IEC 60335-2-81

Edition 4.0 2024-10
COMMENTED VERSION

INTERNATIONAL STANDARD

colour inside

Household and similar electrical appliances – Safety – Part 2-81: Particular requirements for foot warmers and heating mats

IEC 60335-2-81:2024-10 CMV(en)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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 commented version (CMV) of the official standard IEC 60335-2-81:2024 edition 4.0 allows the user to identify the changes made to the previous IEC 60335-2-81:2015+AMD1:2017+AMD2:2020 CSV edition 3.2. Furthermore, comments from IEC TC 61 experts are provided to explain the reasons of the most relevant changes, or to clarify any part of the content.

A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text. Experts' comments are identified by a blue-background number. Mouse over a number to display a pop-up note with the comment.

This publication contains the CMV and the official standard. The full list of comments is available at the end of the CMV.

IEC 60335-2-81 has been prepared by IEC technical committee 61: Safety of household and similar electrical appliances. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2015, Amendment 1:2017 and Amendment 2:2020. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) alignment with IEC 60335-1:2020;
b) conversion of some notes to normative text (Clause 1, 13.2, 16.2, 21.103, 21.104, 21.105, 21.106);
c) addition of test probe 19 for accessibility (8.1.1, 8.1.3, 20.2, B.22.3, B.22.4);
d) addition of external surface temperatures (Clause 11);
e) addition of the test of 21.107 for control units intended to be placed on a surface;
f) alignment of 30.102 with IEC 60335-2-17.

The text of this International Standard is based on the following documents:

Draft	Report on voting
61/7272/FDIS	61/7298/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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.

This part 2 is to be used in conjunction with the latest edition of IEC 60335-1 and its amendments unless that edition precludes it; in that case, the latest edition that does not preclude it is used. It was established on the basis of the sixth edition (2020) 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: Particular requirements for foot warmers and heating mats.

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: Class 0 appliances are allowed if their rated voltage does not exceed 150 V (Japan)

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

NOTE 4 The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations can 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.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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 ~~may~~ 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 and generic standards~~ 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. ~~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.~~ **1**

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. **2**

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-81: Particular requirements for foot warmers and heating mats

1 Scope

This clause of Part 1 is replaced by the following.

This part of IEC 60335 deals with the safety of electric **foot warmers** and **heating mats** for household and similar purposes, their **rated voltage** being not more than 250 V, including direct current (DC) supplied appliances and **battery-operated appliances**. 3

Appliances not intended for normal household use but which nevertheless ~~may~~ can be a source of danger to the public, such as appliances intended to be used by ~~laymen~~ laypersons 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 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.

~~NOTE 101 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.~~

Additional requirements can be necessary for appliances intended to be used in vehicles or on-board ships or aircraft. In many countries, additional requirements are specified by the national health authorities, the national authorities responsible for the protection of labour, the national water supply authorities and similar authorities.

~~NOTE 102~~ This standard does not apply to:

– appliances specifically intended for use under medical supervision;
– electric blankets and pads (IEC 60335-2-17);
– electrically heated carpets (IEC 60335-2-106);
– electrical heating appliances for breeding and rearing animals (IEC 60335-2-71).

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

IEC 60320-1, *Appliance couplers for household and similar general purposes – Part 1: General requirements*

~~IEC 60320-3, *Appliance couplers for household and similar general purposes – Part 3: Standard sheets and gauges*~~

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

ISO 2439, *Flexible cellular polymeric materials – Determination of hardness (indentation technique)*

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1 Definitions relating to physical characteristics

3.1.9 ~~*Replacement*~~ *Modification:*
normal operation

Replace the first paragraph with the following:

operation of the appliance under the following conditions:

Foot warmers are unfilled and placed on a horizontal surface.

Heating mats are placed on a horizontal surface and covered by a piece of expanded polystyrene having dimensions approximately 300 mm × 150 mm × 50 mm.

Note 101 to entry: The density of the polystyrene is approximately 20 kg/m^3 ± 5 kg/m^3.

3.5 Definitions relating to types of appliances

3.5.101
foot warmer
appliance into which the user's feet are inserted in order to warm them

3.5.102
heating mat
appliance having an area not exceeding 0,5 m^2, on which the user's feet are placed in order to warm them

3.6 Definitions relating to parts of appliances

3.~~103~~6.101
heating element with PTC characteristics
heating element of the appliance consisting of a pair of conductors separated by conductive material that has a rapid non-linear increase in resistance when the temperature is raised through a particular range

3.6.102
control unit
device, external to the functional part, by means of which the power input of the appliance or the temperature of the functional part can be adjusted or regulated **4**

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:*

A 15 m length of heating element or internal wiring is required for the tests of 21.102.

*Twelve samples of the enclosure material of **foot warmers**, each having dimensions 200 mm × 100 mm, are required for the test of 30.101.*

5.3 *Addition:*

Washable appliances are laundered twice in accordance with the instructions before testing is started.

*The tests of Clause 13, Clause 15 and Clause 16 are not carried out on **class III appliances** having a **rated voltage** not exceeding 24 V or on **class III constructions** having a **working voltage** not exceeding 24 V.*

5.5 *Addition:*

*If the appliance is provided with a **detachable cover**, the tests are carried out with or without this cover, whichever is more unfavourable.*

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 *Modification:*

Replace the first paragraph with the following:

Appliances shall be **class II** or **class III**.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 *Addition:*

Washable appliances shall be marked with symbol ISO 7000-3114 (~~2012-04~~2011-10) and with symbol ISO 7000-3124 (~~2012-04~~2011-10).

Appliances to be used with a **detachable control unit** shall be marked with the reference of the **control unit** to be used. **5**

7.6 *Addition:*

[symbol ISO 7000-3114 (~~2012-04~~2011-10)] do not dry clean

[symbol ISO 7000-3124 (~~2012-04~~2011-10)] do not bleach

7.12 *Addition:*

The instructions shall ~~state the substance of~~ include the following:

– the appliance is not to be used if there are signs of damage;
– the appliance is not to be used for warming animals;
– details regarding laundering or cleaning.

The instructions for **foot warmers** shall state that outdoor shoes must be removed before use.

The instructions for **heating mats** shall state that the appliance has to be repaired or replaced if the cover is worn. They shall explain how such wear can be observed.

The instructions for **foot warmers** intended to be used after preheating without supply and incorporating an appliance inlet shall state that the cord set must be disconnected from the supply after preheating.

If symbol ISO 7000-3114 (~~2012-04~~2011-10) and symbol ISO 7000-3124 (~~2012-04~~2011-10) are used, their meaning shall be explained.

The instruction for appliances with **detachable control units** shall state that the appliances are only to be used with the type that is marked on the appliances. **6**

7.101 Detachable control units shall be marked with a reference number or by other means of identification.

Compliance is checked by inspection. **7**

8 Protection against access to live parts

This clause of Part 1 is applicable except as follows.

8.1.1 *Addition:*

In addition to the use of test probe 18, test probe 19 of IEC 61032 is also applied wherever test probe 18 is used and with the same test conditions used for test probe 18. **8**

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 except as follows.

10.101 The power input of appliances incorporating **heating elements with PTC characteristics** shall significantly decrease with an increase in temperature.

Compliance is checked by the following test.

*The appliance is supplied at **rated voltage** and operated under **normal operation**. The power input shall have decreased by at least 50 % from the initial value when steady conditions are established, any control operating during this period being short-circuited.*

11 Heating

This clause of Part 1 is applicable except as follows:

11.2 *Modification:*

Appliances are placed as near as possible to one wall of the test corner and away from the other wall.

11.3 *Addition:*

~~*Thermocouples attached to the small blackened disks are also used for measuring the temperature rise of the surface of the appliance.*~~

*Where the external **accessible surfaces** are suitably flat and access permits, then the test probe of Figure 101 is 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. **9**

11.7 ~~*Replacement*~~ *Modification:* **10**

Replace the first paragraph with the following:

Appliances are operated until steady conditions are established.

11.8 *Modification:*

Replace the first paragraph with the following:

During the test, the temperature rises are monitored continuously and shall not exceed the values shown in Table 3 and Table 101. **11**

Add the following to footnote "k" of Table 3:

Similar parts held for short periods include handles or grips of vents and air shutters. **12**

Addition:

When polyvinyl chloride is used for insulating heating elements, the temperature rise of the insulation shall not exceed 80 K.

~~*Addition:*~~

~~*The temperature rise of surfaces likely to be in contact with the user's feet shall not exceed 40 K.*~~

Table 101 – Maximum temperature rises for specified external and other surfaces under normal operating conditions

Surface	*Temperature rise of external and other accessible surfaces* K
Surfaces likely to be in contact with the user's feet	*40*
Other surfaces of:	
– *bare metal*	*38*
– *coated metal* [a]	*42*
– *glass and ceramic*	*51*
– *plastic and plastic coating > 0,4 mm* [b, c]	*58*
NOTE The temperature rise limits of handles, knobs, grips, keyboards, keypads and similar parts are specified in Table 3.	
[a] *Metal is considered coated when a coating having a minimum thickness of 90 µm made of enamel, powder or non-substantially plastic coating is used.*	
[b] *The temperature rise limit of plastic also applies for plastic material having a metal finish of thickness less than 0,1 mm.*	
[c] *When the thickness of the plastic coating does not exceed 0,4 mm, the temperature rise limits of coated metal for underlying metal apply or the temperature rise limits for glass or ceramic material for underlying glass or ceramic material apply.*	

12 ~~Void~~ Charging of metal-ion batteries

This clause of Part 1 is applicable. **13**

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable except as follows.

13.2 ~~*Modification*~~ *Addition:*

*When testing the top surface of **heating mats**, the dimensions of the metal foil are 300 mm × 150 mm.*

~~NOTE 101~~ *If the **heating mat** is reversible, each surface is tested in turn.*

~~*Addition:*~~

***Foot warmers** are also tested with the inside surface completely covered with metal foil.*

14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is applicable except as follows.

15.1.1 *Addition:*

Appliances are subjected to the test of IEC 60529:1989, 14.2.1. However, cord sets, switches and controls in the flexible cord are not subjected to the tests.

15.1.2 *Addition:*

***Foot warmers** are orientated so that the base of the appliance is in contact with the support.*

Appliance inlets are covered before carrying out the test.

16 Leakage current and electric strength

This clause of Part 1 is applicable except as follows.

16.2 ~~*Modification*~~ *Addition:*

*When testing the top surface of **heating mats**, the dimensions of the metal foil are 300 mm × 150 mm.*

~~NOTE 101~~ *If the **heated mat** is reversible, each surface is tested in turn.*

~~*Addition:*~~

***Foot warmers** are also tested with the inside surface completely covered with metal foil.*

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 *Addition:*

The appliance is covered partially or completely, whichever is more unfavourable, with a sheet of open-cell polyether approximately 36 mm thick, having the following properties:

- *cell count* *18 $^{+2}_{0}$ per cm;*
- *specific mass* *30 kg/m^3 + $^{+10}_{0}$ %;*
- *hardness* *120 N to 170 N at 40 % impression, measured according to ISO 2439.*

*If the **foot warmer** has a flexible part that covers the user's legs, this part is folded onto the foot part before covering.*

*A plywood board, having dimensions approximately 500 mm × 500 mm × 20 mm, is placed on top of the polyether sheet covering **foot warmers**.*

19.4 ~~*Modification*~~ *Addition:*

***Heating mats** are tested without being covered by the polystyrene block.*

19.13 *Addition:*

The temperature rise of the insulation of heating elements shall not exceed 145 K.

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.2 *Addition:*

For parts of appliances situated not more than 850 mm above the floor after installation or in normal use, in addition to the use of test probe 18, test probe 19 of IEC 61032 is also applied wherever test probe 18 is used and with the same test conditions used for test probe 18. **14**

21 Mechanical strength

This clause of Part 1 is applicable except as follows.

21.1 *Addition:*

***Foot warmers** are also subjected to the test of 21.101. **Control units** intended to be placed on a surface are also subjected to the test of 21.107.* **15**

21.2 *Addition:*

This requirement is not applicable to textiles and similar materials forming the enclosure.

21.101 *A plywood board, having dimensions approximately 300 mm × 150 mm × 20 mm with rounded edges, is placed in the leg section of the **foot warmer** as shown in ~~Figure 101~~ Figure 102. A load of 30 kg is placed on the board, which is allowed to drop freely from a height of 200 mm above the base, so that the leg section is flexed, and the appliance is compressed between the board and the supporting surface. The total mass of the board, its movable support and the load is 30 kg. If the **foot warmer** does not have a leg section, the board is allowed to fall onto the top surface.*

The test is carried out 1 000 times at a rate of six times per minute.

The test shall not result in

- *damage to the enclosure or displacement of heating elements to such an extent that compliance with the standard is impaired;*
- *open-circuiting of heating elements or controls;*
- *breakage of more than 10 % of the strands of internal wiring;*
- *failure of constructional stitching, or breakage of glued or welded joints, to such an extent that compliance with the standard is impaired.*

NOTE An example of damage to the enclosure that could impair compliance with the standard is a tear in the enclosure. Small holes in textiles that are not part of electrical insulation or do not provide protection against moisture are ignored.

21.102 The insulation of heating elements and internal wiring shall retain adequate flexibility and insulating characteristics throughout the life of the appliance.

Compliance is checked by the tests of 21.~~102.1~~103 and by the tests of 21.~~102.2~~104 and 21.~~102.3~~105 when the insulation exceeds

- *a temperature rise of 50 K during the test of Clause 11, or*
- *a temperature rise of 110 K during the tests of Clause 19.*

The tests are carried out on separate samples of heating element or internal wiring.

For the test of 21.~~102.1~~103, one sample measuring approximately 4 m in length is required. For the tests of 21.~~102.2~~104, at least 12 samples are required, each having a length of 300 mm. For the test of 21.~~102.3~~105, 12 samples are required, each having a length of 300 mm.

