

INTERNATIONAL STANDARD



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



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INTERNATIONAL STANDARD



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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-17: Particular requirements for blankets, pads, clothing and similar flexible heating appliances

FOREWORD

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This commented version (CMV) of the official standard IEC 60335-2-17:2022 edition 4.0 allows the user to identify the changes made to the previous IEC 60335-2-17:2012+AMD1:2015+AMD2:2019 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 60335-2-17 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 2012, Amendment 1:2015 and Amendment 2:2019. 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, 19.106, 21.103, 21.104, 21.110, 30.1, 30.102, Annex BB, CC.19.3);
- c) clarification of the definition of control unit (3.6.105);
- d) revision for adjusting the supply voltage of appliances, other than controlled appliances, when operation at rated power input times a factor is specified (5.12);
- e) clarification of testing of blankets that cannot be folded with five thicknesses (19.101);
- f) updated compliance criteria to include breakage of electrodes (21.1);
- g) clarification of the test method for mattresses based on the rigidity index of the flexible part (21.111.1, Annex DD);
- h) clarification for testing heating elements with a non-circular construction (21.111.3);
- i) addition of requirements to protect the user from overheating in the event of an interruption in the mains supply (22.111)
- j) inclusion of pressure test method from IEC 60320-1:2001 (30.1);
- k) update of test methods for resistance to fire tests (30.101.1, 30.102).

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

Draft	Report on voting
61/6671/FDIS	61/6747/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/standardsdev/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 blankets, pads, clothing and similar flexible heating appliances.

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 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,
- 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.

The following differences exist in the countries indicated below.

- 6.1: Class 0 products are allowed (Japan).

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~~ 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 2-17: Particular requirements for blankets, pads, clothing and similar flexible heating appliances

1 Scope

This clause of Part 1 is replaced by the following.

This part of IEC 60335 deals with the safety of electric **blankets, pads**, clothing and other flexible appliances that heat the bed or human body, 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**

This standard also applies to **control units** supplied with the appliance.

Appliances not intended for normal household use but which nevertheless ~~may be~~ possibly pose a source of danger to the public, such as appliances intended to be used in beauty parlours or by persons in cold ambient temperatures, are within the scope of this standard.

Requirements and tests for clothing are given in **normative** Annex CC.

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~~ Children are considered to be old enough to use an appliance without supervision when they have been adequately instructed by a parent or guardian and are deemed competent to use the appliance safely.

~~NOTE 102~~ Attention is drawn to the fact that

- for appliances intended to be used in vehicles or on board ships or aircraft, additional requirements ~~may~~ can 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 103~~ This standard does not apply to

- appliances intended to be used in locations where special conditions prevail, such as the presence of a corrosive or explosive atmosphere (dust, vapour or gas);
- rigid bed warmers, such as those of metal or ceramic material;
- water bed heaters (IEC 60335-2-66);
- heating appliances for breeding and rearing animals (IEC 60335-2-71);
- foot warmers and heating mats (IEC 60335-2-81);

- appliances specifically intended for use under medical supervision (IEC 60601-2-35);
- heated carpets (IEC 60335-2-106).

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
Amendment 1 (2007)⁴~~

ISO/IEC Guide 37, *Instructions for use of products of consumer interest by consumers*

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

ISO 3758, *Textiles – Care labelling code using symbols*

~~ISO 7000:2014, Graphical symbols for use on equipment – Registered symbols~~

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~~ Addition: **4** ~~normal operation~~

operation of the appliance under the following conditions:

- **blankets** and **pads** are placed between sheets of thermal insulation;
- **duvets** are placed on a sheet of thermal insulation but not covered;
- **mattresses** are covered by a sheet of thermal insulation

Note 101 to entry: The specification for the thermal insulation is given in *normative* Annex AA

The **flexible part** is supported on a plywood base 20 mm thick and positioned not less than 300 mm above the floor. The size of the plywood base is such that the thermal insulation can be fully supported over its entire area. The size of the sheets of thermal insulation is such that the edges extend at least 100 mm beyond the outline of the **heated area**.

Control units held in the hand when they are actuated and cord switches are positioned to hang away from the plywood base. Other **control units** are placed on a supporting surface away from the plywood base.

~~3.101~~

~~flexible part~~

~~all layers of material forming the permanent enclosure of the appliance together with the heating element, electro-conductive textile, thermostats and all other current-carrying parts contained within it~~

~~Note 1 to entry: The flexible part may be inside a detachable cover.~~

⁴ ~~There exists a consolidated edition 2.1 (2007) that includes edition 2 and its Amendment 1.~~

3.5 Definitions relating to types of appliances

~~3.102~~ 3.5.101

blanket

appliance comprising a substantially flat **flexible part** that is intended to form part of the bedding, for heating the bed

~~3.103~~ 3.5.102

underblanket

blanket intended to be used under the occupant of the bed

~~3.104~~

~~Void~~

~~3.105~~ 3.5.103

overblanket

blanket intended to be used over the occupant of the bed

~~3.106~~ 3.5.104

duvet

quilted **overblanket** intended to be used without additional bedding over the occupant of the bed, the **heating element**, **electro-conductive textile**, providing supplementary heat

~~3.107~~ 3.5.105

pad

appliance comprising a **flexible part** having a **heated area** not exceeding 0,3 m² on each face and which is intended to heat part of the human body

If the **pad** is constructed in a cylindrical or similar form, the limit for the **heated area** is 0,6 m².

~~3.108~~ 3.5.106

mattress

appliance for supporting the human body and which incorporates an upholstered **flexible part** for heating the bed

Note 1 to entry: The appliance may be placed on the floor and referred to as a mat.

~~3.109~~ 3.5.107

controlled appliance

appliance incorporating means in the **flexible part**, such as **heating elements with PTC characteristics** or other means, for sensing changes in temperature when the appliance is operated under **normal operation**, thus automatically controlling the average power input

3.5.108

moisture-proof appliance

appliance having a **flexible part** that is suitable for use under moist conditions

3.5.109

wrap

appliance comprising a **flexible part** intended to be draped over the human body in order to keep it warm

3.6 Definitions relating to parts of an appliance

3.6.101

flexible part

all layers of material forming the permanent enclosure of the appliance together with the **heating element**, **electro-conductive textile**, **thermostats** and all other current-carrying parts contained within it

Note 1 to entry: The flexible part may be inside a detachable cover.

3.1106.102**heating element**

heating conductor, including any core and insulation, together with any other integrated conductor

3.1116.103**heated area**

area of the **flexible part** enclosed within the outer perimeter of the **heating element** or **electro-conductive textile**

It includes a margin outside the perimeter that has a width equal to 0,5 times the average distance between adjacent runs of the **heating element**.

The **heated area** includes the return length of the **heating element** if the average distance between this part and the adjacent **heating element** does not exceed the average distance between adjacent runs of the **heating element**.

If a **blanket** or **mattress** has two separate **heated areas**, the surface between the two areas is considered to be part of the **heated areas**, if at any place the distance between the two **heating elements** does not exceed 1,5 times the average distance between adjacent runs of the **heating element**.

3.112**moisture-proof appliance**

~~appliance having a **flexible part** that is suitable for use under moist conditions~~

3.1136.104**bonded enclosure**

enclosure of the **flexible part** that has the opposite faces joined together by means of an adhesive or by welding

3.1146.105**control unit**

device, ~~other than a multi-position cord switch, that does not incorporate components for regulating the power input,~~ external to the **flexible part**, by means of which the average power input of the appliance or the temperature of the **flexible part** can be adjusted or regulated

Note 1 to entry: **Control units** may be incorporated in the **supply cord** or at the end of an **interconnection cord**.

3.115**wrap**

~~appliance comprising a **flexible part** intended to be draped over the human body in order to keep it warm~~

3.1166.106**electro-conductive textile**

material incorporating carbon or other conductive substance, together with any associated insulation, which is connected to a pair of electrodes for the purpose of providing a heated surface

3.1176.107**heating element with PTC characteristics**

heating element 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 Modification:

The tests are carried out on two appliances, identified as appliance A and appliance B.

Addition:

If a further appliance is required in order to continue testing after a test of Clause 19, it shall be adequately preconditioned taking into account 21.102 to 21.107.

*For appliances having a **bonded enclosure**, additional appliances are required for the tests of 21.108 and 21.111. For other appliances, a length of 15 m of **heating element** is required for the tests of 21.111.*

*For **moisture-proof pads** subjected to the tests of 21.110, five additional appliances and 1 m² of enclosure material are required.*

*If heat-shrink material is used to insulate connections in the **flexible part**, a sample at least 150 mm in length is required for the test of 30.102.*

*An additional appliance may be ~~required~~ **used** for the test of 19.107.*

*Additional samples of **pads** may be ~~required~~ **used** for the test of 30.101.*

*For appliances having a **flexible part** incorporating **electro-conductive textile** and a **working voltage** above 24 V, an additional sample may be ~~required~~ **used** for the test of 21.113.2 and a 1 m length of sheet insulation ~~will be~~ **is** required for the test of 21.113.1.*

5.3 Replacement:

The order in which the tests are carried out is as follows:

*Appliance A: Clause 7, 22.11, Clause 8, 22.108, ~~22.112~~, 10, 21.102 to 21.107, **22.104**, Clauses 13, 15, 16, 17, 20, 25.15, 25.16, 19 (except 19.106), 21.108, 22.18, Clauses 30, 31 and 32. 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.*

Appliance B: Clauses 10, 11, 19.106, 21 (remainder), Clause 22 (remainder), Clauses 23, 24, 25 (remainder), Clauses 26, 27, 28, 29 and 14.

*The **flexible part** of washable appliances is laundered twice in accordance with the instructions before testing is started.*

If it is evident from the construction of the appliance that a particular test is not applicable, the test is not carried out.

5.5 Addition:

*If the **flexible part** of the appliance is provided with a **detachable cover**, the tests are carried out with or without this cover, whichever is more unfavourable. However, **duvets** are tested without a **detachable cover**.*

If the construction of a **mattress** incorporates a separate **flexible part** that is detachable, the **detachable flexible part** is tested as an **underblanket**.

If the **heating element** can move in the channels, it is manipulated so that the individual runs are placed in the most unfavourable position.

5.6 Addition:

When testing appliances for DC only, the possible influence of polarity on the operation of the appliance is taken into account.

5.7 Modification:

For **controlled blankets** and **mattresses**, the tests of Clauses 10, 11 and 19 are carried out at an ambient temperature of $15\text{ °C} \pm 5\text{ °C}$.

5.8.1 Addition:

Appliances for DC only are tested with DC.

5.8.101 Controlled appliances are supplied as specified for **motor-operated appliances**.

5.12 Modification:

~~In the note, replace “25 %” by “10 %”.~~

Replacement

For appliances, other than **controlled appliances**, when it is specified that the appliance has to operate at the **rated power input** multiplied by a factor, the supply voltage is determined by supplying the appliance at **rated voltage** until the **heating element** reaches its operating temperature.

The supply voltage is then rapidly increased to the value necessary to give the power input required for the relevant test, this value of the supply voltage being maintained throughout the test. **5**

5.101 Duvets and wraps are tested as **overblankets**.

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 Modification:

Appliances shall be marked with the **rated power input**. If the appliance has two means of connection to the supply, the **rated power input** shall be stated for each circuit separately and the information provided on a single label.

The **rated power input** may be expressed as $2 \times \text{rated power input}$ for each circuit in watts. Other ways of expressing the **rated power input** may be used and the total given, provided they do not give rise to misunderstanding.

Parts of **class III construction** shall not be marked with the **rated voltage** of the appliance.

Addition:

Flexible parts and **detachable covers** shall be marked with the name, trademark or identification mark of the manufacturer or responsible vendor.

Detachable covers shall be marked with the model or type reference of the appliance with which they are intended to be used.

The **flexible part** of appliances to be used with a **detachable control unit** shall be marked with the reference of the **control unit** to be used.

The **flexible part** of appliances to be used with a **detachable transformer** shall be marked with the reference of the transformer to be used.

Flexible parts shall be marked with the substance of the following:

- symbol ISO 7000-0790 (2004-01), or by the text "Read the instructions";
- the ~~symbol~~ sign shown in Figure 101, or by the text "Do not insert pins";
- the ~~symbol~~ sign shown in Figure 102 "Not to be used by very young children (0-3 years)", or by similar text;
- symbol ISO 7000-3114 (2011-10) and symbol ISO 7000-3124 (2011-10);
- intended orientation of **blankets** and **mattresses** (this marking is not required if the appliance complies with 11.101, whichever way it is placed on the bed).

Underblankets, other than those having a **heating element with PTC characteristics**, shall be marked with the ~~symbol~~ sign shown in Figure 103 or by the text "Do not use folded or rucked".

Detachable covers shall be marked with the following:

- symbol ISO 7000-0790 (2004-01);
- ~~symbol~~ sign of Figure 101.

The **flexible part** of **blankets** and **detachable covers** shall be marked with the appropriate laundering symbols specified in ISO 3758. Washable appliances fitted with a **non-detachable flexible cord** shall be marked with symbol ISO 7000-3125 (2011-10). Non-washable appliances shall be marked with symbol ISO 7000-3123 (2011-10).

7.6 Addition:



[symbol ISO 7000-3114
(2011-10)]

do not dry clean



[symbol ISO 7000-3123
(2011-10)]

do not wash



[symbol ISO 7000-3124
(2011-10)]

do not bleach



[symbol ISO 7000-3125
(2011-10)]

wash by hand



~~Not to be used by very young children (0-3 years)~~

7.12 Addition:

The instructions shall contain the substance of the following:

Important instructions. Retain for future use.

When the ~~symbols~~ signs of Figure 101, Figure 102, Figure 103 or those in the addition to 7.6 are used, the meaning shall be explained.

The instructions for **blankets** shall state whether the appliance is an **overblanket** or an **underblanket**.

The instructions shall specify the appropriate settings of controls for continuous use of the appliance.

The instructions for **pads** shall state that when the appliance is likely to be used for an extended period, for instance by the user falling asleep, controls should be adjusted to a setting recommended for continuous use. The instructions for **blankets** and **mattresses** shall state that if the appliance is slept on with the controls set to a higher temperature the user ~~may~~ can suffer skin burns or heat stroke.

The instructions for appliances provided with **detachable control units** or **detachable transformers** shall state that the appliance is only to be used with the types that are marked on the appliance.

The instructions for **duvets** shall state the length and width of the **detachable cover** to be used.

The instructions shall state the substance of the following:

- when not in use, store as follows (quote necessary instructions);
- when storing the appliance, allow it to cool down before folding;

- do not crease the appliance by placing items on top of it during storage (for **blankets** and **pads** only);
- examine the appliance frequently for signs of wear or damage. If there are such signs, if the appliance has been misused or does not work, return it to the supplier before switching it on again;
- this appliance is not intended for medical use in hospitals;
- do not use if wet (this instruction is not required for **moisture-proof appliances** or **class III appliances**);
- this appliance must not be used by persons insensitive to heat and other very vulnerable persons who are unable to react to overheating;
- children under the age of three are not to use this appliance due to their inability to react to overheating.

The instructions for **underblankets** shall state the substance of the following:

- the appliance should not be used on an adjustable bed; or
- if the appliance is used on an adjustable bed, check that the **blanket** and cord do not become trapped or rucked, for example in hinges.

The instructions shall state that the appliance is not to be used by young children over the age of three unless the controls have been pre-set by a parent or guardian, and unless the child has been adequately instructed on how to operate the controls safely.

Washable appliances shall be provided with instructions for laundering. The instructions for washable appliances fitted with a **non-detachable cord** shall state that the switch or **control unit** must not be allowed to get wet during washing and that during drying the cord must be positioned to ensure that water does not flow into the switch or control.

The instructions for non-washable appliances shall state how they can be cleaned, for example with a damp sponge.

7.14 Modification:

*Instead of petroleum spirit, liquid detergent is used to check the marking on **flexible parts** and **detachable covers**.*

Addition:

The height of the lettering on the **flexible part** shall be at least 2,5 mm.

The height of the ~~symbols~~ signs shown in Figure 101, Figure 102 and Figure 103 ~~and the symbol 'not to be used by very young children (0-3 years)'~~ shall be at least 15 mm.

The height of the words "Important instructions" and "Retain for future use" shall be at least 4 mm.

Compliance is checked by measurement in accordance with ISO/IEC Guide 37.

7.15 Addition:

The symbols required to be marked on **detachable covers** shall be visible from the outside after the cover has been fitted.

Symbol IEC 60417-5018 (~~2006-10~~2011-07) shall be placed next to symbol IEC 60417-5172 (2003-02) or symbol IEC 60417-5180 (2003-02), as appropriate.

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.

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.

10.1 Modification:

The negative deviation in Table 1 is increased to 20 %.

If the appliance has two means of connection to the supply, the permitted deviation for power input specified in Table 1 shall be measured separately for each circuit.

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:

The plywood base is placed away from the walls of the test corner.

Addition:

Underblankets having the length of their longest side less than 1 m and **duvets**, other than those having **heating elements with PTC characteristics**, are also tested folded. A single fold across the complete width of the **duvet** is made at a quarter of the length from one end. Controls are adjusted to the highest setting intended for continuous use.

Wraps, other than those having **heating elements with PTC characteristics**, are also tested folded. A single fold is made across the **flexible part** in the most unfavourable place.

11.3 Addition:

Thermocouples used for determining the temperature of **heating elements**, or sheaths containing them, are attached with textile thread over a length of at least 10 mm.

Thermocouples used for determining the temperature of the surface of **electro-conductive textiles** are fixed by means of thin adhesive tape.

Thermocouples used for determining the temperature of the surface of **pads** are attached to plates of copper or brass measuring 65 mm × 65 mm × 0,5 mm. The plates are positioned to cover as many **heating element** runs as possible, with one side parallel to the direction of the run. The temperatures are determined at not less than six places, three on each outer surface of the **flexible part**.

11.4 Addition:

Appliances having a **flexible part** of **class III construction** are supplied with the most unfavourable voltage between 0,94 and 1,06 times **rated voltage**.

11.7 ~~Replacement~~ Addition: 6

Appliances are operated until steady conditions are established.

11.8 Addition:

For **controlled appliances**, the temperatures shall not exceed the values shown in Table 101. If the **flexible part** is comprised of **electro-conductive textile**, the values specified for **heating elements** are applicable to the surface of **supplementary insulation** or **reinforced insulation**, or to the conductive surface if there is no insulation.

Table 101 – Maximum temperatures

Part	Temperature °C
Heating element of blankets and mattresses	
– before the second operation of the thermal control	115
– under steady conditions	95
Heating element of pads	
– before the second operation of the thermal control	120 ^a
– under steady conditions	100
Surface of pads	50 ^b
^a A temperature of 140 °C is allowed for a period of 10 min.	
^b The temperature may exceed 50 °C, but not 85 °C, for a maximum period of 2 h. The period commences when the temperature first exceeds 50 °C.	

For other appliances, the temperature rises shall not exceed the values shown in Table 102.

Table 102 – Maximum temperature rises

Part	Temperature rise K ^a
Heating element	80
Surface of pads	35
^a These values are based on the normal ambient temperature of the appliance and take into consideration the maximum allowed ambient temperature during the test.	

If the ends of the **heating element** of **pads** are contained in a plastic sheath attached to the **flexible part**, the temperature or temperature rise specified for the surface also applies to the **accessible surface** of the sheath.

11.101 It shall be possible to operate **blankets** and **mattresses** without risk of skin burn or heatstroke to the user.

Compliance is checked by the following test.

The appliance is supplied as specified in 11.4 and operated under **normal operation** until steady conditions are established. The ambient temperature is maintained at $15\text{ °C} \pm 2\text{ °C}$. **Control units** and cord switches are adjusted to the highest setting recommended for continuous use, except for **wraps** when the lowest setting for continuous use is used.

The temperature of the surface of the **flexible part** is determined by means of a thermocouple attached to the centre of a plate of copper or brass having dimensions 300 mm × 300 mm × 0,5 mm. For **overblankets**, the plate is placed under the **flexible part**. For **underblankets** and **mattresses**, the plate is placed over the **flexible part**.

The temperature of **controlled appliances** shall not exceed 50 °C during the first hour of operation. It shall then not exceed:

- 45 °C, for one third of the length of the **flexible part** nearest the foot end of the bed;
- 37 °C, for the remainder of the **flexible part**.

The temperature rise of other appliances shall not exceed 33 K during the first hour of operation. It shall then not exceed:

- 28 K for one third of the length of the **flexible part** nearest the foot end of the bed;
- 20 K for the remainder of the **flexible part**.

If the ends of the **heating element** are contained in a plastic sheath attached to the **flexible part**, the temperature limit specified also applies to the **accessible surface** of the sheath.

If the **control unit** automatically switches to a lower setting during the first hour of operation, ~~it may be necessary to continue~~ in case of doubt, the test shall be continued after steady conditions have been established to ensure that the **control unit** does not subsequently revert to a higher heat setting, resulting in the temperature limits being exceeded.

11.102 The surface temperature of **pads** shall not be excessive if they are used partially covered for an extended period.

Compliance is checked by the following test.

Pads are supplied as specified in 11.4 and operated under **normal operation** except that 2/3 of the **flexible part** is positioned so that it overhangs the edge of the plywood support. Controls are adjusted to their highest setting recommended for continuous use and the surface temperature of the pad is measured as specified in 11.3.

The temperature of the surface of the **flexible part of controlled pads** shall not exceed 85 °C and the temperature rise of the surface of other **pads** shall not exceed 60 K.

The covered portion may be secured to prevent the **pad** slipping off the support.

12 ~~Void~~ Charging of metal-ion batteries 7

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.

13.1 Addition:

For **mattresses**, a sheet of metal foil, approximately 0,1 mm thick and of sufficient size to cover the area of that part of the **mattress** incorporating the current-carrying parts, is inserted between the **mattress** and the sheet of thermal insulation. For other appliances, two such sheets of metal foil are inserted, one above and one below the **flexible part**, these sheets being electrically connected together. A uniformly distributed load of approximately 35 kg/m² is placed on the top sheet of thermal insulation.

The arrangement is shown in Figure 104.

13.2 Modification:

For the **flexible part**, the leakage current is measured between any pole of the supply and the sheets of metal foil.

Instead of the values specified, the leakage current for the **flexible part** shall not exceed

- for **pads**, 0,5 mA;
- for **blankets** and **mattresses**, 1 mA/m² of the **heated area**, with a maximum of 2,5 mA.

13.3 Modification:

For the **flexible part**, the test voltage is applied between **live parts** and the sheets of 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 Addition:

For the **flexible part**, compliance is checked as follows:

- for **blankets** and **pads**, by the test of 15.101;
- for **moisture-proof appliances**, by the tests of 15.101 and 15.102. However, **pads** subjected to the tests of 21.109 and 21.110 are not subjected to the tests of 15.102;
- for **mattresses**, by the tests of 15.103.

The tests of Clause 16 are carried out with the appliance still immersed or in contact with the saline solution.

15.3 Addition:

The **flexible part** is not subjected to the test.

15.101 Washable appliances are laundered according to the instructions, with all parts of the **flexible part** immersed.

The **flexible part** is then immersed for 1 h in water containing approximately 1 % NaCl at a temperature of $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ after removing **detachable parts**. All of the **flexible part** is immersed except

- appliance inlets;
- the point of entry of the flexible cord, unless it is a **moisture-proof appliance**;
- the connections of the **heating element** or internal wiring to the appliance inlet.

The appliance shall then withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation that could result in a reduction of **clearances** or **creepage distances** below the values specified in Clause 29.

For **moisture-proof appliances**, inspection shall show that water has not penetrated the **flexible part** to such an extent that it could come into contact with **heating elements** and other current-carrying parts.

The **flexible part** of washable appliances fitted with a **non-detachable flexible cord** is immersed again in the saline solution until it is saturated. It is then folded about its major axis and placed over a line located 2 m above the floor. The cord is freely suspended, any excess length being stretched out along the floor, and the **flexible part** allowed to drip-dry for 24 h.

The switch or **control unit** shall then withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation that could result in a reduction of **clearances** or **creepage distances** below the values specified in Clause 29.

15.102 An incision is made in the permanent enclosure and the **flexible part** is then immersed in the saline solution that is allowed to penetrate freely into the interior.

After a period of 1 h, the appliance shall withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation that could result in a reduction of **clearances** or **creepage distances** below the values specified in Clause 29.

15.103 Mattresses are supported on a piece of plywood. A quantity of water, containing approximately 1 % NaCl, corresponding to 1 l/m² of the upper surface area, is poured uniformly over the **mattress** at the rate of 1 l/min.

The saline solution is allowed to soak into the **mattress** for a period of 30 min.

The **flexible part** shall then withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation that could result in a reduction of **clearances** or **creepage distances** below the values specified in Clause 29.

16 Leakage current and electric strength

This clause of Part 1 is applicable except as follows.

16.2 Addition:

The **flexible part** of **blankets** and **pads** is tested with the voltage applied between **live parts** and an electrode immersed in the saline solution.

The **flexible part** of **mattresses** is covered with metal foil.

The leakage current of **flexible parts** shall not exceed

- for **pads**, 1 mA;
- for **blankets** and **mattresses**, 5 mA.

16.3 Modification:

The **flexible part** of **blankets** and **pads** is tested with the voltage applied between **live parts** and an electrode immersed in the saline solution. However, when the test is carried out on **blankets** and **pads** without first carrying out the tests of Clause 15, the **flexible part** is covered with metal foil instead.

Addition:

After the test, the **flexible part** of **blankets** and **pads** is thoroughly rinsed in water and then allowed to dry for at least 24 h at a temperature between 20 °C and 40 °C. During the drying period, the appliance is stretched in an attempt to regain the original dimensions.

Mattresses are rinsed with a quantity of water corresponding to 0,5 l/m² of the upper surface. The water is poured evenly over the upper surface and then wiped with a sponge, soaking up as much water as possible. This treatment is carried out three times and the **mattress** is then wiped with a dry cloth.

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.

19.1 Modification:

Instead of the tests specified, the following applies.

Blankets are subjected to the tests of 19.101 and 19.103.

Pads are subjected to the tests of 19.103 and 19.105. **Controlled pads** are also subjected to the tests of 19.104.

Mattresses are subjected to the tests of 19.103 and 19.108.

Appliances incorporating a fuse-link or **intentionally weak part** that ruptures due to a short circuit are also subjected to the test of 19.102.

Fuse-links incorporated in an appliance to protect the **flexible part** against overheating or ignition are not subjected to the tests of 19.12 and are not required to comply with IEC 60127. **8**

Appliances incorporating **electronic circuits** are also subjected to the tests of 19.11 and 19.12.

Unless otherwise specified, the appliance is supplied with a voltage

- between 0,9 times and 1,1 times the **rated voltage**, for **controlled appliances**,
- resulting in a power input between 0,85 times and 1,24 times the **rated power input**, for other appliances.

19.11.3 Addition:

The test of 19.106 is not repeated.

19.13 Addition:

The test of 15.101 is carried out before the test of 16.3.

If an electronic switch fails in the **off position** or stand-by mode and the appliance becomes permanently energized, the temperatures or temperature rises specified in 19.106 shall not be exceeded.

The temperature of the **flexible part** in contact with the thermal insulation shall not exceed 165 °C for **controlled appliances** and the temperature rise shall not exceed 150 K for other appliances.

Unless the appliance is no longer in an operating condition after the tests, the temperature of **heating elements** or **electro-conductive textiles** shall not exceed 160 °C for **controlled appliances** and the temperature rise shall not exceed 145 K for other appliances.

~~19.101~~

~~Void~~

~~19.102~~ **101** **Blankets** are operated under normal operation except that the flexible part is uncovered and folded at the most unfavourable place with a five-thickness fold having the most unfavourable dimensions. A sheet of thermal insulation as specified in **normative Annex AA**, having dimensions of 300 mm × 450 mm × 72 mm, is placed on the folded blanket at the most unfavourable location. A **sandbag or other** evenly distributed mass of 5 kg is placed on the sheet of thermal insulation.

The widths of each fold may be different ~~and a sandbag may be used as the mass.~~

If the **blanket** cannot be folded with five thicknesses, it is tested as a **mattress** in accordance with 19.108.

The appliance is supplied with a voltage at the upper limit of the range specified in 19.1.

19.103

Void

19.104

Void

19.105

Void

19.106

Void

19.107 ~~102~~ If compliance with 19.101, 19.105 ~~and~~ or 19.108 depends on the rupturing of a fuse-link or **intentionally weak part**, the test is repeated with the **flexible part** arranged as specified but with the point of maximum impedance of the protection circuit included in the most unfavourable part. The appliance is supplied with a voltage at the lower limit of the range specified in 19.1.

19.108 ~~103~~ Appliances are operated under the conditions specified in Clause 11. Any control that limits the temperature during the test of Clause 11 is short-circuited.

If the appliance incorporates more than one control, they are short-circuited in turn.

19.109 ~~104~~ **Controlled pads** are operated under **normal operation** except that two-thirds of the **flexible part** is positioned so that it overhangs the edge of the plywood support.

The covered portion may be secured to prevent the **pad** slipping off the support.

19.110 ~~105~~ **Pads** are operated under **normal operation** except that the **flexible part** is uncovered and folded at the most unfavourable place with a three-thickness fold having the most unfavourable dimensions. A sheet of thermal insulation as specified in **normative Annex AA**, having dimensions of 300 mm × 450 mm × 72 mm is placed on the folded **pad** at the most unfavourable location. A **sandbag or other** evenly distributed mass of 5 kg is placed on the sheet of thermal insulation.

The widths of each fold may be different ~~and a sandbag may be used as the mass.~~

19.111 ~~106~~ Appliances shall be constructed so that failure of a component does not give rise to an excessive temperature.

Compliance is checked as follows.

Blankets and mattresses are operated under the conditions of 11.101.

Pads are operated under **normal operation**. Controls are adjusted to the highest setting recommended for continuous use, the **pad** being supplied as specified in 11.4.

Failure of components, **other than heating elements and internal wiring**, that could reasonably be expected to occur in normal use is simulated, except that switching contacts are not short-circuited. Only one fault condition is applied at a time.

~~NOTE Heating elements and internal wiring are not considered to be components.~~

Failure of components that are expected to occur in normal use are the fault conditions specified in a) to g) of 19.11.2.

*During the test, the temperature of the surface of the **flexible part** of **controlled appliances** shall not exceed:*

- 60 °C for **blankets** and **mattresses**;
- 85 °C for **pads**.

For other appliances, the temperature rise shall not exceed:

- 43 K for **blankets** and **mattresses**;
- 60 K for **pads**.

19.11.107 Appliances incorporating

- **heating elements**;
- internal wiring having stranded conductors; or
- an unsheathed core of a flexible cord within the **flexible part** extending more than 100 mm from the cord anchorage

shall not attain excessive temperatures ~~in normal use~~ if one or more strands are broken.

Compliance is checked by the tests of 19.107.1 to 19.107.3 as appropriate or by assessment of the protection system.

19.11.107.1 *If **heating elements** or internal wiring do not have integral insulation, and have individual strands that are not electrically insulated from each other, the enclosure of the **flexible part** is opened at the most unfavourable place and a short length of the bare conductor is exposed. All but one of the strands are cut and folded back by approximately 15 mm. The enclosure is then closed and the appliance operated under **normal operation** for 4 h.*

If the single strand ruptures before any damage occurs, the test is repeated with the number of uncut strands increased to the minimum necessary to prevent rupturing.

After the test, there shall be no scorching of the enclosure or of any material in contact with the uncut strands.

19.11.107.2 *If **heating elements** or internal wiring have integral insulation, and have individual strands that are not electrically insulated from each other, the enclosure of the **flexible part** is opened at the most unfavourable place and a short length of the insulated conductor is exposed. A single identical strand 100 mm long is wrapped for one complete turn around the insulation of the conductor, the ends of the turn being spaced 1 mm apart. The strand is connected in series with the conductor, the enclosure is then closed and the appliance operated under **normal operation** for 4 h.*

If the single strand ruptures before any damage occurs, the test is repeated with the number of strands increased to the minimum necessary to prevent rupturing.

*After the test, there shall be no damage to the insulation of the conductor or to other material of the **flexible part**.*

NOTE A slight indentation of the insulation of the conductor is neglected.

19.112107.3 If **heating elements** or internal wiring have individual strands that are electrically insulated from each other, the **heating element** or wiring is disconnected from its terminals. A DC voltage of approximately 500 V is applied for 1 min between any two strands.

The insulation resistance is measured and shall not be less than

- for **class III appliances**, 0,1 MΩ;
- for other appliances, 1 MΩ .

