



Code of practice for
Installation of gas hot water supplies for
domestic purposes (2nd family gases)

(Formerly CP 333 : Part 1)

Code de bonne pratique pour l'installation des appareils de production
d'eau chaud utilisant combustibles gazeux pour l'usage domestique
(gaz de famille 2)

Richtlinie für Installation von Wasserheizern für die Warmwasserbereitung
mit gasförmigen Brennstoffen für Häusliche Benutzung (Gase der zweiten Familie)

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This code of practice represents a standard of good practice and takes the form of recommendations. Compliance with it does not confer immunity from relevant legal requirements, regulations, including the Gas Safety Regulations and the Building Regulations of England and Wales, Scotland and those pertaining to London, and bye-laws.

Foreword

This British Standard code of practice is a revision of CP 333 : Part 1 : 1964 and in its preparation the opportunity has been taken to express the values in metric (SI) units in accordance with the British Standards Institution's programme of metrification. Wherever possible, rounded

metric values have been chosen. The imperial equivalents given in brackets have each been rounded off with sufficient accuracy to ensure that the installation will be satisfactory whether designed in metric or imperial units.

British Standard Code of practice for

Installation of gas hot water supplies for domestic purposes (2nd family gases)

Section one. General

1. Scope

1.1 This British Standard makes recommendations for the selection and installation of appliances burning gas* which supply hot water for domestic purposes in individual dwellings and in other premises where a similar service is required.

1.2 This British Standard does not apply to large scale hot water supply systems such as those in multiple dwellings supplied from a central source.

1.3 Attention is drawn to the fact that many of the practices recommended in this code are obligatory under the Gas Safety Regulations, 1972 and, therefore, persons using the code should be fully conversant with these Regulations.

2. References

The titles of the standards publications referred to in this code are listed on the inside back cover.

3. Definitions

For the purposes of this British Standard the following definitions apply.

3.1 air vent. A non-adjustable purpose-made opening or duct that is designed to allow the passage of air at all times.

3.2 ballvalve. A valve operated by a lever arm with a float attached for automatically controlling the flow of water into a cistern, the float riding on the surface of the water.

3.3 central heating boiler.† An appliance designed for heating water either for space heating or for space heating combined with hot water supply.

3.4 circulation pipe.‡ A pipe forming part of the primary or secondary circuit of a hot water system.

3.5 cistern.‡ A fixed container for water in which the water is at atmospheric pressure. The water is usually supplied through a ballvalve.

3.6 cold feed pipe. A pipe that connects a cistern to a heating system.

3.7 combination hot water supply unit. A single compact unit in which a hot water storage vessel is combined with a feed cistern which is mounted either above or alongside it.

3.8 dead leg.‡ A length of hot water pipe leading to a draw-off point and not forming part of a circuit.

3.9 direct cylinder. A closed cylindrical hot water storage vessel in which the stored hot water has been directly heated in a boiler or circulator.

3.10 distributing pipe.‡ Any pipe conveying water from a storage cistern or from a hot water apparatus supplied from a feed cistern, and under pressure from that cistern or apparatus.

3.11 double-feed indirect cylinder. Any indirect cylinder that requires a separate feed cistern to both the primary and the secondary circuit.

3.12 draining tap.‡ A tap fitted to drain off the contents of a water system, pipe or vessel.

3.13 economy valve.§ A valve which enables hot water to be stored in either part or the whole of the storage vessel.

3.14 feed cistern. A cistern that supplies cold water to a hot water system, and that also accommodates the increase in the volume of the water when hot.

3.15 flow pipe.‡ A pipe in a primary hot water circuit in which water moves away from the boiler, or a pipe in a secondary hot water circuit in which water moves away from the hot water storage vessel.

3.16 hot water storage vessel. A vessel for storing hot water under pressure greater than atmospheric pressure.

3.17 indirect cylinder. A closed cylindrical hot water storage vessel in which the stored water is heated by an internal heating element through which hot water is circulated from a boiler or circulator, there being no mixing of the circulated water with the stored water.

