BRITISH STANDARD

BS EN
60967 : 1991

Specification for

Safety of electrically heated blankets, pads and similar flexible heating appliances for household use

This European Standard EN 60967 : 1990 has the status of a British Standard

Sécurité des couvertures, coussins et appareils chauffants souples analogues pour usage domestique, chauffés électriquement

Sicherheit elektrischer Wärmedecken, Heizkissen und ähnlicher schmiegsamer Heizgeräte für den Hausgebrauch

BSI STANDARDS

Cooperating organizations

The European Committee for Electrotechnical Standardization (CENELEC), under whose supervision this European Standard was prepared, comprises the National Committees of the following countries.

Austria	Italy
Belgium	Luxembourg
Denmark	Netherlands
Finland	Norway
France	Portugal
Germany	Spain
Greece	Sweden
Iceland	Switzerland
Ireland	United Kingdom

This British Standard was published under the authority of the Standards Board and comes into effect on 29 November 1991

The following BSI references relate to the work on this standard:
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Amendments issued since publication

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10156	15-5-99	

Contents

National foreword

This British Standard has been prepared under the direction of the Light Electrical Engineering Standards Policy Committee and is the English language version of EN 60967, 'Safety of electrically heated blankets, pads and similar flexible heating appliances for household use together with amendment A1 : 1993, amendment A51 : 1994, amendment A2 : 1998 and corrigendum May 1998' published by the European Committee for Electrotechnical Standardization (CENELEC). It was derived by CENELEC from IEC publication 967 (1988) first edition which has the same title as the European Standard together with amendment 1 (1991) to that publication

The CENELEC Common Modifications have been implemented at the appropriate places in the text of IEC Publication 967 (1988) first edition, and are indicated by a single vertical line in the margin. The foreword and preface of IEC Publication 967 (1988) first edition and the deleted parts of the original IEC text which do not form part of the text of EN 60967 have been quoted in national appendix NA.

Annexes designated 'normative' are part of the body of the standard. Annexes designated 'informative' are given for information only. National appendices are designated 'informative'.

This British Standard supersedes BS 3456 : Section A4 : 1971 which was withdrawn on 31 August 1991 in accordance with the CENELEC Internal Regulations.

Cross-references. The relationship between other international publications quoted in this standard and British Standards which are either identical or technically equivalent, is given in national appendix NC.

Product approval. Attention is drawn to the fact that products conforming to this British Standard may be approved by the British Electrotechical Approvals Board for the purposes of participation in the CENELEC Certification Agreement and in the CB Scheme of the IECEE. (Details of the BEAB Approval Mark Scheme are given on the inside back cover.)

Compliance with a British Standard does not of itself confer immunity from legal obligations.

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 60967/A2

December 1997

UDC 64.06-83:644.194:620.1:614.8
ICS 13.120; 97.180

Descriptors: Household electrical appliances, heated blanket, safety requirements, protection against electric shock, fire protection, protection against mechanical hazard

English version

Safety of electrically heated blankets, pads and similar flexible heating appliances for household use

(IEC 60967 : 1988/A2 : 1995, modified)

Sécurité des couvertures, coussins et appareils chauffants souples analogues pour usage domestique, chauffés électriquement
(CEI 60967 : 1988/A2 : 1995, modifiée)

Sicherheit elektrischer Wärmezudecken, Wärmeunterbetten, Heizkissen und ähnlicher schmiegsamer Wärmegeräte für den Hausgebrauch
(IEC 60967 : 1988/A2 : 1995, modifiziert)

This amendment A2 modifies the European Standard EN 60967 : 1990; it was approved by CENELEC on 1997-10-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This amendment exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B-1050 Brussels

Ref. No. EN 60967 : 1990/A2 : 1997 E

Foreword

The proposal to endorse amendment 2 : 1995 to IEC 60967 : 1988, document CLC/TC 61 (SEC) 1064, was circulated under the enquiry procedure in March 1996. This proposal was discussed during the Athens meeting in November 1996, when it was decided to submit a draft for an amendment to the formal vote.

This draft was circulated in May 1997 and was approved by CENELEC as amendment A2 to EN 60967 : 1990 on 1997-10-01.

This amendment has been prepared by the secretariat of CENELEC Technical Committee TC 61.

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1998-07-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 1998-10-01

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For products which have complied with EN 60967 : 1990 including its amendments A1 : 1993 and A51 : 1994 before 1998-10-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2003-10-01. However, subclause 19.3 of this previous standard is not to be applied for production after 1998-10-01.

Other publications quoted in this amendment:

EN 60695-2-2 : 1994 Fire hazard testing — Part 2: Test methods — Section 2: Needle-flame test

p In this document p is used in the margin to indicate instructions for preparing the printed version.

COMMON MODIFICATIONS

p Delete the references to page numbers.

19 Abnormal operation

p 19.3 Replace the last sentence by:

The upper sheet of lagging material, having dimensions of 450 mm x 300 mm x 90 mm, is placed on the folded blanket at the most unfavourable location. An evenly distributed mass of 5 kg, such as a sand bag, is placed on the upper sheet of lagging material.

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 60967/A51

February 1994

UDC 64.06-83 : 644.194 : 620.1 : 614.8

Descriptors: Household electrical applicances, heated blanket, safety requirements, protection against electric shock, fire protection, protection against mechanical hazard

Amendment A51 to the English version of EN 60967

Safety of electrically heated blankets, pads and similar flexible heating appliances for household use

Sécurité des couvertures, coussins et appareils chauffants souples analogues pour usage domestique, chauffés électriquement

Sicherheit elecktrischer Wärme-zudecken, Wärmeunterbetten, Heizkissen und ähnlicher schmiegsamer Wärmegeräte für den Hausgebrauch

This amendment A51 modifies the European Standard EN 60967 : 1990. It was approved by CENELEC on 8 December 1993. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This amendment exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B-1050 Brussels

Ref. No. EN 60967 : 1990/A51 : 1994 E

Foreword

A proposal to amend EN 60967 : 1990, document CLC/TC 61 (GB) 388, was discussed during the Valadares meeting in April 1992, when it was decided to submit a draft for an amendment to the voting procedure. This draft was circulated as prAD in July 1992 but the draft did not receive sufficient support.

The comments were discussed during the Berlin meeting in February 1993, when it was decided to submit a second draft to the voting procedure.

This draft was circulated in June 1993 and was ratified by CENELEC as amendment A51 on 8 December 1993.

This amendment has been prepared by the Secretariat of CENELEC Technical Committee TC 61.

The following dates are applicable:

– latest date of publication of an identical national standard	(dop)	1994-07-01
– date of withdrawal of conflicting national standards	(dow)	1996-07-01

This document modifies the corresponding clauses of EN 60967 : 1990 and its amendment.

There are no special national conditions (snc) causing a deviation from this amendment.

There are no national deviations from this amendment.

NOTE. Amendment numbers commencing A1 refer to the endorsement of IEC amendments, while those commencing A51 orginate in CENELEC.

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 60967/A1

April 1993

UDC 64.06-83 : 644.194 : 620.1 : 614.8

Descriptors: Household electrical appliances, heated blanket, safety requirements, protection against electric shock, fire protection, protection against mechanical hazard

Amendment A1 to the English version of EN 60967

Safety of electrically heated blankets, pads and similar flexible heating appliances for household use

(Amendment 1 : 1991 to IEC 967 : 1988, modified)

Sécurité des couvertures, coussins et appareils chauffants souples analogues pour usage domestique, chauffés électriquement
(Amendement 1 : 1991 à la CEI 967 : 1988, modifié)

Sicherheit elektrischer Wärmezudecken, Wärmeunterbetten, Heizkissen und ähnlicher schmiegsamer Wärmegeräte für den Hausgebrauch
(Änderung 1 : 1991 zu IEC 967 : 1988, modifiziert)

This amendment A1 modifies the European Standard EN 60967 : 1990. It was approved by CENELEC on 9 March 1993. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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Central Secretariat: rue de Stassart 35, B-1050 Brussels

Foreword

The proposal to endorse amendment 1 : 1991 to IEC 967 : 1988, document CLC/TC 61 (SEC) 799, was circulated under the enquiry procedure in August 1991. This proposal was discussed during the Valadares meeting in April 1992, when it was decided to submit a draft for an amendment to EN 60967 to the voting procedure.

This draft was circulated as prAC in July 1992 and was ratified by CENELEC as amendment A1 on 9 March 1993.

This amendment has been prepared by the secretariat of CENELEC technical committee TC 61.

The following dates are applicable:

- latest date of publication of an identical national standard (dop) 1993-12-01
- date of withdrawal of conflicting national standards (dow) 1995-12-01

For products which have complied with EN 60967 : 1990 before 1995-12-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2000-12-01.

As a consequence of endorsing amendment 1 to IEC 967, the common modification in EN 60967 concerning subclause 22.17 is withdrawn since it is covered by the IEC text.

There are no special national conditions (snc) causing a deviation from this amendment.

There are no national deviations from this amendment.

