

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

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IEC 60335-2-81:2015
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CONTENTS

FOREWORD.....	4
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references	8
3 Terms and definitions	9
4 General requirement.....	9
5 General conditions for the tests	9
6 Classification.....	10
7 Marking and instructions.....	10
8 Protection against access to live parts.....	11
9 Starting of motor-operated appliances	11
10 Power input and current.....	11
11 Heating.....	11
12 Void.....	12
13 Leakage current and electric strength at operating temperature.....	12
14 Transient overvoltages.....	12
15 Moisture resistance.....	12
16 Leakage current and electric strength.....	12
17 Overload protection of transformers and associated circuits	12
18 Endurance.....	12
19 Abnormal operation	13
20 Stability and mechanical hazards.....	13
21 Mechanical strength	13
22 Construction	16
23 Internal wiring.....	16
24 Components	17
25 Supply connection and external flexible cords	17
26 Terminals for external conductors.....	17
27 Provision for earthing	17
28 Screws and connections	17
29 Clearances, creepage distances and solid insulation	17
30 Resistance to heat and fire.....	18
31 Resistance to rusting.....	20
32 Radiation, toxicity and similar hazards.....	20
Annexes	24
Bibliography.....	25

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IEC 60335-2-81:2015

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Figure 101 – Equipment for the flexing test for foot warmers.....	20
Figure 102 – Equipment for flexing heating elements and internal wiring	21
Figure 103 – Equipment for the spark ignition test	22
Figure 104 – Details of the mask.....	23

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

This third edition cancels and replaces the second edition published in 2002, its Amendment 1 (2007) and its Amendment 2 (2011). It constitutes a technical revision.

The principal changes in this edition as compared with the second edition of IEC 60335-2-81 are as follows (minor changes are not listed):

- Requirements for washable appliances (5.3, 7.1, 7.6, 7.12);
- Requirements for controls in flexible cords (15.1.1, 24.2);
- Requirements for appliance inlets (22.105, 24.1.5, 29.1.3).

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

FDIS	Report on voting
61/4841/FDIS	61/4896/RVD

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

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

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

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

This part 2 supplements or modifies the corresponding clauses in IEC 60335-1, so as to convert that publication into the IEC standard: Safety requirements for 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 committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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

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

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

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

The following differences exist in the countries indicated below.

- 3.1.9: Normal operation is different (USA)
- 6.1: Class 0 appliances are allowed if their rated voltage does not exceed 150 V (Japan)
- 6.1: Class 0 and class I appliances are allowed (USA)
- 7.6: Symbols not permitted to replace required text (USA)
- 11.8: Temperature limit is different (USA)
- 13.2: Method and limit is different (USA)
- 19.2: The test is different (USA)
- 21.101: The test is different (USA)
- 22.101: The tests are different (USA)

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INTRODUCTION

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

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

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

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

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

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

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

NOTE 2 Horizontal and generic standards covering a hazard are not applicable since they have been taken into consideration when developing the general and particular requirements for the IEC 60335 series of standards. For example, in the case of temperature requirements for surfaces on many appliances, generic standards, such as ISO 13732-1 for hot surfaces, are not applicable in addition to Part 1 or part 2 standards.

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

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

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

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

1 Scope

This clause of Part 1 is replaced by the following.

This International Standard 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.

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

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;
- 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 60320-1:2001, *Appliance couplers for household and similar general purposes – Part 1: General requirements*
IEC 60320-1:2001/AMD1:2007¹

¹ There exists a consolidated edition 2.1 (2007) that includes the second edition and its Amendment 1.

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.

3.1.9 Replacement:

normal operation

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 The density of the polystyrene is approximately $20 \text{ kg/m}^3 \pm 5 \text{ kg/m}^3$.

3.101

foot warmer

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

3.102

heating mat

appliance having an area not exceeding $0,5 \text{ m}^2$, on which the user's feet are placed in order to warm them

3.103

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

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 $200 \text{ mm} \times 100 \text{ mm}$, 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 Clauses 13, 15 and 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:

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) and with symbol ISO 7000-3124 (2012-04).

7.6 Addition:

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[symbol ISO 7000-3114 (2012-04)]

Do not dry clean

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[symbol ISO 7000-3124 (2012-04)]

Do not bleach

7.12 Addition:

The instructions shall state the substance of 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) and symbol ISO 7000-3124 (2012-04) are used, their meaning shall be explained.

8 Protection against access to live parts

This clause of Part 1 is applicable.

9 Starting of motor-operated appliances

This clause of Part 1 is not applicable.

10 Power input and current

This clause of Part 1 is applicable 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

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This clause of Part 1 is applicable except as follows:

11.2 Modification:

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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.

11.7 Replacement:

Appliances are operated until steady conditions are established.

11.8 Modification:

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.

12 Void

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable except as follows.

13.2 Modification:

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:

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

16 Leakage current and electric strength

This clause of Part 1 is applicable except as follows.

16.2 Modification:

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 $30 \text{ kg/m}^3 + ^{+10}_0 \%$;
- 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:

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.

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20 Stability and mechanical hazards

This clause of Part 1 is applicable.

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.*

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. 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.