3.18 open-flued appliance. An appliance designed to be connected to an open flue system, its combustion air being drawn from the room or space in which it is installed.

3.19 open vent pipe. A pipe connected to an open water system and communicating with the atmosphere at a point above the highest possible water level of the system.

3.20 overflow pipe.‡ A pipe connected to a vessel, sanitary appliance, sewer or chamber to discharge excess water.

3.21 primary circuit.‡ A circuit in which water circulates between a boiler or other water heater and a hot water storage vessel.

* Gas according to BS 1179 (in course of revision) is normally supplied to the public by a utility undertaking in accordance with statutory requirements. The provisions of this code apply to installations supplied with 2nd family gases or mixtures of liquefied petroleum gas (LPG) and air distributed by a gas undertaking. They do not apply to installations using gases of the 3rd family (neat LPG).

† A central heating boiler may be used for supplying hot water only and in this code is referred to simply as a boiler.

‡ The definition of this term is that given in BS 4118 : 1967.

§ The definition of this term is that given in BS 1179 : 1967.

3.22 return pipe.* A pipe in a primary hot water circuit in which water moves back to the boiler, or a pipe in a secondary hot water circuit in which water moves back to the hot water storage vessel.

3.23 room-sealed appliance.† An appliance which, when in operation, has the combustion air inlet and the combustion products outlet isolated from the room in which the appliance is installed.

3.24 secondary circuit.* A circuit in which water circulates in distributing pipes from and back to a hot water storage vessel.

3.25 single-feed indirect cylinder (self-priming cylinder). An indirect cylinder that requires a feed cistern to the secondary circuit only, the feed to the primary circuit taking place through the internal heating element. The formation of an air seal during filling is designed to prevent mixing and accommodate the expansion of primary water.

3.26 stopvalve. A valve fitted in a pipeline for stopping at will the flow of water.

3.27 warning pipe.* An overflow pipe so fixed that its outlet, whether inside or outside a building, is in a conspicuous position where the discharge of any water therefrom can readily be seen.

3.28 water service pipe. Any pipe that supplies water from a main to any premises, and that is subject to water pressure from that main, or would be so subject but for the closing of some stopvalve.

4. Exchange of information

4.1 Collaboration between the designer, the installer, the gas undertaking and the water authority is desirable at the planning stage of every installation and at appropriate stages during the execution of the work.

4.2 Particular consideration should be given to the following aspects of installation:

- (a) suitability of any existing gas supply and meter or installation, where necessary, of a new gas supply and meter (see clause 16);
- (b) suitability of any existing water supply or installation, where necessary, of a new water supply (see clause 15);
- (c) location of appliance(s) (see clause 11);
- (d) design, location and construction of the flue system (see BS 5440 : Part 1);
- (e) provision of air for combustion and ventilation (see section five);
- (f) electrical requirements (see clause 17).

5. Related codes of practice, regulations and bye-laws

5.1 The following British Standard codes of practice are relevant to the recommendations of this code:

BS 5376 Code of practice for selection and installation of gas space heating (1st and 2nd family gases)
Part 2 Boilers of rated input not exceeding 60 kW

BS 5440 Code of practice for flues and air supply for gas appliances of rated input not exceeding 60 kW (1st and 2nd family gases)

Part 1 Flues

Part 2 Air supply

CP 99 Frost precautions for water services

CP 310 Water supply

CP 331 Installation of pipes and meters for town gas

Part 1 Service pipes

Part 2 Low pressure metering

Part 3 Low pressure installation pipes

CP 342 Centralized hot water supply

Part 1 Individual dwellings

5.2 If the water supply is from the mains of a water authority, the installation should comply with the bye-laws of that authority.

5.3 The installation should comply with the relevant Building Regulations and also be in accordance with the Institution of Electrical Engineers' 'Regulations for the Electrical Equipment of Buildings'.

Section two. Materials, components and appliances

6. Materials, components and appliances

All materials, components and appliances used should comply with the requirements of the appropriate British Standards. Where no appropriate British Standard exists, the manufacturer's guarantee of suitability should be obtained and the materials, components and appliances should be acceptable to the gas undertaking.

