



IEC 60335-2-96

Edition 3.0 2024-10
COMMENTED VERSION

INTERNATIONAL STANDARD

Corrected version
2025-10



Household and similar electrical appliances – Safety –
Part 2-96: Particular requirements for flexible sheet heating elements for room
heating

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-96: Particular requirements for flexible sheet heating elements for room heating

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 60335-2-96:2024 edition 3.0 allows the user to identify the changes made to the previous IEC 60335-2-96:20019 edition 2.0. 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 60335-2-96 has been prepared by IEC technical committee 61: Safety of household and similar electrical appliances. It is an International Standard.

This third edition cancels and replaces the second edition published in 2019. 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, 5.2, 7.12.101);
- c) correction to reinstate the touch current limit in 22.105.

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

Draft	Report on voting
61/7279/FDIS	61/7304/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 flexible sheet heating elements for room heating.

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 additional differences exist in the countries indicated below.

- 1: Flexible sheet heating elements that are cut on site are not allowed (France).
- 7.12.1 c): The instructions in timber floors shall state that the heating unit is to be covered with additional insulation, be supplied through an isolating transformer, or be class II (Sweden).

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.

The content of the corrigendum 1 (2025-10) has been included in this copy.

INTRODUCTION

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

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 which 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 2-96: Particular requirements for flexible sheet heating elements for room heating

1 Scope

This clause of Part 1 is replaced by the following.

This part of IEC 60335 deals with the safety of **flexible sheet heating elements** intended to be incorporated into floors and walls below 1,2 m and above 2,3 m and in ceilings, their **rated voltage** being not more than 250 V for single-phase installations and 480 V for other installations including direct current (DC) supplied appliances. **3**

Flexible sheet heating elements are converted into **heating units** that are incorporated in the building in accordance with the instructions after which the required level of protection against hazards is achieved.

NOTE 101—Attention is drawn to the fact that

- in many countries, different wiring rules apply;
- for **heating units** intended to be used in vehicles or on-board ships or aircraft, additional requirements can be necessary;
- in many countries, additional requirements are specified by the national authorities for fire protection, the national authorities for building regulations, the national health authorities, the national authorities responsible for the protection of labour and similar authorities.

NOTE 102—This standard does not apply to

- **heating units** intended exclusively for industrial purposes;
- **heating units** intended to be used in locations where special conditions prevail, such as the presence of a corrosive or explosive atmosphere (dust, vapour or gas);
- blankets, pads, clothing and similar flexible heating appliances (IEC 60335-2-17);
- foot warmers and heating mats (IEC 60335-2-81);
- heated carpets and for heating units for room heating installed under removable floor coverings (IEC 60335-2-106);
- **flexible sheet heating elements** incorporated in other appliances.

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

IEC 60364-7-701:~~2006~~, *Low-voltage electrical installations – Part 7-701: Requirements for special installations or locations – Locations containing a bath or shower*

IEC 60884-1:~~2002~~2022, *Plugs and socket-outlets for household and similar purposes – Part 1: General requirements*

~~IEC 60884-1:2002/AMD1:2006~~
~~IEC 60884-1:2002/AMD2:2013⁴~~

ISO 3864-1, *Graphical symbols – Safety colours and safety signs – Part 1: Design principles for safety signs and safety markings*

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1 Definitions relating to physical characteristics

Replacement:

3.1.9 *Modification:* **4** **normal operation**

Replace the first paragraph with the following:

operation of the **heating unit** after incorporation into the building in accordance with the instructions.

Flexible sheet heating elements, the current of which can vary depending on the length of the **flexible sheet heating elements** and those that can supply other **flexible sheet heating elements** are loaded so that the current marked on the **flexible sheet heating elements** flows through the **heating unit**.

Heating units for **storage heating applications** are charged for 75 % of the **rated charging period**.

