

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: Règles particulières pour les chancelières et les tapis
chauffants électriques**

IEC 60335-2-81:2002

<https://standards.iteh.ai/standards/iec/833/4104-027c-4699-91ad-b8382d3e71f4/iec-60335-2-81-2002>



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2012 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.
If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.
Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

Useful links:

IEC publications search - www.iec.ch/searchpub

The advanced search enables you to find IEC publications by a variety of criteria (reference number, text, technical committee,...).

It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available on-line and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary (IEV) on-line.

Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente. un corrigendum ou amendement peut avoir été publié.

Liens utiles:

Recherche de publications CEI - www.iec.ch/searchpub

La recherche avancée vous permet de trouver des publications CEI en utilisant différents critères (numéro de référence, texte, comité d'études,...).

Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

Just Published CEI - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications de la CEI. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (VEI) en ligne.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

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: Règles particulières pour les chancelières et les carpettes
chauffantes électriques**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

CJ

ICS 97.100.10

ISBN 978-2-88912-873-0

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references	6
3 Definitions	7
4 General requirement.....	7
5 General conditions for the tests	7
6 Classification.....	8
7 Marking and instructions.....	8
8 Protection against access to live parts.....	8
9 Starting of motor-operated appliances	8
10 Power input and current	8
11 Heating	9
12 Void	9
13 Leakage current and electric strength at operating temperature.....	9
14 Transient overvoltages	9
15 Moisture resistance	9
16 Leakage current and electric strength.....	9
17 Overload protection of transformers and associated circuits	10
18 Endurance.....	10
19 Abnormal operation	10
20 Stability and mechanical hazards	10
21 Mechanical strength.....	11
22 Construction.....	13
23 Internal wiring.....	14
24 Components.....	14
25 Supply connection and external flexible cords	14
26 Terminals for external conductors.....	14
27 Provision for earthing	14
28 Screws and connections.....	15
29 Clearances, creepage distances and solid insulation	15
30 Resistance to heat and fire.....	15
31 Resistance to rusting.....	17
32 Radiation, toxicity and similar hazards.....	17
Annexes	22
Bibliography.....	22
Figure 101 – Equipment for the flexing test for foot warmers.....	18
Figure 102 – Equipment for flexing heating elements and internal wiring	19
Figure 103 – Equipment for the spark ignition test	20
Figure 103a – Details of the mask.....	21

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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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

This consolidated version of IEC 60335-2-81 consists of the second edition (2002) [documents 61/2178/FDIS and 61/2259/RVD], its amendment 1 (2007) [documents 61/3196/FDIS and 61/3236/RVD] and its amendment 2 (2011) [documents 61/4102/CDV and 61/4200/RVC].

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

It bears the edition number 2.2.

A vertical line in the margin shows where the base publication has been modified by amendments 1 and 2.

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

This part 2 is to be used in conjunction with the latest edition of IEC 60335-1 and its amendments. It was established on the basis of the fourth edition (2001) of that standard.

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

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

- 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).
- 19.2: The test is different (USA).
- 21.101: The test is different (USA).
- 22.101: The tests are different (USA).

The committee has decided that the contents of the base publication and its amendments 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.

2 | 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 the amendment 2 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.

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:

- 2 | IEC 60320-1:2001, *Appliance couplers for household and similar general purposes – Part 1: General requirements*
Amendment 1 (2007)¹

ISO 2439, *Polymeric materials, cellular flexible. Determination of hardness (indentation technique)*.

¹ There exists a consolidated edition 2.1 (2007) that includes edition 2 and its Amendment 1.

3 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

2 |

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:

Before testing is started, the appliance is laundered or cleaned twice in accordance with the instructions.

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**.

6.2 Addition:

Appliances shall be at least IPX1. However, switches in the **supply cord** may be IPX0.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

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** incorporating an appliance inlet shall state that the cord set must be disconnected from the supply and from the appliance after preheating.

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

2 | 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.

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.

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 $18 \begin{smallmatrix} +2 \\ 0 \end{smallmatrix}$ per cm;
- specific mass $30 \text{ kg/m}^3 + \begin{smallmatrix} +10 \\ 0 \end{smallmatrix} \%$;
- 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.

20 Stability and mechanical hazards

This clause of Part 1 is applicable.