

Specification for

Safety of household and similar electrical appliances —

Part 102: Particular requirements —

Section 102.21 Storage water heaters

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- Association of Manufacturers of Domestic Electrical Appliances
- British Cable Makers' Confederation
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- Rotating Electrical Machines Association (BEAMA Ltd)
- Royal Society for the Prevention of Accidents
- Small Electrical Appliances Marketing Association
- South of Scotland Electricity Board

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- BEAMA Ltd
- Water Authorities Association

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Foreword

This Section of BS 3456-102 has been prepared under the direction of the Light Electrical Engineering Standards Committee. It is based on IEC¹⁾ 335-2-21 (1979-Second edition). Its number is directly related to the number of the equivalent Section of the IEC publication.

It gives the particular requirements for storage water heaters and is to be read in conjunction with BS 3456-101:1987 “*General requirements*” which it supplements or modifies. The many references to Part 1 should be read as references to BS 3456-101 which is the implementation of the CENELEC²⁾ Harmonization Document for the general requirements, HD 251 S3. In the original IEC text of the particular requirements the precise line numbers in the IEC Part 1 are given. The lines in Part 101 of BS 3456 are not numbered but sufficient information has been included in these particular requirements for the relevant matter in Part 101 to be identified. For ease of production the text of the IEC standard has been used, but it has been modified to take account of the following.

- a) The differences between BS 3456-101:1987 and IEC 335-1:1976 (including Amendments Nos. 1 and 2) that have resulted from the implementation of HD 251 S3.
- b) The United Kingdom Water Byelaws (see **3.201**).
- c) The Building Regulations statutory requirement G3 for England and Wales³⁾⁴⁾.
- d) The United Kingdom practice of using pressure reducing valves.
- e) A new sub-clause (**22.109**) specified in Amendment No. 1 (1984) to IEC 335-2-21.

Sub-clauses and figures numbered 101, 102 etc. are based on additional sub-clauses and figures introduced by IEC 335-2-21. Where textual changes have been made to take account of special United Kingdom requirements [for example items b) to d) above], these are indicated by a vertical side line in the margin. Where these textual changes have resulted in new sub-clauses or figures being introduced, these are numbered 201, 202, etc.

The appendices references A, B and C are as in BS 3456-101, not as in IEC 335-1. This standard is a revision of BS 3456-2.7:1970 and BS 843:1976 which will be withdrawn at a date to be decided by the Technical Committee. The principal change is the introduction of requirements for closed water heaters.

In this British Standard the following print types are used to differentiate between requirements, test specifications and explanatory matter.

- Requirements: in roman type.
- *Test specifications: in italic type.*
- Explanatory matter: in small roman type.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 24, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

¹⁾ IEC = International Electrotechnical Commission.

²⁾ CENELEC = European Committee for Electrotechnical Standardization.

³⁾ The term “unvented hot water storage system” used by the Approved Document attached to Building Regulations statutory requirement G3 is replaced in this standard by the term “closed water heater” in order to align with the terminology used in IEC 335-2-21.

⁴⁾ It is anticipated that the Northern Ireland Building Regulations and the Building Standards (Scotland) will contain, in due course, statutory requirements similar to that of G3 for England and Wales.

1 Scope

This clause of Part 1 is applicable except as follows:

1.1 Replacement:

This standard applies to stationary non-instantaneous storage water heaters intended for heating water to a temperature below 100 °C.

Water heaters may be thermally insulated for long-term storage, or uninsulated for temporary storage, of hot water.

Water heaters not intended for normal household use, but which nevertheless may be a source of danger to the public, such as water heaters intended to be used in shops, in light industry and on farms, are within the scope of this standard.

This standard does not take into account the special hazards which exist in nurseries and other places where there are young children or aged or infirm persons without supervision; in such cases, additional requirements may be necessary.

This standard does not apply to:

- water heaters designed exclusively for industrial purposes;
- water heaters intended to be used in locations where special conditions prevail, such as the presence of a corrosive or explosive atmosphere (dust, vapour or gas);
- instantaneous water heaters, which are covered by BS 3456-3.9.