Other publications quoted in this amendment:

EN 60601-1 : 1990	Medical electrical equipment – Part 1 : General requirements for safety
EN 60730-1 : 1991	Automatic electrical controls for household and similar use – Part 1 : General requirements
EN 60730-2-1 : 1991	Part 2 : Particular requirements for electrical controls for electrical household appliances
HD 441 S1 : 1983	Methods of test for the determination of the flammability of solid electrical insulating materials when exposed to an igniting source
HD 444.2.1 S1 : 1983	Fire hazard testing – Part 2 : Test methods – Glow-wire test and guidance
HD 444.2.2 S1 : 1983	Part 2 : Test methods – Needle flame test
HD 444.2.3 S1 : 1987	Part 2 : Test methods – Bad-connection test with heaters
IEC 685-2-1 : 1980	Connecting devices (junction and/or tapping) for household and similar fixed electrical installations – Part 2 : Particular requirements – Screwless terminals for connecting copper conductors without special preparation
ISO 2439 : 1980	Polymeric materials, cellular flexible – Determinations of hardness (indentation technique)

Common modifications

1. **Scope**

1.1 Replace 'IEC 601' by 'EN 60601'.

24 **Components**

24.1 Replace 'IEC 730' by 'EN 60730' (in five places).

Appendices

APPENDIX B

B19.101 Delete.

B19.104 Delete.

APPENDIX J Replace 'IEC 707' by 'HD 441'.

APPENDIX K Replace 'IEC 695-2-1' by 'HD 444.2.1'

APPENDIX L Replace 'IEC 695-2-3' by 'HD 444.2.3'

APPENDIX M Replace 'IEC 695-2-2' by 'HD 444.2.2'

APPENDIX N Replace 'IEC 112' by 'HD 214'

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 60967

September 1990

UDC64.06-83 : 644.194 : 620.1 : 614.8

Descriptors: Household electrical appliances, heated blanket, safety requirements, protection against electric shock, fire protection, protection against mechanical hazard

English version

Safety of electrically heated blankets, pads and similar flexible heating appliances for household use

(IEC 967 : 1988, modified)

Sécurité des couvertures, coussins et appareils chauffants souples analogues pour usage domestique, chauffés électriquement
(CEI 967 : 1988, modifée)

Sicherheit elektrischer Wärmedecken, Heizkissen und ähnlicher schmiegsamer Heizgeräte für den Hausgebrauch
(IEC 967 : 1988, modifiziert)

This European Standard was approved by CENELEC on 11 September 1989. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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Central Secretariat: rue de Stassart 35, B-1050 Brussels

Brief history

The proposal to endorse the first edition of IEC Publication 967, document CLC/TC 61 (SEC) 542, was circulated under the enquiry procedure in April 1987.

This proposal was discussed during the Brussels meeting in December 1987 when it was decided to circulate a draft for EN 60967 to the voting procedure. This procedure started in September 1988.

A proposal for amending the standard was discussed during the Neusiedl meeting in May 1988 when it was decided to circulate a draft for amendment to EN 60967 under the enquiry procedure, document CLC/TC 61 (SEC) 664 of October 1988, and to submit it also to the voting procedure. The latter procedure started in January 1989.

The texts of both drafts were ratified by the CENELEC Technical Board on the 11th of September 1989 and are combined in EN 60967.

Foreword

This European Standard has been prepared by the Secretariat of CENELEC Technical Committee 61.

The following dates are applicable:

- date of announcement (doa) 1990-03-01
- date of latest publication (dop) 1990-09-01
- date of withdrawal of conflicting national standards (dow) 1991-09-01

For products which have complied with the relevant national standard before 1991-09-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 1996-09-01.

This document supplements or modifies the corresponding clauses of IEC 967 :1988, so as to convert that standard into the European Standard EN 60967.

Subclauses which are in addition to those in IEC 967 are numbered starting with 501.

Special national conditions (snc) causing a deviation from this European Standard are listed in annex ZX, which forms part of this standard.

National deviations from this European Standard are listed in annex ZY, which does not form part of this standard.

The following publications are quoted in this standard:

EN 60238	Edison screw lampholders.
EN 60320-1	Appliance couplers for household and similar general purposes.
EN 60335-2-32	Particular requirements for massage appliances.
EN 60742	Isolating transformers and safety isolating transformers - Requirements.
HD 21	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V.
HD 65.1	Lamp caps and holders together with gauges for the control of interchangeability and safety.
HD 109	Cartridge fuse-links for miniature fuses.
HD 195	Safety requirements for mains operated electronic and related apparatus for household and similar general use.
HD 214	Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions.
HD 495	Spring-operated impact-test apparatus and its calibration.
HD 566	Recommendations for the classification of materials for the insulation of electrical machinery and apparatus in relation to their thermal stability in service (first edition).
IEC 83	Plugs and socket-outlets for domestic and similar general use - Standards.
IEC 328	Switches for appliances.
IEC 384-14	Fixed capacitors for use in electronic equipment. Part 14: Sectional specification: Fixed capacitors for radio interference suppression. Selection of methods of test and general requirements.

NOTE 1. Where reference is made to other harmonized standards, the latest edition of that standard is applicable.

NOTE 2. Compulsory approval of appliances with regard to safety is legally required in Sweden and with regard to safety and to radio and television interference suppression is legally required in Finland, Norway and Switzerland.

The following print types are used:

- requirements: in roman type
- *test specifications:* *in italic type*
- explanations: in small roman type

CONTENTS

Clause

SAFETY OF ELECTRICALLY HEATED BLANKETS, PADS AND SIMILAR FLEXIBLE HEATING APPLIANCES FOR HOUSEHOLD USE

1. Scope

1.1 This standard applies to electrically heated flexible appliances designed for the application of heat to a bed, or to the human body, such as blankets, pads and mattresses for household purposes, and to control units delivered with them.

This standard does not apply to:

- rigid bed warmers, such as those of metal or ceramic material;
- appliances specifically intended for use by persons under medical supervision; (IEC 601)
- appliances for pets and other household animals.
- heaters for water-beds

For appliances incorporating a massage function EN 60335-2-32 is also applicable.

Additional requirements are under consideration for:

- appliances incorporating conductive sheet type heating elements;

1.2 This standard is concerned with safety and takes into account the influence on safety of components necessary to achieve a required degree of radio and television interference suppression.

2. Definitions

2.1 Where the terms voltage and current are used they imply the r.m.s. values, unless otherwise specified.

2.2 The following definitions apply for the purposes of this standard.

1. *Flexible part* denotes all layers of material forming the permanent enclosure of the appliance together with the heating element, thermostats and all other current-carrying parts contained therein.

   The flexible part may be inside a detachable cover.

2. *Blanket* denotes an appliance comprising a substantially flat, flexible part which is intended to form part of the bedding and so provide a general application of heat to the bed.

3. *Under-blanket* denotes a blanket designed to be used under the occupant of the bed.

4. *Ruck-resistant blanket* denotes an under-blanket having a construction of such rigidity that rucking of the flexible part is unlikely.

5. *Over-blanket* denotes a blanket designed to be used over the occupant of the bed.

6. *Pad* denotes an appliance comprising a flexible part having a heated area, measured on one face only, not exceeding 0.2 m^2 and which is designed for the local application of heat to the human body.

7. *Mattress* denotes an appliance comprising an upholstered flexible part which is intended to support the bedding and which is not designed to be folded.

8. *Inherently controlled appliance* denotes an appliance the input of which will automatically decrease significantly due to an increase in temperature of the flexible part when the appliance is operated under conditions of adequate heat discharge.

9. *Control unit* denotes a device, external to the flexible part of the appliance but inserted into its circuit, by means of which the average input of the appliance can be varied or regulated.

   Cord switches are not considered as control units unless they incorporate components controlling other functions.

10. *Cord control unit* denotes a control unit intended to be held in the hand when operated.

    Cord control units may be incorporated either in the power supply cord or at the end of an interconnection cord.

11. *Heating element* denotes the heating conductor, together with any core on which the conductor is wound, any other integral conductor and insulation.

12. *Heated area* denotes that area of the flexible part enclosed within the outer perimeter of the heating element. It includes a margin outside the perimeter having a width equal to 0.5 times the average distance between adjacent parallel 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 parallel 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 area, if at any place the distance between the two heating elements does not exceed 1.5 times the average distance between adjacent parallel runs of the heating element.

13. *Rated voltage* denotes the voltage assigned to the appliance by the maker.

14. *Rated voltage range* denotes the voltage range assigned to the appliance by the maker, expressed by its lower and upper limits.

15. *Working voltage* denotes the maximum voltage to which the part under consideration can be subjected when the appliance is operating at its rated voltage and under normal conditions of use.

    When deducing the working voltage, the effect of possible transient voltages on the supply mains is ignored.

16. *Rated input* denotes the input under conditions of adequate heat discharge, assigned to the appliance by the maker.

17.

NOTE - If no current is assigned to the appliance, the rated current for the purpose of this standard is the current determined from the rated input and the rated voltage. 1

18. *Rated frequency* denotes the frequency assigned to the appliance by the maker.

19. *Detachable part* denotes a part which can be removed without the aid of a tool.

20. *Non-detachable part* denotes a part which can be removed only with the aid of a tool.

21. *Power supply cord* denotes a flexible cord for supply purposes, fixed to the appliance or assembled with the appliance according to one of the following methods:

Type X attachment which denotes a method of attachment such that the flexible cord can easily be replaced, without the aid of special purpose tools, by a flexible cord not requiring any special preparation;

Type M attachment which denotes a method of attachment such that the flexible cord can easily be replaced, without the aid of special purpose tools, by a special cord with, for example, a moulded-on cord guard or crimped terminations; **or by replacing a part of the appliance incorporating the cord;** 1

Type Y attachment which denotes a method of attachment such that the flexible cord can be replaced **by use of a special purpose tool either for gaining access to the connection or for making the connection.** 1

NOTE - Type Y attachment may be used either with a common flexible cord or with a special cord.

Type Z attachment which denotes a method of attachment such that the flexible cord cannot be replaced without breaking or destroying the appliance. 1

22. *Interconnection cord* denotes a flexible cord which connects the flexible part of the appliance to a control unit or cord switch, or is an external interconnection between two flexible parts or two control units.

