

BS EN 60335-2-35:2016

Incorporating corrigendum April 2016



BSI Standards Publication

Household and similar electrical appliances — Safety

Part 2-35: Particular requirements for
instantaneous water heaters

bsi.

National foreword

This British Standard is the UK implementation of EN 60335-2-35:2016. It is derived from IEC 60335-2-35:2012. It supersedes BS EN 60335-2-35:2002+A2:2011, which will be withdrawn on 12 October 2018.

The CENELEC common modifications have been implemented at the appropriate places in the text. The start and finish of each common modification is indicated in the text by tags C C.

The UK participation in its preparation was entrusted by Technical Committee CPL/61, Safety of household and similar electrical appliances, to Subcommittee CPL/61/7, Safety of electrical appliances - Heated appliance group.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

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

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

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| Date | Text affected |
|---------------|---|
| 30 April 2016 | CENELEC Foreword updated and CENELEC Common Modifications implemented in the text |

EUROPEAN STANDARD

EN 60335-2-35

NORME EUROPÉENNE

EUROPÄISCHE NORM

January 2016

ICS 13.120; 97.040.50

Supersedes EN 60335-2-35:2002

English Version

**Household and similar electrical appliances - Safety - Part 2-35:
Particular requirements for instantaneous water heaters
(IEC 60335-2-35:2012 , modified)**

Appareils électrodomestiques et analogues - Sécurité -
Partie 2-35: Exigences particulières pour les chauffe-eau
instantanés
(IEC 60335-2-35:2012 , modifiée)

Sicherheit elektrischer Geräte für den Hausgebrauch und
ähnliche Zwecke - Teil 2-35: Besondere Anforderungen für
Durchflusserwärmer
(IEC 60335-2-35:2012 , modifiziert)

This European Standard was approved by CENELEC on 2015-10-12. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

European foreword

The text of document 61/4454/FDIS, future edition 5 of IEC 60335-2-35, prepared by IEC/TC 61 "Safety of household and similar electrical appliances" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60335-2-35:2016.

A draft amendment, which covers common modifications to IEC 60335-2-35:2012, was prepared by CLC/TC 61 "Safety of household and similar electrical appliances" and approved by CENELEC.

The following dates are fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2016-10-12
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2018-10-12

EN 60335-2-35:2016 will supersede EN 60335-2-35:2002 and its amendments.

This amendment supplements or modifies the corresponding clauses of EN 60335-1:2012 and EN 60335-2-35:2012.

Clauses, subclauses, notes, tables, figures and annexes which are additional to those in IEC 60335-2-35:2012 are prefixed "Z".

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

Endorsement notice

The text of the International Standard IEC 60335-2-35:2012 was approved by CENELEC as a European Standard with agreed common modifications.

Annex ZA (normative)

Special national conditions

Annex ZA of EN 60335-1:2012 is applicable, with the following **addition**:

| <u>Clause</u> | <u>Special national condition</u> |
|---------------|---|
| 22.101 | Denmark, Finland, Norway, Sweden For closed water heaters, the minimum rated pressure is 1,0 MPa. |

Annex ZB (informative)

A-deviations

Annex ZB of EN 60335-1:2012 is applicable, with the following **addition**:

| <u>Clause</u> | <u>Deviation</u> |
|---------------|--|
| 1 | Spain (Royal Decree 842/2002; Spanish regulation on low voltage installations: Technical Instruction ICT-BT-45, subclause 2.1) The household use of appliances incorporating bare heating elements immersed in water as well as those where the water is part of the electric circuit is prohibited. |

Annex ZC (normative)

Normative references to international publications with their corresponding European publications

Annex ZC of EN 60335-1:2012 is applicable, with the **addition** of the EN reference mentioned in Clause 2.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES –
SAFETY –****Part 2-35: Particular requirements for instantaneous water heaters**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

This part of International Standard IEC 60335 has been prepared by IEC technical committee 61: Safety of household and similar electrical appliances.

This fifth edition cancels and replaces the fourth edition published in 2002 including its Amendment 1 (2006) and its Amendment 2 (2009). It constitutes a technical revision.

The principal changes in this edition as compared with the fourth edition of IEC 60335-2-35 are as follows (minor changes are not listed):

- converted notes to normative text (7.12, 7.102, 8.1.5, 22.104, and 22.109.3);
- deleted notes in 19.13, 22.109, and A.101;
- added Annex R and 22.108 for appliances with programmable electronic circuits;
- added requirements for water heaters (22.50, 22.51).

