BS 6798:2014

BSI Standards Publication

Specification for selection, installation, inspection, commissioning, servicing and maintenance of gas-fired boilers of rated input not exceeding 70 kW net

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Contents

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Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 May 2014. It was prepared by Panel GSE/30/-/5, *Boilers of rated input not exceeding 70kW and hot water supply*, 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This British Standard supersedes BS 6798:2009, which is withdrawn.

Information about this document

The structure of this document follows the approach used in other gas installation standards.

Requirements, with corresponding commentary (e.g. explanation/recommendation as appropriate), cover equipment selection and pre-installation, installation and post-installation, to which maintenance has been added as a specific detail.

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industry, which has regarded a chimney as a masonry structure generally associated with solid fuel appliances, has been superseded.

All websites referred to in this British Standard were last viewed on 28 May 2014.

Use of this document

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

This standard recognizes that manufacturers' instructions (assessed at the time of CE type testing as resulting in at least an equivalent level of safety) might specify a method of installation, testing, commissioning, servicing or maintenance which differs in points of detail from this standard. It is important that the manufacturer's instructions are followed.

Presentational conventions

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

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

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

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

- The Gas Safety (Installation and Use) Regulations 1998 [1];
- The Gas Safety (Installation and Use) (Northern Ireland) Regulations 2004 [2];
- The Gas Safety (Installation and Use) Regulations 1994, as amended and applied by the Gas Safety (Application) (Isle of Man) Order 1996 [3];
- The Health and Safety (Gas) (Guernsey) Ordinance 2006 [4];
- The Gas Appliance (Safety) Regulations 1995 [5];
- The Building Regulations 2010 (England and Wales), as amended [6];
- The Building Regulations (Northern Ireland) 2012 [7];
- The Building (Scotland) Regulations 2004, as amended [8];
- The Building Regulations 2007 (for the Isle of Man) [9];
- The Water Supply (Water Fittings) Regulations 1999, as amended [10];
- The Water Byelaws 2004 (Scotland) [11];
- The Water Supply (Water Fittings) Regulations (Northern Ireland) 2009 [12].

1 Scope

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

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

This standard does not apply to:

a) boilers with a rated input of over 70 kW; or

b) groups of boilers with individual ratings of 70 kW or less, but with aggregate inputs of over 70 kW as specified in BS 6644.

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

It is not applicable to the detailed design and installation of the whole heating system, which is specified in BS EN 12828, BS EN 12831:2003 (incorporating corrigendum January 2009) and BS EN 14336:2004 (incorporating corrigendum January 2009).

NOTE 2 With the publication of BS EN 12828, BS EN 12831 and BS EN 14336, BS 5449 has been withdrawn. These Standards are not aligned to UK design and installation practices; they cover commercial as well as domestic heating systems and exclude hot water. Consequently, these standards include UK national annexes covering all the relevant material from BS 5449.

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

This standard applies to boilers which carry a CE mark and also to previously-used boilers which do not carry the CE mark (see **6.2.1**).

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

*NOTE 5 It is essential that persons carrying out the installation of any gas appliance are competent to do so. Clause **4** gives information on competence.*

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

NOTE 7 The general installation requirements for 3rd family installations specified by this standard also apply to gas installations supplied with LPG/air mixtures used in the Channel Islands or the Isle of Man, providing: any gas equipment being installed has been appropriately converted and is suitable for the gas being supplied, and the requirements of the standard do not conflict with local regulations or authorized local custom and practice.

2 Normative references

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

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

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

BS 5258-1, *Safety of domestic gas appliances – Part 1: Specification for central heating boilers and circulators*

BS 5258-8, *Specification for safety of domestic gas appliances – Part 8: Combined appliances: gas fire/back boiler* [1)]

BS 5422:2009, *Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range –40 °C to +700 °C*

BS 5440-1, *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* [2)]

BS 5440-2, *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, *Code of practice for domestic butane- and propane-gas-burning installations – Part 2: Installations in caravans and non-permanent dwellings*

BS 5970, *Thermal insulation of pipework, ductwork, associated equipment and other industrial installations in the temperature range of –100 °C to +870 °C – Code of practice*

BS 6644, *Specification for the installation and maintenance of gas-fired hot water boilers of rated inputs between 70 kW (net) and 1.8 MW (net) (2nd and 3rd family gases)*

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

BS 7671, *Requirements for electrical installations – IET Wiring Regulations – Seventeenth edition* [3)]

BS 7927, *Heating appliances for domestic applications – Portable apparatus designed to detect and measure specific combustion flue gas products – Requirements*

NOTE 1 BS 7927 has been superseded by BS EN 50379-3.

BS 7977-2, *Specification for safety and rational use of energy of domestic gas appliances – Part 2: Combined appliances: Gas fire/back boiler*

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1) Withdrawn. Superseded by BS 7977-2.

2) This standard also gives an informative reference to BS 5440-1:2008.

3) This standard also gives an informative reference to BS 7671:2008.

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

BS EN 12828, *Heating systems in buildings – Design for water-based heating systems*[4)]

BS EN 12831:2003 (incorporating corrigenda January 2009 and September 2013), *Heating systems in buildings – Method of calculation of the design heat load*

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

BS EN 14336:2004 (incorporating corrigenda January 2009 and September 2013), *Heating systems in buildings – Installation and commissioning of water based heating systems*

BS EN 50291, *Electrical apparatus for the detection of carbon monoxide in domestic premises*

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

NOTE 2 BS EN 50379-3 has superseded BS 7927.

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

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

IGEM/G/5, Edition 2: *Gas installations in multi-occupancy buildings*[5)]

IGEM/GM/6, Edition 2: *Non-domestic meter installations – Standard designs*[5)]

IGEM/UP/2, Edition 2, *Installation pipework on industrial and commercial premises*[5)]

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

IGEM/UP/17, *Shared Chimney and Flue Systems for Domestic Gas Appliances*[5)]

UKLPG, Code of Practice 22 – *LPG Piping System Design and Installation*[6)]

3 Terms and definitions

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

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

3.2 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) for use with either open-flued or room-sealed appliances.

4) This standard also gives an informative reference to BS EN 12828:2012.

5) Institution of Gas Engineers and Managers, Kegworth.

6) UKLPG, Kenilworth.

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

NOTE A combination boiler may include primary or secondary storage.

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

3.5 domestic dwelling
self-contained unit designed to accommodate a single household

3.6 flue
passage for conveying combustion products to the outside air

3.7 flue duct
duct containing the flue of a chimney configuration

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

3.9 hot water storage combination unit
hot-water storage vessel with either:

a) a cold water feed cistern immediately above it, the two being fabricated together as a compact unit; or

b) a cold water feed cistern beside it or inside it

3.10 open-flued boiler
boiler designed to be connected to an open-flue chimney

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

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

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

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

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

*NOTE See Clause **4** for the competence requirements of an operative.*

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

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

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

3.17 rated output
useful heat output declared by the manufacturer

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

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

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

3.20 terminal
fitting installed at the outlet of a chimney

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

4 Competence

Persons carrying out work that will have an impact on work covered by the scope of this standard shall ensure that they have the competence relevant for the task such as not to compromise the requirements/recommendations of this standard and, in particular, the safe installation, commissioning and operation of gas equipment.

*COMMENTARY ON **4***
Competence requires sufficient knowledge, practical skill and experience to carry out the job in hand safely, with due regard to good working practice. The installation should also be left in a safe condition for use. Knowledge should be kept up-to-date with changes in law, technology and safe working practice.

There are three principal aspects to competence for gas fired boilers; these are:

a) knowledge of the relevant Building Regulations [6, 7, 8, 9] for domestic premises;

b) ability to ensure that electrical work in dwellings is designed, installed, inspected and tested to the standard required by BS 7671;

c) for "gas work", registration with an appropriate authority.

It is a statutory requirement in Great Britain, the Isle of Man, Northern Ireland and Guernsey (see Table 1) that all "gas work" [item c)] 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 1) to operate and maintain such a register.

At the time of publication, 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.

The qualifications which persons need to have to be deemed competent to carry out gas work are given in Table 2.

Table 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 [1]
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) (Isle of Man) Order 1996 [3]
Northern Ireland	Health and Safety Executive Northern Ireland (HSENI)	Gas Safety (Installation and Use) Regulations (Northern Ireland) 2004 [2]
Guernsey	Health and Safety Executive for the States of Guernsey [HSE (Guernsey)]	Health and Safety (Gas) (Guernsey) Ordinance 2006 [4]

Table 2 **Competence requirements by country/territory**

Qualifications	Great Britain and Isle of Man	Northern Ireland	Guernsey
Current certificate(s) of competence in the type of gas work to be conducted, issued by an awarding body accredited by the United Kingdom Accreditation Service (UKAS) (ACS certification)	✓	✓	✓
National/Scottish Vocational Qualification (N/SVQ accredited by Ofqual), which is aligned in matters of gas safety	✓	✓	✓
National/Scottish Vocational Qualification (N/SVQ accredited by Ofqual), which is aligned under the HSC ACoP arrangement [A)] as approved with the registration body	✓	✓	✗
Any other scheme recognized by the gas registration body for registration purposes	✓	✓	✓

[A)] Guidance on the individual competence 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*" [13]. [7)]

5 Environmental considerations

As part of the planning process, consideration shall be given to the following.

a) Disposal/recycling of existing appliances and systems materials that are to be removed.

b) Disposal/recycling of the new appliance and system components packaging.

c) Optimization of energy usage through appliance selection (see **6.2.1**) and system design.

d) Minimization of harmful emissions discharge (see **6.3.2** and **6.3.3**).

[7)] COP 20 is to be withdrawn in 2014 and replaced by industry guidance *Standards of training in gas work* which can be found at www.igem.org.uk

6 Selection of equipment and pre-installation

6.1 Exchange of information and planning

Both for a first-time installation in a dwelling and replacement of a boiler in an existing heating system, those concerned with the selection of the boiler and the design of the system shall collaborate with the operative, both at the planning stage and during the execution of the work.

*COMMENTARY ON **6.1***
Particular matters that should be considered when carrying out new or replacement installations are:

Consultation with official bodies

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

a) The local authority, about building regulations and planning application requirements.

b) The fire authority, to establish compliance with relevant fire precautionary requirements, and the fire insurers, for notification of any proposed changes in the means of heating.

c) The Health and Safety Executive (HSE), to establish compliance with health and safety requirements in commercial premises, particularly with regard to safety requirements which are not fulfilled as an integral part of the installation.

d) The water authority/company, about the requirements of the relevant Water Fittings Regulations or relevant by-laws.

NOTE 1 The relevant regulations are:

- *England and Wales – Water Supply (Water Fittings) Regulations 1999 (England and Wales) [10];*
- *Scotland – Water Byelaws 2004 (Scotland) [11];*
- *Northern Ireland – Water Supply (Water Fittings) Regulations (Northern Ireland) 2009 [12].*

Liaison between the various trades

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

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

a) the availability and suitability of gas, electrical and water supplies;

*b) the heat requirements (see **6.2.1** and **6.5**);*

c) the compatibility of heat emitters with current needs;

d) the physical size, design and position of the boiler, and its relationship to structural support and to combustible materials;

NOTE 2 Some installations involve preliminary structural work which needs to be completed at the building carcass stage. Suitable bases are required for floor-standing boilers.

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

NOTE 3 Information on gas installations in timber-framed and light steel framed buildings is given in IGEM/UP/7, Edition 2.

NOTE 4 Information on gas installations in flats and other multi-dwelling buildings is given in IGEM/G/5, Edition 2.

f) the size, height, type, support and route of the chimney and the position of termination, including the possible consequences of any plume; particular notice is drawn to:

- *the advice in BS 5440-1:2008, Clause **12**, and IGEM/UP/17 on the connection to SE-duct, U-duct and shared chimneys;*
- *the fact that, where room-sealed fanned draught boilers are installed with the flue ducts and air-supply ducts concealed within voids, due regard needs to be given to the Gas Safety (Installation and Use) Regulations [1, 2, 3, 4] and Building Standards (e.g. Approved Document J [14] in England) concerning the need for inspection throughout the length of the flue duct prior to initial commissioning of the appliance and during routine servicing or maintenance of the appliance. Detailed information concerning the interpretation of "inspection" is given in Technical Bulletin 008 as published by Gas Safe Register [15]*[8)]*;*

g) the provision of adequate air for combustion and ventilation;

*h) the position of any drains for condensate or pressure/temperature relief valve discharge (see **6.3.4**);*

*i) the manufacturer's instructions regarding water hardness, unless the manufacturer's instructions say otherwise, where the mains water total hardness (as $CaCO_3$) exceeds 200 ppm; provisions should be made to treat the feed water to the hot water circuit of combination boilers to reduce the rate of accumulation of limescale (see **8.2.1.3**);*

j) the compatibility of the boiler with any system controls;

k) the system controls for energy conservation and comfort, in particular to avoid unnecessary cycling of the boiler and to comply with Building Regulations [6, 7, 8, 9];

l) whether the pump is adequate for the new boiler and is located so as to avoid entrainment of air or discharge of water from the system;

m) whether the system pipework is adequately sized; and

*n) the need for the central heating system to be thoroughly cleansed and flushed out before installation of a new boiler (see **7.7.4**).*

6.2 Selection of boiler

6.2.1 General

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

A previously-used boiler selected for installation shall either carry a CE mark, or shall conform to BS 5258-1, BS 5258-8 or BS 7977-2.

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

Conversion to another gas shall only be undertaken when permitted by the boiler manufacturer and shall be carried out strictly in accordance with the manufacturer's instructions, using the manufacturer's specified kit of parts.