For water heaters intended to be used in vehicles or on board ships or aircraft, additional requirements may be necessary.

For water heaters to be used in tropical countries, special requirements may be necessary.

2 Definitions

This clause of Part 1 is applicable except as follows:

2.2.29 Replacement:

Conditions of adequate heat discharge denote that the water heater is operated when installed as in normal use and filled with initially cold water.

Additional definitions:

2.2.101 Storage water heater denotes a stationary appliance for heating water in a container intended for long-term or temporary storage of the heated water and provided with a device or devices to control and/or limit the water temperature.

2.2.102 Closed (unvented) water heater denotes a storage water heater without a vent pipe to the atmosphere designed to be fed from the water supply mains either directly or through an inlet pressure reducing valve or from a cistern or via a pump, the flow of hot water being controlled by one or more valves in the outlet system.

Closed water heaters are shown schematically in Figure 101-I(a) and Figure 101-I(b).

Typical closed water heater systems including controls are shown schematically in Figure 201(a) and Figure 201(b)

2.2.103 Cistern-fed water heater denotes a storage water heater intended to be fed from a separate cistern and provided with a vent open to the atmosphere and so arranged that the expanded water can return to the feed cistern, the draw-off of hot water being controlled by one or more valves in the outlet system.

Cistern-fed water heaters are shown schematically in Figure 101-II.

2.2.104 Cistern-type water heater denotes a cistern-fed water heater in which the feed cistern is an integral part of the appliance.

Cistern-type heaters are shown schematically in Figure 101-III.

2.2.105 Open-outlet water heater denotes a storage water heater in which the flow of water is controlled by a valve in the inlet pipe and in which the expanded water overflows through the outlet pipe.

Open-outlet water heaters are shown schematically in Figure 101-IV.

2.2.106 Vented water heater denotes a storage water heater open to the atmosphere, so that under no condition of use can the pressure at the surface of the water be other than atmospheric.

Vented water heaters are shown schematically in Figure 101-V.

2.2.107 Rated pressure denotes the water pressure assigned to the water heater by the maker.

For closed water heaters not fitted with a pressure reducing valve and cistern-fed water heaters, the rated pressure is the maximum nominal pressure of the water system to which the appliance may be connected.

For closed water heaters fitted with a pressure reducing valve, the rated pressure is the output water pressure of the valve.

3 General requirements

This clause of Part 1 is applicable except as follows:

Additional sub-clause:

3.201 Water heaters shall meet the constructional and water requirements specified in Appendix D.

The requirements of Appendix D are based on the tests carried out under the United Kingdom Water Fittings Byelaw Scheme to ensure water heaters comply with the Water Byelaws.

Attention is drawn to the fact that some of the requirements in Appendix D are more stringent than those in the main body of the standard.

4 General conditions for the tests

This clause of Part 1 is applicable except as follows:

4.2 *Addition:*

The test of Sub-clause 22.101 may be made on separate containers or heat exchangers.

4.3 *Replacement:*

The tests are carried out in the order of the clauses of Part 1, except that the tests of Sub-clauses 24.104 and 24.201 are made before the tests of Clause 19 as are the tests of Sub-clauses 22.101 and 22.104, unless these are made on separate containers or heat exchangers not likely to be affected by the tests of Clause 19.

4.4 *Addition:*

Water heaters designed for operation in more than one mounting position are tested in the most unfavourable position indicated in the instructions for installation.

4.5 *Addition:*

Where it is specified that the water heater is to be supplied with cold water, the water is taken directly from the supply mains.

4.6 Paragraph 7 up to NOTE 1 is not applicable.

4.8 and **4.13** Not applicable.

5 Rating

This clause of Part 1 is applicable except as follows:

Additional Sub-clause:

5.101 For closed water heaters not fitted with a pressure reducing valve, the minimum rated pressure is 0.6 MPa = 6 bar = 60 N/cm².

For closed water heaters fitted with a pressure reducing valve, the rated pressure is the output water pressure of the valve.