The text of this standard is based on the following documents:

| | |
|--------------|------------------|
| FDIS | Report on voting |
| 61/4454/FDIS | 61/4507/RVD |

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

This part 2 is to be used in conjunction with the latest edition of IEC 60335-1 and its amendments. It was established on the basis of the fifth edition (2010) of that standard.

NOTE 1 When “Part 1” is mentioned in this standard, it refers to IEC 60335-1.

This part 2 supplements or modifies the corresponding clauses in IEC 60335-1, so as to convert that publication into the IEC standard: Safety requirements for instantaneous water heaters.

When a particular subclause 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.

NOTE 2 The following numbering system is used:

- subclauses, tables and figures that are numbered starting from 101 are additional to those in Part 1;
- 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;
- additional annexes are lettered AA, BB, etc.

NOTE 3 The following print types are used:

- requirements: in roman type;
- *test specifications: in italic type;*
- notes: in small roman type.

Words in **bold** in the text are defined in Clause 3. When a definition concerns an adjective, the adjective and the associated noun are also in bold.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

NOTE 4 The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 12 months or later than 36 months from the date of publication.

A list of all parts of the IEC 60335 series, under the general title: *Household and similar electrical appliances – Safety*, can be found on the IEC website.

The following differences exist in the countries indicated below.

- 6.1: Bare-element water heaters are not allowed (India).
- 6.1: Class 0I appliances are allowed (Japan).
- 7.1: Marking of rated pressure is different and marking of water resistivity is not required (USA).
- 19.4: Flow switches tested for reliability are not short-circuited (USA).
- 19.13: The water temperatures are different (USA).
- 22.101: For closed water heaters, the minimum rated pressure is 1,0 MPa (Norway, Sweden).
- 22.103: Closed water heaters have to incorporate a temperature relief valve or a combined temperature and pressure relief valve that has to operate before the water temperature reaches 100 °C (United Kingdom).
- 22.103: The pressure relief valve is not required to be provided with the heater (USA).

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.

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 may 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 and generic standards 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. For example, in the case of temperature requirements for surfaces on many appliances, generic standards, such as ISO 13732-1 for hot surfaces, are not applicable in addition to Part 1 or part 2 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.

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-35: Particular requirements for instantaneous water heaters

1 Scope

This clause of Part 1 is replaced by the following.

This International Standard deals with the safety of electric **instantaneous 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.

NOTE 101 **Instantaneous water heaters** incorporating bare heating elements are within the scope of this standard.

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

☐ As far as is practicable, this European Standard deals with the common hazards presented by appliances that are encountered by all persons in household and similar environments.

However, in general, it does not take into account

- **children** playing with the appliance,
- the use of the appliance by **very young children** without supervision,
- **user maintenance by children**, including the cleaning of the appliance.

It is recognized that **very vulnerable people** may have needs beyond the level addressed in this European Standard. ☐

NOTE 102 Attention is drawn to the fact that

- for appliances intended to be used in vehicles or on board ships or aircraft, additional requirements may 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.

NOTE 103 This standard does not apply to

- appliances for heating liquids (IEC 60335-2-15);
- storage water heaters (IEC 60335-2-21);
- 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);
- commercial dispensing appliances and vending machines (IEC 60335-2-75).

2 Normative references

☐ This clause of Part 1 is applicable except as follows.

EN 60335-2-5:2003 + A1:2005 + A2:2008 + A11:2009 + A12:2012, *Household and similar electrical appliances – Safety – Part 2-5: Particular requirements for dishwashers (IEC 60335-2-5:2002, mod. + corrigendum May 2003 + A1:2005 + A2:2008)* ☐

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1.9 Replacement:

normal operation

operation of the appliance while supplied with water, the flow being adjusted to attain the highest outlet water temperature without operation of the **thermal cut-out**

3.101

instantaneous water heater

stationary appliance for heating water while it flows through the appliance

Note 1 to entry: **Instantaneous water heaters** are referred to as water heaters.

3.102

closed water heater

instantaneous 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: The operating pressure can be the output pressure of a reducing or boosting device.

3.103

open-outlet water heater

instantaneous water heater in which the flow of water is controlled by a valve in the inlet pipe, there being no valve in the outlet pipe

3.104

bare-element water heater

instantaneous water heater in which uninsulated heating elements are immersed in the water

3.105

rated pressure

water pressure assigned to the appliance by the manufacturer

3.106

flow switch

device that operates in response to a flow of water

3.107

pressure switch

device that operates in response to a change in pressure

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:

NOTE 101 Additional samples can be required for the tests of 22.109.