19.113108 Mattresses are operated under **normal operation** except that the **flexible part** is uncovered and five runs of the **heating element** are bunched together in the most unfavourable way. Sufficient material of the permanent enclosure of the **flexible part** is removed at the most unfavourable location to get access to the **heating element** runs. The **heating element** runs are bunched over a length of 150 mm and secured by thin high-temperature tape which is not to be overlapped more than once. A sheet of thermal insulation as specified in **normative Annex AA**, having dimensions of 300 mm × 450 mm × 72 mm, is placed on the bunched **heating element** at the most unfavourable location. A **sandbag or other** evenly distributed mass of 5 kg is placed on the sheet of thermal insulation. ~~A sandbag may be used as the mass.~~

If the construction does not allow the **heating element** runs to be bunched together, the **heating element** assembly is removed from the **mattress** and subjected to the test of 19.101.

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.1 Addition:

The test is only applied to **control units** intended to be placed on a surface.

21 Mechanical strength

This clause of Part 1 is applicable except as follows.

21.1 Addition:

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

Compliance for the **flexible part** is checked as follows:

- for **blankets**, by the tests of 21.102, 21.105 and 21.106;
- for **mattresses**, by the tests of 21.104 to 21.106;
- for **pads**, by the tests of 21.103 and 21.105 to 21.107.

After these tests, inspection of the **flexible part** shall not show

- damage between electrodes and **electro-conductive textile** or between electrodes and their connections;
- that the enclosure is cracked or torn if it provides electrical insulation or protection against moisture;
- that the heating element has moved in the channels so that two runs come into contact with each other;
- breakage of any conductive thread of **electro-conductive textiles**;
- breakage of the conductors of the **heating element**;

- breakage of more than 10 % of the strands of internal wiring;
- breakage of electrodes; 9
- failure of constructional stitching, or breakage of glued or welded joints, to such an extent that compliance with the standard is impaired;
- loosening of a **non-detachable flexible cord** from the **flexible part**;
- loosening or breakage of electrical connections;
- open-circuiting of controls incorporated in the **flexible part**.

21.2 Addition:

This subclause is not applicable to **flexible parts** except those incorporating **electro-conductive textile** having a **working voltage** above 24 V.

21.101 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.

21.102 **Blankets** are securely attached to the apparatus described in **normative Annex BB**.

The **blanket** is pulled by the driving bar, the driving sprocket operating at a speed of 33 r/min.

The **blanket** is rotated 1 000 times with an end attached to the driving bar. It is then turned through 90° and rotated another 1 000 times.

The tests are carried out with the same face of the **blanket** adjacent to the drum.

When it is obvious which end of the **blanket** is intended to be positioned at the head of the bed, that end is attached to the driving bar. When this is not obvious, the end opposite the cord entry is attached to the driving bar.

When the **blanket** is turned through 90°, the side opposite the cord entry is attached to the driving bar.

21.103 **Pads**, with any **detachable cover** removed, are driven backwards and forwards over a smooth horizontal roller having a diameter of 25 mm. The **pad** is arranged so that one end hangs vertically over the roller while the full length of the other end is clamped to the driving means, which moves in a horizontal plane.

A clamp is attached to the end of the vertical part of the **pad** over its full length. A mass of 0,5 kg, or equivalent to 3 g/mm of the length of the attached end, whichever is greater, is attached to the clamp.

The stroke of the driving means is such that the greatest possible area is subjected to flexing.

The driving means is operated at a rate of approximately 125 mm/s for 2 000 cycles. The **pad** is then turned through 90° and subjected to a further 2 000 cycles. A cycle is two movements, one in each direction.

The tests are carried out with the same face of the **pad** adjacent to the roller.

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

21.104 Mattresses are laid flat on a horizontal plywood support. A roller of similar construction to the drum specified in **normative** Annex BB, having a mass of 61,5 kg and a length of 1 m, is rolled slowly forwards and backwards over the upper surface of the **flexible part** in the most unfavourable place. The roller is applied in the direction of the major axis over the same path for 1 000 cycles.

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

21.105 Appliances are operated continuously under the conditions specified in Clause 11. Non-controlled appliances and **controlled appliances** having a metallic temperature sensor are tested for 500 h. Other appliances are operated for 1 000 h. The surface temperature of the **flexible part** of **controlled appliances** is measured under steady conditions at the beginning and at the end of this period. It shall not have increased by more than 5 K. For appliances with **heating elements with PTC characteristics**, the test is carried out with the **flexible part** fully covered with a sheet of thermal insulation, as specified in **normative** Annex AA, having a thickness of 90 mm. However, the temperature of the **heating element with PTC characteristic** is measured after 100 h and at the end of the test under the conditions specified in Clause 11. It shall not have increased by more than 5 K.

21.106 The **flexible part** is subjected to the following test.

For **blankets**, the test of 21.102 is repeated but with the other face of the **flexible part** adjacent to the drum.

For **pads**, the test of 21.103 is repeated but with the other face of the **flexible part** adjacent to the roller.

For **mattresses**, the test of 21.104 is repeated but with the roller moved in the direction of the minor axis. In this case, 2 000 cycles are carried out, 1 000 in each of two non-overlapping paths.

21.107 Pads are subjected to a test in a tumbling barrel as shown in Figure 105, their **supply cords** having been cut off at a distance of 100 mm from the **flexible part**. The barrel is turned at a rate of 6 r/min to 7 r/min, so that the **pad** falls onto a steel plate twice in each revolution, the number of revolutions being 500.

21.108 Appliances having **heating elements** that are retained in position by bonded layers shall have adequate mechanical strength.

Compliance is checked by the following test.

Six samples of the bonded material, each having dimensions of 100 mm × 130 mm, are cut from the **flexible part**. Three of the samples are cut in the direction of the runs of the **heating element** and the other three samples are cut perpendicular to this direction.

From the ends measuring 100 mm, a strip of the material retaining the **heating element** in position and having a width of 25 mm is cut away from one face at one end of each sample. Another similar strip is removed from the opposite face and at the opposite end of the sample. Any **heating element** situated under the removed strips is also cut away.

NOTE It ~~may~~ can be necessary to cut away more than one layer in order to test the bonding of the layers retaining the **heating element**.

Clamps are attached to the full length of the remaining layers of material at both ends of the sample.

The sample is then suspended by one of the clamps and subjected to a total load of 1,25 kg by means of the other clamp. The test is carried out for 1 h at a temperature of 20 °C, and then for 1 h at a temperature of 80 °C.

*The test is repeated on six samples taken from the **flexible part** of a new appliance.*

*The layers retaining the **heating element** in position shall not separate.*

21.109 The enclosure of **moisture-proof appliances** consisting of plastic sheeting shall have adequate flexibility under cold conditions.

Compliance is checked by the following test unless the appliance complies with the test of 15.102 or has an enclosure made from reinforced plastic sheeting.

The sheeting is cut into 10 rectangular samples, each being 145 mm long and 50 mm wide with the longer dimension perpendicular to any striations resulting from the manufacturing process.

Each sample is folded about its minor axis and allowed to form a loop without creases. It is stapled to a card twice, the staples being placed close together and approximately 30 mm from the edges, as shown in Figure 106.

The test apparatus, which is also shown in Figure 106, has a steel arm that is freely pivoted at one end so that the other end can fall against a steel anvil on which the sample is placed. The mass of the arm assembly is $3,1 \text{ kg} \pm 0,03 \text{ kg}$, the arm and anvil being grooved to clear the staples fixing the samples to the card.

With its arm in the open position, the test apparatus is placed in a top-opening cabinet, the temperature of which is maintained at $-20 \text{ °C} \pm 2 \text{ °C}$.

When steady conditions are established, all 10 samples are placed on the floor of the cabinet with their loops uppermost for 1 h. A sample is then placed with its loop uppermost on the anvil of the test apparatus.

The arm of the test apparatus is then allowed to fall and strike the sample from an angle of 85° to the horizontal.

The test is carried out on the other samples as quickly as possible.

No more than two samples shall break into separate pieces.

21.110 The enclosure of **moisture-proof appliances** shall have adequate resistance to tearing under normal conditions of use.

For enclosures of plastic sheeting, compliance is checked by the test of 21.110.1, unless the appliance has been subjected to the test of 15.102 or the enclosure is made from reinforced plastic sheeting.

~~NOTE – The test is not carried out if the appliance has been subjected to the test of 15.102 or if the enclosure is made from reinforced plastic sheeting.~~

For enclosures of rubberised or similarly treated fabrics, compliance is checked by the tests of 21.110.2 to 21.110.4. For enclosures of seamed fabric, compliance is also checked by the test of 21.110.5.

21.110.1 Five samples of the plastic sheeting, as shown in Figure 107, are conditioned at an ambient temperature of $23\text{ °C} \pm 2\text{ °C}$. The longer dimension is perpendicular to any striations resulting from the manufacturing process.

The shorter edges of each sample are attached over their full length to the clamps of a tensile machine, the sample and the clamps being in the same plane. The clamps are separated at a rate of 50 mm/min until the sample tears. The maximum breaking load is measured.

The average breaking load of the five samples shall be not less than 12,5 N.

21.110.2 A sample of the treated fabric having a diameter of 76 mm is clamped between two disks, each having a diameter not less than 76 mm and a concentric aperture having a diameter of $26\text{ mm} \pm 0,7\text{ mm}$. This assembly is mounted in an apparatus so that water pressure can be applied to the untreated side of the fabric. The water pressure is gradually increased and is measured when leakage occurs through the fabric. It shall not be less than 410 kPa.

This test is carried out on three samples.

The average value of the pressure shall be at least 490 kPa.

21.110.3 Three sets of three samples, as specified in 21.110.2, are conditioned as follows.

The first set is immersed in boiling water for 1 h and then aged in a heating cabinet at a temperature of $100\text{ °C} \pm 1\text{ °C}$ for 1 000 h. The samples are then immersed again for 1 h in boiling water.

The second set is aged in an oxygen bomb for 168 h, the oxygen having a pressure of approximately 2,0 MPa and a temperature of $80\text{ °C} \pm 1\text{ °C}$.

The third set is aged in an air bomb for 20 h, the air having a pressure of approximately 0,55 MPa and a temperature of $127\text{ °C} \pm 1\text{ °C}$.

The test of 21.110.2 is then carried out on each sample.

The average value of the pressure for each set of samples shall be at least 70 % of the value obtained during the original test of 21.110.2.

21.110.4 Three samples, as specified in 21.110.2, are folded backwards and forwards 10 times.

This test is also carried out on three similar samples that have been conditioned as specified in 21.110.3 for the first set.

The samples shall show no crack, hard spot or other evidence of deterioration.

21.110.5 Twenty samples of seamed fabric, having dimensions of 75 mm × 25 mm, are cut so that the seam lies along the minor axis. They are then divided into four sets of five samples and three of the sets are conditioned as specified in 21.110.3.

All four sets of samples are then subjected to a gradually increasing tensile force until the seam starts to separate.

The average value of the force necessary to separate the seams shall be at least 22 N.

21.111 The insulation of **heating elements** and internal wiring in the **flexible part** shall retain adequate flexibility and insulating characteristics throughout the life of the appliance.

The requirement does not apply to **class III appliances** having a **rated voltage** not exceeding 24 V or to **class III constructions** having a **working voltage** not exceeding 24 V.

Compliance is checked by the tests of 21.111.1 and also by the tests of 21.111.2 and 21.111.3 when the insulation exceeds

- a temperature of 75 °C for **controlled appliances** or a temperature rise of 50 K for other appliances during the test of Clause 11, or
- a temperature of 135 °C for **controlled appliances** or a temperature rise of 110 K for other appliances during the tests of Clause 19.

*The tests are carried out on new samples of **heating element** or internal wiring. For appliances having a **bonded enclosure**, the samples are taken from a new appliance.*

For the test of 21.111.1, one sample measuring approximately 4 m in length is required. For the tests of 21.111.2, at least 12 samples are required, each having a length of 300 mm. For the test of 21.111.3, 12 samples are required each having a length of 300 mm.

*The test of 21.111.2 is also applied to the plastic sheath that protects the ends of the **heating element** and is attached to the **flexible part**.*

*The tests are also applied to a sheath that comprises **basic insulation** over earthed parts when the sheath is integral with the **heating element**.*

21.111.1 *The sample of **heating element** or internal wiring is attached to the equipment shown in Figure 108. 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 to which the carrier is moving.

*The diameter of the pulley is increased to 60 mm and the initial load to 0,5 kg for **heating elements with PTC characteristics** used in **mattresses**. The width and form of the groove of the pulley are to be appropriate for the sample under test.*

The carrier is moved by a means of a chain over a distance of 1 m at 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 may be passed through the sample during the test to help 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.

For a **heating element with PTC characteristics** integrated in the **flexible part of mattresses**, having a rigidity index measured according to normative Annex DD equal or greater than 25 N/m, the test is performed with two pulleys having the diameter at the base of the groove being modified as specified in Table 103. **10**

Table 103 – Pulley diameter for heating elements with PTC characteristic in mattresses

Cross sectional conductive area of heating element mm ²	Pulley diameter mm
≤ 6,0	120
> 6,0 to ≤ 10	160
> 10	200

21.111.2 The insulation is pulled off from 12 samples of the **heating element** or internal wiring. All conductive material, including sensor wires, is removed. If the insulation cannot be pulled off, it is slit longitudinally and allowed to re-close after removal of the conductive material. If the insulation of the **heating element** consists of more than one layer, only the outer layer is pulled off and tested.

In addition, if the **heating element** includes a functional earth conductor, the **basic insulation** of this conductor is removed and subjected to the test.

Six of the samples are conditioned by suspending them vertically so that they hang freely in a heating cabinet, having forced air circulation, 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 stabilised by 16 h after removal from the cabinet.

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

21.111.3 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. If the **heating element** has a non-circular construction, the diameter of the mandrel is approximately equal to the length of its minor axis **11**. The samples, together with the remaining six samples, are placed in a heating cabinet having forced air circulation and 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 stabilised by 16 h after removal from the cabinet.

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. There shall be no breakdown.

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

21.112 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.

21.113 The insulation of **flexible parts** incorporating **electro-conductive textile** shall retain adequate flexibility and insulating characteristics throughout the life of the appliance. The requirement does not apply to **class III appliances** having a **rated voltage** not exceeding 24 V or to **class III constructions** having a **working voltage** not exceeding 24 V.

Compliance is checked by the tests of 21.113.1 and 21.113.2 when the insulation exceeds

- a temperature of 75 °C for **controlled appliances** or a temperature rise of 50 K for other appliances during the test of Clause 11; or
- a temperature of 135 °C for **controlled appliances** or a temperature rise of 110 K for other appliances during the tests of Clause 19.

The tests are carried out on new samples of the **flexible part**.

21.113.1 Twelve samples having the shape as shown in Figure 109 are stamped from the **supplementary insulation** or **reinforced insulation**, six from the longitudinal direction and six from the lateral direction. If the insulation is integrated with the fabric supporting the conductive threads, the test is not carried out.

Three samples from each direction are conditioned by suspending them vertically so that they hang freely in a heating cabinet, having forced air circulation, 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.

The 12 samples are placed in a tensile machine in turn. 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.

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

21.113.2 Twelve samples having dimensions 200 mm × 100 mm are cut from the **electro-conductive textile**, any other covering being removed. At least one sample is to include a portion of electrode. The samples are then tightly rolled on a metal mandrel having a diameter of 25 mm along the line of the conductive threads, if any. The roll may be held together by suitable tape.

*They are then placed in a heating cabinet having forced air circulation 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**. They are then unwound and removed from the mandrel.*

A sample is then placed centrally on a metal plate having dimensions of 180 mm × 80 mm and a similar plate placed on top and weighted so that the applied mass is 5 kg. The sample is then subjected to the electric strength test of 16.3. The other 11 samples are then tested in the same way in turn.

Inspection shall show that there are no visible cracks in the insulation.

22 Construction

This clause of Part 1 is applicable except as follows.

~~22.101~~

~~Void~~

~~22.102~~

~~Void~~

~~22.103~~**101** The **flexible part** shall be constructed so that **heating elements**, **electro-conductive textiles** and internal wiring are retained in their intended position. The **heating element** shall be located so that there are no crossover points.

If the **heating element** or **electro-conductive textile** is supported by a separate layer of material, this material shall be firmly secured to the enclosure to prevent internal rucking.

Crossing of internal wiring shall be avoided as far as possible. When this is unavoidable, the wiring shall be secured in order to prevent any relative movement. This requirement does not apply to signal conductors dissipating less than 150 mW/m.

Compliance is checked by inspection.

~~22.104~~**102** There shall be no significant change in the position of the **heating elements** or electrodes if the stitching retaining them in position is broken.

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

~~22.105~~**103** **Thermostats** and **thermal cut-outs** incorporated in the **flexible part** shall be individually enclosed in insulating material.

Compliance is checked by inspection.

22.106

Void

22.107

Void

22.104 The dimensions of **detachable covers** shall be greater than those of the **flexible part**.

Compliance is checked by measurement after laundering the cover three times in accordance with the instructions.

22.105 **Control units** intended to stand on a table shall not have openings on the underside that could allow small items to penetrate and touch **live parts**.

*Compliance is checked by inspection and by measuring the distance between the supporting surface and **live parts** through openings. This distance shall be at least 6 mm.*

22.106 Fuse links or **thermal links** that are incorporated to protect the **flexible part** against overheating or ignition shall not be replaceable by the user.

Compliance is checked by inspection.

22.107 **Duvets** shall have adequate thermal properties.

Compliance is checked by the following test.

*The **duvet** is placed on a sheet of thermal insulation having a thickness of 72 mm as specified in **normative Annex AA**. A heat source as specified in **normative Annex AA** is placed between the thermal insulation and the **duvet**. When steady conditions are established, the temperature rise shall exceed 40 K.*

22.108 Appliances shall incorporate a manually operated switch to control the **flexible part**. The switch shall be constructed to prevent its actuating member from rotating continuously in the same direction. Switches actuated by contact or proximity of a finger, with little or no movement of the contact surface, shall require at least two manual operations to switch on the **heating element** but only one operation to switch it off. Touching the contact surface at the same point twice is not considered to be two operations.

Switches and **control units** in flexible cords shall have an **off position** at both ends of the travel of the actuating member, unless an indicator lamp is incorporated to show when the switch is in an on position.

Compliance is checked by inspection.

22.113

Void

22.109 **Wraps** and **pads** intended to be used in close contact with the human body in order to provide heat to create moisture for cosmetic purposes shall be **moisture-proof appliances** or the **flexible part** shall be **class III construction**.

Compliance is checked by inspection and test.

22.115

~~Void~~

22.116 **Blankets** having a **detachable cord** for the connection of the **flexible part** shall be washable.

Compliance is checked by inspection.

22.111 Reconnection of the mains supply to a **blanket** or **mattress** after an interruption shall not result in overheating of the user.

Compliance is checked by the following test.

*The control is adjusted to any setting specified for continuous use and the appliance is operated at **rated voltage** for 1 min. It is then disconnected from the supply for 1 min after which it is reconnected. It shall not be operating at a setting of the control higher than the highest setting specified for continuous use. **12***

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:*

*Appliance couplers used for supplying the **flexible part** shall comply with the requirements of IEC 60320-1 as far as they reasonably apply.*

24.2 *Modification:*

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.

25.2 Addition:

Blankets and **mattresses** for double beds having two separate **heated areas** may have two means of connection to the supply.

25.5 Addition:

Type Z attachment is allowed.

Non-detachable flexible cords shall be connected to the **flexible part** only by **type Y attachment** or **type Z attachment**.

25.7 Addition:

Light polyvinyl chloride sheathed cords may be used, irrespective of the mass of the appliance.

25.8 Modification:

Cords having a nominal cross-sectional area of 0,5 mm² may be used, irrespective of their length.

25.14 Addition:

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

25.15 Modification:

*Flexible cords connected to the **flexible part** are subjected to a pull force of 100 N that is only applied three times for 1 min each time, the longitudinal measurement not being made. The **flexible part** is securely held by means of clamps that grip the entire length of the edge opposite the cord entry. If the cord enters at a corner, the clamps grip the entire length of both edges adjacent to the opposite corner.*

*Flexible cords connected to switches and **control units** are subjected to a pull force of 100 N and a torque of 0,1 Nm.*

25.23 Addition:

If an **interconnection cord** has more than two conductors, the current density of each conductor shall not exceed 12 A/mm² and the sum of the cross-sectional areas shall be at least 1 mm².

If non-standardized flexible cords are used, their electrical and mechanical properties shall be at least equal to those specified in IEC 60227.

When the ends of the **heating element** are contained in a plastic sheath attached to the **flexible part**, the requirements related to current density and those of IEC 60227 do not apply to the **heating element** or the plastic sheath.

25.101 The length of cord of washable appliances fitted with a **non-detachable flexible cord**, measured between the points of entry to the **flexible part** and switch or **control unit**, shall be at least 0,4 m.

Compliance is checked by inspection and by measurement.

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 except as follows.

28.2 Addition:

The requirement does not apply to the connections to the **heating elements** and **electro-conductive textiles**.

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 of the flexible part 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 **flexible part**.

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

30.1 Addition:

The requirement does not apply to the enclosure of the **flexible part**.

Modification:

~~Parts of resilient plastic material fitted to the **flexible part** are subjected to the pressure test of 24.1.3 of IEC 60320-1 instead of the ball pressure test of IEC 60695-10-2.~~

~~NOTE 101 — Examples of resilient plastic material are interconnection couplers and connection blocks.~~

*For parts of resilient plastic material fitted to the **flexible part**, such as interconnection couplers and connection blocks, compliance is checked by the following test instead of the ball pressure test of IEC 60695-10-2.*

The parts are subjected to a pressure test in an apparatus similar to that shown in Figure 110, the test being made in a heating cabinet at a temperature of $100\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$.

The specimen is clamped between steel jaws, having a cylindrical face of 25 mm radius, and 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 this standard. 13

30.2 Addition:

*The enclosure of the **flexible part** is not tested.*

30.2.1 Addition:

Electro-conductive textiles shall comply with the requirements specified in ISO 9772 for category HBF material.

30.2.2 Not applicable.

30.2.3.2 Addition:

*The needle-flame test is not carried out on the enclosure of the **flexible part**.*

30.101 The enclosure of the **flexible part** shall be resistant to ignition, unless the appliance incorporates means to prevent overheating resulting from the arcing of conductors.

Compliance is checked by the test of

- 30.101.1, for assessing the resistance to ignition of the **flexible part**, or
- 30.101.2, for appliances incorporating means to prevent overheating resulting from the arcing of conductors.

30.101.1 ~~Six~~ *Three* samples, having dimensions of 100 mm × 200 mm, are cut from the enclosure so that their shorter sides are parallel with the runs of the **heating element** or conductive threads of **electro-conductive textile**. They are selected from parts of the enclosure so that no two samples contain the same warp thread or the same weft thread. If this is not possible, the samples are selected so that the same threads do not appear in more than two samples. Any pieces of **heating element** or **electro-conductive textile** and trimming are removed from the samples.

The test equipment, as shown in Figure 111, has two brass electrodes 3 mm in diameter that are supported by brass pillars mounted on a base of insulating material so that their axes are aligned. The base 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 part of a hardwood mask, as shown in detail A of Figure 112a, is placed on the adjustable platform in the position indicated.

The test equipment, including the upper part of the mask as shown in detail B of Figure 112b, is placed in a heating cabinet having a door with an inspection window and air 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 $65\text{ °C} \pm 2\text{ °C}$. 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 equipment 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** or **electro-conductive textile**. 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 $6,0\text{ mm} \pm 0,1\text{ mm}$. The sample is smoothed out and the upper part 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 which lasts no more than 3 s being ignored. If the sample does not ignite, a time of 120 s is recorded.~~

~~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 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.~~

The supply is switched on and sparks are allowed to pass between the electrodes for a period of 2 min and any ignition shall not reach the inner edge of the mask. The test is repeated on two additional samples. **14**

30.101.2 A suitable length of the conductor is exposed and the insulation of the conductor is removed over a length of 25 mm. This part of the conductor is bent in a radius of 75 mm and immersed in a non-conductive liquid having a temperature of $230\text{ °C} \pm 2\text{ °C}$, the appliance being supplied at **rated voltage**. Within 30 s, the protection system shall operate so that the power input of the **flexible part** does not exceed 1 W.

The conductor is withdrawn from the liquid when the protection system has operated. If the power input of the **flexible part** subsequently increases above 1 W, the test is carried out 100 times or until the power input is permanently reduced below 1 W, whichever occurs first.

30.102 The insulation of **heating elements** or **electro-conductive textiles** and internal wiring, including connections other than connections to the appliance inlet, within the **flexible part** shall be sufficiently resistant to abnormal heat and to fire.

~~NOTE This requirement also applies to material used to insulate connections.~~

Compliance is checked by the following test.

A sample of the **heating element** or internal wiring at least 150 mm long is supported by a grid inclined at 45°. If **electro-conductive textile** is used, the sample has dimensions of 150 mm × 150 mm. 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.

The two grids are placed centrally within the laboratory fume-hood/chamber as specified in IEC 60695-11-5:2016 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 and ~~is maintained until the insulation ceases to burn~~ 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 **15**. Additionally, if there are connections to be tested, the needle flame, as specified in IEC 60695-11-5, 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. **16**

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

The test is repeated on two additional samples. **17**

In any of the test specimens, 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.



IEC

Figure ~~102~~ 101 – Sign for "Do not insert pins"

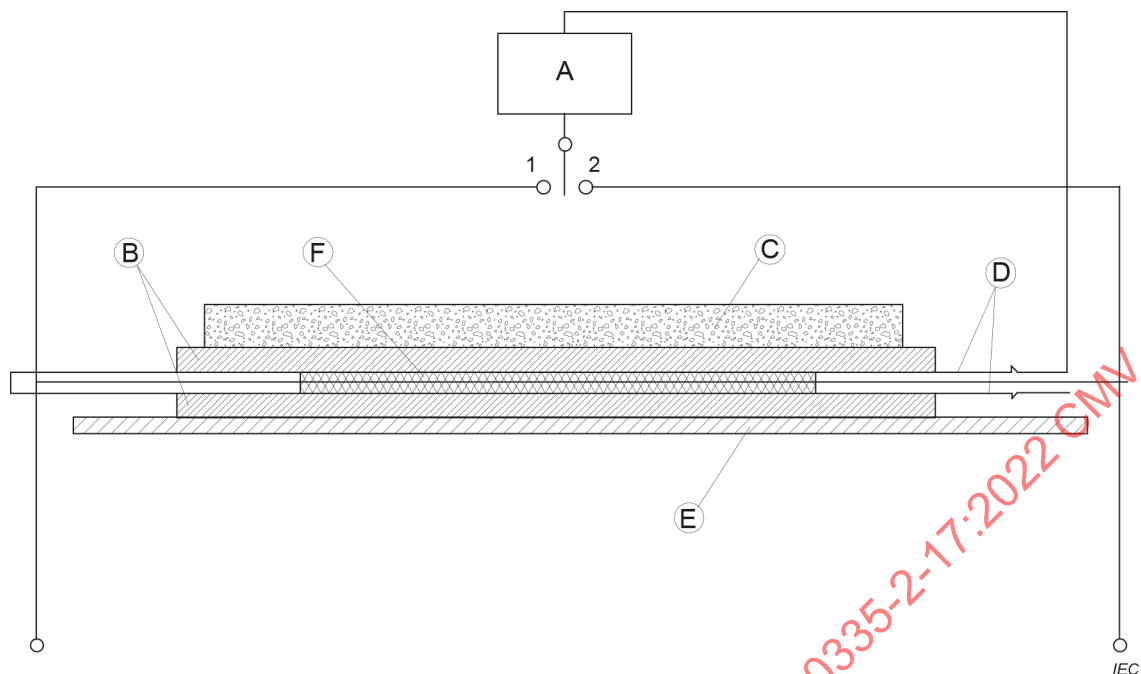


Figure 102 – Sign for "Not to be used by very young children (0-3 years)"



IEC

Figure ~~101~~ 103 – Sign for "Do not use folded or rucked"



Key

- A circuit of Figure 4 of IEC 60990:2016
- B sheets of thermal insulation
- C uniformly distributed load
- D aluminium foil
- E plywood base
- F flexible part

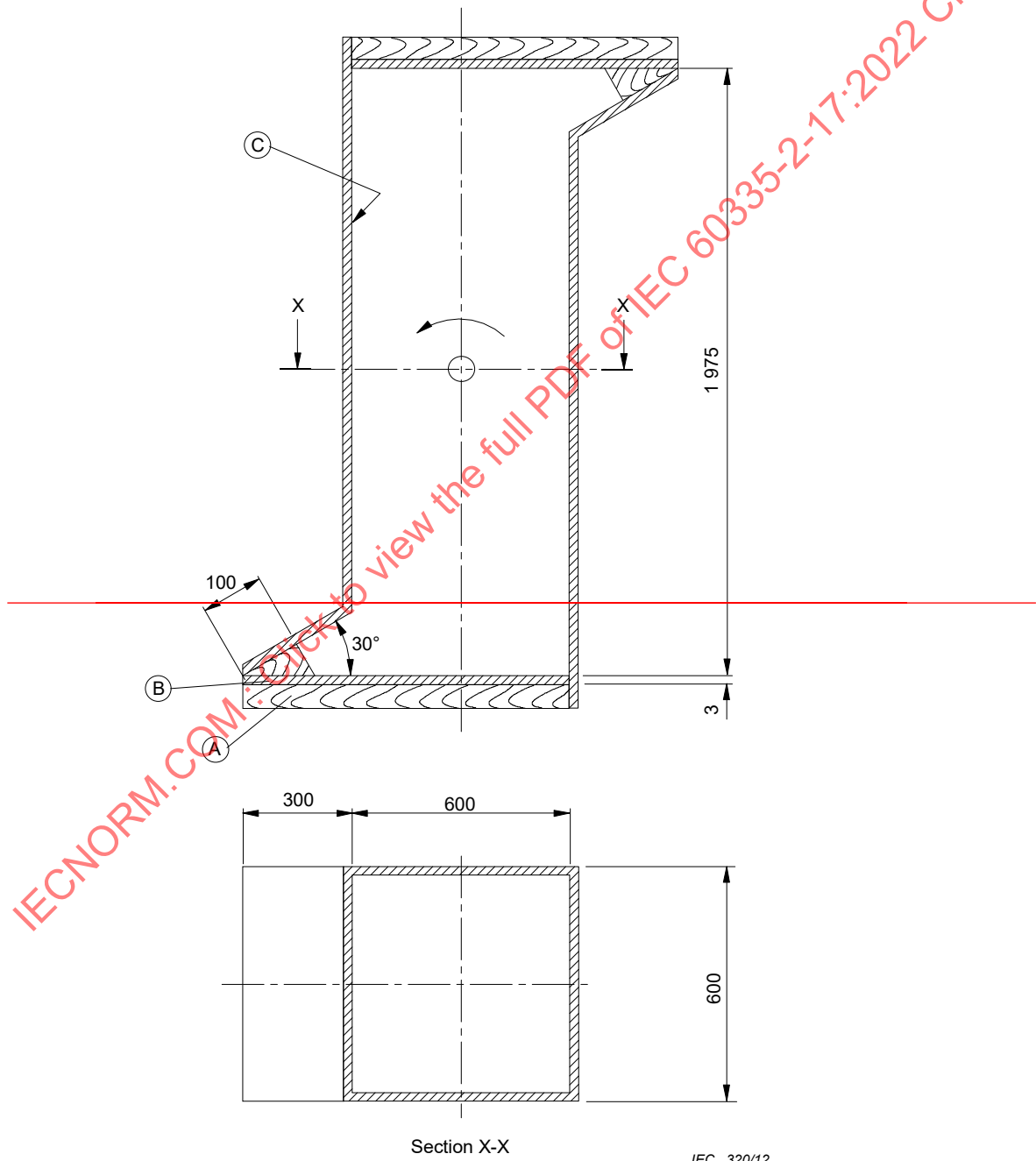
Figure 104 – Arrangement for measuring leakage current and electric strength of the flexible part