The boiler shall only be fitted with external control devices, e.g. flue dampers or economizers, as approved by the boiler manufacturer.

The boiler selected shall be suitable for use with any existing control system to which it is to be fitted.

The boiler rating shall be in accordance with **6.5**.

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8) TB 008 is to be withdrawn when the new edition of BS 5440-1 is published (expected December 2014).

*COMMENTARY ON **6.2.1***
For selection of a gas-fired boiler in England, Wales and Northern Ireland attention is drawn to the DCLG publication, Domestic Building Services Compliance Guide [16]. In particular, Section 2, gas-fired space heating and hot water systems, requires that gas-fired boilers installed are to be condensing boilers, whether they are replacements or new installations, with a few exceptions. See also the DCLG publication, Guide to the Condensing Boiler Installation Assessment Procedure for Dwellings [17].

For selection of a boiler in Scotland attention is drawn to the Building (Scotland) Regulations 2004 Domestic Technical Handbook, Section 6 (Energy) [18].

Similar requirements might apply in other areas of the UK.

The HSE publication, Safety in the installation and use of gas systems and appliances [19] should also be consulted.

For CE-marked boilers

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

a) the letters "GB";

b) the type of gas and the pressure of utilization indicated as follows:

1) "G20 and/or natural gas 20 mbar" for a boiler adjusted for natural gas;

2) "G31 and/or propane 37 mbar" for a boiler adjusted for propane;

3) "G30 and/or butane 29 mbar" for a boiler adjusted for butane;

4) "G30, G31 and/or butane/propane 29/37 mbar" for a boiler which will burn either butane or propane at the correct pressure.

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

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

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

For all boilers

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

The operative should check the data provided with the boiler to confirm that the boiler is appropriate for the installation, and should confirm the basis on which the heat input rating is quoted, i.e. gross or net.

The ratio of gross to net heat input is approximately 1.11:1 for natural gas, 1.09:1 for propane and 1.08:1 for butane.

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

6.2.2 Boilers for sealed systems

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

*COMMENTARY ON **6.2.2***
Boilers used in sealed systems should incorporate appropriate protection devices.

6.3 Condensing boilers

6.3.1 General

Boilers designed to be used in the condensing mode shall be installed in accordance with the manufacturer's installation instructions, or, if there are no specific instructions, in accordance with **6.3.2**, **6.3.3**, **6.3.4**, **6.3.5**, **6.3.6**, **6.3.7**, **6.3.8**, **6.3.9** and **6.4**.

*COMMENTARY ON **6.3.1***
The manufacturer's installation instructions might contain particular requirements for the condensing boiler, e.g. a means for disposal of condensate, the air-gas ratio valve setting and the water temperature operating range.

6.3.2 Location

6.3.2.1 General

The following issues shall be considered when determining the suitability of a particular location:

a) chimney outlet location (see **6.3.3**);

b) access to the condensate discharge termination for the condensate drainage pipe (see **6.3.4** and **6.3.5**) if necessary;

c) air supply and ambient conditions (see **7.1** and **7.3.11**, respectively);

d) ventilation (see **7.1** and **7.3.2.5**);

e) space, both for installation and subsequent service access (see **7.3.1**);

f) support for the installed weight of the water-filled appliance and connecting pipework and ancillary controls (see **7.3.1**);

g) specific requirements for the appliance siting position chosen (see **7.3.2** to **7.3.10** inclusive).

*COMMENTARY ON **6.3.2.1***
*Room-sealed boilers may be installed in any room or space. However, it is not recommended that any type of boiler be installed in an under-stairs cupboard, bathroom or shower-room, bedroom or bed-sitting room, or within a toilet or cloakroom, but such installations are acceptable subject to the requirements of **7.3.4** to **7.3.7**.*

Boilers and their condensate pipes should not be located in such a position that a leak of water or condensate from these components could cause damage to other building services.

Where a boiler is located in an exposed position, such as an external location, roof space or an unheated garage, consideration should be given to additional frost protection whilst avoiding an adverse effect on the energy consumption of the installation, e.g. installation of a pipe thermostat on the boiler return.

There is no restriction on the type of boiler that can be installed in a private garage, except where the manufacturer states otherwise. Great care is required in the location of a boiler in any premises where concentrations of flammable vapour could accumulate, e.g. commercial garages and associated workshops.

6.3.2.2 3rd family gases

A boiler for use with 3rd family gases shall not be installed in a room or internal space situated below ground level, e.g. a basement or cellar.

*COMMENTARY ON **6.3.2.2***
This does not preclude the installation of such appliances in rooms which are basements with respect to one side of the building but open to ground level on the opposite side.

6.3.3 Siting of the chimney outlet

The chimney outlet shall be sited in accordance with BS 5440-1.

NOTE 1 Information on room-sealed (natural/fanned-draught) and open-flued (fanned-draught) appliance flues terminating within covered passageways (ginnells) is given in Technical Bulletin 007, as published by Gas Safe Register [20].

NOTE 2 Chimney outlet was originally referred to as flue terminal in UK standards.

NOTE 3 Information on plume management is provided in BS 5440-1.

Where it is considered that the plume from a chimney outlet installed in accordance with BS 5440-1 might cause a nuisance to the user or their neighbours, reference shall be made to the boiler manufacturer's instructions for specialist advice on how to redirect the chimney outlet, for example, by the:

a) partial rotation of the chimney terminal;

b) fitting of a deflector elbow; or

c) use of a kit that provides high level termination.

In particular, the potential for the plume to discharge across the following 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; and

5) an area used for car parking.

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

Some appliances are designed to disperse condensate within the combustion products discharge. Particular care is necessary when siting the terminal to ensure safe disposal of the condensate in accordance with the manufacturer's instructions (see Note 4 of **6.3.8**). If such advice is not included in the appliance instructions the manufacturer shall be consulted.

*COMMENTARY ON **6.3.3***
Condensing boilers produce a visible plume of water vapour for a significant proportion of their operating time. At low level, this plume might cause nuisance.

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

a) a free passage of air is needed to aid plume dispersal;

b) the combustion products of a condensing boiler should not be discharged under a carport;

c) in cold weather, the plume could cause a safety hazard if it freezes on pathways, or if it results in frost damage to surfaces;

d) the plume could trigger infra-red security lighting if sited in the wrong place;

e) the plume could affect the performance of external temperature sensors associated with energy management control systems;

f) the chimney outlet or plume should not obscure security camera field of vision;

g) the chimney outlet guards should be able to resist corrosive properties of the condensate;

h) the need for a plume management kit when provided or specified by the appliance manufacturer; and

i) for roof space installations, running a chimney system (twin pipe or concentric system) from a room-sealed, fan-assisted boiler, horizontally through the tiles of an adjacent tiled roof should not be attempted unless specifically permitted by the boiler manufacturer's installation instructions.

NOTE This technique is prone to possible blockage from snow and condensing boilers tend to cause damage to the roof tiles immediately below the chimney outlet, due to condensate leaching the colour out of concrete tiles.

For guidance on how to reduce the possibility of nuisance to neighbouring buildings, refer to the section on flue terminal siting in Guide to the Condensing Boiler Installation Assessment Procedure for Dwellings [17].

6.3.4 Selection of condensate discharge point

The possibility of the condensate drainage pipe freezing downstream of the connection point to the boiler during prolonged spells of extremely cold weather shall be considered when choosing the siting of the condensate discharge point.

Wherever possible, the condensate drainage pipe shall be terminated at an internal foul water discharge point (see **A.1**).

Where discharge to an internal foul water discharge is not possible due to impractical, very long pipe runs being required to reach a suitable internal discharge point, an external discharge point can be used (see **A.2**).

Where the pressure relief valve and condensate discharge pipes are combined (see **6.3.5** and **6.3.7.2**), the combined discharge pipe should be terminated internally to the property, unless other means of ensuring safe pressure relief valve discharge in the event of freezing have been specified in the appliance instructions.

*COMMENTARY ON **6.3.4***
Winters in the UK can involve prolonged spells of extremely cold weather – down to –20 °C in many areas. This can cause freezing of the condensate in the condensate discharge pipe, causing the pipe to become blocked with ice and the boiler to shut down. Whilst there can never be a guarantee (under widespread and prolonged very low temperatures) that the condensate discharge will not freeze, parts of the condensate discharge pipe that are located externally are particularly at risk of freezing; hence the recommendation to use an internal foul water discharge point wherever possible.

A slightly longer pipe run, for example, to an internal soil stack, might be preferable to a shorter run connecting into a kitchen waste pipe discharging directly through the wall to an external drain.

6.3.5 Combined discharge from pressure relief valve and boiler condensate drain

Special conditions shall apply where the pressure relief valve discharge pipe and the condensate drainage pipe have been combined (see **6.3.7.2**).

The discharge pipe from the pressure relief valve shall continue to conform to **7.4.3.2**a).

*COMMENTARY ON **6.3.5***
For some condensing boilers, either:

a) the boiler installation instructions will advise that the boiler has been designed such that the discharge pipe from the boiler pressure relief valve and the boiler condensate discharge pipe are combined internally within the boiler case to provide a single connection point to which the condensate discharge pipe is to be fitted; OR

b) the boiler installation instructions will advise that the pressure relief valve discharge pipe can be combined with the condensate discharge pipe by the installer, outside the boiler case.

6.3.6 Use of condensate pump

Where gravity discharge of the condensate is not possible, e.g. the discharge point is above the boiler location or access is obstructed by a doorway, consideration shall be given to the use of a proprietary condensate pump of a specification recommended by the boiler or pump manufacturer (see **6.3.7.1** or **6.3.7.2,** as appropriate).

*COMMENTARY ON **6.3.6***
Examples of where a condensate pump can provide solutions are where a boiler 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 are able to provide detailed suggestions for the optimum disposal routes.

6.3.7 Choice of discharge pipe

6.3.7.1 Separate pressure relief valve and condensate discharge pipes

6.3.7.1.1 Condensate removal

For condensate removal by gravity, or by use of a condensate pump, the requirements of **6.3.7.1.2**, **6.3.7.1.3** and **6.3.7.1.4** shall be satisfied.

6.3.7.1.2 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).

*COMMENTARY ON **6.3.7.1.2***
Condensate drainage pipe should be jointed in accordance with the pipe manufacturer's instructions.

6.3.7.1.3 Diameter of internally run condensate pipe

The condensate drainage pipe connected to the condensate drain outlet on the boiler shall have a minimum internal diameter (ID) of 19 mm, or as recommended by the boiler manufacturer, to promote the clearance of condensate.

*COMMENTARY ON **6.3.7.1.3***
Historically, the outside diameter (OD) has been used to specify the size of condensate pipe required as this automatically delivered the internal diameter (ID) considered necessary to aid efficient disposal of the condensate. With the advent of European Standards, plastic pipe manufacturers can now choose to manufacture to a variety of ODs and wall thicknesses, yet the minimum ID requirement to aid efficient disposal of the condensate remains. Hence the minimum ID is now specified as the requirement, providing the maximum flexibility of choice for the installer.

6.3.7.1.4 Diameter of externally run condensate pipe

Any external condensate drainage pipe shall be increased to a minimum of 30 mm ID to reduce the risk of freezing.

*COMMENTARY ON **6.3.7.1.4***
When a boiler is to be installed in an unheated location, e.g. a loft, basement or garage, all condensate drainage pipes downstream from the trap or siphon should be considered as external.

Historically, the outside diameter (OD) has been used to specify the size of condensate pipe required as this automatically delivered the internal diameter (ID) considered necessary to aid efficient disposal of the condensate. With the advent of European Standards, plastic pipe manufacturers can now choose to manufacture to a variety of ODs and wall thicknesses, yet the minimum ID requirement to aid efficient disposal of the condensate remains. Hence the minimum ID is now specified as the requirement, providing the maximum flexibility of choice for the installer.

6.3.7.2 Combined pressure relief valve and condensate discharge pipes

6.3.7.2.1 Discharge pipes combined outside the boiler during installation

Where the boiler instructions advise that the pressure relief valve discharge pipe can be combined with the condensate discharge pipe outside the boiler case during installation, the discharge from the pressure relief valve shall be indirectly or directly visible to the installer.

*NOTE See Commentary on **7.4.3.2**c) for an explanation of "indirectly or directly".*

6.3.7.2.2 Removal by gravity

For removal by gravity, where the boiler instructions advise that the pressure relief valve discharge pipe can be combined with the condensate discharge pipe outside the boiler case during installation:

a) the pipe size and type used up to the point of combination shall be as specified in the boiler instructions;

b) the method of combination of the two pipes shall be as specified in the boiler instructions;

c) if metallic pipe is used between the pressure relief valve discharge outlet on the boiler and the point of combination, a means of ensuring the condensate cannot flow back into the metallic pipe shall be employed as specified in the boiler instructions;

d) internally within the dwelling the pipe size, type and means of connection of individual lengths of pipe, used after the point of combination, shall be as specified in the boiler instructions;

e) if this information is not in the boiler instructions, the boiler manufacturer shall be consulted; and

f) the diameter of any discharge pipe external to the dwelling shall be as specified in **6.3.7.1.4**.