23. *Detachable flexible cord* denotes a power supply cord or an interconnection cord intended to be connected by means of a suitable appliance coupler.

24. *Basic insulation* denotes the insulation applied to live parts to provide basic protection against electric shock.

Basic insulation does not necessarily include insulation used exclusively for functional purposes.

25. *Supplementary insulation* denotes an independent insulation applied in addition to basic insulation in order to provide protection against electric shock in the event of a failure of basic insulation.

26. *Double insulation* denotes an insulation comprising both basic insulation and supplementary insulation.

27. *Reinforced insulation* denotes a single insulation system applied to live parts which provides a degree of protection against electric shock equivalent to double insulation under the conditions specified in this standard.

The term "insulation system" does not imply that the insulation must be one homogeneous piece. It may comprise several layers which cannot be tested singly as supplementary insulation or basic insulation.

28. Void

29. *Class II appliance* denotes an appliance in which protection against electric shock does not rely on basic insulation only, but in which additional safety precautions, such as double insulation or reinforced insulation, are provided, there being no provision for protective earthing or reliance upon installation conditions.

Such an appliance may incorporate one of the following constructions:

a) a durable and substantially continuous enclosure of insulating material which envelopes all metal parts, with the exception of small parts, such as name plates, screws and rivets, which are isolated from live parts by insulation at least equivalent to reinforced insulation; an appliance of this construction is called an insulation-encased Class II appliance;

b) a substantially continuous metal enclosure, in which double insulation is used throughout, except for those parts where reinforced insulation is used, because the application of double insulation is manifestly impracticable; an appliance of this construction is called a metal-encased Class II appliance;

c) is a combination of the constructions *a)* and *b)*.

The enclosure of an insulation-encased Class II appliance may form a part or the whole of the supplementary insulation or of the reinforced insulation.

Constructions of types *b)* and *c)* are not applicable to the flexible part.

Class II appliances may have parts operating at safety extra-low voltage.

30. *Class III appliance* denotes an appliance in which protection against electric shock relies on supply at safety extra-low voltage and in which voltages higher than those of safety extra-low voltage are not generated.

Appliances intended to be operated at safety extra-low voltage and having internal circuits which operate at voltages other than safety extra-low voltage, are not included in the classification and are subject to additional requirements.

31. *Extra-low voltage* denotes a voltage supplied from a source within the appliance and, when the appliance is operated at its rated voltage, does not exceed 42 V between conductors and between conductors and earth, the extra-low voltage circuit being separated from other circuits by basic insulation only.

32. *Safety extra-low voltage* denotes a nominal voltage not exceeding 42 V between conductors and between conductors and earth, the no-load voltage not exceeding 50 V.

When safety extra-low voltage is obtained from the supply mains, it must be through a safety isolating transformer or a convertor with separate windings.

The voltage limits specified are based on the assumption that the safety isolating transformer is operated at its rated supply voltage.

33. *Safety isolating transformer* denotes a transformer the input winding of which is electrically separated from the output windings by an insulation at least equivalent to double insulation or reinforced insulation, and which is designed to supply an appliance at safety extra-low voltage.

34. *Conditions of adequate heat discharge* denote that the flexible part is operated as follows:

The flexible part is supported by a piece of plywood, 20 mm thick, situated not less than 300 mm above the floor.

Mattresses are placed on the plywood and covered by a sheet of lagging material.

Other appliances, except duvets, are placed between sheets of lagging material on a plywood base. 1

Duvets are operated as overblankets but without the upper sheet of lagging material. 1

The size of the plywood is such that the lagging material can be fully supported over its entire area. Unless otherwise specified, the size of the sheets of lagging material is such that the edges extend at least 100 mm beyond the outline of the heated area.

NOTE - The specification for the lagging material is given in appendix C. 1

35. *Thermostat* denotes a temperature sensing device, the operating temperature of which may be either fixed or adjustable and which, during normal operation, keeps the temperature of an appliance, or of parts of it, between certain limits by automatically opening and closing a circuit.

36. *Temperature limiter* denotes a temperature sensing device, the operating temperature of which may be either fixed or adjustable and which, during normal operation, operates by opening or closing a circuit when the temperature of an appliance, or parts of it, reaches a predetermined value.

It does not make the reverse operation during the normal duty cycle of the appliance. It may or may not require manual resetting.

37. *Thermal cut-out* denotes a device which, during abnormal operation, limits the temperature of an appliance, or of parts of it, by automatically opening the circuit or by reducing the current, and which is so constructed that its setting cannot be altered by the user.

38. *All-pole disconnection* denotes disconnection of both supply conductors by a single initiating action.

39. *Accessible part or accessible surface* denotes a part or surface which can be touched by means of the standard test finger shown in Figure 1.

40. *Creepage distance* denotes the shortest path between two conductive parts, or between a conductive part and the bounding surface of the appliance, measured along the surface of the insulating material.

The bounding surface of the appliance is the outer surface of the enclosure, considered as though metal foil were pressed into contact with accessible surfaces of insulating material.

41. *Clearance* denotes the shortest distance between two conductive parts, or between a conductive part and the bounding surface of the appliance, measured through air.

42. *Tool* denotes a screwdriver, a coin or any other object which may be used to operate a screw or similar fixing means.

43. The term *body* includes all accessible metal parts, shafts of handles, knobs, grips and the like, and metal foil in contact with all accessible surfaces of insulating material; it does not include inaccessible metal parts.

The term body is not used in connection with the flexible part.

44. *Unsupported flexible plastic sheeting* denotes sheet material, the characteristic constituent of which is polyvinyl chloride resin or polyvinyl acetate co-polymer resin.

The word "flexible" implies that the material is fully plasticized and the word "unsupported" indicates a complete absence of reinforcing fibres, threads and fabric.

45. *Bonded enclosure* denotes an enclosure of the flexible part where the opposite faces are joined together by means of an adhesive or welding. 1

2.2.46 *Duvet* denotes a quilted overblanket intended to be used without additional bedding over the occupant of the bed and in which the heating element provides supplementary heat.

2.2.47 *PTC heating element* denotes a heating element consisting of two conductors separated by a conductive material which has a rapid non-linear increase in resistance when the temperature is raised through a particular range. 1

3. General requirement

3.1 Appliances shall be so designed and constructed that in normal use they function safely so as to cause no danger to persons or surroundings, even in the event of such careless use as may occur in normal service.

In general, compliance is checked by carrying out all the relevant tests.

4. General notes on tests

4.1 *Tests according to this standard are type tests.*

4.2 *The tests are made on two samples (A and B) which shall withstand all the relevant tests.*

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

Sample A is subjected to the tests of Clauses and Sub-clauses 5, 7, 8, 22.28 10, 11.7, 21.2, 21.3, 21.4, 21.5, 21.6, 21.7, 22.17, 13, 15, 16, 17, 20, 25.10, 25.11, 25.12, 19, 22.10 21.8, 21.9, 22.23, and 31. 1

Sample B is subjected to the tests of Clauses and Sub-clauses 10, 11(remainder), 21.17, 21.18, 21.23 22 (remainder), 23, 24, 25 (remainder), 26, 27, 28 and 29. 1

An additional sample may be required for the test of Sub-clause 19.9.

For appliances of having a bonded enclosure an additional sample is required for the tests of Sub-clauses 21.9 and 21.19 to 21.22.

For appliances other than those having a bonded enclosure a length of 15 m of heating element is required for the tests of Sub-clauses 21.19 to 21.22.

For moisture-proof pads subjected to the tests of Sub-clauses 21.10 to 21.16 five additional samples and 1 m^2 of enclosure material are required.

If it is evident from the design of the appliance that a particular test is not applicable, that test is not made.

Unless otherwise specified duvets are tested as overblankets.

4.3 *Before testing is started, both samples A and B are operated at rated voltage in order to verify that they are in working order.*

For washable appliances the flexible part is laundered twice in accordance with the manufacturer's instructions.

4.4 *Unless otherwise specified the tests are carried out with the appliance or any moveable part of it placed in the most unfavourable position which may occur in normal use.*

4.5 *If the flexible part of the appliance is provided with a detachable cover, the tests are made with or without this cover, whichever is the more unfavourable.*

Duvets are tested without a detachable cover. 1

4.6 *Unless otherwise specified, the tests are made at an ambient temperature of (20 ± 5) °C.*

Unless otherwise specified for flexible parts incorporating PTC heating elements, the tests are made at the most unfavourable temperature within the range of 0 °C to 25 °C. 1

For other inherently controlled blankets *and mattresses the ambient temperature is maintained at the most unfavourable temperature within the range 0 °C to 15 °C when carrying out the tests of Clauses 10, 11 and 19.* 1

Refer snc.

4.7 *Appliances for a.c. only are tested with a.c., at rated frequency if marked; those for d.c. only are tested with d.c. and those for both a.c. and d.c. are tested with the more unfavourable supply.*

Appliances designed for more than one rated voltage are tested with the most unfavourable voltage.

Unless otherwise specified, appliances designed for one or more rated voltage ranges are tested at the most unfavourable voltage within the relevant range.

When it is specified, for inherently controlled appliances marked with a rated voltage range, that the supply voltage is equal to the rated voltage multiplied by a factor, the supply voltage is equal to:

- *the upper limit of the rated voltage range multiplied by this factor, if greater than 1;*

- *the lower limit of the rated voltage range multiplied by this factor, if smaller than 1.*

When testing appliances for d.c. only, the possible influence of polarity on the operation of the appliance is taken into consideration.

Where reference is made to maximum or minimum rated input the rated input related to the upper limit or lower limit respectively of the rated voltage range is meant.