5.3 Addition:

When the tests are carried out on a single appliance, the tests of 22.102, 22.107, 22.108 and 24.102 are carried out before the tests of Clause 19.

5.7 Addition:

Water having a temperature of $15\text{ °C} \pm 5\text{ °C}$ is used for the tests.

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 Modification:

Bare-element water heaters shall be **class I** or **class III**.

Other water heaters shall be **class I**, **class II** or **class III**.

6.2 Addition:

Water heaters shall be at least IPX1.

NOTE 101 Specific zones in which the water heater is installed require a higher degree of protection as specified in IEC 60364.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.


7.1 Addition:

The marked rated frequency for bare-element water heaters shall not be less than 50 Hz.

Appliances shall be marked with the **rated pressure** in pascals.

Bare-element water heaters shall be marked with the minimum water resistivity with which the appliance may be used, and the marked value shall not be greater than $1\,300\ \Omega\text{cm}$.

7.11 Addition:

Controls that are operated in use and that affect the water temperature shall be detectable by a shape, a position or an indication. When only an indication is used, the height of the letters or symbols measured on the capital letters shall be at least 5 mm. If only indicated by increasing dots or bands, the height of the indication for maximum setting shall be at least 7 mm with the minimum value less than 25 % of the maximum value used. 

- ☐ When a digital display is used for the indication of the water temperature, the height of the digits of the display shall be at least 10 mm.

These requirements are not applicable

- for settings that are normally adjusted by the installer during the installation and that can be adjusted by the user only after having removed a detachable cover, or
- for maximum temperature setting of 38 °C.

In giving these indications, a suitable contrast shall be given between indications and background.

NOTE Z101 Guidance on contrast can be found in CEN ISO/TR 22411:2011, 8.5 Z¹⁾. ☐

7.12 ☐ *Modification*

Replace the first sentence in the fourth paragraph of EN 60335-1:2012, by the following:

This appliance can be used by children aged from 3 years and above and persons with reduced physical, sensory or mental capabilities or lack of experience and knowledge if they have been given supervision or instruction concerning use of the appliance in a safe way and understand the hazards involved. ☐

Addition:

The instructions for **open-outlet water heaters** to be used with a spray head shall state that the spray head must be descaled regularly.

The instructions for an appliance not incorporating a flow switch shall include the substance of the following:

WARNING: Do not switch on if there is a possibility that the water in the heater is frozen.

- ☐ Add the substance of the following for single point open outlet water heaters for showering purposes.

'Fit only shower heads recommended by the manufacturer and never fit any additional device to restrict the water outlet flow'. ☐

7.12.1 *Addition:*

The installation instructions for **open-outlet water heaters** shall state that the outlet must not be connected to any tap or fitting other than those specified.

If a pressure relief device is required for **closed water heaters**, the instructions shall state that it must be fitted during installation, unless it is incorporated in the appliance.

The installation instructions for **bare-element water heaters** shall state the substance of the following:

- the resistivity of the water supply must not be less than ... Ωcm;

☐ Z1) CEN ISO/TR 22411:2011, *Ergonomics data and guidelines for the application of ISO/IEC Guide 71 to products and services to address the needs of older persons and persons with disabilities (ISO/TR 22411:2008)*. ☐

- the appliance must be permanently connected to fixed wiring (not necessary if it complies with the requirements for the connection by a supply cord fitted with a plug specified in 13.2 and 24.101);
- the appliance must be earthed (for **class I appliances** only).

When **bare-element water heaters** cannot be emptied, the installation instruction shall state that the appliance is not to be installed in locations where freezing can occur.

In a multiple water outlet system where the water temperature can be set at each individual water outlet, the instructions shall state the substance of the following:

The system shall be installed so that the control for setting the water temperature in normal use installed at a shower outlet shall take priority over any other controls in the system that set the water temperature in normal use at other water outlets.

7.15 *Addition:*

The additional markings for **bare-element water heaters** shall be visible during the installation of the appliance.

7.101 The water inlet and 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.

7.102 **Class I bare-element water heaters** shall be marked to state that the appliance must be earthed.

Compliance is checked by inspection.

The use of a removable label or tag attached to the appliance is an acceptable means of meeting this requirement.