6.3.7.2.3 Removal with condensate pump

Where the installation requires a condensate pump:

a) such a pump shall only be used where the pump instructions state that the pump is suitable for such an application;

b) the pipe size and type used up to the point of combination shall be as specified in the boiler instructions;

c) the method of combination of the two pipes shall be as specified in the boiler instructions and the point of combination shall be before the condensate pump;

d) if metallic pipe is used between the pressure relief valve discharge outlet on the boiler and the point of combination, a means of ensuring the condensate cannot flow back into the metallic pipe shall be employed as specified in the boiler instructions;

e) the pipe size, type and means of connection of individual lengths of pipe, used after the point of combination up to the condensate pump, shall be as specified in the boiler instructions;

f) internally within the dwelling the pipe size, type and means of connection of individual lengths of pipe used after the condensate pump shall be as specified in the condensate pump instructions;

g) there shall be an interlock to cause shutdown of the boiler in the event of condensate pump failure;

h) if the relevant information is not in the condensate pump instructions or the boiler instructions, the appropriate manufacturer shall be consulted; and

i) the diameter of any discharge pipe external to the dwelling shall be as specified in **6.3.7.1.4**.

6.3.7.2.4 Discharge pipes combined internally within the boiler case

6.3.7.2.4.1 Removal by gravity

For removal by gravity, where the boiler design joins the discharge pipe from the boiler pressure relief valve and the condensate discharge pipe internally within the boiler case to provide a single discharge connection point at the boiler:

a) internally within the dwelling the pipe size, type and means of connection of individual lengths of pipe shall be as specified in the boiler instructions;

b) if this information is not in the boiler instructions, the boiler manufacturer shall be consulted; and

c) the diameter of any discharge pipe external to the dwelling shall be as specified in **6.3.7.1.4**.

6.3.7.2.4.2 Removal with condensate pump

Where the installation requires a condensate pump:

a) such a pump shall only be used where the pump instructions state that the pump is suitable for such an application;

b) the pipe and any jointing of the pipe between the boiler and the condensate pump inlet, and between the condensate pump outlet and the condensate discharge point, shall be of the material and jointing type and internally within the dwelling, the size recommended by the boiler installation instructions;

c) if the relevant information is not available in the boiler or condensate pump instructions, the boiler or pump manufacturer shall be consulted as appropriate; and

d) the diameter of any discharge pipe external to the dwelling shall be as specified in **6.3.7.1.4**.

*COMMENTARY ON **6.3.7.2***
Where the condensate discharge from the boiler and the discharge from the pressure relief valve of the boiler are carried away from the boiler in a single pipe, special conditions might apply to the choice of pipe material, pipe size and method of jointing of the pipe, and, where applicable, if a condensate pump is used, because:

- *discharge from a pressure relief valve will be at a greater volume, pressure and temperature than condensate discharge, and only the boiler manufacturer can advise on the type, size and jointing of pipe and the performance of condensate pump required to accommodate this discharge;*

- *if an inhibitor has been used in the heating system it is possible that any discharge from the pressure relief valve could contain some of this inhibitor and only the condensate pump manufacturer can advise on the possible effect of such inhibitors on the performance of their pump.*

6.3.8 Positioning and termination of the condensate drainage pipe

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 away from the boiler. 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 **6.3.7.1** or **6.3.7.2**, as appropriate, for guidance on condensate removal pumps.*

Suitable condensate discharge arrangements shall be provided by connection to:

a) a soil and vent stack [internal (see **A.1**) and external (see **A.2.3**)];

b) an internal waste pipe (see **A.2.2** and **A.2.1**);

c) an external drain or gully, which discharges into a foul water system and does not discharge into a surface water or storm drain (see **A.2.4** and **A.2.1**);

d) a rainwater hopper that is part of a combined system, i.e. a sewer that carries both foul water and rainwater (see **A.2.4** and **A.2.1**);

NOTE 2 Further information on the identification of a combined system can be obtained from the local water undertaker.

e) a rainwater downpipe (see **A.2.5**);

f) a purpose-made soakaway (see **A.2.6** and **A.2.1**) if none of the condensate discharge arrangements in a) to e) are practicable;

NOTE 3 Foul water drains carry waste water from toilets, sinks, baths and household appliances to the sewage treatment works. This water is treated before it can safely flow back into rivers and streams. However, some houses have a combined drainage system, meaning that foul and surface water all drain to the foul sewer. If this is the case, all the water from the house goes to a sewage plant for treatment. Surface water drains, or "storm drains", carry rainwater from road surfaces and rooftops into local rivers and streams and flows into the river untreated.

NOTE 4 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.

*NOTE 5 For condensate removal by gravity, provided that the condensate drainage pipe has been installed in accordance with **6.3.7.1.2** and **6.3.7.1.3**, there is no length restriction. However, it is recommended that the drainage pipe should take the shortest and "most vertical" route to the discharge point.*

NOTE 6 For condensate removal by use of a condensate pump, the pump manufacturer should be consulted for any length restrictions.

*COMMENTARY ON **6.3.8***
Internal discharge points are strongly recommended 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 for the sewerage system has agreed that it will not adversely impact on the system. To make this assessment, the person responsible needs 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.

6.3.9 In-line condensate neutralizer devices

6.3.9.1 In-line condensate neutralizer devices fitted to a dedicated condensate discharge pipe

NOTE A dedicated condensate discharge pipe is a pipe that only carries condensate from the boiler condensate drain.

An in-line neutralizer device can be fitted in the condensate line, unless the boiler manufacturer's installation instructions prohibit this. In addition:

a) the flow rate capability specified for the device shall be compatible with the condensate flow rate specified by the boiler manufacturer's instructions;

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

c) details of this effective life shall be prominently and durably fixed to the outside of the boiler 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; and

*COMMENTARY ON **6.3.9.1**c)*
A suitable service regime is either:

- *an annual boiler service that includes either obligatory replacement of the neutralizing medium or a check of the acidity of the condensate downstream of the neutralizing device in accordance with the neutralizer manufacturer's instructions and replacement of the neutralizing medium if necessary; or*
- *a periodic check of the acidity of the condensate downstream of the device and replacement of the neutralizing medium when necessary, with the interval of the periodic check and the method of measuring the acidity of the condensate after the neutralizer matched to the advice in the neutralizer manufacturer's instructions.*

An example of how the neutralizer manufacturer might advise to check for correct operation of the neutralizer agent is to recommend measurement of the pH of the condensate.

d) the restrictions on condensate drainage pipe material in **6.3.7.1.2**, the size requirements of **6.3.7.1.3** and **6.3.7.1.4** appropriate to the siting of the condensate discharge point and the discharge arrangements specified in **6.3.8** shall continue to apply, unless the system is designed to automatically turn off the boiler in the event of the neutralizing agent no longer neutralizing the condensate and requires a qualified operative to restart the boiler.

*COMMENTARY ON **6.3.9.1**d)*
*Unless the neutralizing device automatically shuts off the boiler as described in item d) (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 is other than specified in **6.3.7.1.2**, it is likely the drainage pipe will corrode and perforate and the acidic condensate will be inappropriately discharged.*

6.3.9.2 In-line condensate neutralizer device fitted to a combined pressure relief valve and condensate discharge pipe

6.3.9.2.1 Discharge pipes combined outside the boiler during installation

In addition to the requirements of **6.3.9.1** and **6.3.7.2.1,** where the boiler instructions advise that the pressure relief valve discharge pipe can be combined with the condensate discharge pipe outside the boiler case during installation, the pressure relief valve discharge pipe shall be connected to the condensate discharge pipe after the outlet of the neutralizer unless the neutralizer instructions allow the connection to the inlet.

6.3.9.2.2 Discharge pipes combined internally within the boiler

In addition to the requirements of **6.3.9.1** and **6.3.7.2.4,** where the boiler design joins the discharge pipe from the boiler pressure relief valve and the condensate discharge pipe internally within the boiler case to provide a single discharge connection point at the boiler to which the condensate discharge pipe is to be fitted, a neutralizer shall only be fitted in the condensate discharge pipe if the installation instructions supplied with the neutralizer allow this.

*COMMENTARY ON **6.3.9.2***
Where the condensate discharge from the boiler and the discharge from the pressure relief valve of the boiler are carried away from the boiler in a single pipe, as well as the special conditions that might apply to the choice of pipe material, pipe size and method of jointing of the pipe, a specific design of neutralizer might be required, because:

- *discharge from a pressure relief valve will be at a greater volume, pressure and temperature than condensate discharge; and*
- *if an inhibitor has been used in the heating system it is possible that any discharge from the pressure relief valve could contain some of this inhibitor.*

Consequently, only the neutralizer manufacturer can advise if the neutralizer can handle this volume of discharge and the possible chemicals in this discharge.

6.4 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 Fittings Regulations [10], which require that materials in contact, or likely to come in contact, with wholesome water (water supplied for such domestic purposes as 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. For example, solder containing lead is not to be used in pipework conveying water which is required to be wholesome.

*COMMENTARY ON **6.4***
Where no British or European Standard exists, materials and components should be of a suitable quality, and should be designed, constructed and installed to fulfil 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 in the Water Fittings and Materials Directory published by the Water Regulations Advisory Scheme (WRAS) (see www.wras.co.uk/directory).

6.5 Boiler rating

The heat requirements of the system, as agreed between supplier and purchaser, shall be documented.

The rated output of the boiler shall be at least equal to this documented requirement.

*COMMENTARY ON **6.5***
When determining the boiler rating, provision should be made for the space-heating demand of the building, which depends on how frequently the heating will be used and on the characteristics of the premises.

BS EN 12831 gives calculations for determining heat demand.

In a system providing both a space heating and a domestic hot water service, additional boiler output might be necessary, the actual amount depending upon the hot-water storage capacity and the pattern of usage.

This is particularly important in low-energy housing where the hot-water service might take a greater proportion of the total heat requirements. Where system controls give priority to one service, or for some types of combination boiler where the heat output is independently controlled for heating and domestic hot water, this additional output is not necessary.

7 Installation

7.1 Air supply for combustion and ventilation

A boiler shall have an air supply for combustion and ventilation that conforms to BS 5440-2.

*COMMENTARY ON **7.1***
BS 5440-2 specifies the air supply requirements of open-flued and room-sealed appliances installed in compartments and in rooms.

For premises insulated against external noise (e.g. noise of traffic, aircraft), attention is drawn to local noise insulation regulations.

7.2 Chimney system

The products of combustion shall be conducted to the outside air. The chimney system shall conform to BS 5440-1.

Where a room-sealed, fanned draught flue system is to be concealed within a void, in England it shall be installed in accordance with Approved Document J [14].

NOTE Northern Ireland, Scotland and Wales might have alternative requirements.

*COMMENTARY ON **7.2***
Guidance on chimneys for permanently sited mobile homes, caravans and boats is given in BS 5482-2 and PD 5482-3.

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

Information on chimneys for timber framed and light steel framed buildings is given in IGEM/UP/7, Edition 2.

Information on room-sealed fanned draught flue systems concealed within voids is given in Technical Bulletin 008, as published by Gas Safe Register [15].

Information on existing room-sealed, fanned-draught vertical condensing flexible flues concealed within voids is given in Technical Bulletin 139, published by Gas Safe Register [21].

Further information on the use and maintenance of shared chimney and flue systems for domestic gas appliances is given in IGEM/UP/17.

7.3 Siting of the appliance

7.3.1 General

The floor or wall on which the boiler is to be installed shall be capable of supporting the weight of the appliance when it is filled with water, and the floor shall be flat and level.

The space around the boiler shall be at least the minimum specified in the manufacturer's installation instructions.

The floor or wall on which the boiler is to be mounted shall be protected in accordance with the manufacturer's instructions.

*COMMENTARY ON **7.3.1***
The space around the boiler should be adequate:

a) to ensure sufficient air circulation for any draught diverter to operate;

b) to ensure sufficient air for combustion and cooling; and

c) for maintenance and servicing.

7.3.2 Boiler compartment installations

7.3.2.1 The boiler compartment shall be a fixed, rigid structure, the internal surfaces of which conform to the boiler installation instructions.

*COMMENTARY ON **7.3.2.1***
If the boiler manufacturer's installation instructions do not give specific advice, then any internal surface of the boiler compartment which is of combustible material should either be at least 75 mm from any part of the boiler or should be lined with non-combustible material. Methods of determining whether a material can be described as combustible or non-combustible are given in BS 476-22. For further advice, see HSE publication, Safety in the installation and use of gas systems and appliances [19].

7.3.2.2 The compartment shall permit access for inspection and servicing of the boiler and any ancillary equipment. A notice shall be fixed in a prominent position within the compartment to warn against its use as a storage cupboard. The compartment shall be fitted with a door that will permit withdrawal of the boiler and any ancillary equipment.

7.3.2.3 If the boiler compartment houses an open-flued boiler, neither the door nor the air vents shall communicate with a room containing a bath or shower (see **7.3.5**).

7.3.2.4 Open-flued boilers installed in compartments communicating directly with a room used or intended to be used for sleeping accommodation shall have a heat input of less than 14 kW gross (12.6 kW net) and shall include a safety control designed to shut down the boiler before a dangerous quantity of the products of combustion accumulates in the room concerned (see **7.3.6**).

7.3.2.5 Where necessary, according to manufacturer's instructions, the compartment shall incorporate air vents for cooling and air for combustion and correct operation of the chimney (see **7.1** and **7.2**).

*COMMENTARY ON **7.3.2.5***
Communication of the door of an open-flued boiler compartment with a bedroom or bed-sitting room is not recommended and should only be considered if there is no alternative.

7.3.3 Airing cupboard installations

7.3.3.1 Airing cupboard installations where the space is to continue to be used as an airing cupboard

7.3.3.1.1 An airing cupboard adapted to house a boiler shall conform to **7.3.2**.

7.3.3.1.2 The airing spaces shall be separated from the boiler compartment by a non-combustible partition, which may be perforated, if necessary, by apertures having a major dimension not greater than 13 mm.