For other water heaters, the rated pressure is:

- 0.2 MPa = 2 bar = 20 N/cm² for cistern-fed water heaters;
- 0 Pa = 0 bar = 0 N/cm² for cistern-type water heaters, open-outlet water heaters and vented water heaters.

Compliance is checked by inspection of the marking.

Although the value of the rated pressure of open-outlet water heaters and vented water heaters is zero, these water heaters are, for safety reasons, subjected to the test of Sub-clause 22.101.

6 Classification

This clause of Part 1 is applicable except as follows:

Additional Sub-clauses:

6.101 Water heaters are classified according to operating conditions:

- closed water heaters;
- cistern-fed water heaters;
- cistern-type water heaters;

- open-outlet water heaters;
- vented water heaters.

Water heaters may have parts with different classifications according to operating conditions.

6.201 Water heaters, other than those for building-in, shall be drip-proof.

7 Marking

This clause of Part 1 is applicable except as follows:

7.1 Item e) and the paragraph after item j) are not applicable.

Addition:

Water heaters shall be marked with rated pressure in bars⁵⁾.

Vented water heaters and open-outlet water heaters shall be marked 0 bar.

7.2 Not applicable.

7.8 Paragraph 1.

Replacement:

Water heaters to be connected to more than two supply conductors shall be provided with a connection diagram fixed to the appliance, unless the correct mode of connection is obvious.

For water heaters for multiple supply, the terminals or leads for each circuit shall be clearly identified by a marking adjacent to the terminals or leads, unless the water heater is provided with a suitable wiring diagram.

Addition

A water heater for multiple supply is, for example, a water heater in which one or more heating elements are intended to be connected through a clock-operated switch or a demand meter.

7.12 *Addition:*

Open-outlet water heaters shall be accompanied by an instruction sheet stating that the outlet acts as a vent and must not be connected to any form of tap or fitting not recommended by the manufacturer.

Closed water heaters shall be accompanied by an instruction sheet giving the following information.

- a) The markings as required by Sub-clause 7.1.
- b) The manufacturer's or responsible vendor's address.
- c) The serial number or month and year of manufacture unless this is marked on the water heater.
- d) A note to the installer stating the maximum water supply pressure to which the heater should be connected.
- e) The output water pressure of the pressure reducing valve (where applicable).
- f) The set temperature and pressure of the combined temperature and pressure relief valve or the set temperature of the temperature relief valve.
- g) The expansion valve pressure setting.
- h) A note to the installer to leave the instruction sheet with the householder after installation and to advise the householder to retain the instruction sheet for future use.
- i) A warning notice to the householder of what action to take if water issues from the discharge warning pipe.
- j) An instruction to the householder in bold print to retain the instruction sheet for future use.
- k) The storage capacity (in litres).
- l) The weight of the water heater, when full (in kg).
- m) For water heaters having a capacity in excess of 15 L, the floor or wall strength requirements of the intended locations of the water heater.
- n) The method of handling and storing the water heater prior to installation.
- o) The method of connection of the water and electrical supplies, in particular stating that relief valve connections should not be used for any other purpose.

⁵⁾ 1 MPa = 10 bar = 100 N/cm².

p) A note to the installer giving discharge warning pipe installation details, including the following:

- the type of metal to be used for the discharge pipe;
- the size of the discharge pipe;

This should not be less than the outlet size of the relief valve.

- the discharge is to be via an air break adjacent to the water heater;
- the discharge pipe is to be laid in a continuous downward slope with a maximum resistance to flow equivalent to 9 m straight length of pipe unless the internal diameter is suitably increased;
- the discharge from the pipe is to be visible but in a safe place;

A gully, where there is no risk of contact with hot water by persons using the building, is considered to be a safe place.

q) Immersion heater, thermostat and non-self-resetting thermal cut-out details.

r) Filling the system.

s) Method of commissioning the system, including the following:

- check that all the necessary components are supplied and for those not factory fitted, that they are the type recommended by the manufacturer for the particular water heater;
- check that the water heater/components are undamaged;
- manually check the operation of the temperature or combined temperature/pressure relief valve;
- check that the discharge pipe is plumbed so that it falls continuously and that no taps or valves or other shut off devices are installed in the pipe;
- check that the discharge pipe incorporates an airbreak and that it drains safely to waste and is readily visible;
- check in the case where some components are not factory fitted, that they are marked so as to refer to the warning label on the water heater.

t) Thermal insulation of the cylinder (if not factory applied).

u) What action to take if the water heater malfunctions.

v) How to drain the water heater.

w) Advice on restricting water temperatures in hard water areas.

x) The charge pressure of the expansion vessel.

