भारतीय मानक

Indian Standard

IS 302 (Part 2/Sec 21) : 2024
IEC 60335-2-21 : 2022

घरेलू एवं समान विद्युतीय साधित्र — सुरक्षा

भाग 2 विशेष अपेक्षाएँ

अनुभाग 21 भंडारण किस्म के वाटर हीटर

(तीसरा पुनरीक्षण)

Household and Similar Electrical Appliances — Safety

Part 2 Particular Requirements

Section 21 Storage Water Heaters

(Third Revision)

ICS 13.120; 91.140.65

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NATIONAL FOREWORD

This Indian Standard (Part 2/Section 21) (Third Revision) which is identical to IEC 60335-2-21 : 2022 'Household and similar electrical appliances — Safety — Part 2-21: Particular requirements for storage water heaters' issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendation of the Electrical Appliances Sectional Committee and approval of the Electrotechnical Division Council.

This standard was first published in 1992 and revised in 2011, 2018. This revision has been brought out to harmonize with the latest version of IEC 60335-2-21.

This standard covers the safety requirements of storage water heaters. This standard does not cover the performance requirements, which are covered under a separate standard (*see* IS 2082 'Stationary storage type electric water heaters').

This Part 2 is to be used in conjunction with IS 302 (Part 1) : 2024 'Household and similar electrical appliances — Safety: Part 1 General requirements (*seventh revision*)'.

NOTE — When 'Part 1' is mentioned in this standard, it refers to IS 302 (Part 1).

This standard supplements or modifies the corresponding clauses in IS 302 (Part 1), so as to convert that publication into the Indian standard: Safety requirements for storage water heaters.

When a particular sub clause of Part 1 is not mentioned in this Part 2, that subclause applies as far as is reasonable. When this standard states 'addition', 'modification' or 'replacement', the relevant text in Part 1 is to be adapted accordingly.

NOTES

1 The following numbering system is used:

a) Subclauses, tables and figures that are numbered starting from 101 are additional to those in Part 1;
b) Unless notes are in a new subclause or involve notes in Part 1, they are numbered starting from 101, including those in a replaced clause or subclause; and
c) Additional annexes are lettered AA, BB, etc.

2 The following print types are used:

a) Requirements: in roman type;
b) Test specifications: in italic type; and
c) Notes: in small roman type.

Should however, any deviation exist between IS 302 (Part 1) : 2024 and this standard, the provisions of the latter shall apply.

This revision includes the following significant technical changes with respect to the previous version (minor changes are not listed):

a) Addition of direct current (DC) supplied appliances and battery-operated appliances (1);
b) Some notes have been converted to normative text (**1**, **5.2**, **15.3**, **19.1**, **19.2**, **19.3**, **19.4**, **22.47**, **22.104**, Annex AA introduction);
c) Addition of the temperature rises of external accessible surfaces (**11.3**, Table 101);
d) Introduction of a new 12 charging of metal-ion batteries;
e) Clarified that a drain hole needs to meet the minimum dimensions or it is considered to be blocked when determining compliance (**22.6**);

f) Addition of construction requirements for open-outlet water heaters having plastic containers (**22.110**);

g) Modification in construction requirements of water heaters (**22.111**);

h) Updated requirement restricting use of appliance inlets (**25.1**);

j) Figure of probe for measuring surface temperatures added; and

k) Modification in contents of Annex R and Annex AA.

The text of IEC standard has been approved as suitable for publication as an Indian Standard without deviations. Certain terminologies and conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'; and

b) Comma (,) has been used as a decimal marker, while in Indian Standards the current practice is to use a point (.) as the decimal marker.

In this standard, reference appears to International Standards for which Indian Standards also exist. The corresponding Indian Standards, which are to be substituted, are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding IndianStandard*	*Degree of Equivalence*
IEC 60335-1 Household and similar electrical appliances — Safety — Part 1: General requirements	IS 302 (Part1) : 2024/IEC 60335-1 : 2020 Household and similar electrical appliances — Safety: Part 1 General requirements (*seventh revision*)	Identical
IEC 60584-1 Thermocouples — Part 1: EMF specifications and tolerances	IS 16923 (Part 1) : 2018/IEC 60584-1 : 2023 Thermocouples: Part 1 EMF specifications and tolerances (*first revision*)	Identical
IEC 60730-1 : 2013 Automatic electrical controls — Part 1: General requirements	IS/IEC 60730-1 : 1999 Automatic electrical controls for household and similar use: Part 1 General requirements	Identical with IEC 60730-1 : 1999

The Committee has reviewed the provisions of the following International Standards referred in this adopted standard and decided that they are acceptable for use in conjunction with this standard:

International Standard	*Title*
IEC 60730-1 : 2013/AMD 1 : 2015	Automatic electrical controls — Part 1: General requirements
IEC 60730-1 : 2013/AMD 2 : 2020	Automatic electrical controls — Part 1: General requirements

This standard is one among the IS 302 series of Indian Standards on safety of household and similar electrical appliances. Part 1 of the series specifies the general requirements, and sections of Part 2 of the series specify the particular requirements for the safety of different types of household and similar electrical appliances. Information on IS 302 (Part 1) and all sections of the IS 302 (Part 2) series, published under the general title 'Household and similar electrical appliances — Safety', can be accessed from the BIS website www.bis.gov.in .