21.~~102.1~~103 *The sample of heating element or internal wiring is attached to the equipment shown in ~~Figure 102~~ Figure 103. This equipment has a carrier with two pulleys, each having a groove with a radius of 4 mm, the diameter at the base of the groove being 25 mm.*

~~NOTE 1~~ *For samples not having a circular cross-section, the form of the groove in the pulley is suitably modified. The pulleys are arranged so that the sample is horizontal where it passes between them.*

The sample is stretched over the pulleys, each end being loaded with a mass of 0,25 kg. If necessary, the mass at each end is increased in steps of 0,1 kg in order to ensure that the wires leaving the pulleys are parallel to each other. Restraining clamps are positioned so that the pull is always applied by the mass in the opposite direction from which the carrier is moving.

The carrier moves over a distance of 1 m with a constant speed of approximately 0,33 m/s for 25 000 cycles.

~~NOTE 2~~ *A cycle is two movements, one in each direction.*

The sample shall not break during the test.

~~NOTE 3~~ *A monitoring current not exceeding 50 mA can be passed through the sample during the test to detect breakage of the conductor.* **16**

*For **heating elements with PTC characteristics**, the power input is measured before and after the test. The measurement is made with the heating element suspended vertically in free air and supplied at the **rated voltage** of the appliance. Both measurements are carried out at the same ambient temperature and when the power input has stabilized. The power input shall not increase during the test.*

The sample is then immersed in water containing approximately 1 % NaCl. A DC voltage of approximately 500 V is applied between the conductor and the saline solution.

The insulation resistance is measured 1 min after immersion and shall be at least 1 MΩ.

21.~~102.2~~104 *The conductors are pulled out from 12 samples of heating element or internal wiring. If this is not possible, the insulation is slit longitudinally, the conductor is removed and the insulation allowed to close.*

Six of the samples are conditioned by suspending them vertically so that they hang freely in a heating cabinet at a temperature of 125 °C ± 2 °C for 336 h. The samples are removed from the cabinet and allowed to cool down to ***room temperature****. When the material has stabilized, the length of the samples is measured and shall not be less than 90 % of the original length.*

~~NOTE~~ *PVC material ~~is considered to~~ will have stabilized by 16 h after removal from the cabinet.*

The heating cabinet shall have forced air circulation in order to ensure that there is no temperature gradient over the length of the samples.

The 12 samples are placed in a tensile machine, in turn, so that the length between the clamps is at least 50 mm. The machine is operated at a uniform speed of 500 mm/min ± 50 mm/min. The force and elongation at the instant of rupture are determined.

Results obtained from any sample that ruptured at a force differing from the average value by more than 10 %, and from samples that ruptured within a distance of 15 mm from the clamp, are disregarded. Additional samples are tested in order to obtain 12 valid results.

The elongation of each of the unconditioned samples shall not be less than 100 % and their tensile strength shall not be less than 8,75 MPa.

The average value of both the elongation and tensile strength of the conditioned samples shall be not less than 75 % of the average value determined for the unconditioned samples.

21.~~102.3~~105 *A 10 mm length of insulation is removed from each end of 12 samples of heating element or internal wiring.*

Six of the samples are wound in a close helix of six turns on a metal mandrel having a diameter approximately equal to the external diameter of the samples. Together with the remaining six samples, they are placed in a heating cabinet at a temperature of 125 °C ± 2 °C for 336 h. The samples are removed from the cabinet and allowed to cool down to ***room temperature****.*

When the material has stabilized, the other six samples are also wound on the mandrel in the same way.

~~NOTE~~ *PVC material ~~is considered to~~ will have stabilized by 16 h after removal from the cabinet.*

The heating cabinet shall have forced air circulation in order to ensure that there is no temperature gradient over the length of the samples.

The mandrel is immersed for 1 h in water containing approximately 1 % NaCl. The samples are then subjected to a test voltage of 1 000 V for ***class II appliances*** *and 500 V for* ***class III appliances****. The voltage is applied for 1 min between the conductors and the solution and there shall be no breakdown.*

The samples are unwound from the mandrel and inspection shall show that there are no visible cracks.

21.~~103~~106 Heating elements with PTC characteristics shall be resistant to crushing.

Compliance is checked by the following test.

The flexible part is fully supported by a piece of plywood 20 mm thick and supplied as specified in 11.4. When steady conditions are established, the temperature of the heating element is measured. A block having dimensions of 100 mm × 300 mm and a mass of 80 kg with rounded edges in contact with the flexible part is applied for 5 min to the surface in the most unfavourable place. After removing the block, the appliance is again operated until steady conditions are established and the temperature of the heating element is measured. The temperature of the heating element where the block has been applied shall not have increased by more than 10 K.

~~NOTE 1 The edges of the block in contact with the flexible part are rounded.~~

NOTE ~~2~~ The most unfavourable place to apply the block is usually at a loop in the element.

21.107 *The **control unit** is dropped from a height of 40 mm onto a rigidly mounted steel plate having a thickness of at least 15 mm and a mass of at least 15 kg. It is dropped so that it lands on its base, the test being carried out 100 times.*

*The **control unit** is then dropped three times from a height of 500 mm onto a hardwood floor by pulling it from a horizontal support by means of its cord so that it falls freely.*

*After the test, the **control unit** shall not be damaged to such an extent that compliance with this standard is impaired. If the **control unit** still operates, the appliance shall withstand the tests of Clause 11.* **17**

22 Construction

This clause of Part 1 is applicable except as follows.

22.101 Appliances shall be constructed so that heating elements and internal wiring are retained in their intended position. No part of the heating element shall cross over another part of the heating element.

Crossing of internal wiring shall be avoided ~~as far as possible. When this is unavoidable,~~ unless the wiring ~~shall be~~ is secured in order to prevent any relative movement.

Compliance is checked by inspection.

22.102 There shall be no ~~significant~~ change in the position of the heating elements that impairs compliance with this standard if the stitching retaining them in position is broken.

Compliance is checked by inspection after breaking the thread in the most unfavourable place.

22.103 The insulation of heating elements and internal wiring, except in **class III appliances**, shall be integral with the conductor.

Compliance is checked by inspection.

22.104 Heating mats shall be constructed so that exposure of insulation of heating element and internal wiring shall be readily observed.

Compliance is checked by inspection after removing other materials such as carpet pile. The colours of the insulation shall be different from the colours of the other materials.

22.105 The appliance inlet in **foot warmers** shall be positioned so that the connector is not in contact with the floor.

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 *Modification:*

Switches are tested for 6 000 cycles of operation.

24.1.4 *Modification:*

Thermostats are operated for 100 000 cycles of operation and **self-resetting thermal cut-outs** for 10 000 cycles of operation.

24.1.5 *Addition:*

All parts of IEC 60320-1 are applicable except for those that make reference to the connectors in the standard sheets of IEC 60320-3.

24.2 ~~*Modification*~~ *Addition:*

Appliances may be fitted with switches and ~~controls~~ **control units** in flexible cords.

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows.

25.5 *Addition:*

Type Z attachment is allowed.

25.14 *Addition:*

*The test is applicable to appliances fitted with a **non-detachable flexible cord**. It also applies to switches and ~~controls~~ **control units** fitted in the flexible cord.*

25.15 *Modification:*

The pull force for appliances with a mass of 1 kg or less is increased to 60 N.

Flexible cords connected to switches and **control units** are subjected to a pull force of 60 N and a torque of 0,1 Nm. **18**

26 Terminals for external conductors

This clause of Part 1 is applicable.

27 Provision for earthing

This clause of Part 1 is applicable.

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 except as follows.

29.1.3 *Addition:*

*The **clearance** between the engagement face and contact tubes of appliance couplers used for supplying the flexible part shall be at least 3,5 mm.*

29.2 *Addition:*

The microenvironment is pollution degree 3 unless the insulation is enclosed or located so that it is unlikely to be exposed to pollution during normal use of the appliance.

29.3 *Addition:*

The requirement does not apply to the part containing heating elements.

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

30.1 *Addition:*

The test is not applied to enclosures that are likely to be flexed in normal use.

Modification:

Connectors of resilient plastic material are not subjected to the ball pressure test but are subjected to a pressure test using an apparatus similar to that shown in ~~Figure 105~~ Figure 104, the test being made in a heating cabinet at a temperature of 100 °C ± 2 °C.

The specimen is clamped between steel jaws, having a cylindrical face of 25 mm radius, a width of 15 mm and a length of 50 mm. The corners are rounded with a radius of 2,5 mm.

The specimen is clamped in such a way that the jaws press against it in the area where it is gripped in normal use, the centre line of the jaws coinciding as nearly as possible with the centre of this area.

The force applied through the jaws is 20 N.

After 1 h, the jaws are removed and the specimen shall show no damage ~~within the meaning of~~ impairing compliance with this standard.

30.2 *Modification:*

The test is not carried out on textiles and similar materials forming the enclosure of ***foot warmers****.*

30.2.2 Not applicable.

30.2.3.2 *Addition:*

The needle-flame test is not carried out on textile materials.

30.101 Textiles and similar materials forming the enclosure of **foot warmers** shall be adequately resistant to ignition.

Compliance is checked by a spark ignition test that is carried out on ~~six~~ three samples of the material. Each sample has dimensions approximately 200 mm × 100 mm. Any pieces of heating element and trimming are removed from the samples.

The test fixture, as shown in ~~Figure 103~~ Figure 105, has two brass electrodes 3 mm in diameter that are supported by brass pillars mounted on a base plate of insulating material so that their axes are aligned. The base plate also supports a platform of insulating material, having dimensions of 100 mm × 100 mm, and located centrally between the brass pillars. Provision is made for the height of the platform to be adjusted.

One of the electrodes is fixed in position while the other electrode is movable, thus allowing the sample to be inserted. The tip of the fixed electrode has an angle of 45°. The electrode is positioned so that the point furthest from the brass pillar is at the top and at a distance of approximately 3 mm from the centre of the platform. The movable electrode has a flat end.

The lower member of a two-part hardwood mask, as shown in detail A of ~~Figure 103~~ Figure 106, is placed on the adjustable platform in the position indicated.

The test fixture, including the upper member of the mask as shown in detail B of ~~Figure 103~~ Figure 106, is placed in a heating cabinet having a door with an inspection window, air being circulated by natural convection. The electrodes are connected in series with an adjustable non-inductive resistor to a supply having a sinusoidal output voltage of 10 kV and a characteristic such that the output voltage does not decrease by more than 100 V when a current of 1 mA is flowing.

The temperature of the heating cabinet is raised to 65 °C ± 2 °C. The electrodes are then short-circuited, and the resistor adjusted so that a current of 1 mA flows. The supply is then disconnected, and the samples are placed in the cabinet for a period of 3 h.

Without removing the fixture from the heating cabinet, the movable electrode is withdrawn and one sample is pulled over the fixed electrode so that the electrode is situated centrally in the space normally occupied by the heating element. The sample is adjusted so that its end is approximately level with the edge of the adjustable platform. The movable electrode is then inserted into the other end of the element space and is fixed so that the distance between the electrodes is 6,0 mm ± 0,1 mm. The sample is smoothed out and the upper member of the mask is placed in position. The door of the heating cabinet is then closed for a further period of 5 min in order to stabilise the temperature.

The supply is switched on and sparks are allowed to pass between the electrodes for a period of 2 min. ~~If the sample ignites, the time from the instant of switching on until the flame reaches~~

~~*the inner edge of the mask is recorded, any ignition of surface fibres that last no more than 3 s being ignored. If the sample does not ignite, a time of 120 s is recorded.*~~ *Any ignition shall not reach the inner edge of the mask.* **19**

The sample is then removed and repositioned between the electrodes with the other surface uppermost and so that the opposite end is subjected to the test.

The test is repeated on the other ~~*five*~~ *two* **20** *samples.*

~~*If any time recorded is less than 30 s, the complete test is repeated on a second set of six samples. In this case, no sample shall have a recorded time less than 30 s.*~~

~~*The average of the 12 values recorded is calculated and shall not be less than 80 s. All values differing by more than 30 s from the average are ignored and, if necessary, the average of the remaining values is recalculated.*~~ **21**

30.102 The insulation of heating elements and internal wiring, including connections other than connections to the appliance inlet, shall be sufficiently resistant to abnormal heat and fire.

Compliance is checked by the following test.

A sample of the heating element or internal wiring including connections at least 150 mm long is supported by a grid inclined at 45°. The grid is formed from parallel wires 0,6 mm in diameter, spaced 20 mm apart and it is large enough to fully support the sample. The sample is positioned perpendicular to the horizontal wires and centrally between the other wires.

A second grid of similar dimensions is placed on top of the sample so that its horizontal wires are displaced by 10 mm from the horizontal wires of the first grid.

~~*The grid is mounted at the centre of a three-sided metal screen in a substantially draught-free location. The screen is approximately 900 mm high, 450 mm wide and 300 mm deep, of rectangular plan with open front and closed top.*~~

The wires of both grids that are parallel to the sample are aligned with each other.

~~*A needle flame, as specified in IEC 60695-11-5, is applied to the sample and is maintained until the insulation ceases to burn.*~~

The two grids are placed centrally within the laboratory fume-hood or chamber as specified in IEC 60695-11-5 and are held in position so that there is no movement during the test.

A needle flame, as specified in IEC 60695-11-5:2016, Figure 2a, is applied to the sample at a point mid-way between the wires, so that the tip of the flame is in contact with the surface of the sample and near its lower end. Additionally, if there are connections to be tested, the needle flame, as specified in IEC 60695-11-5:2016, Figure 2a, is applied to the sample so that the tip of the flame is in contact with the surface of the insulation of the connection.

The flame is maintained until the test specimen ceases to burn.

The test is repeated on two additional samples.