7.3.3.1.3 Any flue duct which passes through the airing space shall be double-walled or thermally insulated, unless the duct is surrounded by an air inlet duct.

7.3.3.1.4 Where the boiler is of the open-flued type, the draught diverter and the air vents shall be in the boiler compartment and shall connect to the room and not the airing space.

*COMMENTARY ON **7.3.3.1***
For a double-wall chimney conforming to BS EN 1856-1, or for a flue duct concentric with an air inlet duct, the external skin and the air gap provide sufficient insulation and no extra precautions are necessary, other than normal installation tolerances.

A single-wall chimney should be protected by an air gap of at least 25 mm for a distance of at least 1 m from the draught diverter outlet connection.

This air gap can be provided by a non-combustible guard which forms an annular space around the chimney of not less than 25 mm.

Any clearance between the chimney guard and the compartment partition where the chimney passes through should not exceed 13 mm (see Figure 1).

Expanded metal or rigid wire meshes are suitable materials for the partition and guard.

7.3.3.2 Airing cupboard installations where the space is no longer to be used as an airing cupboard

7.3.3.2.1 An airing cupboard adapted to house a boiler shall conform to **7.3.2**.

7.3.3.2.2 Any shelving or similar clothing storage facility shall be removed.

7.3.3.2.3 A durable label shall be securely fitted to the inside of the cupboard door stating that in the event that the cupboard is to be reinstated as an airing cupboard, the boiler installation and cupboard construction are to be reviewed and brought in line as necessary with the relevant requirements of BS 6798.

*COMMENTARY ON **7.3.3.2.3***
The user should be informed that:

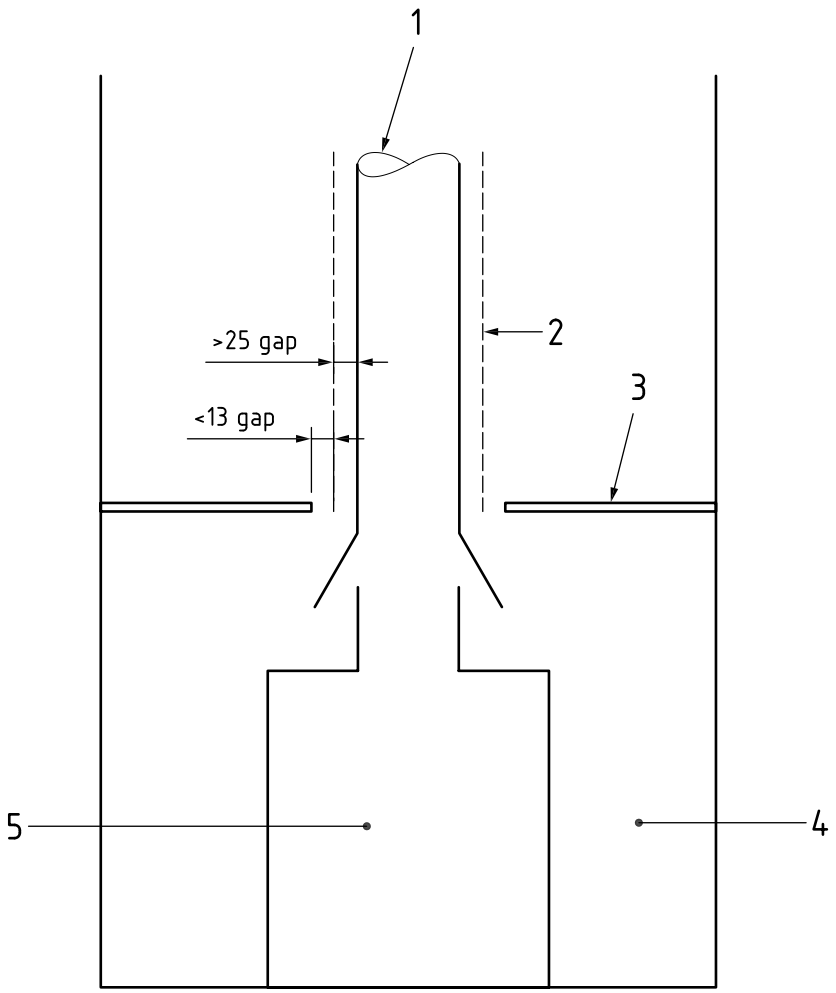
a) the label should not be damaged, obscured or removed; and

b) if it is decided to use the cupboard in the future as an airing cupboard, before they do they should ask a qualified gas installer to review the boiler installation and cupboard construction to ensure it is safe to use for airing clothes.

7.3.3.2.4 The customer shall be made aware of this label.

Figure 1 **Open-flued boiler chimney clearances**

Dimensions in millimetres



Key

1 Chimney
2 Guard
3 Compartment partition
4 Boiler compartment
5 Boiler

7.3.4 Understairs cupboard installations

If a boiler is installed in an understairs cupboard, the cupboard shall conform to one of the following.

a) Where the premises in which the cupboard is located have not more than two storeys, the cupboard shall conform to **7.3.2**.

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

*COMMENTARY ON **7.3.4***
Installation in an understairs cupboard should only be considered if there is no alternative location.

Whenever possible, the boiler in an understairs cupboard should be of the room-sealed type.

7.3.5 Bathroom and shower room installations

7.3.5.1 Boilers installed in a room or internal space containing a fixed bath or shower shall be room-sealed.

*COMMENTARY ON **7.3.5.1***
Installation in a bathroom or shower room should only be considered if there is no reasonable alternative location.

7.3.5.2 The electrical installation shall conform to BS 7671.

*COMMENTARY ON **7.3.5.2***
Attention is drawn particularly to BS 7671 with regard to zoning requirements in locations containing a bath or shower and to the requirement for residual current device (RCD) protection and supplementary equipotential bonding (if required).

7.3.5.3 Any electrical isolation shall be RCD-protected, for example by a double pole switched fused connection unit with 30 MA RCD protection.

7.3.6 Bedroom and bed-sitting room installations

7.3.6.1 A boiler of 14 kW gross (12.6 kW net) heat input or greater installed in a bedroom or bed-sitting room or any room used or intended to be used for sleeping accommodation shall be room-sealed.

7.3.6.2 An open-flued boiler of less than 14 kW gross (12.6 kW net) heat input that is installed in a room used or intended to be used for sleeping accommodation shall incorporate a device which shuts down the boiler before a dangerous quantity of products of combustion accumulates in the room.

*COMMENTARY ON **7.3.6***
Installation in a bedroom or bed-sitting room should only be considered if there is no alternative location.

7.3.7 Toilet and cloakroom installations

The air vents from any boiler installed within a toilet or cloakroom shall be direct to outside air.

*COMMENTARY ON **7.3.7***
Installation within a toilet or cloakroom should only be considered if there is no alternative location.

7.3.8 Roof space installation

*COMMENTARY ON **7.3.8***
Consideration should be given as to whether a guard should be provided to prevent contact between stored articles and the boiler, its associated pipework and chimney.

7.3.8.1 Roof spaces incorporating boiler installations shall conform to the following.

a) For an open system, vertical clearances shall be provided so that the static head requirement of **7.7.2.1** is met.

b) Flooring area sufficient to allow access for normal use and servicing shall be provided under and around the boiler. The boiler support shall be capable of supporting the load of the water-filled boiler, associated pipework and equipment.

*COMMENTARY ON **7.3.8.1**b)*
Where the floor is of combustible material and supports the boiler, a non-combustible insulating base at least 12 mm thick should be provided directly under the boiler.

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

*COMMENTARY ON **7.3.8.1**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 shall be provided for the boiler installation and the means of access.

7.3.8.2 When a boiler is connected to an existing brick chimney at a level higher than the connection for a previous installation, the lower section of the chimney shall not be used. The unused lower portion of the chimney shall be sealed from the used portion by means of a plate inserted below the boiler connection to the chimney, but ensuring that other flues in the same chimney stack are not sealed off. Where the chimney is unlined, the plate shall be inserted to form a void extending approximately 250 mm below the boiler connection to the chimney.

*COMMENTARY ON **7.3.8.2***
Consideration should be given to providing access to the void immediately below the boiler connection to the chimney. Any openings into the lower portion of an internal flue, i.e. the sealed-off section, should be permanently closed off. For a chimney with at least one external face, the lower disused section should be ventilated to the external air at high and low level to prevent damp penetration.

7.3.9 External installation

7.3.9.1 A boiler installed in an external location shall be either:

a) a boiler specifically designated in the manufacturer's literature as being suitable for external installation without the need for additional protection; or

b) installed in an enclosure/compartment capable of providing permanent weather protection.

*COMMENTARY ON **7.3.9.1**b)*
The enclosure should be waterproof and the boiler and associated pipework should be protected by a frost thermostat.

7.3.9.2 If an enclosure/compartment is necessary, it shall conform to **7.3.2**. In addition, there shall be fitted within the enclosure an accessible waterproof, switched fused connection unit to completely isolate the boiler and all associated equipment, e.g. pumps, motorized valves, room thermostat. The enclosure shall be ventilated in accordance with the boiler instructions.

*COMMENTARY ON **7.3.9.2***
The lowest part of the low-level vent should be not less than 300 mm above ground level. Any permanent openings to the enclosure, including those in the air vents, should have a minor dimension not greater than 10 mm in order to prevent the entry of birds or rodents. However, this dimension should not be less than 5 mm in order to minimize the risk of blockage. A means should be incorporated to prevent access by unauthorized persons to the boiler enclosure.

Attention is drawn to the Building Regulations [6, 7, 8, 9], which can apply to such enclosures.

7.3.9.3 Any boiler installed in an external enclosure/compartment shall be provided with a chimney as specified in **7.2**.

7.3.9.4 External gas pipework shall be protected against corrosion and damage in accordance with BS 6891 or IGEM/UP/2, Edition 2, as appropriate.

7.3.9.5 Water-carrying pipework shall be insulated against freezing as specified in BS 5422 and installed in accordance with BS 5970 (see **7.4.4.2**).

7.3.10 Other installations

A boiler installed in a location other than described in **7.3.2** to **7.3.9** shall be installed in accordance with the manufacturer's instructions.

*COMMENTARY ON **7.3.10***
Information on chimneys for timber-framed and light steel framed buildings is given in document IGEM/UP/7, Edition 2.

Information on gas installations in flats and other multi-dwelling buildings is given in IGEM/G/5.

Guidance on installations using 3rd family gases is given in BS 5482-1, BS 5482-2 and PD 5482-3.

7.3.11 Ambient conditions

The appliance shall be installed in a clean, dry, ventilated area that ensures that the manufacturer's stated acceptable upper and lower ambient temperature range is not exceeded.

*COMMENTARY ON **7.3.11***
The boiler may have an automatic feature that protects it from frost, but additional arrangements might be needed to protect pipework from freezing.

7.4 Protection

7.4.1 Open systems

For open systems, an open vent pipe shall be provided from the circulating system to discharge over the feed and expansion cistern above the level of the overflow connection. The internal diameter of the pipe shall be not less than 19 mm. The vent pipe shall rise continuously and be connected in such a position as to prevent discharge of water or ingress of air in all normal conditions of service.

There shall be no valves or components other than full-bore pipe fittings between the boiler and the discharge point of the open vent pipe, unless specified in the manufacturer's instructions.

*COMMENTARY ON **7.4.1***
Except where the boiler manufacturer's instructions specifically state otherwise, the open vent pipe should be fitted to the flow connection or flow pipe from the boiler. The vent pipe may be used as part of the circulating system. Except where the boiler manufacturer's instructions specifically state otherwise, a close coupled cold feed and open vent configuration may be fitted provided that there is a cold water feed path available when all automatic valves are in the closed position. When this configuration is used the cold feed and open vent connections should be not more than 150 mm apart. Except where the boiler manufacturer's instructions specifically state otherwise, a combined feed and vent pipe may be fitted provided that the boiler incorporates an overheat cut-off device.

For further information on the installation of open vented cisterns, see the UK National Annex to BS EN 12828.

7.4.2 Sealed systems

For sealed systems, an expansion vessel conforming to BS EN 13831 shall be provided, which may be integral to the boiler (supplied by the boiler manufacturer) or external, or a combination of both. If external to the boiler, it shall be connected to the system by a pipe or fitting which shall not incorporate valves of any sort. The vessel(s) shall have sufficient capacity to accept the expansion of the system water when heated from 10 °C to 110 °C without raising

the pressure in the system to more than 0.35 bar below the lift pressure of the safety valve.

*COMMENTARY ON **7.4.2***
*Information concerning the calculation of vessel sizes is given in BS EN 12828:2012, UK National Annex **NA**.**4.7.1.2**. The expansion vessel itself might be located in a position remote from the heating circuit, but its connection with the circuit should be at a point close to the pump inlet. The charge pressure should not be less than the static head at the point of connection.*

7.4.3 Pressure relief valve

7.4.3.1 A sealed system shall incorporate a pressure relief valve. This valve shall either be supplied integral with the boiler or, where installed as a separate component, it shall be fitted as close as possible to the top of the boiler in the flow pipe with no intervening valve or restriction.

7.4.3.2 The location and method of fitting the pressure relief valve shall be such that:

a) the discharge pipe from the valve is metallic, unless an alternative material is specified as acceptable by either the boiler or pipe manufacturer to withstand the maximum temperatures and pressures for the life of the boiler (for water or steam) to which it is likely to be subjected under fault conditions, and it falls throughout its length; or

b) alternatively, where an appliance incorporates an integral pressure relief valve and the manufacturer specifies arrangements to discharge from a secondary valve above the height of the appliance, their specific guidance shall be followed, e.g. where sealed system boilers are to be sited in below-ground locations such as cellars; and

c) the discharge is indirectly or directly visible and will not discharge on to the occupants of the premises or on to any electrical components or wiring.