Only the English language text has been retained while adopting it in this Indian Standard, and as such, the page numbers given here are not the same as in the IEC publication.

India specific changes have been made to the adopted IEC 60335-2-21 as outlined in National Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding of numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

CONTENTS

INTRODUCTION

It has been assumed in the drafting of this International Standard that the execution of its provisions is entrusted to appropriately qualified and experienced persons.

Guidance documents concerning the application of the safety requirements for appliances can be accessed via TC 61 supporting documents on the IEC website

https://www.iec.ch/tc61/supportingdocuments

This information is given for the convenience of users of this International Standard and does not constitute a replacement for the normative text in this standard.

This standard recognizes the internationally accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of appliances when operated as in normal use taking into account the manufacturer's instructions. It also covers abnormal situations that can be expected in practice and takes into account the way in which electromagnetic phenomena can affect the safe operation of appliances.

This standard takes into account the requirements of IEC 60364 as far as possible so that there is compatibility with the wiring rules when the appliance is connected to the supply mains. However, national wiring rules can differ.

If an appliance within the scope of this standard also incorporates functions that are covered by another part 2 of IEC 60335, the relevant part 2 is applied to each function separately, as far as is reasonable. If applicable, the influence of one function on the other is taken into account.

When a part 2 standard does not include additional requirements to cover hazards dealt with in Part 1, Part 1 applies.

NOTE 1 This means that the technical committees responsible for the part 2 standards have determined that it is not necessary to specify particular requirements for the appliance in question over and above the general requirements.

This standard is a product family standard dealing with the safety of appliances and takes precedence over horizontal and generic standards covering the same subject.

NOTE 2 Horizontal publications, basic safety publications and group safety publications covering a hazard are not applicable since they have been taken into consideration when developing the general and particular requirements for the IEC 60335 series of standards.

An appliance that complies with the text of this standard will not necessarily be considered to comply with the safety principles of the standard if, when examined and tested, it is found to have other features that impair the level of safety covered by these requirements.

An appliance employing materials or having forms of construction differing from those detailed in the requirements of this standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be considered to comply with the standard.

NOTE 3 Standards dealing with non-safety aspects of household appliances are:

– IEC standards published by TC 59 concerning methods of measuring performance;
– CISPR 11, CISPR 14-1 and relevant IEC 61000-3 series standards concerning electromagnetic emissions;
– CISPR 14-2 concerning electromagnetic immunity;
– IEC standards published by TC 111 concerning environmental matters.

Indian Standard

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES — SAFETY

PART 1 PARTICULAR REQUIREMENTS

SECTION 21 STORAGE WATER HEATERS

(Third Revision)

1 Scope

This clause of Part 1 is replaced by the following.

This part of IEC 60335 deals with the safety of electric **storage water heaters** for household and similar purposes and intended for heating water below boiling temperature, their **rated voltage** being not more than 250 V for single-phase appliances and 480 V for other appliances including direct current (DC) supplied appliances and **battery-operated appliances**.

This standard also deals with:

– appliances not intended for normal household use, but which nevertheless possibly pose a source of danger to the public, such as appliances intended to be used by laymen in shops and on farms;

– **immersion heater units** intended to be retrofitted in a **heat exchange closed water heater** having provision for retrofitting. Additional requirements are given in Annex AA.

As far as is practicable, this standard deals with the common hazards presented by appliances that are encountered by all persons in and around the home. However, in general, it does not take into account

– persons (including children) whose
  - physical, sensory or mental capabilities, or
  - lack of experience and knowledge

  prevents them from using the appliance safely without supervision or instruction;

– children playing with the appliance.

Attention is drawn to the fact that

– for appliances intended to be used in vehicles or on board ships or aircraft, additional requirements can be necessary;

– in many countries, additional requirements are specified by the national health authorities, the national authorities responsible for the protection of labour and similar authorities;

– in many countries regulations exist for the installation of equipment connected to the water mains.

This standard does not apply to

– appliances for boiling water (IEC 60335-2-15);

– instantaneous water heaters (IEC 60335-2-35);

– commercial dispensing appliances and vending machines (IEC 60335-2-75);

– appliances intended exclusively for industrial purposes;

– appliances intended to be used in locations where special conditions prevail, such as the presence of a corrosive or explosive atmosphere (dust, vapour or gas).

2 Normative references

This clause of Part 1 is applicable except as follows:

Addition:

IEC 60584-1, *Thermocouples – Part 1: EMF specifications and tolerances*

IEC 60730-1:2013, *Automatic electrical controls – Part 1: General requirements*
IEC 60730-1:2013/AMD1:2015
IEC 60730-1:2013/AMD2:2020

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1 Definitions relating to physical characteristics

3.1.9 *Addition:*
operation of the appliance after installation in accordance with the instructions and filled with cold water

3.1.101
rated pressure
water pressure assigned to the appliance by the manufacturer

3.5 Definitions relating to types of appliances

3.5.101
storage water heater
stationary appliance for heating and storing water in a container and incorporating devices to control the water temperature

3.5.102
closed water heater
unvented **storage water heater** intended to operate at the pressure of the water system, the flow of water being controlled by one or more valves in the outlet system

Note 1 to entry: A **closed water heater** is shown in Figure 101a).

Note 2 to entry: The operating pressure may be the output pressure of a reducing or boosting device.