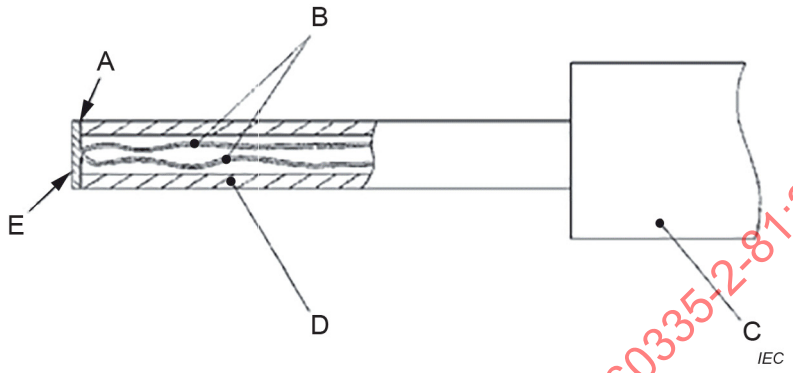
In any of the test specimen the length of the sample damaged by fire shall not exceed 65 mm, measured from the point where the flame is applied. **22**

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 adhesive

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

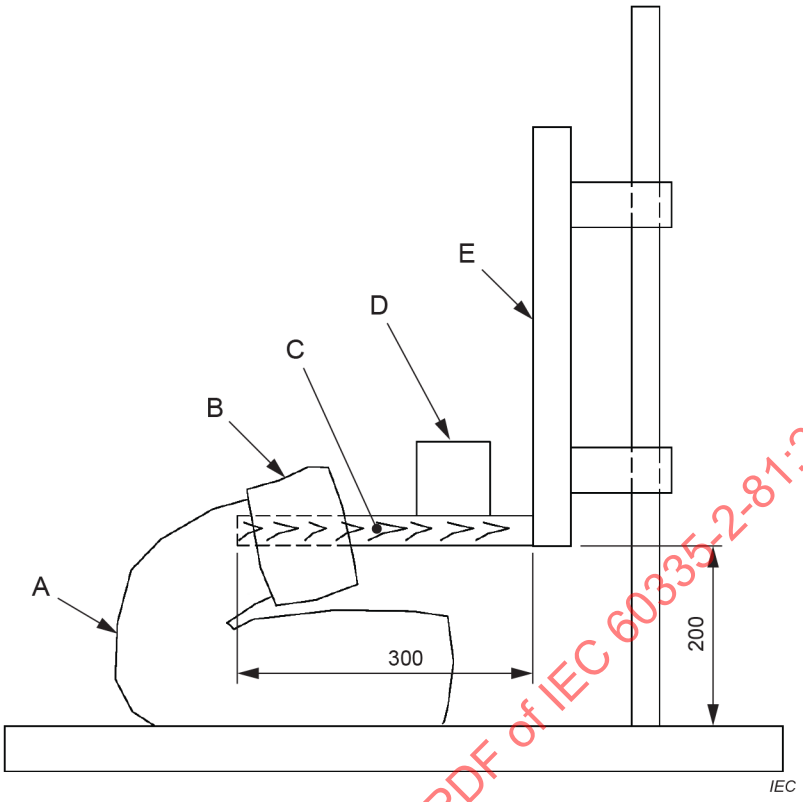
C handle arrangement permitting a contact force of 4 N ± 1 N

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 101 – Probe for measuring surface temperatures

Dimensions in millimetres



Key

A foot warmer

B leg section

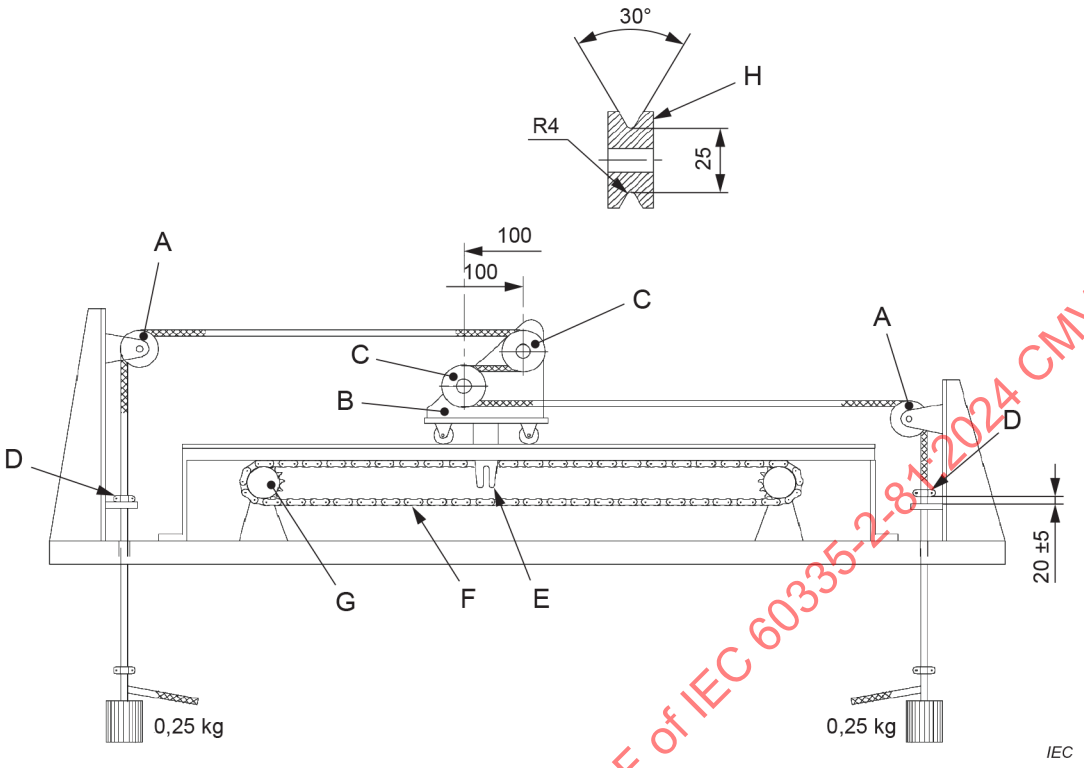
C plywood board, 150 mm wide

D load

E movable support

Figure ~~101~~ 102 – Equipment for the flexing test for foot warmers

Dimensions in millimetres

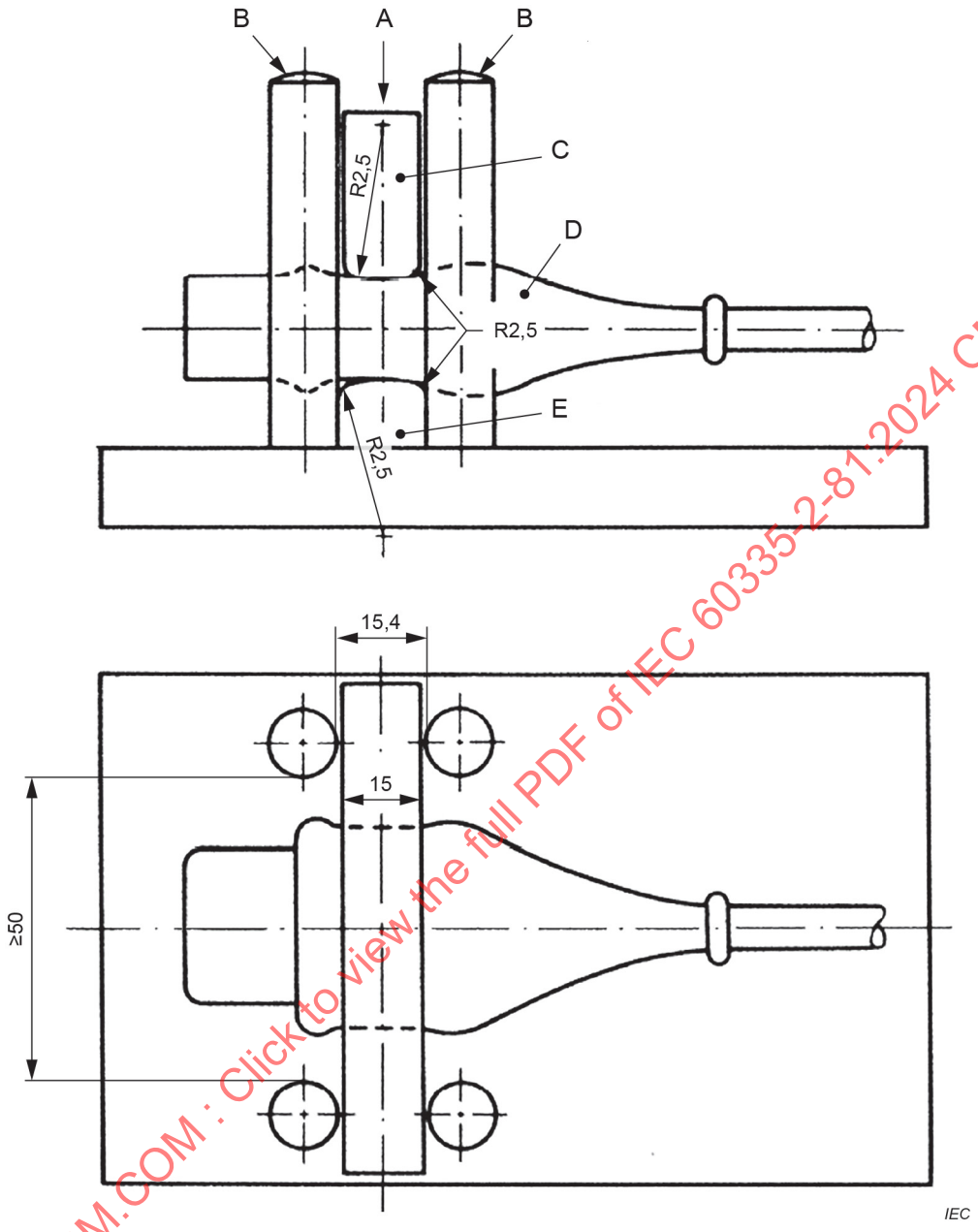


Key

A pulley having a diameter > 50 mm
B carrier
C grooved pulley
D restraining clamp
E engagement pin
F chain having a pitch of 12,7 mm
G sprocket having 20 teeth with a pitch circle diameter of 88,9 mm
H details of pulleys C

Figure ~~102~~ 103 – Equipment for flexing heating elements and internal wiring

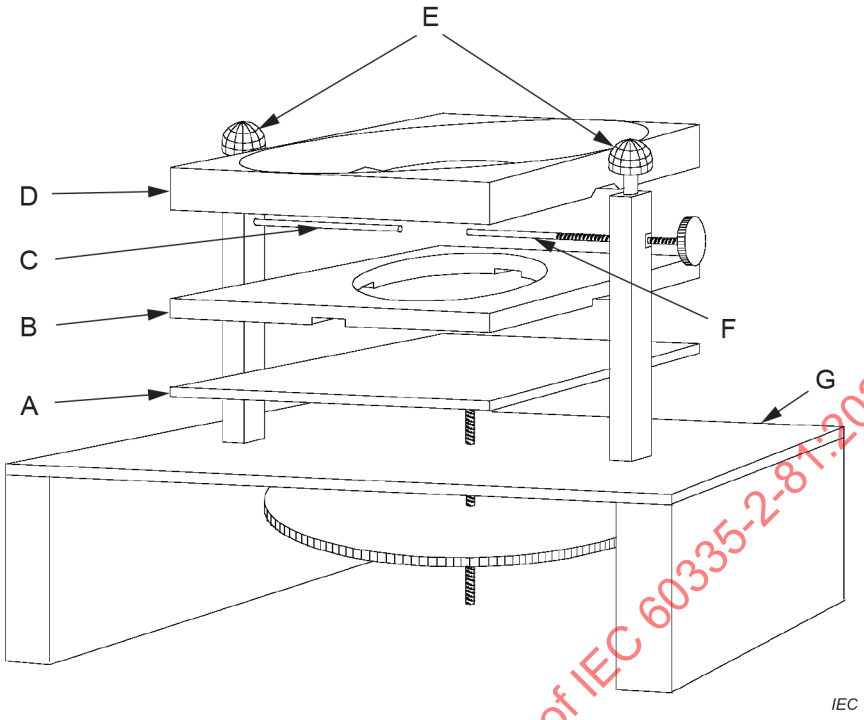
Dimensions in millimetres



Key

A force
B guides
C moving jaw
D sample
E fixed jaw

Figure ~~105~~ 104 – Apparatus for pressure test on connectors



Key

A adjustable platform

B lower part of mask (see detail A of ~~Figure 104~~ Figure 106)

C fixed electrode

D upper part of mask (see detail B of ~~Figure 104~~ Figure 106)