*COMMENTARY ON **7.4.3.2**c)*
Examples of "directly" are via a tundish, transparent pipework or external discharge.

Examples of "indirectly" are visible or audible indication on the boiler of pressure loss.

7.4.3.3 Where a pressure relief valve is installed as a separate component outside the boiler, it shall conform to BS EN 1491 if the boiler is of less than 44 kW rated output, or to BS EN ISO 4126-1 if the boiler is of 44 kW rated output and above. The valve shall be installed in accordance with the boiler manufacturer's instructions.

7.4.3.4 For sealed systems, pressure relief valves shall have the following features:

a) a non-adjustable spring-loaded pre-set lift pressure not exceeding 3 bar;

b) a manual testing device; and

c) provision for connecting a full-bore discharge pipe.

*COMMENTARY ON **7.4.3***
*In addition to the requirements of **7.4.3.2** the pressure relief valve should be located where its discharge is unlikely to cause damage to the premises.*

It is essential that the pressure relief valve does not stick in the closed position and that it reseals.

A pressure relief valve is not necessary for an open system.

7.4.4 Freezing

7.4.4.1 A draining tap or taps shall be provided in an accessible position at the system low point(s) so that the whole system, including the boiler, can be drained.

7.4.4.2 Any boiler feed and expansion cistern, cold feed pipe, open vent pipe, overflow pipe or any circulating system pipework situated where it might be vulnerable to freezing (e.g. in a roof space) shall be protected by thermal insulation. Thermal insulating materials shall conform to BS 5422:2009, Clause **11**, and be installed in accordance with BS 5970.

*COMMENTARY ON **7.4.4.2***
Insulation slows down but does not prevent loss of heat from water in a pipe. Insulation does not give complete protection if the temperature continues at or falls further below freezing point. However, a suitable thickness does delay the onset of freezing. Consideration should be given to fitting a frost thermostat which should be set to operate at a temperature of approximately 4 °C. The thermostat should be sited and set in accordance with the manufacturer's instructions. Pipe insulation should be continuous over pipe and fittings for frost protection and where condensation might occur. Where a feed and expansion cistern is fitted in a roof space, insulation should not be fitted underneath it.

7.5 Gas supplies and pipework

7.5.1 First and second family gases

7.5.1.1 The gas supply pressure to the boiler shall be in accordance with the boiler manufacturer's instructions.

7.5.1.2 Where a service pipe exists, the operative shall confirm with the gas supplier or gas transporter that the pipe is of sufficient size for the maximum gas rate of the whole installation.

7.5.1.3 When a meter is fitted by a gas supplier or gas transporter, the operative shall confirm that the meter is of sufficient capacity for the maximum gas rate of the whole installation.

*COMMENTARY ON **7.5.1.3***
A credit meter is preferred, and its installation should conform to BS 6400-1 or BS 6400-2 or IGEM/GM/6, as appropriate. The use of a prepayment meter could cause considerable inconvenience to the user and for this reason is not considered to be good practice. A prepayment meter should only be adopted at the insistence of the user or the gas supplier.

7.5.1.4 All gas installation pipes shall be sized and installed in accordance with BS 6891 or IGEM/UP/2, Edition 2, as appropriate.

*COMMENTARY ON **7.5.1.4***
When replacing an existing boiler and reusing the existing gas supply pipe, the operative should confirm that the pipe is of adequate size to supply the new boiler before fitting the boiler.

In addition to the requirements of BS 6891 on protection, attention should be given to the protection of pipes within fireplace openings from corrosion and damage by debris such as soot or parging that might fall from the chimney. A suitable method of protection is to wrap the pipe with a compatible tape. See BS 5871-1 or BS 5871-2, as appropriate, for further guidance.

7.5.1.5 A boiler shall be provided with an adjacent isolating valve if this is not already supplied with the boiler.

7.5.2 Third family gases

7.5.2.1 The gas storage vessels shall not be installed or stored in the boiler compartment or inside the premises.

7.5.2.2 All gas installations shall be sized and installed in accordance with BS 5482-1, BS 5482-2, PD 5482-3, IGEM/UP/2, Edition 2, or UKLPG Code of Practice 22, as appropriate.

*COMMENTARY ON **7.5.2.2***
Unless supplied from a central storage system, 3rd family gas installations do not normally incorporate a gas meter.

7.5.2.3 When a meter is already in place, the operative shall confirm that the meter and pipework are of sufficient capacity for the maximum gas rate of the whole installation.

*COMMENTARY ON **7.5.2.3***
A credit meter is preferred and its installation should conform to BS 6400-3. The use of a prepayment meter could cause considerable inconvenience to the user and for this reason is not considered to be good practice. A prepayment meter should only be adopted at the insistence of the user or the gas supplier.

7.6 Electricity supplies and wiring

7.6.1 The electrical installation shall conform to BS 7671.

7.6.2 Electricity supplies to the boiler 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.

7.6.3 Connection to the mains electricity shall be either a) or b).

a) Single point of electrical isolation

The heating system boiler and controls connection to the mains electricity supply shall be readily accessible and shall provide a method of electrical isolation of the boiler and all ancillary electrical controls by either:

1) a double-pole switched fused connection unit; or
2) a fused three-pin plug and an unswitched shuttered socket outlet (refer to **7.3.5.3** if the boiler is going to be installed in a bathroom).

b) Two (or more) separate and independent points of isolation

The heating system can have multiple points of isolation, providing:

1) there is no physical "electrical" connection between the parts of the system that are separately isolated;
2) in the event that one point of isolation is invoked there shall be no possibility that this isolation can be overridden by activation of part(s) of the non-isolated part of the system;
3) the isolation points are adjacent to the equipment to be isolated, obvious by location as to the equipment they isolate and readily accessible;
4) sufficient durable labels are in place, stating that the heating system has multiple points of electrical isolation and stating where the other isolation points are located and positioned such that an operative working on the system will be fully aware; and
5) the labelling is in accordance with the Health and Safety (Safety Signs and Signals) Regulations 1996 [22].

The method of electrical connection shall be:

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

ii) a fused three-pin plug and an unswitched shuttered socket outlet; or

iii) in a bathroom or shower room, equipment that is RCD-protected.

*COMMENTARY ON **7.6.3**a) AND b)*
*In some instances mains-powered wireless control systems can offer practical advantages for installation, such as less disruption to the existing structure and fittings of the customer's premises, resulting in quicker installation at less cost. These controls have the additional safety feature over the conventional "standard wired" heating system of wireless separation. BS 7671:2008, **514**, allows the alternative approach of separate isolation set out in **7.6.3**b). BS 7671 recognizes that enacting these requirements should not pose a danger to operatives providing they follow safe electrical isolation processes.*

The Health and Safety (Safety Signs and Signals) Regulations 1996 [22] require that the labels display the prescribed electrical hazard triangular shaped symbol and font size for the specific warning/advice, using black on yellow colouring.

*COMMENTARY ON **7.6.3***
The Institution of Electrical Engineers' Electrician's Guide to the Building Regulations [23] advises that a minimum of 300 mm should be allowed from the edge of kitchen sinks and draining boards to the boiler's point of connection to the mains electricity to reduce the risk of being splashed.

7.6.4 All fuses shall be in accordance with the boiler and component manufacturer's instructions.

7.7 Water supplies and pipework

NOTE Attention is drawn to the Water Fittings Regulations [10] or relevant by-laws which apply to the design and installation of all hot water systems.

Where it is permissible to connect a water heater system directly to the water mains, reference should be made to BS 5546.

7.7.1 General

7.7.1.1 Water pipework within a fireplace opening shall be protected from corrosion and damage caused by soot and debris that might fall from the chimney.

*COMMENTARY ON **7.7.1.1***
A suitable method of protecting pipework is to wrap the pipe with a compatible tape. See BS 5871-1 or BS 5871-2, as appropriate, for further guidance.

7.7.1.2 The proximity to the boiler of any plastic pipe or fitting shall be limited in accordance with the pipe/fitting manufacturer's and the boiler manufacturer's instructions. The pressure and temperature rating of plastic pipes and fittings shall be appropriate for the maximum operating pressure and temperature of the system. Plastic pipe and fittings shall be selected from those which have been verified and listed under the Water Fittings and Materials Directory (see Commentary on **6.4**) and they shall be used in accordance with the recommendations of the pipe/boiler manufacturer.

*COMMENTARY ON **7.7.1.2***
In considering the suitability of any plastic pipe and/or fitting, the following should be taken into account:

a) the manufacturer's instructions on close connection to the boiler;

b) deterioration due to sunlight;

c) porosity; and

d) conformity with the recommendations of the pipe/boiler manufacturer.

7.7.2 Open systems

7.7.2.1 Feed and expansion cistern

In an open system, a feed and expansion cistern shall be fitted in accordance with the UK National Annex to BS EN 14336. The cistern shall be fitted so that its base is at least 1 m above the highest point of the circulating system or at such lesser height as specified in the boiler and pump manufacturers' installation instructions.

The internal diameter of the warning/overflow pipe shall be not less than 19 mm.

*COMMENTARY ON **7.7.2.1***
When the feed and expansion cistern is manufactured from plastics or similar materials, it should be supported over the entire area of its base such as to support the cistern in its filled condition in the event of accidental water spillage. It is recommended that any support extends a minimum 150 mm in all directions beyond the edge of the maximum dimensions of the cistern.

7.7.2.2 Hot-water storage vessel

Any independent hot-water storage vessel shall be installed in accordance with the UK National Annex to BS EN 14336.

*COMMENTARY ON **7.7.2.2***
Pipework connections should be in accordance with the storage vessel and boiler manufacturer's instructions. This is particularly important when it is proposed to use a hot water storage combination unit conforming to BS 3198.

7.7.2.3 Primary cold feed

7.7.2.3.1 The primary cold feed pipe from the feed and expansion cistern to the boiler or heating system shall be made of copper or stainless steel, or of a suitable plastics material (see **7.7.1.2**).

7.7.2.3.2 The internal diameter of the primary cold feed pipe shall be not less than 13 mm, except in the case of a combined cold feed and open vent pipe, where the internal diameter shall be not less than 19 mm.

7.7.2.3.3 The primary cold feed pipe shall not supply water for any other purpose.

7.7.2.3.4 The primary cold feed pipe shall not be fitted with a valve or other component unless required by the local water supplier. Where required, the valve or any other component shall be full bore.

7.7.2.4 Single-feed systems

A cold feed to a single-feed system (heating and storage hot water separated by an air bubble) shall conform to **7.7.2.3**.

7.7.3 Sealed systems

7.7.3.1 Filling and make-up equipment

In a sealed system, facilities shall be provided for filling the system and for water make-up as specified in the UK National Annex to BS EN 14336.

*COMMENTARY ON **7.7.3.1***
Attention is drawn to the Water Fittings Regulations [10] or relevant by-laws.

7.7.3.2 Fittings

All water-carrying components, including the pump and the primary circuit of the indirect hot-water storage cylinder, shall be designed for operation at 110 °C and

at the maximum pressure permitted by the safety valve. Single-feed cylinders shall not be used in sealed primary systems.

*COMMENTARY ON **7.7.3.2***
Single-feed cylinders are not designed for use with sealed primary systems.

7.7.3.3 Venting

Provision shall be made to vent air from the system.

*COMMENTARY ON **7.7.3.3***
The system may be vented either by automatic air vents or manually. Hygroscopic types of automatic air vent should not be used for sealed systems, as they allow continuous evaporation of small quantities of water.

7.7.3.4 Methods of filling sealed systems

Sealed systems shall be filled in accordance with Schedule 2, Section 8, Paragraph 24 of the Water Regulations Advisory Service (WRAS) Water Regulations Guide [24].

*COMMENTARY ON **7.7.3.4***
Guidance G24.1 and G24.2 and the accompanying Recommendations R24.1 and R24.2 to the WRAS Guide provide the detail.

7.7.4 Waterways

7.7.4.1 The whole of the primary heating system shall be thoroughly cleansed and flushed out before a new boiler is installed.

Unless a single-feed cylinder is connected to the system (see **7.7.4.2**), a chemical cleanser appropriate for the materials of the system shall be used, in accordance with any special instructions from the manufacturer of the boiler and the manufacturer of the cleanser. The cleanser shall be compatible with any inhibitor which is to be added to the system.

*COMMENTARY ON **7.7.4.1***
*Reasonable provision on how to cleanse and flush out the system is given in BS 7593:2006, Clause **5**.*

The chemical cleanser should be added to the system on the initial fill and any airlocks cleared. The whole system should be heated to maximum working temperature and examined for leaks. The system should then be switched off and rapidly drained while still hot, to remove any foreign matter and excess flux. The system should again be filled, cleared of air locks and re-examined for water leaks. Further guidance on system cleansing and flushing is given in BS 7593.

7.7.4.2 Chemical cleansers shall not be used if single-feed cylinders or similar devices are fitted to the system.

*COMMENTARY ON **7.7.4.2***
Devices that depend upon an air bubble with no physical barrier between the two circuits could allow water from the central heating circuit to contaminate the domestic hot water supply.

7.8 Selection of heating system controls

Where the heating system controls are specified in the appliance instructions, these shall be fitted.

*COMMENTARY ON **7.8***
The control systems built into boilers are becoming progressively more sophisticated, and matching the heating system controls to the appliance is important. There are so many variations of appliance control systems and heating control systems on the market that it is not possible to provide generic recommendations.