Section three. Selection of system

7. General

7.1 Gas water heaters are available in a variety of types and sizes sufficient to allow the design of systems suitable for normal domestic requirements. The choice of system will be determined ultimately by consideration of the probable pattern of usage and the economic circumstances of the user. The final selection should not be made without careful consideration of location, flueing and room ventilation requirements (see clauses 11 and 12, and section five). The water bye-laws of the local water authority may also influence the choice.

Boilers, and those instantaneous water heaters that require a flue, should preferably be of the room-sealed type.

7.2 There are two basic types of water heating system, instantaneous and storage. Clauses 8 and 9 give brief descriptions of each system and of the salient features of the water heaters appropriate to them.

7.3 The water heater selected should comply with the requirements of BS 5258 : Parts 1 and 7, BS 5386 : Part 1 and BS 1250 : Parts 1 and 3 where relevant, and should be suitable for use with the gas that is to be supplied.

8. Instantaneous systems

8.1 General. In these types of system cold water is heated as it passes through the appliance directly to the draw-off point, and the flow of hot water can continue for as long as is required. The outlet temperature at any particular rate of

*The definition of this term is that given in BS 4118 : 1967.

†The definition of this term is that given in BS 1179 : 1967.

flow depends upon the heat input and the inlet water temperature.

The types of appliance used in these systems are known as instantaneous water heaters, some models of which incorporate a water pressure governor or a thermostat to provide automatic control of water flow rate and/or outlet temperature.

The rated heat input largely determines the usage of these appliances, of which there are two categories, small water heaters and large water heaters.

8.2 Small water heater. This is intended primarily for flueless operation to supply hot water in small quantities for use at a sink or wash basin. Delivery may be by a swivel spout, but most models incorporate a connection from which an additional delivery point can be supplied by direct connection to a draw-off tap.

Some models can be used for supplying hot water to showers (see clause 23), and for this and other purposes for which the appliance is to be continuously operated for more than 5 min, the appliance should be flued.

The heat input rate to a sink heater is up to 12 kW (41 000 Btu/h) which provides an approximate hot water flow rate of 2.3 litres/min (0.5 gal/min) raised by 55 °C (100 °F).

8.3 Large water heater. This is a flued appliance available in a range of sizes designed to supply either bathroom requirements only or a comprehensive service to a number of points including a bath (see 11.2). Delivery of hot water can be by swivel spout or by direct connection to a draw-off tap or taps.

The range of heat inputs available is from approximately 22 kW (75 000 Btu/h) to 35 kW (120 000 Btu/h), providing hot water flow rates of approximately 4.5 litres/min (1 gal/min) to 7 litres/min (1.5 gal/min) raised by 55 °C (100 °F).

8.4 Installation. Particular features of the installation of instantaneous water heating systems are given in clause 18. A typical cistern-fed large instantaneous water heater installation is shown in figure 1.

9. Storage systems

9.1 General. In this type of system, water is heated and then stored in an insulated vessel until required.

The temperature of the stored water is controlled by a thermostat which is fitted to the storage vessel or to the water heater. The whole of the stored volume of hot water can be drawn off at a relatively constant temperature regardless of the rate of flow, which is limited only by the resistance of the pipework and the available head of water.

The insulated vessel may be integral with the water heater or connected to it by flow and return pipes; the latter case is known as a circulating system. Such a system incorporates a circulator or boiler from which heated water either rises naturally or is pumped to the upper portion of an independent hot water storage vessel. Cooler water returns from the lower portion of the vessel to the circulator or boiler for reheating. There are two types of circulating system.

(a) *Direct system.* A system in which the hot water supplied from the storage vessel to the draw-off taps has been heated directly in a boiler or circulator.

(b) *Indirect system.* A system in which the hot water supplied to the draw-off taps has been heated and stored

in an indirect cylinder and has not passed through the circulator or boiler.

The appliances used in these systems are storage water heaters, circulators and boilers and are described in 9.2 to 9.4.