If an appliance is designed for a rated voltage range, the upper limit of the voltage range will usually be the most unfavourable voltage within the range.

4.8 *When it is specified that the appliance has to be supplied at a voltage such that the input is greater than rated input, this voltage applies only to heating elements without appreciable positive temperature coefficient of resistance. For other heating elements, this voltage is determined as follows:*

First, the rated voltage is supplied until the heating element reaches its operating temperature. The supply voltage is then rapidly increased to the value necessary to give the input required for the relevant test and the test is made as specified, the value of the supply voltage being maintained throughout the test.

In general, the temperature coefficient is considered to be appreciable if, at rated voltage, the input of the appliance in cold condition differs by more than 15% from the input at operating temperature.

4.9 *Unless otherwise specified, appliances provided with a thermostat, a regulating device or a similar control are tested with these controls adjusted to their most unfavourable setting, if the setting can be altered by the user.*

If the adjusting means of the control is accessible without the aid of a tool, this sub-clause applies whether the setting can be altered by hand or with the aid of a tool. **If the adjusting means is not accessible without the aid of a tool and if the setting is not intended to be altered by the user, this subclause does not apply.**

Adequate sealing is regarded as preventing alteration of the setting by the user.

4.10 *Class III appliances are tested together with their supply transformers if the transformer is supplied with the appliance.*

Control units supplied with the appliance are tested together with the appliance.

4.11 *If Class II appliances have parts operating at safety extra-low voltage, such parts are checked for compliance with the appropriate requirements specified for Class III appliances.*

4.12 *For appliances incorporating electronic circuits Appendix B applies.*

5. Rating

The maximum rated voltage is:

- 250 V for Class II appliances;
- 24 V for Class III appliances.

Compliance is checked by inspection of the marking.

5.501 Single-phase appliances intended to be connected directly to the supply mains, shall have a rated voltage covering their use at 220 V or 230 V and a rated frequency covering their use at 50 Hz.

Compliance is checked by inspection.

Refer snc.

6. Classification

6.1 Appliances are classified:

1. According to the protection against electric shock:
   - Class II appliances;
   - Class III appliances.
2. According to degree of protection against moisture:
   - moisture-resistant appliances;
   - moisture-proof appliances.

The classification of an appliance is determined by the classification of its flexible part.

The class numbers are not intended to reflect the safety level of the appliance or control unit, but only the means by which the safety is obtained.

Control units and Class III appliances are not classified according to degree of protection against moisture.

In Sub-clauses 22.1 and 22.2, requirements with regard to the classification of the appliance are given.

7. Marking

7.1 *a)* The flexible part and detachable control units shall be marked with:

– rated voltage(s) or rated voltage range(s), in volts;

- Do not use folded (pads and blankets only; marking not required for duvets and appliances with PTC heating elements);

- Do not use rucked (under-blankets only; marking not required for appliances with PTC heating elements);

- Do not tuck in (blankets only; marking not required for duvets and appliances with PTC heating elements). However if the outline of the wired area can be seen, the marking may state "Do not use with the wired area tucked in";

– maker's model or type reference.

- Detachable covers must have dimensions exceeding (duvets only).

NOTE - The length and width of the cover is to be stated.

b) The flexible part, detachable cover and detachable control units shall be marked with the maker's or responsible vendor's name, trade mark or identification mark.

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

d) 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.

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

Compliance is checked by inspection.

7.2 *a)* The flexible part and detachable cover shall be marked with the following instructions:

– Read instructions carefully;

– Do not use folded (pads and blankets only);

– Do not use rucked (blankets only);

– Do not use with the wired area tucked in (blankets only);

– Do not insert pins;

– Do not use if wet (moisture-resistant appliances only);

– Use only as an under-blanket (under-blankets only);

– Use only as an over-blanket (over-blankets only);

– Do not use with a helpless person, an infant or a person insensitive to heat,

– Overlong application at high setting can result in skin burns (pads only, except those fitted with a timer which switches off the supply after a period not exceeding 1 h).

The words "at high setting" are not required on pads without temperature adjustment.

b) The flexible part of washable blankets shall be marked with:

"Launder according to the instruction sheet. Do not dry clean".

Additional laundering instructions, for instance, in the form of symbols, may be given.

The flexible part of other blankets shall be marked with:

"Do not launder or dry clean."

c) Detachable covers shall be marked with:

"This cover may be laundered (or dry-cleaned) in accordance with the manufacturer's instructions and must be removed for that purpose."

Compliance is checked by inspection.

7.3 For appliances marked with a rated voltage range, the upper and lower limits of the rated input shall be marked on the appliance so that the relation between input and voltage appears distinctly, unless the difference between the limits of a rated voltage range does not exceed 10% of the mean value of the range, in which case the marking for rated input may be related to the mean value of the range.

Compliance is checked by inspection.

7.4 When symbols are used, they shall be as follows:

V	volts
A	amperes
Hz	hertz
W	watts
~	alternating current
⎓	direct current
⧈	Class II construction.

The symbol for nature of supply shall be placed next to the marking for rated voltage.

The dimensions of the symbol for Class II construction shall be such that the length of the sides of the outer square is about twice the length of the sides of the inner square. The length of the sides of the outer square shall be not less than 5 mm, unless the largest dimension of the control unit does not exceed 150 mm, in which case the dimensions of the symbol may be reduced, but the length of the sides of the outer square shall be not less than 3 mm.

The symbol for Class II construction shall be so placed that it will be obvious that it is part of the technical information and is unlikely to be confused by any other marking.

NOTE - Additional symbols are allowed provided they do not give rise to misunderstanding.

Compliance is checked by inspection.

7.5 Unless it is obviously unnecessary, switches, the operation of which might cause a hazard, shall be marked or placed so as to indicate clearly which part of the appliance they control.

Indications used for this purpose shall, wherever practicable, be comprehensible without a knowledge of languages, national standards, etc.

Compliance is checked by inspection.

7.6 The different positions of switches and regulating devices shall be indicated by figures, letters or other visual means.

An indication for the direction of adjustment to increase or decrease the value of the characteristic being adjusted shall be provided.

If figures are used for indicating the different positions, the "off" position shall be indicated by the figure 0 and the position for a greater heat output shall be indicated by a higher figure.

The figure 0 shall not be used for any other indication, unless it is so positioned and associated with other numbers that it does not give rise to confusion with the indication of the "off" position.

The figure 0 may, for example, also be used on a digital programming keyboard.

An indication of + and − is considered to be sufficient.

Compliance is checked by inspection.

7.7 An instruction sheet shall be provided with the appliance. If it is necessary to take special precautions when using the appliance, details of these shall be given.

Refer snc:

a) The instruction sheet shall contain the words:

Important instructions — Retain for future use.

These words shall be written in lettering having a height of at least 6 mm.

b) The instruction sheet shall contain the substance of the marking requirements of Sub-clause 7.2.

c) The instruction sheet supplied with under-blankets, other than blankets having a factor *g* greater than 1,2 measured as specified in 22.16, shall state how the blanket is to be secured to the mattress. 3 1

d) The instruction sheet shall give full instructions regarding laundering for washable blankets and detachable covers.

e) The instruction sheet for pads shall contain a warning that the user should not fall asleep when the appliance is energized.

This requirement does not apply to pads fitted with a timer which switches off the supply after a period not exceeding 1 h.

f) The instruction sheet for appliances to be used with detachable control units or transformers shall state that the appliance is only to be used with those marked on the appliance.

g) The instruction sheet shall contain the substance of the following:

- When not in use, store as follows (quote necessary instructions);

- Avoid pressing creases into the appliance (for blankets and pads only);

- Examine the appliance frequently, for signs of wear or damage. If there are such signs, or if the appliance has been misused, return it to the supplier prior to any further use; 1

- This appliance is not intended for use in hospitals.

- For appliances with Type M attachment: If the supply cord of this appliance is damaged, it must be replaced by the special cord (quote the appropriate part reference);

- For appliances with Type Y attachment: If the supply cord of this appliance is damaged, it must only be replaced in a repair shop appointed by the manufacturer, because special purpose tools are required;

- For appliances with Type Z attachment: The supply cord of this appliance cannot be replaced; if the cord is damaged, the appliance must be discarded.

Compliance is checked by inspection and measurement.

7.8 Markings, other than symbols, shall be in the official language(s) of the country in which the appliance is to be sold.

Marking required by this standard shall be durable and easily legible. For the flexible part the lettering shall have a height of not less than 2.5 mm.

Markings on, and indications for, switches, thermostats, thermal cut-outs and other control devices shall be placed in the vicinity of these components; they shall not be placed on removable parts if these parts can be replaced in such a way that the marking is misleading.

Compliance is checked by inspection, by measurement and by rubbing the marking by hand for 15 s with a piece of cloth soaked with water and again for 15 s with a piece of cloth soaked with:

– *detergent, for markings on the flexible part and detachable covers;*

– *petroleum spirit for other markings.*

After all the tests of this standard, the marking shall be easily legible; it shall not be easily possible to remove labels and marking plates shall show no curling.

If compliance with this standard depends upon the operation of a replaceable thermal link or fuse-link, the reference number or other means for identifying the link shall be marked on the link or at a place such that it is clearly visible when the appliance has been dismantled to the extent necessary for replacing the link. 1

NOTE - The petroleum spirit to be used for the test is aliphatic solvent hexane having a maximum aromatics content of 0,1% by volume, a kauri-butanol value of 29, an initial boiling-point of approximately 65 °C, a dry-point of approximately 69 °C and a specific mass of approximately 0,68 kg/l.