Choosing the heating system controls best suited to a particular appliance, heating system and property depends on many factors and the manufacturer's instructions should be consulted for their recommendations before making this choice.

8 Post-installation

8.1 Inspection

Before it is commissioned, the boiler installation shall be inspected to ensure that:

a) the work has been carried in accordance with this standard, the boiler manufacturer's instructions, the relevant sections of the current Gas Safety (Installation and Use) Regulations [1, 2] and BS 7671; and

NOTE 1 Attention is drawn to:

1) the Gas Safety (Installation and Use) Regulations [1, 2] and particularly to the requirements that:

i) the provision of ventilation air and combustion air is adequate;

ii) the chimney is correctly constructed;

iii) the general condition of the boiler and the installation is adequate; and

iv) the gas fittings and other works for the supply of gas are adequate;

*2) if more than a single point of electrical isolation is employed [see **7.6.3**b)], the points of electrical isolation are labelled.*

b) where it is a legal requirement that an independently-mounted carbon monoxide detector having an audible alarm (conforming to BS EN 50291) is fitted, this has been complied with.

NOTE 2 Attention is drawn to the fact that, in some parts of the UK, it is a legal requirement that an independently-mounted carbon monoxide detector having an audible alarm (conforming to BS EN 50291) is fitted.

8.2 Commissioning

NOTE Schedule 1 of the Building Regulations 2010 (England and Wales), as amended [6], requires a notice signed by a suitably qualified person that includes a declaration that the manufacturer's commissioning procedures have been completed satisfactorily. Similar requirements might apply in other areas of the UK.

For example, the Benchmark Commissioning Checklist provided by most boiler manufacturers at the rear of the appliance instruction manual or a commissioning checklist from a Competent Persons Scheme provider can be used to show that commissioning has been carried out satisfactorily.

8.2.1 Final filling of the system

8.2.1.1 During final filling of the system a chemical water treatment formulation shall be added to the primary circuit to control corrosion and the formation of scale and sludge.

The chemical treatment used shall be appropriate to the boiler and to the metals in the system, e.g. steel, copper or aluminium, and shall be introduced into the system according to the manufacturer's instructions. A label indicating that the system has been so treated shall be attached to the system, indicating the nature of the inhibitor present and the date of its addition.

*COMMENTARY ON **8.2.1.1***
Reasonable provision for final filling of the system would be to follow the recommendations of BS 7593.

The boiler manufacturer's instructions should be consulted for guidance on appropriate products. The use of an unsuitable inhibitor can have detrimental effects. It should be noted that many types of inhibitor can be used only with certain materials and the boiler/inhibitor manufacturer's instructions should be consulted concerning compatibility of any inhibitor with all the materials in the system. For further advice, BS 7593 should be consulted.

The local water supplier can be consulted for advice concerning the quality of the local water supply.

The inhibitor concentration should be rechecked annually, with further inhibitor being added when necessary, to maintain the optimum dosage.

Unless the manufacturer(s) state(s) to the contrary, products from different manufacturers or different products from the same manufacturer should not be mixed.

8.2.1.2 Inhibitors and biocides shall not be used where single-feed cylinders or similar devices, e.g. single feed automatic recovery tanks, are fitted in a system.

*COMMENTARY ON **8.2.1.2***
Devices that depend upon an air bubble with no physical barrier between the two circuits could allow water from the central heating circuit to contaminate the domestic hot water supply.

8.2.1.3 Naturally soft waters of low alkalinity or those supplied via a base-exchange resin softener shall only be used in a central heating system if a corrosion inhibitor specifically formulated for the purpose is added. Inhibitor manufacturers shall be consulted for advice, paying particular attention to dosage levels, and the owner of the appliance should be made aware of the need to have the system properly maintained.

*COMMENTARY ON **8.2.1.3***
Naturally soft waters of low alkalinity or those supplied via a base-exchange resin softener have an increased potential for corrosion, and if they are to be used in a central heating system a corrosion inhibitor specifically formulated for the purpose should be added and properly maintained.

8.2.2 Boiler

8.2.2.1 The boiler shall be put into operation and commissioned as described in the manufacturer's instructions.

*COMMENTARY ON **8.2.2.1***
The boiler manufacturer's instructions should be consulted for guidance on the appropriate commissioning procedure for the specific boiler and heating system.

Since April 2014, Technical Bulletin 143 [25] has made it mandatory to measure and record CO and combustion ratio on commissioning. Completion of appropriate commissioning documentation is a requirement of Building Regulations [6, 7, 8, 9] and, as part of their follow-up inspection processes, Gas Safe Register will defect an installation for non-compliance if the CO level and combustion ratio are not correctly recorded on the commissioning documentation. Similar requirements apply in other geographical areas covered by Gas Safe Register. Full details are given in Technical Bulletin 143 [25].

8.2.2.2 The operative shall ensure that the heat input is measured and, where necessary, correctly adjusted in accordance with the manufacturer's instructions.

*COMMENTARY ON **8.2.2.2***
Where appropriate, the pressure at the burner pressure test point should be checked to ensure that it is in accordance with the recommended value. The gas rate can be measured by the gas meter test dial or index, having first ensured that no other appliance supplied through the meter is in operation and that the boiler is operating at its nominal rate throughout the measurement, i.e. without cycling or modulating.

These checking and adjustment procedures should be carried out with the burner in the hot condition. It is recommended that a heat-up time of at least 10 min is allowed, except where the manufacturer's instructions advise otherwise. The heat input may

be quoted on the basis of either net or gross calorific value. The operative should establish from the manufacturer's instructions which of these is being quoted. If there is any doubt, the boiler manufacturer should be contacted. When a heat input is to be calculated from a measured gas rate, the appropriate gross or net calorific value (CV) should be used.

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 Technical Bulletin 021 [26] (available on the Gas Safe Register website www.gassaferegister.co.uk).

Where the measured combustion performance is used to demonstrate that the appliance is operating safely, the operative needs to:

1) have access to the boiler manufacturer's instructions and a calibrated electronic portable combustion gas analyser conforming to BS 7927 or BS EN 50379-3; and

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

This competence can be demonstrated by satisfactory completion of the relevant ACS assessment, which covers the use of electronic portable combustion gas analysers.

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

*COMMENTARY ON **8.2.2.3***
The safe removal of combustion products should be checked by the method described in the manufacturer's installation instructions. If these are not specific, the method given in BS 5440-1 should be used.

8.2.2.4 After the boiler heat input has been confirmed (see **8.2.2.2**) the primary water flow rate shall be adjusted to conform to the manufacturer's instructions.

*COMMENTARY ON **8.2.2.4***
The temperature differential should be measured at the flow and return pipes as close to the boiler as possible, when the system is in full operation and the flow temperature is approaching boiler thermostat cut-off point. Adjustment should be made using the variable head pump adjustment and/or by alteration of a control valve provided for the purpose in the main flow pipe of the system and/or by adjusting the bypass (if fitted).

8.2.2.5 The boiler controls, safety devices and system controls shall be checked to ensure that they function in accordance with the manufacturer's instructions.

*COMMENTARY ON **8.2.2.5***
Where the manufacturer's instructions require the combustion performance to be checked, the operative needs to have access to a calibrated electronic portable combustion gas analyser conforming to BS 7927 or BS EN 50379-3 and be competent in its use and the interpretation of any reading obtained. This competence can be demonstrated by satisfactory completion of the relevant ACS assessment, which covers the use of electronic portable combustion gas analysers.

8.3 Advice to user of the appliance

NOTE This is advice to be given to the user by the operative at the time of handover.

8.3.1 User instructions

8.3.1.1 The operative shall ensure that the user has been provided with the manufacturer's instructions for operating the boiler.

NOTE The GSIUR [1, 2] require that all the manufacturer's instructions are left with the owner.

8.3.1.2 The correct operating procedure for the boiler, any safety shut-off controls and ancillary controls shall be demonstrated to the user.

*COMMENTARY ON **8.3.1.2***
It is recommended that instructions for operating ancillary controls be provided by the operative.

In some parts of the UK, it is a legal requirement that an independently-mounted carbon monoxide detector having an audible alarm (conforming to BS EN 50291) is fitted.

Where there is no such legal requirement, the user should be informed that an independently-mounted carbon monoxide detector having an audible alarm (conforming to BS EN 50291) may be fitted in a room containing a gas appliance.

In both cases, the user should be informed that this is to give reassurance to customers, but the detector should not be regarded as a substitute for correct installation of the boiler and regular servicing by a competent person.

Where an independently-mounted carbon monoxide audible alarm to BS 7860 is already fitted in a room containing a gas appliance, the operative should advise the user that manufacture of such alarms to BS 7860 ceased in March 2006, by which time all manufacture of such alarms was to the updated requirements of BS EN 50291. With the expected working life of BS 7860 alarms being approximately five years, the user should be recommended to replace the alarm with one manufactured to BS EN 50291.

Since the implementation of the Gas Appliance (Safety) Regulations [5] in 1996, the majority of installed open-flued boilers are fitted with a flue spillage or atmospheric sensing device designed to shut down the boiler under fault conditions. The user should be informed of the possible need to call an operative to rectify any fault and reset the control.

8.3.1.3 If the heating system has been installed with multiple points of electrical isolation [see **7.6.3**b)], the owner of the boiler shall be advised that it is their (the owner's) responsibility to ensure that the safety labelling specified in **7.6.3**b)4) is maintained and kept up-to-date.

*COMMENTARY ON **8.3.1.3***
It should be explained to the owner of the appliance that the labelling is provided to ensure the safety of any subsequent operative who might be required to carry out work on the appliance or the associated electrical system in the future. Hence, the need to ensure the labelling is not damaged, obscured or removed (i.e. maintained) and kept up-to-date (for example, if the electrical connection was to be changed in the future).

8.3.2 Precautions

The user shall be advised of any precautions necessary to prevent damage to the boiler system or the building if the system remains inoperative during freezing conditions.

8.3.3 Maintenance

If the premises in which the boiler is installed are owned by the occupier, the occupier shall be advised in writing that, for continued efficient and safe operation of the appliance, it is important that adequate and regular maintenance of the boiler and heating system is carried out by a competent person (i.e. a Gas Safe Register-registered operative) in accordance with the appliance manufacturer's recommendations.

If the premises are tenanted and the landlord owns the gas appliance, the landlord shall be advised in writing of the duty imposed by the Gas Safety (Installation and Use) Regulations [1, 2] to ensure that the appliance installation is maintained in a safe condition and checked for safety every 12 months.

*COMMENTARY ON **8.3.3***
The Gas Safety (Installation and Use) Regulations [1, 2] impose a general obligation on landlords providing gas appliances in tenanted premises to have these maintained in a safe condition and checked for safety every 12 months.

Where an independently-mounted carbon monoxide audible alarm conforming to BS EN 50291 is fitted in or recommended for a room containing a gas appliance, the operative should advise the user that such an alarm is not to be regarded as a substitute for proper installation and regular servicing by a competent person.

Where an independently-mounted carbon monoxide audible alarm conforming to BS 7860 is already fitted in a room containing a gas appliance, the operative should advise the user that manufacture of such alarms to BS 7860 ceased in March 2006, by which time all manufacture of such alarms was to the updated requirements of BS EN 50291. With the expected working life of BS 7860 alarms being approximately five years, the user should be recommended to replace the alarm with one manufactured to BS EN 50291.

*The user should be advised that the maintenance ought to include an annual check of the inhibitor concentration (see **8.2.1.1**).*

8.4 Service and maintenance

NOTE 1 It is important that service and maintenance of the boiler and heating system are carried out by a competent person (i.e. a Gas Safe Register-registered operative) in accordance with the appliance manufacturer's recommendations.

Where the manufacturer's instructions require the combustion performance to be checked, the operative shall have access to a calibrated electronic portable combustion gas analyser conforming to BS 7927 or BS EN 50379-3, and shall be competent in its use and the interpretation of any reading obtained.

NOTE 2 This competence can be demonstrated by satisfactory completion of the relevant ACS assessment, which covers the use of these electronic portable combustion gas analysers.

*COMMENTARY ON **8.4***
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 Technical Bulletin 021 [26] (available on the Gas Safe Register website www.gassaferegister.co.uk).

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 Technical Bulletin 008 [15].

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 Technical Bulletin 001 Gas Industry Unsafe Situations Procedure [27].

Annex A (normative) Connection options for condensate and combined pressure relief valve/condensate discharge

A.1 Connection to an internal soil and vent stack system (Figure A.1), i.e. an internal foul water discharge point

The condensate drainage pipe shall incorporate a trap with a minimum condensate seal of 75 mm. Many condensing boilers incorporate a condensate trap within the boiler; 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 boiler 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 the invert 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; and

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.

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 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.