9.2 Storage water heaters

9.2.1 Small capacity storage water heater. This is a flueless appliance, with an integral hot water storage vessel of small capacity, supplying hot water to a sink or wash basin. Water flow is controlled at the inlet to the appliance and delivered through a swivel spout or fixed open draw-off pipe.

Typical heaters of this type have storage capacities up to 10 litres (2.2 gal) and heat the stored water to 65 °C (150 °F) in approximately 20 min.

9.2.2 Large capacity storage water heater. This is a flued appliance with an integral hot water storage vessel of large capacity, supplying hot water to one or more draw-off taps, one of which may serve a bath. The appliance requires a feed cistern which may be integral with it.

Typical heaters of this type have storage capacities ranging from 45 litres to 120 litres (10 gal to 25 gal) and heat the stored water to 65 °C (150 °F) in approximately 1 h.

9.3 Circulator. This is a low-rated flued appliance that is designed for connection by flow and return pipes to an independent hot water storage vessel in a circulating system (see clause 20). The rated heat input will not normally exceed 4.5 kW (15 300 Btu/h) but, where rapid recovery is required, more than one circulator may be connected to a direct storage vessel.

Some types of circulator are designed for installation in a fireplace opening in combination with any one of the range of gas fires specified by the manufacturer. A number of models of circulator are designed as integral components of the combined ducted-air/water heater type of appliance.

9.4 Boiler. This is a high-rated flued appliance, which is used in a circulating system. The rated heat input will not normally be less than 8 kW (27 000 Btu/h), and it is therefore capable of providing a hot water service with a rapid recovery rate. This type of appliance is frequently used to provide a combined space heating and domestic hot water service.

9.5 Installation. Particular features of the installation of storage water heating systems are given in clause 19 and typical installations are shown in figures 2, 3 and 4.

Section four. Planning the installation

10. General

10.1 The manufacturer's instructions should be followed. Where the water heater is combined with a gas appliance of another type, reference should also be made to the appropriate installation code for the other appliance.

10.2 Special consideration should be given to the following matters:

- (a) location;
- (b) flueing;
- (c) air supply;
- (d) access for servicing;
- (e) water supply;
- (f) gas supply;
- (g) electricity supply



11. Location

11.1 General

11.1.1 Room-sealed water heaters are permissible in any room or internal space, provided that the terminal can be located as recommended in BS 5440 : Part 1.

11.1.2 Open-flued or flueless types should only be installed where specifically allowed by the following subclauses (see **11.3**, **11.4**, **11.9** and **11.10**). Large open-flued instantaneous water heaters are considered unsuitable for installation in individual dwellings, e.g. houses, flats, hotel rooms, etc.

11.1.3 Specific requirements for the provision of combustion air and room or compartment ventilation for all types of water heater are detailed in BS 5440 : Part 2 (see section five).

11.1.4 Any room or internal space, the use of which is covered by more than one of the subclauses **11.2** to **11.10**, should be treated according to the most stringent requirements of the relevant subclauses; e.g. a kitchen containing a bath should be treated as a bathroom.

11.1.5 Correct operation may depend upon minimum clearances being maintained around the appliance, and manufacturer's instructions in this respect should be carefully followed.

11.2 Bathrooms

11.2.1 Under no circumstances should an open-flued or flueless water heater be installed in a room containing a bath or shower. Only room-sealed water heaters should be installed in such locations.

11.2.2 Where a room-sealed water heater is located in a room containing a fixed bath or a shower, compliance with the Institution of Electrical Engineers' 'Regulations for the electrical equipment of buildings' requires that any electrical switch, means of control or adjustment utilizing mains electricity should be so situated that it cannot be touched by a person using the bath or shower.

11.3 Bedrooms and bed-sitting rooms. In bedrooms and bed-sitting rooms, water heaters of the room-sealed type should be used but the following alternatives are acceptable where the room volume exceeds 21 m^3 (740 ft^3).

(a) A flueless small instantaneous water heater with heat input not exceeding 12 kW ($41\,000 \text{ Btu/h}$), serving a wash basin or sink only in the room in which it is fitted, provided that it will not be in use for periods in excess of 5 min.