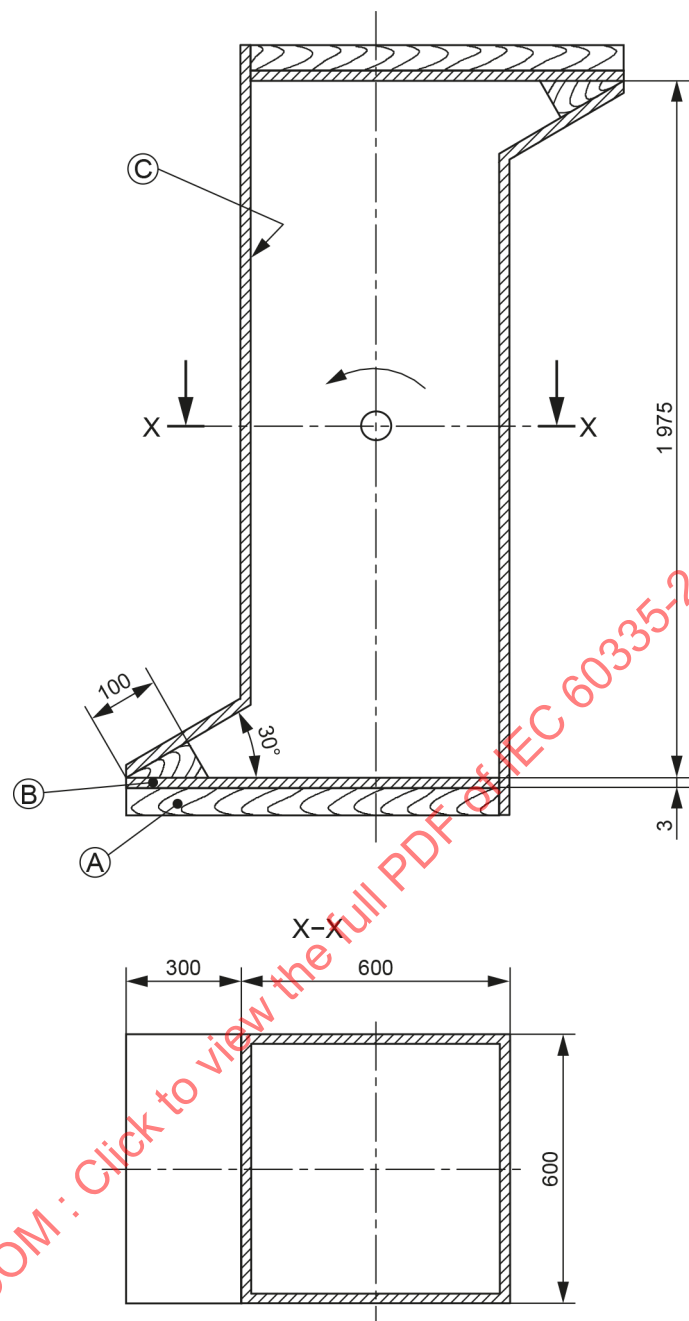
Figure 104 – Void

Figure 105 – Void

Figure 106 – Void

Dimensions in millimetres





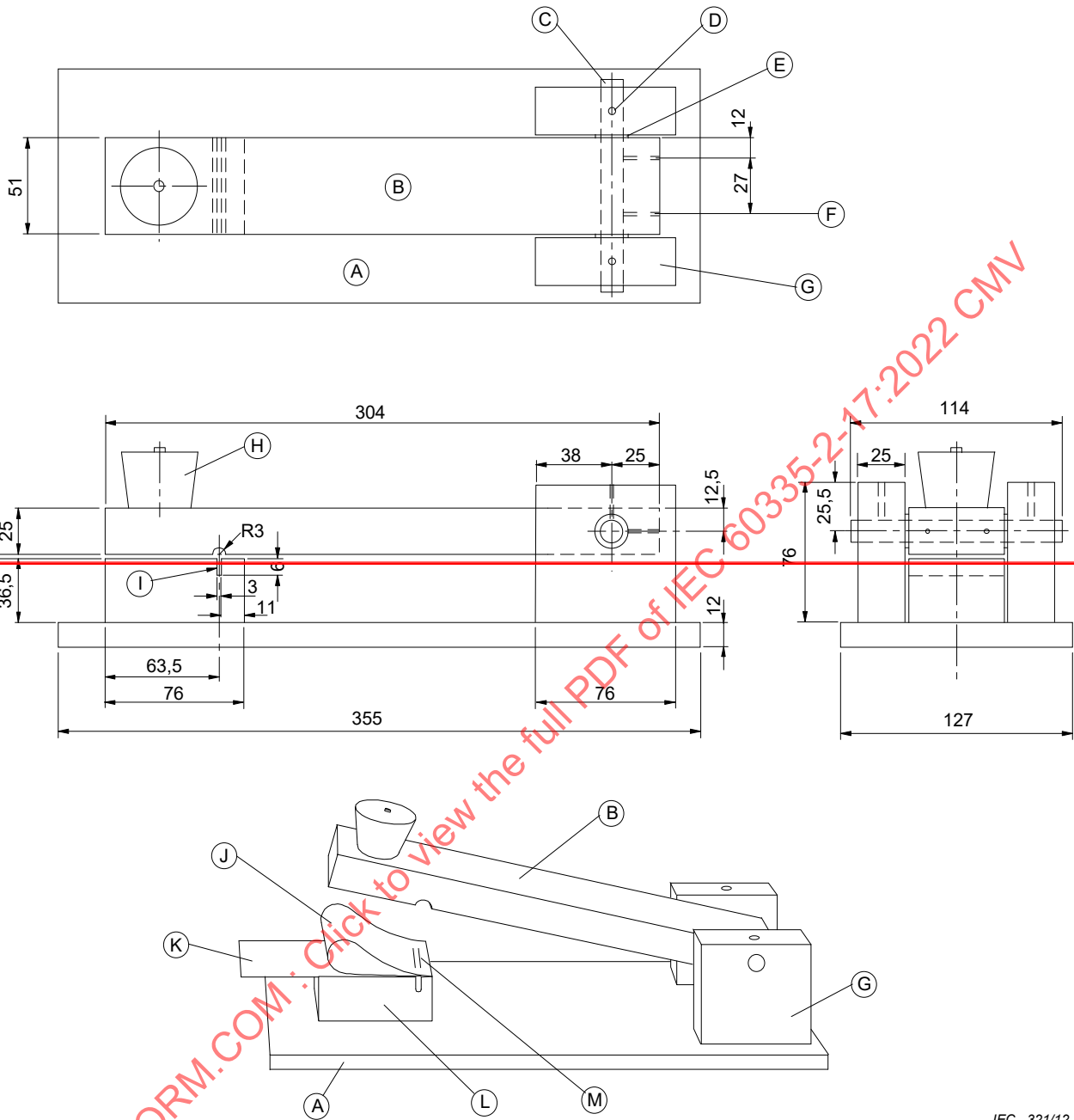
IEC

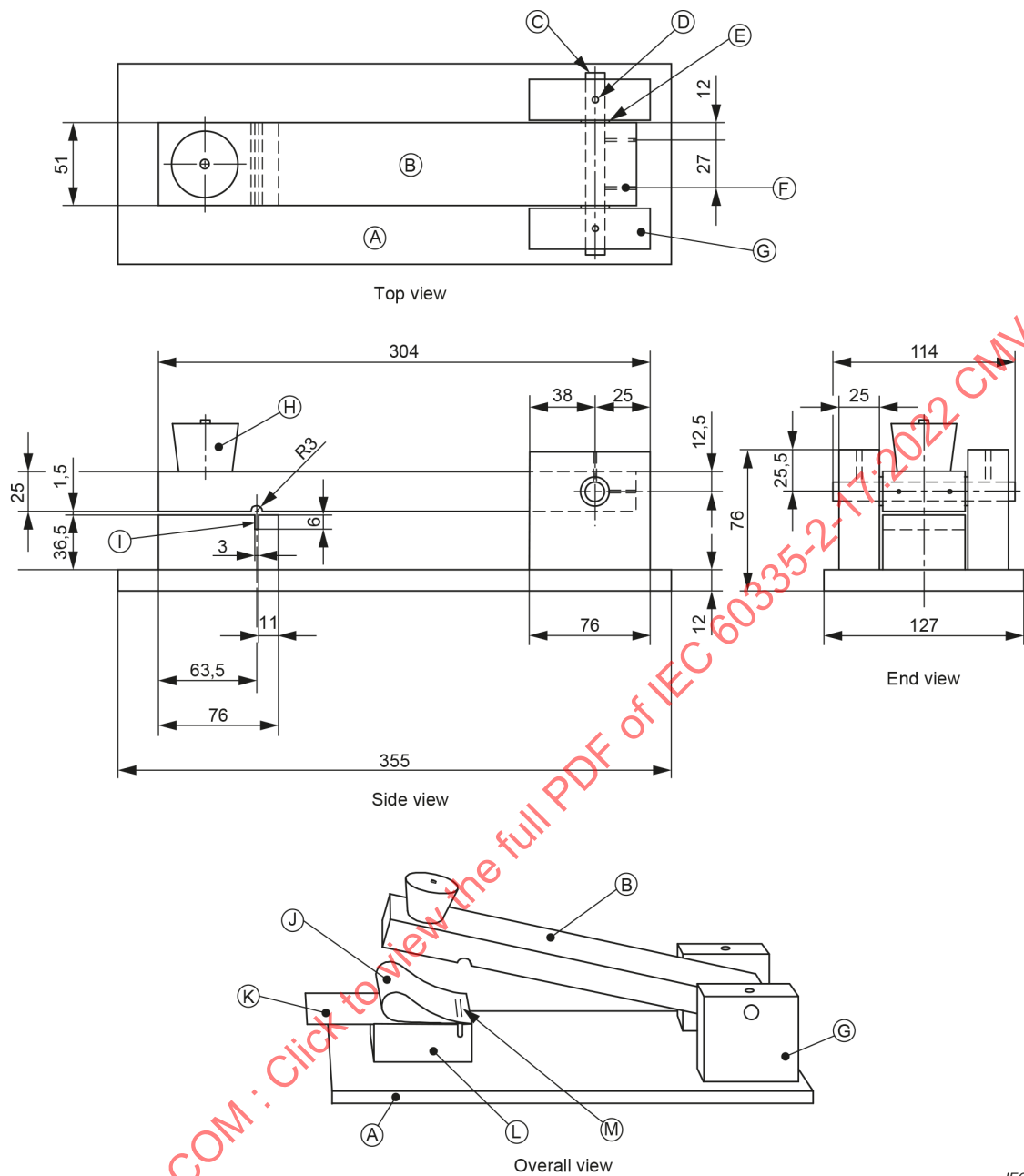
Key

- A wooden support
- B steel plate
- C smooth metal sides

Figure 105 – Tumbling barrel for testing the mechanical strength of pads

Dimensions in millimetres





Key

- A base
- B arm
- C loose fitting shaft
- D countersunk oil hole
- E machined washer
- F tapped hole for set screw
- G arm support
- H knob
- I slot
- J sample
- K card
- L anvil
- M staples

Figure 106 – Impact apparatus for testing enclosures of moisture-proof appliances

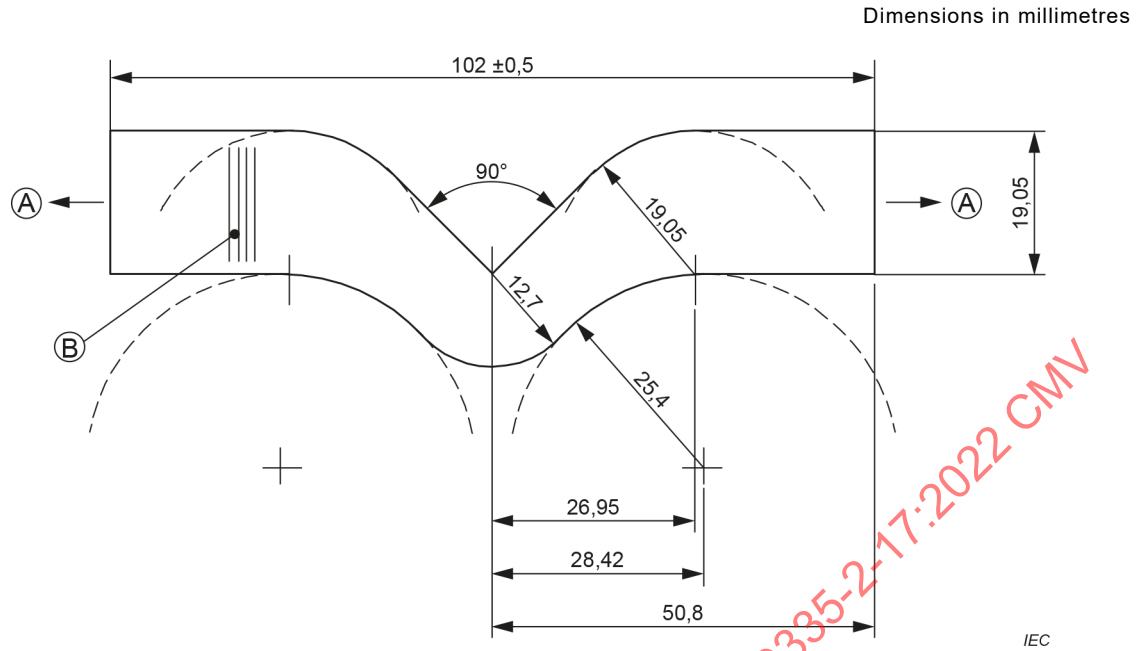
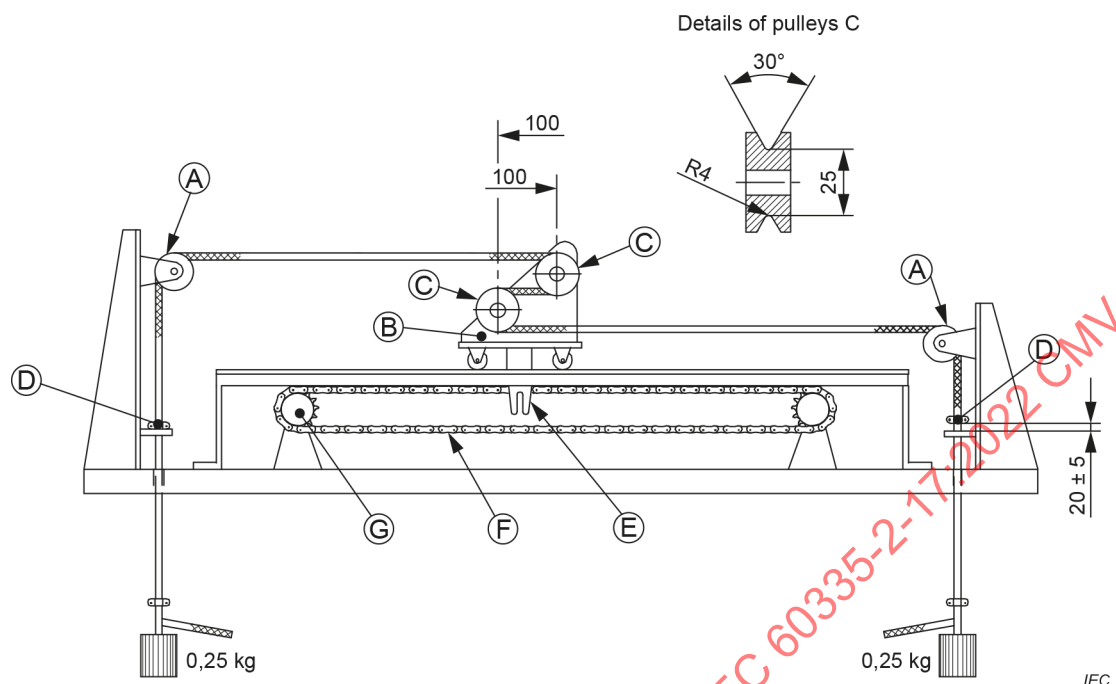


Figure 107 – Shape of the sample for the tear resistance test

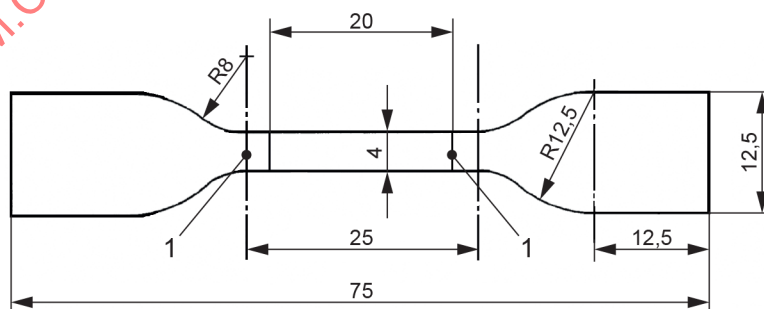
Dimensions in millimetres

**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

Figure 110 108 – Equipment for flexing heating elements and internal wiring

Dimensions in millimetres

**Key**

- 1 reference marks

Figure 114 109 – Shape of the test piece for the tensile test

Dimensions in millimetres

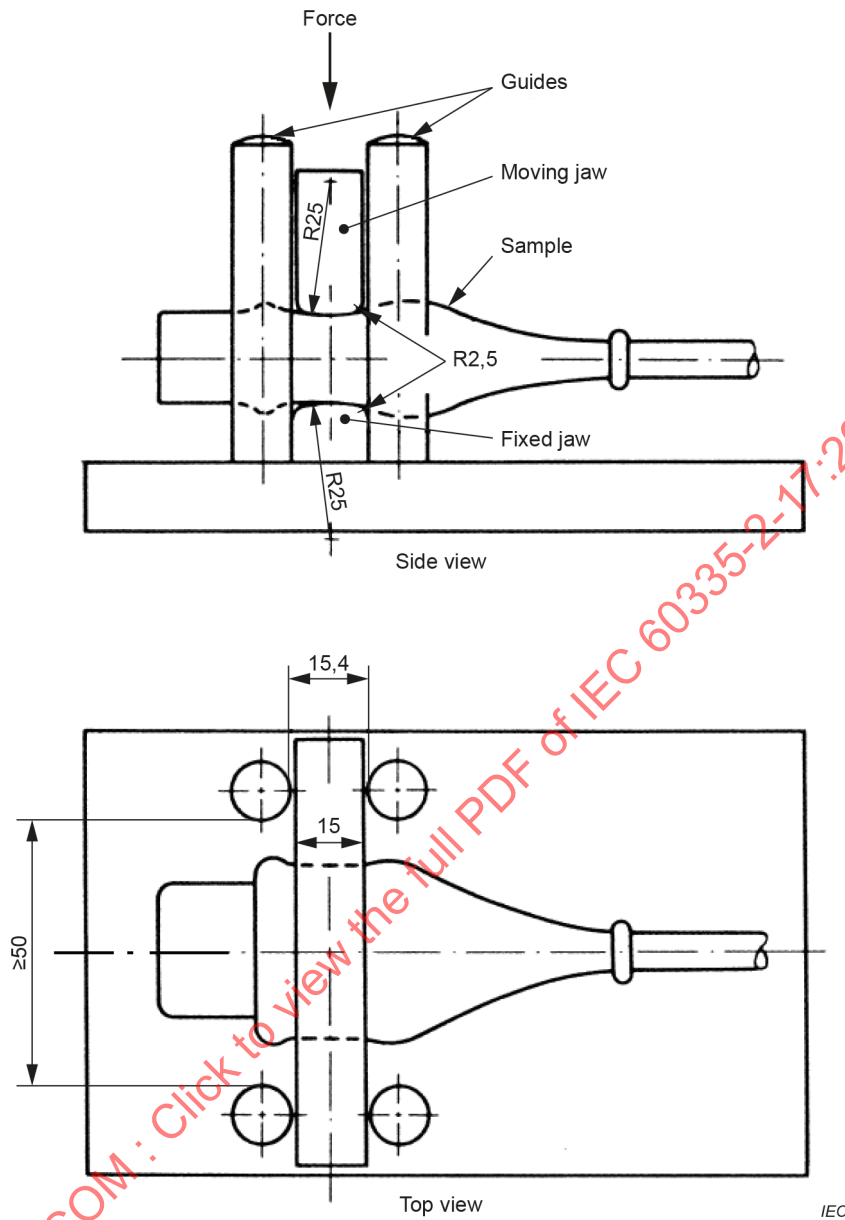
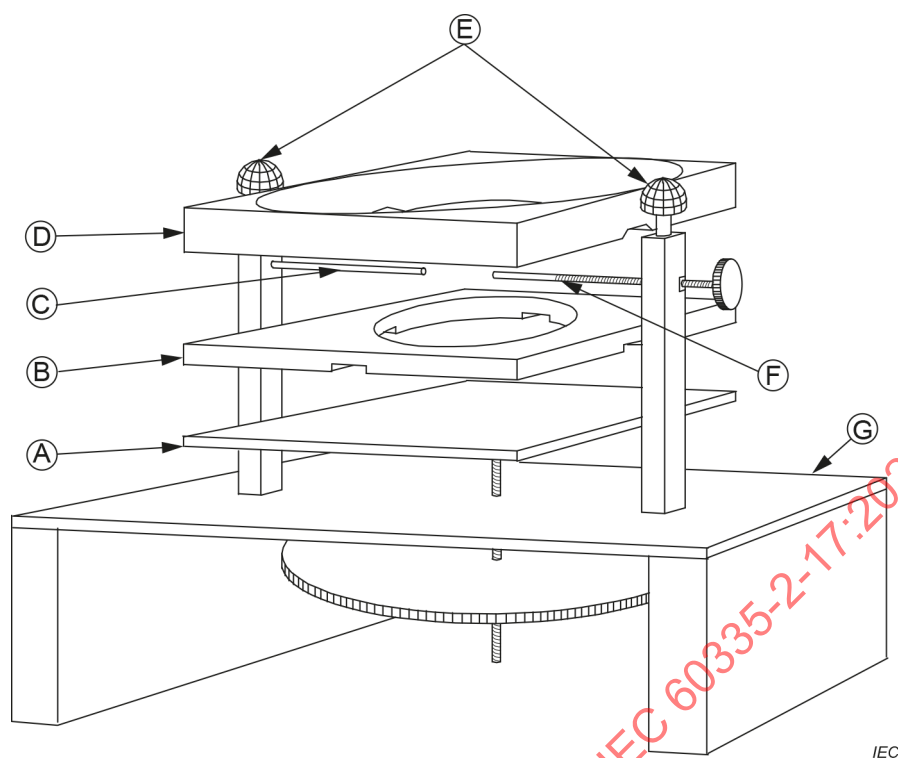


Figure 110 – Apparatus for pressure test on connectors

Figure 111 – Void

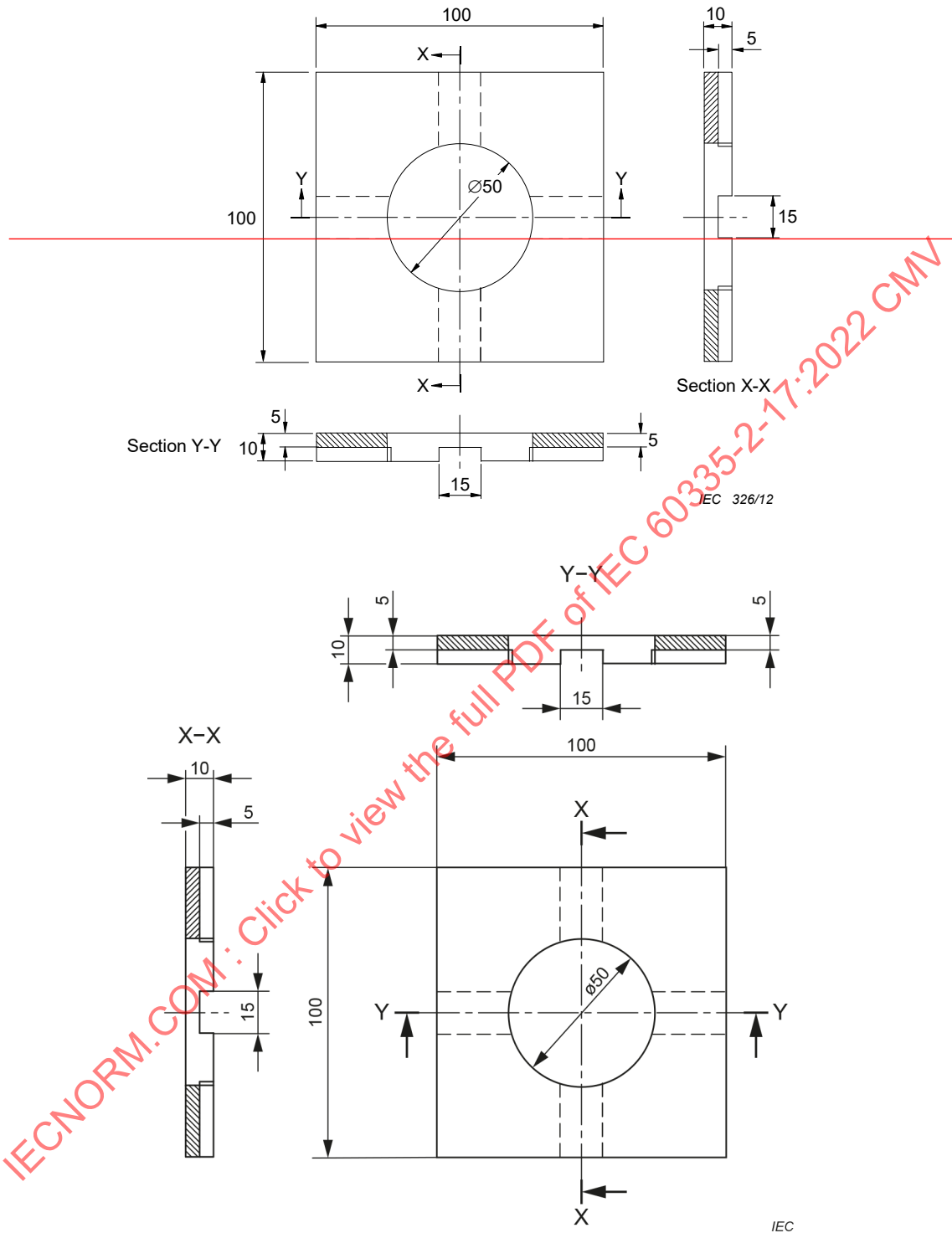


Key

- A adjustable platform
- B lower part of mask (see detail A of Figure 112a)
- C fixed electrode
- D upper part of mask (see detail B of Figure 112b)
- E terminals
- F movable electrode
- G base plate

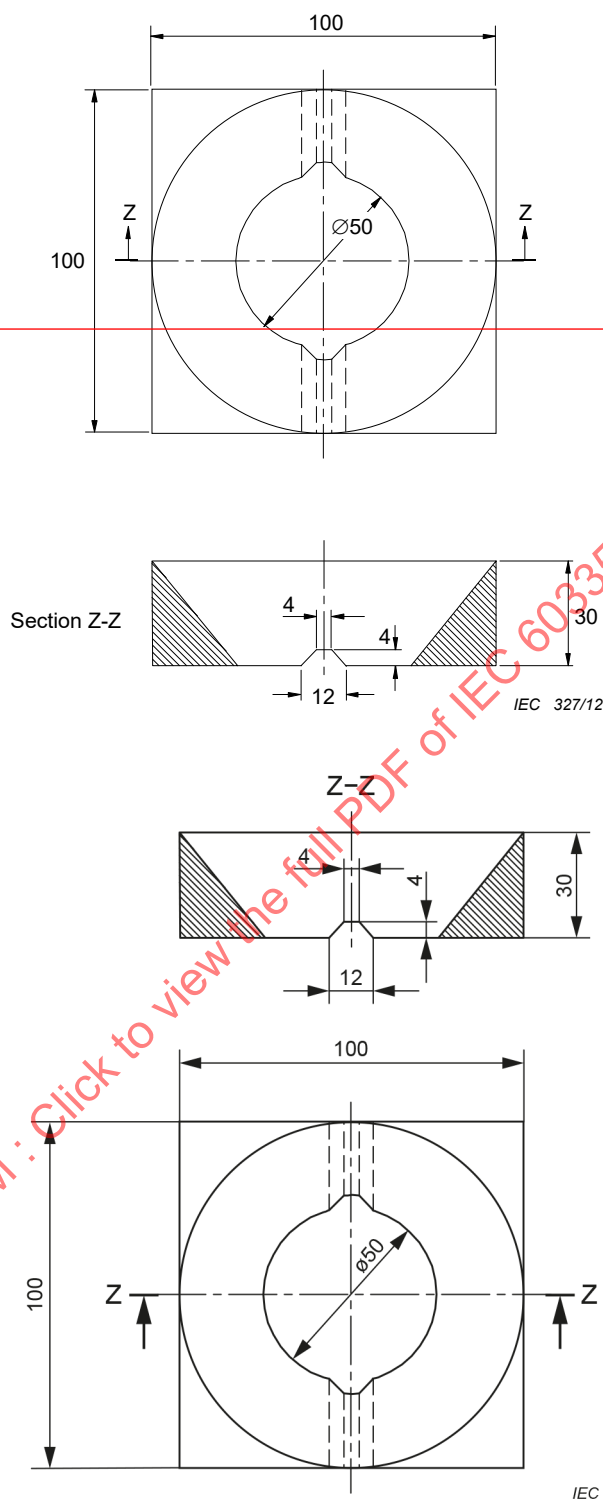
Figure 112 111 – Equipment for the spark ignition test

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 112 – Equipment for the spark ignition test – Details of the mask

Annexes

The annexes of Part 1 are applicable except as follows.

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Annex A (informative)

Routine tests

This annex of Part 1 is applicable except as follows:

A.23 Electric strength test

Addition:

An additional electric strength test is carried out between **live parts** and **accessible parts** of the **flexible part**, other than parts operating at **safety extra-low voltage**. The test voltage is determined from Table A.101.

Table A.101 – Test voltages

Type of test voltage	Test voltage V	
	Rated voltage	
	$\leq 150 \text{ V}$	$> 150 \text{ V and } < 250$
AC	$2\,000 + X$	$2\,500 + X$
DC	$3\,000 + X$	$3\,750 + X$

The value of X is determined as follows.

The **flexible part** is opened and the insulation of the **heating element** or **electro-conductive textile** is removed over a length of 5 mm to expose the conductor. The **heating element** or **electro-conductive textile** is then reinserted into the enclosure of the **flexible part**. A test voltage of 1 000 V (1 500 V DC) is applied between the conductor and the external surface of the **flexible part**. The voltage is increased in steps of 500 V (750 V DC) until breakdown occurs. The value of X is the test voltage before breakdown occurs.

~~NOTE 101~~ If the **flexible part** incorporates a permanent outer enclosure made of electrical insulating material such as PVC, the value of X is determined with this enclosure removed.

~~NOTE 102~~ Acceptable methods of applying the test voltage are

- passing the **flexible part** between rollers;
- passing the **flexible part** on a conveyor by a metal plate;
- placing the **flexible part** between metal plates;
- sweeping a chain wire brush over the **flexible part**.

A.34 Functional test

Addition:

The functional test includes

- a check that the resistance of the **heating element** or **electro-conductive textile** is within the tolerance;
- a check that no current flows when the control is in the **off position**.

NOTE 101 The tolerance selected is to ensure that the power input deviation of Clause 10 is not exceeded.

Annex AA (normative)

Specification for the thermal insulation

The thermal insulation has the following composition.

Open-cell polyether:

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.

In order to determine the thickness of the sheets of thermal insulation to be used, an evenly distributed heat source, having dimensions of 1 m × 1 m and a power input of $100 \text{ W} \pm 2 \text{ W}$, is placed centrally between two layers of thermal insulation having dimensions at least 1,2 m × 1,2 m.

An oxidized copper plate having dimensions 65 mm × 65 mm × 0,5 mm to which a fine-wire thermocouple is attached is placed at the centre of the upper surface of the heat source.

The heat source is connected to the supply and the temperature rise is measured. The thickness of the thermal insulation is established when the following steady temperature rise values are recorded:

- 25 K ± 1 K, for **overblankets** and clothing;
- 60 K ± 2 K, for **underblankets, pads and mattresses**.

If the thickness of the thermal insulation below the heat source is 2 d, the approximate thickness of the thermal insulation covering the heat source is

- 0,2 d, corresponding to a temperature rise of 25 K;
- d, corresponding to a temperature rise of 60 K.

The dimension d is approximately 36 mm.

The heat source may consist of a conductive sheet or two cotton sheets between which a heating conductor is uniformly arranged, so that the distance between adjacent runs does not exceed 20 mm.

Slight adjustments of the heat discharge can be achieved by adding a few sheets of suitable textile material.

No additional load is applied to the upper surface of the thermal insulation.