8. **Protection against electric shock**

8.1 Appliances shall be constructed and enclosed so that there is adequate protection against accidental contact with live parts and, for Class II appliances, with basic insulation or with metal parts separated from live parts by basic insulation only. 1 This requirement applies for all positions of the appliance when it is operated as in normal use, even after removal of detachable parts, except for lamps located behind a detachable cover, provided the appliance can be isolated from the supply by means of a plug or an all-pole switch, the "off" position of which is clearly indicated. During the insertion or removal of lamps, protection against accidental contact with live parts of the lamp cap shall also be ensured.

The insulating properties of lacquer, enamel, ordinary paper, cotton, oxide film on metal parts, beads and sealing compound shall not be relied upon to give the required protection against accidental contact with live parts.

The enclosure of appliances shall have no openings other than those necessary for the use and working of the appliance, which give access to live parts and, for Class II appliances, to basic insulation or to metal parts separated from live parts by basic insulation only. 1

Parts operating at safety extra-low voltage not exceeding 24 V are not considered to be live parts.

If a manufacturer instructs the user to remove a part during normal operation or user maintenance, that part is regarded as a detachable part even if a tool has to be used for its removal.

This requirement excludes the use of screw-type fuses, and screw-type miniature circuit-breakers if they are accessible without the aid of a tool.

Self-hardening resins are not regarded as sealing compound.

Compliance is checked by inspection and by a test with the standard test finger shown in Figure 1.

In addition, apertures in Class II appliances other than those giving access to lamp caps or live parts in socket-outlets are tested with the test pin shown in Figure 2. The test finger and the test pin are applied without appreciable force, in every possible position.

Apertures preventing the entry of the finger are further tested by means of a straight unjointed test finger of the same dimensions, which is applied with a force of 20 N; if this finger enters, the test with the finger shown in Figure 1 is repeated, the finger being introduced through the aperture. If the unjointed test finger does not enter, the force applied is increased to 30 N. If then the guard is so displaced or the aperture so distorted that the test finger shown in Figure 1 can be inserted without force, the test with the latter finger is repeated. An electrical contact indicator is used to show contact.

It shall not be possible to touch bare live parts or live parts protected by lacquer, enamel, ordinary paper, cotton, oxide film, beads or sealing compound only, with the test finger. In addition, it shall not be possible to touch bare live parts with the test pin when testing apertures as indicated above.

For Class II appliances it shall not be possible to touch basic insulation or metal parts separated from live parts by basic insulation only, with the test finger shown in figure 1. 1

The standard test finger must be so designed that each of the jointed sections can be turned through an angle of 90° with respect to the axis of the finger in the same direction only.

It is recommended that a lamp be used for the indication of contact and that the voltage be not less than 40 V.

8.2 Shafts of operating knobs, handles, levers and the like shall not be live.

Compliance is checked by inspection.

8.3 For appliances other than those of Class III, handles, levers and knobs which are held or actuated in normal use shall not become live in the event of an insulation fault. If these handles, levers or knobs are of metal and if their shafts or fixings are likely to become live in the event of an insulation fault, they shall either be adequately covered by insulating material or their accessible parts shall be separated from their shafts or fixings by supplementary insulation.

Compliance is checked by inspection and, if necessary, by the tests specified for supplementary insulation.

For the purpose of this sub-clause, parts separated from live parts by double insulation or reinforced insulation are not regarded as likely to become live in the event of an insulation fault.

8.4 For Class II control units, capacitors shall not be connected to accessible metal parts, and their casings, if of metal, shall be separated from accessible metal parts by supplementary insulation.

Compliance is checked by inspection and by the tests specified for supplementary insulation.

8.5 Appliances intended to be connected to the supply by means of a flexible cord and a plug shall be so designed that in normal use there is no risk of electric shock from charged capacitors when touching the pins of the plug.

Compliance is checked by the following test, which is made ten times.

The appliance is operated at rated voltage.

The switch, if any, is then moved to the "off" position and the appliance is disconnected from the supply by means of the plug.

One second after disconnection, the voltage between the pins of the plug is measured with an instrument which does not appreciably affect the value to be measured.

This voltage shall not exceed 34 V.

Capacitors having a rated capacitance not exceeding 0.1 µF are not considered to entail a risk of electric shock.

9. **Void**

10. **Input**

10.1 The input of the appliance at rated voltage and at normal operating temperature shall not deviate from the rated input by more than +10% and −20%.

1 **However, for appliances incorporating PTC heating elements the negative deviation is unlimited.**

Compliance is checked by measuring the input of the appliance, operated at rated voltage and in accordance with conditions of adequate heat discharge, when the input has stabilized.

If the input varies continuously, as in the case of a high temperature coefficient heating element under thermostatic control, the input measured is the maximum input when the appliance is operating under steady cyclic conditions.

The input is the input of the flexible part and does not include transformer losses and power consumed by the control unit.

For appliances marked with a rated voltage range having limits differing by more than 10% of the mean value of the range, the permissible deviation applies for both limits of the range.

1 **10.2 The input of appliances incorporating PTC heating elements 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 conditions of adequate heat discharge. The input shall have decreased by at least 50 % from the initial value when steady conditions are established, any control which may operate during this period made inoperative.

11. **Heating**

11.1 Appliances and their surroundings shall not attain excessive temperatures in normal use.

Compliance is checked by determining the temperature or temperature rise of the various parts under the conditions specified in Sub-clauses 11.2 to 11.5.

11.2 *The appliance is operated in accordance with conditions of adequate heat discharge.*

Cord control units and cord switches are allowed to hang in still air, away from the test bed.

Other control units are placed on a supporting surface of dull black painted plywood having a thickness of 20 mm.

1 ***In addition duvets, other than those with PTC heating elements are tested folded. A single fold across the complete width of the duvet is made a quarter of the length from one end. Controls are set to the maximum position intended for all-night use.***

11.3 *Temperature rises of windings are determined by the resistance method unless the windings are non-uniform or it involves severe complications to make the necessary connections, in which case the temperature rise is determined by means of thermocouples.*

Temperature rises other than those of windings are determined by means of fine-wire thermocouples so chosen and positioned that they have the minimum effect on the temperature of the part under test.

Thermocouples having wires with a diameter not exceeding 0.3 mm are considered to be fine-wire thermocouples.

Thermocouples used for determining the temperature of a heating element are tied to the heating element by textile thread, over a length of at least 10 mm adjacent to the junction.

The temperature rise of electrical insulation, other than that of windings, is determined on the surface of the insulation, at places where failure could cause a short-circuit, contact between live parts and accessible metal parts, bridging of insulation or reduction of creepage distances or clearances below the values specified in Sub-clause 29.1.

Thermocouples used for determining the temperature of the surface of heating pads are soldered to plates of copper or brass 65 mm × 65 mm and 0.5 mm thick. The plates are positioned to cover the maximum number of heating element runs possible with one side parallel to the direction of the run. The temperatures are determined at a minimum of six places, three on each outer surface of the flexible part.

Thermocouples are positioned at those places where the highest temperatures are expected.

When determining the temperature rises of handles, knobs, grips and the like, consideration is given to all parts which are gripped in normal use and, if of insulating material, to parts in contact with hot metal.

For the flexible part, the positions where thermocouples are placed may be determined by a test, with, for example, heat sensitive paper.

The point of separation of the cores of a multicore cable or cord is an example of a place where a thermocouple is positioned.

11.4 *For inherently controlled appliances the test is made at the most unfavourable voltage between 0.94 and 1.06 times the rated voltage.*

For other appliances the test is made at a supply voltage such that the input is 1.15 times rated input.

11.5 *Temperatures are monitored continuously until steady conditions are established, and the temperatures or temperature rises shall not exceed the values specified in Sub-clause 11.6.*

Except for electronic controls without moving parts, thermal cut-outs shall not operate during the test. Sealing compound, if any, shall not flow out.

11.6 *a)* For inherently controlled appliances having a temperature sensor within the flexible part which functions during the test, the temperatures of the parts specified shall not exceed the values shown in the following table.

Part	Temperature °C
Blankets and mattresses	
Heating element	
• Before second operation of the thermal control	115
• Under steady conditions	95
Pads	
Heating element	
• Before second operation of the thermal control	120 [1]
• Under steady conditions	100
Surface	60 [2]

[1] A maximum temperature of 140 °C is allowed for a period of 10 min.

[2] A maximum temperature of 85 °C is permitted if the surface temperature does not exceed 60 °C at a lower setting of the control.

b) For other appliances the temperature rises of the parts specified shall not exceed the values shown in the following table.

Part	Temperature rise K [1]
Heating element	80
Surface of pads	45

[1] These values are based on the normal ambient temperature of the appliance and take into consideration the maximum permitted test ambient temperatures.

c) The temperature rises of other materials shall not exceed the values shown in the following table.