3.5.103
cistern-fed water heater
storage water heater that is vented to atmosphere and intended to be supplied by water under gravity from a separate cistern, the flow of water being controlled by one or more valves in the outlet system

Note 1 to entry: A **cistern-fed water heater** is shown in Figure 101d).

Note 2 to entry: The water heater may be installed so that the expanded water returns to the cistern.

Note 3 to entry: In a **cistern-fed water heater**, the pressure in the container results from the column of water in the cistern.

3.5.104
cistern-type water heater
storage water heater having a container supplied by water under gravity from a cistern incorporated in the appliance

Note 1 to entry: The expanded water can return to the cistern, the flow of water being controlled by one or more valves in the outlet system.

Note 2 to entry: A **cistern-type water heater** is shown in Figure 101c).

Note 3 to entry: In a **cistern-type water heater**, the surface of the water is always at atmospheric pressure.

3.5.105
open-outlet water heater
storage water heater in which the flow of water is only controlled by a valve in the inlet pipe and in which the expanded or displaced water flows through the outlet

Note 1 to entry: An **open-outlet water heater** is shown in Figure 101b).

Note 2 to entry: In an **open-outlet water heater**, the static pressure at the outlet is always at atmospheric pressure.

3.5.106
low-pressure water heater
storage water heater that is vented to atmosphere and intended to be connected to the water mains through a pressure reducing valve, the flow of water being controlled by one or more valves in the outlet system

Note 1 to entry: A **low-pressure water heater** is shown in Figure 101e).

3.5.107
heat exchange water heater
storage water heater in which heated water is fed into a heat exchanger, such as a coiled tube or similar device, which is itself immersed in a container with the water to be heated

Note 1 to entry: The heated water fed into the heat exchanger is heated from a primary heat source such as a solar panel or heat pump.

Note 2 to entry: A **heat exchange water heater** is shown in Figure 101f).

4 General requirement

This clause of Part 1 is applicable.

5 General conditions for the tests

This clause of Part 1 is applicable except as follows.

5.2 *Addition:*

Additional appliances can be required if damage occurs during the tests of 19.2 or 19.3.

5.3 *Addition:*

When the tests are carried out on a single appliance, the tests of 22.47, 22.102, 22.103, and 24.102 are carried out before the tests of Clause 19.

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 Modification:

Water heaters shall be **class I**, **class II** or **class III**.

6.2 *Addition:*

Water heaters for installation outdoors shall be at least IPX4. Other water heaters shall be at least IPX1.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 *Addition:*

Appliances, other than **cistern-type water heaters**, shall be marked with the **rated pressure** in pascals.

Appliances shall be marked with the rated capacity in litres.

Closed water heaters shall be marked with a statement that a pressure-relief device is to be fitted in the installation, unless it is incorporated in the appliance.

Closed water heaters having a **rated pressure** less than 0,6 MPa and **low-pressure water heaters** shall be marked with a statement that a pressure reducing valve is to be fitted in the installation.

Open-outlet water heaters shall be marked, close to the outlet connection or on a tag attached to the appliance, with the substance of the following:

WARNING: This outlet acts as a vent and must only be connected to a fitting recommended by the manufacturer. It must not be connected to a tap.

7.12 *Addition:*

The instructions for **closed water heaters** shall state the substance of the following:

– the water can drip from the discharge pipe of the pressure-relief device and that this pipe must be left open to the atmosphere;
– the pressure-relief device is to be operated regularly to remove lime deposits and to verify that it is not blocked;
– how the water heater can be drained.

7.12.1 *Addition:*

The installation instructions shall state the substance of the following:

– the type or characteristics of the pressure-relief device and how to connect it, unless it is incorporated in the appliance;
– a discharge pipe connected to the pressure-relief device is to be installed in a continuously downward direction and in a frost-free environment;
– the type or characteristics of a pressure reducing valve and the installation details (for appliances having a **rated pressure** less than 0,6 MPa).

The instructions for **closed water heaters** incorporating a heat exchanger shall give details on the installation of control devices and the temperature settings that are necessary to prevent operation of the **thermal cut-out** caused by the heat from the exchanger.

The instructions for **cistern-fed water heaters** and **low-pressure water heaters** shall contain the substance of the following:

WARNING: Do not connect any pressure-relief device to the vent pipe of this water heater.

7.101 The water inlet and the water outlet shall be identified. This identification shall not be on **detachable parts**. If colours are used, blue shall be used for the inlet and red for the outlet. An alternative means of identification may be by means of arrows showing the direction of the water flow.

Compliance is checked by inspection.

8 Protection against access to live parts

This clause of Part 1 is applicable.

9 Starting of motor-operated appliances

This clause of Part 1 is not applicable.

10 Power input and current

This clause of Part 1 is applicable.

11 Heating

This clause of Part 1 is applicable except as follows.

11.3 *Addition:*

*Where the external **accessible surfaces** are suitably flat and access permits, then the test probe of Figure 102 may be used to measure the temperature rises of external **accessible surfaces** specified in Table 101. The probe is applied with a force of 4 N ± 1 N to the surface in such a way that the best possible contact between the probe and the surface is ensured. The measurement is performed after a contact period of 30 s.*

The probe may be held in place using a laboratory stand clamp or similar device. Any measuring instrument giving the same results as the probe may be used.