Annex BB (normative)

Equipment for the mechanical strength test for blankets

The equipment, as shown in Figure BB.1, has a rotating drum 160 mm in diameter and of sufficient length to accommodate the length of the **blanket**. Solid rubber spheres, having a diameter of 60 mm $\pm$ 2,5 mm and a hardness of 40 IRHD to 50 IRHD, are cut and attached to the drum so that they project above the surface by 25 mm. The spheres are arranged in six rows equally spaced around the circumference of the drum, the spheres in each row being 320 mm apart. The spheres are positioned mid-way between pairs of spheres in adjacent rows, as shown in Figure BB.2. The drum is free to rotate about its carrier shaft.

Below the drum, a 25 mm square bar is attached in such a way that it can freely rotate in carriers mounted in guide rails that are free to move up and down. Weights can be attached to the carriers so that the total mass of the bar and carriers can be adjusted.

Smooth hardwood cylinders, having a diameter of 65 mm and a length of 140 mm, are positioned above the drum. Each cylinder is locked to a pair of arms that pivot on an axis at a distance of 160 mm from the axis of the cylinder. The cylinders are positioned so that every sphere passes under the centre of a cylinder. The pivot bar is positioned so that when the cylinders are in contact with the top of the drum, the axis of the arms is at an angle of 25° to the horizontal. The force exerted by each cylinder on the drum is 5,1 N.

A sprocket having a pitch circle diameter of 230 mm is secured to each end of the drum carrier shaft. Endless chains, that carry a driving bar, pass over these sprockets and round the square bar in its lowest position.

The clamping bar, as shown in Figure BB.3, is attached to the driving bar by means of 3,5 mm diameter screws. Wire swivels are attached to the lower edge of the clamping bar as shown in the figure.

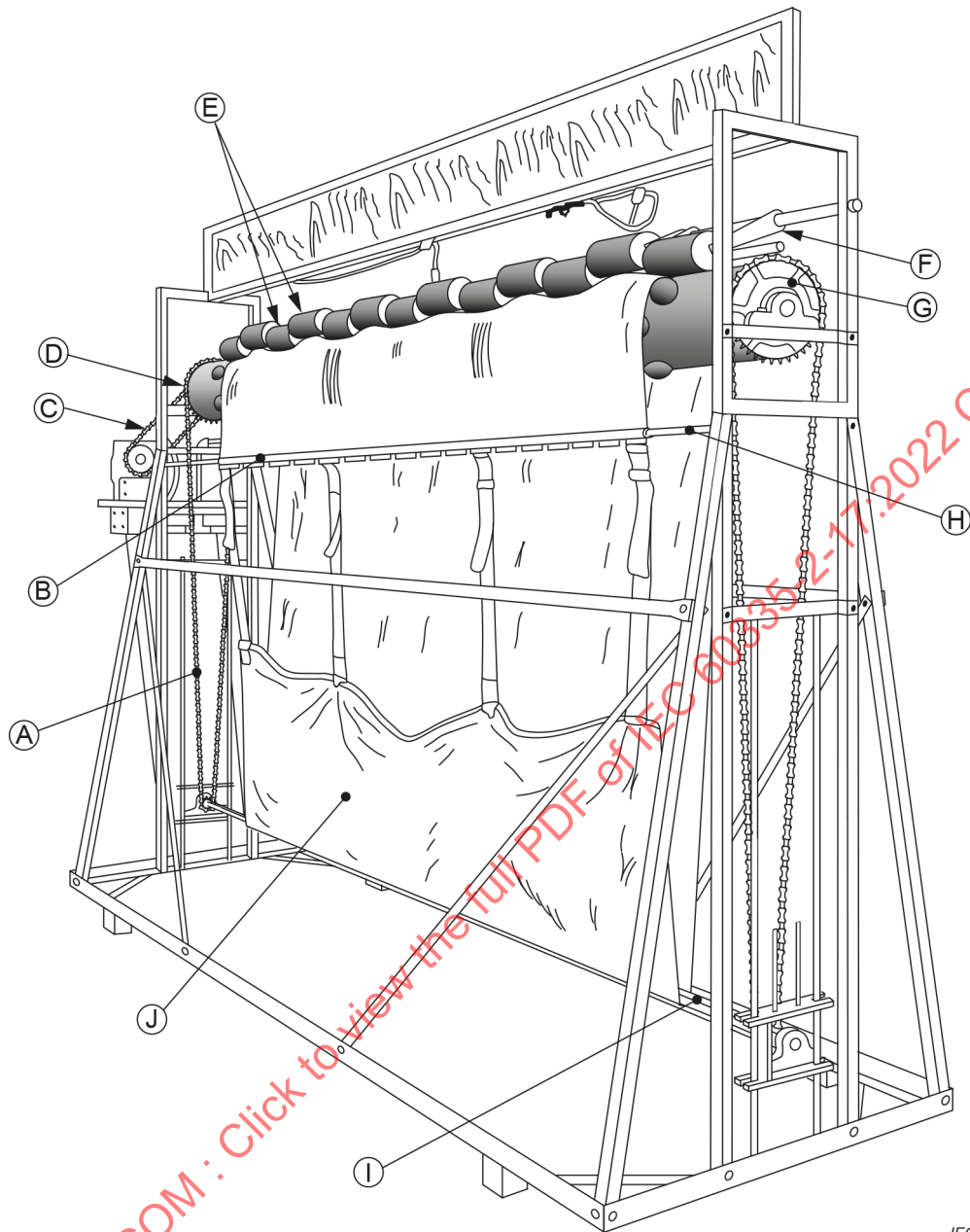
The **blanket** is secured over its entire length to the wire swivels by means of clips and adjustable webbing straps. It is then passed over the drum, under the square section bar and clipped to the other end of the webbing straps. The **blanket** and straps form a continuous belt that is tensioned by adding weights to the carriers so that the total mass of the bar assembly and carriers is 6 kg/m of attached edge of the **blanket** or 6,5 kg, whichever is greater. The webbing straps are adjusted so that the square bar and carriers are lifted 50 mm above their rest position. The tension on the straps is not subsequently altered. The straps are positioned so that they pass between the spheres on the drum.

NOTE 1—Sufficient straps are provided to prevent the **blanket** from rucking.

NOTE 2—Any **supply cord** is attached to the driving bar in such a way that it will not affect the result of the test.

NOTE 3—Means are provided to raise the cylinders when the driving bar passes over the drum to avoid damaging the equipment.

NOTE 4—The driving bar is separately driven. Both the drum and square bar are rotated by means of the **blanket** passing over them.

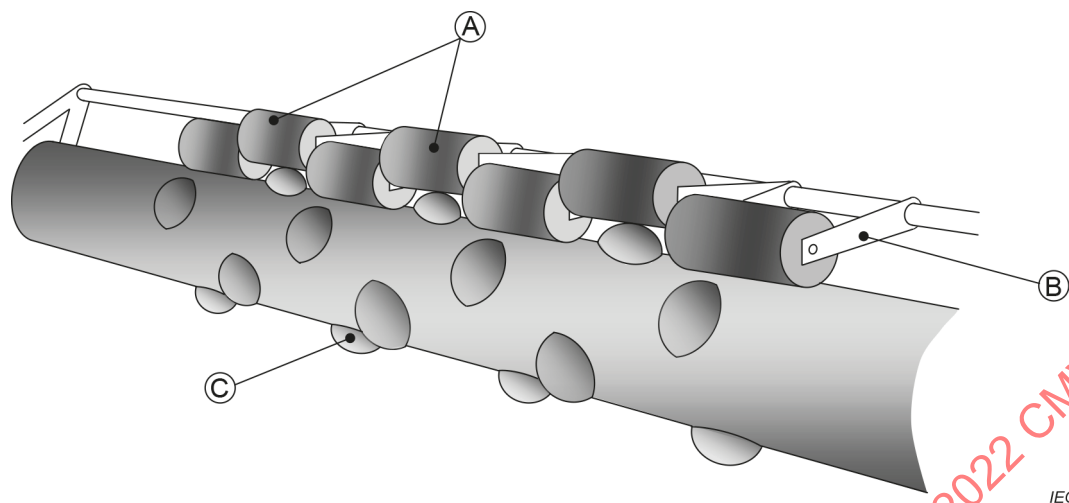


IEC

Key

- A driving chain
- B clamping bar
- C driving chain
- D self-aligning bearings
- E locked cylinders
- F cylinder arm
- G sprocket
- H drawing bar
- I square bar
- J blanket under test

Figure BB.1 – Equipment for the mechanical strength test of blankets

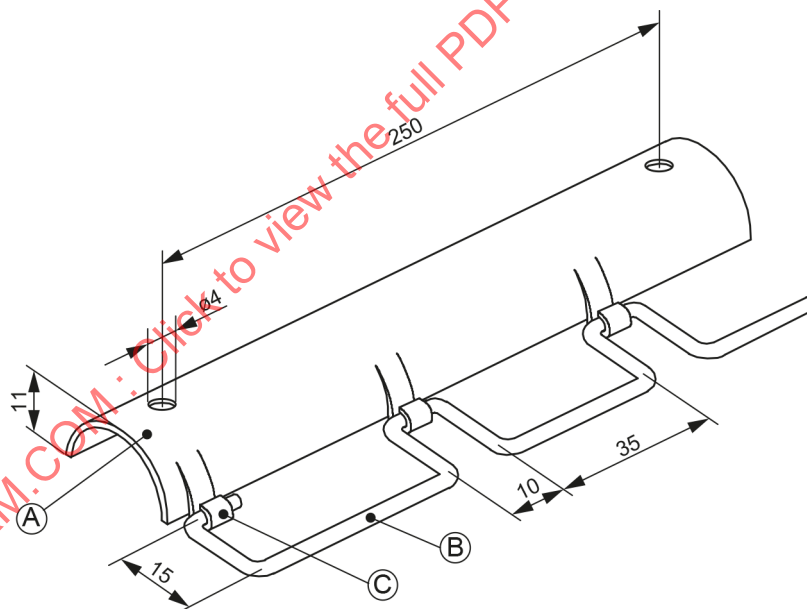


Key

- A cylinder
- B cylinder arm
- C solid rubber spheres

Figure BB.2 – Detail of the drum and cylinders

Dimensions in millimetres



Key

- A steel channel 25 mm diameter, 1,6 mm thick
- B steel wire swivel, 2,5 mm diameter
- C hinges brazed to channel

Figure BB.3 – Detail of the clamping bar

Annex CC (normative)

Clothing

The following modifications to this standard are applicable for clothing.

~~NOTE—Additional subclauses and notes in this annex are numbered starting with 201.~~

The clause numbers in this annex refer to the clause numbers in the main part of this standard that are modified or not applicable. Clauses that are additional to the clauses in the main part of this standard are identified by adding the annex letter followed by the numbering starting at 1.

3 Terms and definitions

3.1.9 Addition:

Clothing is placed between sheets of thermal insulation. The bottom sheet has a thickness of $2d$ and the top sheet a thickness of $0,2d$, as specified in **normative** Annex AA. The clothing is positioned so that different **heated areas** are separated from each other unless they are likely to come into contact with each other in normal use.

~~It may be necessary to cut~~ The clothing may be cut in order to separate the different **heated areas**.

5 General conditions for the tests

5.7 *The modification is not applicable.*

6 Classification

6.1 Modification:

Clothing shall be **class III**.

7 Marking and instructions

7.1 Modification:

The marking "Do not use folded or rucked" or the ~~symbol~~ sign of Figure 103 is not required.

7.12 Modification:

The instruction "Do not crease the appliance by placing items on top of it during storage" is also applicable to clothing.

Addition:

The instructions for clothing shall state that if the clothing is likely to be used for an extended period, the control should be adjusted to the setting recommended for continuous use. Instructions shall also include advice on precautions and how to recognize heat fatigue and the onset of heat stroke.

The instructions for clothing, other than **controlled clothing**, shall state the substance of the following:

WARNING: In order to avoid the possibility of heatstroke, disconnect the clothing when moving to an environment having significantly higher temperature.

11 Heating

11.3 Replace the first paragraph of the addition by the following:

*Thermocouples used for determining the temperature of **heating elements** are tied to them with textile thread over a length of at least 10 mm. The temperature of the surface of the **flexible part** closest to the human body is determined by means of a thermocouple attached to the centre of a disk of copper or brass 15 mm in diameter and 1,0 mm thick.*

11.8 Addition to Table 101:

Surface of clothing	50
---------------------	----

Addition to Table 102:

Surface of clothing for use in sub-zero temperatures ^b	45
Surface of other clothing	30

^b Examples of such clothing are garments used in cold stores and in the polar regions.

19 Abnormal operation

19.1 Addition:

Clothing is subjected to the tests of 19.102, 19.103, CC.19.2011 and CC.19.2022.

19.11.3 Addition:

The test of CC.19.2033 is not repeated.

19.107102 Modification:

The reference to "19.101 ~~to 19.106~~, 19.105 or 19.108" is replaced by "CC.19.2011 and CC.19.2022".

CC.19.2011 Clothing is operated under **normal operation**, except that the **flexible part** is uncovered and folded in the most unfavourable way so that four layers of the **flexible part** are placed one on top of the other.

NOTE A flattened sleeve is considered to be two layers of the **flexible part**.

*A sheet of thermal insulation, having dimensions of 300 mm × 450 mm × 90 mm, is placed on the folded clothing at the most unfavourable location. A **sandbag or other** evenly distributed mass of 5 kg is placed on the sheet of thermal insulation.*

~~A sandbag may be used as the mass.~~

CC.19.2022 Clothing is folded so that separate **heated areas** are positioned as close as possible to each other and then placed on the sheet of thermal insulation specified for **normal operation**. The clothing is operated without additional covering.

CC.19.2033 Clothing shall be constructed so that failure of a component does not give rise to a temperature that could be hazardous to the human body.

Compliance is checked by carrying out the test of Clause 11 but with controls adjusted to the highest setting recommended for continuous use. Failure of components that could reasonably be expected to occur during normal use is simulated, except that switching contacts are not short circuited. Only one fault condition is applied at a time.

*Failure of components, other than **heating elements** and **internal wiring**, that are expected to occur in normal use are the fault conditions specified in items a) to g) of 19.11.2.*

~~NOTE – Heating elements and internal wiring are not considered to be components.~~

*During the test, the temperature of the surface of **controlled clothing** shall not exceed 75 °C. The temperature rise of the surface of other clothing shall not exceed*

- 70 K, if the clothing is intended for use in sub-zero temperatures,
- 55 K, for other clothing.

21 Mechanical strength

21.1 Addition:

Compliance for clothing is checked by the tests of 21.103 to 21.107.

21.104 Modification:

*The plywood support is covered by a sheet of thermal insulation, as specified in **normative Annex AA**, having a thickness of 36 mm.*

22 Construction

22.105103 Not applicable.

25 Supply connection and external flexible cords

25.1 Modification:

Clothing shall be fitted with an appliance inlet.

25.23 The addition is applicable to clothing.

30 Resistance to heat and fire

30.2 Addition:

Clothing is subjected to the tests of 30.2.2.

Annex DD (normative)

Rigidity index test for mattresses 18

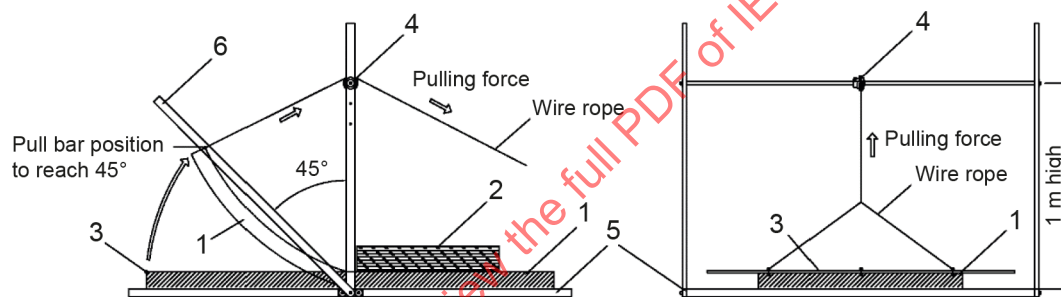
The **mattress** is laid on a flat and rigid surface as per Figure DD.1; 1 m or half the length of the **mattress**, whichever the shorter, is to be lifted, while the rest is covered by a solid pallet.

A 1,5 m long steel pull bar, having a 12 mm diameter, is properly secured to the **mattress** top edge, in order to evenly pull its entire width.

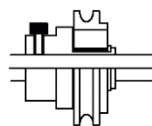
The freely rotating guide pulley is fixed 1 m high from the rigid flat surface.

The pull force shall be measured to lift the bar up to 45° as shown in Figure DD.1

The measured pull force shall be divided by the width in meters to obtain the rigidity index in N/m.



Example of guide pulley



IEC

Key

- 1 mattress sample
- 2 solid pallet
- 3 1,5 m long steel pull bar, having a 12 mm diameter
- 4 freely rotating guide pulley having 57 mm of groove diameter
- 5 rigid flat surface
- 6 45° indicator stick

Figure DD.1 – Mattress rigidity index test setup

Bibliography

The bibliography of Part 1 is applicable except as follows.

Addition:

IEC 60335-2-66, *Household and similar electrical appliances – Safety – Part 2-66: Particular requirements for water-bed heaters*

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

IEC 60335-2-81, *Household and similar electrical appliances – Safety – Part 2-81: Particular requirements for foot warmers and heating mats*

IEC 60335-2-106, *Household and similar electrical appliances – Safety – Part 2-106: Particular requirements for heated carpets and for heating units for room heating installed under removable floor coverings*

IEC 60601-2-35, *Medical electrical equipment – Part 2-35: Particular requirements for the basic safety and essential performance of heating devices using blankets, pads or mattresses and intended for heating in medical use*

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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 revision maintains the normal operation while charging as specified in IEC 60335-1:2020.
 - 5 Controlled appliances are covered by Subclause 5.8.101. Other appliances are tested as specified in Subclause 5.12 of IEC 60335-1:2020. This is revised to utilize this method for all other appliances instead of only those where the power input in the cold condition differs by more than 10% from the power input at operating temperature.
 - 6 This revision maintains the test duration while charging as specified in IEC 60335-1:2020.
 - 7 This revision is for alignment with IEC 60335-1:2020.
 - 8 Clarification that fuse-links do not need to comply with IEC 60127.
 - 9 In addition to damage between the electrodes and their connection, breakage of the electrodes is also evaluated after the tests.
 - 10 Modification of the flexing test method for mattresses where the flexibility is limited by the rigidity of the construction.
 - 11 The test method is clarified for non-circular heating elements.
 - 12 To prevent overheating of the user when power is restored after an interruption in the mains supply, the control setting is to be no higher than the highest setting for continuous use.
 - 13 The previously referenced test method from IEC 60320-1 is no longer in the latest edition, so the test method is incorporated into this standard.
 - 14 The test is modified
 - to use three samples instead of six, and
 - to simplify the compliance criteria by specifying that ignition shall not reach the edge of the mask instead of measuring the time until any flame reaches the edge of the mask.
 - 15 The test specification is updated to better describe the test setup.
 - 16 The test specification is updated to include specific test conditions for testing the connections.
 - 17 The test specification is updated to require testing of three samples.
 - 18 Annex DD is added to specify the method for determining the rigidity index for mattresses.
-

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

**Appareils électrodomestiques et analogues – Sécurité –
Partie 2-17: Exigences particulières pour les couvertures, coussins, vêtements
et appareils chauffants souples analogues**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES –
SAFETY –****Part 2-17: Particular requirements for blankets, pads,
clothing and similar flexible heating appliances**

FOREWORD

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IEC 60335-2-17 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 2012, Amendment 1:2015 and Amendment 2:2019. 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, 19.106, 21.103, 21.104, 21.110, 30.1, 30.102, Annex BB, CC.19.3);
- c) clarification of the definition of control unit (3.6.105);
- d) revision for adjusting the supply voltage of appliances, other than controlled appliances, when operation at rated power input times a factor is specified (5.12);

- e) clarification of testing of blankets that cannot be folded with five thicknesses (19.101);
- f) updated compliance criteria to include breakage of electrodes (21.1);
- g) clarification of the test method for mattresses based on the rigidity index of the flexible part (21.111.1, Annex DD);
- h) clarification for testing heating elements with a non-circular construction (21.111.3);
- i) addition of requirements to protect the user from overheating in the event of an interruption in the mains supply (22.111)
- j) inclusion of pressure test method from IEC 60320-1:2001 (30.1);
- k) update of test methods for resistance to fire tests (30.101.1, 30.102).

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

Draft	Report on voting
61/6671/FDIS	61/6747/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/standardsdev/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 blankets, pads, clothing and similar flexible heating appliances.

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 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,
- 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.

The following differences exist in the countries indicated below.

- 6.1: Class 0 products are allowed (Japan).

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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.

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 2-17: Particular requirements for blankets, pads, clothing and similar flexible heating appliances

1 Scope

This clause of Part 1 is replaced by the following.

This part of IEC 60335 deals with the safety of electric **blankets, pads**, clothing and other flexible appliances that heat the bed or human body, for household and similar purposes, their **rated voltage** being not more than 250 V including direct current (DC) supplied appliances and **battery-operated appliances**.

This standard also applies to **control units** supplied with the appliance.

Appliances not intended for normal household use but which nevertheless possibly pose a source of danger to the public, such as appliances intended to be used in beauty parlours or by persons in cold ambient temperatures, are within the scope of this standard.

Requirements and tests for clothing are given in normative Annex CC.

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.

Children are considered to be old enough to use an appliance without supervision when they have been adequately instructed by a parent or guardian and are deemed competent to use the appliance safely.

Attention is drawn to the fact that

- for appliances 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 health authorities, the national authorities responsible for the protection of labour and similar authorities.

This standard does not apply to

- appliances intended to be used in locations where special conditions prevail, such as the presence of a corrosive or explosive atmosphere (dust, vapour or gas);
- rigid bed warmers, such as those of metal or ceramic material;
- water bed heaters (IEC 60335-2-66);
- heating appliances for breeding and rearing animals (IEC 60335-2-71);
- foot warmers and heating mats (IEC 60335-2-81);

- appliances specifically intended for use under medical supervision (IEC 60601-2-35);
- heated carpets (IEC 60335-2-106).

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

ISO/IEC Guide 37, *Instructions for use of products by consumers*

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

ISO 3758, *Textiles – Care labelling code using symbols*

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1 Definitions relating to physical characteristics

3.1.9 *Addition:*

operation of the appliance under the following conditions:

- **blankets** and **pads** are placed between sheets of thermal insulation;
- **duvets** are placed on a sheet of thermal insulation but not covered;
- **mattresses** are covered by a sheet of thermal insulation

Note 101 to entry: The specification for the thermal insulation is given in normative Annex AA

The **flexible part** is supported on a plywood base 20 mm thick and positioned not less than 300 mm above the floor. The size of the plywood base is such that the thermal insulation can be fully supported over its entire area. The size of the sheets of thermal insulation is such that the edges extend at least 100 mm beyond the outline of the **heated area**.

Control units held in the hand when they are actuated and cord switches are positioned to hang away from the plywood base. Other **control units** are placed on a supporting surface away from the plywood base.

3.5 Definitions relating to types of appliances

3.5.101

blanket

appliance comprising a substantially flat **flexible part** that is intended to form part of the bedding, for heating the bed

3.5.102

underblanket

blanket intended to be used under the occupant of the bed

3.5.103

overblanket

blanket intended to be used over the occupant of the bed

3.5.104

duvet

quilted **overblanket** intended to be used without additional bedding over the occupant of the bed, the **heating element**, **electro-conductive textile**, providing supplementary heat

3.5.105

pad

appliance comprising a **flexible part** having a **heated area** not exceeding 0,3 m² on each face and which is intended to heat part of the human body

If the **pad** is constructed in a cylindrical or similar form, the limit for the **heated area** is 0,6 m².

3.5.106

mattress

appliance for supporting the human body and which incorporates an upholstered **flexible part** for heating the bed

Note 1 to entry: The appliance may be placed on the floor and referred to as a mat.

3.5.107

controlled appliance

appliance incorporating means in the **flexible part**, such as **heating elements with PTC characteristics** or other means, for sensing changes in temperature when the appliance is operated under **normal operation**, thus automatically controlling the average power input

3.5.108

moisture-proof appliance

appliance having a **flexible part** that is suitable for use under moist conditions

3.5.109

wrap

appliance comprising a **flexible part** intended to be draped over the human body in order to keep it warm

3.6 Definitions relating to parts of an appliance

3.6.101

flexible part

all layers of material forming the permanent enclosure of the appliance together with the **heating element**, **electro-conductive textile**, **thermostats** and all other current-carrying parts contained within it

Note 1 to entry: The flexible part may be inside a detachable cover.

3.6.102

heating element

heating conductor, including any core and insulation, together with any other integrated conductor

3.6.103

heated area

area of the **flexible part** enclosed within the outer perimeter of the **heating element** or **electro-conductive textile**

It includes a margin outside the perimeter that has a width equal to 0,5 times the average distance between adjacent runs of the **heating element**.

The **heated area** includes the return length of the **heating element** if the average distance between this part and the adjacent **heating element** does not exceed the average distance between adjacent runs of the **heating element**.

If a **blanket** or **mattress** has two separate **heated areas**, the surface between the two areas is considered to be part of the **heated areas**, if at any place the distance between the two **heating elements** does not exceed 1,5 times the average distance between adjacent runs of the **heating element**.

3.6.104

bonded enclosure

enclosure of the **flexible part** that has the opposite faces joined together by means of an adhesive or by welding

3.6.105

control unit

device, external to the **flexible part**, by means of which the average power input of the appliance or the temperature of the **flexible part** can be adjusted or regulated

Note 1 to entry: **Control units** may be incorporated in the **supply cord** or at the end of an **interconnection cord**.

3.6.106

electro-conductive textile

material incorporating carbon or other conductive substance, together with any associated insulation, which is connected to a pair of electrodes for the purpose of providing a heated surface

3.6.107

heating element with PTC characteristics

heating element 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 Modification:

The tests are carried out on two appliances, identified as appliance A and appliance B.

Addition:

If a further appliance is required in order to continue testing after a test of Clause 19, it shall be adequately preconditioned taking into account 21.102 to 21.107.

*For appliances having a **bonded enclosure**, additional appliances are required for the tests of 21.108 and 21.111. For other appliances, a length of 15 m of **heating element** is required for the tests of 21.111.*

*For **moisture-proof pads** subjected to the tests of 21.110, five additional appliances and 1 m² of enclosure material are required.*

*If heat-shrink material is used to insulate connections in the **flexible part**, a sample at least 150 mm in length is required for the test of 30.102.*

An additional appliance may be used for the test of 19.107.

Additional samples of **pads** may be used for the test of 30.101.

For appliances having a **flexible part** incorporating **electro-conductive textile** and a **working voltage** above 24 V, an additional sample may be used for the test of 21.113.2 and a 1 m length of sheet insulation is required for the test of 21.113.1.

5.3 Replacement:

The order in which the tests are carried out is as follows:

Appliance A: Clause 7, 22.11, Clause 8, 22.108, 10, 21.102 to 21.107, 22.104, Clauses 13, 15, 16, 17, 20, 25.15, 25.16, 19 (except 19.106), 21.108, 22.18, Clauses 30, 31 and 32. 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.

Appliance B: Clauses 10, 11, 19.106, 21 (remainder), Clause 22 (remainder), Clauses 23, 24, 25 (remainder), Clauses 26, 27, 28, 29 and 14.

The **flexible part** of washable appliances is laundered twice in accordance with the instructions before testing is started.

If it is evident from the construction of the appliance that a particular test is not applicable, the test is not carried out.

5.5 Addition:

If the **flexible part** of the appliance is provided with a **detachable cover**, the tests are carried out with or without this cover, whichever is more unfavourable. However, **duvets** are tested without a **detachable cover**.

If the construction of a **mattress** incorporates a separate **flexible part** that is detachable, the **detachable flexible part** is tested as an **underblanket**.

If the **heating element** can move in the channels, it is manipulated so that the individual runs are placed in the most unfavourable position.

5.6 Addition:

When testing appliances for DC only, the possible influence of polarity on the operation of the appliance is taken into account.

5.7 Modification:

For **controlled blankets** and **mattresses**, the tests of Clauses 10, 11 and 19 are carried out at an ambient temperature of $15\text{ °C} \pm 5\text{ °C}$.

5.8.1 Addition:

Appliances for DC only are tested with DC.

5.8.101 Controlled appliances are supplied as specified for **motor-operated appliances**.

5.12 Replacement

For appliances, other than **controlled appliances**, when it is specified that the appliance has to operate at the **rated power input** multiplied by a factor, the supply voltage is determined by supplying the appliance at **rated voltage** until the **heating element** reaches its operating temperature.

The supply voltage is then rapidly increased to the value necessary to give the power input required for the relevant test, this value of the supply voltage being maintained throughout the test.

5.101 Duvets and wraps are tested as **overblankets**.

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 Modification:

Appliances shall be marked with the **rated power input**. If the appliance has two means of connection to the supply, the **rated power input** shall be stated for each circuit separately and the information provided on a single label.

The **rated power input** may be expressed as $2 \times \text{rated power input}$ for each circuit in watts. Other ways of expressing the **rated power input** may be used and the total given, provided they do not give rise to misunderstanding.

Parts of **class III construction** shall not be marked with the **rated voltage** of the appliance.

Addition:

Flexible parts and **detachable covers** shall be marked with the name, trademark or identification mark of the manufacturer or responsible vendor.

Detachable covers shall be marked with the model or type reference of the appliance with which they are intended to be used.

The **flexible part** of appliances to be used with a **detachable control unit** shall be marked with the reference of the **control unit** to be used.

The **flexible part** of appliances to be used with a **detachable transformer** shall be marked with the reference of the transformer to be used.

Flexible parts shall be marked with the substance of the following:

- symbol ISO 7000-0790 (2004-01), or by the text "Read the instructions";
- the sign shown in Figure 101, or by the text "Do not insert pins";
- the sign shown in Figure 102 "Not to be used by very young children (0-3 years)", or by similar text;
- symbol ISO 7000-3114 (2011-10) and symbol ISO 7000-3124 (2011-10);
- intended orientation of **blankets** and **mattresses** (this marking is not required if the appliance complies with 11.101, whichever way it is placed on the bed).

Underblankets, other than those having a **heating element with PTC characteristics**, shall be marked with the sign shown in Figure 103 or by the text "Do not use folded or rucked".

Detachable covers shall be marked with the following:

- symbol ISO 7000-0790 (2004-01);
- sign of Figure 101.

The **flexible part** of **blankets** and **detachable covers** shall be marked with the appropriate laundering symbols specified in ISO 3758. Washable appliances fitted with a **non-detachable flexible cord** shall be marked with symbol ISO 7000-3125 (2011-10). Non-washable appliances shall be marked with symbol ISO 7000-3123 (2011-10).

7.6 Addition:



[symbol ISO 7000-3114
(2011-10)]

do not dry clean



[symbol ISO 7000-3123
(2011-10)]

do not wash



[symbol ISO 7000-3124
(2011-10)]

do not bleach



[symbol ISO 7000-3125
(2011-10)]

wash by hand

7.12 Addition:

The instructions shall contain the substance of the following:

Important instructions. Retain for future use.

When the signs of Figure 101, Figure 102, Figure 103 or those in the addition to 7.6 are used, the meaning shall be explained.

The instructions for **blankets** shall state whether the appliance is an **overblanket** or an **underblanket**.

The instructions shall specify the appropriate settings of controls for continuous use of the appliance.

The instructions for **pads** shall state that when the appliance is likely to be used for an extended period, for instance by the user falling asleep, controls should be adjusted to a setting recommended for continuous use. The instructions for **blankets** and **mattresses** shall state that if the appliance is slept on with the controls set to a higher temperature the user can suffer skin burns or heat stroke.

The instructions for appliances provided with **detachable control units** or **detachable transformers** shall state that the appliance is only to be used with the types that are marked on the appliance.

The instructions for **duvets** shall state the length and width of the **detachable cover** to be used.

The instructions shall state the substance of the following:

- when not in use, store as follows (quote necessary instructions);
- when storing the appliance, allow it to cool down before folding;
- do not crease the appliance by placing items on top of it during storage (for **blankets** and **pads** only);
- examine the appliance frequently for signs of wear or damage. If there are such signs, if the appliance has been misused or does not work, return it to the supplier before switching it on again;
- this appliance is not intended for medical use in hospitals;
- do not use if wet (this instruction is not required for **moisture-proof appliances** or **class III appliances**);
- this appliance must not be used by persons insensitive to heat and other very vulnerable persons who are unable to react to overheating;
- children under the age of three are not to use this appliance due to their inability to react to overheating.

