstream of a sink, basin, bath or shower waste trap**

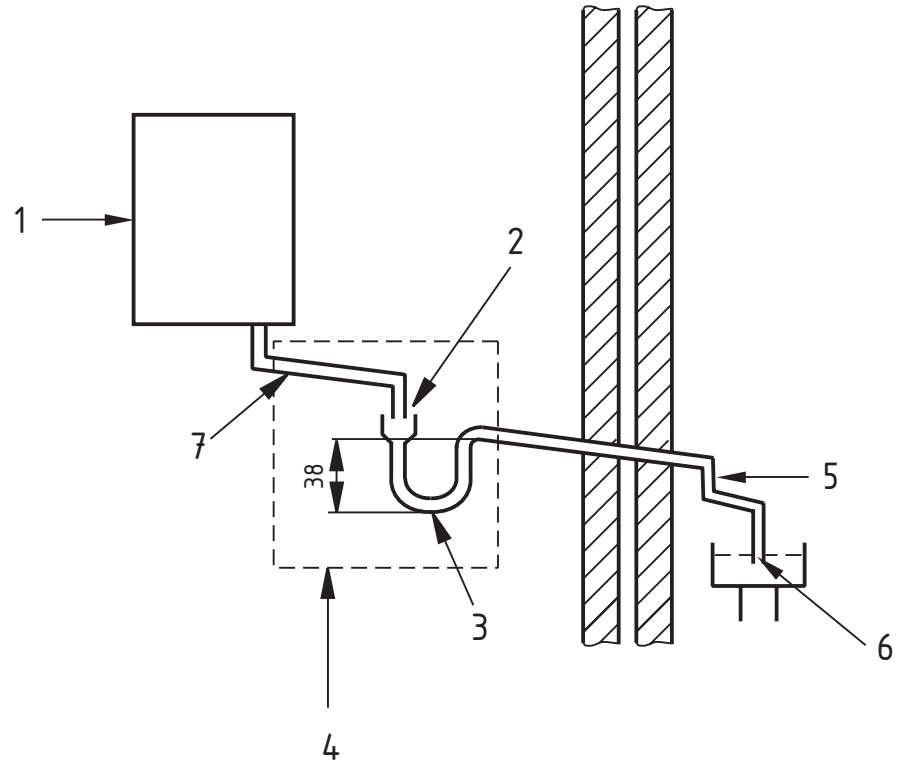


Key

1 Warm air
2 Visible air break at plug-hole
3 75 mm sink, basin, bath or shower waste trap
4 Sink, basin, bath or shower with integral overflow
5 Open end of condensate drainage pipe direct into gully below grating but above water level
6 Nominal diameter 22 mm

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013 Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Figure 3 **External termination of condensate drainage pipe**



Key

1 Warm air
2 Visible air break
3 38 mm minimum trap
4 Visible air break and trap not required if there is a trap with a minimum condensate seal of 38 mm incorporated into the heater
5 External length of pipe 3 m maximum
6 Open end of condensate drainage pipe direct into gully below grating but above water level
7 Nominal diameter 22 mm

4.4.4.5 Connection to a purpose-made soakaway (Figure 4)

If none of the condensate discharge arrangements in **4.4.4.2**, **4.4.4.3** and **4.4.4.4** are practicable, a purpose-made soakaway shall be used. It shall be sited in a convenient position as close as possible to the heater, but clear of the building's foundations, ensuring that no other services are in the vicinity to avoid interfering with their functions.

NOTE 1 An example of a suitable design is shown in Figure 4.

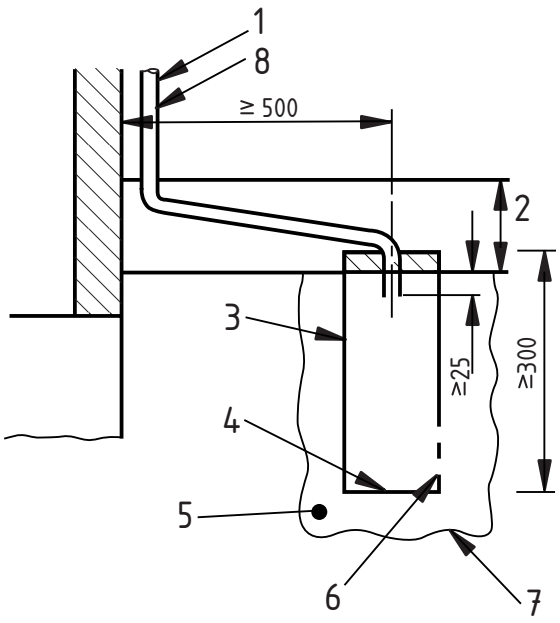
Unless the heater includes a trap of at least 38 mm depth, a trap of at least 38 mm shall be installed between the heater and the discharge point, with a visible air break between the heater and the trap.

*NOTE 2 For general guidance on external condensate drainage pipes, see **4.4.3.2**.*

If the existing installation includes a purpose-made soakaway, when a new heater is installed and the soakaway is to be reused, the limestone chippings in and/or around the soakaway shall be replaced.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013 Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Figure 4 **Example of a purpose-made soakaway**



Key

1 External length of uninsulated pipe 3 m maximum
2 Ground (this section of the condensate drainage pipe may be run either above or below ground level)
3 Diameter 100 mm minimum plastic tube
4 Bottom of tube sealed
5 Limestone chippings
6 Two rows of three 12 mm holes at 25 mm centres, 50 mm from bottom of tube and facing away from house
7 Hole depth 400 mm minimum by 300 mm diameter
8 Nominal diameter 22 mm

4.4.5 In-line condensate neutralizer devices

Where an in-line neutralizer device is fitted in the condensate line:

a) the heater manufacturer's installation instructions shall allow that such a device can be fitted;

b) the flow rate through the device shall be compatible with the condensate flow rate stated by the heater manufacturer's instructions;

c) the installation instructions supplied with the neutralizer device shall include advice on the effective life of the neutralizing agent, temperature limitations and method of replacement;

d) details of this effective life shall be prominently and durably fixed to the outside of the heater casing by the operative and shall clearly state that it is the responsibility of the customer to ensure that a suitable service regime is in place;

e) the restrictions on condensate drainage pipe material in **4.4.3** and the discharge arrangements specified in **4.4.4.1** shall continue to apply, unless the system is designed to automatically turn off the heater in the event of the neutralizing agent no longer neutralizing the condensate, and requires a qualified operative to restart the heater.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

*COMMENTARY AND RECOMMENDATION ON **4.4.5***
*Unless the neutralizing device automatically shuts off the heater as described in item e) (because there is no guarantee that the customer will have a suitable service regime in place) then, if the drainage pipe fitted to the outlet of the device be other than specified in **4.4.3**, it is likely the drainage pipe will corrode and perforate and the acidic condensate will be inappropriately discharged.*

4.4.6 Materials and components

All materials and components used in the installation shall conform to the applicable British or European Standard if such a standard exists.

Materials containing asbestos shall not be used. High-melting-point solders incorporating cadmium shall not be used.

NOTE Attention is drawn to the Water Supply (Water Fittings) Regulations (as amended) [12], which require that materials in contact, or likely to come in contact with wholesome water (water supplied for such domestic purposes as exist in or include, cooking, drinking, food preparation or washing) do not constitute a toxic hazard, do not contribute to microbiological growth and do not give rise to unpleasant taste or odour, cloudiness or discolouration of the water.

*COMMENTARY AND RECOMMENDATIONS ON **4.4.6***
Where no British or European Standard exists, materials and components should be of a suitable quality, and should be designed, constructed and installed to fulfill their intended purpose and so as not to put the safety of persons at risk.

Products for installation in the United Kingdom should be selected from those which have been verified and listed under the UK Water Fittings Byelaws Scheme, at The WRc, Evaluation and Testing Centre, Fern Close, Pen-Y-Fan Industrial Estate, Oakdale, Gwent, NP11 4EH, see www.wrcnsf.com.