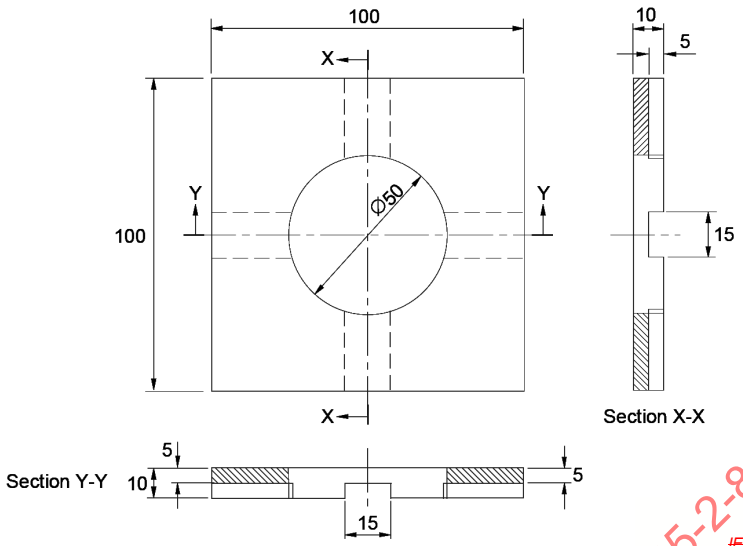
E terminals

F movable electrode

G base plate

Figure ~~103~~ 105 – Equipment for the spark ignition test

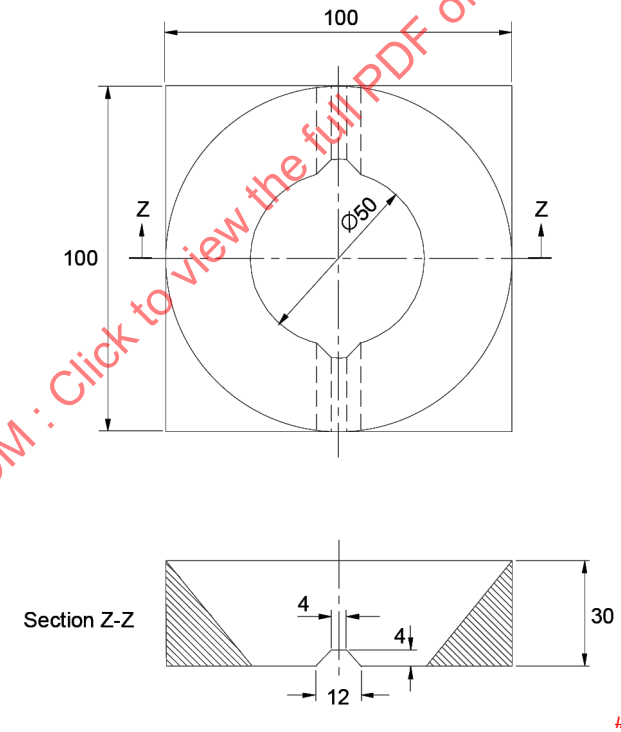
~~Dimensions in millimetres~~



~~IEC~~

~~a) Detail A – Lower part of mask~~

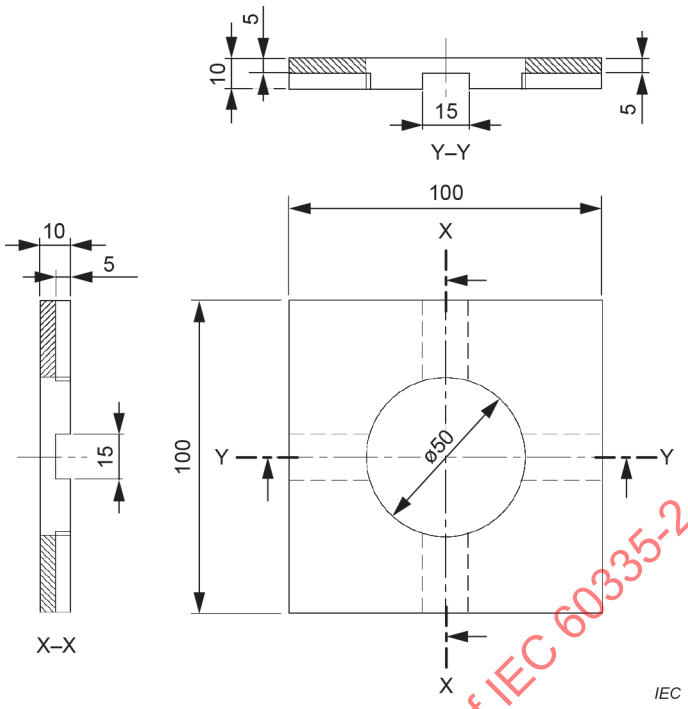
~~Dimensions in millimetres~~



~~IEC~~

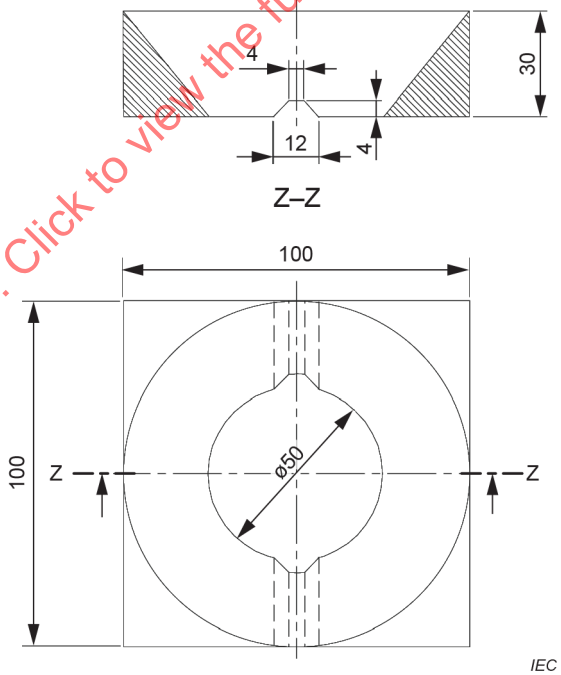
~~b) Detail B – Upper part of mask~~

Dimensions in millimetres



a) Detail A – Lower part of mask

Dimensions in millimetres



b) Detail B – Upper part of mask

NOTE The mass of the upper part of the mask is approximately 100 g, which is achieved by modifying its thickness.

Figure ~~104~~ 106 – Details of the mask

Annexes

The annexes of Part 1 are applicable except as follows.

Annex B
(normative)

Battery-operated appliances, separable batteries and detachable batteries for battery-operated appliances

This annex of Part 1 Is applicable except as follows.

B.22.3 *Addition:*

In addition to the use of test probe 18, test probe 19 of IEC 61032 is also applied wherever test probe 18 is used and with the same test conditions used for test probe 18.

B.22.4 *Addition:*

In addition to the use of test probe 18, test probe 19 of IEC 61032 is also applied wherever test probe 18 is used and with the same test conditions used for test probe 18. **23**

Bibliography

The Bibliography in Part 1 is applicable except as follows.

Addition:

IEC 60335-2-17, *Household and similar electrical appliances – Safety – Part 2-17: Particular requirements for blankets, pads, clothing and similar flexible heating appliances*

IEC 60335-2-71, *Household and similar electrical appliances – Safety – Part 2-71: Particular requirements for electrical heating appliances for breeding and rearing animals*

List of comments

1 This revision is for alignment with IEC 60335-1:2020.

2 This revision is for alignment with IEC 60335-1:2020.

3 This revision is for alignment with IEC 60335-1:2020.

4 This term is added due to the addition of requirements for control units for alignment with IEC 60335-2-17.

5 This marking is added for alignment with IEC 60335-2-17.

6 This instruction is added for appliances with detachable control units in alignment with IEC 60335-2-17.

7 This marking is added for detachable control units in alignment with IEC 60335-2-17.

8 Appliance can be located on the floor where they would be accessible to children up to 3 years in age, so test probe 19 is applicable.

9 Limits on the temperature rise of external accessible surfaces are introduced to address the risk of thermal injury from contact with external accessible surfaces based on IEC Guide 117 for Temperatures of touchable hot surfaces.

10 This revision maintains the requirements for appliance outlets and socket outlets and the test duration for charging of battery-operated appliances as specified in IEC 60335-1:2020.

11 Limits on the temperature rise of external accessible surfaces are introduced to address the risk of thermal injury from contact with external accessible surfaces based on IEC Guide 117 for Temperatures of touchable hot surfaces.

12 This addition clarifies that these parts are considered to be held for short periods only.

13 This revision is for alignment with IEC 60335-1:2020.

14 Appliance can be located on the floor where they would be accessible to children up to 3 years in age, so test probe 19 is applicable.

15 The test of Subclause 21.107 is added for evaluation of the enclosure of a control unit in alignment with IEC 60335-2-17.

16 The reason for applying a monitoring current is to detect if there is any breakage of the conductor. This is in alignment with IEC 60335-2-17.

17 The test of Subclause 21.107 is added for evaluation of the enclosure of a control unit intended to be placed on a surface in alignment with IEC 60335-2-17.

18 This is added to align with IEC 60335-2-17. However, the pull force of 60 N is specified to align with the testing of these appliances with a mass up to 4 kg.

19 The compliance criteria is updated to indicate that any ignition shall not reach the inner edge of the mask to align with IEC 60335-2-17. Therefore, measuring the time to ignition is no longer necessary.

20 The number of samples is changed from 5 to 2 to align with IEC 60335-2-17.

21 The compliance criteria is updated to indicate that any ignition shall not reach the inner edge of the mask to align with IEC 60335-2-17. Therefore, measuring the time to ignition is no longer necessary.

22 Changes are made to Subclause 30.102 to align with IEC 60335-2-17.

23 Battery-operated appliance can be located on the floor where they would be accessible to children up to 3 years in age, so test probe 19 is applied to battery-operated appliances, detachable batteries and separable batteries.

_____

IEC 60335-2-81

Edition 4.0 2024-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Household and similar electrical appliances – Safety – Part 2-81: Particular requirements for foot warmers and heating mats

Appareils électrodomestiques et analogues – Sécurité – Partie 2-81: Exigences particulières pour les chancelières et les carpettes chauffantes électriques

IEC 60335-2-81:2024-10(en-fr)

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-81: Particular requirements for foot warmers and heating mats

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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 60335-2-81 has been prepared by IEC technical committee 61: Safety of household and similar electrical appliances. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2015, Amendment 1:2017 and Amendment 2:2020. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) alignment with IEC 60335-1:2020;
b) conversion of some notes to normative text (Clause 1, 13.2, 16.2, 21.103, 21.104, 21.105, 21.106);
c) addition of test probe 19 for accessibility (8.1.1, 8.1.3, 20.2, B.22.3, B.22.4);

d) addition of external surface temperatures (Clause 11);

e) addition of the test of 21.107 for control units intended to be placed on a surface;

f) alignment of 30.102 with IEC 60335-2-17.

The text of this International Standard is based on the following documents:

Draft	Report on voting
61/7272/FDIS	61/7298/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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.

This part 2 is to be used in conjunction with the latest edition of IEC 60335-1 and its amendments unless that edition precludes it; in that case, the latest edition that does not preclude it is used. It was established on the basis of the sixth edition (2020) 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: Particular requirements for foot warmers and heating mats.

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: Class 0 appliances are allowed if their rated voltage does not exceed 150 V (Japan)

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

NOTE 4 The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations can 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.

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.

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-81: Particular requirements for foot warmers and heating mats

1 Scope

This clause of Part 1 is replaced by the following.

This part of IEC 60335 deals with the safety of electric **foot warmers** and **heating mats** for household and similar purposes, their **rated voltage** being not more than 250 V, including direct current (DC) supplied appliances and **battery-operated appliances**.

Appliances not intended for normal household use but which nevertheless can be a source of danger to the public, such as appliances intended to be used by laypersons 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 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.

Additional requirements can be necessary for appliances intended to be used in vehicles or on-board ships or aircraft. In many countries, additional requirements are specified by the national health authorities, the national authorities responsible for the protection of labour, the national water supply authorities and similar authorities.

This standard does not apply to:

– appliances specifically intended for use under medical supervision;
– electric blankets and pads (IEC 60335-2-17);
– electrically heated carpets (IEC 60335-2-106);
– electrical heating appliances for breeding and rearing animals (IEC 60335-2-71).

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

IEC 60320-1, *Appliance couplers for household and similar general purposes – Part 1: General requirements*

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

ISO 2439, *Flexible cellular polymeric materials – Determination of hardness (indentation technique)*

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1 Definitions relating to physical characteristics

3.1.9 *Modification:*
normal operation

Replace the first paragraph with the following:

operation of the appliance under the following conditions:

Foot warmers are unfilled and placed on a horizontal surface.

Heating mats are placed on a horizontal surface and covered by a piece of expanded polystyrene having dimensions approximately 300 mm × 150 mm × 50 mm.

Note 101 to entry: The density of the polystyrene is approximately 20 kg/m^3 ± 5 kg/m^3.

3.5 Definitions relating to types of appliances

3.5.101
foot warmer
appliance into which the user's feet are inserted in order to warm them

3.5.102
heating mat
appliance having an area not exceeding 0,5 m^2, on which the user's feet are placed in order to warm them

3.6 Definitions relating to parts of appliances

3.6.101
heating element with PTC characteristics
heating element of the appliance consisting of a pair of conductors separated by conductive material that has a rapid non-linear increase in resistance when the temperature is raised through a particular range

3.6.102
control unit
device, external to the functional part, by means of which the power input of the appliance or the temperature of the functional part can be adjusted or regulated

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:*

A 15 m length of heating element or internal wiring is required for the tests of 21.102.

*Twelve samples of the enclosure material of **foot warmers**, each having dimensions 200 mm × 100 mm, are required for the test of 30.101.*

5.3 *Addition:*

Washable appliances are laundered twice in accordance with the instructions before testing is started.

*The tests of Clause 13, Clause 15 and Clause 16 are not carried out on **class III appliances** having a **rated voltage** not exceeding 24 V or on **class III constructions** having a **working voltage** not exceeding 24 V.*

5.5 *Addition:*

*If the appliance is provided with a **detachable cover**, the tests are carried out with or without this cover, whichever is more unfavourable.*

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 *Modification:*

Replace the first paragraph with the following:

Appliances shall be **class II** or **class III**.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 *Addition:*

Washable appliances shall be marked with symbol ISO 7000-3114 (2011-10) and with symbol ISO 7000-3124 (2011-10).

Appliances to be used with a **detachable control unit** shall be marked with the reference of the **control unit** to be used.

7.6 *Addition:*

[symbol ISO 7000-3114 (2011-10)] do not dry clean

[symbol ISO 7000-3124 (2011-10)] do not bleach

7.12 *Addition:*

The instructions shall include the following:

– the appliance is not to be used if there are signs of damage;
– the appliance is not to be used for warming animals;
– details regarding laundering or cleaning.

The instructions for **foot warmers** shall state that outdoor shoes must be removed before use.

The instructions for **heating mats** shall state that the appliance has to be repaired or replaced if the cover is worn. They shall explain how such wear can be observed.

The instructions for **foot warmers** intended to be used after preheating without supply and incorporating an appliance inlet shall state that the cord set must be disconnected from the supply after preheating.

If symbol ISO 7000-3114 (2011-10) and symbol ISO 7000-3124 (2011-10) are used, their meaning shall be explained.

The instruction for appliances with **detachable control units** shall state that the appliances are only to be used with the type that is marked on the appliances.

7.101 Detachable control units shall be marked with a reference number or by other means of identification.

Compliance is checked by inspection.

8 Protection against access to live parts

This clause of Part 1 is applicable except as follows.