The instructions for **underblankets** shall state the substance of the following:

- the appliance should not be used on an adjustable bed; or
- if the appliance is used on an adjustable bed, check that the **blanket** and cord do not become trapped or rucked, for example in hinges.

The instructions shall state that the appliance is not to be used by young children over the age of three unless the controls have been pre-set by a parent or guardian, and unless the child has been adequately instructed on how to operate the controls safely.

Washable appliances shall be provided with instructions for laundering. The instructions for washable appliances fitted with a **non-detachable cord** shall state that the switch or **control unit** must not be allowed to get wet during washing and that during drying the cord must be positioned to ensure that water does not flow into the switch or control.

The instructions for non-washable appliances shall state how they can be cleaned, for example with a damp sponge.

7.14 Modification:

*Instead of petroleum spirit, liquid detergent is used to check the marking on **flexible parts** and **detachable covers**.*

Addition:

The height of the lettering on the **flexible part** shall be at least 2,5 mm.

The height of the signs shown in Figure 101, Figure 102 and Figure 103 shall be at least 15 mm.

The height of the words "Important instructions" and "Retain for future use" shall be at least 4 mm.

Compliance is checked by measurement in accordance with ISO/IEC Guide 37.

7.15 *Addition:*

The symbols required to be marked on **detachable covers** shall be visible from the outside after the cover has been fitted.

Symbol IEC 60417-5018 (2011-07) shall be placed next to symbol IEC 60417-5172 (2003-02) or symbol IEC 60417-5180 (2003-02), as appropriate.

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.

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.

10.1 *Modification:*

The negative deviation in Table 1 is increased to 20 %.

If the appliance has two means of connection to the supply, the permitted deviation for power input specified in Table 1 shall be measured separately for each circuit.

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:

The plywood base is placed away from the walls of the test corner.

Addition:

Underblankets having the length of their longest side less than 1 m and **duvets**, other than those having **heating elements with PTC characteristics**, are also tested folded. A single fold across the complete width of the **duvet** is made at a quarter of the length from one end. Controls are adjusted to the highest setting intended for continuous use.

Wraps, other than those having **heating elements with PTC characteristics**, are also tested folded. A single fold is made across the **flexible part** in the most unfavourable place.

11.3 Addition:

Thermocouples used for determining the temperature of **heating elements**, or sheaths containing them, are attached with textile thread over a length of at least 10 mm.

Thermocouples used for determining the temperature of the surface of **electro-conductive textiles** are fixed by means of thin adhesive tape.

Thermocouples used for determining the temperature of the surface of **pads** are attached to plates of copper or brass measuring 65 mm × 65 mm × 0,5 mm. The plates are positioned to cover as many **heating element** runs as possible, with one side parallel to the direction of the run. The temperatures are determined at not less than six places, three on each outer surface of the **flexible part**.

11.4 Addition:

Appliances having a **flexible part** of **class III construction** are supplied with the most unfavourable voltage between 0,94 and 1,06 times **rated voltage**.

11.7 Addition:

Appliances are operated until steady conditions are established.

11.8 Addition:

For **controlled appliances**, the temperatures shall not exceed the values shown in Table 101. If the **flexible part** is comprised of **electro-conductive textile**, the values specified for **heating elements** are applicable to the surface of **supplementary insulation** or **reinforced insulation**, or to the conductive surface if there is no insulation.

Table 101 – Maximum temperatures

Part	Temperature °C
Heating element of blankets and mattresses	
– before the second operation of the thermal control	115
– under steady conditions	95
Heating element of pads	
– before the second operation of the thermal control	120 ^a
– under steady conditions	100
Surface of pads	50 ^b
^a A temperature of 140 °C is allowed for a period of 10 min.	
^b The temperature may exceed 50 °C, but not 85 °C, for a maximum period of 2 h. The period commences when the temperature first exceeds 50 °C.	

For other appliances, the temperature rises shall not exceed the values shown in Table 102.

Table 102 – Maximum temperature rises

Part	Temperature rise K^a
Heating element	80
Surface of pads	35
^a These values are based on the normal ambient temperature of the appliance and take into consideration the maximum allowed ambient temperature during the test.	

If the ends of the **heating element of pads** are contained in a plastic sheath attached to the **flexible part**, the temperature or temperature rise specified for the surface also applies to the **accessible surface** of the sheath.

11.101 It shall be possible to operate **blankets** and **mattresses** without risk of skin burn or heatstroke to the user.

Compliance is checked by the following test.

The appliance is supplied as specified in 11.4 and operated under **normal operation** until steady conditions are established. The ambient temperature is maintained at 15 °C ± 2 °C. **Control units** and cord switches are adjusted to the highest setting recommended for continuous use, except for **wraps** when the lowest setting for continuous use is used.

The temperature of the surface of the **flexible part** is determined by means of a thermocouple attached to the centre of a plate of copper or brass having dimensions 300 mm × 300 mm × 0,5 mm. For **overblankets**, the plate is placed under the **flexible part**. For **underblankets** and **mattresses**, the plate is placed over the **flexible part**.

The temperature of **controlled appliances** shall not exceed 50 °C during the first hour of operation. It shall then not exceed:

- 45 °C, for one third of the length of the **flexible part** nearest the foot end of the bed;
- 37 °C, for the remainder of the **flexible part**.

The temperature rise of other appliances shall not exceed 33 K during the first hour of operation. It shall then not exceed:

- 28 K for one third of the length of the **flexible part** nearest the foot end of the bed;
- 20 K for the remainder of the **flexible part**.

If the ends of the **heating element** are contained in a plastic sheath attached to the **flexible part**, the temperature limit specified also applies to the **accessible surface** of the sheath.

If the **control unit** automatically switches to a lower setting during the first hour of operation, in case of doubt, the test shall be continued after steady conditions have been established to ensure that the **control unit** does not subsequently revert to a higher heat setting, resulting in the temperature limits being exceeded.

11.102 The surface temperature of **pads** shall not be excessive if they are used partially covered for an extended period.

Compliance is checked by the following test.

Pads are supplied as specified in 11.4 and operated under **normal operation** except that 2/3 of the **flexible part** is positioned so that it overhangs the edge of the plywood support. Controls are adjusted to their highest setting recommended for continuous use and the surface temperature of the pad is measured as specified in 11.3.

The temperature of the surface of the **flexible part** of **controlled pads** shall not exceed 85 °C and the temperature rise of the surface of other **pads** shall not exceed 60 K.

The covered portion may be secured to prevent the **pad** slipping off the support.

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.

13.1 Addition:

For **mattresses**, a sheet of metal foil, approximately 0,1 mm thick and of sufficient size to cover the area of that part of the **mattress** incorporating the current-carrying parts, is inserted between the **mattress** and the sheet of thermal insulation. For other appliances, two such sheets of metal foil are inserted, one above and one below the **flexible part**, these sheets being electrically connected together. A uniformly distributed load of approximately 35 kg/m² is placed on the top sheet of thermal insulation.

The arrangement is shown in Figure 104.

13.2 Modification:

For the **flexible part**, the leakage current is measured between any pole of the supply and the sheets of metal foil.

Instead of the values specified, the leakage current for the **flexible part** shall not exceed

- for **pads**, 0,5 mA;

- for **blankets and mattresses**, 1 mA/m² of the **heated area**, with a maximum of 2,5 mA.

13.3 Modification:

For the **flexible part**, the test voltage is applied between **live parts** and the sheets of 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 Addition:

For the **flexible part**, compliance is checked as follows:

- for **blankets and pads**, by the test of 15.101;
- for **moisture-proof appliances**, by the tests of 15.101 and 15.102. However, **pads** subjected to the tests of 21.109 and 21.110 are not subjected to the tests of 15.102;
- for **mattresses**, by the tests of 15.103.

The tests of Clause 16 are carried out with the appliance still immersed or in contact with the saline solution.

15.3 Addition:

The **flexible part** is not subjected to the test.

15.101 Washable appliances are laundered according to the instructions, with all parts of the **flexible part** immersed.

The **flexible part** is then immersed for 1 h in water containing approximately 1 % NaCl at a temperature of 20 °C ± 5 °C after removing **detachable parts**. All of the **flexible part** is immersed except

- appliance inlets;
- the point of entry of the flexible cord, unless it is a **moisture-proof appliance**;
- the connections of the **heating element** or internal wiring to the appliance inlet.

The appliance shall then withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation that could result in a reduction of **clearances** or **creepage distances** below the values specified in Clause 29.

For **moisture-proof appliances**, inspection shall show that water has not penetrated the **flexible part** to such an extent that it could come into contact with **heating elements** and other current-carrying parts.

The **flexible part** of washable appliances fitted with a **non-detachable flexible cord** is immersed again in the saline solution until it is saturated. It is then folded about its major axis and placed over a line located 2 m above the floor. The cord is freely suspended, any excess length being stretched out along the floor, and the **flexible part** allowed to drip-dry for 24 h.

The switch or **control unit** shall then withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation that could result in a reduction of **clearances** or **creepage distances** below the values specified in Clause 29.

15.102 An incision is made in the permanent enclosure and the **flexible part** is then immersed in the saline solution that is allowed to penetrate freely into the interior.

After a period of 1 h, the appliance shall withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation that could result in a reduction of **clearances** or **creepage distances** below the values specified in Clause 29.

15.103 Mattresses are supported on a piece of plywood. A quantity of water, containing approximately 1 % NaCl, corresponding to 1 l/m² of the upper surface area, is poured uniformly over the **mattress** at the rate of 1 l/min.

The saline solution is allowed to soak into the **mattress** for a period of 30 min.

The **flexible part** shall then withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation that could result in a reduction of **clearances** or **creepage distances** below the values specified in Clause 29.

16 Leakage current and electric strength

This clause of Part 1 is applicable except as follows.

16.2 Addition:

The **flexible part** of **blankets** and **pads** is tested with the voltage applied between **live parts** and an electrode immersed in the saline solution.

The **flexible part** of **mattresses** is covered with metal foil.

The leakage current of **flexible parts** shall not exceed

- for **pads**, 1 mA;
- for **blankets** and **mattresses**, 5 mA.

16.3 Modification:

The **flexible part** of **blankets** and **pads** is tested with the voltage applied between **live parts** and an electrode immersed in the saline solution. However, when the test is carried out on **blankets** and **pads** without first carrying out the tests of Clause 15, the **flexible part** is covered with metal foil instead.

Addition:

After the test, the **flexible part** of **blankets** and **pads** is thoroughly rinsed in water and then allowed to dry for at least 24 h at a temperature between 20 °C and 40 °C. During the drying period, the appliance is stretched in an attempt to regain the original dimensions.

Mattresses are rinsed with a quantity of water corresponding to 0,5 l/m² of the upper surface. The water is poured evenly over the upper surface and then wiped with a sponge, soaking up as much water as possible. This treatment is carried out three times and the **mattress** is then wiped with a dry cloth.

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.

19.1 Modification:

Instead of the tests specified, the following applies.

Blankets are subjected to the tests of 19.101 and 19.103.

Pads are subjected to the tests of 19.103 and 19.105. **Controlled pads** are also subjected to the tests of 19.104.

Mattresses are subjected to the tests of 19.103 and 19.108.

Appliances incorporating a fuse-link or **intentionally weak part** that ruptures due to a short circuit are also subjected to the test of 19.102.

Fuse-links incorporated in an appliance to protect the **flexible part** against overheating or ignition are not subjected to the tests of 19.12 and are not required to comply with IEC 60127.

Appliances incorporating **electronic circuits** are also subjected to the tests of 19.11 and 19.12.

Unless otherwise specified, the appliance is supplied with a voltage

- between 0,9 times and 1,1 times the **rated voltage**, for **controlled appliances**,
- resulting in a power input between 0,85 times and 1,24 times the **rated power input**, for other appliances.

19.11.3 Addition:

The test of 19.106 is not repeated.

19.13 Addition:

The test of 15.101 is carried out before the test of 16.3.

If an electronic switch fails in the **off position** or stand-by mode and the appliance becomes permanently energized, the temperatures or temperature rises specified in 19.106 shall not be exceeded.

The temperature of the **flexible part** in contact with the thermal insulation shall not exceed 165 °C for **controlled appliances** and the temperature rise shall not exceed 150 K for other appliances.

Unless the appliance is no longer in an operating condition after the tests, the temperature of **heating elements** or **electro-conductive textiles** shall not exceed 160 °C for **controlled appliances** and the temperature rise shall not exceed 145 K for other appliances.

19.101 Blankets are operated under normal operation except that the flexible part is uncovered and folded at the most unfavourable place with a five-thickness fold having the most unfavourable dimensions. A sheet of thermal insulation as specified in normative Annex AA, having dimensions of 300 mm × 450 mm × 72 mm, is placed on the folded blanket at the most unfavourable location. A sandbag or other evenly distributed mass of 5 kg is placed on the sheet of thermal insulation.

The widths of each fold may be different.

If the **blanket** cannot be folded with five thicknesses, it is tested as a **mattress** in accordance with 19.108.

The appliance is supplied with a voltage at the upper limit of the range specified in 19.1.

19.102 If compliance with 19.101, 19.105 or 19.108 depends on the rupturing of a fuse-link or **intentionally weak part**, the test is repeated with the **flexible part** arranged as specified but with the point of maximum impedance of the protection circuit included in the most unfavourable part. The appliance is supplied with a voltage at the lower limit of the range specified in 19.1.

19.103 Appliances are operated under the conditions specified in Clause 11. Any control that limits the temperature during the test of Clause 11 is short-circuited.

If the appliance incorporates more than one control, they are short-circuited in turn.

19.104 Controlled pads are operated under **normal operation** except that two-thirds of the **flexible part** is positioned so that it overhangs the edge of the plywood support.

The covered portion may be secured to prevent the **pad** slipping off the support.

19.105 Pads are operated under **normal operation** except that the **flexible part** is uncovered and folded at the most unfavourable place with a three-thickness fold having the most unfavourable dimensions. A sheet of thermal insulation as specified in normative Annex AA, having dimensions of 300 mm × 450 mm × 72 mm is placed on the folded **pad** at the most unfavourable location. A sandbag or other evenly distributed mass of 5 kg is placed on the sheet of thermal insulation.

The widths of each fold may be different.

19.106 Appliances shall be constructed so that failure of a component does not give rise to an excessive temperature.

Compliance is checked as follows.

Blankets and mattresses are operated under the conditions of 11.101.

Pads are operated under **normal operation**. Controls are adjusted to the highest setting recommended for continuous use, the **pad** being supplied as specified in 11.4.

Failure of components, other than **heating elements** and internal wiring, that could reasonably be expected to occur in normal use is simulated, except that switching contacts are not short-circuited. Only one fault condition is applied at a time.

Failure of components that are expected to occur in normal use are the fault conditions specified in a) to g) of 19.11.2.

*During the test, the temperature of the surface of the **flexible part** of **controlled appliances** shall not exceed:*

- 60 °C for **blankets** and **mattresses**;
- 85 °C for **pads**.

For other appliances, the temperature rise shall not exceed:

- 43 K for **blankets** and **mattresses**;
- 60 K for **pads**.

19.107 Appliances incorporating

- **heating elements**;
- internal wiring having stranded conductors; or
- an unsheathed core of a flexible cord within the **flexible part** extending more than 100 mm from the cord anchorage

shall not attain excessive temperatures if one or more strands are broken.

Compliance is checked by the tests of 19.107.1 to 19.107.3 as appropriate or by assessment of the protection system.

19.107.1 *If **heating elements** or internal wiring do not have integral insulation, and have individual strands that are not electrically insulated from each other, the enclosure of the **flexible part** is opened at the most unfavourable place and a short length of the bare conductor is exposed. All but one of the strands are cut and folded back by approximately 15 mm. The enclosure is then closed and the appliance operated under **normal operation** for 4 h.*

If the single strand ruptures before any damage occurs, the test is repeated with the number of uncut strands increased to the minimum necessary to prevent rupturing.

After the test, there shall be no scorching of the enclosure or of any material in contact with the uncut strands.

19.107.2 *If **heating elements** or internal wiring have integral insulation, and have individual strands that are not electrically insulated from each other, the enclosure of the **flexible part** is opened at the most unfavourable place and a short length of the insulated conductor is exposed. A single identical strand 100 mm long is wrapped for one complete turn around the insulation of the conductor, the ends of the turn being spaced 1 mm apart. The strand is connected in series with the conductor, the enclosure is then closed and the appliance operated under **normal operation** for 4 h.*

If the single strand ruptures before any damage occurs, the test is repeated with the number of strands increased to the minimum necessary to prevent rupturing.

*After the test, there shall be no damage to the insulation of the conductor or to other material of the **flexible part**.*

NOTE A slight indentation of the insulation of the conductor is neglected.

19.107.3 *If **heating elements** or internal wiring have individual strands that are electrically insulated from each other, the **heating element** or wiring is disconnected from its terminals. A DC voltage of approximately 500 V is applied for 1 min between any two strands.*

The insulation resistance is measured and shall not be less than

- for **class III appliances**, 0,1 MΩ;
- for other appliances, 1 MΩ .

19.108 Mattresses are operated under **normal operation** except that the **flexible part** is uncovered and five runs of the **heating element** are bunched together in the most unfavourable way. Sufficient material of the permanent enclosure of the **flexible part** is removed at the most unfavourable location to get access to the **heating element** runs. The **heating element** runs are bunched over a length of 150 mm and secured by thin high-temperature tape which is not to be overlapped more than once. A sheet of thermal insulation as specified in normative Annex AA, having dimensions of 300 mm × 450 mm × 72 mm, is placed on the bunched **heating element** at the most unfavourable location. A sandbag or other evenly distributed mass of 5 kg is placed on the sheet of thermal insulation.

If the construction does not allow the **heating element** runs to be bunched together, the **heating element** assembly is removed from the **mattress** and subjected to the test of 19.101.

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.1 Addition:

The test is only applied to **control units** intended to be placed on a surface.

21 Mechanical strength

This clause of Part 1 is applicable except as follows.

21.1 Addition:

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

Compliance for the **flexible part** is checked as follows:

- for **blankets**, by the tests of 21.102, 21.105 and 21.106;
- for **mattresses**, by the tests of 21.104 to 21.106;
- for **pads**, by the tests of 21.103 and 21.105 to 21.107.

After these tests, inspection of the **flexible part** shall not show

- damage between electrodes and **electro-conductive textile** or between electrodes and their connections;
- that the enclosure is cracked or torn if it provides electrical insulation or protection against moisture;
- that the heating element has moved in the channels so that two runs come into contact with each other;
- breakage of any conductive thread of **electro-conductive textiles**;
- breakage of the conductors of the **heating element**;
- breakage of more than 10 % of the strands of internal wiring;
- breakage of electrodes;
- failure of constructional stitching, or breakage of glued or welded joints, to such an extent that compliance with the standard is impaired;

- loosening of a **non-detachable flexible cord** from the **flexible part**;
- loosening or breakage of electrical connections;
- open-circuiting of controls incorporated in the **flexible part**.

21.2 Addition:

This subclause is not applicable to **flexible parts** except those incorporating **electro-conductive textile** having a **working voltage** above 24 V.

21.101 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.

21.102 **Blankets** are securely attached to the apparatus described in normative Annex BB.

The **blanket** is pulled by the driving bar, the driving sprocket operating at a speed of 33 r/min.

The **blanket** is rotated 1 000 times with an end attached to the driving bar. It is then turned through 90° and rotated another 1 000 times.

The tests are carried out with the same face of the **blanket** adjacent to the drum.

When it is obvious which end of the **blanket** is intended to be positioned at the head of the bed, that end is attached to the driving bar. When this is not obvious, the end opposite the cord entry is attached to the driving bar.

When the **blanket** is turned through 90°, the side opposite the cord entry is attached to the driving bar.

21.103 **Pads**, with any **detachable cover** removed, are driven backwards and forwards over a smooth horizontal roller having a diameter of 25 mm. The **pad** is arranged so that one end hangs vertically over the roller while the full length of the other end is clamped to the driving means, which moves in a horizontal plane.

A clamp is attached to the end of the vertical part of the **pad** over its full length. A mass of 0,5 kg, or equivalent to 3 g/mm of the length of the attached end, whichever is greater, is attached to the clamp.

The stroke of the driving means is such that the greatest possible area is subjected to flexing.

The driving means is operated at a rate of approximately 125 mm/s for 2 000 cycles. The **pad** is then turned through 90° and subjected to a further 2 000 cycles. A cycle is two movements, one in each direction.

The tests are carried out with the same face of the **pad** adjacent to the roller.

21.104 Mattresses are laid flat on a horizontal plywood support. A roller of similar construction to the drum specified in normative Annex BB, having a mass of 61,5 kg and a length of 1 m, is rolled slowly forwards and backwards over the upper surface of the **flexible part** in the most unfavourable place. The roller is applied in the direction of the major axis over the same path for 1 000 cycles. A cycle is two movements, one in each direction.

21.105 Appliances are operated continuously under the conditions specified in Clause 11. Non-controlled appliances and **controlled appliances** having a metallic temperature sensor are tested for 500 h. Other appliances are operated for 1 000 h. The surface temperature of the **flexible part** of **controlled appliances** is measured under steady conditions at the beginning and at the end of this period. It shall not have increased by more than 5 K. For appliances with **heating elements with PTC characteristics**, the test is carried out with the **flexible part** fully covered with a sheet of thermal insulation, as specified in normative Annex AA, having a thickness of 90 mm. However, the temperature of the **heating element with PTC characteristic** is measured after 100 h and at the end of the test under the conditions specified in Clause 11. It shall not have increased by more than 5 K.

21.106 The **flexible part** is subjected to the following test.

For **blankets**, the test of 21.102 is repeated but with the other face of the **flexible part** adjacent to the drum.

For **pads**, the test of 21.103 is repeated but with the other face of the **flexible part** adjacent to the roller.

For **mattresses**, the test of 21.104 is repeated but with the roller moved in the direction of the minor axis. In this case, 2 000 cycles are carried out, 1 000 in each of two non-overlapping paths.

21.107 Pads are subjected to a test in a tumbling barrel as shown in Figure 105, their **supply cords** having been cut off at a distance of 100 mm from the **flexible part**. The barrel is turned at a rate of 6 r/min to 7 r/min, so that the **pad** falls onto a steel plate twice in each revolution, the number of revolutions being 500.

21.108 Appliances having **heating elements** that are retained in position by bonded layers shall have adequate mechanical strength.

Compliance is checked by the following test.

Six samples of the bonded material, each having dimensions of 100 mm × 130 mm, are cut from the **flexible part**. Three of the samples are cut in the direction of the runs of the **heating element** and the other three samples are cut perpendicular to this direction.

From the ends measuring 100 mm, a strip of the material retaining the **heating element** in position and having a width of 25 mm is cut away from one face at one end of each sample. Another similar strip is removed from the opposite face and at the opposite end of the sample. Any **heating element** situated under the removed strips is also cut away.

NOTE It can be necessary to cut away more than one layer in order to test the bonding of the layers retaining the **heating element**.

Clamps are attached to the full length of the remaining layers of material at both ends of the sample.

The sample is then suspended by one of the clamps and subjected to a total load of 1,25 kg by means of the other clamp. The test is carried out for 1 h at a temperature of 20 °C, and then for 1 h at a temperature of 80 °C.

*The test is repeated on six samples taken from the **flexible part** of a new appliance.*

*The layers retaining the **heating element** in position shall not separate.*

21.109 The enclosure of **moisture-proof appliances** consisting of plastic sheeting shall have adequate flexibility under cold conditions.

Compliance is checked by the following test unless the appliance complies with the test of 15.102 or has an enclosure made from reinforced plastic sheeting.

The sheeting is cut into 10 rectangular samples, each being 145 mm long and 50 mm wide with the longer dimension perpendicular to any striations resulting from the manufacturing process.

Each sample is folded about its minor axis and allowed to form a loop without creases. It is stapled to a card twice, the staples being placed close together and approximately 30 mm from the edges, as shown in Figure 106.

The test apparatus, which is also shown in Figure 106, has a steel arm that is freely pivoted at one end so that the other end can fall against a steel anvil on which the sample is placed. The mass of the arm assembly is $3,1 \text{ kg} \pm 0,03 \text{ kg}$, the arm and anvil being grooved to clear the staples fixing the samples to the card.

With its arm in the open position, the test apparatus is placed in a top-opening cabinet, the temperature of which is maintained at $-20 \text{ }^{\circ}\text{C} \pm 2 \text{ }^{\circ}\text{C}$.

When steady conditions are established, all 10 samples are placed on the floor of the cabinet with their loops uppermost for 1 h. A sample is then placed with its loop uppermost on the anvil of the test apparatus.

The arm of the test apparatus is then allowed to fall and strike the sample from an angle of 85° to the horizontal.

The test is carried out on the other samples as quickly as possible.

No more than two samples shall break into separate pieces.

21.110 The enclosure of **moisture-proof appliances** shall have adequate resistance to tearing under normal conditions of use.

For enclosures of plastic sheeting, compliance is checked by the test of 21.110.1, unless the appliance has been subjected to the test of 15.102 or the enclosure is made from reinforced plastic sheeting.

For enclosures of rubberised or similarly treated fabrics, compliance is checked by the tests of 21.110.2 to 21.110.4. For enclosures of seamed fabric, compliance is also checked by the test of 21.110.5.

21.110.1 *Five samples of the plastic sheeting, as shown in Figure 107, are conditioned at an ambient temperature of $23 \text{ }^{\circ}\text{C} \pm 2 \text{ }^{\circ}\text{C}$. The longer dimension is perpendicular to any striations resulting from the manufacturing process.*

The shorter edges of each sample are attached over their full length to the clamps of a tensile machine, the sample and the clamps being in the same plane. The clamps are separated at a rate of 50 mm/min until the sample tears. The maximum breaking load is measured.

The average breaking load of the five samples shall be not less than 12,5 N.

21.110.2 A sample of the treated fabric having a diameter of 76 mm is clamped between two disks, each having a diameter not less than 76 mm and a concentric aperture having a diameter of $26 \text{ mm} \pm 0,7 \text{ mm}$. This assembly is mounted in an apparatus so that water pressure can be applied to the untreated side of the fabric. The water pressure is gradually increased and is measured when leakage occurs through the fabric. It shall not be less than 410 kPa.

This test is carried out on three samples.

The average value of the pressure shall be at least 490 kPa.

21.110.3 Three sets of three samples, as specified in 21.110.2, are conditioned as follows.

The first set is immersed in boiling water for 1 h and then aged in a heating cabinet at a temperature of $100 \text{ }^{\circ}\text{C} \pm 1 \text{ }^{\circ}\text{C}$ for 1 000 h. The samples are then immersed again for 1 h in boiling water.

The second set is aged in an oxygen bomb for 168 h, the oxygen having a pressure of approximately 2,0 MPa and a temperature of $80 \text{ }^{\circ}\text{C} \pm 1 \text{ }^{\circ}\text{C}$.

The third set is aged in an air bomb for 20 h, the air having a pressure of approximately 0,55 MPa and a temperature of $127 \text{ }^{\circ}\text{C} \pm 1 \text{ }^{\circ}\text{C}$.

The test of 21.110.2 is then carried out on each sample.

The average value of the pressure for each set of samples shall be at least 70 % of the value obtained during the original test of 21.110.2.

21.110.4 Three samples, as specified in 21.110.2, are folded backwards and forwards 10 times.

This test is also carried out on three similar samples that have been conditioned as specified in 21.110.3 for the first set.

The samples shall show no crack, hard spot or other evidence of deterioration.

21.110.5 Twenty samples of seamed fabric, having dimensions of $75 \text{ mm} \times 25 \text{ mm}$, are cut so that the seam lies along the minor axis. They are then divided into four sets of five samples and three of the sets are conditioned as specified in 21.110.3.

All four sets of samples are then subjected to a gradually increasing tensile force until the seam starts to separate.

The average value of the force necessary to separate the seams shall be at least 22 N.

21.111 The insulation of **heating elements** and internal wiring in the **flexible part** shall retain adequate flexibility and insulating characteristics throughout the life of the appliance.

The requirement does not apply to **class III appliances** having a **rated voltage** not exceeding 24 V or to **class III constructions** having a **working voltage** not exceeding 24 V.

Compliance is checked by the tests of 21.111.1 and also by the tests of 21.111.2 and 21.111.3 when the insulation exceeds

- a temperature of $75 \text{ }^{\circ}\text{C}$ for **controlled appliances** or a temperature rise of 50 K for other appliances during the test of Clause 11, or

- a temperature of 135 °C for **controlled appliances** or a temperature rise of 110 K for other appliances during the tests of Clause 19.

The tests are carried out on new samples of **heating element** or internal wiring. For appliances having a **bonded enclosure**, the samples are taken from a new appliance.

For the test of 21.111.1, one sample measuring approximately 4 m in length is required. For the tests of 21.111.2, at least 12 samples are required, each having a length of 300 mm. For the test of 21.111.3, 12 samples are required each having a length of 300 mm.

The test of 21.111.2 is also applied to the plastic sheath that protects the ends of the **heating element** and is attached to the **flexible part**.

The tests are also applied to a sheath that comprises **basic insulation** over earthed parts when the sheath is integral with the **heating element**.

21.111.1 The sample of **heating element** or internal wiring is attached to the equipment shown in Figure 108. 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 to which the carrier is moving.

The diameter of the pulley is increased to 60 mm and the initial load to 0,5 kg for **heating elements with PTC characteristics** used in **mattresses**. The width and form of the groove of the pulley are to be appropriate for the sample under test.

The carrier is moved by a means of a chain over a distance of 1 m at 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 may be passed through the sample during the test to help 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.

For a **heating element with PTC characteristics** integrated in the **flexible part** of **mattresses**, having a rigidity index measured according to normative Annex DD equal or greater than 25 N/m, the test is performed with two pulleys having the diameter at the base of the groove being modified as specified in Table 103.

Table 103 – Pulley diameter for heating elements with PTC characteristic in mattresses

Cross sectional conductive area of heating element mm ²	Pulley diameter mm
≤ 6,0	120
> 6,0 to ≤ 10	160
> 10	200

21.111.2 The insulation is pulled off from 12 samples of the **heating element** or internal wiring. All conductive material, including sensor wires, is removed. If the insulation cannot be pulled off, it is slit longitudinally and allowed to re-close after removal of the conductive material. If the insulation of the **heating element** consists of more than one layer, only the outer layer is pulled off and tested.

In addition, if the **heating element** includes a functional earth conductor, the **basic insulation** of this conductor is removed and subjected to the test.

Six of the samples are conditioned by suspending them vertically so that they hang freely in a heating cabinet, having forced air circulation, at a temperature of $125\text{ °C} \pm 2\text{ °C}$ 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 stabilised by 16 h after removal from the cabinet.

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 $500\text{ mm/min} \pm 50\text{ mm/min}$. 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 the tensile strength of the conditioned samples shall not be less than 75 % of the average value determined for the unconditioned samples.

21.111.3 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. If the **heating element** has a non-circular construction, the diameter of the mandrel is approximately equal to the length of its minor axis. The samples, together with the remaining six samples, are placed in a heating cabinet having forced air circulation and a temperature of $125\text{ °C} \pm 2\text{ °C}$ 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 stabilised by 16 h after removal from the cabinet.

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. There shall be no breakdown.

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

21.112 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.

21.113 The insulation of **flexible parts** incorporating **electro-conductive textile** shall retain adequate flexibility and insulating characteristics throughout the life of the appliance. The requirement does not apply to **class III appliances** having a **rated voltage** not exceeding 24 V or to **class III constructions** having a **working voltage** not exceeding 24 V.

Compliance is checked by the tests of 21.113.1 and 21.113.2 when the insulation exceeds

- a temperature of 75 °C for **controlled appliances** or a temperature rise of 50 K for other appliances during the test of Clause 11; or
- a temperature of 135 °C for **controlled appliances** or a temperature rise of 110 K for other appliances during the tests of Clause 19.

The tests are carried out on new samples of the **flexible part**.

21.113.1 Twelve samples having the shape as shown in Figure 109 are stamped from the **supplementary insulation** or **reinforced insulation**, six from the longitudinal direction and six from the lateral direction. If the insulation is integrated with the fabric supporting the conductive threads, the test is not carried out.

Three samples from each direction are conditioned by suspending them vertically so that they hang freely in a heating cabinet, having forced air circulation, 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.

The 12 samples are placed in a tensile machine in turn. 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.

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

21.113.2 Twelve samples having dimensions 200 mm × 100 mm are cut from the **electro-conductive textile**, any other covering being removed. At least one sample is to include a portion of electrode. The samples are then tightly rolled on a metal mandrel having a diameter of 25 mm along the line of the conductive threads, if any. The roll may be held together by suitable tape.