5 Installation

5.1 Ventilation

5.1.1 General

The installation of ventilation for a heater shall be in accordance with the heater manufacturer's instructions and BS 5440-2.

*COMMENTARY AND RECOMMENDATIONS ON **5.1.1***
The building control officer at the local authority should be consulted to determine whether radon gas has been identified as a problem in the locality. See BS 5440-2 for further details.

Guidance on ventilation for permanently sited leisure accommodation vehicles, residential park homes and boats is given in BS 5482-1, BS EN ISO 10239, BS EN 721, BS 3632 and PD 5482-3. Information for timber framed housing is given in IGEM/UP/7.

5.1.2 Combined appliances

The ventilation requirements for a combined air heater/circulator shall be calculated from the sum of the maximum heat inputs of the two appliances.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

5.1.3 Multi-appliance installations

If a heater is to be installed in a room or space that already contains one or more fuel appliances, the ventilation required shall be calculated as specified in BS 5440-2 and BS 5871-3, as appropriate.

5.1.4 Fanned air supply

5.1.4.1 Where the supply of outside air is to be introduced by the heater's circulating fan, a minimum flow of 2.2 m^3/h shall be drawn into the return duct or plenum for every 1 kW of net input rating. Provision shall be made for the adjustment of the flow of induced air by means of a lockable damper or a similar control.

*COMMENTARY AND RECOMMENDATIONS ON **5.1.4.1***
An acceptable method of providing a supply of outside air is to connect a duct from a ventilated roof space, or from a grille on an outside wall, to the return air duct or return plenum. Where this method of air supply is to be employed, guidance should be sought from the heater manufacturer. Information on setting air flows for this method of air supply is given in Annex D, in The Warm Air Heating System Design Guide [1] *and in manufacturers' instructions and/or guidance.*

Figure 5 shows a typical installation where the air is supplied from a ventilated roof space.

5.1.4.2 For fan-assisted provision of outside air, a duct from the ventilated roof space or outside wall grille shall be connected to the return air duct or return air plenum.

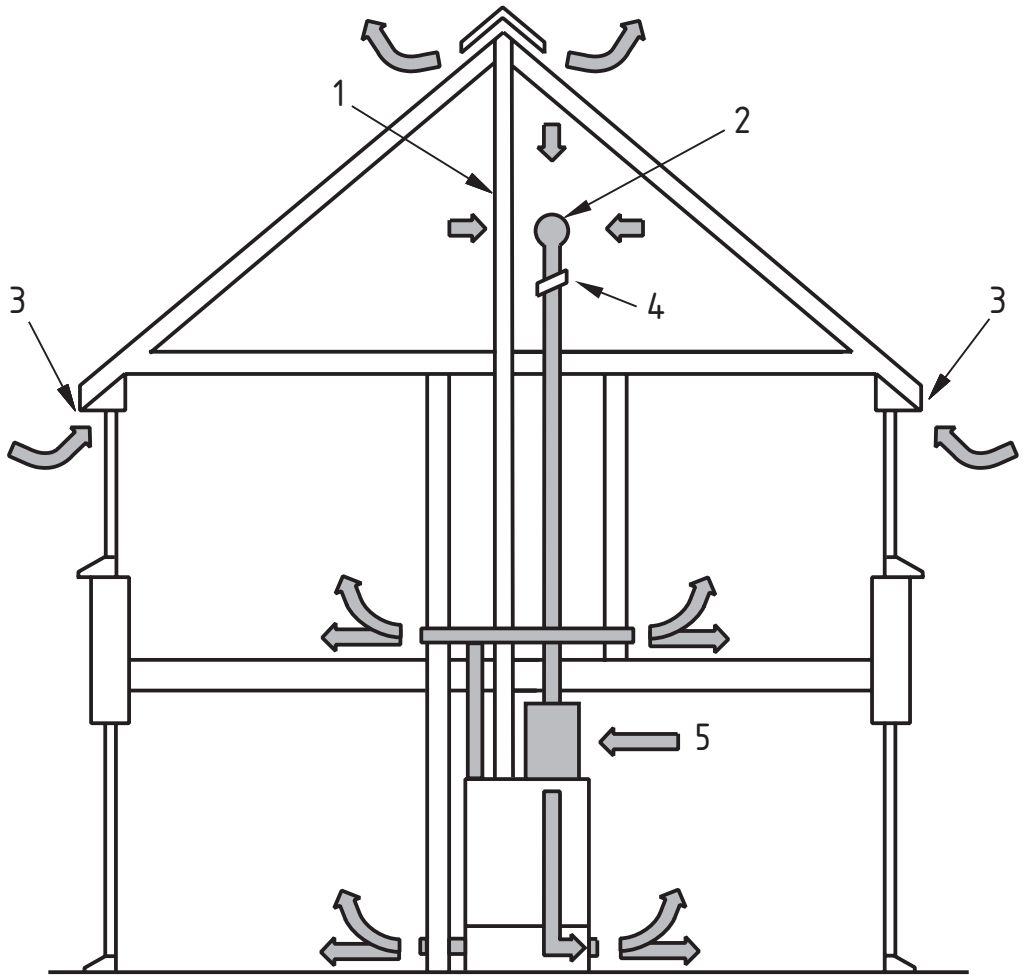
*COMMENTARY ON **5.1.4.2***
When the heater operates, its fan draws in outside air, mixes it with return air and circulates it. Warm air is circulated to the space where the heater is installed.

5.1.4.3 Where the air supply is ducted from the roof space, the air vent opening shall be sited not less than 300 mm above joists or 150 mm above the level of the insulation, whichever is the greater, and a bird guard shall be fitted to the duct inlet (see Figure 5). The route for the air supply shall be in the form of a non-closable heat outlet grille located in the same space as the combustion air inlet to the heater. Where the heater is installed within a compartment, the non-closable heat outlet grille shall be located in the same space as the air inlet to the compartment.

*NOTE Where combustion air is taken from the roof space, if that roof space is ventilated using a "breathable roofing felt", the roof space should not be considered as outside air (see BS 5440-2:2009, **6.2**).*

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013
Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Figure 5 **Typical installation where combustion air is supplied from a ventilated roof space**



Key

1 Flue
2 Air inlet
3 Soffit vents
4 Lockable damper
5 Return air

5.2 Chimney system

5.2.1 General

The installation of the chimney system and the mode of connection to the heater shall be in accordance with the requirements of the appliance manufacturer's installation instructions and BS 5440-1.

When connecting a new heater to an existing chimney system, the chimney system shall be upgraded to the edition of BS 5440-1 current at the time of installation, as applicable.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

*COMMENTARY AND RECOMMENDATIONS ON **5.2.1***
Where 600 mm to the first bend as specified by BS 5440-1 is not practicable, reference should be made to the manufacturer's instructions. BS 5440-1:2008, Annex B, provides a procedure for estimating whether a given chimney design is likely to ensure full clearance of combustion products.

Wherever practicable, a room-sealed heater should be fitted.

The Asbestos (Prohibition) Regulations 1992 [5] place restrictions on the use of asbestos materials, including a total ban of asbestos cement and its products. Existing chimney systems may only be re-used in situ provided they are mechanically sound and the requirements and working procedures in BS 5440-1 are met.

*Heaters for use with SE-duct and U-duct chimney systems should be approved by a notified body for the application (see Commentary and Recommendations on **4.2.1**). Reference should be made to the heater manufacturer and BS 5440-1.*

Information on flueing for timber framed housing is given in IGEM/UP/7.

Guidance on chimneys for:

- *permanently sited residential park homes is given in BS 5482-1;*
- *leisure accommodation vehicles is given in BS 5482-2; and*
- *boats is given in PD 5482-3.*

Chimneys for residential park homes conforming to BS 3632 should be installed following the guidance given in BS 5440-1.