3.1.101 **rated charging period**

longest uninterrupted charging period assigned to the **heating unit** by the manufacturer

3.2 Definitions relating to means of connection

3.2.1 *Replacement:* **supply leads**

set of wires intended for connecting the appliance to fixed wiring

3.5 Definitions relating to types of appliances

3.5.4 *Addition:*

Note 101 to entry: **Heating units** are considered to be **fixed appliances**.

3.5.101 **flexible sheet heating element**

heating element consisting of sheets of electrical insulation laminated with electrical resistance material, or a base material on which electrically insulated heating wires are fixed

Note 1 to entry: This definition does not preclude other methods of combining the insulation and resistance materials.

⁴ ~~There exists a consolidated edition 3.2:2013 that includes edition 3:2002, its Amendment 1:2006 and Amendment 2:2013.~~

3.5.102

heating unit

flexible sheet heating element equipped with means of connection to the supply and with insulation surrounding **live parts**

Note 1 to entry: The **heating unit** can be partly or completely prefabricated.

3.5.103

modular heating unit

prefabricated assembly consisting of a **heating unit** and other materials to form a rigid construction for mounting on a ceiling

3.5.104

storage heating application

use of **heating units** to heat thermal accumulating material

Note 1 to entry: The heat is discharged naturally, the heat output being varied by adjusting the energy input.

3.6 Definitions relating to parts of an appliance

3.6.101

electrode

conductive part incorporated in a **flexible sheet heating element** for supplying the heating material

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 Replacement:

In general, eight samples are required for the tests.

The tests of 13.3 and of Clause 15 and Clause 16 are carried out on one sample.

The tests of 18.101 and of Clause 30 are carried out on one sample.

The test of 21.102 is carried out on two samples. One of these samples is also used for the test of 22.101.

The test of 22.103 is carried out on one sample.

The remaining tests are carried out on the sixth sample. The other two samples are required for incorporating into the test arrangement to create the necessary thermal environment.

~~NOTE 101—Additional samples can be necessary if tests have to be repeated.~~

*Nine samples of **modular heating units** are necessary for the tests of 11.2.102.*

Additional samples are necessary if the tests of 18.102 are carried out.

~~Additional samples can be necessary for testing different sizes of **heating units**.~~

The test of 22.105 is carried out on the same sample as that used for the test of 13.2.

Two samples of the additional layer of material, of ~~sufficient~~ a size necessary to cover the heating unit, are required if the test of 21.104 is carried out.

NOTE 101 Additional samples can be necessary if tests have to be repeated or for testing different sizes of heating units.

5.3 Addition:

The test of 22.105 is carried out after the test of 13.2.

5.6 Addition:

Thermostats sensitive to room air temperature or outdoor air temperature are short circuited. However, the thermostat is not short circuited if it can be set so that it does not cycle.

5.10 Addition:

However, for flexible sheet heating elements that are cut on site, the tests are carried out after connecting the supply leads and protecting the edges in accordance with the instructions.

5.101 Heating units intended to be installed in walls above a height of 2,3 m are subjected to the tests for installation in ceilings.

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 Addition:

It is not necessary to classify heating units ~~need not be classified~~. However, if a heating unit is classified, the relevant requirements apply.

6.2 Addition:

Heating units for installation in concrete or similar materials shall be at least IPX7.

Other **heating units** shall be at least IPX1.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 Modification:

Instead of the marking of **rated power input** or **rated current** the following applies:

- **heating units** shall be marked with their **rated power input**;
- **flexible sheet heating elements** without connection between adjacent elements shall be individually marked with their **rated power input**;
- other **flexible sheet heating elements** shall be marked with their **rated power input** per metre length.

Flexible sheet heating elements shall be marked with their maximum current if

- the current can vary depending on the length of the **flexible sheet heating element**;
- other **flexible sheet heating elements** can be supplied through them.

Addition:

Flexible sheet heating elements shall be marked with:

- the indication of orientation, unless **heating units** are symmetrical;
- the intended installation (ceilings, walls between 0,2 m and 1,2 m and/or above 2,3 m, or floors);
- the heating mode (direct heating or storage heating), unless intended for both modes.