8 Protection against access to live parts

This clause of Part 1 is applicable except as follows.

8.1.5 *Addition:*

The connections to the water mains and electrical supply are assumed to be in position during the test.

The requirement does not apply to wall-mounted appliances intended to be permanently connected to fixed wiring by cables having a nominal cross-sectional area more than 2,5 mm².

However, the cross-sectional area of the cable entry shall not exceed 25 cm² and there shall be no **accessible live parts** within the projection of the opening.

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.

11.7 Replacement:

The appliance is operated until steady conditions are established.

12 Void

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable except as follows.

13.2 Addition:

Bare-element water heaters are tested with water having the resistivity marked on the appliance.

NOTE 101 The appropriate resistivity can be obtained by adding ammonium phosphate to the water.

For class I bare-element water heaters, the leakage current is measured between a metal sieve positioned in the water 10 mm from the orifice of the outlet, and the earthing terminal. For single-phase appliances, the terminals of the heating element are connected through the selector switch to each pole of the supply in turn, as shown in Figure 101. For three-phase appliances, the earthing terminal is connected to the neutral conductor, as shown in Figure 102.

The leakage current shall not exceed 0,25 mA.

*For bare-element water heaters intended to be connected to the power supply by a **supply cord** fitted with a plug, the leakage current test is repeated. During this test, the leakage current is measured between the earthing terminal of the appliance and the neutral conductor, as shown in Figure 103. The leakage current, measured with the selector switch in each position, shall not exceed 2,75 mA.*

14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is applicable except as follows.

15.1.2 Addition:

Wall-mounted appliances are fixed at a distance of 3 mm from the mounting surface, unless the installation instructions specify a larger value.

Ⓒ **15.Z101** Water heaters installed in shower cabinets above shower basins or baths shall be protected against penetration of water and chemicals that can remain on the top of the enclosure.

Appliances allowing a 50 mm diameter, 100 mm high cylinder to be placed on the top when the water heater is mounted in accordance with the manufacturer's instructions shall be subjected to the following test:

A quantity of 0,5 l of water containing approximately 1 % NaCl and 0,6 % of any commercially available rinsing agent may be used, but if there is any doubt with regards to the test results, a rinsing agent, as specified in EN 60335-2-5:2003, Annex AA, is poured over the top of the appliance, the controls being placed in the ON position. The controls are then operated through their working range, this operation being repeated after a period of 5 min.

The appliance shall then withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation that could result in reduction of clearances and creepage distances below the values specified in Clause 29.

Compliance is checked by the relevant test and by inspection. Ⓒ

16 Leakage current and electric strength

This clause of Part 1 is applicable except as follows.

16.2 Addition:

Bare-element water heaters are tested with water having the resistivity marked on the appliance.

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.

19.2 Not applicable.

19.3 Not applicable.

19.4 Addition:

For open-outlet water heaters, flow switches and pressure switches that operate during the test of Clause 11 are short-circuited, the water-control valve being adjusted to the most unfavourable position.

NOTE 101 The closed position of the valve can be the most unfavourable position.

Flow switches of closed water heaters are short-circuited and any pressure relief device rendered inoperative, the outlet valve being closed. However, if the appliance has no flow switch and back-siphonage is likely to occur, the water heater is filled with just sufficient water to cover the heating element and operated with the outlet valve open.

NOTE 102 Back-siphonage is not considered likely to occur if a non-return valve or a pipe interrupter is incorporated in the appliance or if the instructions state that a non-return valve has to be included in the installation.

19.13 Addition:

During the test of 19.4, the water container shall not rupture and the water temperature shall not exceed

- 99 °C, for **open-outlet water heaters** having a capacity exceeding 1 l;
- 140 °C, for **closed water heaters** having a capacity exceeding 1 l.

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 the electrical insulation, unless water cannot accumulate within the enclosure in normal use. The hole shall be at least 5 mm in diameter or 20 mm² in area with a width of at least 3 mm.

Compliance is checked by inspection and by measurement.

22.33 Addition:

The requirement does not apply to **bare-element water heaters**.

22.40 Addition:

Water heaters shall be fitted with an accessible switch to stop the water heating function.

NOTE Z101 A tap is considered a suitable device. **C**

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

*If an **open-outlet water heater** incorporates a valve that regulates the water flow, a water pressure of 2 MPa is applied to the inlet of the appliance, the valve being closed.*

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 5 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.