*Where it is proposed to route a room-sealed fan draught chimney system within a void, reference should be made to BS 5440-1:2008, **10.2.4**.*

5.2.2 Condensing heaters

Heaters designed to be used in the condensing mode shall be installed in accordance with the manufacturer's installation instructions.

*COMMENTARY AND RECOMMENDATIONS ON **5.2.2***
See BS 6798 for relevant information on the installation of condensing appliances.

5.3 Installation and location

5.3.1 General

A heater shall be located where there is sufficient space for ready access for installation, operation and servicing of the heater and its chimney, and, where not specified in the manufacturer's instructions, there shall be a minimum of 75 mm clearance from the appliance casing to any combustible material.

NOTE Clearance from the chimney system should conform to BS 5440-1.

5.3.2 Location of heaters within certain types of building

5.3.2.1 Buildings

In buildings of one or two storeys, heaters shall be installed in accordance with the manufacturer's instructions.

*COMMENTARY AND RECOMMENDATIONS ON **5.3.2.1***
The Warm Air Heating System Design Guide *[1] and the CIBSE* Guide B3: Ductwork *[24] contain information on the design and installation parameters.*

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013
Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

For installations in new buildings of two or more storeys, reference should be made to the applicable building regulations. Reference should also be made to BS 5588-1, which recommends that:

a) transfer grilles should not be fitted in any wall, floor or ceiling enclosing a protected stairway;

b) all ductwork passing through an enclosure to a protected stairway should be so fitted that all joints between the duct and the boundary are fire-stopped;

c) where ductwork is used to convey warm air into the protected stairway through the enclosure of the protected stairway, the return air from the protected stairway should be ducted back to the heater; and

d) warm air and transfer grilles or registers should be positioned at a height not exceeding 450 mm above floor level.

Items a) to d) do not apply to dwellings located within new buildings of two or more storeys which have their own access at ground or first floor level, or dwellings with a floor level not more than 4.5 m above ground or access level. Also exempt are existing dwellings in which an existing heater is to be replaced with a new heater of the same output and without significant alteration and/or extension to the duct system. In such instances, the manufacturer's instructions should be consulted.

5.3.2.2 Buildings of timber and steel frame construction

Installation shall be in accordance with the manufacturer's instructions and the IGEM publication, IGEM/UP/7.

5.3.3 Locations for installations

5.3.3.1 Compartments

If a heater is to be installed in a compartment, it shall only be installed, in accordance with the manufacturer's instructions, in a compartment possessing the following characteristics.

a) It is a fixed rigid structure, the internal surfaces of which are insulated from heat to the degree specified in the heater manufacturer's installation instructions.

b) It incorporates air vents for the provision of air for compartment cooling and, where necessary, combustion and correct operation of the chimney, in accordance with BS 5440.

NOTE 1 BS 5440-2 requires that no air vent penetrates a protected stairway.

c) It permits access for inspection and servicing of the heater and any ancillary equipment.

d) It is fitted with a door that permits withdrawal of the heater from any ancillary equipment.

e) In order to discourage the compartment's use as a storage cupboard, a notice is fixed in a prominent position to warn against such use.

f) Where the compartment is to house an open-flued heater, the return air grille(s) is connected by ductwork directly to the return air inlet on the heater (see **3.5**).

g) Where the compartment houses an open-flued heater, the door does not communicate with a room containing a bath or shower.

NOTE 2 BS 5440-2 requires that no air vent communicates with a bedroom or a room containing a bath or shower.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

h) Where the compartment houses an open-flued heater, the air vents and/or compartment door do not communicate directly with a bedroom or a room used or intended to be used as sleeping accommodation, unless the net heat input to the heater is below 12.7 kW (14 kW gross) and the heater incorporates a safety control designed to shut it down before a dangerous quantity of the products of combustion builds up in the room concerned.

i) Its floor, ceiling and wall are insulated from heat to the degree specified in the heater manufacturer's installation instructions.

j) Where the air heater is of the open-flued type, the draught diverter opening(s) and the air vents are located within the heater space.

NOTE 3 Where the heater manufacturer's installation requirements cannot be achieved, advice should be sought from the manufacturer. Where advice from the manufacturer is not available, any internal surface of the compartment which is of combustible material should be at least 75 mm from any part of the heater. It might be possible to reduce this dimension if the internal surfaces of the compartment are lined with non-combustible material. Methods of determining whether a material may be described as combustible or non-combustible are given in BS 476-22.

*COMMENTARY AND RECOMMENDATIONS ON **5.3.3.1***
Figure 6 shows a typical compartment installation.

5.3.3.2 Airing cupboards

If an airing cupboard is to be adapted to house a heater, the heater shall only be installed if the airing cupboard conforms to **5.3.3.1**.

Where the flue pipe passes through the airing space, the contents of the space shall be separated from the flue pipe by a guard comprising, for example, expanded metal or rigid wire mesh.

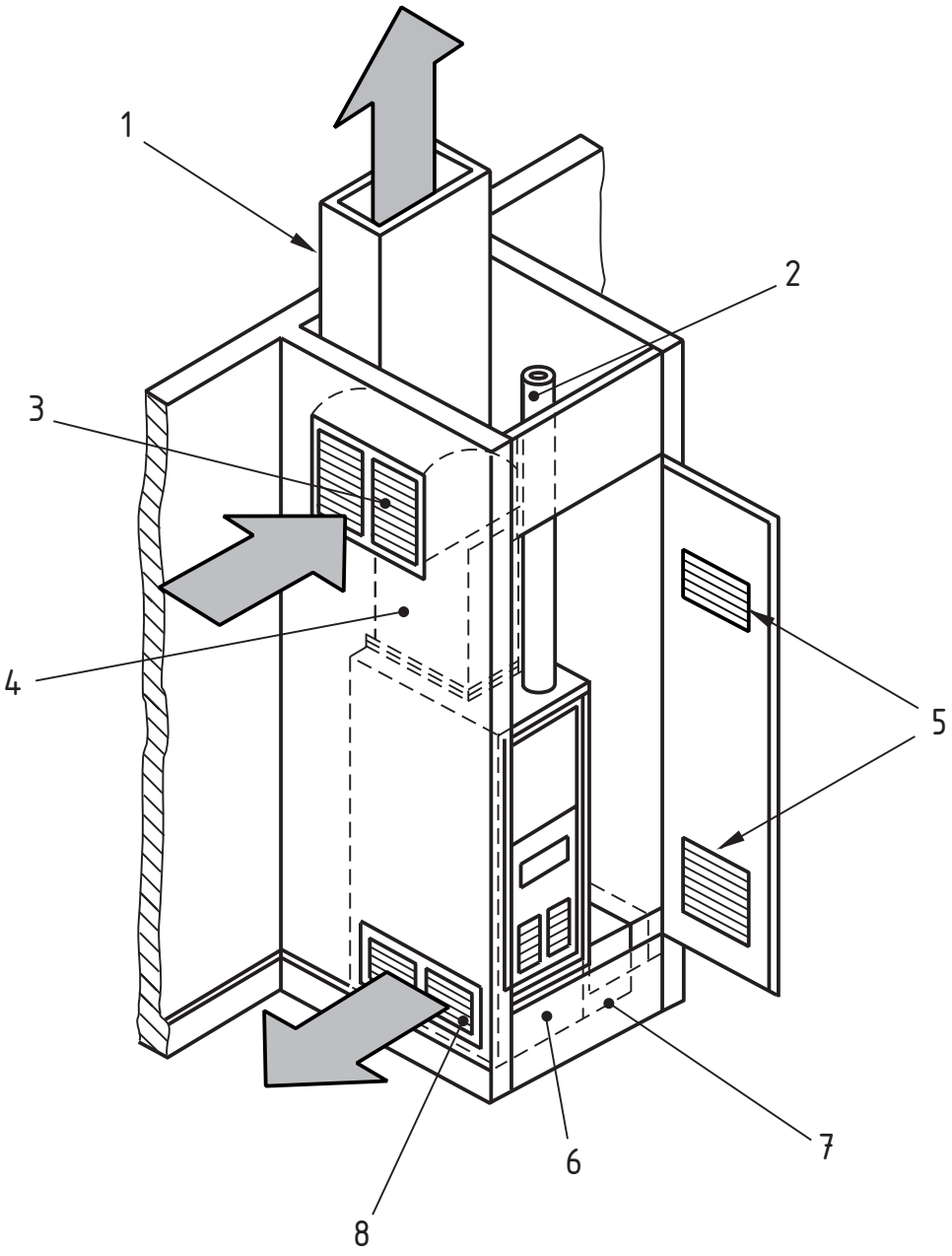
*COMMENTARY AND RECOMMENDATIONS ON **5.3.3.2***
BS 5440-2 requires that any airing space is separated from a gas appliance by a fire-resistant partition and that, where such a partition is formed from perforated material, the major dimension of the apertures does not exceed 13 mm.