*They are then placed in a heating cabinet having forced air circulation 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**. They are then unwound and removed from the mandrel.*

A sample is then placed centrally on a metal plate having dimensions of 180 mm × 80 mm and a similar plate placed on top and weighted so that the applied mass is 5 kg. The sample is then subjected to the electric strength test of 16.3. The other 11 samples are then tested in the same way in turn.

Inspection shall show that there are no visible cracks in the insulation.

22 Construction

This clause of Part 1 is applicable except as follows.

22.101 The **flexible part** shall be constructed so that **heating elements**, **electro-conductive textiles** and internal wiring are retained in their intended position. The **heating element** shall be located so that there are no crossover points.

If the **heating element** or **electro-conductive textile** is supported by a separate layer of material, this material shall be firmly secured to the enclosure to prevent internal rucking.

Crossing of internal wiring shall be avoided as far as possible. When this is unavoidable, the wiring shall be secured in order to prevent any relative movement. This requirement does not apply to signal conductors dissipating less than 150 mW/m.

Compliance is checked by inspection.

22.102 There shall be no significant change in the position of the **heating elements** or electrodes 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 **Thermostats** and **thermal cut-outs** incorporated in the **flexible part** shall be individually enclosed in insulating material.

Compliance is checked by inspection.

22.104 The dimensions of **detachable covers** shall be greater than those of the **flexible part**.

Compliance is checked by measurement after laundering the cover three times in accordance with the instructions.

22.105 **Control units** intended to stand on a table shall not have openings on the underside that could allow small items to penetrate and touch **live parts**.

*Compliance is checked by inspection and by measuring the distance between the supporting surface and **live parts** through openings. This distance shall be at least 6 mm.*

22.106 Fuse links or **thermal links** that are incorporated to protect the **flexible part** against overheating or ignition shall not be replaceable by the user.

Compliance is checked by inspection.

22.107 Duvets shall have adequate thermal properties.

Compliance is checked by the following test.

*The **duvet** is placed on a sheet of thermal insulation having a thickness of 72 mm as specified in normative Annex AA. A heat source as specified in normative Annex AA is placed between the thermal insulation and the **duvet**. When steady conditions are established, the temperature rise shall exceed 40 K.*

22.108 Appliances shall incorporate a manually operated switch to control the **flexible part**. The switch shall be constructed to prevent its actuating member from rotating continuously in the same direction. Switches actuated by contact or proximity of a finger, with little or no movement of the contact surface, shall require at least two manual operations to switch on the **heating element** but only one operation to switch it off. Touching the contact surface at the same point twice is not considered to be two operations.

Switches and **control units** in flexible cords shall have an **off position** at both ends of the travel of the actuating member, unless an indicator lamp is incorporated to show when the switch is in an on position.

Compliance is checked by inspection.

22.109 Wraps and **pads** intended to be used in close contact with the human body in order to provide heat to create moisture for cosmetic purposes shall be **moisture-proof appliances** or the **flexible part** shall be **class III construction**.

Compliance is checked by inspection and test.

22.110 Blankets having a **detachable cord** for the connection of the **flexible part** shall be washable.

Compliance is checked by inspection.

22.111 Reconnection of the mains supply to a **blanket** or **mattress** after an interruption shall not result in overheating of the user.

Compliance is checked by the following test.

*The control is adjusted to any setting specified for continuous use and the appliance is operated at **rated voltage** for 1 min. It is then disconnected from the supply for 1 min after which it is reconnected. It shall not be operating at a setting of the control higher than the highest setting specified for continuous use.*

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:

*Appliance couplers used for supplying the **flexible part** shall comply with the requirements of IEC 60320-1 as far as they reasonably apply.*

24.2 Modification:

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.

25.2 Addition:

Blankets and **mattresses** for double beds having two separate **heated areas** may have two means of connection to the supply.

25.5 Addition:

Type Z attachment is allowed.

Non-detachable flexible cords shall be connected to the **flexible part** only by **type Y attachment** or **type Z attachment**.

25.7 Addition:

Light polyvinyl chloride sheathed cords may be used, irrespective of the mass of the appliance.

25.8 Modification:

Cords having a nominal cross-sectional area of 0,5 mm² may be used, irrespective of their length.

25.14 Addition:

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

25.15 Modification:

*Flexible cords connected to the **flexible part** are subjected to a pull force of 100 N that is only applied three times for 1 min each time, the longitudinal measurement not being made. The **flexible part** is securely held by means of clamps that grip the entire length of the edge opposite the cord entry. If the cord enters at a corner, the clamps grip the entire length of both edges adjacent to the opposite corner.*

*Flexible cords connected to switches and **control units** are subjected to a pull force of 100 N and a torque of 0,1 Nm.*

25.23 Addition:

If an **interconnection cord** has more than two conductors, the current density of each conductor shall not exceed 12 A/mm² and the sum of the cross-sectional areas shall be at least 1 mm².

If non-standardized flexible cords are used, their electrical and mechanical properties shall be at least equal to those specified in IEC 60227.

When the ends of the **heating element** are contained in a plastic sheath attached to the **flexible part**, the requirements related to current density and those of IEC 60227 do not apply to the **heating element** or the plastic sheath.

25.101 The length of cord of washable appliances fitted with a **non-detachable flexible cord**, measured between the points of entry to the **flexible part** and switch or **control unit**, shall be at least 0,4 m.

Compliance is checked by inspection and by measurement.

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 except as follows.

28.2 Addition:

The requirement does not apply to the connections to the **heating elements** and **electro-conductive textiles**.

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 of the flexible part 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 **flexible part**.

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

30.1 Addition:

The requirement does not apply to the enclosure of the **flexible part**.

Modification:

For parts of resilient plastic material fitted to the **flexible part**, such as interconnection couplers and connection blocks, compliance is checked by the following test instead of the ball pressure test of IEC 60695-10-2.

The parts are subjected to a pressure test in an apparatus similar to that shown in Figure 110, the test being made in a heating cabinet at a temperature of $100\text{ °C} \pm 2\text{ °C}$.

The specimen is clamped between steel jaws, having a cylindrical face of 25 mm radius, and 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 this standard.

30.2 Addition:

The enclosure of the **flexible part** is not tested.

30.2.1 Addition:

Electro-conductive textiles shall comply with the requirements specified in ISO 9772 for category HBF material.

30.2.2 Not applicable.**30.2.3.2 Addition:**

The needle-flame test is not carried out on the enclosure of the **flexible part**.

30.101 The enclosure of the **flexible part** shall be resistant to ignition, unless the appliance incorporates means to prevent overheating resulting from the arcing of conductors.

Compliance is checked by the test of

- 30.101.1, for assessing the resistance to ignition of the **flexible part**, or
- 30.101.2, for appliances incorporating means to prevent overheating resulting from the arcing of conductors.

30.101.1 Three samples, having dimensions of 100 mm × 200 mm, are cut from the enclosure so that their shorter sides are parallel with the runs of the **heating element** or conductive threads of **electro-conductive textile**. They are selected from parts of the enclosure so that no two samples contain the same warp thread or the same weft thread. If this is not possible, the samples are selected so that the same threads do not appear in more than two samples. Any pieces of **heating element** or **electro-conductive textile** and trimming are removed from the samples.

The test equipment, as shown in Figure 111, has two brass electrodes 3 mm in diameter that are supported by brass pillars mounted on a base of insulating material so that their axes are aligned. The base 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 part of a hardwood mask, as shown in detail A of Figure 112a, is placed on the adjustable platform in the position indicated.

The test equipment, including the upper part of the mask as shown in detail B of Figure 112b, is placed in a heating cabinet having a door with an inspection window and air 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 equipment 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** or **electro-conductive textile**. 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 part 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 and any ignition shall not reach the inner edge of the mask. The test is repeated on two additional samples.

30.101.2 A suitable length of the conductor is exposed and the insulation of the conductor is removed over a length of 25 mm. This part of the conductor is bent in a radius of 75 mm and immersed in a non-conductive liquid having a temperature of 230 °C ± 2 °C, the appliance being supplied at **rated voltage**. Within 30 s, the protection system shall operate so that the power input of the **flexible part** does not exceed 1 W.

*The conductor is withdrawn from the liquid when the protection system has operated. If the power input of the **flexible part** subsequently increases above 1 W, the test is carried out 100 times or until the power input is permanently reduced below 1 W, whichever occurs first.*

30.102 The insulation of **heating elements** or **electro-conductive textiles** and internal wiring, including connections other than connections to the appliance inlet, within the **flexible part** shall be sufficiently resistant to abnormal heat and to fire.

Compliance is checked by the following test.

*A sample of the **heating element** or internal wiring at least 150 mm long is supported by a grid inclined at 45°. If **electro-conductive textile** is used, the sample has dimensions of 150 mm × 150 mm. 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/chamber as specified in IEC 60695-11-5:2016 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, 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 specimens, 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.



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Figure 101 – Sign for "Do not insert pins"

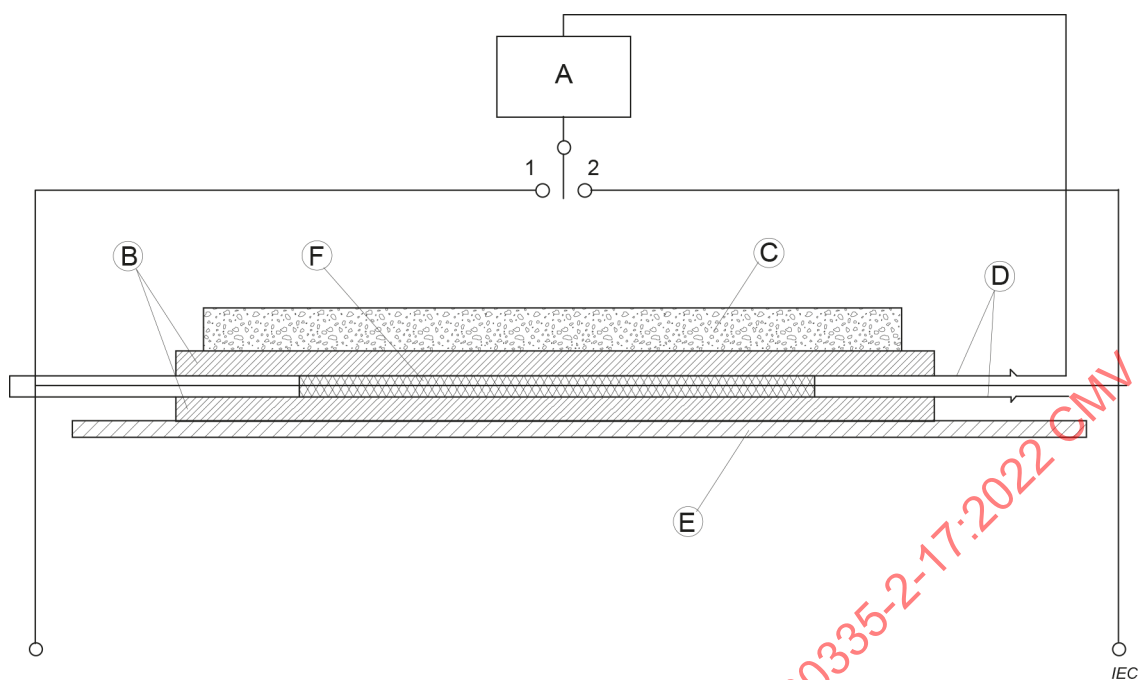


Figure 102 – Sign for "Not to be used by very young children (0-3 years)"



IEC

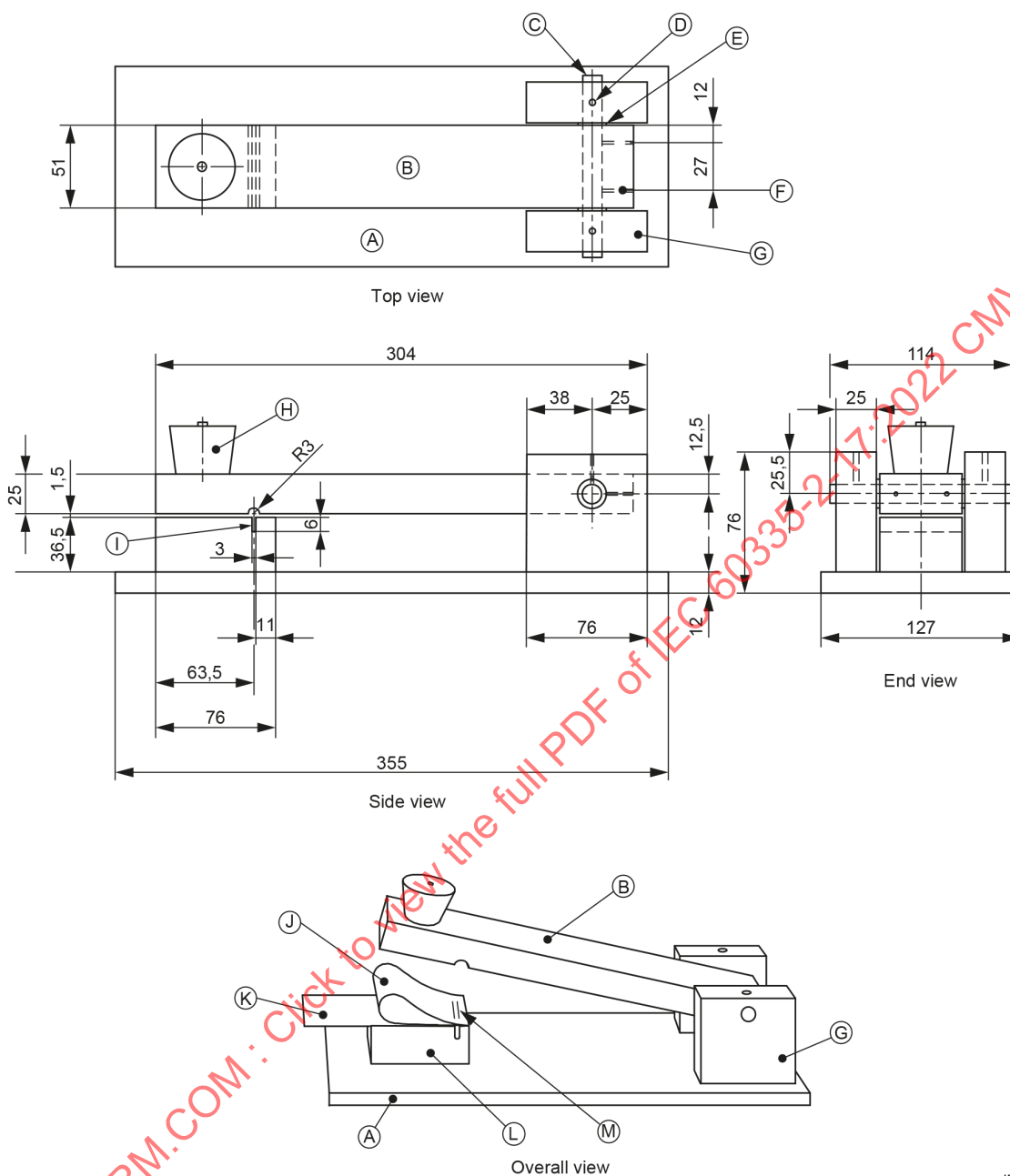
Figure 103 – Sign for "Do not use folded or rucked"

**Key**

- A circuit of Figure 4 of IEC 60990:2016
- B sheets of thermal insulation
- C uniformly distributed load
- D aluminium foil
- E plywood base
- F flexible part

Figure 104 – Arrangement for measuring leakage current and electric strength of the flexible part

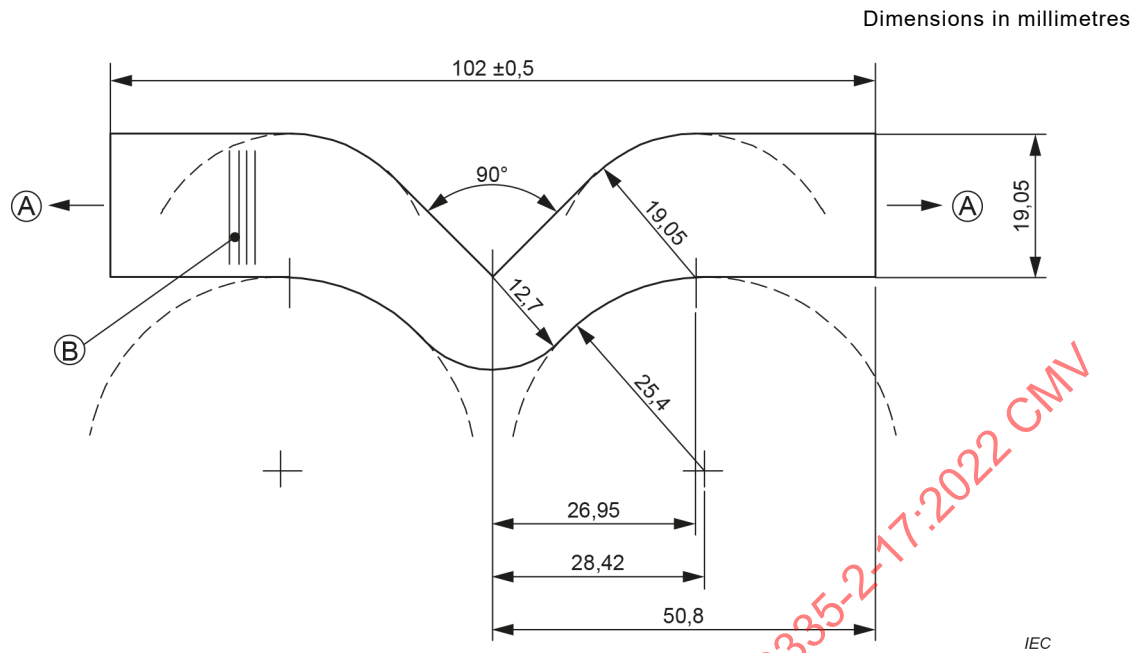
Dimensions in millimetres

**Key**

- A base
- B arm
- C loose fitting shaft
- D countersunk oil hole
- E machined washer
- F tapped hole for set screw
- G arm support
- H knob
- I slot
- J sample
- K card
- L anvil
- M staples

IEC

Figure 106 – Impact apparatus for testing enclosures of moisture-proof appliances

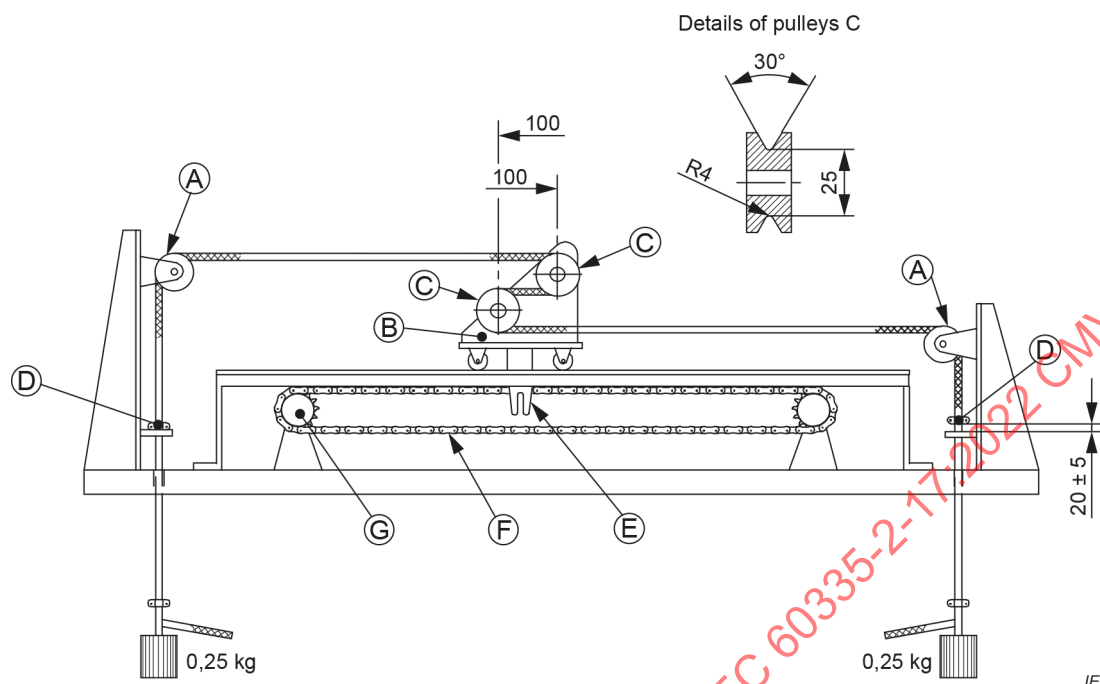


Key

- A direction of pull
- B direction of striations

Figure 107 – Shape of the sample for the tear resistance test

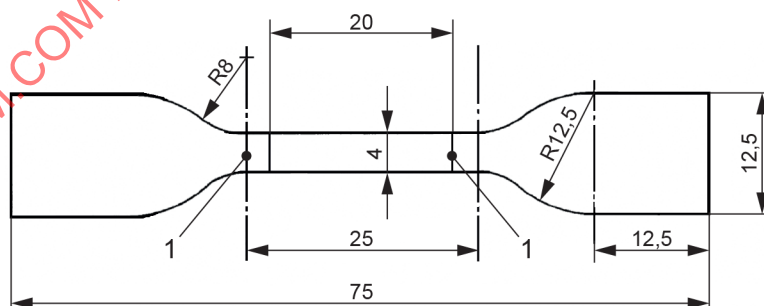
Dimensions in millimetres

**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

Figure 108 – Equipment for flexing heating elements and internal wiring

Dimensions in millimetres

**Key**

- 1 reference marks

Figure 109 – Shape of the test piece for the tensile test

Dimensions in millimetres

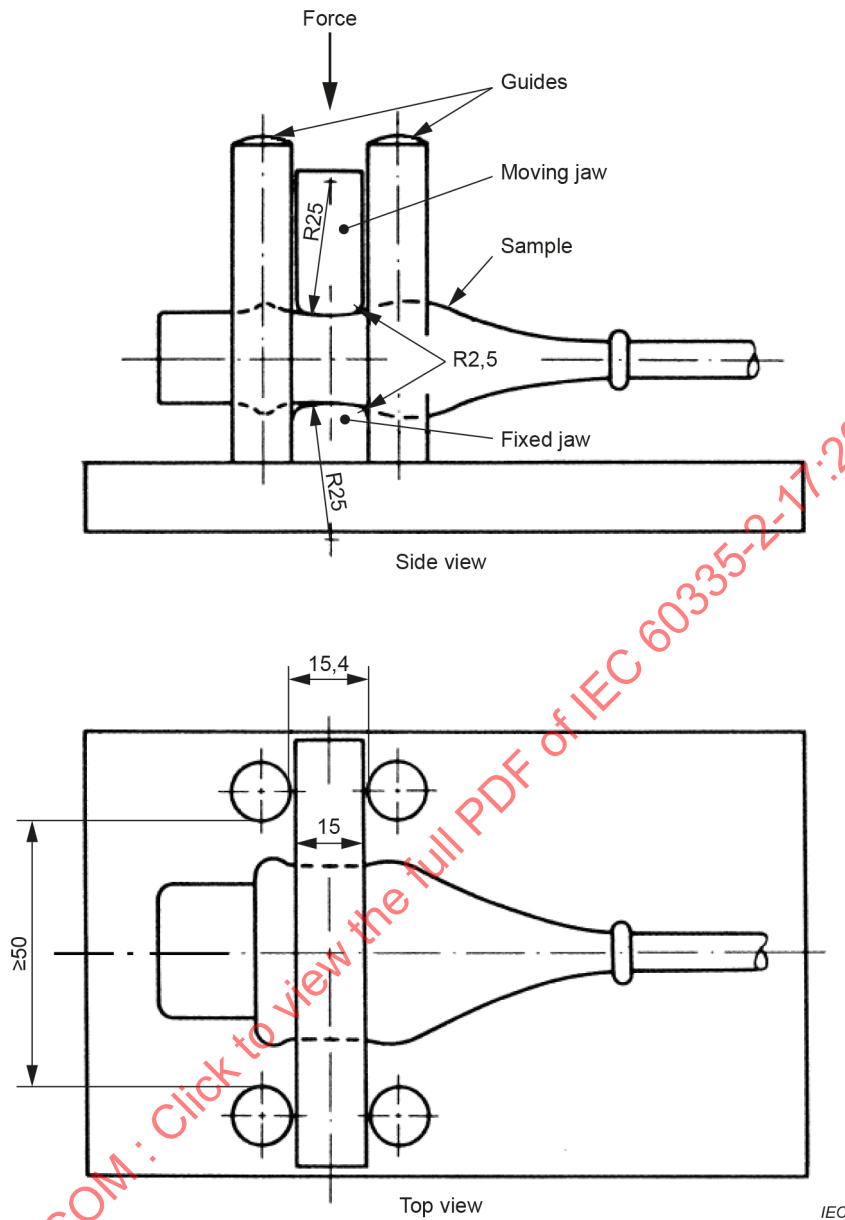
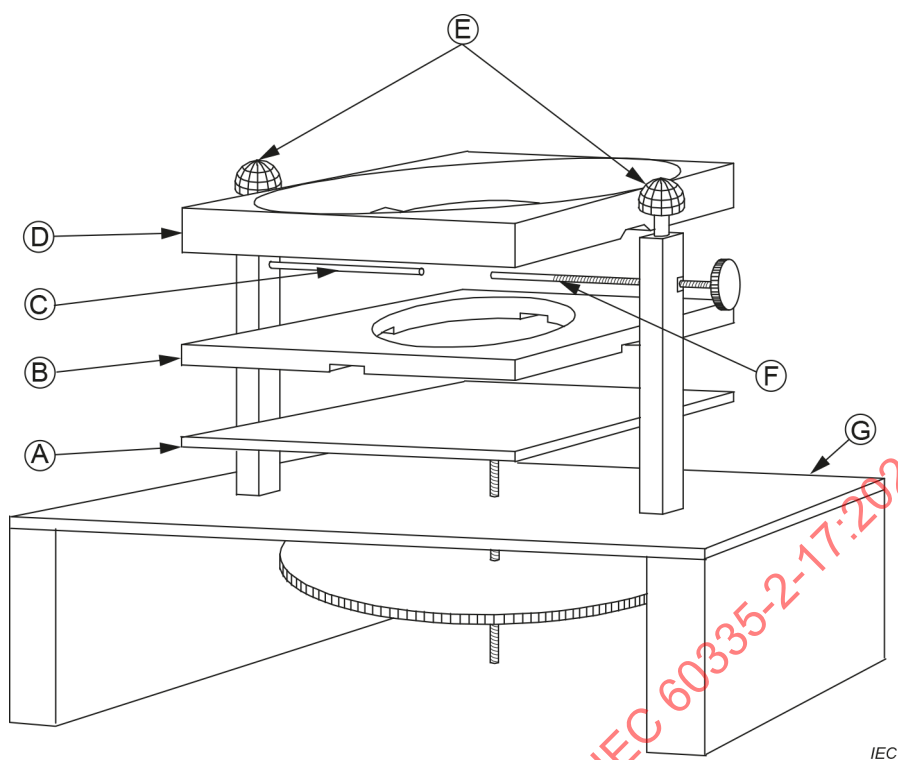


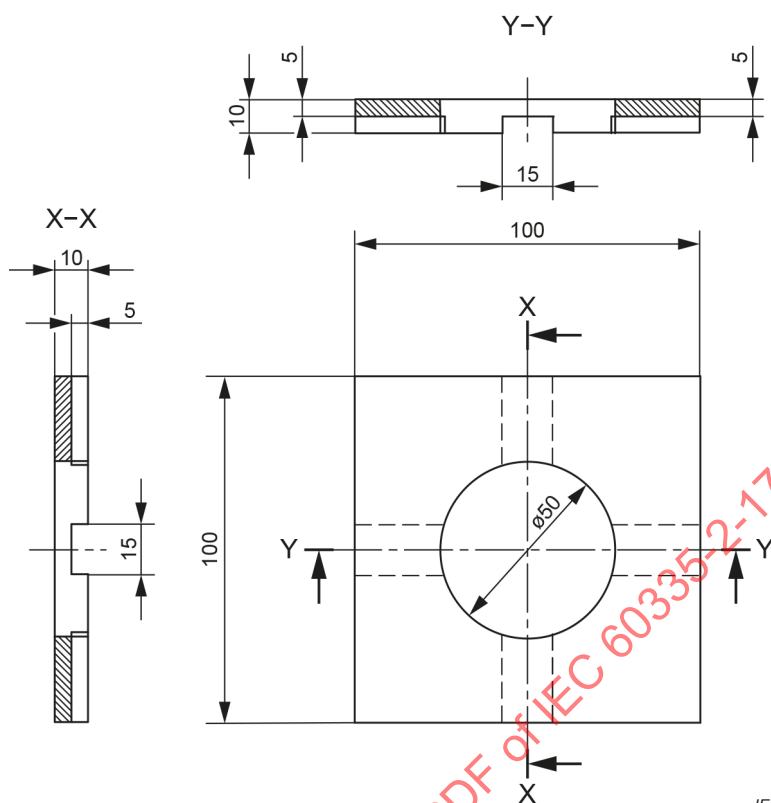
Figure 110 – Apparatus for pressure test on connectors

**Key**

- A adjustable platform
- B lower part of mask (see detail A of Figure 112a)
- C fixed electrode
- D upper part of mask (see detail B of Figure 112b)
- E terminals
- F movable electrode
- G base plate

Figure 111 – Equipment for the spark ignition test

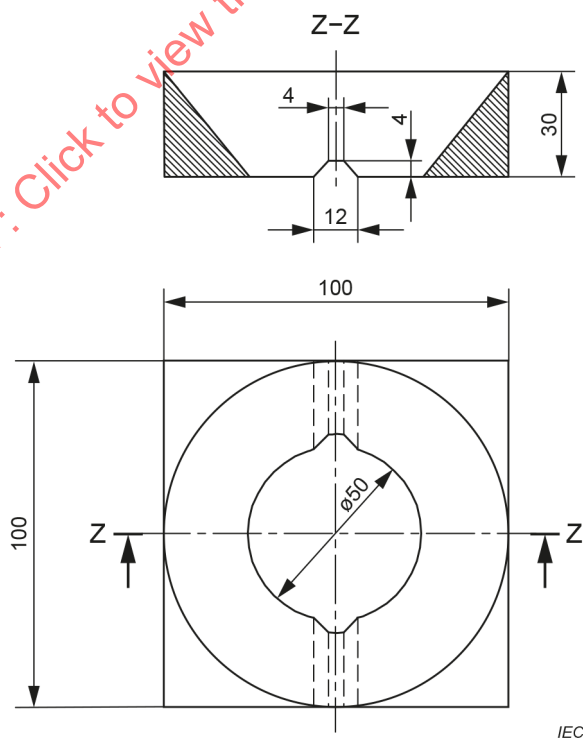
Dimensions in millimetres



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a) Detail A – Lower part of mask

Dimensions in millimetres



IEC

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 112 – Equipment for the spark ignition test – Details of the mask

Annexes

The annexes of Part 1 are applicable except as follows.

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Annex A (informative)

Routine tests

This annex of Part 1 is applicable except as follows:

A.3 Electric strength test

Addition:

An additional electric strength test is carried out between **live parts** and **accessible parts** of the **flexible part**, other than parts operating at **safety extra-low voltage**. The test voltage is determined from Table A.101.

Table A.101 – Test voltages

Type of test voltage	Test voltage V	
	Rated voltage	
	$\leq 150 \text{ V}$	$> 150 \text{ V and } < 250$
AC	$2\,000 + X$	$2\,500 + X$
DC	$3\,000 + X$	$3\,750 + X$

The value of X is determined as follows.

The **flexible part** is opened and the insulation of the **heating element** or **electro-conductive textile** is removed over a length of 5 mm to expose the conductor. The **heating element** or **electro-conductive textile** is then reinserted into the enclosure of the **flexible part**. A test voltage of 1 000 V (1 500 V DC) is applied between the conductor and the external surface of the **flexible part**. The voltage is increased in steps of 500 V (750 V DC) until breakdown occurs. The value of X is the test voltage before breakdown occurs.

If the **flexible part** incorporates a permanent outer enclosure made of electrical insulating material such as PVC, the value of X is determined with this enclosure removed.

Acceptable methods of applying the test voltage are

- passing the **flexible part** between rollers;
- passing the **flexible part** on a conveyor by a metal plate;
- placing the **flexible part** between metal plates;
- sweeping a chain wire brush over the **flexible part**.