22.48 Not applicable.

22.50 *Addition:*

The requirement is not applicable provided the maximum temperature of the water from the system cannot exceed 55 °C in normal use.

If the maximum temperature of the water from the system exceeds 55 °C in normal use then the requirement is not applicable provided that the system is such that a shower outlet normal use water temperature control takes precedence in setting the system temperature. In the case of systems with multiple shower outlets, the shower with the lowest temperature setting shall take precedence, the other shower outlets taking precedence over non-shower outlets.

22.51 *Addition:*

The requirement is not applicable provided the maximum temperature of the water from the system cannot exceed 55 °C in normal use.

If the maximum temperature of the water from the system exceeds 55 °C in normal use then the requirement is not applicable provided that the system is such that the shower outlet normal use water temperature control takes precedence in setting the system temperature. In the case of systems with multiple shower outlets, a shower with the lowest temperature setting shall take precedence, the other shower outlets taking precedence over non-shower outlets.

22.101 The **rated pressure of closed water heaters** shall be at least 0,6 MPa.

The **rated pressure of closed water heaters** intended to be supplied by a pressure reducing valve shall be at least 0,1 MPa.

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

Compliance is checked by inspection.

22.102 The outlet water of appliances other than those intended to supply water for showering shall not attain an excessive temperature due to a sudden pressure drop in the water supply.

Compliance is checked by the following test.

*The appliance is operated at **rated power input** with the controls or switching devices adjusted to their most unfavourable possible setting to attain the maximum water temperature. Any regulating valve is fully opened and the water flow is adjusted so that the **flow switch** or the **pressure switch** is on the verge of operating.*

Any control devices that operate during the test of Clause 11 are short-circuited. The water flow is reduced in steps of 10 % per minute until:

- for **closed water heaters**, the **thermal cut-out** incorporated to comply with 22.106 operates or steady conditions are established;
- for **open-outlet water heaters**, a **non-self-resetting thermal cut-out** operates or steady conditions are established.

*If the rupture of a heating element or an **intentionally weak part** leads to a permanent open circuit, the test is repeated on a second sample. This second test shall be terminated in the same mode unless the test is otherwise satisfactorily completed.*

22.103 Closed water heaters having a capacity exceeding 3 l shall be supplied with a pressure relief device that prevents excessive pressure.

Compliance is checked by inspection and by subjecting the appliance to a slowly increasing water pressure.

*The pressure relief device shall operate before the water pressure exceeds the **rated pressure** by more than 0,1 MPa.*

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 in normal use.

Compliance is checked by inspection.

The requirement is considered to be met if the cross-sectional area of the water outlet is not less than that of the inlet.

22.105 Open outlet water heaters incorporating a **flow switch** shall be constructed so that if there is no water flow, the heating element cannot be switched on, and it is switched off if the water flow ceases.

Compliance is checked by inspection and by manual test.

*However, if compliance with this subclause relies on the correct operation of an **electronic circuit**, the appliance is further tested as follows.*

a) *The appliance is operated for one cycle. In addition, the electromagnetic phenomena tests of 19.11.4.1 to 19.11.4.7 are applied during the test. The tests are carried out with surge protective devices disconnected, unless they incorporate spark gaps.*

If there is no water flow, the heating element shall not be switched on, and it is switched off without delay if the water flow ceases.

b) *The appliance is operated for one cycle. The fault conditions in a) to g) of 19.11.2 are then considered and applied one at a time to the **electronic circuit**.*

If there is no water flow, the heating element shall not be switched on, and it is switched off without delay if the water flow ceases.

One cycle consists of opening and closing of the water tap.

*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 Annex R.*

22.106 Closed water heaters shall incorporate a **thermal cut-out** that operates independently from a **thermostat** or **flow switch**. It shall only be possible to reset the **thermal cut-out** after removal of a **non-detachable cover**.

If the capacity does not exceed 1 l and the appliance incorporates a **flow switch**, an alternative **protective device**, such as a **pressure switch**, may be used instead of the **thermal cut-out**.

Compliance is checked by inspection.

22.107 Water shall not attain an excessive temperature in normal use.

Compliance is checked by the following test.

*The appliance is operated at **rated power input**. Any regulating valve is fully opened and the water flow is adjusted so that the flow switch or pressure switch is on the verge of operating.*

The temperature of the outlet water shall not be higher than 95 °C and shall not exceed the temperature of the inlet water by more than 75 K.