11.7 *Modification:*

*The appliance is operated until steady conditions are established or until the **thermostat** interrupts the current for the first time after 16 h, whichever is shorter.*

11.8 *Modification:*

During the test, the temperature rises are monitored continuously and shall not exceed the values shown in Table 3 and Table 101.

Table 101 – Maximum temperature rises of external accessible surfaces under normal operating conditions

Surface [a]	*Temperature rise* K
Bare metal	*42*
Coated metal [b]	*49*
Glass and ceramic	*56*
Plastic and plastic coating > 0,4 mm [c,d]	*62*

[a] *Temperature rises are not measured on:*
- *tapping connections, pipes, hoses, plumbing fittings, pressure relief valves and sight gauges;*
- *appliances intended for installation on the roof;*
- *surfaces not accessible to the 75 mm diameter probe having a hemispherical end.*

[b] *Metal is considered coated when a coating having a minimum thickness of 90 µm made of enamel or non-substantially plastic coating is used.*

[c] *The temperature rise limit of plastic also applies for plastic material having a metal finish of thickness less than 0,1 mm.*

[d] *When the thickness of the plastic coating does not exceed 0,4 mm, the temperature rise limits of the coated metal or of glass and ceramic material apply.*

12 Charging of metal-ion batteries

This clause of Part 1 is applicable.

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable.

14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is applicable except as follows.

15.2 *Addition:*

The test is only applicable to ***cistern-type water heaters****.*

15.3 *Addition:*

If the appliance is too large for the humidity cabinet, the test can be carried out on those parts that contain electrical components.

16 Leakage current and electric strength

This clause of Part 1 is applicable.

17 Overload protection of transformers and associated circuits

This clause of Part 1 is applicable.

18 Endurance

This clause of Part 1 is not applicable.

19 Abnormal operation

This clause of Part 1 is applicable except as follows.

19.1 *Modification:*

Instead of the tests specified for appliances incorporating heating elements, the following applies.

*For **closed water heaters**, **low-pressure water heaters** and **open-outlet water heaters**, compliance is checked by the tests of 19.2, 19.3 and 19.4 if applicable. However, 19.101 applies instead for appliances not liable to be emptied in normal use and having all four of the following features:*

– *an outer enclosure of metal, except for the cover used for the supply terminals and controls that may be non-metallic, or a water container of metal and an outer enclosure of non-metallic material;*
– *non-combustible thermal insulation;*
– *a capacity exceeding 30 l;*
– *a **rated power input** not exceeding 6 kW.*

Appliances are not considered liable to be emptied in normal use if emptying through the inlet is prevented by a check valve, a pipe interrupter or an air gap. These devices may be fitted in the inlet pipe in accordance with the instructions. Emptying through openings provided for servicing purposes only is not considered to be normal use.

Thermal insulation complying with the needle flame test of normative Annex E is considered to be non-combustible.

***Cistern-fed water heaters** and **cistern-type water heaters** are not subjected to the tests specified for appliances incorporating heating elements.*

19.2 *Addition:*

The appliance is operated empty, any thermal control that operates during the test of Clause 11 being short-circuited.

If the appliance is provided with more than one thermal control, these are short-circuited in turn.

19.3 *Addition:*

If the water heater has been damaged during the previous test, a new appliance is used.

19.4 *Replacement:*

*For **open-outlet water heaters**, the test of 19.2 is repeated but with the container filled with water to a level at least 10 mm above the highest point of the heating element. The appliance is operated at 1,15 times **rated power input** under **normal operation**.*

If the water heater has been damaged during previous tests, a new appliance is used.

19.13 *Addition:*

There shall be no leakage from the container during the tests.

19.101 *The appliance is tested for 24 h under the conditions specified in Clause 11 but with the container empty.*

20 Stability and mechanical hazards

This clause of Part 1 is applicable.

21 Mechanical strength

This clause of Part 1 is applicable.

22 Construction

This clause of Part 1 is applicable except as follows.

22.6 *Addition:*

The enclosure shall have a drain hole positioned so that the water can drain without impairing electrical insulation, unless condensed water cannot accumulate within the enclosure in normal use. The hole shall be at least 5 mm in diameter or 20 mm^2 in area with a width of at least 3 mm. Holes that do not meet these dimensions are considered to be blocked when determining compliance.

Compliance is checked by inspection and measurement.

22.20 *Addition:*

Thermal insulation shall not be used for **basic insulation** of internal wiring.

22.47 *Replacement:*

Appliances shall withstand the water pressure occurring in normal use.

Compliance is checked by subjecting the appliance to a water pressure of

– *twice the **rated pressure**, for **closed water heaters**. If the water heater is supplied through a pressure reducing valve, the container is instead subjected to twice the maximum working pressure in the container during the test of Clause 11;*

NOTE 101 The pressure reducing valve can be incorporated in the water-inlet pipe.

– *1,5 times **rated pressure**, for **cistern-fed water heaters** and **low-pressure water heaters**;*

– *0,15 MPa, for **open-outlet water heaters**;*

– *0,03 MPa, for **cistern-type water heaters**.*

Heat exchangers incorporated in an appliance are subjected to a pressure test based on the maximum working pressure in the heat exchanger during the test of Clause 11.

Pressure-relief devices are rendered inoperative. The pressure is raised at a rate of 0,13 MPa/s to the specified value and is maintained at that value for 15 min.