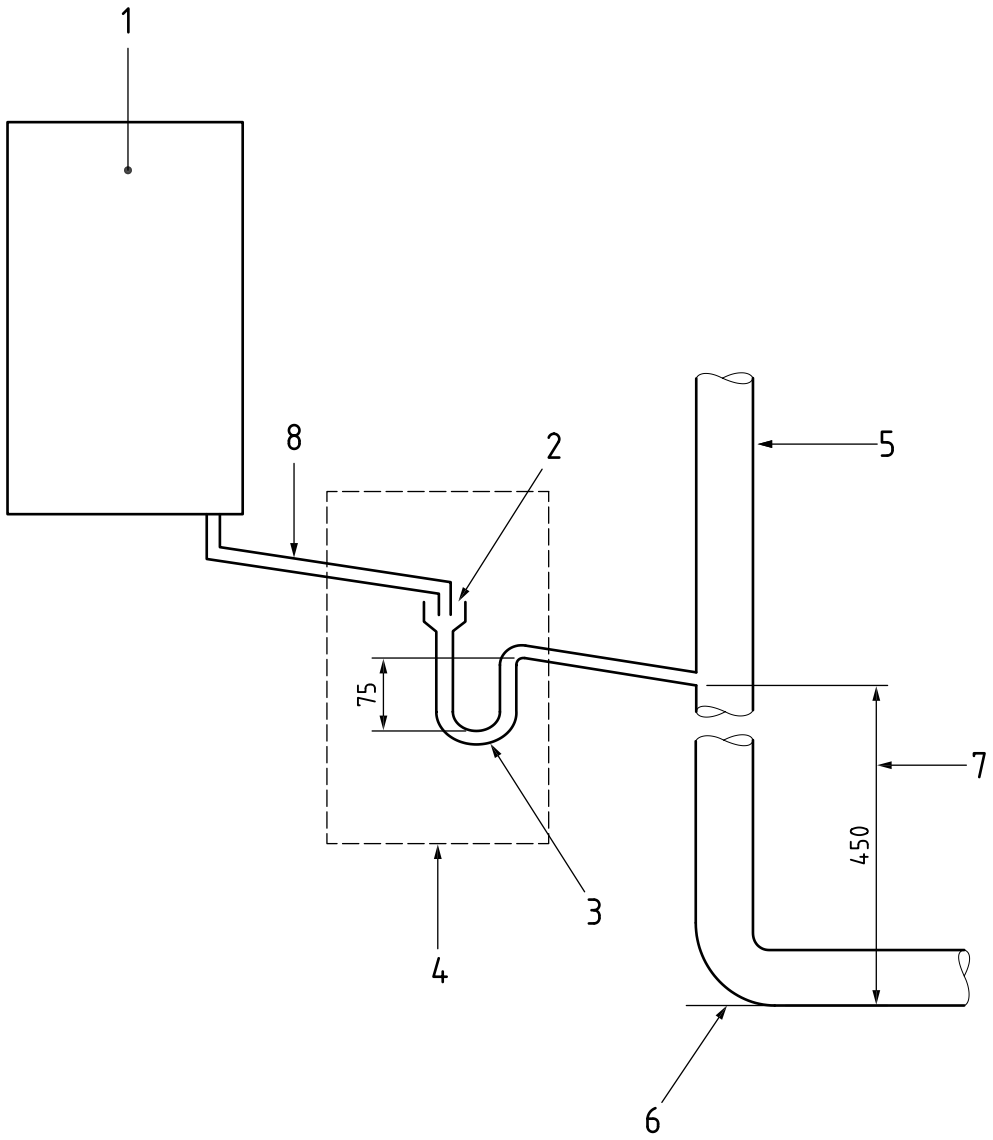
Any parts of the cast iron stack likely to be exposed to the condensate shall either be in a vertical plain, or be of reasonably short length with significant fall to limit the likelihood of concentrations of condensate at any point.

*COMMENTARY ON **A.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 exercised 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.

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

Dimensions in millimetres



Key

1 Boiler
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 boiler
5 Soil and vent stack
6 Invert
7 450 mm minimum up to three storeys
8 Minimum internal diameter 19 mm

A.2 Connection to an external foul water discharge point

A.2.1 General

Where an external foul water discharge point is used the following measures shall be adopted.

a) The pipe shall be run internally within the building as far as possible before going external. Where the discharge pipe is external to the building the pipe diameter shall be increased to a minimum of 30 mm ID before it passes through the wall. Wherever practicable, for condensate discharge pipe operating under gravity, the fall to the horizontal for the 30 mm ID pipe through the wall shall be greater than the 2.5° required for internal 19 mm ID pipe.

b) The external run shall be kept as short as possible, preferably less than 3 m, taking the most direct and most vertical route possible to the discharge point, with no horizontal sections in which the condensate might collect.

c) The use of fittings, elbows, etc., shall be kept to a minimum and any internal burrs on cut pipework shall be removed to ensure that the internal pipe section is as smooth as possible.

d) To minimize wind chill at the open end of the condensate drainage pipe, the end of the pipe shall:

   1) terminate below the grating and above the water level; and

   2) be covered by a drain cover such as those used to prevent blockage by leaves.

e) To improve drainage the end of the pipe shall be cut at 45°.

f) The pipe shall be insulated from the point at which it emerges from the outside of the external wall of the building (ensuring no gaps between insulation and wall) using suitable waterproof and weatherproof insulation, e.g. Class O with a suitable PVC or other UV protective coating.

g) The owner of the appliance shall be advised that this type of installation is more likely to freeze in prolonged periods of extremely cold weather (see **6.3.4**), resulting in boiler shutdown requiring remedial action.

h) Where there are likely to be extremes of temperature or wind chill, the use of proprietary trace heating systems incorporating an external frost thermostat can be considered, ensuring that the installation instructions of the trace heating manufacturer are followed.

*COMMENTARY ON **A.2.1***
Other cold weather protection methods that are endorsed by the specific boiler manufacturer and/or specific service organizations can be adopted if the method adopted is acceptable to the owner of the appliance, e.g. innovations such as preheating condensate before it leaves the thermal envelope of the dwelling, and blowing warm air down the condensate pipe.

Class O insulation is not UV stable and therefore subject to deterioration when exposed to sunlight. PVC coated versions are UV stable and have added mechanical strength.

A.2.2 Connection to an internal waste pipe (Figure A.2)

The connection shall be made to the internal waste pipe from a sink, washing machine, dishwasher, basin, bath or shower, either downstream [Figure A.2a)] or upstream [Figure A2b)] of the waste trap.

NOTE 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 boiler 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 boiler and the additional trap, as shown in Figure A.2a).

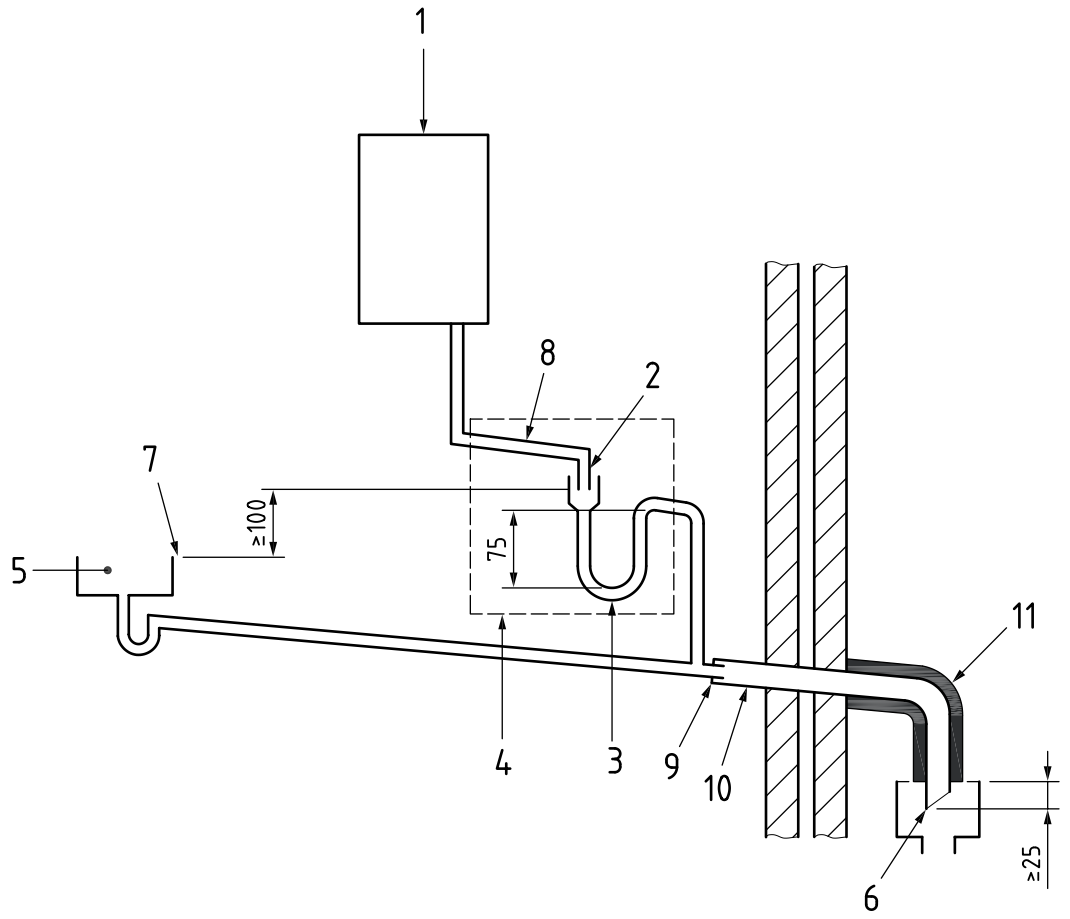
If the connection is upstream of the waste trap, then a visible air break is necessary between the waste trap and the condensate trap, but, in the case of a sink, basin or bath, this is provided by the sink, basin or bath waste pipe itself as long as the sink, basin or bath has an integral overflow, as shown in Figure A.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 ON **A.2.2***
It is preferable to connect to a washing machine drain rather than a kitchen sink as this reduces the likelihood of solid waste and fats blocking or restricting the drainage of condensate.

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

Dimensions in millimetres

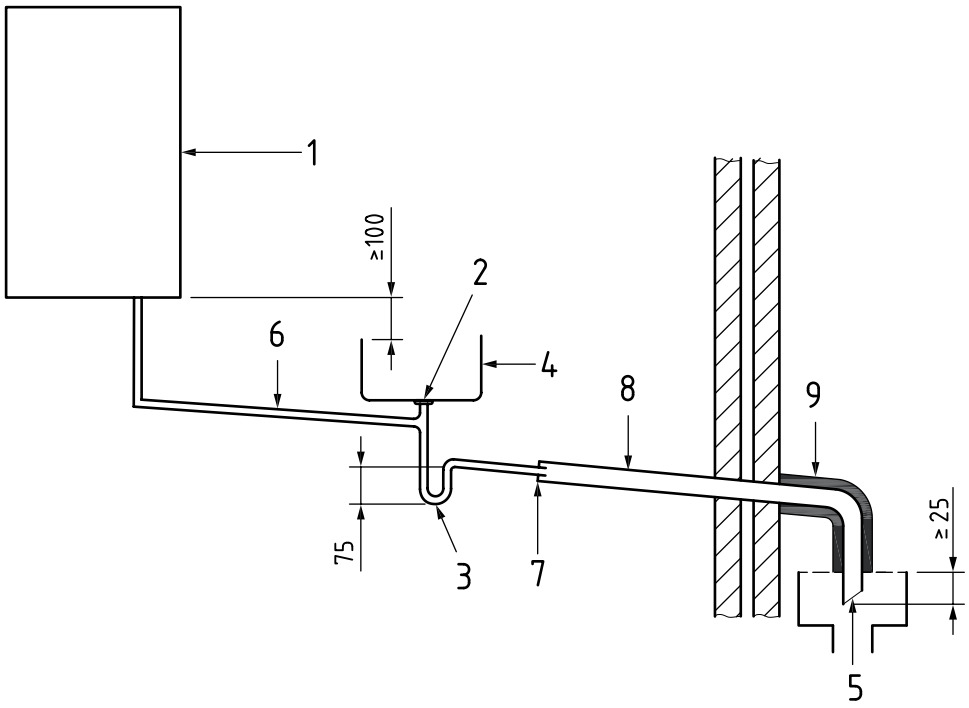


Key

1 Boiler
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 boiler. In this case the 100 mm is measured to the trap in the boiler.
5 Sink, basin, bath or shower
6 Open end of condensate drainage pipe direct into gully 25 mm min. below grating but above water level; end cut at 45°
7 Sink lip
8 Minimum internal diameter 19 mm
9 Pipe size transition
10 Minimum internal diameter 30 mm
11 Insulation

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

Dimensions in millimetres



Key

1 Boiler
2 Visible air break at plughole
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 25 mm min. below grating but above water level; end cut at 45°
6 Minimum internal diameter 19 mm
7 Pipe size transition
8 Minimum internal diameter 30 mm
9 Insulation

A.2.3 Connection to an external soil and vent stack system (Figure A.3)

If the termination is to be to an external soil and vent stack, the connection shall conform to **A.1**, having taken note of and implemented the general requirements for external condensate drainage pipes (see **A.2.1** and Figure A.3).