For appliances intended to supply water for showering the test is carried out under normal operation and with a water pressure of 0,2 MPa. The temperature of the water at the outlet shall not exceed 55 °C.

22.108 The outlet water of appliances intended to supply water for showering shall not attain an excessive temperature due to a sudden pressure drop in the water supply.

Compliance is checked by the following test.

*The appliance is supplied with water at a pressure of 0,4 MPa. It is operated at **rated power input** with the regulating valve adjusted so that the outlet water temperature is $25\text{ K} \pm 1\text{ K}$ above the inlet water temperature. The water pressure is then reduced to 0,2 MPa within 1 s.*

The outlet water temperature shall not rise by more than 25 K within 10 s.

The outlet water temperature is measured by means of a fine-wire thermocouple placed in the centre of a plastic cylindrical receptacle having a diameter of 30 mm and a height of 12 mm. The receptacle is positioned 25 mm below the shower head.

*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 outlet water temperature shall not rise by more than 25 K within 10 s 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 Annex R.*

22.109 Water containers of **open-outlet water heaters** having a **pressure switch** shall not rupture due to excessive internal pressure.

Compliance is checked by inspection and for

- *appliances having a weak part that is ejected or ruptures when the pressure is excessive, by the test of 22.109.1;*

NOTE 1 Examples of weak parts are diaphragms and plugs.

- *appliances having other means for relieving pressure, by the tests of 22.109.1 and 22.109.3;*
- *appliances having heating elements that*
 - *rupture before the internal pressure is excessive, or*
 - *cannot be energized when the internal pressure is excessive,**by the tests of 22.109.2 and 22.109.3.*

After the tests, the appliance shall comply with Clauses 8 and 16.2.

NOTE 2 The tests simulate a blocked outlet or frozen water in the container.

22.109.1 *The appliance is filled with water, the water outlet being sealed. The water pressure is then steadily increased.*

The weak part shall be ejected or rupture, or the pressure relief device operate, before the internal pressure reaches 1,1 MPa.

After the pressure has been relieved, water is allowed to flow for a period of 1 min.

22.109.2 *The appliance is filled with water, the water outlet being sealed and the inlet valve closed. Controls are short-circuited or open-circuited, whichever is more unfavourable. The appliance is then operated at **rated power input**.*

The heating element shall rupture without causing a hazard unless it remains de-energized.

If the heating element ruptures, the inlet valve is opened and the water pressure steadily increased until it reaches 1,1 MPa. The pressure is maintained for 1 min.

22.109.3 *The appliance is filled with water, the water inlet and outlet being sealed. Controls are short-circuited or open-circuited, whichever is more unfavourable.*

*The appliance is placed as in normal use in an ambient having a temperature not exceeding –5 °C until the water is frozen. The appliance is then placed in the normal ambient and operated at **rated power input**.*

The heating element shall rupture without causing a hazard or any excessive pressure shall be relieved by means of a pressure relief device, unless the heating element remains de-energized.

The appliance is switched off and allowed to reach room temperature.

If the heating element remains de-energized or has ruptured, water is supplied through the inlet and the pressure is steadily increased until it reaches 1,1 MPa. The pressure is maintained for 1 min.

If a pressure relief device has operated, the appliance is connected to the water supply for a period of 1 min with the outlet still sealed.

22.110 *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.

23 Internal wiring

This clause of Part 1 is applicable.

24 Components

This clause of Part 1 is applicable except as follows.

24.1.3 Addition:

Flow switches are tested for 50 000 cycles of operation.

Pressure switches for open-outlet water heaters and pressure switches for appliances intended to supply water for showering only are tested for 20 000 cycles of operation. Pressure switches for other water heaters are tested for 50 000 cycles of operation.

24.1.4 Addition:

Thermal cut-outs incorporated in closed water heaters shall comply with the requirements for type 2B controls in Clauses 13, 15, 16, 17 and 20 of IEC 60730-1, unless they are tested with the appliance.

If a self-resetting thermal cut-out operates during the test of 22.107, the number of cycles of operation is increased to

- 3 000, for water heaters intended to supply water for showering;*
- 1 000, for other appliances.*

24.101 The **thermal cut-out** or other **protective device** incorporated to comply with 22.106 shall be non-self-resetting and, for multi-phase appliances, provide **all-pole disconnection**.