A.4 Functional test

Addition:

The functional test includes

- *a check that the resistance of the **heating element** or **electro-conductive textile** is within the tolerance;*
- *a check that no current flows when the control is in the **off position**.*

NOTE 101 The tolerance selected is to ensure that the power input deviation of Clause 10 is not exceeded.

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Annex AA (normative)

Specification for the thermal insulation

The thermal insulation has the following composition.

Open-cell polyether:

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.

In order to determine the thickness of the sheets of thermal insulation to be used, an evenly distributed heat source, having dimensions of $1 \text{ m} \times 1 \text{ m}$ and a power input of $100 \text{ W} \pm 2 \text{ W}$, is placed centrally between two layers of thermal insulation having dimensions at least $1,2 \text{ m} \times 1,2 \text{ m}$.

An oxidized copper plate having dimensions $65 \text{ mm} \times 65 \text{ mm} \times 0,5 \text{ mm}$ to which a fine-wire thermocouple is attached is placed at the centre of the upper surface of the heat source.

The heat source is connected to the supply and the temperature rise is measured. The thickness of the thermal insulation is established when the following steady temperature rise values are recorded:

- $25 \text{ K} \pm 1 \text{ K}$, for **overblankets** and clothing;
- $60 \text{ K} \pm 2 \text{ K}$, for **underblankets, pads and mattresses**.

If the thickness of the thermal insulation below the heat source is $2d$, the approximate thickness of the thermal insulation covering the heat source is

- $0,2d$, corresponding to a temperature rise of 25 K ;
- d , corresponding to a temperature rise of 60 K .

The dimension d is approximately 36 mm .

The heat source may consist of a conductive sheet or two cotton sheets between which a heating conductor is uniformly arranged, so that the distance between adjacent runs does not exceed 20 mm .

Slight adjustments of the heat discharge can be achieved by adding a few sheets of suitable textile material.

No additional load is applied to the upper surface of the thermal insulation.

Annex BB (normative)

Equipment for the mechanical strength test for blankets

The equipment, as shown in Figure BB.1, has a rotating drum 160 mm in diameter and of sufficient length to accommodate the length of the **blanket**. Solid rubber spheres, having a diameter of 60 mm $\pm$ 2,5 mm and a hardness of 40 IRHD to 50 IRHD, are cut and attached to the drum so that they project above the surface by 25 mm. The spheres are arranged in six rows equally spaced around the circumference of the drum, the spheres in each row being 320 mm apart. The spheres are positioned mid-way between pairs of spheres in adjacent rows, as shown in Figure BB.2. The drum is free to rotate about its carrier shaft.

Below the drum, a 25 mm square bar is attached in such a way that it can freely rotate in carriers mounted in guide rails that are free to move up and down. Weights can be attached to the carriers so that the total mass of the bar and carriers can be adjusted.

Smooth hardwood cylinders, having a diameter of 65 mm and a length of 140 mm, are positioned above the drum. Each cylinder is locked to a pair of arms that pivot on an axis at a distance of 160 mm from the axis of the cylinder. The cylinders are positioned so that every sphere passes under the centre of a cylinder. The pivot bar is positioned so that when the cylinders are in contact with the top of the drum, the axis of the arms is at an angle of 25° to the horizontal. The force exerted by each cylinder on the drum is 5,1 N.

A sprocket having a pitch circle diameter of 230 mm is secured to each end of the drum carrier shaft. Endless chains, that carry a driving bar, pass over these sprockets and round the square bar in its lowest position.

The clamping bar, as shown in Figure BB.3, is attached to the driving bar by means of 3,5 mm diameter screws. Wire swivels are attached to the lower edge of the clamping bar as shown in the figure.

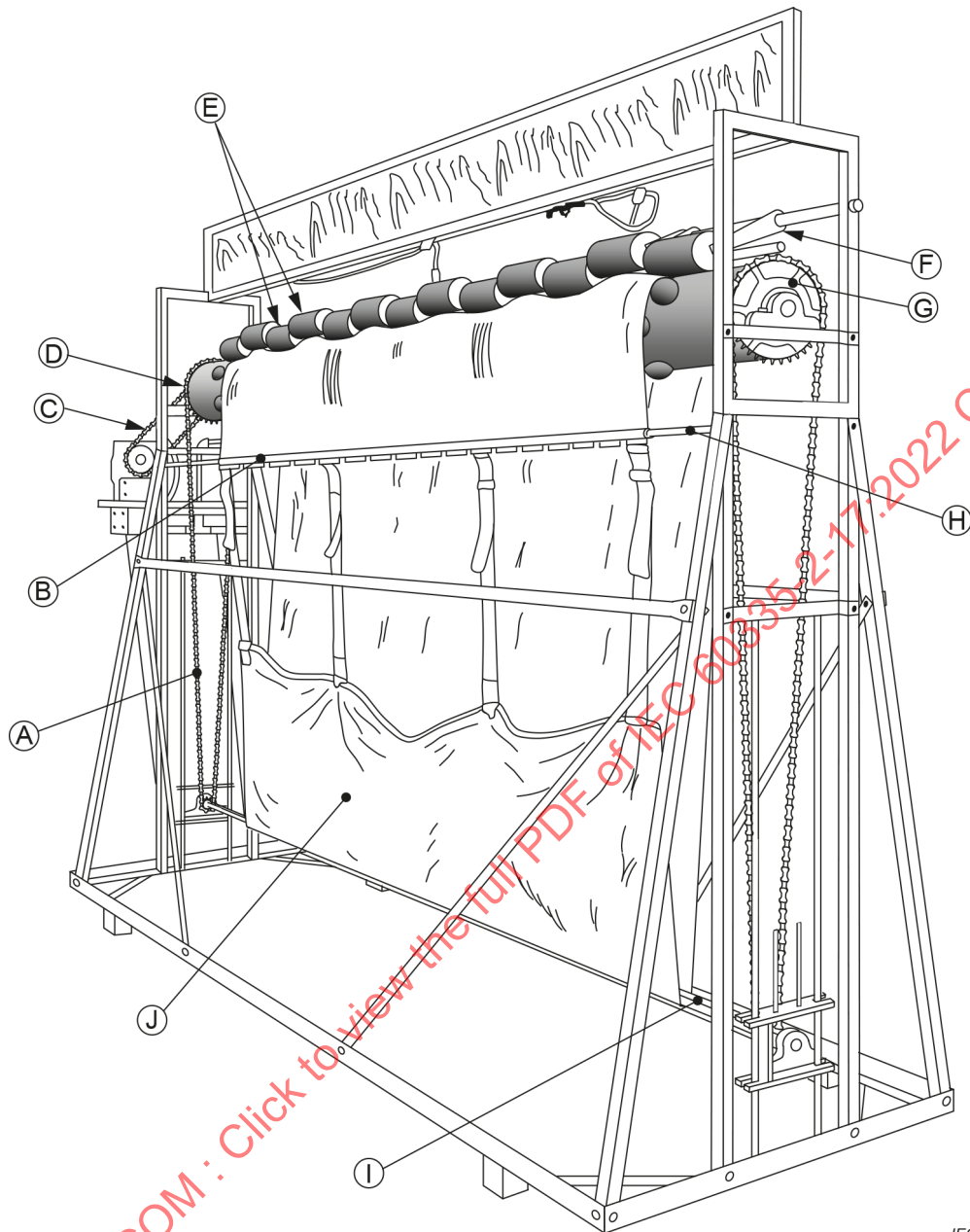
The **blanket** is secured over its entire length to the wire swivels by means of clips and adjustable webbing straps. It is then passed over the drum, under the square section bar and clipped to the other end of the webbing straps. The **blanket** and straps form a continuous belt that is tensioned by adding weights to the carriers so that the total mass of the bar assembly and carriers is 6 kg/m of attached edge of the **blanket** or 6,5 kg, whichever is greater. The webbing straps are adjusted so that the square bar and carriers are lifted 50 mm above their rest position. The tension on the straps is not subsequently altered. The straps are positioned so that they pass between the spheres on the drum.

Sufficient straps are provided to prevent the **blanket** from rucking.

Any **supply cord** is attached to the driving bar in such a way that it will not affect the result of the test.

Means are provided to raise the cylinders when the driving bar passes over the drum to avoid damaging the equipment.

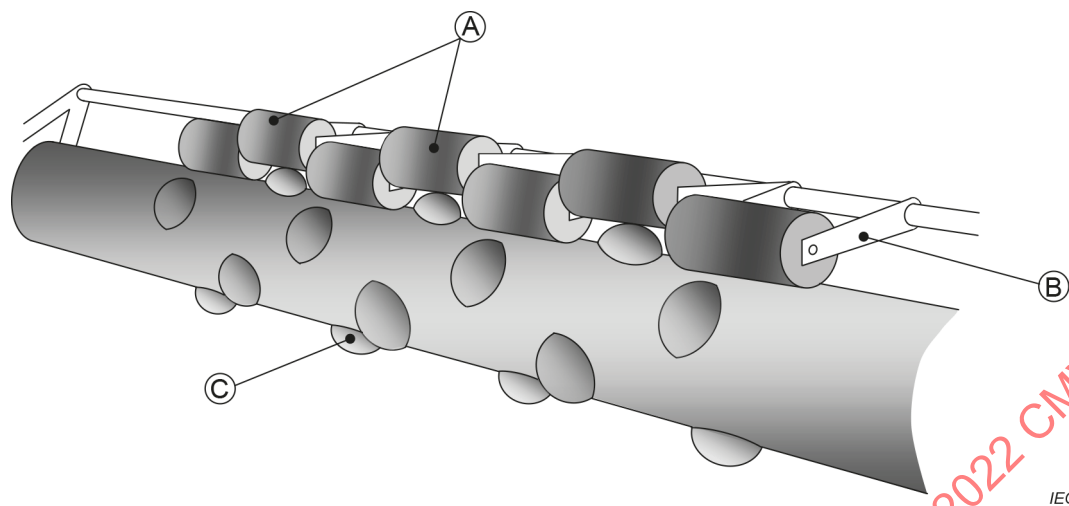
The driving bar is separately driven. Both the drum and square bar are rotated by means of the **blanket** passing over them.



Key

- A driving chain
- B clamping bar
- C driving chain
- D self-aligning bearings
- E locked cylinders
- F cylinder arm
- G sprocket
- H drawing bar
- I square bar
- J blanket under test

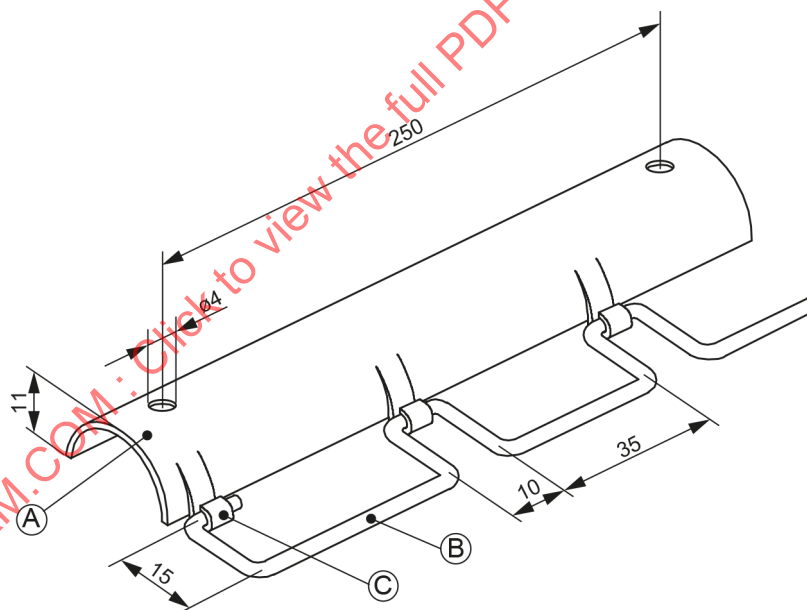
Figure BB.1 – Equipment for the mechanical strength test of blankets

**Key**

- A cylinder
- B cylinder arm
- C solid rubber spheres

Figure BB.2 – Detail of the drum and cylinders

Dimensions in millimetres

**Key**

- A steel channel 25 mm diameter, 1,6 mm thick
- B steel wire swivel, 2,5 mm diameter
- C hinges brazed to channel

Figure BB.3 – Detail of the clamping bar

Annex CC (normative)

Clothing

The following modifications to this standard are applicable for clothing.

The clause numbers in this annex refer to the clause numbers in the main part of this standard that are modified or not applicable. Clauses that are additional to the clauses in the main part of this standard are identified by adding the annex letter followed by the numbering starting at 1.

3 Terms and definitions

3.1.9 Addition:

Clothing is placed between sheets of thermal insulation. The bottom sheet has a thickness of $2d$ and the top sheet a thickness of $0,2d$, as specified in normative Annex AA. The clothing is positioned so that different **heated areas** are separated from each other unless they are likely to come into contact with each other in normal use.

The clothing may be cut in order to separate the different **heated areas**.

5 General conditions for the tests

5.7 *The modification is not applicable.*

6 Classification

6.1 Modification:

Clothing shall be **class III**.

7 Marking and instructions

7.1 Modification:

The marking "Do not use folded or rucked" or the sign of Figure 103 is not required.

7.12 Modification:

The instruction "Do not crease the appliance by placing items on top of it during storage" is also applicable to clothing.

Addition:

The instructions for clothing shall state that if the clothing is likely to be used for an extended period, the control should be adjusted to the setting recommended for continuous use. Instructions shall also include advice on precautions and how to recognize heat fatigue and the onset of heat stroke.

The instructions for clothing, other than **controlled clothing**, shall state the substance of the following:

WARNING: In order to avoid the possibility of heatstroke, disconnect the clothing when moving to an environment having significantly higher temperature.

11 Heating

11.3 Replace the first paragraph of the addition by the following:

*Thermocouples used for determining the temperature of **heating elements** are tied to them with textile thread over a length of at least 10 mm. The temperature of the surface of the **flexible part** closest to the human body is determined by means of a thermocouple attached to the centre of a disk of copper or brass 15 mm in diameter and 1,0 mm thick.*

11.8 Addition to Table 101:

Surface of clothing	50
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Addition to Table 102:

Surface of clothing for use in sub-zero temperatures ^b	45
Surface of other clothing	30

^b Examples of such clothing are garments used in cold stores and in the polar regions.

19 Abnormal operation

19.1 Addition:

Clothing is subjected to the tests of 19.102, 19.103, CC.19.1 and CC.19.2.

19.11.3 Addition:

The test of CC.19.3 is not repeated.

19.102 Modification:

The reference to "19.101, 19.105 or 19.108" is replaced by "CC.19.1 and CC.19.2".

CC.19.1 *Clothing is operated under **normal operation**, except that the **flexible part** is uncovered and folded in the most unfavourable way so that four layers of the **flexible part** are placed one on top of the other.*

NOTE A flattened sleeve is considered to be two layers of the **flexible part**.

A sheet of thermal insulation, having dimensions of 300 mm × 450 mm × 90 mm, is placed on the folded clothing at the most unfavourable location. A sandbag or other evenly distributed mass of 5 kg is placed on the sheet of thermal insulation.

CC.19.2 *Clothing is folded so that separate **heated areas** are positioned as close as possible to each other and then placed on the sheet of thermal insulation specified for **normal operation**. The clothing is operated without additional covering.*

CC.19.3 Clothing shall be constructed so that failure of a component does not give rise to a temperature that could be hazardous to the human body.

Compliance is checked by carrying out the test of Clause 11 but with controls adjusted to the highest setting recommended for continuous use. Failure of components that could reasonably be expected to occur during normal use is simulated, except that switching contacts are not short circuited. Only one fault condition is applied at a time.

*Failure of components, other than **heating elements** and internal wiring, that are expected to occur in normal use are the fault conditions specified in items a) to g) of 19.11.2.*

*During the test, the temperature of the surface of **controlled clothing** shall not exceed 75 °C. The temperature rise of the surface of other clothing shall not exceed*

- 70 K, if the clothing is intended for use in sub-zero temperatures,
- 55 K, for other clothing.

21 Mechanical strength

21.1 Addition:

Compliance for clothing is checked by the tests of 21.103 to 21.107.

21.104 Modification:

The plywood support is covered by a sheet of thermal insulation, as specified in normative Annex AA, having a thickness of 36 mm.

22 Construction

22.103 Not applicable.

25 Supply connection and external flexible cords

25.1 Modification:

Clothing shall be fitted with an appliance inlet.

25.23 The addition is applicable to clothing.

30 Resistance to heat and fire

30.2 Addition:

Clothing is subjected to the tests of 30.2.2.

Annex DD (normative)

Rigidity index test for mattresses

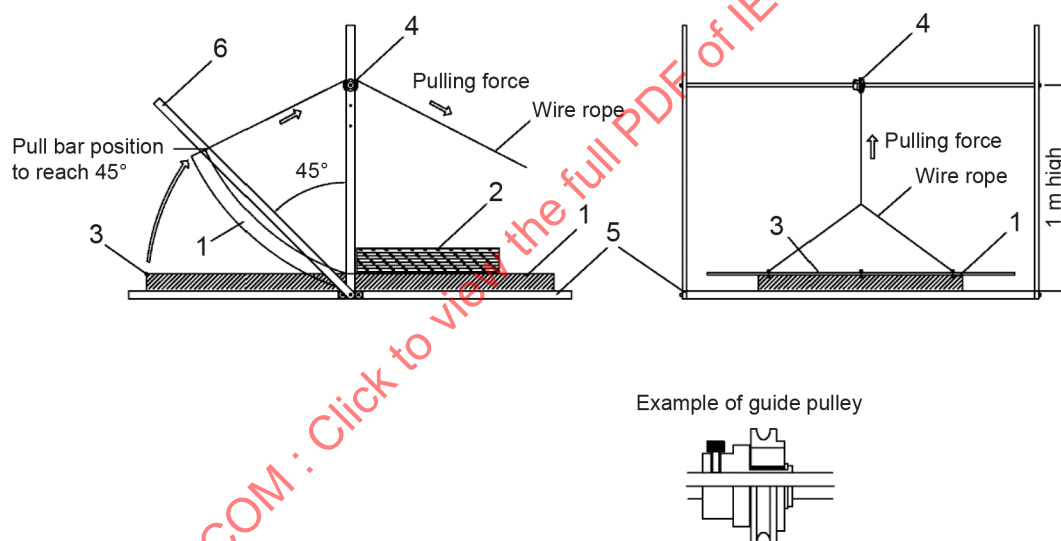
The **mattress** is laid on a flat and rigid surface as per Figure DD.1; 1 m or half the length of the **mattress**, whichever the shorter, is to be lifted, while the rest is covered by a solid pallet.

A 1,5 m long steel pull bar, having a 12 mm diameter, is properly secured to the **mattress** top edge, in order to evenly pull its entire width.

The freely rotating guide pulley is fixed 1 m high from the rigid flat surface.

The pull force shall be measured to lift the bar up to 45° as shown in Figure DD.1

The measured pull force shall be divided by the width in meters to obtain the rigidity index in N/m.



IEC

Key

- 1 mattress sample
- 2 solid pallet
- 3 1,5 m long steel pull bar, having a 12 mm diameter
- 4 freely rotating guide pulley having 57 mm of groove diameter
- 5 rigid flat surface
- 6 45° indicator stick

Figure DD.1 – Mattress rigidity index test setup

Bibliography

The bibliography of Part 1 is applicable except as follows.

Addition:

IEC 60335-2-66, *Household and similar electrical appliances – Safety – Part 2-66: Particular requirements for water-bed heaters*

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

IEC 60335-2-81, *Household and similar electrical appliances – Safety – Part 2-81: Particular requirements for foot warmers and heating mats*

IEC 60335-2-106, *Household and similar electrical appliances – Safety – Part 2-106: Particular requirements for heated carpets and for heating units for room heating installed under removable floor coverings*

IEC 60601-2-35, *Medical electrical equipment – Part 2-35: Particular requirements for the basic safety and essential performance of heating devices using blankets, pads or mattresses and intended for heating in medical use*

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

APPAREILS ÉLECTRODOMESTIQUES ET ANALOGUES – SÉCURITÉ –

Partie 2-17: Exigences particulières pour les couvertures, coussins, vêtements et appareils chauffants souples analogues

AVANT-PROPOS

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L'IEC 60335-2-17 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 2012, l'Amendement 1:2015 et l'Amendement 2:2019. 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, 19.106, 21.103, 21.104, 21.110, 30.1, 30.102, Annexe BB, CC.19.3);
- c) la définition d'une unité de commande a été explicitée (3.6.105);
- d) le réglage de la tension d'alimentation des appareils, autres que les appareils régulés, lorsque leur fonctionnement à la puissance assignée multipliée par un facteur est spécifié, a été révisé (5.12);
- e) les essais des couvertures qui ne peuvent pas être pliées en cinq épaisseurs ont été explicités (19.101);
- f) les critères de conformité ont été mis à jour afin d'inclure la rupture des électrodes (21.1);
- g) la méthode d'essai des matelas en fonction de l'indice de rigidité de la partie souple a été explicitée (21.111.1, Annexe DD);
- h) les essais des éléments chauffants à construction non circulaire ont été explicités (21.111.3);
- i) des exigences ont été ajoutées pour protéger l'utilisateur d'une surchauffe en cas de coupure du réseau d'alimentation (22.111);
- j) la méthode d'essai de compression de l'IEC 60320-1:2001 a été ajoutée (30.1);
- k) les méthodes d'essai de tenue au feu ont été mises à jour (30.101.1, 30.102).

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

Projet	Rapport de vote
61/6671/FDIS	61/6747/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/standardsdev/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 couvertures, coussins, vêtements et appareils chauffants souples analogues.

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.

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. A cette date, le document sera

- reconduit,
- supprimé,
- remplacé par une édition révisée, ou
- amendé.

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.

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

- 6.1: Les produits de la classe 0 sont admis (Japon).

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 qui peuvent être attendues dans la pratique et elle tient compte de la façon dont les phénomènes électromagnétiques peuvent altérer 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 d'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.

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APPAREILS ÉLECTRODOMESTIQUES ET ANALOGUES – SÉCURITÉ –

Partie 2-17: Exigences particulières pour les couvertures, coussins, vêtements et appareils chauffants souples analogues

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 **couvertures, coussins**, vêtements et autres appareils électriques souples, destinés à chauffer un lit ou le corps humain, pour usages domestiques et analogues, et dont la **tension assignée** des appareils est inférieure ou égale à 250 V, y compris les appareils alimentés en courant continu et les **appareils alimentés par batteries**.

La présente norme s'applique également aux **unités de commande** fournies avec l'appareil.

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 dans les instituts de beauté ou par des personnes à des températures ambiantes froides, sont compris dans le domaine d'application de la présente norme.

Les exigences et les essais relatifs aux vêtements sont donnés à l'Annexe CC normative.

Dans la mesure du possible, la présente norme traite des dangers courants que présentent les appareils et auxquels sont exposés tous les individus situés 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.

Les enfants sont considérés comme étant suffisamment âgés pour utiliser un appareil sans surveillance lorsque les parents ou les personnes qui en ont la garde leur ont expliqué les instructions et qu'ils sont ainsi aptes à utiliser l'appareil en toute sécurité.

L'attention est attirée sur le fait que :

- pour les appareils destinés à être utilisés dans des véhicules ou à bord de navires ou d'avions, des exigences supplémentaires peuvent être nécessaires;
- 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 et par des organismes similaires.

La présente norme ne s'applique pas :

- aux appareils destinés à être utilisés dans des locaux qui présentent des conditions particulières, telles que la présence d'une atmosphère corrosive ou explosive (poussière, vapeur ou gaz);
- aux dispositifs de chauffage rigides des lits, comme ceux en métal ou en céramique;
- aux dispositifs de chauffage pour matelas à eau (IEC 60335-2-66);
- aux appareils de chauffage destinés à la reproduction et à l'élevage des animaux (IEC 60335-2-71);
- aux chancelières et carpettes chauffantes (IEC 60335-2-81);
- aux appareils spécifiquement destinés à être utilisés sous surveillance médicale (IEC 60601-2-35);
- aux tapis chauffants (IEC 60335-2-106).

2 Références normatives

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

Addition:

Guide 37 de l'ISO/IEC, *Instructions d'emploi des produits par les consommateurs*

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

ISO 3758, *Textiles – Code d'étiquetage d'entretien au moyen de symboles*

3 Termes et définitions

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

3.1 Définitions relatives aux caractéristiques physiques

3.1.9 *Addition:*

fonctionnement de l'appareil dans les conditions suivantes:

- les **couvertures** et les **coussins** sont placés entre deux feuilles d'isolant thermique;
- les **couettes** sont placées sur une feuille d'isolant thermique, mais ne sont pas recouvertes;
- les **matelas** sont recouverts d'une feuille d'isolant thermique.

Note 101 à l'article: La spécification de l'isolant thermique est fournie à l'Annexe AA normative.

La **partie souple** est soutenue par un panneau de contreplaqué de 20 mm d'épaisseur, placé à 300 mm au moins au-dessus du sol. Les dimensions du socle en contreplaqué sont telles que l'isolant thermique peut être complètement soutenu sur toute sa surface. Les dimensions des feuilles d'isolant thermique sont telles que les bords dépassent la **zone chauffée** d'au moins 100 mm.

Les **unités de commande** tenues à la main lorsqu'elles sont actionnées et les interrupteurs incorporés dans les câbles souples sont positionnés pour pendre à distance du socle en contreplaqué. Les autres **unités de commande** sont placées sur une surface support à distance du socle en contreplaqué.

3.5 Définitions relatives aux types d'appareils

3.5.101

couverture

appareil qui comporte une **partie souple** pratiquement plane, destinée à faire partie de la literie et à chauffer le lit

3.5.102

couverture de dessous

couverture destinée à être utilisée sous l'occupant du lit

3.5.103

couverture de dessus

couverture destinée à être utilisée sur l'occupant du lit

3.5.104

couette

couverture de dessus piquée, destinée à être utilisée, sans autre élément de literie, sur l'occupant du lit et dans laquelle un **élément chauffant**, le **textile électroconducteur**, assure un apport de chaleur supplémentaire

3.5.105

coussin

appareil qui comporte une **partie souple** ayant une **zone chauffée** qui ne dépasse pas 0,3 m² sur chacune des faces et qui est destiné à chauffer une partie du corps humain

Si le **coussin** est de forme cylindrique ou analogue, la limite de la **zone chauffée** est égale à 0,6 m².

3.5.106

matelas

appareil destiné à soutenir le corps humain et qui comporte une **partie souple** capitonnée pour chauffer le lit

Note 1 à l'article: L'appareil peut être placé sur le sol et être assimilé à un tapis.

3.5.107

appareil régulé

appareil qui comporte, dans la **partie souple**, des dispositifs comme des **éléments chauffants à caractéristiques CTP** ou autres, pour déceler les variations de température lorsque l'appareil est utilisé dans les **conditions de fonctionnement normal**, contrôlant ainsi automatiquement la puissance moyenne

3.5.108

appareil résistant à l'humidité

appareil qui comporte une **partie souple** appropriée pour une utilisation dans des conditions humides

3.5.109

châle

appareil qui comporte une **partie souple** destinée à recouvrir le corps humain pour le maintenir chaud

3.6 Définitions relatives aux parties d'un appareil

3.6.101

partie souple

ensemble des couches de matériau qui forme l'enveloppe permanente de l'appareil, y compris l'**élément chauffant**, le **textile électroconducteur**, les **thermostats** ainsi que toutes les autres parties conductrices qui y sont contenues

Note 1 à l'article: La partie souple peut être située dans une housse amovible.

3.6.102

élément chauffant

conducteur chauffant, y compris l'âme et l'isolant éventuel, ainsi que tout autre conducteur qui y est incorporé

3.6.103

zone chauffée

zone de la **partie souple** située à l'intérieur du périmètre extérieur de l'**élément chauffant** ou du **textile électroconducteur**

Elle inclut, à l'extérieur de ce périmètre, une marge dont la largeur est égale à 0,5 fois la distance moyenne entre deux trajets adjacents de l'**élément chauffant**.

La **zone chauffée** comprend la partie de retour de l'**élément chauffant** si la distance moyenne entre cette partie et l'**élément chauffant** adjacent n'est pas supérieure à la distance moyenne entre deux trajets adjacents de l'**élément chauffant**.

Si une **couverture** ou un **matelas** comporte deux **zones chauffées** distinctes, la surface entre les deux zones est considérée comme faisant partie de la **zone chauffée** si, en tout point, la distance entre les deux **éléments chauffants** n'est pas supérieure à 1,5 fois la distance moyenne entre deux trajets adjacents de l'**élément chauffant**.

3.6.104

enveloppe collée

enveloppe de la **partie souple** dont les faces opposées sont jointes par un adhésif ou une soudure

3.6.105

unité de commande

dispositif, externe à la **partie souple**, au moyen duquel la puissance moyenne de l'appareil ou la température de la **partie souple** peut être réglée ou régulée

Note 1 à l'article: Les **unités de commande** peuvent être incorporées dans le **câble d'alimentation** ou à l'extrémité d'un **câble d'interconnexion**.

3.6.106

textile électroconducteur

matériau qui incorpore du carbone ou toute autre substance conductrice, avec l'isolant éventuel, qui est connecté à une paire d'électrodes dans le but de produire une surface chauffée

3.6.107

élément chauffant à caractéristiques CTP

élément chauffant constitué d'une paire de conducteurs séparés par un matériau conducteur qui présente un accroissement rapide non linéaire de la résistance lorsque la température s'élève à l'intérieur d'une plage spécifique

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 Modification:

Les essais sont effectués sur deux appareils, identifiés "appareil A" et "appareil B".

Addition:

Si un appareil supplémentaire est exigé pour poursuivre les essais après un essai de l'Article 19, celui-ci doit être conditionné de façon appropriée en fonction des essais des 21.102 à 21.107.

Pour les appareils équipés d'une **enveloppe collée**, des appareils supplémentaires sont exigés pour les essais du 21.108 et du 21.111. Pour les autres appareils, un **morceau d'élément chauffant** de 15 m de longueur est exigé pour les essais du 21.111.

Pour les **coussins résistant à l'humidité** soumis aux essais du 21.110, cinq appareils supplémentaires et 1 m² du matériau de l'enveloppe sont exigés.

Si un matériau thermorétractable est utilisé pour isoler les connexions dans la **partie souple**, un échantillon d'au moins 150 mm de longueur est exigé pour l'essai du 30.102.

Un appareil supplémentaire peut être utilisé pour l'essai du 19.107.

Des échantillons supplémentaires de **coussins** peuvent être utilisés pour l'essai du 30.101.

Pour les appareils qui comportent une **partie souple** qui incorpore un **textile électroconducteur** et dont la **tension de service** est supérieure à 24 V, un échantillon supplémentaire peut être utilisé pour l'essai du 21.113.2 et une feuille d'isolant d'une longueur de 1 m est exigée pour l'essai du 21.113.1.

5.3 Remplacement:

Les essais sont effectués dans l'ordre suivant:

Appareil A: Article 7, 22.11, Article 8, 22.108, 10, 21.102 à 21.107, 22.104, Articles 13, 15, 16, 17 et 20, 25.15, 25.16, Article 19 (à l'exception du 19.106), 21.108, 22.18, Articles 30, 31 et 32. Les essais des Articles 13, 15 et 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 **constructions de la classe III** dont la **tension de service** est inférieure ou égale à 24 V.

Appareil B: Articles 10 et 11, 19.106, Article 21 (pour le reste), Article 22 (pour le reste), Articles 23, 24 et 25 (pour le reste), Articles 26, 27, 28, 29 et 14.

Avant d'être soumise aux essais, la **partie souple** des appareils lavables est lavée deux fois conformément aux instructions.

S'il est évident d'après la construction de l'appareil qu'un essai spécifique ne s'applique pas, l'essai n'est pas effectué.

5.5 Addition:

Si la **partie souple** de l'appareil est fournie avec une **housse amovible**, les essais sont effectués avec ou sans la housse, si cette condition est plus défavorable. Toutefois, les **couettes** sont soumises à l'essai sans **housse amovible**.

Si la construction d'un **matelas** intègre une **partie souple** séparée qui est amovible, la **partie souple amovible** est soumise aux essais comme une **couverture de dessous**.

Si l'**élément chauffant** peut se déplacer dans les gaines, celui-ci est manipulé de manière à amener les différents trajets dans la position la plus défavorable.

5.6 Addition:

Pour les essais des appareils destinés à fonctionner en courant continu seulement, l'influence possible de la polarité sur le fonctionnement de l'appareil est prise en compte.