Water shall not leak from the appliance and there shall be no permanent deformation to such an extent that compliance with this standard is impaired.

Damage to a protective coating on the inside of containers is not considered to be a hazard.

22.101 The **rated pressure** of **closed water heaters** intended for direct connection to the water main shall be at least 0,6 MPa.

The **rated pressure** of **closed water heaters** and **low-pressure water heaters**, intended to be supplied by a pressure reducing valve that is not incorporated in the appliance, shall be at least 0,1 MPa.

The **rated pressure** of **cistern-fed water heaters** shall not exceed 0,2 MPa.

NOTE The **rated pressure** of **open-outlet water heaters** is 0 Pa.

Compliance is checked by inspection.

22.102 **Closed water heaters** shall be constructed so that repeated drawing off does not cause the water to boil.

Compliance is checked by the following test.

The appliance is operated as specified in Clause 11.

*When the **thermostat** has operated for the first time, water is drawn off at a rate of approximately 2 l/min or 10 % of the capacity of the appliance per minute, whichever is less, until the **thermostat** switches on again.*

*When the **thermostat** next operates, water is drawn off again at the same rate until the **thermostat** switches on, this sequence being repeated until steady conditions are established.*

The temperature of the water, measured by means of a thermocouple at the outlet, shall not exceed 98 °C.

22.103 Pressure-relief devices of **closed water heaters** shall prevent the pressure in the container from exceeding the **rated pressure** by more than 0,1 MPa.

Compliance is checked by subjecting the container to a slowly increasing water pressure.

NOTE The pressure-relief device can be fitted during installation.

22.104 The outlet of **open-outlet water heaters** shall be constructed so that the water flow is not limited to such an extent that the container is subjected to a significant pressure. This requirement is considered to be met if the cross-sectional area of the water outlet is not less than that of the inlet.

The vent pipe of **low pressure water heaters** shall have an internal diameter of at least 20 mm.

Compliance is checked by inspection and measurement.

22.105 Cistern-type water heaters shall be constructed so that the container is always at atmospheric pressure by means of a vent having an area of at least 30 mm^2 and a minimum dimension of at least 3 mm.

Compliance is checked by inspection and by measurement.

22.106 Closed water heaters shall incorporate a **thermal cut-out** providing **all-pole disconnection** and which operates independently from the **thermostat**. However, for appliances intended to be connected to fixed wiring, the neutral conductor need not be disconnected.

Compliance is checked by inspection.

22.107 Heating elements and thermal control sensors in contact with the outer surface of the container shall be held in position securely.

Compliance is checked by inspection.

22.108 Appliances for wall mounting shall have reliable provision for fixing to a wall, independent of the connection to the water mains.

Compliance is checked by inspection.

22.109 Appliances having a capacity of more than 15 l that cannot be emptied through a drain fitted in the water pipes shall incorporate means for draining that requires a **tool** for its operation.

Compliance is checked by inspection and by manual test.

NOTE 1 Residual water in the container below the end of the inlet pipe is disregarded.

NOTE 2 The means for draining can be combined with a pressure-relief valve.

22.110 Open-outlet water heaters having plastic containers shall be constructed to ensure that the appliance is only likely to be installed in the intended orientation.

Appliances marked with the mounting position adjacent to the water connections are considered to meet this requirement.

Compliance is checked by inspection.

22.111 Closed water heaters incorporating a heat exchanger shall be constructed so that during normal use the **thermal cut-out** does not operate due to heat from the exchanger.

Thermostatic valves, by-pass valves and similar controlling devices used for this purpose shall be supplied with the appliance.

Compliance is checked by inspection.

23 Internal wiring

This clause of Part 1 is applicable.

24 Components

This clause of Part 1 is applicable except as follows.

24.1.4 *Addition:*

Thermal cut-outs *incorporated in* ***closed water heaters*** *shall comply with the requirements for Type 2.B controls in IEC 60730-1:2013, Clauses 13, 15, 16, 17 and 20, including IEC 60730-1:2013/AMD1:2015, Clauses 13 and 20 and IEC 60730-1:2013/AMD2:2020, Clauses 13, 17 and 20, unless they are tested with the appliance.*

24.101 **Thermal cut-outs** shall be non-self-resetting. They shall have a trip-free switching mechanism or be located so that they can only be reset after removal of a **non-detachable cover**.

Compliance is checked by inspection.

24.102 The operating temperature of the **thermal cut-out** of a **closed water heater** shall ensure that the water temperature cannot exceed 99 °C or that the **thermal cut-out** operates before its temperature exceeds 110 °C.

Compliance is checked by the test of 24.102.1 for water temperatures not exceeding 99 °C or by the test of 24.102.2 for ***thermal cut-outs*** *having an operating temperature up to 110 °C.*

24.102.1 *The appliance is operated under the conditions specified in Clause 11 until the* ***thermostat*** *operates for the first time. A quantity of water equal to 25 % of the capacity of the container is then drawn off so that it is replaced by cold water.*

Immediately after the ***thermostat*** *operates for the second time, it is short-circuited. The test is continued until the* ***thermal cut-out*** *operates. The outlet valve is then opened and the temperature of the water measured at the outlet.*

The temperature shall not exceed 99 °C.