For **bare-element water heaters** intended to be connected to the power supply by a **supply cord** fitted with a non-polarized plug, the **thermal cut-out** or other protected device incorporated in the appliance shall provide **all-pole disconnection**.

Compliance is checked by inspection.

24.102 The **thermal cut-out** or other **protective device**, incorporated for compliance with 22.106 in **closed water heaters** having a capacity not exceeding 1 l, shall maintain its operating characteristics.

Compliance is checked by the following test.

*The appliance is supplied at **rated voltage** and operated under **normal operation** but with any control that operates during the test of Clause 11 short-circuited. The water flow is adjusted so that the temperature of the water increases by approximately 1 K per minute.*

*The **thermal cut-out** is caused to operate five times, the temperatures at which it operates are measured and the mean value determined. The **thermal cut-out** is subjected to 50 000 cycles of temperature fluctuation. Each cycle consists of a variation in temperature between the maximum value measured during the test of 22.107 and half this value.*

*The **thermal cut-out** is then caused to operate 20 times and the mean value of the temperatures at which it operates shall not deviate by more than 20 % from the mean value previously determined.*

*If the **protective device** is sensitive to pressure, the appliance is not energized and is subjected to a slowly increasing water pressure. The mean operating pressure of the **protective device** is determined over five cycles. The **protective device** is subjected to 50 000 cycles of pressure fluctuation. Each cycle consists of a variation in pressure between the **rated pressure** of the appliance and half this value.*

*The **protective device** is then caused to operate 20 times and the mean value of the pressures at which it operates shall not deviate by more than 20 % from the mean value previously determined.*

25 Supply connection and external flexible cords

This clause of Part 1 is applicable.

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 appliances**, 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, which 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.

For **class I bare-element water heaters**, the water shall enter and leave through metal pipes that are permanently and reliably connected to the earthing terminal or flow over metal parts that are similarly earthed.

NOTE 101 Examples of such metal parts are grids or rings.

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.

30.2.2 Not applicable.

30.2.3.1 Modification:

*This test is not applicable to parts of insulating material supporting the heating elements and their connections of **bare-element water heaters**.*

30.2.3.2 Modification:

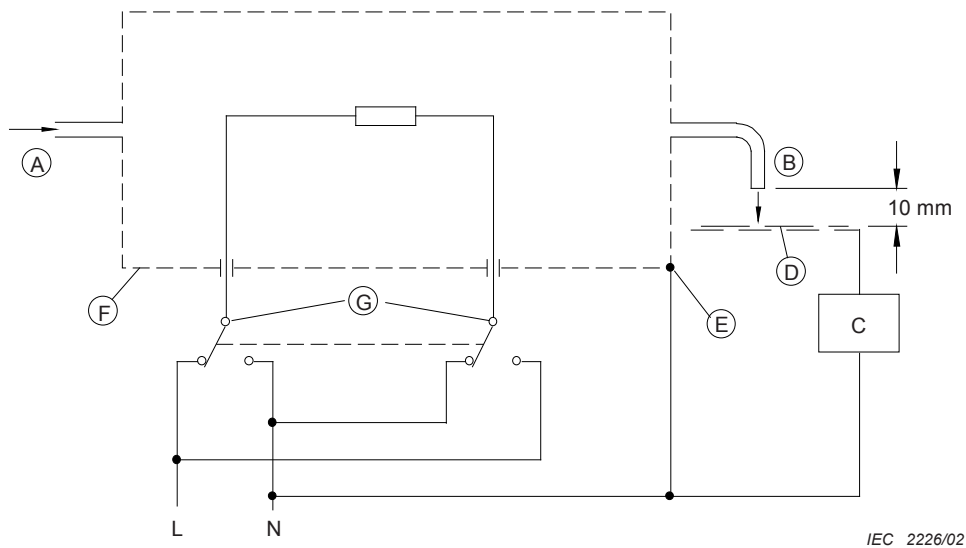
*For **bare-element water heaters**, the glow wire test is carried out on parts of insulating material supporting the heating elements and their connections as specified for other connections.*

31 Resistance to rusting

This clause of Part 1 is applicable.