For a double-walled flue pipe conforming to BS EN 1856-1, the level of insulation provided by the air gap between the internal and external walls may be deemed sufficient to provide the necessary protection.

For a single-walled flue pipe, a fire-resistant guard should be fitted around the flue pipe, with a minimum clearance of 25 mm between the pipe and the guard. The clearance between the flue guard and the compartment partition should be not less than 13 mm.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013
Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Figure 6 **Typical compartment installation of a down-flow fan-assisted ducted-air heater**



Key

1 Warm air rising duct (insulted where appropriate)
2 Flue
3 Return air grille
4 Return air duct
5 Vents for combustion air supply and compartment cooling
6 Warm air plenum
7 Warm air duct
8 Warm air outlet register

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

5.3.3.3 Under-stairs cupboards

If a heater is to be installed in an under-stairs cupboard, the heater shall only be installed in a cupboard which conforms to item a) or b), as applicable.

a) Where the building in which the cupboard is located is no more than two storeys, the cupboard shall conform to **5.3.3.1**.

b) Where the building in which the cupboard is located is more than two storeys, all the internal surfaces of the cupboard, including the base, shall be fire-resistant or lined with a material having a fire-resistance of not less than 0.5 h when determined in accordance with BS 476-22. The air vents shall be direct to the outside air.

*COMMENTARY AND RECOMMENDATIONS ON **5.3.3.3***
Where no practicable alternative location is available, an under-stairs cupboard installation may be considered.

Wherever possible, the heater in an under-stairs cupboard should be of the room-sealed type.

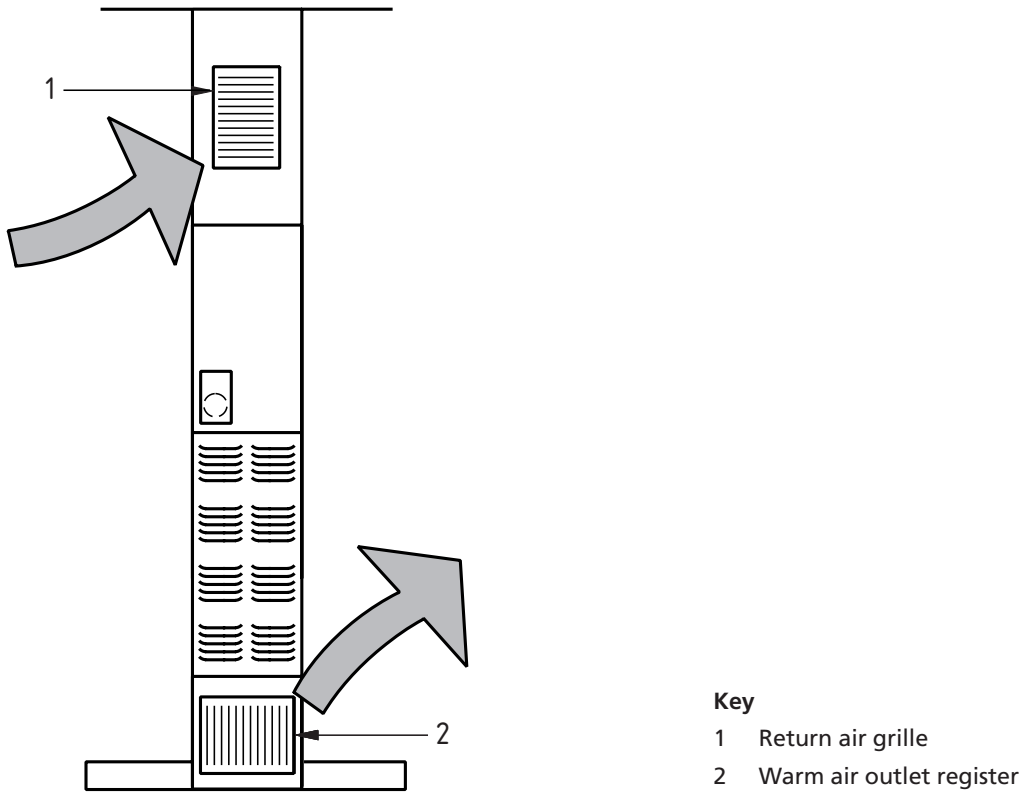
For buildings of three or more storeys, where ventilation direct to the outside air is not practicable, the approval of the local building control officer should be sought for the use of intumescent type air vents.

5.3.3.4 Slot-fit

Only those heaters specifically designed for slot-fit applications shall be installed in this manner and they shall conform to the manufacturer's instructions.

*COMMENTARY AND RECOMMENDATIONS ON **5.3.3.4***
Figure 7 shows a typical slot-fit installation.

Figure 7 **Typical slot-fit installation**



Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

5.3.3.5 Roof space installations

Roof spaces incorporating heater installations shall conform to the requirements listed below.

a) Flooring area sufficient to allow access for normal use and servicing shall be provided around the heater. The heater support shall be capable of supporting the load of the heater, ducting and associated pipework and equipment.

b) Where the floor is of combustible material and supports the heater, a non-combustible insulating base at least 12 mm thick shall be provided directly under the heater.

c) A purpose-designed means of access to the heater installation shall be provided.

*COMMENTARY AND RECOMMENDATIONS ON **5.3.3.5**c)*
A permanently fixed retractable roof ladder is considered to satisfy the requirement for a purpose-designed means of access. A safety guard should be provided around the roof space access opening.

d) Fixed lighting for the heater installation and the access shall be provided.

e) A guard shall be provided to prevent contact between stored articles and the heater, its associated pipework and chimney.

A heater with an integral circulator shall only be installed where the circulation head of water obtainable above the circulator conforms to the circulator manufacturer's instructions.

NOTE Vertical clearances should be provided for an air heater with an integral circulator.

5.4 Gas supply

The gas supply to the heater shall be installed in accordance with BS 6891, IGE/UP/2, BS EN 1949, BS 5482-1 or BS 5482-2, or, in the case of boats, PD 5482-3 or BS EN ISO 10239, as appropriate.

5.5 Electrical supplies and wiring

5.5.1 The electrical wiring installation to the heater shall conform to BS 7671.

*COMMENTARY AND RECOMMENDATIONS ON **5.5.1***
For installations in which a bath or shower is situated, attention is drawn to BS 7671.

5.5.2 Electricity supplies to the heater and any electrical controls shall be installed in accordance with the heater manufacturer's instructions. Only electrical components designed for use with the electrical supply voltage and of a rating sufficient to carry the electrical current required for the operation of the equipment shall be used.