If compliance relies on the operation of an ***electronic circuit****, the test is repeated under the following conditions applied separately:*

– *the fault conditions in a) to g) of 19.11.2 applied one at a time to the* ***electronic circuit****;*
– *the electromagnetic phenomena tests of 19.11.4.1 to 19.11.4.7 applied to the appliance. The tests are carried out with surge protective devices disconnected, unless they incorporate spark gaps.*

The temperature of the water at the outlet shall not exceed 99 °C during or after each of the tests.

If the ***electronic circuit*** *is programmable, the software shall contain measures to control the fault/error conditions specified in Table R.1 and is evaluated in accordance with the relevant requirements of normative Annex R.*

24.102.2 *The operating temperature of the* ***thermal cut-out*** *is measured by means of a thermocouple positioned on its sensing element or as close as possible to it.*

The water temperature for appliances having vertically oriented metallic water containers is measured by a thermocouple attached to the outer surface of the upper dome. If the water container is horizontally oriented, two thermocouples are attached to the outer surface. The position of the thermocouple is shown in Figure 103.

The water temperature for appliances having non-metallic water containers is measured at the most unfavourable position by a thermocouple positioned 50 mm below the upper inner surface of the container. This method may also be used to measure the water temperature of appliances having metallic containers.

The appliance is operated at 1,15 times ***rated power*** *input under* ***normal operation*** *with the outlet valve closed and* ***thermostats*** *short-circuited. The test is continued until the* ***thermal cut-out*** *operates.*

The ***thermal cut-out*** *shall operate before its temperature exceeds 110 °C. The water temperature shall not exceed 20 K of the maximum permitted operating temperature of the* ***thermal cut-out****.*

If compliance relies on the operation of an ***electronic circuit****, the test is repeated under the following conditions applied separately:*

– *the fault conditions in a) to g) of 19.11.2 applied one at a time to the* ***electronic circuit****;*
– *the electromagnetic phenomena tests of 19.11.4.2 and 19.11.4.5 applied to the appliance.*

The temperature of the water at the outlet shall not exceed 110 °C during or after each of the tests.

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows.

25.1 *Modification:*

Appliances having a capacity exceeding 5 l or a **rated current** exceeding 16 A shall not incorporate an appliance inlet.

26 Terminals for external conductors

This clause of Part 1 is applicable.

27 Provision for earthing

This clause of Part 1 is applicable except as follows.

27.1 *Addition:*

For **class I water heaters**, the sheath of the heating element shall be permanently and reliably connected to the earthing terminal unless

– the container is provided with inlet and outlet pipes of metal that are permanently and reliably connected to the earthing terminal, and
– other **accessible metal parts** of the container in contact with the water are permanently and reliably connected to the earthing terminal.

28 Screws and connections

This clause of Part 1 is applicable.

29 Clearances, creepage distances and solid insulation

This clause of Part 1 is applicable.

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

30.1 *Addition:*

The temperature rises occurring during the tests of 19.2, 19.3 and 19.101 are not taken into account.

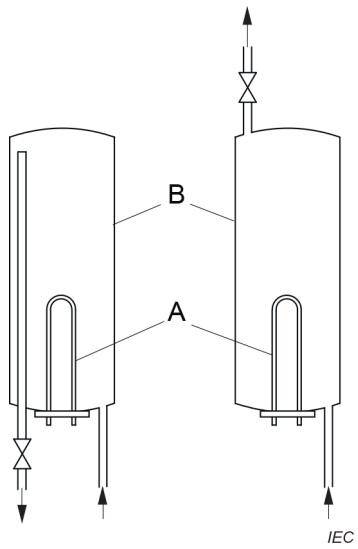
30.2.2 Not applicable.

31 Resistance to rusting

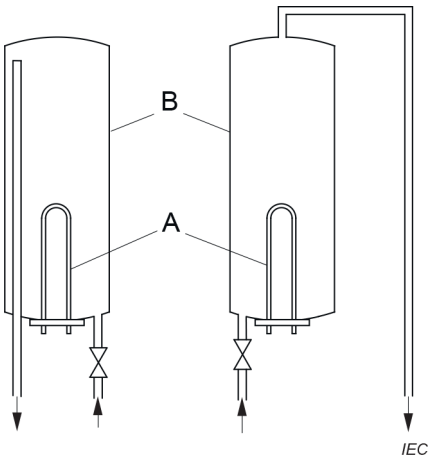
This clause of Part 1 is applicable.

32 Radiation, toxicity and similar hazards

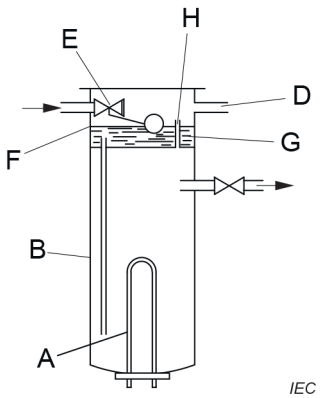
This clause of Part 1 is applicable.



