INTERNATIONAL STANDARD

IEC 60335-2-35

Edition 4.1
2006-11

Edition 4:2002 consolidated with amendment 1:2006

Household and similar electrical appliances – Safety –

Part 2-35: Particular requirements for instantaneous water heaters

*This **English-language** version is derived from the original **bilingual** publication by leaving out all French-language pages. Missing page numbers correspond to the French-language pages.*

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CONTENTS

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

This consolidated version of IEC 60335-2-35 consists of the fourth edition (2002) [documents 61/2170/FDIS and 61/2251/RVD] and its amendment 1 (2006) [documents 61/3088/FDIS and 61/3144/RVD].

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience.

It bears the edition number 4.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

The French version of this standard has not been voted upon.

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 fourth edition (2001) 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 electric 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 following differences exist in the countries indicated below.

– 6.1: Bare-element water heaters are not allowed (Greece, India, Indonesia, Israel, Malaysia, Singapore, and Turkey).
– 6.1: Class 0I appliances are allowed (Japan).
– 7.1: Closed water heaters having a rated pressure less than 1,0 MPa have to be marked with a statement that a pressure reducing valve is to be fitted in the installation (Sweden).
– 7.1: Marking of rated pressure is different and marking of water resistivity is not required (USA).
– 7.12: Information concerning the removal of air from bare-element water heaters has to be given (Poland).
– 7.12.1: The installation of bare-element water heaters has to comply with particular conditions dependent on the supply system and which are to be included in the instructions (France, Poland and Spain).
– 19.4: Flow switches tested for reliability are not short-circuited (USA).
– 19.13: The water temperature in closed water heaters having a capacity in excess of 15 l is limited to 99 °C (Israel, Norway and United Kingdom).
– 19.13: The water temperatures are different (USA).
– 22.101: For closed water heaters, the minimum rated pressure is 1,0 MPa (Norway).
– 22.103: Closed water heaters having a capacity in excess of 15 l have to be provided with a pressure relief device (Israel).
– 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).

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the maintenance result 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.

The contents of the corrigendum of April 2007 have been included in this copy.

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.

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.

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 standard deals with the common hazards presented by appliances which are encountered by all persons in and around the home. However, in general, it does not take into account

– the use of appliances by young children or infirm persons without supervision;
– playing with the appliance by young children.

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 boiling water (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.

3 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 **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 The operating pressure may 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
switch that operates in response to a flow of water

3.107
pressure switch
switch 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 may 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 °C ± 5 °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 A higher degree of protection may be required depending on the zone in which the water heater is installed, as specified in IEC 60364.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 *Addition:*

NOTE 101 The minimum rated frequency **for bare-element water heaters** is 50 Hz.

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

Bare-element water heaters shall be marked with the substance of the following:

The water resistivity must not be less than… Ωcm.

NOTE 102 The value of the water resistivity is not to exceed 1 300 Ωcm at a temperature of 15 °C.

7.12 *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 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.

NOTE 101 This warning is not required if the appliance incorporates a **flow switch**.

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;
– 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.

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.

NOTE 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.

NOTE The marking may be on a removable label or tag attached to the appliance.

8 Protection against access to live parts

This clause of Part 1 is applicable except as follows.

8.1.5 *Addition*:

NOTE 101 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 mm^2. However, the cross-sectional area of the cable entry shall not exceed 25 cm^2 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 may 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.

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 may 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:*

NOTE 101 The water container is considered to be an enclosure.

During the test of 19.4, the 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 condensed 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**.

22.101 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 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 maintained 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.

22.103 **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 may 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.

NOTE 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 Appliances 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.

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 only, 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 only 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 K ± 1 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.

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.

NOTE 3 When carrying out the tests, precautions have to be taken against the consequences of explosive rupture.

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 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****.*

NOTE The orientation of the appliance at low temperature is the same as in normal use.

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 waters heaters intended to supply water for showering only;*

– *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*:

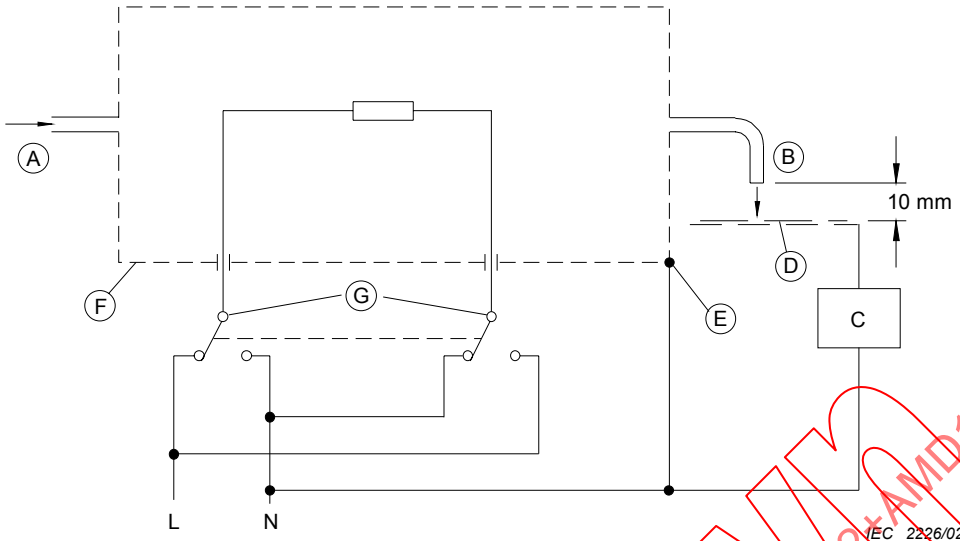
For ***bare-element water heaters****, the glow wire test is carried out on parts of insulating material supporting the heating elements and their connections as specified for other connections.*

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