5.5.3 The electrical installation shall conform to BS 7671.

5.5.4 Electricity supplies to the heater and any ancillary controls shall be installed in accordance with the manufacturer's instructions. All electrical components shall be designed for the electrical supply voltage and shall be of a rating sufficient to carry the electrical current required by the operation of the equipment. The boiler and its controls shall be suitably IP (ingress protection) rated for use in the intended location.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013
Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

5.5.5 The point of connection to the mains electricity shall be readily accessible and the method of connection shall provide electrical isolation of the heater and all ancillary electrical controls by either:

a) a double-pole switched fused connection unit; or

b) a fused three-pin plug and an unswitched shuttered socket outlet.

*COMMENTARY AND RECOMMENDATIONS ON **5.5.5***
The Institution of Electrical Engineers' Electrician's Guide to the Building Regulations *[28] advises that a minimum of 300 mm should be allowed from the edge of kitchen sinks and draining boards to the heater's point of connection to the mains electricity to reduce the risk of being splashed.*

5.5.6 All fuses/circuit breakers shall be rated in accordance with the heater and component manufacturer's instructions.

5.6 Water connections

Any water connections shall be fitted in accordance with the heater manufacturer's instructions and BS 5546.

*COMMENTARY AND RECOMMENDATIONS ON **5.6***
Attention is drawn to the Water Supply (Water Fittings) Regulations 1999 [12] and relevant bylaws, which apply to the design and installation of all hot water systems.

5.7 Ducting

NOTE Reference should be made to The Warm Air Heating System Design Guide *[1] and/or CIBSE,* Guide B3: Ductwork *[24] for the design and installation of duct systems.*

5.7.1 Ductwork for new installations

5.7.1.1 All ductwork, including joints, insulation and linings selected for installation shall be of fire-resistant construction, and capable of maintaining its dimensional stability in terms of the cross-sectional area of the duct, up to an internal air temperature of 120 °C. Where the spaces between joists are used as duct routes, they shall be fully lined with a fire-resistant material.

*COMMENTARY AND RECOMMENDATIONS ON **5.7.1.1***
Only material of low heat capacity should be used in the construction of delivery ductwork and for any added insulation.

Joints and the seams of ducts and fittings should be made as air-tight as possible by being mechanically fastened and taped as described in the Heating and Ventilation Contractors Association (HVCA) document, DW/144: Specification for Sheet Metal Ductwork *[29].*

5.7.1.2 Where a new warm air heater is being fixed to an existing duct system using spaces between joists as duct routes, all new ductwork within the heater compartment above and below the warm air heater shall be constructed of fire-resistant material.

5.7.2 Warm air ducting

Where warm air ducting is thermally insulated, non-combustible insulation shall be used. For insulated ducting within 2 m of the heater, the insulation shall, in addition, be thermally stable up to a temperature of 120 °C.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013
Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

*COMMENTARY AND RECOMMENDATIONS ON **5.7.2***
All warm-air ducting should be insulated and the manufacturer's recommendations in this regard followed.

Where dampness is likely to occur, consideration should be given to the protection of the insulation against ingress of moisture.

5.7.3 Return air ducting

5.7.3.1 Where flexible return air ducting is used it shall be as short as possible and it shall be supported in accordance with the manufacturer's instructions.

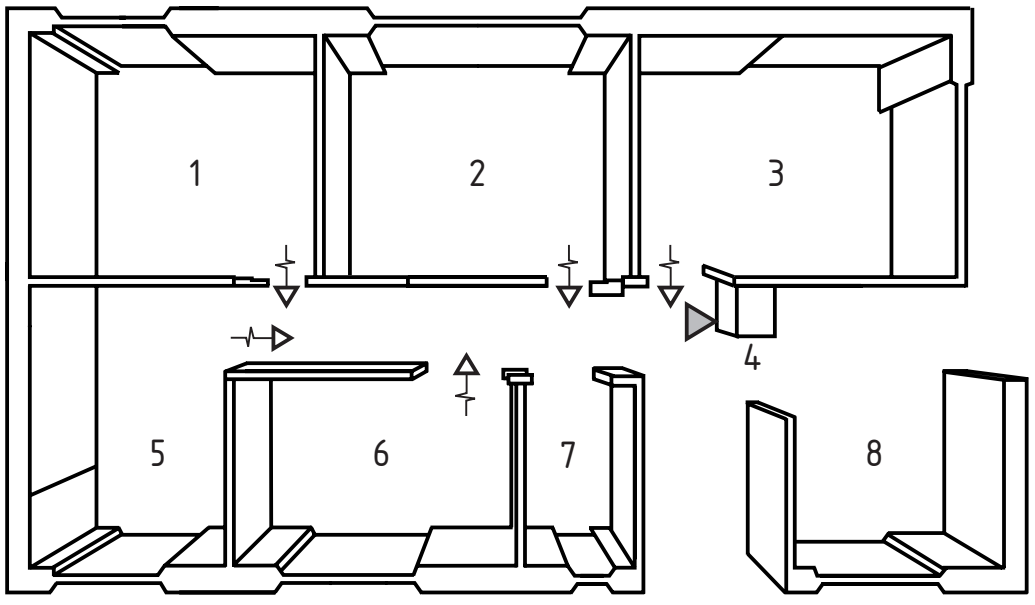
5.7.3.2 An unobstructed return air path to the heater shall be provided from all heated rooms and spaces, with the exception of kitchens, bathrooms, shower rooms and water closets.

*COMMENTARY AND RECOMMENDATIONS ON **5.7.3.2***
Figure 8 shows a typical return air system layout.

Return air ducts should be designed to minimize noise transmission from the heater fan compartment. This can be achieved by avoiding very short return air ducts and by incorporating at least one bend, or by lining short ducts with sound-absorbing material.

When installing a new heater in an existing system without transfer grilles from all heated spaces, if it is not practicable to install such transfer grilles, the provision of adequate return air should be assured.

Figure 8 **Typical return air arrangements**



Key

1	Bed 1	6	Bed 3
2	Lounge	7	Bath
3	Dining room	8	Kitchen
4	Heater		Transfer air opening
5	Bed 2		Return air grille

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

5.7.3.3 The return air arrangements for open-flued heaters shall be such that suction from the circulating air fan does not interfere with the operation of the flue, or of the flue of any other appliance in the room or any other room, especially an adjoining room (see also **6.2**). Therefore, the return air grille(s) shall be connected directly to the return air inlet on the heater by means of ducting. With the exception of the method described in **5.1.4**, the ducting shall be sealed in such a way that the return air is separated from the combustion air within the heater compartment.

*COMMENTARY AND RECOMMENDATIONS ON **5.7.3.3***
A room-sealed heater may be installed without such ducting, provided that the path between the return air grille and the heater return air inlet is protected in such a manner that the required airflow is maintained at all times.

5.7.4 Plenums

Plenums shall be of non-combustible materials of adequate strength to support the heater. All joints to the plenum shall be fixed by mechanical means, e.g. riveted or screwed, and sealed with a self-adhesive tape suitable for the type of surface to which it is to be affixed and capable of maintaining its seal throughout the range of temperatures to which it is expected to be subjected.

5.7.5 Plenum adaptors

Where an existing plenum is to be reused, any adaptor plates or fittings shall be those either supplied or recommended by the heater manufacturer. All joints to the plenum adaptor shall be fixed by mechanical means, e.g. riveted or screwed, and sealed with a self-adhesive tape suitable for the type of surface to which it is to be affixed and capable of maintaining its seal throughout the range of temperatures to which it is expected to be subjected.

On completion of the installation, spillage testing shall be carried out in accordance with the manufacturer's instructions. Additional care shall be taken when the rear of the appliance is not visible.