Part	Temperature rise K
Windings [1]	
if the winding insulation is:	
– of Class A material [2]	75 (65)
– of Class E material [2]	90 (80)
– of Class B material [2]	95 (85)
– of Class F material [2]	115
– of Class H material [2]	140
Pins of appliance inlets	40
Ambient of switches and thermostats within control units: [3]	
– without T-marking	30
– with T-marking	T-25
Rubber or polyvinyl chloride insulation of internal and external wiring, including power supply cords:	
– without T-marking	50 [4]
– with T-marking	T-25 [5]
Cord sheaths used as supplementary insulation	35 [6]

Part	Temperature rise K
Material used as electrical insulation other than that specified for wires and windings:	
– impregnated or varnished textile, paper or press board	70
– laminates bonded with:	
• melamine-formaldehyde, phenol-formaldehyde or phenol-furfural resins	85
• urea-formaldehyde resins	65
– mouldings of:	
• phenol-formaldehyde with cellulose fillers	85
• phenol-formaldehyde with mineral fillers	100
• melamine-formaldehyde	75
• urea-formaldehyde	65
– polyester with glass fibre reinforcement	110
– silicone rubber	145
– polytetrafluoroethylene	265
– pure mica and tightly sintered ceramic material, when such materials are used as supplementary insulation or as reinforced insulation	400
– thermoplastic material[1]	–
Wood[2]	65
Outer surface of capacitors:	
– with marking of maximum operating temperature (T)	T-35
– without marking of maximum operating temperature:	
• small ceramic capacitors for radio and television interference suppression	50
• other capacitors	20
External enclosure of control units and transformers, except handles, knobs, grips and the like	60
– Cord control units, cord switches, handles, knobs, grips and the like:	
– of metal	35
– of porcelain or vitreous material	45
– of moulded material, rubber or wood	60

[1] To allow for the fact that the temperature of windings of relays, solenoids, etc., is usually above the average at the points where thermocouples are placed, the figures without parentheses apply when the resistance method is used and those within parentheses apply when thermocouples are used.

[2] The classification is in accordance with HD 566

Examples of Class A material are:

– impregnated cotton, silk, artificial silk and paper;

– enamels based on oleo- or polyamide resins.

Examples of Class B material are:

– glass fibre, melamine-formaldehyde and phenol-formaldehyde resins.

Examples of Class E material are:

– mouldings with celullose fillers, cotton fabric laminates and paper laminates, bonded with melamine-formaldehyde, phenol-formaldehyde or phenol-furfural resins;

– cross-linked polyester resins, cellulose triacetate films, polyethylene terephthalate films;

– varnished polyethylene terephthalate textiles bonded with oil-modified alkyd resin varnish:

– enamels based on polyvinyl-formaldehyde, polyurethane or epoxy resin.

[3] T signifies the maximum operating temperature.

The ambient of switches and thermostats is the temperature of the air at the hottest point at a distance of 5 mm from the surface of the switch or thermostat concerned.

For the purpose of this test, switches and thermostats marked with individual ratings may be considered as having no marking for the maximum operating temperature, if requested by the appliance manufacturer.

[4] This limit applies to cables, cords and wires complying with the relevant European or IEC standards; for others it may be different.

[5] This limit will become applicable as soon as there are IEC standards for high-temperature cables, cords and wires.

2 [6] This value is not applicable where heating elements are taken out of the blanket within a flexible sleeve. In such cases the temperature rise of the accessible surface of the sleeve shall not exceed 70 K.

1 [7] For parts of thermoplastic material, other than heating elements, no specific limit is specified since it must withstand the tests of Sub-clauses 30.3 for which purpose the temperature rises are determined.

[8] The limit specified concerns the deterioration of wood and it does not take into account deterioration of surface finishes.

If these or other materials are used, they shall not be subjected to temperatures in excess of the thermal capabilities as determined by ageing tests made on the materials themselves.

The values in the table are based on an ambient temperature not normally exceeding 25 °C but occasionally reaching 35 °C. However, the temperature rise values specified are based on an ambient temperature of 25 °C.

The value of the temperature rise of a copper winding is calculated from the formula:

$$\Delta t = \frac{R_2 - R_1}{R_1} (234.5 + t_1) - (t_2 - t_1)$$

Where:

Δt is the temperature rise
R_1 is the resistance at the beginning of the test
R_2 is the resistance at the end of the test
t_1 is the room temperature at the beginning of the test
t_2 is the room temperature at the end of the test.

At the beginning of the test, the windings must be at room temperature.

It is recommended that the resistance of windings at the end of the test be determined by taking resistance measurements as soon as possible after switching off, and then at short intervals so that a curve of resistance against time can be plotted for ascertaining the resistance at the instant of switching off.

The classification of handles, knobs, grips and the like, and of parts referred to in Sub-clause 11.6 which are accessible in normal use, according to their materials is derived from the constant:

$$b = \sqrt{\lambda \cdot c \cdot \gamma}$$

Where:

λ is the thermal conductivity of the material in W/m.K
c is the specific heat of the material in J/kg.K
γ is the specific mass of the material in kg/m³

The materials are classified as follows:

- value of b greater than 3500 ... metal;
- value of b between 1000 and 3500 ... porcelain or vitreous material;
- value of b less than 1000 ... moulded material, rubber or wood.

An alternative method of determining the constant b is as follows:

- samples of materials with known values of the constant b and a sample of the material to be classified, all samples having the same dimensions, are fixed to a heated metal plate;
- the temperatures of the upper surfaces of the various samples are measured and the temperatures of the reference samples are plotted as a function of the constant b;
- the constant b of the material to be classified is derived from this curve by reading off the values b corresponding to the temperature attained by the sample under investigation.

11.7 It shall be possible to operate blankets and mattresses without the risk of heatstroke to the user.

Compliance is checked by the following test:

The appliance is operated under the conditions specified in Sub-clause 11.2 and supplied as specified in Sub-clause 11.4. The ambient temperature is maintained at the most unfavourable temperature in the range from 0° to 15 °C. Any control unit or cord switch is adjusted to the lowest setting which permits the heating element to be energized.

When steady conditions are established, but at least 1 h after switching on the appliance, the temperature of the surface of the heated area is measured. The measurements are made using the resistance method by means of a grid as shown in Figure 3. The grid is 300 mm wide and of sufficient length to cover four runs of the heating element, but not less than 300 mm. The grid is placed against the enclosure of the appliance so that the wires of the grid are perpendicular to the runs of the heating element. For over-blankets, the grid is placed under the appliance. For under-blankets and mattresses the grid is placed over the appliance.

For appliances provided with a means for automatically switching to a low heat output after a given time, the control unit is set at maximum throughout the test.

The temperature measured shall not exceed 37 °C.

12. Operation under overload conditions

12.1 Appliances shall be so designed and constructed that they withstand overloads liable to occur in normal use.

Compliance is checked by the tests of this standard.

13. Electrical insulation and leakage current at operating temperature

13.1 The electrical insulation of appliances at operating temperature shall be adequate and the leakage current in normal use shall not be excessive.

Compliance is checked by the tests of the following sub-clauses:

- *for the flexible part ..... Sub-clauses 13.2 and 13.4*
- *for control units ..... Sub-clauses 13.3 and 13.4.*

The appliance is operated in accordance with conditions of adequate heat discharge until steady conditions are established and with a supply voltage:

- *equal to 1.06 times rated voltage for inherently controlled appliances;*
- *such that the input is 1.15 times rated input for other appliances.*

The tests are made with a.c., unless the appliance is for d.c. only, in which case the test is made with d.c.

For mattresses a sheet of metal foil, approximately 0.1 mm thick and of a size sufficient to cover the area of that part of the mattress incorporating the current-carrying parts, is

inserted between the mattress and the sheet of lagging material. 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.

The sheets of metal foil are applied to the heated area with an evenly distributed pressure of 350 Pa.

The highest leakage current is normally attained immediately before a thermostat operates.

13.2 *For the flexible part the leakage current is measured between any pole of the supply and the sheets of metal foil. The circuit arrangement is shown in Figure 4. The measuring circuit has a total resistance of (1 750 ± 250)Ω and is shunted by a capacitor such that the time constant of the circuit is (225 ± 15)μs.*

The leakage current is measured with the selector switch in each of the positions 1 and 2. If the control unit switches in one pole only, these measurements are also made after the control unit has opened the circuit.

The leakage current shall not exceed:

- *for pads ..... 0.5 mA,*
- *for blankets and mattresses ..... 1 mA per square metre of the heated area with a maximum of 2.5 mA.*

Details of a suitable circuit for measuring leakage currents are given in Appendix G.

13.3 *For control units a measurement is made of the leakage current passing between either pole of the supply, and*

- *accessible metal parts and metal foil with an area not exceeding 200 mm × 100 mm in contact with accessible surfaces of insulating material, connected together,*

- *metal parts of Class II control units separated from live parts by basic insulation only.*

The circuit arrangement is shown in Figure 5. The measuring circuit has a total resistance of (1 750 ± 250)Ω and is shunted by a capacitor such that the time constant of the circuit is (225 ± 15)μs.

The leakage current is measured with the selector switches in each of the positions A1, A2, B1 and B2, for Class II control units and shall not exceed the following values:

- *to accessible metal parts and metal foil: 0.25 mA*
- *to metal parts separated from live parts by basic insulation only: 5.0 mA*

If the control unit incorporates one or more capacitors and is provided with a single-pole switch, the measurements are repeated with the switch in the "off" position.

The metal foil has the largest area possible on the surface under test, without exceeding the dimensions specified. If its area is smaller than that under test, it is moved so as to test all parts of the surface; the heat dissipation of the control unit must, however, not be affected by the metal foil.

It is recommended that the control unit be supplied through an isolating transformer; otherwise it must be insulated from earth.

The test with the switch in the "off" position is made to verify that capacitors connected behind a single-pole switch do not cause an excessive leakage current.

Details of a suitable circuit for measuring leakage currents are given in Appendix G.

13.4 *The insulation is subjected for 1 min to a voltage of substantially sine-wave form, having a frequency of 50 Hz or 60 Hz, the test circuit being as shown in Figure 6.*

The insulation to be tested and the value of the test voltage are as follows:

– *for Class II flexible parts, between live parts and the metal foil* ..... *3750 V*

– *for Class II control units:*

- *between live parts and metal parts separated from live parts by basic insulation only* ..... *1000 V*
- *between metal parts separated from live parts by basic insulation only and the body* ..... *2750 V*
- *between live parts and the body* ..... *3750 V*

Initially, not more than half the prescribed voltage is applied, then it is raised rapidly to the full value.