(b) A flueless small storage heater with a storage capacity not exceeding 9 litres (2 gal) and a heat input not exceeding 3 kW ($10\,000 \text{ Btu/h}$) serving a wash basin or sink only.

(c) An open-flued circulator with a heat input not exceeding 4.5 kW ($15\,300 \text{ Btu/h}$), the flue being in accordance with the recommendations of BS 5440 : Part 1.

When planning a bedroom or bed-sitting room installation, consideration should be given to factors affecting amenity, such as noise of operation.

11.4 Kitchens, halls and passageways. All types of water heater are permissible in kitchens, halls and passageways provided that the flueing and air supply requirements of BS 5440 are implemented, but see **11.1.2**. Where a kitchen includes a bath, the recommendations for bathrooms should be observed (see **11.1.4**).

11.5 Cloakrooms and water closets. All types of water heater are permissible in cloakrooms and water closets provided that the flueing and air supply requirements of BS 5440 are implemented, but see **11.1.2**. Flueless water heaters should not be installed where the volume of the room is 6 m^3 (210 ft^3) or less. Any air vent in a water closet or cloakroom should communicate direct with outside air.

11.6 Basement rooms. The types of water heater that may be installed in basement rooms depend upon the usage for which the room is intended and the recommendations of appropriate clauses in this respect should be implemented.

11.7 Living rooms

11.7.1 When a living room installation is planned, careful consideration should be given to factors affecting amenity, such as noise of operation, condensation, appearance and the need for servicing.

11.7.2 Boilers and circulators designed for installation in fireplaces are preferable; however, a water heater of any type may be fitted provided that the room is ventilated where necessary, see section five, but see also **11.1.2**.

11.8 Compartments and cupboards

11.8.1 A compartment is an enclosed space within a building, either constructed or modified specifically to accommodate a water heater and its ancillary equipment. A water heater should not be installed in a cupboard unless the cupboard is in accordance with the recommendations for a compartment given in **11.8.2**.

11.8.2 The recommendations for a water heater compartment are as follows.

(a) It should be a fixed rigid structure, the internal surfaces of which are in accordance with the recommendations of (e) below.

(b) It should incorporate air vents for the provision of air for ventilation and, where necessary, for combustion as recommended in BS 5440 : Part 2.

(c) It should be of sufficient size to permit access for inspection and servicing of the water heater and any associated hot water storage vessel and ancillary equipment. The compartment should be no larger than is necessary consistent with the above, and in order to discourage its use as a storage cupboard a label should be provided to warn the consumer against such use.

(d) It should be fitted with a door of sufficient size to permit withdrawal of the appliance and any associated equipment installed in the compartment.

(e) Any provision required for the protection of the floor or wall on which the water heater is to be mounted will be detailed in the appliance installation instructions. Any other internal surface of the compartment that is of combustible material, such as wood or hardboard, should be at least 75 mm (3 in) from any part of the water heater, consistent with the recommendations in (c) above. Alternatively, it should be lined with non-combustible material or treated with a fire-retardant paint acceptable to the local gas undertaking. Methods for determining whether a material may be described as combustible or non-combustible are detailed in BS 476.

11.8.3 A water heater installed in a compartment should be flued. An instantaneous water heater should not be installed in a compartment unless it is of the room-sealed type.

11.8.4 Where no practicable alternative location is available a water heater may be installed in an under-stairs cupboard provided that the water heater is in a compartment that complies with the recommendations in 11.8.2, and that all internal surfaces including the base are non-combustible or lined with non-combustible material. Wherever possible a room-sealed water heater should be used in preference to an open-flued type but, with either type, the compartment air vents (see 11.8.2(b)), should be direct to outside air.

11.9 Cylinder/airing cupboards

11.9.1 A circulator with an input rating up to 4.5 kW (15 300 Btu/h) may be fitted to a hot water storage cylinder in a cylinder/airing cupboard (see figure 5) provided that the circulator compartment and the airing compartment are separated by a 13 mm ($\frac{1}{2}$ in) mesh metal guard, fitted above the heater to prevent any articles of combustible material, particularly stored linen, from falling into the circulator compartment.