8.1.1 *Addition:*

In addition to the use of test probe 18, test probe 19 of IEC 61032 is also applied wherever test probe 18 is used and with the same test conditions used for test probe 18.

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 except as follows.

10.101 The power input of appliances incorporating **heating elements with PTC characteristics** shall significantly decrease with an increase in temperature.

Compliance is checked by the following test.

*The appliance is supplied at **rated voltage** and operated under **normal operation**. The power input shall have decreased by at least 50 % from the initial value when steady conditions are established, any control operating during this period being short-circuited.*

11 Heating

This clause of Part 1 is applicable except as follows:

11.2 *Modification:*

Appliances are placed as near as possible to one wall of the test corner and away from the other wall.

11.3 *Addition:*

Where the external ***accessible surfaces*** *are suitably flat and access permits, then the test probe of Figure 101 is 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:*

Replace the first paragraph with the following:

Appliances are operated until steady conditions are established.

11.8 *Modification:*

Replace the first paragraph with the following:

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

Add the following to footnote "k" of Table 3:

Similar parts held for short periods include handles or grips of vents and air shutters.

Addition:

When polyvinyl chloride is used for insulating heating elements, the temperature rise of the insulation shall not exceed 80 K.

Table 101 – Maximum temperature rises for specified external and other surfaces under normal operating conditions

Surface	*Temperature rise of external and other accessible surfaces* *K*
Surfaces likely to be in contact with the user's feet	*40*
Other surfaces of:	
– *bare metal*	*38*
– *coated metal* [a]	*42*
– *glass and ceramic*	*51*
– *plastic and plastic coating > 0,4 mm* [b, c]	*58*
NOTE The temperature rise limits of handles, knobs, grips, keyboards, keypads and similar parts are specified in Table 3.	
[a] *Metal is considered coated when a coating having a minimum thickness of 90 µm made of enamel, powder or non-substantially plastic coating is used.* [b] *The temperature rise limit of plastic also applies for plastic material having a metal finish of thickness less than 0,1 mm.* [c] *When the thickness of the plastic coating does not exceed 0,4 mm, the temperature rise limits of coated metal for underlying metal apply or the temperature rise limits for glass or ceramic material for underlying glass or 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 except as follows.

13.2 *Addition:*

*When testing the top surface of **heating mats**, the dimensions of the metal foil are 300 mm × 150 mm.*

*If the **heating mat** is reversible, each surface is tested in turn.*

***Foot warmers** are also tested with the inside surface completely covered with metal foil.*

14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is applicable except as follows.

15.1.1 *Addition:*

Appliances are subjected to the test of IEC 60529:1989, 14.2.1. However, cord sets, switches and controls in the flexible cord are not subjected to the tests.

15.1.2 *Addition:*

***Foot warmers** are orientated so that the base of the appliance is in contact with the support.*

Appliance inlets are covered before carrying out the test.

16 Leakage current and electric strength

This clause of Part 1 is applicable except as follows.

16.2 *Addition:*

*When testing the top surface of **heating mats**, the dimensions of the metal foil are 300 mm × 150 mm.*

*If the **heated mat** is reversible, each surface is tested in turn.*

***Foot warmers** are also tested with the inside surface completely covered with metal foil.*

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 *Addition:*

The appliance is covered partially or completely, whichever is more unfavourable, with a sheet of open-cell polyether approximately 36 mm thick, having the following properties:

- *cell count* *18 $^{+2}_{0}$ per cm;*
- *specific mass* *30 kg/m^3 + $^{+10}_{0}$ %;*
- *hardness* *120 N to 170 N at 40 % impression, measured according to ISO 2439.*

*If the **foot warmer** has a flexible part that covers the user's legs, this part is folded onto the foot part before covering.*

A plywood board, having dimensions approximately 500 mm × 500 mm × 20 mm, is placed on top of the polyether sheet covering ***foot warmers****.*

19.4 *Addition:*

Heating mats *are tested without being covered by the polystyrene block.*

19.13 *Addition:*

The temperature rise of the insulation of heating elements shall not exceed 145 K.

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.2 *Addition:*

For parts of appliances situated not more than 850 mm above the floor after installation or in normal use, in addition to the use of test probe 18, test probe 19 of IEC 61032 is also applied wherever test probe 18 is used and with the same test conditions used for test probe 18.

21 Mechanical strength

This clause of Part 1 is applicable except as follows.

21.1 *Addition:*

Foot warmers *are also subjected to the test of 21.101.* ***Control units*** *intended to be placed on a surface are also subjected to the test of 21.107.*

21.2 *Addition:*

This requirement is not applicable to textiles and similar materials forming the enclosure.

21.101 *A plywood board, having dimensions approximately 300 mm × 150 mm × 20 mm with rounded edges, is placed in the leg section of the* ***foot warmer*** *as shown in Figure 102. A load of 30 kg is placed on the board, which is allowed to drop freely from a height of 200 mm above the base, so that the leg section is flexed, and the appliance is compressed between the board and the supporting surface. The total mass of the board, its movable support and the load is 30 kg. If the* ***foot warmer*** *does not have a leg section, the board is allowed to fall onto the top surface.*

The test is carried out 1 000 times at a rate of six times per minute.

The test shall not result in

- *damage to the enclosure or displacement of heating elements to such an extent that compliance with the standard is impaired;*
- *open-circuiting of heating elements or controls;*
- *breakage of more than 10 % of the strands of internal wiring;*
- *failure of constructional stitching, or breakage of glued or welded joints, to such an extent that compliance with the standard is impaired.*

NOTE An example of damage to the enclosure that could impair compliance with the standard is a tear in the enclosure. Small holes in textiles that are not part of electrical insulation or do not provide protection against moisture are ignored.

21.102 The insulation of heating elements and internal wiring shall retain adequate flexibility and insulating characteristics throughout the life of the appliance.

Compliance is checked by the tests of 21.103 and by the tests of 21.104 and 21.105 when the insulation exceeds

– *a temperature rise of 50 K during the test of Clause 11, or*

– *a temperature rise of 110 K during the tests of Clause 19.*

The tests are carried out on separate samples of heating element or internal wiring.

For the test of 21.103, one sample measuring approximately 4 m in length is required. For the tests of 21.104, at least 12 samples are required, each having a length of 300 mm. For the test of 21.105, 12 samples are required, each having a length of 300 mm.

21.103 *The sample of heating element or internal wiring is attached to the equipment shown in Figure 103. This equipment has a carrier with two pulleys, each having a groove with a radius of 4 mm, the diameter at the base of the groove being 25 mm. For samples not having a circular cross-section, the form of the groove in the pulley is suitably modified. The pulleys are arranged so that the sample is horizontal where it passes between them.*

The sample is stretched over the pulleys, each end being loaded with a mass of 0,25 kg. If necessary, the mass at each end is increased in steps of 0,1 kg in order to ensure that the wires leaving the pulleys are parallel to each other. Restraining clamps are positioned so that the pull is always applied by the mass in the opposite direction from which the carrier is moving.

The carrier moves over a distance of 1 m with a constant speed of approximately 0,33 m/s for 25 000 cycles.

A cycle is two movements, one in each direction.

The sample shall not break during the test.

A monitoring current not exceeding 50 mA can be passed through the sample during the test to detect breakage of the conductor.

*For **heating elements with PTC characteristics**, the power input is measured before and after the test. The measurement is made with the heating element suspended vertically in free air and supplied at the **rated voltage** of the appliance. Both measurements are carried out at the same ambient temperature and when the power input has stabilized. The power input shall not increase during the test.*

The sample is then immersed in water containing approximately 1 % NaCl. A DC voltage of approximately 500 V is applied between the conductor and the saline solution.

The insulation resistance is measured 1 min after immersion and shall be at least 1 MΩ.

21.104 *The conductors are pulled out from 12 samples of heating element or internal wiring. If this is not possible, the insulation is slit longitudinally, the conductor is removed and the insulation allowed to close.*

Six of the samples are conditioned by suspending them vertically so that they hang freely in a heating cabinet at a temperature of 125 °C ± 2 °C for 336 h. The samples are removed from the cabinet and allowed to cool down to ***room temperature****. When the material has stabilized, the length of the samples is measured and shall not be less than 90 % of the original length. PVC material will have stabilized by 16 h after removal from the cabinet.*

The heating cabinet shall have forced air circulation in order to ensure that there is no temperature gradient over the length of the samples.

The 12 samples are placed in a tensile machine, in turn, so that the length between the clamps is at least 50 mm. The machine is operated at a uniform speed of 500 mm/min ± 50 mm/min. The force and elongation at the instant of rupture are determined.

Results obtained from any sample that ruptured at a force differing from the average value by more than 10 %, and from samples that ruptured within a distance of 15 mm from the clamp, are disregarded. Additional samples are tested in order to obtain 12 valid results.

The elongation of each of the unconditioned samples shall not be less than 100 % and their tensile strength shall not be less than 8,75 MPa.

The average value of both the elongation and tensile strength of the conditioned samples shall be not less than 75 % of the average value determined for the unconditioned samples.

21.105 *A 10 mm length of insulation is removed from each end of 12 samples of heating element or internal wiring.*

Six of the samples are wound in a close helix of six turns on a metal mandrel having a diameter approximately equal to the external diameter of the samples. Together with the remaining six samples, they are placed in a heating cabinet at a temperature of 125 °C ± 2 °C for 336 h. The samples are removed from the cabinet and allowed to cool down to ***room temperature****.*

When the material has stabilized, the other six samples are also wound on the mandrel in the same way. PVC material will have stabilized by 16 h after removal from the cabinet.

The heating cabinet shall have forced air circulation in order to ensure that there is no temperature gradient over the length of the samples.

The mandrel is immersed for 1 h in water containing approximately 1 % NaCl. The samples are then subjected to a test voltage of 1 000 V for ***class II appliances*** *and 500 V for* ***class III appliances****. The voltage is applied for 1 min between the conductors and the solution and there shall be no breakdown.*

The samples are unwound from the mandrel and inspection shall show that there are no visible cracks.

21.106 Heating elements with PTC characteristics shall be resistant to crushing.

Compliance is checked by the following test.

The flexible part is fully supported by a piece of plywood 20 mm thick and supplied as specified in 11.4. When steady conditions are established, the temperature of the heating element is measured. A block having dimensions of 100 mm × 300 mm and a mass of 80 kg with rounded edges in contact with the flexible part is applied for 5 min to the surface in the most unfavourable place. After removing the block, the appliance is again operated until steady conditions are established and the temperature of the heating element is measured. The temperature of the heating element where the block has been applied shall not have increased by more than 10 K.

NOTE The most unfavourable place to apply the block is usually at a loop in the element.

21.107 *The **control unit** is dropped from a height of 40 mm onto a rigidly mounted steel plate having a thickness of at least 15 mm and a mass of at least 15 kg. It is dropped so that it lands on its base, the test being carried out 100 times.*

*The **control unit** is then dropped three times from a height of 500 mm onto a hardwood floor by pulling it from a horizontal support by means of its cord so that it falls freely.*

*After the test, the **control unit** shall not be damaged to such an extent that compliance with this standard is impaired. If the **control unit** still operates, the appliance shall withstand the tests of Clause 11.*

22 Construction

This clause of Part 1 is applicable except as follows.

22.101 Appliances shall be constructed so that heating elements and internal wiring are retained in their intended position. No part of the heating element shall cross over another part of the heating element.

Crossing of internal wiring shall be avoided unless the wiring is secured in order to prevent any relative movement.

Compliance is checked by inspection.

22.102 There shall be no change in the position of the heating elements that impairs compliance with this standard if the stitching retaining them in position is broken.

Compliance is checked by inspection after breaking the thread in the most unfavourable place.

22.103 The insulation of heating elements and internal wiring, except in **class III appliances**, shall be integral with the conductor.

Compliance is checked by inspection.

22.104 **Heating mats** shall be constructed so that exposure of insulation of heating element and internal wiring shall be readily observed.

Compliance is checked by inspection after removing other materials such as carpet pile. The colours of the insulation shall be different from the colours of the other materials.

22.105 The appliance inlet in **foot warmers** shall be positioned so that the connector is not in contact with the floor.

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 *Modification:*

Switches are tested for 6 000 cycles of operation.

24.1.4 *Modification:*

Thermostats are operated for 100 000 cycles of operation and **self-resetting thermal cut-outs** for 10 000 cycles of operation.

24.1.5 *Addition:*

All parts of IEC 60320-1 are applicable except for those that make reference to the connectors in the standard sheets of IEC 60320-3.

24.2 *Addition:*

Appliances may be fitted with switches and **control units** in flexible cords.

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows.

25.5 *Addition:*

Type Z attachment is allowed.

25.14 *Addition:*

*The test is applicable to appliances fitted with a **non-detachable flexible cord**. It also applies to switches and **control units** fitted in the flexible cord.*

25.15 *Modification:*

The pull force for appliances with a mass of 1 kg or less is increased to 60 N.

Flexible cords connected to switches and **control units** are subjected to a pull force of 60 N and a torque of 0,1 Nm.

26 Terminals for external conductors

This clause of Part 1 is applicable.

27 Provision for earthing

This clause of Part 1 is applicable.

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 except as follows.

29.1.3 *Addition:*

*The **clearance** between the engagement face and contact tubes of appliance couplers used for supplying the flexible part shall be at least 3,5 mm.*

29.2 *Addition:*

The microenvironment is pollution degree 3 unless the insulation is enclosed or located so that it is unlikely to be exposed to pollution during normal use of the appliance.

29.3 *Addition:*

The requirement does not apply to the part containing heating elements.

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

30.1 *Addition:*

The test is not applied to enclosures that are likely to be flexed in normal use.

Modification:

Connectors of resilient plastic material are not subjected to the ball pressure test but are subjected to a pressure test using an apparatus similar to that shown in Figure 104, the test being made in a heating cabinet at a temperature of 100 °C ± 2 °C.

The specimen is clamped between steel jaws, having a cylindrical face of 25 mm radius, a width of 15 mm and a length of 50 mm. The corners are rounded with a radius of 2,5 mm.