Items a) to j) inclusive shall appear on the first page of the instruction sheet.

Any instructions which cannot be amply explained in words should be supplemented by drawings and/or photographs.

Additional Sub-clauses

7.101 The water inlet and the water outlet shall be clearly indicated. These indications shall not be placed on detachable parts.

If colours are used for this purpose, the colour blue shall be used to indicate the cold water inlet and the colour red to indicate the hot water outlet.

The water inlet and the water outlet may, for example, be indicated by means of arrows showing the direction of the water flow.

7.102 The operating temperature of thermal cut-outs incorporating replaceable parts shall be marked. This marking shall be visible after the cut-out has been installed, if necessary after removal of the cover giving access to the electrical components, but without removing any separate thermal insulation.

7.201 Closed water heaters shall have a label firmly attached to the water heater and visible after installation stating the following:

WARNING TO USER.

- a) DO NOT REMOVE OR ADJUST ANY COMPONENT PART OF THIS UNVENTED WATER HEATER; CONTACT THE SERVICE ENGINEER.
- b) IF THIS UNVENTED WATER HEATER DEVELOPS A FAULT, SUCH AS A FLOW OF HOT WATER FROM THE DISCHARGE PIPE, SWITCH THE HEATER OFF AND CONTACT THE SERVICE ENGINEER.

WARNING TO SERVICE ENGINEER.

USE ONLY MANUFACTURER'S RECOMMENDED REPLACEMENT PARTS.

Components of closed water heaters not factory fitted shall carry a durable label stating:

“SEE WARNING LABEL ON WATER HEATER”.

7.202 Open outlet water heaters shall be permanently marked close to the outlet connection with the substance of the following:

“WARNING: This outlet acts as a vent and must not be connected to any tap or fitting other than those recommended by the manufacturer”.

Compliance with the requirements of Sub-clauses 7.101, 7.102, 7.201 and 7.202 is checked by inspection.

8 Protection against electric shock

This clause of Part 1 is applicable except as follows:

8.2 and 8.3 Not applicable.

9 Starting of motor-operated appliances

This clause of Part 1 is not applicable.

10 Input and current

This clause of Part 1 is applicable except as follows:

10.2 Not applicable.

11 Heating

This clause of Part 1 is applicable except as follows:

11.2 Paragraphs 1 and 5 are not applicable.

11.5 and 11.6 Not applicable.

11.7 *Replacement:*

The water heater is operated until steady conditions are established, until a temperature limiter operates or until the thermostat interrupts the current for the first time after 16 h, whichever is the shortest period.

11.8 Item “Wood, in general” of Table 3.

Replacement:

Wood, in general 65

Walls, ceiling and floor of the test corner:

— for thermally insulated water heaters 60

— for other water heaters 65

12 Operation under overload conditions of appliances with heating elements

This clause of Part 1 is applicable except as follows:

12.1 TEST. First sentence.

Replacement:

Compliance is checked by the test of Sub-clause 12.2, followed immediately, for water heaters other than vented water heaters, by the test of Sub-clause 12.101 and, for water heaters provided with a pressure switch, by the test of Sub-clause 12.3.

12.2 Paragraph 1 is not applicable.

Paragraphs 4 and 5.

Replacement:

The water heater is subjected to four periods of operation, as specified in Sub-clause 11.7, in accordance with conditions of adequate heat discharge, the periods of operation being separated by cooling periods of 8 h. At the beginning and again at the end of each cooling period, the content of the water heater is replaced by cold water.

Throughout the periods of operation, all heating elements that can be operated at the same time are switched on, the supply voltage being such that the input is 1.27 times rated input.