No flashover or breakdown shall occur during the test.

Glow discharges without drop in voltage are neglected.

The high-voltage transformer used for the test must have a rating of at least 500 VA.

If the secondary winding of the isolating transformer is not provided with a tap at the midpoint, the output winding of the high-voltage transformer can be connected to the midpoint of a potentiometer having a total resistance not exceeding 2000Ω, and connected across the output winding of the isolating transformer.

14. Radio and television interference suppression

NOTE - Attention is drawn to the fact that compliance with the requirements concerning the limits for interference effects generated by the appliance, as specified in the CISPR recommendations and when measured in accordance with the relevant CISPR specifications, will in most cases ensure that the appliance has the required degree of radio and television interference suppression.

Under particularly unfavourable conditions, national authorities may require a greater degree of suppression than that recommended by the CISPR which may necessitate the fitting of additional suppressors; it is therefore recommended that this be taken into account when designing the appliance.

15. Moisture resistance

15.1 The enclosure of appliances, other than those of Class III, shall provide the degree of protection against moisture in accordance with the classification of the appliance.

Compliance is checked as follows:

– *the flexible part of blankets and moisture-resistant pads by the test of Sub-clause 15.2;*

– *the flexible part of moisture-proof pads by the test of Sub-clause 15.2 and, in addition by the test of Sub-clause 15.3, unless the pads are subjected to the tests of Sub-clauses 21.10 to 21.16;*

– *the flexible part of mattresses by the tests of Sub-clause 15.4;*

– *control units and cord switches by the test of Sub-clause 15.5;*

After the treatment specified the appliance shall withstand the appropriate tests of Clause 16 and inspection shall show that:

– *for moisture-resistant appliances, there is no trace of water on insulation which could result in a reduction of creepage distances and clearances below the limits specified in Sub-clause 29.1;*

– *for moisture-proof pads, after the tests of Sub-clause 15.3, water has not entered the enclosure to such an extent that it comes into contact with the heating elements and other current-carrying parts.*

Where saline solution is specified for the tests the composition is 2 g of sodium chloride (NaCl) per litre of distilled water.

15.2 *Washable appliances are laundered according to the manufacturer's instructions.*

The flexible part of blankets and pads is immersed for 1 h in saline solution at a temperature of (20 ± 5) °C. All the flexible part is immersed except appliance inlets. For moisture-resistant pads the point of entry of the flexible cord is not immersed.

With the flexible part still immersed in the saline solution the appliance is subjected to the appropriate tests of Clause 16. For this test appliance connectors are engaged and the appliance coupler wrapped in metal foil.

15.3 *After the treatment of Sub-clause 15.2 followed by the tests of Clause 16 moisture-proof pads have an incision made in the outer layer of the permanent enclosure. The pad is returned to the saline solution and the solution allowed to penetrate freely into the interior of the pad.*

After a period of 1 h the test of Sub-clause 16.3 is repeated, the test voltage being 1 250 V.

15.4 *Mattresses are supported on a piece of plywood. A quantity of saline solution equivalent to 1 litre/m² of the upper surface area is poured uniformly over the mattress at the rate of one litre per minute.*

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

15.5 *Control units and cord switches are placed in a humidity cabinet containing air with a relative humidity of (93 ± 2)%. The temperature of the air at all places where samples can be located is maintained within 1 K of any convenient value t between 20 °C and 30 °C.*

Before being placed in the humidity cabinet, parts which can be removed without the aid of a tool are removed. The sample is then brought to a temperature between t and (t + 4) °C.

If necessary, the parts which have been removed are subjected to the humidity treatment with the main part.

The sample is kept in the cabinet for 48 h.

In most cases, the sample may be brought to the specified temperature by keeping it at this temperature for at least 4 h before the humidity treatment.

A relative humidity of (93 ± 2)% can be obtained by placing in the humidity cabinet a saturated solution of sodium sulphate (Na_2SO_4) or potassium nitrate (KNO_3) in water, having a sufficiently large contact surface with the air.

In order to achieve the specified conditions within the cabinet, it is necessary to ensure constant circulation of the air within and, in general, to use a cabinet which is thermally insulated.

16. Insulation resistance and electric strength

16.1 The insulation resistance and electric strength of appliances shall be adequate.

Compliance is checked:

- *for the flexible parts, other than those of Class III, by the tests of Sub-clauses 16.2 and 16.3.*

After these tests the flexible part is subjected to the treatment specified in Sub-clause 16.4;

- *for control units and cord switches, by the tests of Sub-clauses 16.5 and 16.6.*

The tests of this clause are made on the cold appliance, not connected to the supply.

The tests are carried out immediately after the treatments of Clause 15, while the appliance is still immersed, in contact with the saline solution or in the humidity cabinet, as appropriate.

For control units and cord switches the tests are carried out after reassembly of those parts which may have been removed.

Metal foil is applied as specified in Clause 13.

16.2 *A test voltage equal to 1.06 times rated voltage is applied between live parts and metal foil or between live parts and an electrode immersed in the saline solution, as applicable.*

The leakage current is measured within 5 s after the application of the test voltage and shall not exceed:

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

16.3 *The insulation between live parts and metal foil or between live parts and an electrode immersed in the saline solution, as applicable, is subjected for 1 min to a voltage of substantially sine-wave form having a frequency of 50 Hz or 60 Hz.*

The value of the test voltage is:

- *3750 V for Class II appliances.*

Initially, not more than half the prescribed voltage is applied, then it is raised rapidly to the full value.

No flashover or breakdown shall occur during the test.

16.4 *After the tests of Sub-clauses 16.2 and 16.3 the flexible part is thoroughly rinsed in fresh 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 as nearly as possible back to the original dimensions.

For mattresses, the rinsing is carried out as follows:

A quantity of fresh water, equivalent to 0.5 l for each square metre of the upper surface, 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 finally wiped with a dry cloth.

16.5 *A test voltage, d.c. for control units and cord switches for d.c. only and a.c. for other control units and cord switches, is applied as specified in Item 1 of the table of Sub-clause 16.6, the metal foil having a size not exceeding 200 mm × 100 mm and being moved, if necessary so as to test all parts of the surface. In addition, for Class II control units and cord switches the test voltage is applied between live parts and metal parts separated from live parts by basic insulation only.*

The test voltage is 1.06 times rated voltage.

The leakage current, measured within 5 s after the application of the test voltage, shall in no case exceed the following values:

- *between the parts specified in Item 1 of the table for Class II controls ..... 0.25 mA*

- *between live parts and metal parts of Class II controls separated from live parts by basic insulation only ..... 5.0 mA*

16.6 *Immediately after the test of Sub-clause 16.5 the insulation is subjected for 1 min to a voltage of substantially sine-wave form, having a frequency of 50 Hz or 60 Hz. The value of the test voltage and the points of application are shown in the following table:*

Point of application of test voltage	*Test voltage V*
	Class II controls
1. Between live parts and parts of the body that are separated from live parts by reinforced insulation	*3750*
2. Between live parts of different polarity	*1250*
3. For parts with double insulation, between metal parts separated from live parts by basic insulation only, and:	
– live parts	*1250*
– the body	*2500*
4. Between metal foil in contact with knobs, grips and the like and their shafts, if these shafts can become live in the event of an insulation fault	*2500*
5. Between the body and either the power supply cord wrapped with metal foil or a metal rod of the same diameter as the power supply cord, inserted in its place, fitted in inlet bushings of insulating material, cord guards, cord anchorages and the like	*2500*

The test between live parts of different polarity is only made where the necessary disconnections can be made without damaging the control unit or cord switch.

The test is not made between the contacts of switches of micro-gap construction, relays, thermostats, thermal cut-outs and the like, or on the insulation of capacitors connected between live parts of different polarity.

Initially, not more than half the prescribed voltage is applied, then it is raised rapidly to the full value.

No flashover or breakdown shall occur during the test.

Care is taken that the metal foil is so placed that no flashover occurs at the edges of the insulation.

For Class II controls incorporating both reinforced insulation and double insulation, care is taken that the voltage applied to the reinforced insulation does not overstress the basic insulation or the supplementary insulation.

When testing insulating coatings, the metal foil may be pressed against the insulation by means of a sandbag of such a size that the pressure is about 5 kPa. The test may be limited to places where the insulation is likely to be weak, for example where there are sharp metal edges under the insulation.

If practicable, insulating linings are tested separately.

17. Overload protection

17.1 Appliances incorporating circuits supplied from a transformer shall be so constructed that, in the event of short-circuits which are likely to occur in normal use, excessive temperatures do not occur in the transformer or in the associated circuits.

Compliance is checked by applying the most unfavourable short circuit or overload which is likely to occur in normal use, the appliance being operated at a voltage equal to 0.94 or 1.06 times rated voltage, whichever is the more unfavourable.

The temperature rise of the insulation of the conductors of safety extra-low voltage circuits is determined and shall not exceed the relevant value specified in the table of Sub-clause 11.6 by more than 15 K. The winding temperature of transformers shall not exceed the values in the following table:

Type of appliance	*Limiting temperature °C*				
	Class of insulation				
	A	*E*	*B*	*F*	*H*
– if impedance-protected	*150*	*165*	*175*	*190*	*210*
– if protected by protection devices which operate					
• during the first hour, maximum value	*200*	*215*	*225*	*240*	*260*
• after the first hour, maximum value	*175*	*190*	*200*	*215*	*235*
• after the first hour, arithmetic average	*150*	*165*	*175*	*190*	*210*

Examples of short-circuits which are likely to occur in normal use are the short-circuiting of bare or inadequately insulated conductors of safety extra-low voltage circuits which are accessible, and the internal short-circuiting of lamp filaments.