The specimen is clamped in such a way that the jaws press against it in the area where it is gripped in normal use, the centre line of the jaws coinciding as nearly as possible with the centre of this area.

The force applied through the jaws is 20 N.

After 1 h, the jaws are removed and the specimen shall show no damage impairing compliance with this standard.

30.2 *Modification:*

*The test is not carried out on textiles and similar materials forming the enclosure of **foot warmers**.*

30.2.2 Not applicable.

30.2.3.2 *Addition:*

The needle-flame test is not carried out on textile materials.

30.101 Textiles and similar materials forming the enclosure of **foot warmers** shall be adequately resistant to ignition.

Compliance is checked by a spark ignition test that is carried out on three samples of the material. Each sample has dimensions approximately 200 mm × 100 mm. Any pieces of heating element and trimming are removed from the samples.

The test fixture, as shown in Figure 105, has two brass electrodes 3 mm in diameter that are supported by brass pillars mounted on a base plate of insulating material so that their axes are aligned. The base plate also supports a platform of insulating material, having dimensions of 100 mm × 100 mm, and located centrally between the brass pillars. Provision is made for the height of the platform to be adjusted.

One of the electrodes is fixed in position while the other electrode is movable, thus allowing the sample to be inserted. The tip of the fixed electrode has an angle of 45°. The electrode is positioned so that the point furthest from the brass pillar is at the top and at a distance of approximately 3 mm from the centre of the platform. The movable electrode has a flat end.

The lower member of a two-part hardwood mask, as shown in detail A of Figure 106, is placed on the adjustable platform in the position indicated.

The test fixture, including the upper member of the mask as shown in detail B of Figure 106, is placed in a heating cabinet having a door with an inspection window, air being circulated by natural convection. The electrodes are connected in series with an adjustable non-inductive resistor to a supply having a sinusoidal output voltage of 10 kV and a characteristic such that the output voltage does not decrease by more than 100 V when a current of 1 mA is flowing.

The temperature of the heating cabinet is raised to 65 °C ± 2 °C. The electrodes are then short-circuited, and the resistor adjusted so that a current of 1 mA flows. The supply is then disconnected, and the samples are placed in the cabinet for a period of 3 h.

Without removing the fixture from the heating cabinet, the movable electrode is withdrawn and one sample is pulled over the fixed electrode so that the electrode is situated centrally in the space normally occupied by the heating element. The sample is adjusted so that its end is approximately level with the edge of the adjustable platform. The movable electrode is then inserted into the other end of the element space and is fixed so that the distance between the electrodes is 6,0 mm ± 0,1 mm. The sample is smoothed out and the upper member of the mask is placed in position. The door of the heating cabinet is then closed for a further period of 5 min in order to stabilise the temperature.

The supply is switched on and sparks are allowed to pass between the electrodes for a period of 2 min. Any ignition shall not reach the inner edge of the mask.

The sample is then removed and repositioned between the electrodes with the other surface uppermost and so that the opposite end is subjected to the test.

The test is repeated on the other two samples.

30.102 The insulation of heating elements and internal wiring, including connections other than connections to the appliance inlet, shall be sufficiently resistant to abnormal heat and fire.

Compliance is checked by the following test.

A sample of the heating element or internal wiring including connections at least 150 mm long is supported by a grid inclined at 45°. The grid is formed from parallel wires 0,6 mm in diameter, spaced 20 mm apart and it is large enough to fully support the sample. The sample is positioned perpendicular to the horizontal wires and centrally between the other wires.

A second grid of similar dimensions is placed on top of the sample so that its horizontal wires are displaced by 10 mm from the horizontal wires of the first grid.

The wires of both grids that are parallel to the sample are aligned with each other.

The two grids are placed centrally within the laboratory fume-hood or chamber as specified in IEC 60695-11-5 and are held in position so that there is no movement during the test.

A needle flame, as specified in IEC 60695-11-5:2016, Figure 2a, is applied to the sample at a point mid-way between the wires, so that the tip of the flame is in contact with the surface of the sample and near its lower end. Additionally, if there are connections to be tested, the needle flame, as specified in IEC 60695-11-5:2016, Figure 2a, is applied to the sample so that the tip of the flame is in contact with the surface of the insulation of the connection.

The flame is maintained until the test specimen ceases to burn.

The test is repeated on two additional samples.

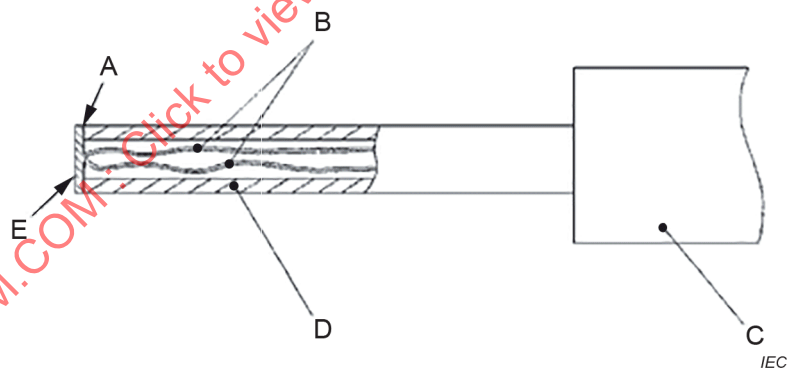
In any of the test specimen the length of the sample damaged by fire shall not exceed 65 mm, measured from the point where the flame is applied.

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 adhesive

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

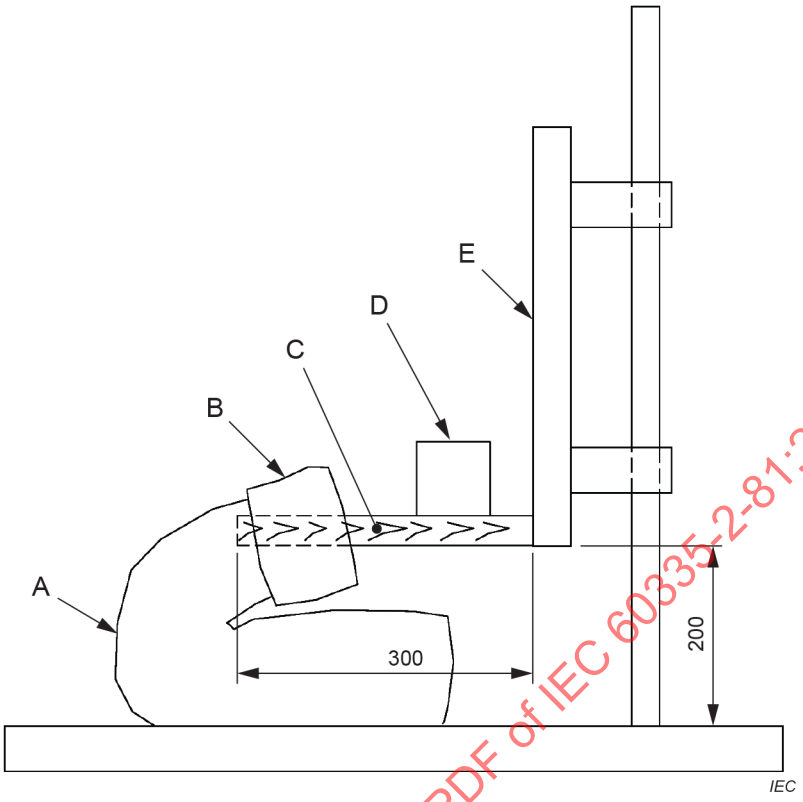
C handle arrangement permitting a contact force of 4 N ± 1 N

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 101 – Probe for measuring surface temperatures

Dimensions in millimetres



Key

A foot warmer

B leg section

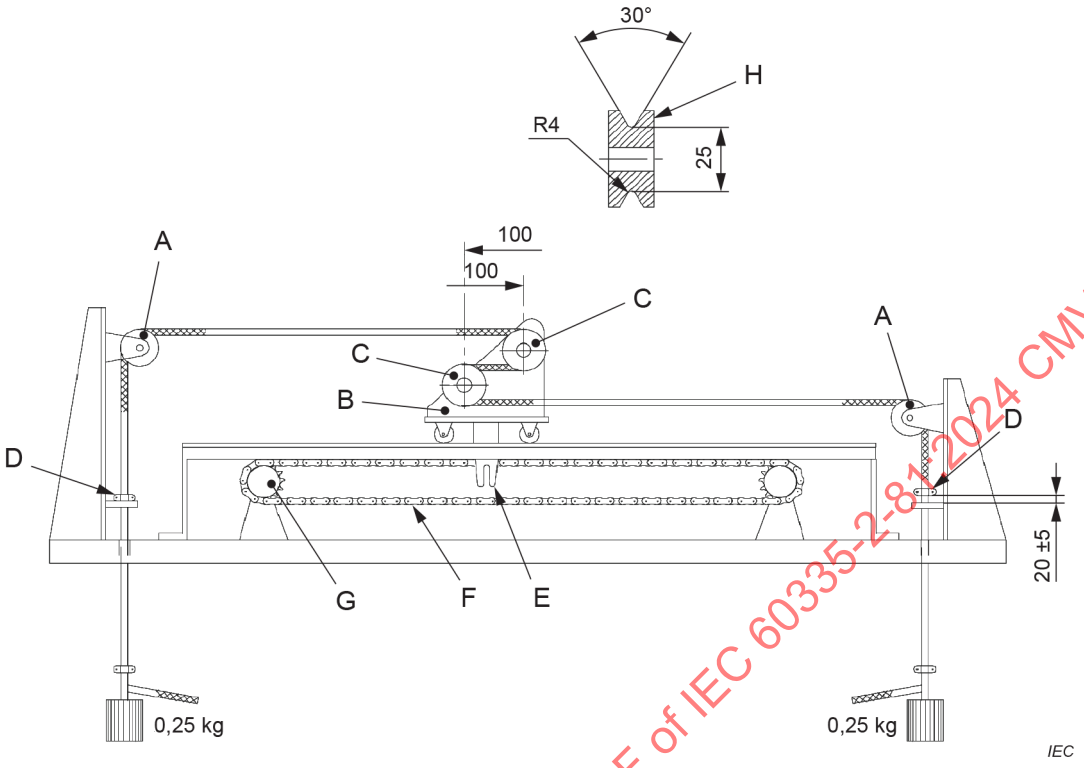
C plywood board, 150 mm wide

D load

E movable support

Figure 102 – Equipment for the flexing test for foot warmers

Dimensions in millimetres

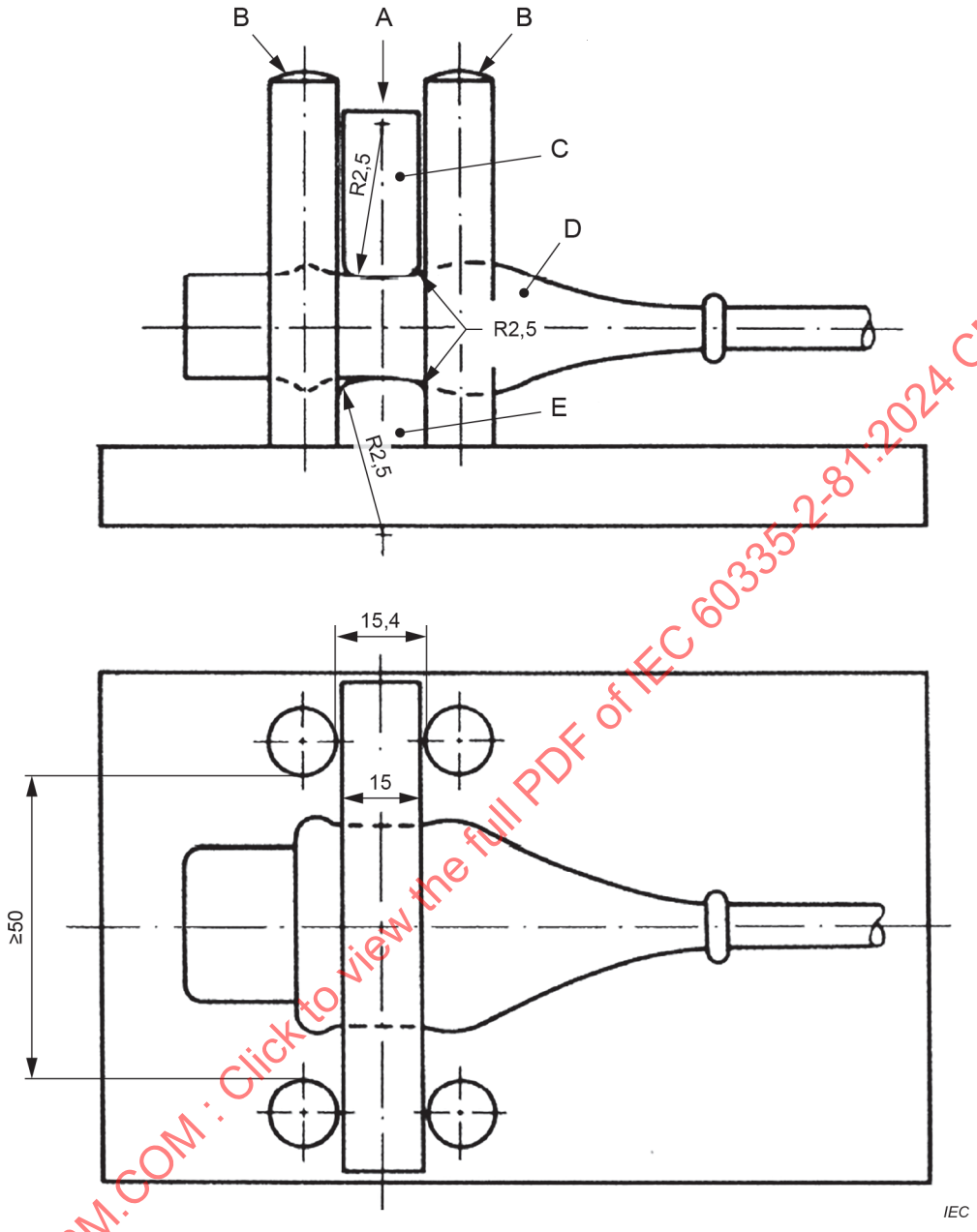


Key

A pulley having a diameter > 50 mm
B carrier
C grooved pulley
D restraining clamp
E engagement pin
F chain having a pitch of 12,7 mm
G sprocket having 20 teeth with a pitch circle diameter of 88,9 mm
H details of pulleys C