Where the circulator is of the open-flued type the draught diverter should be in the circulator compartment. The flue pipe should not pass through the airing compartment unless protected by a guard, such as wire mesh, that prevents stored linen being placed within 25 mm (1 in) of the flue pipe.

11.9.2 Cylinder insulation should be in accordance with the recommendations in 22.10.

11.9.3 The circulator compartment should never be used for storage, drying or airing, and a label should be provided warning the consumer to this effect.

11.9.4 The cylinder/airing cupboard should be provided with air vents in accordance with the recommendations of BS 5440 : Part 2 for a compartment ventilated to an internal space.

11.10 Roof spaces

11.10.1 Where no practicable alternative location exists and where local regulations permit, an open-flued (but see 11.1.2) or room-sealed water heater may be installed in a ventilated roof space provided that products of combustion are flued direct to outside air, and that effective provisions against frost damage can be provided.

11.10.2 Under no circumstances should a flueless water heater be installed in a roof space.

11.10.3 When planning a roof space installation it is essential that:

- (a) flooring of sufficient strength and area to facilitate usage and servicing should be provided;
- (b) for floor standing models, the flooring should be protected by an insulating base and be of sufficient strength to support the appliance.

12. Flueing

Detailed information on the design of flue systems, and the location of terminals is given in BS 5440 : Part 1.

The following water heaters should always be flued:

- (a) large instantaneous;
- (b) large storage;
- (c) circulator;
- (d) boiler;
- (e) small instantaneous used for special purposes (see 8.2).

13. Air supply

See section five.

14. Access for servicing

Adequate provision should be made on installation for access to all components that require servicing, adjustment, or exchange. Any relevant instructions given by the manufacturer should be followed.

15. Water supply

15.1 General. Where a hot water system is supplied with water from the mains of a water authority it is essential that its design and installation is strictly in accordance with the bye-laws of that authority.

It is permissible to supply any type of water heater from a cistern (see 15.3) but direct connection to a water service pipe is only permissible under the conditions specified in clause 15.2.

15.2 Supply from a water service pipe. Water bye-laws permit a direct connection from a water service pipe to water heaters of the following types only:

- (a) instantaneous water heaters;
- (b) storage water heaters, of not more than 3 gal (13.5 litre*) capacity;
- (c) storage heaters, of not more than 15 gal (68 litre*) capacity, that are fitted with a device to prevent back-siphonage or to limit the water siphoned back to not more than 20 % of the capacity of the heater;

and then only provided that:

- (d) the working pressure to which the heater is subjected is no greater than that for which it is designed; and
- (e) the water is discharged from the heater into the air at a level not less than 13 mm ($\frac{1}{2}$ in) above the lowest part of the top edge of the bath, sink, wash basin or similar appliance supplied therefrom.

Alternatively, these water heaters may be supplied from a cistern. All other heaters not described above should be supplied with cold water from a cistern (see 15.3).

15.3 Supply from a cistern. Model Water Bye-laws require that any pipe which delivers water from a cistern to a hot water storage vessel or to any water heater other than an instantaneous type should deliver water to that appliance only. This means that:

- (a) every storage water heater should be supplied by a separate feed pipe, but that
- (b) there is no limitation on the number of instantaneous water heaters and draw-off taps that may be fed from a distributing pipe.

A cold water storage cistern that supplies water to draw-off taps may also be used as a feed cistern to supply water to a direct hot water storage system or the secondary side only of an indirect hot water storage system, provided that the water capacity of the cistern is not less than that prescribed by the water authority. Where two cisterns are used to provide the necessary capacity they should be interconnected so as to function as one cistern. A suitable cover should be provided on the cistern(s), but should not be airtight.

A feed cistern supplying water to the primary circuit of an

*Model Water Bye-laws have not yet been published in metric units and therefore these metric values should be regarded as approximate.