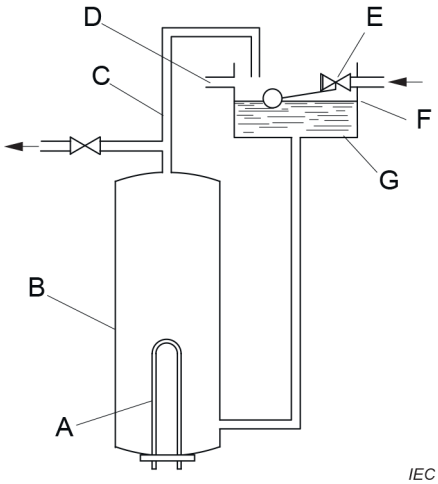
a) Closed water heaters



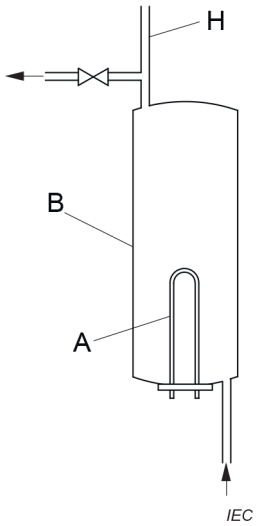
b) Open-outlet water heaters



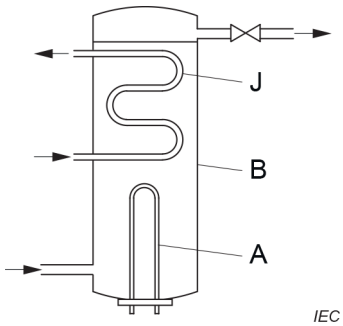
c) Cistern-type water heater



d) Cistern-fed water heater



e) Low-pressure water heater

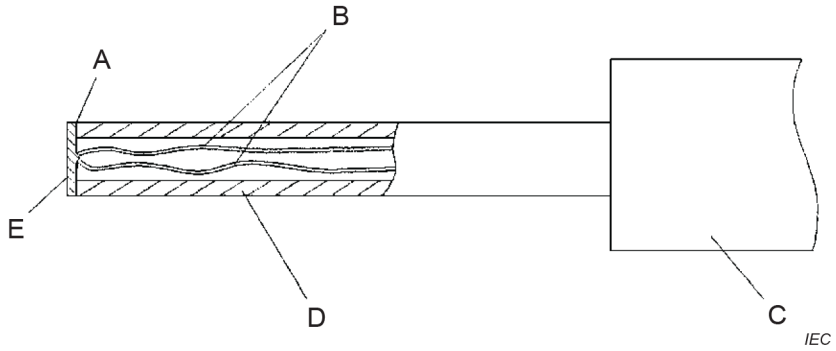


f) Heat exchange water heater

Key

A	Heating element	B	Container
C	Expansion pipe	D	Overflow pipe
E	Ball valve	F	Water level
G	Cistern	H	Vent pipe
J	Heat exchanger		

Figure 101 – Examples of types of storage water heaters



Key

A adhesive

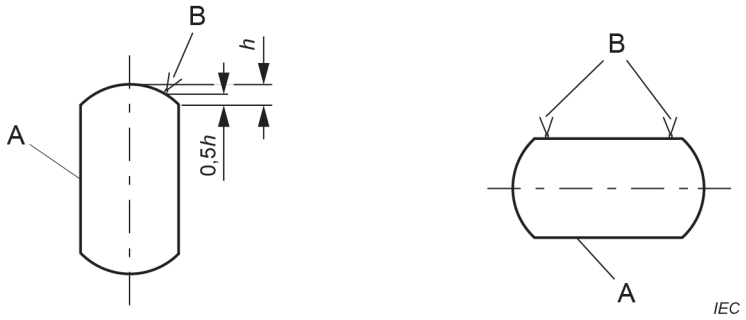
B thermocouple wires 0,3 mm diameter to IEC 60584-1 Type K

C handle arrangement permitting a contact force of 4 N ± 1 N

D polycarbonate tube: inside diameter 3 mm, outside diameter 5 mm

E tinned copper disc: 5 mm diameter, 0,5 mm thick with a flat contact face

Figure 102 – Probe for measuring surface temperatures



Key

A container

B external thermocouple

Figure 103 – Example of positions of the thermocouples

Annexes

The annexes of Part 1 are applicable except as follows.

Annex A
(informative)

Routine tests

A.101 Pressure test

The water container is subjected to a pressure test using a fluid.

When a liquid is used, the pressure is

– *for **closed water heaters**, 0,7 MPa for those having a **rated pressure** not greater than 0,6 MPa, and 1,1 times **rated pressure** for others;*
– *for **cistern-fed water heaters** and **low-pressure water heaters**, 1,1 times rated **pressure**;*
– *for **open-outlet water heaters**, 0,05 MPa;*
– *for **cistern-type water heaters**, 0,03 MPa.*

When gas is used, these pressures may be reduced but are to be sufficient to reveal leakage.

Leakage of the fluid shall not occur during the test.

Annex R
(normative)

Software evaluation

R.2.2.5 *Modification:*

For programmable **electronic circuits** with functions requiring software incorporating measures to control the fault/error conditions specified in Table R.1 or Table R.2, detection of a fault/error shall occur before compliance with Clause 19 or 24.102.1 is impaired.

R.2.2.9 *Modification:*

The software and safety-related hardware under its control shall be initialized and shall terminate before compliance with Clause 19 or 24.102.1 is impaired.

Annex AA
(normative)

Additional requirement for immersion heater units intended for the installation in heat exchange closed water heaters

The following modifications to this standard are for **immersion heater units** intended for the installation in a **heat exchange closed water heater**.