32 Radiation, toxicity and similar hazards

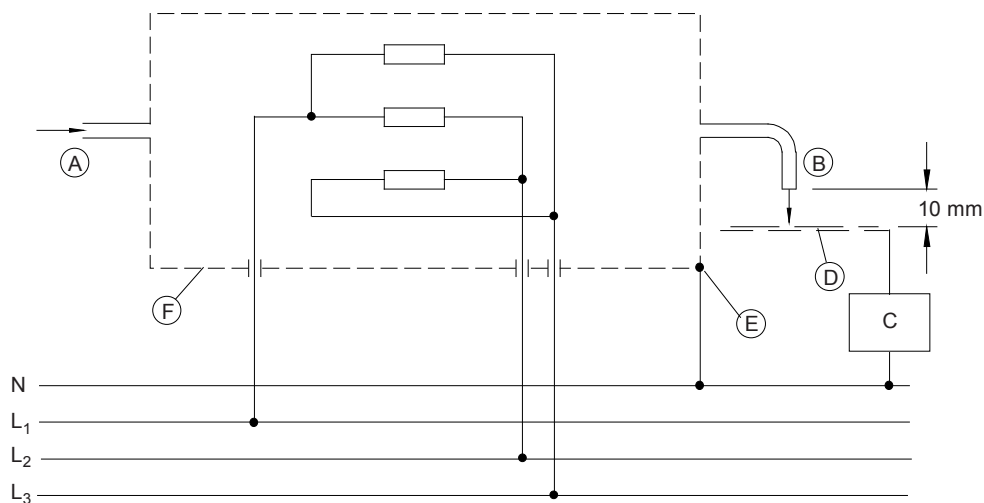
This clause of Part 1 is applicable.



Key

- A water inlet
- B water outlet
- C circuit of Figure 4 of IEC 60990
- D metal sieve
- E earthing terminal
- F body of the water heater
- G selector switch

Figure 101 – Diagram for the leakage current measurement for single-phase bare-element water heaters

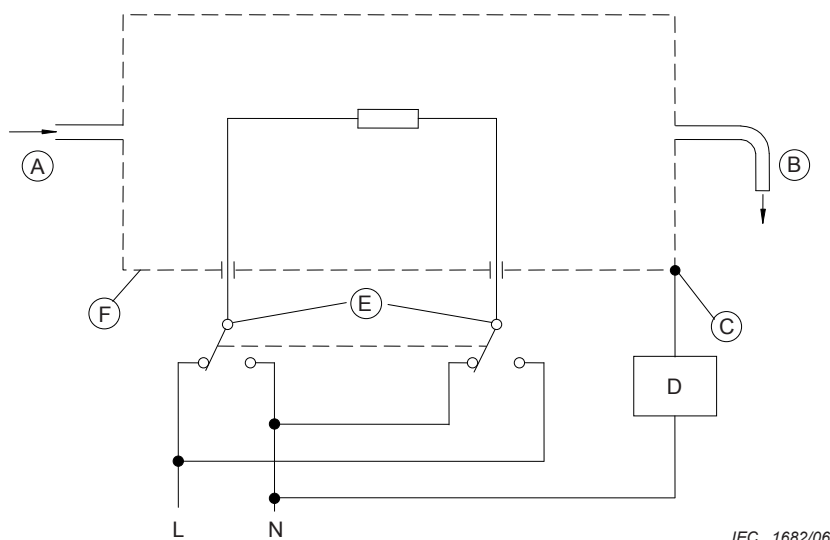


IEC 2227/02

Key

- A water inlet
- B water outlet
- C circuit of Figure 4 of IEC 60990
- D metal sieve
- E earthing terminal
- F body of the water heater

Figure 102 – Diagram for the leakage current measurement for three-phase bare-element water heaters



IEC 1682/06

Key

- A water inlet
- B water outlet
- C earthing terminal
- D low impedance milliammeter
- E selector switch
- F body of the water heater

Figure 103 – Diagram for the leakage current measurement for single-phase bare-element water heaters supplied by a supply cord fitted with a plug

Annexes

The annexes of Part 1 are applicable except as follows.

Annex A (informative)

Routine tests

This annex of Part 1 is applicable except as follows.

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 **open-outlet water heaters**, 0,05 MPa;*

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

Leakage of the fluid is not to 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, 22.105 and 22.108 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, 22.105 and 22.108 is impaired.

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 60335-2-15 NOTE Harmonized as EN 60335-2-15. ☐

IEC 60335-2-21, *Household and similar electrical appliances – Safety – Part 2-21: Particular requirements for storage water heaters*

☐ IEC 60335-2-21 NOTE Harmonized as EN 60335-2-21. ☐

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

☐ IEC 60335-2-75 NOTE Harmonized as EN 60335-2-75. ☐

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