Figure 103 – Equipment for flexing heating elements and internal wiring

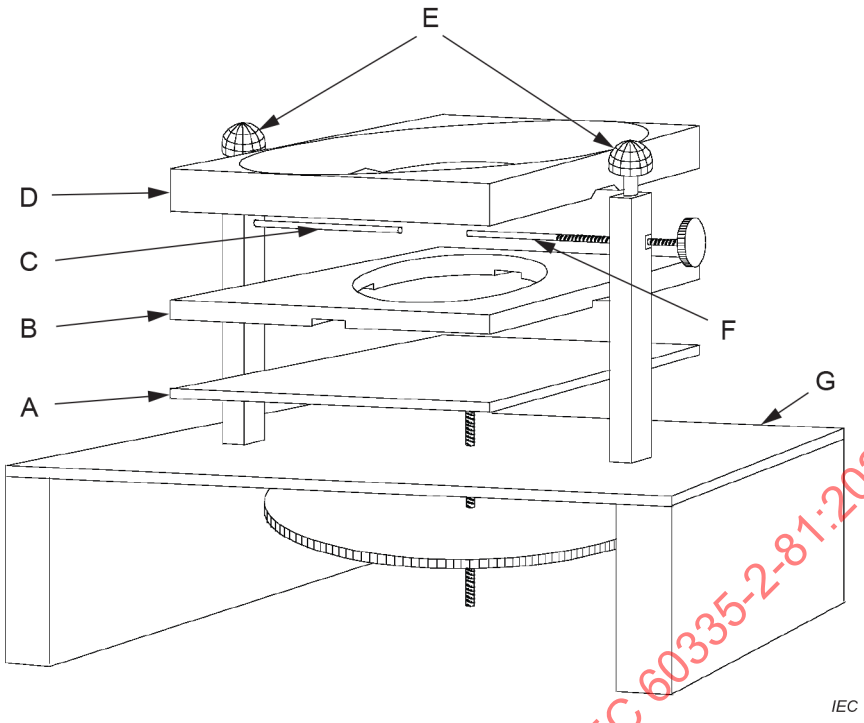
Dimensions in millimetres



Key

A force
B guides
C moving jaw
D sample
E fixed jaw

Figure 104 – Apparatus for pressure test on connectors

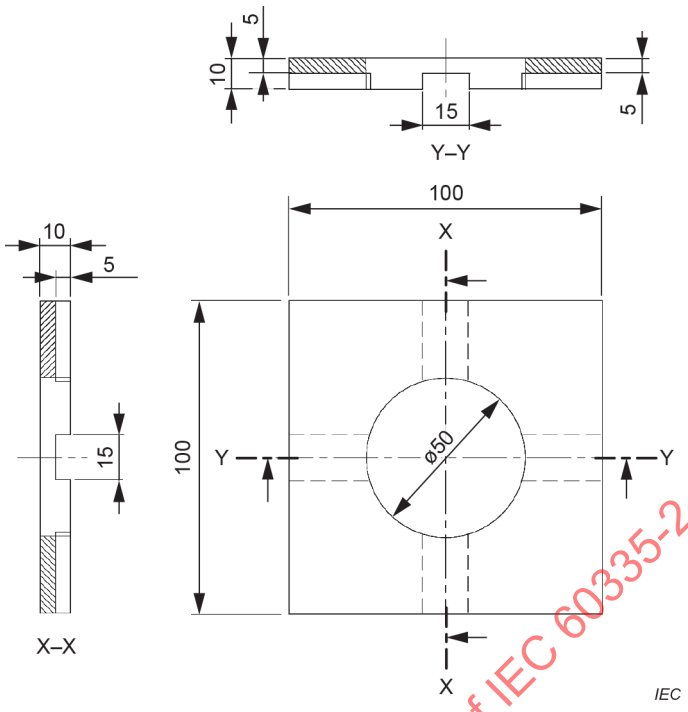


Key

A adjustable platform
B lower part of mask (see detail A of Figure 106)
C fixed electrode
D upper part of mask (see detail B of Figure 106)
E terminals
F movable electrode
G base plate

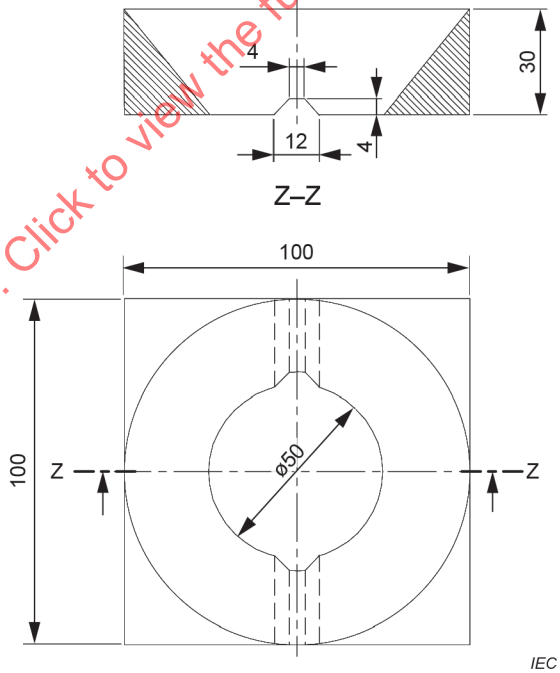
Figure 105 – Equipment for the spark ignition test

Dimensions in millimetres



a) Detail A – Lower part of mask

Dimensions in millimetres



b) Detail B – Upper part of mask

NOTE The mass of the upper part of the mask is approximately 100 g, which is achieved by modifying its thickness.

Figure 106 – Details of the mask

Annexes

The annexes of Part 1 are applicable except as follows.

Annex B
(normative)

Battery-operated appliances, separable batteries and detachable batteries for battery-operated appliances

This annex of Part 1 Is applicable except as follows.

B.22.3 *Addition:*

In addition to the use of test probe 18, test probe 19 of IEC 61032 is also applied wherever test probe 18 is used and with the same test conditions used for test probe 18.

B.22.4 *Addition:*

In addition to the use of test probe 18, test probe 19 of IEC 61032 is also applied wherever test probe 18 is used and with the same test conditions used for test probe 18.

Bibliography

The Bibliography in Part 1 is applicable except as follows.

Addition:

IEC 60335-2-17, *Household and similar electrical appliances – Safety – Part 2-17: Particular requirements for blankets, pads, clothing and similar flexible heating appliances*

IEC 60335-2-71, *Household and similar electrical appliances – Safety – Part 2-71: Particular requirements for electrical heating appliances for breeding and rearing animals*

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SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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APPAREILS ÉLECTRODOMESTIQUES ET ANALOGUES – SÉCURITÉ –

Partie 2-81: Exigences particulières pour les chancelières et les carpettes chauffantes électriques

AVANT-PROPOS

1) La Commission Électrotechnique Internationale (IEC) est une organisation mondiale de normalisation composée de l'ensemble des comités électrotechniques nationaux (Comités nationaux de l'IEC). L'IEC a pour objet de favoriser la coopération internationale pour toutes les questions de normalisation dans les domaines de l'électricité et de l'électronique. À cet effet, l'IEC – entre autres activités – publie des Normes internationales, des Spécifications techniques, des Rapports techniques, des Spécifications accessibles au public (PAS) et des Guides (ci-après dénommés "Publication(s) de l'IEC"). Leur élaboration est confiée à des comités d'études, aux travaux desquels tout Comité national intéressé par le sujet traité peut participer. Les organisations internationales, gouvernementales et non gouvernementales, en liaison avec l'IEC, participent également aux travaux. L'IEC collabore étroitement avec l'Organisation Internationale de Normalisation (ISO), selon des conditions fixées par accord entre les deux organisations.
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8) L'attention est attirée sur les références normatives citées dans cette publication. L'utilisation de publications référencées est obligatoire pour une application correcte de la présente publication.
9) L'IEC attire l'attention sur le fait que la mise en application du présent document peut entraîner l'utilisation d'un ou de plusieurs brevets. L'IEC ne prend pas position quant à la preuve, à la validité et à l'applicabilité de tout droit de brevet revendiqué à cet égard. À la date de publication du présent document, l'IEC n'avait pas reçu notification qu'un ou plusieurs brevets pouvaient être nécessaires à sa mise en application. Toutefois, il y a lieu d'avertir les responsables de la mise en application du présent document que des informations plus récentes sont susceptibles de figurer dans la base de données de brevets, disponible à l'adresse https://patents.iec.ch. L'IEC ne saurait être tenue pour responsable de ne pas avoir identifié de tels droits de brevets et de ne pas avoir signalé leur existence.

L'IEC 60335-2-81 a été établie par le comité d'études 61 de l'IEC: Sécurité des appareils électrodomestiques et analogues. Il s'agit d'une Norme internationale.

Cette quatrième édition annule et remplace la troisième édition parue en 2015, l'Amendement 1:2017 et l'Amendement 2:2020. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) le texte a été aligné sur l'IEC 60335-1:2020;
b) certaines notes ont été converties en texte normatif (Article 1, 13.2, 16.2, 21.103, 21.104, 21.105, 21.106);
c) le calibre d'essai 19 a été ajouté pour l'accessibilité (8.1.1, 8.1.3, 20.2, B.22.3, B.22.4);
d) les températures des surfaces extérieures ont été ajoutées (Article 11);
e) l'essai du 21.107 a été ajouté pour les unités de commande destinées à être placées sur une surface;
f) le texte du 30.102 a été aligné sur l'IEC 60335-2:17.

Le texte de cette Norme internationale est issu des documents suivants:

Projet	Rapport de vote
61/7272/FDIS	61/7298/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/publications.

Une liste de toutes les parties de la série IEC 60335, publiées sous le titre général *Appareils électrodomestiques et analogues – Sécurité*, se trouve sur le site web de l'IEC.

La présente partie 2 doit être utilisée conjointement avec la dernière édition de l'IEC 60335-1 et ses amendements sauf si cette édition l'exclut. Dans ce cas, la dernière édition qui n'exclut pas la présente partie 2 est utilisée. Elle a été établie sur la base de la sixième édition (2020) de cette norme.

NOTE 1 L'expression "la Partie 1" utilisée dans la présente norme fait référence à l'IEC 60335-1.

La présente partie 2 complète ou modifie les articles correspondants de l'IEC 60335-1, de façon à transformer cette publication en norme IEC: Exigences particulières pour les chancelières et les carpettes chauffantes électriques.

Lorsqu'un paragraphe particulier de la Partie 1 n'est pas mentionné dans cette partie 2, ce paragraphe s'applique pour autant que cela soit raisonnable. Lorsque la présente norme mentionne "addition", "modification" ou "remplacement", le texte correspondant de la Partie 1 doit être adapté en conséquence.

NOTE 2 Le système de numérotation suivant est utilisé:

– les paragraphes, tableaux et figures qui s'ajoutent à ceux de la Partie 1 sont numérotés à partir de 101;
– à l'exception de celles qui sont dans un nouveau paragraphe ou de celles qui concernent des notes de la Partie 1, les notes sont numérotées à partir de 101, y compris celles des articles ou paragraphes qui sont remplacés;
– les annexes qui sont ajoutées sont désignées AA, BB, etc.

NOTE 3 Les caractères d'imprimerie suivants sont utilisés:

– exigences: caractères romains;
– *modalités d'essais: caractères italiques*;
– notes: petits caractères romains.

Les termes en **gras** dans le texte sont définis à l'Article 3. Lorsqu'une définition concerne un adjectif, l'adjectif et le nom associé figurent également en gras.

Les différences suivantes existent dans les pays indiqués ci-après.

– 6.1: Les appareils de la classe 0 sont admis si leur tension assignée ne dépasse pas 150 V (Japon)

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous webstore.iec.ch dans les données relatives au document recherché. À cette date, le document sera

- reconduit,
- supprimé, ou
- révisé.

NOTE 4 L'attention des Comités nationaux est attirée sur le fait que les fabricants d'appareils et les organismes d'essai peuvent avoir besoin d'une période transitoire après la publication d'une nouvelle publication IEC, ou d'une publication amendée ou révisée, pour fabriquer des produits conformes aux nouvelles exigences et pour adapter leurs équipements aux nouveaux essais ou aux essais révisés.

Le comité recommande que le contenu de cette publication soit adopté pour application nationale (obligatoire) au plus tôt 12 mois et au plus tard 36 mois après la date de publication.

INTRODUCTION

Il a été admis par hypothèse, en établissant la présente Norme internationale, que l'exécution de ses dispositions était confiée à des personnes expérimentées et ayant une qualification appropriée.

Les documents de recommandations concernant l'application des exigences de sécurité pour les appareils peuvent être consultés dans les documents de support du CE 61, accessibles sur le site web de l'IEC à l'adresse:

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

Cette information est donnée à l'intention des utilisateurs de la présente Norme internationale et ne constitue nullement un remplacement du texte normatif de la présente norme.

La présente norme reconnaît le niveau de protection internationalement accepté contre les risques électriques, mécaniques, thermiques, liés au feu et au rayonnement des appareils, lorsqu'ils fonctionnent comme en usage normal en tenant compte des instructions du fabricant. Elle couvre également les situations anormales auxquelles on peut s'attendre dans la pratique et elle tient compte de la façon dont les phénomènes électromagnétiques peuvent affecter le fonctionnement sûr des appareils.

La présente norme tient compte autant que possible des exigences de l'IEC 60364, de façon à rester compatible avec les règles d'installation quand l'appareil est raccordé au réseau d'alimentation. Cependant, des règles nationales d'installation peuvent être différentes.