The clause numbers in this annex refer to the clause numbers in the main part of this standard that are modified or not applicable. Clauses that are additional to the clauses in the main part of this standard are identified by adding the annex letter followed by the numbering starting at 1.

Other subclauses of this standard not mentioned in this annex are applicable. Where "water heater" is written, the requirement applies for "**immersion heater units**" of this annex.

3 Terms and definitions

3.1 Definitions relating to physical characteristics

3.1.9 *Addition:*
normal operation
operation of the **immersion heater unit** after installation in accordance with the instructions in the smallest tank specified, the tank being thermally insulated and filled with water

NOTE 101 Accessible parts of the **immersion heater unit** are not thermally insulated.

3.5 Definitions relating to types of appliances

AA.3.5.1
immersion heater unit
appliance consisting of heating element and controls in a single unit to control the temperature in both normal and abnormal conditions and intended to be retrofitted to a **heat exchange closed water heater**

5 General conditions for the tests

5.2 *Addition:*

*Additional **immersion heater units** may be used for the tests of Clause 19 and 22.102.*

5.3 *Addition:*

*The test is to be carried out in a water tank according to the instructions of the manufacturer of the **immersion heater unit**.*

NOTE 101 Several tests for different mounting positions (vertically from the top or bottom, horizontally) can be required.

7 Marking and instructions

7.1 *Replacement:*

Immersion heater units for multiple supply shall be marked with their **rated power input** for each supply circuit.

Immersion heater units shall be marked with the **rated pressure**. The **rated pressure** shall not be lower than 0,6 MPa.

7.12.1 *Replacement:*

The installation instruction shall include the following:

– type, the volume or volume range, and dimensions of the tank in which the immersion heater unit can be installed;
– the positioning of the immersion heater unit within the tank;
– a statement that the installer must check that there is water in the tank before the immersion heater unit is switched on the first time;
– that a pressure-relief device is to be installed in the installation, unless it is not already part of the water tank installation;
– the type and properties of the pressure-relief device and how to install it;
– that a discharge pipe connected to the pressure relief device shall be installed with a steady downward inclination in a frost-free environment.

The instructions for **immersion heater units** for water tanks with an incorporated heat exchanger shall include instructions for the installation of **thermal controls** and their temperature setting in order to prevent the **thermal cut-out** from operating due to the heat of the heat exchanger.

For water storage tanks without an integrated heat exchanger that may be retrofitted with an **immersion heater unit**, the instructions shall provide information that retrofitting with an **immersion heater unit** is possible and shall specify the acceptable **immersion heater units**.

19 Abnormal operation

19.1 *Addition:*

*For **immersion heater units**, the tests of 19.2 and 19.3 are applicable.*

19.13 *Addition:*

*During the test, the **immersion heater unit** shall not show any leakage.*

22 Construction

22.47 *Replacement:*

The **immersion heater units** shall withstand the water pressure occurring in normal use.

Compliance is checked by the following:

*The **immersion heater units** are exposed to a water pressure which is twice as high as the **rated pressure**.*

The pressure is raised to the specified value at a rate of 0,13 MPa/s and maintained at this value for 5 min.

*No water is allowed to leak and no permanent deformation of the parts of the **immersion heater unit** intended to withstand the water pressure is allowed to an extent which would impair conformity to this standard.*

22.101 *Replacement:*

The **rated pressure** of **immersion heater units** intended to be exposed directly to the water main shall be at least 0,6 MPa.

22.111 *Replacement:*

Void.

AA.22.1 **Immersion heater units** shall be supplied with a seal or similar means to ensure that there is no leakage from the tank after installation.

Compliance is checked by inspection during the test of Clause 11.

AA.22.2 The **immersion heater unit** shall not be able to be removed from the tank without the aid of a tool.

Compliance is checked by inspection.

The cover of the compartment containing the supply terminals shall be prevented from rotating by more than 180° with respect to the fixed part of the **immersion heater unit**.

Compliance is checked by inspection.

24 Components

24.102 *Replacement:*

The **thermal cut-out** shall operate before the water temperature exceeds 99 °C and the water temperature shall not exceed the opening temperature of the **thermal cut-out** by more than 20 K.

Compliance is checked by the following test.

*The operating temperature of the **thermal cut-out** is measured with a thermo element that is attached to the sensor element or arranged in its close vicinity.*

If the tank is in a horizontal position, the water temperature is measured at the most unfavourable position by a thermocouple positioned 50 mm below the upper inner surface of the container.

*The **immersion heater unit** is operated at 1,15 times its **rated power input** with the **thermostat** short-circuited but under the conditions of **normal operation** and with the output valve of the tank closed.*

The test is continued until the thermal cut-out operates.

Bibliography

The bibliography of Part 1 is applicable except as follows.

Addition:

IEC 60335-2-15, *Household and similar electrical appliances – Safety – Part 2-15: Particular requirements for appliances for heating liquids*

IEC 60335-2-35, *Household and similar electrical appliances – Safety – Part 2-35: Particular requirements for instantaneous water heaters*

IEC 60335-2-75, *Household and similar electrical appliances – Safety – Part 2-75: Particular requirements for commercial dispensing appliances and vending machines*

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NATIONAL ANNEX A

(*National Foreword*)

A-1 The National Annex A of Part 1 is applicable.

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