If the **heating unit** is only intended for application in floors of concrete or similar materials, it shall be marked with the symbol for installation in concrete or similar materials.

The marking shall be repeated at least once every 0,5 m of the **flexible sheet heating element** or on every section that can be cut to form a **heating unit**.

Flexible sheet heating elements that can be cut on site and have to be cut at specified places shall be marked appropriately.

Appliances with separate controls, without a control, or with **detachable controls** shall be marked with the reference number or by other means of identification of the control.

7.6 Addition:

Sample Document



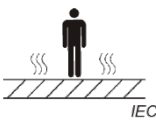
[symbol IEC 60417-6447
(2021-01)]

heating, direct ceiling-heating



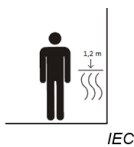
[symbol IEC 60417-6446
(2021-01)]

heating, direct floor-heating



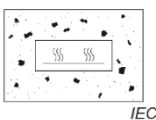
[symbol IEC 60417-6448
(2021-01)]

heating, floor storage-heating



[symbol IEC 60417-6445
(2021-01)]

wall-heating, wall



[symbol IEC 60417-6449
(2021-01)]

heating, installation in concrete or similar materials

These symbols are information signs and, except for the colours, the rules of ISO 3864-1 apply.

7.12.1 Addition:

Instructions shall be provided. They shall include

- a) explanation of the marking and symbols, if necessary;
- b) information for incorporating the **heating units** into the building, in particular the following:
 - precautions to be taken to avoid damage during installation, such as dropping sharp objects or stepping on the **heating unit**, or careless pouring of concrete;
 - dimensions and distances to be taken into account;
 - a statement that the **heating units** have to be separated from other heat sources such as luminaires and chimneys;
 - description of the fixing areas of the **heating unit** and the separate screen, if applicable;
 - guidance on how to avoid air gaps between the **flexible sheet heating element** and the screed of concrete floors;
 - guidance on how to avoid damage to a **flexible sheet heating element** and its terminations in timber constructions due to relative movement after installation;
 - the lowest ambient temperature at which **heating units** ~~may be installed~~ are recommended for installation;
 - the minimum radius for bending the **flexible sheet heating element**, if applicable;
 - a statement that **heating units** ~~shall~~ are not ~~cross~~ to be installed across expansion joints of the building or structure;
 - a statement to ensure that attachment of room fittings does not restrict heat emission from heated areas.

Except for **modular heating units**, the instructions shall include the following:

- precautions to be taken to avoid creasing the **flexible sheet heating element**;
 - a statement that the **heating unit** is not to be installed on irregular surfaces;
 - a description of the intended orientation and a statement that the **heating unit** is to be installed in this way (for **heating units** having non-symmetric construction);
- c) a statement that ~~the installation is to be in accordance with the national wiring rules. The substance of the following information shall be included~~ national wiring rules can apply for the installation including the following:
 - a statement that the **heating units** are to be supplied through a residual current device (RCD) having a rated residual operating current not exceeding 30 mA. The RCD shall not be of the time delayed type. Alternatively, except for installations in floors surrounding swimming pools or walls below a height of 2,3 m, they may be supplied through an isolating transformer. This statement is not required for **class III heating units** and for applications in
 - timber floors provided that the instructions for installation state that there is to be an air gap between the heating unit and the floor;
 - timber ceilings;
 - floors of concrete or similar materials in dry locations (dry locations are areas outside zone 3 as defined in IEC 60364-7-701) as long as the **basic insulation** and additional electrical insulation each withstand the electric strength test of 16.3 for **reinforced insulation**;
 - how to connect **heating units** to the supply, giving the cross-sectional area of the leads, if applicable;
 - how to interconnect the **heating units**, giving the cross-sectional area of the leads, if applicable;
 - a statement that **heating units** shall be installed to avoid increasing the ambient temperature of any existing electrical installation;