Si un appareil relevant du domaine d'application de la présente norme comporte également des fonctions couvertes par une autre partie 2 de l'IEC 60335, la partie 2 correspondante est appliquée à chaque fonction séparément, dans la limite du raisonnable. Si cela s'applique, l'influence d'une fonction sur les autres fonctions est prise en compte.

Lorsqu'une partie 2 ne comporte pas d'exigences complémentaires pour couvrir les dangers traités dans la Partie 1, la Partie 1 s'applique.

NOTE 1 Cela signifie que les comités d'études responsables pour les parties 2 ont déterminé qu'il n'était pas nécessaire de spécifier des exigences particulières pour l'appareil en question en plus des exigences générales.

La présente norme est une norme de famille de produits traitant de la sécurité d'appareils et a préséance sur les normes horizontales et génériques couvrant le même sujet.

NOTE 2 Les publications horizontales, les publications fondamentales de sécurité et les publications groupées de sécurité couvrant un danger ne s'appliquent pas, parce qu'elles ont été prises en considération lorsque les exigences générales et particulières ont été étudiées pour la série de normes IEC 60335.

Un appareil conforme au texte de la présente norme ne sera pas nécessairement jugé conforme aux principes de sécurité de la norme si, lorsqu'il est examiné et soumis aux essais, il apparaît qu'il présente d'autres caractéristiques qui compromettent le niveau de sécurité visé par ces exigences.

Un appareil utilisant des matériaux ou présentant des modes de construction différents de ceux décrits dans les exigences de la présente norme peut être examiné et soumis aux essais en fonction de l'objectif poursuivi par ces exigences et, s'il est jugé pratiquement équivalent, il peut être estimé conforme aux principes de sécurité de la présente norme.

NOTE 3 Les normes traitant des aspects non relatifs à la sécurité des appareils électrodomestiques sont:

– les normes IEC publiées par le comité d'études 59 concernant les méthodes de mesure de l'aptitude à la fonction;
– les normes CISPR 11 et CISPR 14-1, ainsi que les normes applicables de la série IEC 61000-3 concernant les émissions électromagnétiques;
– la norme CISPR 14-2 concernant l'immunité électromagnétique;
– les normes IEC publiées par le comité d'études 111 concernant l'environnement.

APPAREILS ÉLECTRODOMESTIQUES ET ANALOGUES – SÉCURITÉ –

Partie 2-81: Exigences particulières pour les chancelières et les carpettes chauffantes électriques

1 Domaine d'application

L'article de la Partie 1 est remplacé par le texte suivant.

La présente partie de l'IEC 60335 traite de la sécurité des **chancelières** et des **carpettes chauffantes** électriques destinées à un usage domestique et analogue, dont la **tension assignée** est inférieure ou égale à 250 V, y compris les appareils alimentés en courant continu et les **appareils alimentés par batteries**.

Les appareils non destinés à un usage domestique normal, mais qui peuvent néanmoins constituer une source de danger pour le public, tels que les appareils destinés à être utilisés par des usagers non avertis dans des magasins, chez des artisans et dans des fermes, sont compris dans le domaine d'application de la présente norme.

Dans la mesure du possible, la présente norme traite des dangers ordinaires présentés par les appareils, encourus par tous les individus à l'intérieur et autour de l'habitation. Cependant, elle ne tient en général pas compte

– des personnes (y compris des enfants) dont
  - les capacités physiques, sensorielles ou mentales; ou
  - le manque d'expérience et de connaissance

  les empêchent d'utiliser l'appareil en toute sécurité sans surveillance ou instruction;
– des enfants qui jouent avec l'appareil.

Des exigences supplémentaires peuvent être nécessaires pour les appareils destinés à être utilisés dans des véhicules ou à bord de navires ou d'avions. Dans de nombreux pays, des exigences supplémentaires sont spécifiées par les organismes nationaux de la santé, par les organismes nationaux responsables de la protection des travailleurs, par les organismes nationaux responsables de l'alimentation en eau et par des organismes similaires.

La présente norme ne s'applique pas:

– aux appareils spécifiquement destinés à être utilisés sous surveillance médicale;
– aux couvertures et coussins électriques (IEC 60335-2-17);
– aux tapis chauffants électriques (IEC 60335-2-106);
– aux appareils de chauffage électrique destinés à la reproduction et à l'élevage des animaux (IEC 60335-2-71).

2 Références normatives

L'article de la Partie 1 s'applique, avec< l'exception suivante.

Addition:

IEC 60320-1, *Connecteurs pour usages domestiques et usages généraux analogues – Partie 1: Exigences générales*

IEC 60584-1, *Couples thermoélectriques – Partie 1: Spécifications et tolérances en matière de FEM*

ISO 2439, *Matériaux polymères alvéolaires souples – Détermination de la dureté (technique par indentation)*

3 Termes et Définitions

L'article de la Partie 1 s'applique, avec les exceptions suivantes.

3.1 Définitions relatives aux caractéristiques physiques

3.1.9 *Modification:*
fonctionnement normal

Remplacer le premier alinéa par ce qui suit:

fonctionnement de l'appareil dans les conditions suivantes:

Les **chancelières** sont vides et placées sur une surface horizontale.

Les **carpettes chauffantes** sont placées sur une surface horizontale et recouvertes d'un bloc de polystyrène expansé dont les dimensions sont d'environ 300 mm × 150 mm × 50 mm.

Note 101 à l'article: La densité du polystyrène est d'environ 20 kg/m^3 ± 5 kg/m^3.

3.5 Définitions relatives aux types d'appareils

3.5.101
chancelière
appareil dans lequel l'utilisateur introduit ses pieds pour les réchauffer

3.5.102
carpette chauffante
appareil dont la surface n'excède pas 0,5 m^2 et sur lequel l'utilisateur pose ses pieds pour les réchauffer

3.6 Définitions relatives aux parties d'un appareil

3.6.101
élément chauffant à caractéristiques CTP
élément chauffant de l'appareil constitué d'une paire de conducteurs séparés par un matériau conducteur qui présente une augmentation de résistance rapide et non linéaire lorsque la température est augmentée dans une plage donnée

3.6.102
unité de commande
dispositif, externe à la partie fonctionnelle, au moyen duquel la puissance de l'appareil ou la température de la partie fonctionnelle peut être réglée ou régulée

4 Exigences générales

L'article de la Partie 1 s'applique.

5 Conditions générales d'essais

L'article de la Partie 1 s'applique, avec les exceptions suivantes.

5.2 *Addition:*

Une longueur d'élément chauffant ou de conducteur interne de 15 m est nécessaire pour les essais du 21.102.

*Douze échantillons du matériau de l'enveloppe des **chancelières**, mesurant chacun 200 mm × 100 mm, sont nécessaires pour l'essai du 30.101.*

5.3 *Addition:*

Les appareils lavables sont lavés deux fois, conformément aux instructions, avant de commencer les essais.

*Les essais de l'Article 13, de l'Article 15 et de l'Article 16 ne sont pas réalisés sur les **appareils de la classe III** dont la **tension assignée** est inférieure ou égale à 24 V ni sur les **parties de la classe III** dont la **tension de service** est inférieure ou égale à 24 V.*

5.5 *Addition:*

*Si l'appareil comporte une **housse amovible**, les essais sont effectués avec ou sans la housse, si cette condition est plus défavorable.*

6 Classification

L'article de la Partie 1 s'applique, avec l'exception suivante.

6.1 *Modification:*

Remplacer le premier alinéa par ce qui suit:

Les appareils doivent être de la **classe II** ou de la **classe III**.

7 Marquage et instructions

L'article de la Partie 1 s'applique, avec les exceptions suivantes.

7.1 *Addition:*

Les appareils lavables doivent porter le marquage du symbole ISO 7000-3114 (2011-10) et du symbole ISO 7000-3124 (2011-10).

Les appareils à utiliser avec une **unité de commande amovible** doivent porter un marquage qui fait référence à l'**unité de commande** à utiliser.

7.6 *Addition:*

[symbole ISO 7000-3114 (2011-10)] Ne pas nettoyer à sec

[symbole ISO 7000-3124 (2011-10)] Ne pas utiliser de Javel

7.12 *Addition:*

Les instructions doivent inclure les éléments suivants:

– l'appareil ne doit pas être utilisé s'il présente des signes de détérioration;
– l'appareil ne doit pas être utilisé pour réchauffer des animaux;
– des précisions concernant le lavage ou le nettoyage.

Les instructions pour les **chancelières** doivent indiquer que les chaussures d'extérieur doivent être enlevées avant utilisation.

Les instructions pour les **carpettes chauffantes** doivent indiquer que l'appareil doit être réparé ou remplacé si la housse est usée. Elles doivent expliquer comment une telle usure peut être constatée.

Les instructions pour les **chancelières** destinées à être utilisées après un préchauffage sans alimentation et équipées d'un socle de connecteur doivent indiquer que le cordon connecteur doit être déconnecté de l'alimentation après le préchauffage.

Si le symbole ISO 7000-3114 (2011-10) et le symbole ISO 7000-3124 (2011-10) sont utilisés, leur signification doit être expliquée.

Les instructions pour les appareils avec des **unités de commande amovibles** doivent indiquer que l'appareil ne doit être utilisé qu'avec le type marqué sur l'appareil.

7.101 Les **unités de commande amovibles** doivent porter un numéro de référence ou un autre moyen d'identification.

La vérification est effectuée par examen.

8 Protection contre l'accès aux parties actives

L'article de la Partie 1 s'applique, avec l'exception suivante.

8.1.1 *Addition:*

En plus d'utiliser le calibre d'essai 18, le calibre d'essai 19 de l'IEC 61032 est également appliqué chaque fois que le calibre d'essai 18 est utilisé, dans les mêmes conditions d'essai que le calibre d'essai 18.

9 Démarrage des appareils à moteur

L'article de la Partie 1 ne s'applique pas.

10 Puissance et courant

L'article de la Partie 1 s'applique, avec l'exception suivante.

10.101 La puissance des appareils qui comportent des **éléments chauffants à caractéristiques CTP** doit diminuer de façon significative lorsque la température augmente.

La vérification est effectuée par l'essai suivant.

*L'appareil est alimenté sous la **tension assignée** et mis en fonctionnement dans les **conditions de fonctionnement normal**. La puissance doit avoir diminué d'au moins 50 % par rapport à la valeur initiale au moment de l'établissement des conditions de régime, toute commande en fonctionnement pendant cette période étant mise en court-circuit.*

11 Échauffements

L'article de la Partie 1 s'applique, avec les exceptions suivantes.

11.2 *Modification:*

Les appareils sont placés aussi près que possible de l'une des parois du coin d'essai et à distance de l'autre paroi.

11.3 *Addition:*

*Lorsque les **surfaces accessibles** extérieures sont suffisamment planes et permettent l'accès, le calibre d'essai de la Figure 101 est utilisé pour mesurer les échauffements des **surfaces accessibles** extérieures spécifiées dans le Tableau 101. Le calibre est appliqué sur la surface avec une force de 4 N ± 1 N de manière à établir le meilleur contact possible entre le calibre et la surface. Le mesurage est effectué après une durée de contact de 30 s.*

Le calibre peut être maintenu en place à l'aide d'une pince de laboratoire sur statif ou d'un dispositif analogue. Tout instrument de mesure qui donne les mêmes résultats que le calibre peut être utilisé.

11.7 *Modification:*

Remplacer le premier alinéa par ce qui suit:

Les appareils sont mis en fonctionnement jusqu'à l'établissement des conditions de régime.

11.8 *Modification:*

Remplacer le premier alinéa par ce qui suit:

Pendant l'essai, les échauffements sont relevés en permanence et ne doivent pas dépasser les valeurs indiquées dans le Tableau 3 et le Tableau 101.

Ajouter le texte suivant dans la note de bas de tableau "k" du Tableau 3:

Les parties analogues touchées pendant de courtes périodes incluent les poignées ou les manettes des évents et des obturateurs d'air.

Addition:

Lorsque du polychlorure de vinyle est utilisé pour isoler les éléments chauffants, l'échauffement de l'isolation ne doit pas dépasser 80 K.

Tableau 101 – Échauffements maximaux pour les surfaces accessibles extérieures et autres surfaces spécifiées en conditions de fonctionnement normal

Surface	***Échauffement des surfaces accessibles extérieures et autres*** ***K***
Surfaces susceptibles d'être au contact des pieds de l'utilisateur	*40*
Autres surfaces en:	
– *métal nu*	*38*
– *métal recouvert* [a]	*42*
– *verre et céramique*	*51*
– *plastique et revêtement plastique > 0,4 mm* [b, c]	*58*
NOTE Les limites d'échauffement des poignées, boutons, manettes, claviers, pavés numériques et parties analogues sont spécifiées dans le Tableau 3.	
[a] *Un métal est considéré comme recouvert lorsqu'un revêtement en émail ou en poudre d'une épaisseur minimale de 90 µm ou qu'un revêtement non constitué majoritairement de plastique est utilisé.* [b] *La limite d'échauffement du plastique s'applique également aux matières plastiques dont l'épaisseur de la finition métallique est inférieure à 0,1 mm.* [c] *Lorsque l'épaisseur du revêtement plastique ne dépasse pas 0,4 mm, les limites d'échauffement du métal recouvert pour le métal sous-jacent s'appliquent ou les limites d'échauffement du matériau en verre et céramique pour le matériau en verre ou céramique sous-jacent s'appliquent.*	

12 Charge des batteries à ions métalliques

L'article de la Partie 1 s'applique.

13 Courant de fuite et rigidité diélectrique à la température de régime

L'article de la Partie 1 s'applique, avec l'exception suivante.

13.2 *Addition:*

Lors de l'essai de la surface supérieure des ***carpettes chauffantes****, les dimensions de la feuille métallique sont de 300 mm × 150 mm.*

Si la ***carpette chauffante*** *est réversible, chacune des surfaces est soumise à l'essai à tour de rôle.*

Les ***chancelières*** *sont également soumises à l'essai avec la surface intérieure totalement recouverte d'une feuille métallique.*