5.7 Modification:

Pour les **couvertures** et les **matelas régulés**, les essais des Articles 10, 11 et 19 sont effectués à une température ambiante de $15\text{ °C} \pm 5\text{ °C}$.

5.8.1 Addition:

Les appareils destinés à fonctionner en courant continu seulement sont soumis à l'essai en courant continu.

5.8.101 Les **appareils régulés** sont alimentés comme cela est spécifié pour les **appareils à moteur**.

5.12 Remplacement

Pour les appareils autres que les **appareils régulés**, lorsqu'il est spécifié que l'appareil doit fonctionner à la **puissance assignée** multipliée par un facteur, la tension d'alimentation est déterminée en alimentant l'appareil à la **tension assignée** jusqu'à ce que l'**élément chauffant** atteigne sa température de régime.

La tension d'alimentation est alors rapidement portée à la valeur nécessaire pour donner la puissance exigée pour l'essai concerné, cette valeur de tension d'alimentation étant maintenue pendant toute la durée de l'essai.

5.101 Les **couettes** et les **châles** sont soumis à l'essai comme des **couvertures de dessus**.

6 Classification

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

6.1 Modification:

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 Modification:

Les appareils doivent porter le marquage de leur **puissance assignée**. Si l'appareil possède deux moyens de raccordement à l'alimentation, la **puissance assignée** doit être spécifiée séparément pour chaque circuit sur une étiquette.

La **puissance assignée** peut être exprimée par $2 \times$ la **puissance assignée** pour chaque circuit en watts. La **puissance assignée** et la puissance totale peuvent être indiquées d'une autre manière, à condition que ces indications ne donnent pas lieu à confusion.

Les **parties de la classe III** ne doivent pas porter le marquage de la **tension assignée** de l'appareil.

Addition:

Les **parties souples** et les **housses amovibles** doivent porter le nom, la marque commerciale ou la marque d'identification du fabricant ou du vendeur responsable.

Les **housses amovibles** doivent porter le marquage de la référence du modèle ou du type de l'appareil avec lequel elles sont destinées à être utilisées.

La **partie souple** des appareils à utiliser avec une **unité de commande amovible** doit porter le marquage de la référence de l'**unité de commande** à utiliser.

La **partie souple** des appareils à utiliser avec un **transformateur amovible** doit porter le marquage de la référence du transformateur à utiliser.

Les **parties souples** doivent porter en substance les marquages suivants:

- le symbole ISO 7000-0790 (2004-01) ou le texte "Lire les instructions";
- le symbole représenté à la Figure 101 ou le texte "Ne pas insérer d'épingles";
- le symbole représenté à la Figure 102 "Ne doit pas être utilisé par de très jeunes enfants (0-3 ans)" ou un texte analogue;
- le symbole ISO 7000-3114 (2011-10) et le symbole ISO 7000-3124 (2011-10);
- l'orientation prévue des **couvertures** et des **matelas** (ce marquage n'est pas exigé si l'appareil est conforme au 11.101, quelle que soit la façon dont il est placé sur le lit).

Les **couvertures de dessous**, autres que celles comportant des **éléments chauffants à caractéristiques CTP**, doivent être marquées du symbole représenté à la Figure 103 ou du texte "Ne pas utiliser plié ou froissé".

Les **housses amovibles** doivent porter les marquages suivants :

- le symbole ISO 7000-0790 (2004-01) ;
- le symbole de la Figure 101.

La **partie souple** des **couvertures** et des **housses amovibles** doit porter le marquage des symboles de nettoyage appropriés spécifiés dans l'ISO 3758. Les appareils lavables équipés d'un **câble souple non amovible** doivent porter le marquage du symbole ISO 7000-3125 (2011-10). Les appareils non lavables doivent porter le marquage du symbole ISO 7000-3123 (2011-10).

7.6 Addition:



[symbole ISO 7000-3114
(2011-10)]

Ne pas nettoyer à
sec



[symbole ISO 7000-3123
(2011-10)]

Ne pas laver



[symbole ISO 7000-3124
(2011-10)]

Ne pas utiliser de
Javel



[symbole ISO 7000-3125
(2011-10)]

Lavage à la main

7.12 Addition:

Les instructions doivent comporter en substance les indications suivantes:

Instructions importantes. A conserver pour usage ultérieur.

Lorsque les symboles de la Figure 101, de la Figure 102, de la Figure 103 ou ceux de l'ajout au 7.6 sont utilisés, leur signification doit être expliquée.

Les instructions des **couvertures** doivent indiquer si l'appareil est une **couverture de dessus** ou une **couverture de dessous**.

Les instructions doivent spécifier les réglages de commande appropriés pour une utilisation continue de l'appareil.

Les instructions des **coussins** doivent indiquer que, lorsque l'appareil est susceptible d'être utilisé sur une période prolongée, par exemple par un utilisateur qui s'endort, il convient d'ajuster les commandes au réglage recommandé pour une utilisation continue. Les instructions des **couvertures** et des **matelas** doivent indiquer que l'utilisateur peut souffrir de brûlures cutanées ou d'un choc thermique s'il s'endort avec l'appareil réglé sur une température élevée.

Les instructions des appareils fournis avec des **unités de commande amovibles** ou des **transformateurs amovibles** doivent indiquer que l'appareil ne doit être utilisé qu'avec les types marqués sur l'appareil.

Les instructions des **couettes** doivent indiquer la longueur et la largeur de la **housse amovible** à utiliser.

Les instructions doivent comporter en substance les indications suivantes:

- lorsque l'appareil n'est pas utilisé, le ranger comme cela est indiqué (suivi des instructions nécessaires);
- au moment de ranger l'appareil, le laisser refroidir avant de le plier;

- ne pas faire de faux plis à l'appareil en plaçant des objets dessus lorsqu'il est rangé (pour les **couvertures** et les **coussins** seulement);
- examiner fréquemment l'appareil pour déceler tout signe d'usure ou de détérioration. Si de tels signes sont observés, si l'appareil a été utilisé de façon anormale ou s'il ne fonctionne pas, le retourner au fournisseur avant de le remettre sous tension;
- cet appareil n'est pas destiné à un usage médical dans les hôpitaux;
- ne pas utiliser humide (cette instruction n'est pas exigée pour les **appareils résistant à l'humidité** ou les **appareils de la classe III**);
- cet appareil ne doit pas être utilisé par des personnes insensibles à la chaleur ou par d'autres personnes très vulnérables, incapables de réagir en cas de surchauffe;
- les enfants de moins de trois ans ne doivent pas utiliser cet appareil en raison de leur incapacité à réagir en cas de surchauffe.

Les instructions des **couvertures de dessous** doivent comporter en substance les indications suivantes:

- il convient de ne pas utiliser l'appareil dans un lit pliant; ou
- si l'appareil est utilisé dans un lit pliant, vérifier que la **couverture** et les câbles ne peuvent pas être coincés ou froissés; par exemple dans les charnières.

Les instructions doivent spécifier que l'appareil ne doit pas être utilisé par les jeunes enfants de plus de trois ans sauf si les commandes ont été préréglées par un parent ou par une personne assurant la garde et si les instructions ont été données à l'enfant de manière adéquate pour qu'il puisse faire fonctionner les commandes en toute sécurité.

Les appareils lavables doivent être fournis avec des instructions de nettoyage. Les instructions des appareils lavables équipés d'un **câble souple non amovible** doivent indiquer que l'**unité de commande** ou l'interrupteur ne doit pas être mouillé au cours du lavage et que, au cours du séchage, le câble doit être positionné de telle sorte que l'eau ne pénètre pas dans le dispositif de commande ou l'interrupteur.

Les instructions des appareils non lavables doivent indiquer comment ils peuvent être nettoyés, par exemple avec une éponge humide.

7.14 *Modification:*

En lieu et place de l'essence, un détergent liquide est utilisé pour vérifier le marquage des parties souples et des housses amovibles.

Addition:

La hauteur des caractères sur la **partie souple** doit être d'au moins 2,5 mm.

La hauteur des caractères représentée à la Figure 101, à la Figure 102 et à la Figure 103 doit être d'au moins 15 mm.

La hauteur des caractères pour les indications "Instructions importantes" et "A conserver pour usage ultérieur" doit être d'au moins 4 mm.

La conformité est vérifiée par mesurage conformément au Guide 37 de l'ISO/IEC.

7.15 *Addition:*

Les symboles exigés par marquage sur les **housses amovibles** doivent être visibles de l'extérieur après la mise en place de la couverture.

Le symbole IEC 60417-5018 (2011-07) doit être placé à côté du symbole IEC 60417-5172 (2003-02) ou du symbole IEC 60417-5180 (2003-02), selon le cas.

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

La conformité est vérifiée par un examen.

8 Protection contre l'accès aux parties actives

L'article de la Partie 1 s'applique.

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.

10.1 Modification:

L'écart négatif spécifié dans le Tableau 1 est porté à 20 %.

Si l'appareil possède deux moyens de raccordement à l'alimentation, l'écart admis pour la puissance spécifié dans le Tableau 1 doit être mesuré séparément pour chaque circuit.

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

La conformité est vérifiée par l'essai suivant.

*L'appareil est alimenté à 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 Echauffements

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

11.2 Modification:

Le socle en contreplaqué est placé à distance des parois du coin d'essai.

Addition:

*Les **couvertures de dessous** dont la longueur sur leur côté le plus long est inférieure à 1 m et les **couettes**, autres que celles comportant des **éléments chauffants à caractéristiques CTP**, sont également soumises à l'essai pliées. Un pli simple est formé sur toute la largeur de la **couette** à un quart de la longueur de l'un des côtés. Les commandes sont ajustées sur le réglage le plus élevé prévu pour une utilisation continue.*

Les **châles**, autres que ceux comportant des **éléments chauffants avec des caractéristiques CTP**, sont également soumis à l'essai pliés. Un pli simple est formé en travers de la **partie souple** à l'endroit le plus défavorable.

11.3 Addition:

Les thermocouples utilisés pour déterminer la température des **éléments chauffants**, ou des gaines les contenant, sont fixés au moyen de fils textiles sur une longueur d'au moins 10 mm.

Les thermocouples utilisés pour déterminer la température de surface des **textiles électroconducteurs** sont fixés par un ruban adhésif de faible épaisseur.

Les thermocouples utilisés pour déterminer la température de surface des **coussins** sont fixés sur des plaques de cuivre ou de laiton de dimensions 65 mm × 65 mm × 0,5 mm. Les plaques sont réparties de manière à recouvrir le plus grand nombre possible de trajets de l'**élément chauffant**, un côté étant parallèle au trajet. Les températures sont déterminées en six endroits au moins, trois sur chaque surface extérieure de la **partie souple**.

11.4 Addition:

Les appareils qui comportent une **partie souple** de la **classe III** sont alimentés à la tension la plus défavorable comprise entre 0,94 fois et 1,06 fois la **tension assignée**.

11.7 Addition:

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

11.8 Addition:

Pour les **appareils régulés**, les températures ne doivent pas dépasser les valeurs indiquées dans le Tableau 101. Si la **partie souple** est constituée de **textile électroconducteur**, les valeurs spécifiées pour les **éléments chauffants** s'appliquent à la surface de l'**isolation supplémentaire** ou de l'**isolation renforcée**, ou à la surface conductrice en l'absence d'isolation.

Tableau 101 – Températures maximales

Partie	Température °C
Élément chauffant des couvertures et matelas	
– avant le deuxième déclenchement de la commande thermique	115
– dans les conditions de régime	95
Élément chauffant des coussins	
– avant le deuxième déclenchement de la commande thermique	120 ^a
– dans les conditions de régime	100
Surface des coussins	50 ^b
^a Une température de 140 °C est admise sur une période de 10 min. ^b La température peut dépasser 50 °C, sans cependant dépasser 85 °C, sur une période maximale de 2 h. La période commence lorsque la température dépasse 50 °C pour la première fois.	

Pour les autres appareils, les échauffements ne doivent pas dépasser les valeurs indiquées dans le Tableau 102.

Tableau 102 – Echauffements maximaux

Partie	Echauffement K ^a
Élément chauffant	80
Surface des coussins	35
^a Ces valeurs reposent sur la température ambiante normale de l'appareil et tiennent compte de la température ambiante maximale admise pendant l'essai.	

Si les extrémités de l'**élément chauffant** des **coussins** se trouvent dans une gaine plastique fixée à la **partie souple**, la température ou l'échauffement spécifié pour la surface s'applique également à la **surface accessible** de la gaine.

11.101 Il doit être possible de faire fonctionner les **couvertures** et les **matelas** sans risque de brûlure cutanée ou de choc thermique pour l'utilisateur.

La conformité est vérifiée par l'essai suivant.

L'appareil est alimenté comme cela est spécifié en 11.4 et mis en fonctionnement dans les **conditions de fonctionnement normal** jusqu'à l'établissement des conditions de régime. La température ambiante est maintenue à $15\text{ °C} \pm 2\text{ °C}$. Les **unités de commande** et les interrupteurs de câble sont ajustés sur le réglage le plus élevé recommandé pour une utilisation continue, à l'exception des **châles** pour lesquels le réglage le plus faible en utilisation continue est utilisé.

La température de surface de la **partie souple** est déterminée au moyen d'un thermocouple fixé au centre d'une plaque de cuivre ou de laiton de dimensions 300 mm × 300 mm × 0,5 mm. Pour les **couvertures de dessus**, la plaque est placée sous la **partie souple**. Pour les **couvertures de dessous** et les **matelas**, la plaque est placée sur la **partie souple**.

La température des **appareils régulés** ne doit pas dépasser 50 °C pendant la première heure de fonctionnement. Ensuite, elle ne doit pas dépasser:

- 45 °C pour un tiers de la longueur de la **partie souple** la plus proche du pied du lit;
- 37 °C pour le reste de la **partie souple**.

L'échauffement des autres appareils ne doit pas dépasser 33 K pendant la première heure de fonctionnement. Ensuite, il ne doit pas dépasser:

- 28 K pour un tiers de la longueur de la **partie souple** la plus proche du pied du lit;
- 20 K pour le reste de la **partie souple**.

Si les extrémités de l'**élément chauffant** sont dans une gaine plastique fixée à la **partie souple**, la limite de température spécifiée s'applique également à la **surface accessible** de la gaine.

Si l'**unité de commande** commute automatiquement à un réglage plus faible pendant la première heure de fonctionnement, en cas de doute, l'essai doit être poursuivi après l'établissement des conditions de régime afin de s'assurer que l'**unité de commande** ne repasse pas ultérieurement à un réglage thermique plus élevé, ce qui provoquerait un dépassement des limites de température.

11.102 La température de surface des **coussins** ne doit pas être excessive s'ils sont utilisés partiellement recouverts sur une période prolongée.

La conformité est vérifiée par l'essai suivant.

Les **coussins** sont alimentés comme cela est spécifié en 11.4 et mis en fonctionnement dans les **conditions de fonctionnement normal**, si ce n'est que les deux tiers de la **partie souple** sont positionnés de telle sorte qu'ils surplombent le bord du support en contreplaqué. Les commandes sont ajustées sur leur réglage le plus élevé recommandé pour une utilisation continue, et la température de surface du coussin est mesurée comme cela est spécifié en 11.3.

La température de surface de la **partie souple** des **coussins régulés** ne doit pas dépasser 85 °C, et l'échauffement de la surface des autres **coussins** ne doit pas dépasser 60 K.

La partie recouverte peut être sécurisée pour empêcher le décrochage du **coussin** de son support.

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 les exceptions suivantes.

13.1 Addition:

Pour les **matelas**, une feuille métallique, d'environ 0,1 mm d'épaisseur et de dimensions suffisantes pour recouvrir la surface de la partie du **matelas** qui comporte les parties conductrices, est insérée entre le **matelas** et la feuille d'isolant thermique. Pour les autres appareils, deux feuilles métalliques comme celles décrites ci-dessus sont insérées, l'une au-dessus et l'autre au-dessous de la **partie souple**, ces feuilles étant reliées électriquement. Une pression d'environ 35 kg/m² répartie de façon uniforme est appliquée à la feuille supérieure de l'isolant thermique.

Le montage est représenté à la Figure 104 .

13.2 Modification:

Pour la **partie souple**, le courant de fuite est mesuré entre un pôle de l'alimentation et les feuilles métalliques.

En lieu et place des valeurs spécifiées, le courant de fuite de la **partie souple** ne doit pas dépasser:

- 0,5 mA pour les **coussins**;
- 1 mA/m² de **zone chauffée**, avec une intensité maximale de 2,5 mA pour les **couvertures** et les **matelas**.

13.3 Modification:

Pour la **partie souple**, la tension d'essai est appliquée entre les **parties actives** et la feuille métallique.

14 Surtensions transitoires

L'article de la Partie 1 s'applique.

15 Résistance à l'humidité

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

15.1 Addition:

Pour la **partie souple**, la conformité est vérifiée comme suit:

- par l'essai du 15.101 pour les **couvertures** et les **coussins**;
- par les essais du 15.101 et du 15.102 pour les **appareils résistant à l'humidité**. Toutefois, les **coussins** soumis aux essais du 21.109 et du 21.110 ne sont pas soumis aux essais du 15.102;
- par les essais du 15.103 pour les **matelas**.

Les essais de l'Article 16 sont réalisés alors que l'appareil est encore immergé ou en contact avec la solution saline.

15.3 Addition:

La **partie souple** n'est pas soumise à cet essai.

15.101 Les appareils lavables sont nettoyés conformément aux instructions, toutes les parties de la **partie souple** étant immergées.

La **partie souple** est ensuite immergée pendant 1 h dans de l'eau contenant approximativement 1 % de NaCl à une température de $20\text{ °C} \pm 5\text{ °C}$ après avoir retiré les **parties amovibles**. La **partie souple** est immergée complètement, à l'exception:

- des socles de connecteurs;
- du point d'entrée du câble souple, sauf pour les **appareils résistant à l'humidité**;
- des connexions de l'**élément chauffant** ou des conducteurs internes au socle de connecteur.

L'appareil doit alors satisfaire à l'essai de rigidité diélectrique du 16.3 et l'examen ne doit révéler aucune trace d'eau sur l'isolant susceptible d'entraîner une réduction des **distances dans l'air** ou des **lignes de fuite** au-dessous des valeurs spécifiées à l'Article 29.

Pour les **appareils résistant à l'humidité**, l'examen doit montrer que l'eau n'a pas pénétré la **partie souple** à un point tel qu'elle pourrait entrer en contact avec les **éléments chauffants** et les autres parties conductrices.

La **partie souple** des appareils lavables équipés d'un **câble souple non amovible** est à nouveau immergée dans la solution saline jusqu'à ce qu'elle soit saturée. Elle est alors pliée suivant son axe principal et placée sur une ligne située 2 m au-dessus du sol. Le câble est en suspension libre, toute longueur excessive étant étendue sur le sol, et la **partie souple** est ainsi mise à sécher, sans repassage, pendant 24 h.

L'interrupteur ou l'**unité de commande** doivent alors satisfaire à l'essai de rigidité diélectrique du 16.3 et l'examen ne doit révéler aucune trace d'eau sur l'isolant susceptible d'entraîner une réduction des **distances dans l'air** ou des **lignes de fuite** au-dessous des valeurs spécifiées à l'Article 29.

15.102 Une incision est pratiquée dans l'enveloppe permanente, puis la **partie souple** est immergée dans la solution saline qui peut pénétrer librement à l'intérieur.

Après une période de 1 h, l'appareil doit satisfaire à l'essai de rigidité diélectrique du 16.3 et l'examen ne doit révéler aucune trace d'eau sur l'isolant susceptible d'entraîner une réduction des **distances dans l'air** ou des **lignes de fuite** au-dessous des valeurs spécifiées à l'Article 29.

15.103 Les **matelas** sont placés sur un panneau de contreplaqué. Une quantité d'eau contenant approximativement 1 % de NaCl, correspondant à 1 l/m² de la surface supérieure, est versée uniformément sur le **matelas** à un débit de 1 l/min.

On laisse la solution saline imbiber le **matelas** pendant 30 min.

La **partie souple** doit alors satisfaire à l'essai de rigidité diélectrique du 16.3 et l'examen ne doit révéler aucune trace d'eau sur l'isolant susceptible d'entraîner une réduction des **distances dans l'air** ou des **lignes de fuite** au-dessous des valeurs spécifiées à l'Article 29.

16 Courant de fuite et rigidité diélectrique

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

16.2 Addition:

La **partie souple** des **couvertures** et des **coussins** est soumise à l'essai, la tension étant appliquée entre les **parties actives** et une électrode immergée dans la solution saline.

La **partie souple** des **matelas** est recouverte d'une feuille métallique.

Le courant de fuite des **parties souples** ne doit pas dépasser:

- 1 mA pour les **coussins**;
- 5 mA pour les **couvertures** et les **matelas**.

16.3 Modification:

La **partie souple** des **couvertures** et des **coussins** est soumise à l'essai, la tension étant appliquée entre les **parties actives** et une électrode immergée dans la solution saline. Toutefois, lorsque l'essai est effectué sur les **couvertures** et les **coussins** sans réaliser les essais de l'Article 15 au préalable, la **partie souple** est recouverte d'une feuille métallique.

Addition:

Après l'essai, la **partie souple** des **couvertures** et des **coussins** est abondamment rincée dans l'eau puis mise à sécher pendant au moins 24 h à une température comprise entre 20 °C et 40 °C. Pendant la période de séchage, l'appareil est étiré pour tenter de rétablir ses dimensions d'origine.

Les **matelas** sont rincés avec une quantité d'eau qui correspond à 0,5 l/m² de la surface supérieure. L'eau est versée uniformément sur la surface supérieure et essuyée avec une éponge, en absorbant autant d'eau que possible. Ce traitement est effectué trois fois et le **matelas** est finalement essuyé avec un linge sec.

17 Protection contre la surcharge des transformateurs et des circuits associés

L'article de la Partie 1 s'applique.

18 Endurance

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

19 Fonctionnement anormal

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

19.1 Modification:

Les essais suivants s'appliquent en lieu et place des essais spécifiés.

Les **couvertures** sont soumises aux essais du 19.101 et du 19.103.

Les **coussins** sont soumis aux essais du 19.103 et du 19.105. Les **coussins régulés** sont également soumis aux essais du 19.104.

Les **matelas** sont soumis aux essais du 19.103 et du 19.108.

Les appareils qui comportent un fusible ou une **partie intentionnellement faible** qui se rompt en cas de court-circuit sont également soumis à l'essai du 19.102.

Les fusibles qui sont incorporés dans un appareil pour protéger la **partie souple** contre les surchauffes ou le feu ne sont pas soumis aux essais du 19.12 et leur conformité à l'IEC 60127 n'est pas exigée.

Les appareils qui incorporent des **circuits électroniques** sont également soumis aux essais du 19.11 et du 19.12.

Sauf spécification contraire, l'appareil est alimenté à une tension:

- comprise entre 0,9 fois et 1,1 fois la **tension assignée** pour les **appareils régulés**;
- qui donne une puissance comprise entre 0,85 fois et 1,24 fois la **puissance assignée** pour les autres appareils.

19.11.3 Addition:

L'essai du 19.106 n'est pas répété.

19.13 Addition:

L'essai du 15.101 est effectué avant l'essai du 16.3.

Si un interrupteur électronique est défaillant en **position arrêt** ou en mode veille et que l'appareil se met sous tension en permanence, les températures ou les échauffements spécifiés en 19.106 ne doivent pas être dépassés.

La température de la **partie souple** en contact avec l'isolant thermique ne doit pas dépasser 165 °C pour les **appareils régulés**, et l'échauffement ne doit pas dépasser 150 K pour les autres appareils.

Sauf si l'appareil n'est plus en état de fonctionner après les essais, la température des **éléments chauffants** ou des **textiles électroconducteurs** ne doit pas dépasser 160 °C pour les **appareils régulés** et l'échauffement ne doit pas dépasser 145 K pour les autres appareils.

19.101 Les **couvertures** sont mises en fonctionnement dans les conditions de fonctionnement normal sauf que la partie souple n'est pas recouverte et qu'elle est pliée à l'endroit le plus défavorable avec un pli en cinq épaisseurs ayant les dimensions les plus défavorables. Une feuille d'isolant thermique, telle que celle spécifiée à l'Annexe AA normative et de dimensions 300 mm × 450 mm × 72 mm, est placée à l'endroit le plus défavorable sur la couverture pliée. Un sac de sable ou une masse uniformément répartie de 5 kg est placé sur la feuille d'isolant thermique.

Les largeurs de chaque pli peuvent être différentes.

Si la **couverture** ne peut pas être pliée en cinq épaisseurs, elle est soumise aux essais comme un **matelas** conformément au 19.108.

L'appareil est alimenté à la tension la plus élevée de la plage spécifiée en 19.1.

19.102 Si la conformité au 19.101, au 19.105 ou au 19.108 est conditionnée par la rupture d'un fusible ou d'une **partie intentionnellement faible**, l'essai est répété en plaçant la **partie souple** comme cela est spécifié, mais avec le point d'impédance maximale du circuit de protection inclus dans la partie la plus défavorable. L'appareil est alimenté à la tension la plus faible de la plage spécifiée en 19.1.

19.103 Les appareils sont mis en fonctionnement dans les conditions spécifiées à l'Article 11. Tout dispositif de commande qui limite la température pendant l'essai de l'Article 11 est court-circuité.

Si l'appareil est équipé de plusieurs dispositifs de commande, ces derniers sont court-circuités successivement.

19.104 Les **coussins réglés** sont mis en fonctionnement dans les **conditions de fonctionnement normal**, si ce n'est que les deux tiers de la **partie souple** sont positionnés de telle sorte qu'ils surplombent le bord du support en contreplaqué.

La partie recouverte peut être sécurisée pour empêcher le décrochage du **coussin** de son support.

19.105 Les **coussins** sont mis en fonctionnement dans les **conditions de fonctionnement normal**, sauf que la **partie souple** n'est pas recouverte et qu'elle est pliée à l'endroit le plus défavorable avec un pli en trois épaisseurs ayant les dimensions les plus défavorables. Une feuille d'isolant thermique, telle que celle spécifiée à l'Annexe AA normative et de dimensions 300 mm × 450 mm × 72 mm, est placée à l'endroit le plus défavorable sur le **coussin** plié. Un sac de sable ou une masse uniformément répartie de 5 kg est placé sur la feuille d'isolant thermique.

Les largeurs de chaque pli peuvent être différentes.

19.106 Les appareils doivent être construits de telle sorte que la défaillance d'un composant ne provoque pas de température excessive.

La conformité est vérifiée comme suit.

Les **couvertures** et les **matelas** sont mis en fonctionnement dans les conditions spécifiées en 11.101.

Les **coussins** sont mis en fonctionnement dans les **conditions de fonctionnement normal**. Les commandes sont ajustées sur leur réglage le plus élevé recommandé pour une utilisation continue, le **coussin** étant alimenté comme cela est spécifié en 11.4.

Une défaillance de composants, autres que les **éléments chauffants** et les conducteurs internes, susceptible de se produire en usage normal est simulée, mais sans court-circuiter les contacts de commutation. Une seule condition de défaut est appliquée à la fois.

Les défaillances de composants susceptibles de se produire en usage normal sont les conditions de défaut a) à g) spécifiées en 19.11.2.

Pendant l'essai, la température de surface de la **partie souple** des **appareils régulés** ne doit pas dépasser:

- 60 °C pour les **couvertures** et les **matelas**;
- 85 °C pour les **coussins**.

Pour les autres appareils, l'échauffement ne doit pas dépasser:

- 43 K pour les **couvertures** et les **matelas**;
- 60 K pour les **coussins**.

19.107 Les appareils qui comportent

- des **éléments chauffants**;
- des conducteurs internes constitués de conducteurs toronnés; ou
- une âme dénudée d'un câble souple à l'intérieur de la **partie souple** qui dépasse de plus de 100 mm le dispositif d'arrêt de traction ne doivent pas atteindre des températures excessives en cas de rupture d'un ou de plusieurs brins.

La conformité est vérifiée par les essais des 19.107.1 à 19.107.3, selon le cas, ou par une évaluation du système de protection.

19.107.1 Si les **éléments chauffants** ou les conducteurs internes ne possèdent pas d'isolation intégrale et possèdent des brins qui ne sont pas isolés électriquement les uns des autres, l'enveloppe de la **partie souple** est ouverte à l'endroit le plus défavorable et une courte longueur de conducteur est dénudée. Tous les brins sauf un sont sectionnés et repliés sur environ 15 mm. L'enveloppe est alors refermée et l'appareil est mis en fonctionnement dans les **conditions de fonctionnement normal** pendant 4 h.

Si le brin se rompt avant qu'une détérioration ne se produise, l'essai est répété en augmentant le nombre des brins non sectionnés jusqu'au nombre minimal nécessaire pour empêcher la rupture.

Après l'essai, l'enveloppe ou tout autre matériau en contact avec les brins non sectionnés ne doit pas être brûlant.

19.107.2 Si les **éléments chauffants** ou les conducteurs internes possèdent une isolation intégrale et possèdent des brins qui ne sont pas isolés électriquement les uns des autres, l'enveloppe de la **partie souple** est ouverte à l'endroit le plus défavorable et une courte longueur de conducteur est dénudée. Un brin identique de longueur 100 mm est enroulé en un tour complet autour de l'isolant du conducteur, en espaçant les extrémités du tour de 1 mm. Le brin est connecté en série au conducteur, l'enveloppe est ensuite fermée et l'appareil est mis en fonctionnement dans les **conditions de fonctionnement normal** pendant 4 h.

Si le brin se rompt avant qu'une détérioration ne se produise, l'essai est répété en augmentant le nombre de brins jusqu'au nombre minimal nécessaire pour empêcher la rupture.

Après l'essai, aucun dommage ne doit être observé sur l'isolant du conducteur ou sur d'autres matériaux de la **partie souple**.

NOTE Une légère échancrure de l'isolant du conducteur n'est pas prise en compte.

19.107.3 Si les **éléments chauffants** ou les conducteurs internes possèdent des brins qui sont électriquement isolés entre eux, l'**élément chauffant** ou le conducteur est déconnecté de ses bornes. Une tension d'environ 500 V en courant continu est appliquée pendant 1 min entre deux brins.

La résistance d'isolement est mesurée et ne doit pas être inférieure à:

- 0,1 MΩ pour les **appareils de la classe III**;
- 1 MΩ pour les autres appareils.

19.108 Les **matelas** sont mis en fonctionnement dans les **conditions de fonctionnement normal** sauf que la **partie souple** n'est pas recouverte et que cinq trajets de l'**élément chauffant** sont regroupés de la manière la plus défavorable. Une quantité suffisante du matériau de l'enveloppe permanente de la **partie souple** est retirée à l'endroit le plus défavorable pour avoir accès aux trajets de l'**élément chauffant**. Les trajets de l'**élément chauffant** sont regroupés sur une longueur de 150 mm et fixés à l'aide d'un ruban à haute résistance thermique de faible épaisseur dont l'enroulement ne doit pas dépasser deux tours. Une feuille d'isolant thermique, telle que celle spécifiée à l'Annexe AA normative et de dimensions 300 mm × 450 mm × 72 mm, est placée à l'endroit le plus défavorable sur l'**élément chauffant** assemblé. Un sac de sable ou une masse uniformément répartie de 5 kg est placé sur la feuille d'isolant thermique.

Si la construction ne permet pas de regrouper les trajets de l'**élément chauffant**, l'ensemble **élément chauffant** est retiré du **matelas** et soumis à l'essai du 19.101.

20 Stabilité et dangers mécaniques

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

20.1 Addition:

L'essai ne s'applique qu'aux **unités de commande** destinées à être placées sur une surface.

21 Résistance mécanique

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

21.1 Addition:

Les **unités de commande** destinées à être placées sur une surface sont également soumises à l'essai du 21.101.

La conformité de la **partie souple** est vérifiée:

- par les essais du 21.102, du 21.105 et du 21.106 pour les **couvertures**;
- par les essais des 21.104 à 21.106 pour les **matelas**;
- par les essais du 21.103 et du 21.105 à 21.107 pour les **coussins**.

Après ces essais, l'examen de la **partie souple** ne doit pas révéler

- de détérioration entre les électrodes et les **textiles électroconducteurs** ou entre les électrodes et leurs connexions;
- de déchirure ou d'accroc de l'enveloppe si elle assure l'isolation électrique ou la protection contre l'humidité;
- de déplacement de l'élément chauffant dans les gaines de telle sorte que deux lignes viennent en contact l'une avec l'autre;