*COMMENTARY AND RECOMMENDATIONS ON **5.7.4** and **5.7.5***
Additional information is given in the Heating and Ventilation Contractors' Association (HVCA) document, DW/144: Specification for Sheet Metal Ductwork *[29].*

When replacing a heater, the connection between the plenum and the heater and any adaptor, plate or fitting(s) should be fixed by mechanical means, e.g. riveted or screwed, and sealed with a self-adhesive tape suitable for the type of surface to which it is to be affixed and capable of maintaining its seal throughout the range of temperatures to which it is expected to be subjected.

Additional information on spillage testing is given in Gas Safe Register Technical Bulletin 087 [30].

5.7.6 Room temperature thermostats or thermistorstats

5.7.6.1 General

Only room temperature thermostats or thermistorstats which are compatible with the heater control system shall be used.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013
Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

5.7.6.2 Ducting in buildings

In a building of one or two storeys, the room temperature thermostat or thermistorstat shall be sited in a room or space heated by the heating system.

*COMMENTARY AND RECOMMENDATIONS ON **5.7.6.2***
The room temperature thermostat or thermistorstat has to control the whole warm air system from the temperature it senses, and therefore selection of the optimum location is most important.

The preferred location is a room or space, the temperature of which has the most significant effect on comfort. The room temperature thermostat or thermistorstat should be mounted:

a) at a height of 1 200 mm to 1 500 mm above floor level;

b) on an inside wall; and

c) away from local heat sources and direct sunlight.

For a building of more than two storeys, a room temperature thermostat or thermistorstat should be mounted between 1 200 mm and 1 500 mm above floor level. This does not apply to dwellings located within new buildings of two or more storeys which have their own access at ground or first floor level, or dwellings with floor level not more than 4.5 m above ground or access level. Also exempt are existing dwellings in which an existing heater is to be replaced with a new heater of the same output and without significant alteration and/or extension to the duct system. In such instances, the manufacturer's instructions should be consulted.

6 Post-installation

6.1 Inspection

Before the heater is commissioned, the installation shall be inspected to ensure that the installation work has been carried out in accordance with the heater manufacturer's instructions.

*COMMENTARY AND RECOMMENDATIONS ON **6.1***
Attention is drawn to the Gas Safety (Installation and Use) Regulations [2], particularly those relating to:

a) the provision of ventilation air and combustion air;

b) the construction of the chimney;

c) the general condition of the heater and the installation;

d) the gas fittings and other works for the supply of gas.

6.2 Commissioning

NOTE Schedule 1 of the Building Regulations [6] requires installations of heat producing appliances to be notified to the relevant building control authority (see Part L1A [15] and Part L1B [16]). Additionally, the Benchmark Commissioning Checklist provided by most manufacturers at the rear of the appliance instruction manual should be completed.

6.2.1 All gas fittings forming part of the installation shall be tested for gas tightness and purged in accordance with either IGE/UP/1B Edition 2, IGE/UP/1 Edition 2, IGE/UP/1A Edition 2, or in accordance with BS 5482-1 for domestic LP installations and IGE/UP/1 for commercial LP installations and UIS 14 for permanently sited leisure accommodation vehicles, as appropriate.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

6.2.2 The heater shall be lit as described in the manufacturer's instructions.

6.2.3 The gas rate or pressure shall be checked and adjusted, where necessary, to the correct setting as specified in the heater manufacturer's instructions.

6.2.4 The air supply and the operation of the chimney system shall be checked to ensure that the products of combustion are being safely removed.

6.2.5 Where any room of the premises is fitted with a fan (e.g. an extract fan or a fan incorporated within a heater), the performance of the chimney shall be checked to ensure that it is not adversely affected by the operation of the fan(s) when the chimney is tested in accordance with manufacturer's instructions or BS 5440-1.

6.2.6 Spillage testing shall be carried out, firstly without the air circulation fan operating to check the operation of the chimney and, secondly, with the air circulation fan operating to check that the fan is not adversely affecting the operation of the chimney.

6.2.7 Operation of the circulatory fan, heater controls, safety devices and system controls shall be checked to ensure that they operate in accordance with the heater manufacturer's instructions.

6.2.8 The heating air flow shall be set to meet the requirements of the heated spaces.

*COMMENTARY AND RECOMMENDATIONS ON **6.2.8***
Information on setting air flows is given in The Warm Air Heating System Design Guide *[1].*

6.2.9 The operation of the heater shall be checked to ensure that it does not affect the operation of other fuel-burning appliances (see **5.7**).

*COMMENTARY AND RECOMMENDATIONS ON **6.2.9***
Where the measured combustion performance is used to demonstrate that the appliance is operating safely, the operative should:

a) have access to the heater manufacturer's instructions and a calibrated electronic portable combustion gas analyser conforming to BS EN 50379-3; and

b) be competent in its use and the interpretation of any reading obtained.

Competence can be demonstrated by satisfactory completion of the CPA1 ACS assessment, which covers the use of electronic portable combustion gas analysers in accordance with BS 7967, Parts 1 to 4.

6.2.10 Where an integral circulator is fitted, commissioning of the circulator shall be in accordance with the air heater manufacturer's instructions.

6.3 Advice to be given to the user

6.3.1 Operating instructions

The correct operating procedure for the heater and any safety shut-off controls shall be demonstrated to the owner or occupier of the premises in which the heater is installed.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

*COMMENTARY AND RECOMMENDATIONS ON **6.3.1***
Some open-flued heaters are fitted with a flue spillage or atmosphere-sensing device that can shut them down under fault conditions. The owner or occupier of the premises in which the heater is installed should be informed of the need to call a registered gas engineer to rectify any fault and reset the control in the event of the heater failing.

Attention is drawn to the Gas Safety (Installation and Use) Regulations 1998 [2], which require the installer to leave, for the use of the owner or occupier of the premises in which a heater is installed, all the manufacturer's instructions.

6.3.2 Maintenance

6.3.2.1 General

If the premises in which a heater is installed are owned by the occupier, the occupier shall be advised in writing that, for continued efficient and safe operation of the heater, it is important that adequate and regular maintenance is carried out by a competent person in accordance with the heater manufacturer's recommendations (see Annex A).

If the premises are tenanted and the landlord owns the heater, the landlord shall be advised in writing of the duty imposed by the Gas Safety (Installation and Use) Regulations [2] to ensure that the heater installation is maintained in a safe condition and checked for safety every 12 months.

*COMMENTARY AND RECOMMENDATIONS ON **6.3.2.1***
The Gas Safety (Installation and Use) Regulations 1998 [2] impose a general obligation on landlords providing gas heaters in tenanted premises to have these maintained in a safe condition and checked for safety every 12 months.

Where an independently mounted carbon monoxide (CO) detector is fitted or recommended for a room containing a gas heater, the installer should advise the user that a detector should not be regarded as a substitute for careful installation and regular servicing by a competent person.

NOTE For guidance on checking the condition of the heat exchanger of open-flued heaters, see Annex C.

6.3.2.2 Combustion performance

Where the manufacturer's instructions require the combustion performance to be checked, the engineer shall have access to a calibrated electronic portable combustion gas analyser, conforming to BS EN 50379-3 and shall be competent in its use and the interpretation of any reading obtained.

NOTE 1 This competence can be demonstrated by satisfactory completion of the CPA1 ACS assessment, which covers the use of these electronic portable combustion gas analysers in accordance with BS 7967, Parts 1 to 4.

NOTE 2 Where the heater is combined with an integral circulator, combustion performance should be measured individually as the ratios can be different for each individual appliance (see BS 7967-3).

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

*COMMENTARY AND RECOMMENDATIONS ON **6.3.2.2***
Where:

a) there is no meter to measure directly the heat input into the gas appliance; and

b) it is not possible to measure the operating pressure of the gas appliance because it incorporates a pre-mix burner and a zero set pressure regulator;

it is permissible to use the measured combustion performance to demonstrate that the appliance is operating safely; see the HSE Certificate of Exemption No.1:2008, for which further guidance is given in Gas Safe Register Technical Bulletin 021 [31].