A.2.4 Connection to an external drain, gully or rainwater hopper (Figure A.4)

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

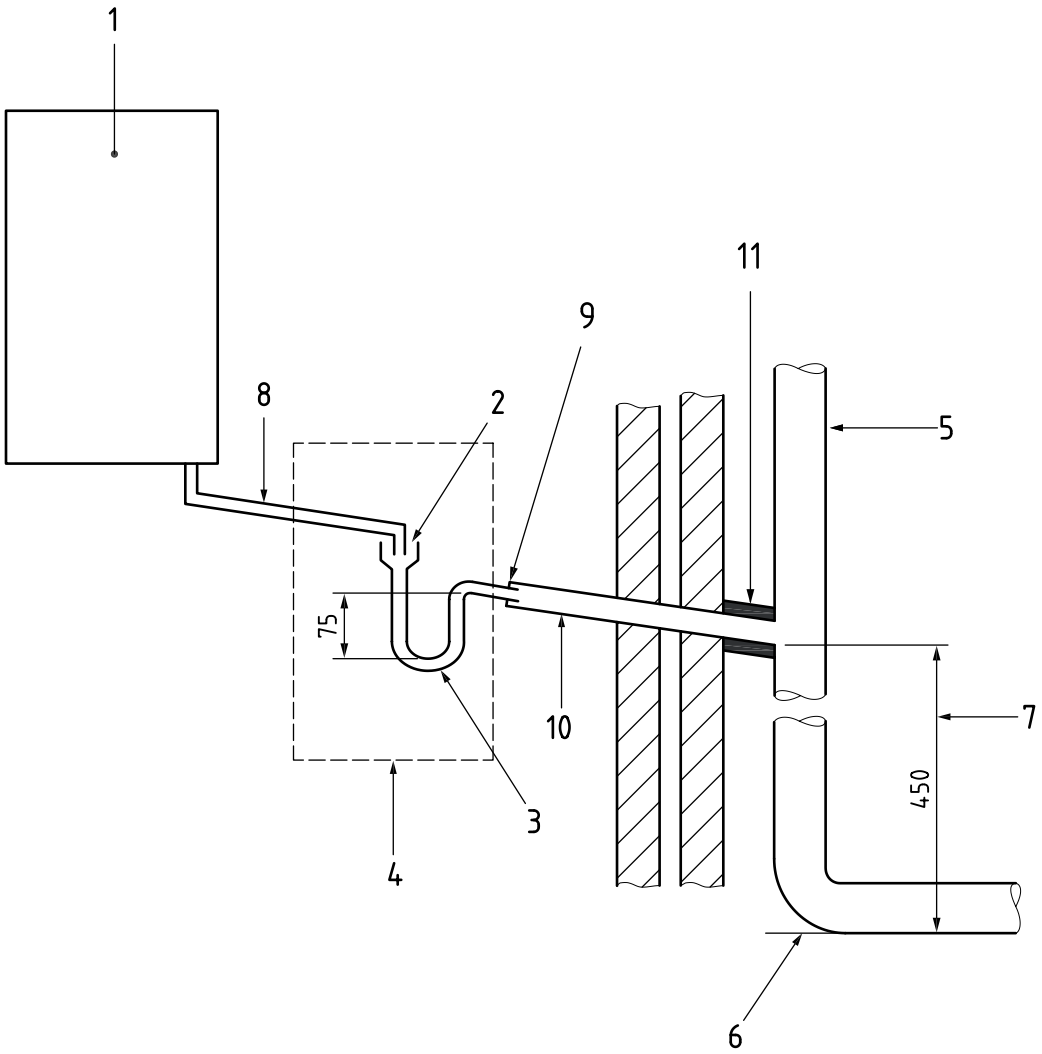
The rainwater hopper shall be part of a combined system [see **6.3.8**d)].

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

NOTE 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) [28].

Figure A.3 **Connection of condensate drainage pipe to external soil and vent stack**

Dimensions in millimetres

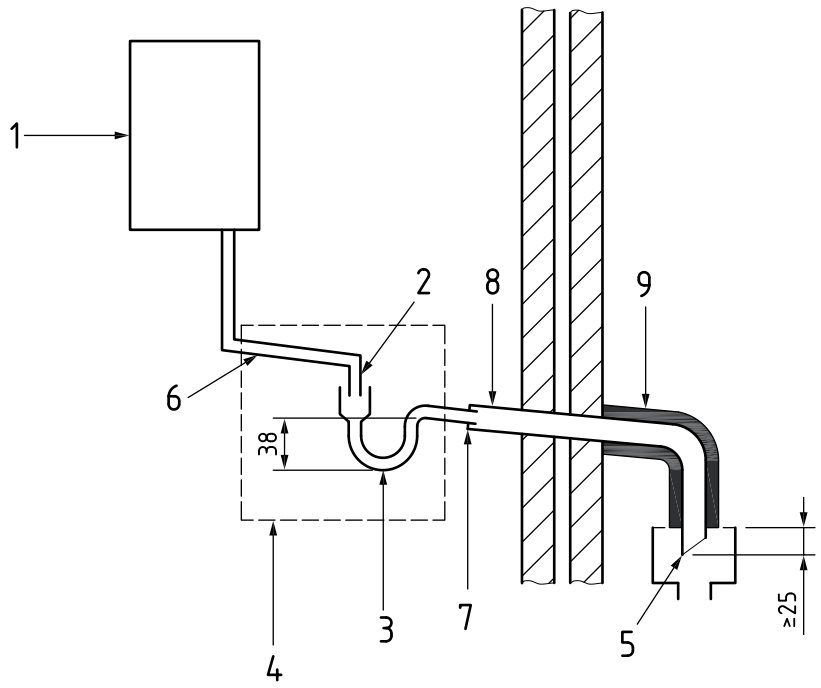


Key

1 Boiler
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 boiler
5 Soil and vent stack
6 Invert
7 450 mm min. up to three storeys
8 Minimum internal diameter 19 mm
9 Pipe size transition point
10 Minimum internal diameter 30 mm
11 Insulation

Figure A.4 **External drain, gully or rainwater hopper**

Dimensions in millimetres



Key

1	Boiler	5	Open end of condensate drainage pipe direct into gully 25 mm min. below grating but above water level; end cut at 45°
2	Visible air break	6	Minimum internal diameter 19 mm
3	38 mm min. trap	7	Pipe size transition point
4	Visible air break and trap not required if there is a trap with a minimum condensate seal of 38 mm incorporated into the boiler	8	Minimum internal diameter 30 mm
		9	Insulation

A.2.5 Special conditions when using a rainwater downpipe (Figure A.5)

A rainwater downpipe shall only be used for condensate discharge if the downpipe passes to a combined foul and rainwater drainage system.

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

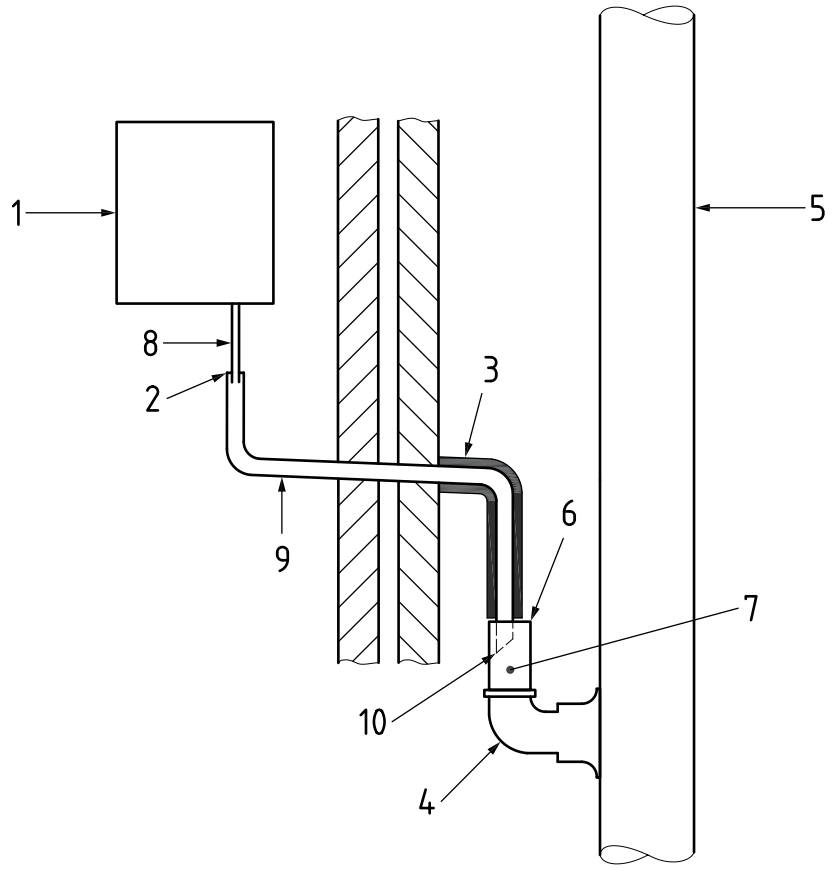
NOTE An "appropriate fitting" is any of the commercially available "soil and rainwater boss connectors".

To avoid reverse flow of rain water into the boiler if the downpipe becomes flooded or frozen, either:

- an air break, as illustrated in Figure A.5, shall be installed outside the building envelope between the condensate drainage pipe and the downpipe; or
- a non-return valve shall be installed in the condensate drainage pipe inside the building envelope.

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

Figure A.5 **External termination to rainwater downpipe**



Key

1	Boiler	6	External air break
2	Pipe size transition point	7	Air gap
3	Insulation	8	Minimum internal diameter 19 mm
4	90° male/female bend	9	Minimum internal diameter 30 mm
5	External rain water pipe into foul water	10	End cut at 45°

A.2.6 Connection to a purpose-made soakaway (Figure A.6)

A purpose-made soakaway shall be sited in a convenient position as close as possible to the boiler, 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 A.6.

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

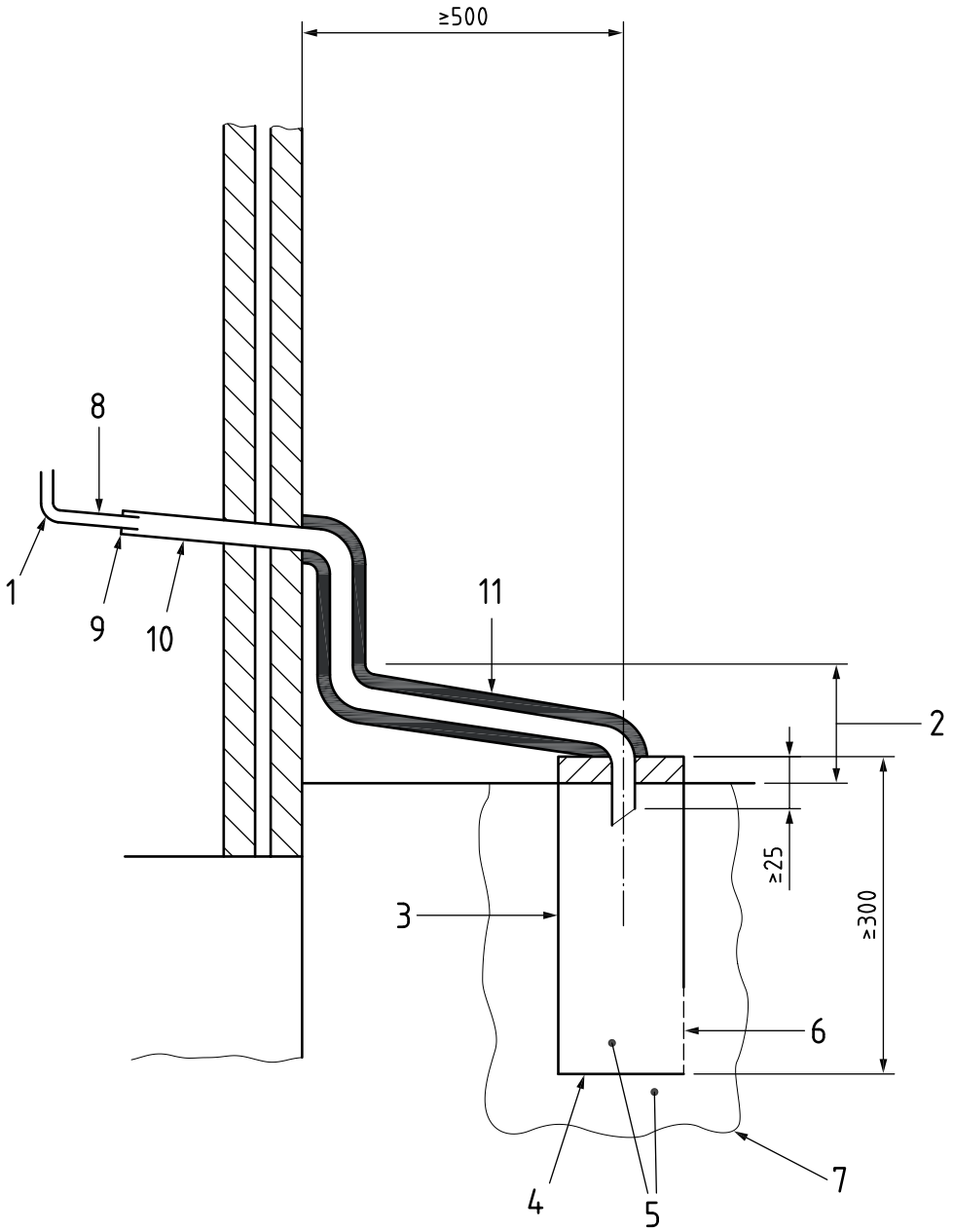
*NOTE 2 For general guidance on external condensate drainage pipes, see **6.3.7.1.4**.*

If an existing soakaway is to be reused, the limestone chippings in and around the soakaway shall be replaced.

*COMMENTARY ON **A.2.6***
Before deciding to use a purpose-made soakaway the history of the locality and the ability of the surrounding area to disperse the condensate should be taken into account, e.g. areas prone to flooding and ground with a high clay content will result in an increased risk of freezing causing the condensate pipe to become blocked with ice and the boiler to shut down.

Figure A.6 **Example of a purpose made soakaway**

Dimensions in millimetres



Key

1 Condensate discharge pipe from boiler
2 Ground (this section of the condensate drainage pipe may be run either above or below ground level); end cut at 45°
3 Diameter 100 mm min. plastic tube
4 Bottom of tube sealed
5 Limestone chippings, both inside and outside the soakaway tube
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 min. by 300 mm diameter
8 Minimum internal diameter 19 mm
9 Pipe size transition point
10 Minimum internal diameter 30 mm
11 Insulation

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