In the case of a room-sealed fanned draught flue system concealed within a void, advice on inspection of the flue system is given in Gas Safe Register Technical Bulletin 008 [32].

Where any defects that cannot be rectified are identified as part of any maintenance or safety check activity, reference should be made to the requirements of the Gas Industry Unsafe Situations Procedure *[33].*

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Annex A (informative) Competence

Persons carrying out design, installation, servicing or maintenance associated with and/or impacting on gas work, electrical installation, water supply and drainage or the ventilation provision for gas appliances shall be competent.

It is a statutory requirement in the United Kingdom, Isle of Man and Guernsey (see Table A.1) that all gas work be carried out by a business or self-employed person(s) that is a member of a "class of persons" registered with a registration body which has been approved by an approval body (see Table A.1) to operate and maintain such a register.

The only body with approval to operate and maintain a register of individuals/businesses who are "members of a class of persons" is the Gas Safe Register. Thus it is essential that all businesses or self employed gas engineers are registered with the Gas Safe Register.

Table A.1 **Approval bodies and statutory regulations by country/territory**

Country/territory	Approval body	Statutory regulations
Great Britain	Health and Safety Executive (HSE)	Gas Safety (Installation and Use) Regulations 1998 [2]
Isle of Man	Health and Safety at Work Inspectorate (HSWI)	Gas Safety (Installation and Use) Regulations 1994, as amended and applied by the Gas Safety (Application) Order 1996 [34]
Northern Ireland	Health and Safety Executive Northern Ireland (HSENI)	Gas Safety (Installation and Use) (Northern Ireland) Regulations 2004 [3]
Guernsey	Health and Safety Executive for the States of Guernsey [HSE (Guernsey)]	Health and Safety (Gas) (Guernsey) Ordinance 2006 [35]

Guidance on the individual competency required for gas work is given in the Health and Safety Commission's Approved Code of Practice (ACOP) (COP 20) Standards of training in safe gas installation *[36]. Persons deemed to be competent to carry out gas work are those who hold:*

a) a current certificate of competence in the type of activity issued under the Nationally Accredited Certification Scheme for Individual Gas Fitting Operatives (ACS) in line with ACOP (COP20); or

b) a National/Scottish Vocational Qualification (N/SVQ) aligned in matters of gas safety.

Persons therefore have a statutory duty to ensure that they are working to the appropriate competency standards.

Annex B (informative) Servicing and maintenance of convection chamber installations

A convection chamber installation is a purpose-designed compartment constructed of brick, block or prefabricated panels, in which low level air inlet grilles allow cold air to be drawn into the chamber where it is warmed by the appliance heat exchanger and then discharged, by natural convection, through registers and/or grilles fitted at the top of the compartment.

This type of heater is no longer manufactured or installed and only spare parts are available.

Servicing and maintenance of such heaters should be undertaken in accordance with the manufacturer's instructions.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Annex C (informative) Checking the condition of the heat exchanger of open-flued heaters

C.1 Visual inspection

Remove any access panel(s) and the circulating fan assembly to gain access to the top, bottom or side of the heat exchanger, depending on the heated air flow direction. Using an inspection lamp or powerful torch, firstly, check the heat exchanger externally looking for cracks or holes, particularly around any welded seams and check that the primary flue is correctly connected to the top of the heat exchanger. Then introduce the light source into the combustion chamber and examine the heat exchanger again via the access panel(s) and fan assembly aperture for traces of light. When replacing access panels, replace the gaskets or seals with manufacturer's approved or supplied replacement gaskets or materials, as appropriate.

Following re-assembly, turn on the appliance checking the gas rate, operating pressure and adjusting to the manufacturers specified settings as necessary. Visually inspect the flame picture and, if disturbed when the circulation fan operates, check for any air leaks between the heater and plenum, paying particular attention to appliances with draught diverters located at the rear. Leakage can also result from poorly fitted primary flue connections. Rectify any faults found before proceeding. Allow the appliance to reach its normal operating temperature (10 min to 15 min) and re-check the burner flame stability, making sure that the operation of the circulation fan does not affect the flame picture.

C.2 Smoke method

Another method which can be used to check the heat exchanger's integrity is the use of a smoke pellet. Light the appliance and allow it to reach its normal operating temperature (10 min to 15 min). Turn off the appliance (both gas and electricity), close all warm air outlet registers except the one closest to the heater and place a lighted smoke pellet into the combustion chamber. Ensure that the smoke pellet to be used is of the correct size so as not to produce too much smoke spilling from the burner aperture. Switch on the circulation fan and check for traces of smoke from this outlet register. Any traces of smoke can indicate a fault with the heat exchanger. If traces of smoke are present, check the heat exchanger again using the visual inspection method given in **C.1**. If, following a smoke pellet test, no fault is found, the appliance may be brought back into service and the flame picture/stability checked using the visual inspection method given in **C.1**.

C.3 Spillage test (open flued heater)

Close all doors and windows and, if fitted, switch on any extractor fans.

NOTE If an extractor fan is fitted in an adjoining or adjacent room, carry out the test with the interconnecting doors open.

If the draught diverter is accessible (with the appliance operating fully):

a) introduce smoke, into the draught diverter adjacent to an exit from the heat exchanger, by means of a smoke match or puffer;

b) ensure that there is no spillage present (indicated by displacement of smoke downwards and out of the draught diverter);

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

c) repeat the spillage test with the air circulation fan running, or Summer Airflow switch set to 'ON'.

If the draught diverter is not accessible (with the draught diverter pre-heated):

a) introduce smoke by means of part of a smoke pellet on a non combustible support, into the heat exchanger;

b) extinguish the main burner and any permanent pilot burner;

c) ensure that there is no spillage evident by visually observing the draught diverter location on the heater;

d) if spillage is evident, further investigation and rectification is required before re-testing the heater;

e) repeat spillage test with the air circulation fan running, or Summer Airflow switch set to 'ON'.

Annex D (informative) Setting up the fan assisted provision of combustion air

The following procedure to set up the fan assisted provision of combustion air is reproduced from *The Warm Air Heating System Design Guide* [1] with the kind permission of CORGI Services Limited.

a) On warm air heaters with modulating controls, set the speed of the heater fan to maximum and arrange for it to run at this speed. On some modulating controls there is a switch labelled "Continuous" to allow for this.

NOTE On standard heaters it will be necessary to bridge out the fan switch and set the fan speed to maximum.

b) Referring to the heater manufacturer's instructions, obtain the desired airflow.

c) Remove the bird guard from the air inlet duct in the roof space and fit the vane instrument over the duct end.

d) Adjust the lockable damper until the correct airflow is achieved.

e) Lock the damper into position.

f) Refit the bird guard.

g) Ensure that the outlet grille in the room containing the heater cannot be closed off.

h) On standard heaters it will be necessary to remove the bridge from the fan switch (see note above).

i) Manufacturers guidance for ducts connected to a wall grille, where access to it is not practicable, is to fit the vane instrument inline in the duct to measure the correct airflow. Lock the damper into position. Remove the vane instrument and re-connect the duct.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Bibliography

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards publications

BS 3632, *Residential park homes – Specification*

BS 5588-1, *Fire precautions in the design, construction and use of buildings – Part 1: Code of practice for residential buildings*

BS 6798, *Specification for installation and maintenance of gas-fired boilers of rated input not exceeding 70 kW net*

BS 7967-1, *Carbon monoxide in dwellings and the combustion performance of gas-fired appliances – Part 1: Guide for identifying and managing sources of fumes, smells, spillage/leakage of combustion products and carbon monoxide detector activation*

BS 7967-2, *Carbon monoxide in dwellings and the combustion performance of gas-fired appliances – Part 2: Guide for using electronic portable combustion gas analysers in the measurement of carbon monoxide and the determination of combustion performance*

BS 7967-3, *Carbon monoxide in dwellings and the combustion performance of gas-fired appliances – Part 3: Guide for responding to measurements obtained from electronic portable combustion gas analysers*

BS 7967-4, *Carbon monoxide in dwellings and the combustion performance of gas-fired appliances – Part 4: Guide for using electronic portable combustion gas analysers as part of the process of servicing and maintenance of gas-fired appliances*

BS EN 721, *Leisure accommodation vehicles – Safety ventilation requirements*

BS EN 778, *Domestic gas-fired forced convection air heaters for space heating not exceeding a net heat input of 70 kW, without a fan to assist transportation of combustion air and/or combustion products*

BS EN 1319, *Domestic gas-fired forced convection air heaters for space heating, with fan-assisted burners not exceeding a net heat input of 70 kW*

BS EN 1856-1, *Chimneys – Requirements for metal chimneys – Part 1: System chimney products*

DD 221, *General guidance for the marking of gas appliances*

Other publications

[1] COUNCIL FOR REGISTERED GAS INSTALLERS (CORGI). *The Warm Air Heating System Design Guide (First Edition),* Basingstoke: CORGI, 2003 (this publication can be purchased from CORGI direct by telephoning 0870 516 8111 or online by visiting www.corgi-direct.com).

[2] GREAT BRITAIN. The Gas Safety (Installation and Use) Regulations 1998, SI 1998, No. 2451, London: The Stationery Office.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

[3] GREAT BRITAIN. The Gas Safety (Installation and Use) Regulations (Northern Ireland) 2004, SR 2004, No. 63, London: The Stationery Office.

[4] GREAT BRITAIN. The Gas Appliance (Safety) Regulations 1995, SI 1995, No. 1629, London: The Stationery Office.

[5] GREAT BRITAIN. The Asbestos (Prohibitions) Regulations 2003, SI 2003, No. 1889, London: The Stationery Office.

[6] GREAT BRITAIN. The Building (Amendment) Regulations 2009, SI 2009, No. 0466, as amended, London: The Stationery Office.

[7] GREAT BRITAIN. The Building (Scotland) Amendment Regulations 2007, SI 2007, No. 0119, as amended, London: The Stationery Office.

[8] GREAT BRITAIN. The Building (Northern Ireland) Amendment Regulations 2009, SR 2009 London: The Stationery Office.

[9] GREAT BRITAIN. The Building Control Act (Isle of Man) 1991, London: The Stationery Office.

[10] GREAT BRITAIN. The Building (Isle of Man) Regulations 2007, London: The Stationery Office.

[11] GREAT BRITAIN. The Gas Safety (Application) (Isle of Man) Order 1996, SD 326/96, London: The Stationery Office.

[12] GREAT BRITAIN. The Water Supply (Water Fittings) Regulations 1999, as amended, SI 1999, No. 1148, London: The Stationery Office.

[13] INSTITUTION OF GAS ENGINEERS AND MANAGERS (IGEM) – BRITISH GAS plc. IGE/G/5, *Gas installations in flats and other multi-dwelling buildings,* Edition 3, Derbyshire: IGEM, 2009.

[14] DEPARTMENT FOR COMMUNITIES AND LOCAL GOVERNMENT (DCLG). *Domestic Heating Compliance Guide – Compliance with Approved Documents L1A: New dwellings and L1B: Existing dwellings,* London: The Stationary Office, 2006.

[15] STATIONERY OFFICE. *The Building Regulations 2009 – Approved Document L1A – Conservation of Fuel and Power – New Dwellings*. London: The Stationery Office, 2006.

[16] STATIONERY OFFICE. *The Building Regulations 2009 – Approved Document L1B – Conservation of Fuel and Power – Existing Dwellings*. London: The Stationery Office, 2006.

[17] STATIONERY OFFICE. *The Building Regulations 2009 – Approved Document L2A – Conservation of Fuel and Power – New buildings other than dwellings*. London: The Stationery Office, 2006.

[18] STATIONERY OFFICE. *The Building Regulations 2009 – Approved Document L2B – Conservation of Fuel and Power – Existing buildings other than dwellings*. London: The Stationery Office, 2006.

[19] DEPARTMENT FOR COMMUNITIES AND LOCAL GOVERNMENT (DCGL). *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,* RIBA, 2006.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

[20] HEALTH AND SAFETY COMMISSION. *Approved Code of Practice (ACoP) L56 – Safety in the installation and use of gas systems and appliances*, London: HSE Books, 2007.

[21] SCOTTISH BUILDING STANDARDS AGENCY, *Technical Handbook Domestic*, 2009 (available from http://www.sbsa.gov.uk).

[22] SCOTTISH BUILDING STANDARDS AGENCY, *Technical Handbook Non-domestic*, 2009 (available from http://www.sbsa.gov.uk).

[23] EUROPEAN COMMUNITIES. Council Directive 90/396/EEC of 29 June 1990 on the approximation of the laws of the Member States relating to appliances burning gaseous fuels, Luxembourg: Office for Official Publications of the European Communities, 1997 (OJ No. L196, 26.07.1990).

[24] THE CHARTERED INSTUTION FOR BUILDING SERVICE ENGINEERS (CIBSE). *Guide B3: Ductwork*, London: 2002.

[25] INSTITUTION OF GAS ENGINEERS AND MANAGERS (IGEM) – BRITISH GAS plc. *IM/28: Gas appliances in garage workshops*, 1st edition. Derbyshire: IGEM, 1993.

[26] DEPARTMENT FOR COMMUNITIES AND LOCAL GOVERNMENT (DCLG). *Guide to the condensing boiler installation assessment procedure for dwellings*. London: The Stationery Office, 2005.

[27] WATER REGULATIONS ADVISORY SERVICE (WRAS). *Information and Guidance Note No. 9-02-04: Reclaimed Water Systems – Information about Installing, Modifying or Maintaining Reclaimed Water Systems*. Newport: WRAS, 1999.

[28] INSTITUTION OF ELECTRICAL ENGINEERS. *Electrician's Guide to the Building Regulations.* Stevenage: IET, 2008.

[29] HEATING AND VENTILATION CONTRACTORS' ASSOCIATION (HVCA). *DW/144: Specification for Sheet Metal Ductwork*, London: HVCA,1998.

[30] GAS SAFE REGISTER (GSR). *TB 087: Warm air heaters – change to spillage testing requirements*. Hampshire: GSR, 2009.

[31] GAS SAFE REGISTER (GSR). *TB 021*: *The Gas Safe (Installation and Use) Regulations 1009 – Certificate of Exemption No.1 of 2008*. Hampshire: GSR, 2009.

[32] GAS SAFE REGISTER (GSR). *TB 008: Room-sealed fanned draught flue systems concealed within voids. Hampshire: GSR, 2009.*

[33] COUNCIL FOR REGISTERED GAS INSTA LLERS (CORGI). *Gas Industry Unsafe Situations Procedur*e. Basingstoke: CORGI, 2005.

[34] GREAT BRITAIN. The Gas Safety (Installation and Use) Regulations 1994. SI 1886, No. 2451, London: HMSO, as amended and applied by the ISLE OF MAN Gas Safety (Application) Order 1996.

[35] GUERNSEY. The Health and Safety (Gas) (Guernsey) Ordinance 2006.

[36] HEALTH AND SAFETY COMMISSION. *ACoP (COP20) – Standards of training in safe gas installation*, London: HSE Books, 1987.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013
Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013 Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

This page deliberately left blank

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

All the data, software and documentation set out in all British Standards and other BSI publications are the property of and copyrighted by BSI, or some person or entity that owns copyright in the information used (such as the international standardization bodies) and has formally licensed such information to BSI for commercial publication and use. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI. Details and advice can be obtained from the Copyright & Licensing Department.

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.

...making excellence a habit.™

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013