The failure of insulation complying with the requirements specified for basic insulation other than Class III construction is not, for the purpose of this requirement, considered as likely to occur in normal use.

Protection of transformer windings may be obtained by the inherent impedance of the windings, or by means of fuses, automatic switches, thermal cut-outs or similar devices incorporated in the transformer or located inside the appliance, provided these devices are only accessible with the aid of a tool.

18. Endurance

18.1 Appliances shall be so constructed that, in normal use, there will be no electrical or mechanical failure that might impair compliance with this standard. The insulation shall not be damaged and contacts and connections shall not work loose as a result of heating, vibration, etc.

Compliance is checked by the tests of this standard.

19. Abnormal operation

19.1 Appliances shall be so designed that the risk of fire or mechanical damage impairing safety or the protection against electric shock as a result of abnormal or careless use is obviated as far as is practicable.

Compliance is checked as follows:

- *blankets, other than ruck-resistant blankets, by the tests of Sub-clauses 19.2 to 19.4, 19.7 and 19.8;*
- *pads and ruck-resistant blankets by the tests of Sub-clauses 19.5 to 19.8;*
- *mattresses by the tests of Sub-clauses 19.5, 19.7 and 19.8.*

Sub-clause 19.9 applies for all appliances.

Blankets and mattresses are additionally checked by the test of Sub-clause 19.10.

Flexible parts incorporating stranded conductors are additionally checked by the tests of Sub-clauses 19.11 to 19.14.

Unless otherwise specified the appliance is supplied with a voltage resulting in the most unfavourable conditions but within the range:

- *for inherently controlled appliances 0.9 times rated voltage to 1.1 times rated voltage.*
- *for other appliances, that giving 0.85 times rated input to 1.24 times rated input.*

The tests are continued until steady conditions are established.

If, in any of the tests, a non-self-resetting thermal cut-out operates, the heating element ruptures, or if the current is otherwise interrupted before steady conditions are established, the heating period is considered to be ended, but if the interruption is due to the rupture of a heating element, or of an intentionally weak part, the relevant test is repeated on a separate sample which shall then also comply with the conditions specified in Sub-clause 19.9.

Rupture of a heating element or of an intentionally weak part in the second sample will not in itself entail a rejection.

Fuses, thermal cut-outs, over-current releases or the like, incorporated in the appliance, may be used to provide the necessary protection.

An intentionally weak part is a part designed to fail under conditions of abnormal operation so as to prevent the occurrence of a condition which is unsafe within the meaning of this standard. Such a part may be a replaceable component, such as a resistor, a capacitor or a thermal fuse, or a part of a component to be replaced.

If more than one of the tests is applicable for the same appliance these tests are made consecutively.

For tests of Sub-clauses 19.2 to 19.4, the folds in the blankets may be secured by stitching.

19.2 *Blankets, other than ruck-resistant blankets, provided with thermostats or thermal cut-outs are operated under conditions of adequate heat discharge except that the blanket is folded with a three-thickness fold, 40 mm wide and 400 mm long, as shown in Figure 7, at the most unfavourable place. The fold is perpendicular to the direction of the runs of the heating element and is fanned out at the ends. The upper sheet of lagging material having dimensions of 300 mm × 450 mm and a thickness d as specified in Appendix C is placed on the folded blanket in the most unfavourable position.*

For all under-blankets, other than ruck-resistant blankets, the test is also carried out with the blanket completely covered, as specified for conditions of adequate heat discharge.

19.3 ***Underblankets, other than ruck-resistant blankets, are operated under conditions of adequate heat discharge except that the blanket is folded with a five-thickness fold 100 mm wide at the most unfavourable place. The fold is perpendicular to the direction of the runs of the heating element and across the full width of the blanket. The lower sheet of lagging is approximately 72 mm thick. The upper sheet of lagging material, having dimensions of 300 mm x 800 mm and a thickness of approximately 180 mm in a single layer, is placed on the folded blanket at the most unfavourable place.***

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

19.4 *Over-blankets are operated under conditions of adequate heat discharge except that the blanket is folded with a five-thickness fold of any equal width up to 75 mm and a length of 400 mm. The fold is perpendicular to the direction of the runs of the heating element and is fanned out at the ends. The position and width of the folds are chosen so as to produce the most unfavourable result.*

The test is made with the blanket covered or uncovered, whichever is the more unfavourable.

The lagging material has a thickness of approximately d as specified in appendix C and dimensions of 300 mm x 450 mm. It is applied to the folded blanket in the most unfavourable position.

19.5 *Ruck-resistant blankets, pads and mattresses incorporating more than one thermostat in each circuit are operated under conditions of adequate heat discharge, except that the upper sheet of lagging material covers only one-third of the flexible part. This test is made eight*

times, the boundary of the area covered being in turn parallel to each of the sides and to the diagonals of the flexible part, as shown in Figure 8.

19.6 *Ruck-resistant blankets and pads are operated under conditions of adequate heat discharge, but with the upper sheet of lagging material removed and the flexible part folded in such a manner that will produce the most unfavourable double-thickness fold. The folds are parallel to one of the edges of the flexible part, the position of the folds and their width being chosen so as to produce the most unfavourable result.*

The upper surface of the flexible part is uncovered or partially covered by a sheet of lagging material, whichever is the more unfavourable. The length of this covering is equal to the length of that edge which is parallel to the fold and the width is equal to one-third of the length of the adjacent edge. The lagging material has a thickness of approximately d as specified in Appendix C.

It is placed in the most unfavourable position that completely covers the flexible part in the direction parallel to the folds and partially covers it in the direction across the folds.

Examples of the way in which the flexible part is folded and the covering applied are shown in Figure 9.

19.7 *Appliances with controls incorporating switching contacts which operate during the test of Clause 11 are operated under conditions of adequate heat discharge with these switching contacts short-circuited in turn.*

19.8 *If compliance with the tests of Sub-clauses 19.2 and 19.4 to 19.7 depends upon the operation of a control unit, the tests are repeated with each component in the control unit being in turn subjected to the type of fault that might reasonably be expected to occur in normal use, except that switching contacts are not short-circuited.*

For circuits incorporating electronic components, the faults which may be expected to occur are stated in Sub-clause B19.101 of Appendix B.

19.9 *During the tests specified in Sub-clauses 19.2 to 19.8 the appliance shall not emit flames or molten metal or poisonous or ignitable gas in hazardous amounts and, unless the appliance is no longer in an operating condition after the tests, the maximum temperature of heating elements shall not exceed 160 °C for inherently controlled appliances or, for other appliances, the maximum temperature rise shall not exceed 145 K.*
The temperature of PTC heating elements shall not exceed 105 °C. 1

After the tests, the appliance shall show no deterioration likely to impair its safety and, after it has cooled down to approximately room temperature, it shall withstand an electric strength test as specified in Sub-clause 13.4 under the conditions specified in Sub-clause 13.1, but without being connected to the supply.

If during the tests a fuse in the appliance ruptures due to a short circuit, the appliance is further tested as follows:

A short circuit which is likely to occur in use is applied to the conductors at the point of maximum impedance and the appliance is supplied with a voltage at the lower limit as specified in Sub-clause 19.1.

This test is carried out three times and the fuse shall rupture each time.

Discoloration of the enclosure without other deterioration is not regarded as damage likely to impair the safety of the appliance.

NOTE – A short circuit which could occur in use is one which could occur during the tests of 19.2 to 19.8 and 19.10.

19.10 Blankets and mattresses shall be so constructed that failure of a component does not give rise to a temperature which could be hazardous to the human body.

Compliance is checked by repeating the test specified in Sub-clause 11.7 and causing each component in turn to fail in a manner that might reasonably be expected to occur in normal use. Switching contacts are, however, not short-circuited and only one fault condition is introduced at a time. The voltage applied is as specified in Sub-clause 11.4.

During the test the temperature of the surface of the heated area shall not exceed 60 °C.

The test is not made if it is obvious from inspection of the circuitry that the requirement will be met.

The temperature is not measured during the first hour of operation.

NOTE - Heating elements and internal wiring are not regarded as components.

19.11 Appliances incorporating heating elements or internal wiring consisting of stranded conductors shall not attain excessive temperatures in normal use if a heating element or internal conductor has one or more of its strands broken.

Compliance is checked by the tests of Sub-clauses 19.12 to 19.14 as appropriate.

Any unsheathed core of flexible cord within the flexible part extending beyond 100 mm from the cord anchorage is considered to be internal wiring.

19.12 *If internal wiring or heating elements do not have integral insulation and have individual strands which are not electrically insulated from each other, the enclosure of the flexible part is opened to expose a short length of the internal wiring or heating element at the most unfavourable place. All but one of the strands are cut and folded back to leave a gap of approximately 15 mm. The enclosure is then closed and the appliance operated in accordance with conditions of adequate heat discharge for 4 h.*

If the current passing through the single strand causes it to fuse before any damage occurs, the test is repeated with the number of strands left in circuit increased to the minimum necessary to prevent fusing.

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

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

If the current passing through the single strand causes it to fuse before any damage occurs, the test is repeated with the number of strands wrapped around the insulation of the internal wiring or heating element increased to the minimum necessary to prevent fusing.

After the test, there shall be no damage to the insulation of the internal wiring, heating element or to other material of the flexible part.

Slight indentation of the insulation of the conductor or heating element is neglected.

19.14 *If internal wiring or heating elements have individual strands which are electrically insulated from each other, the wiring or heating element is disconnected from its terminations and the ends of the conductors separated. A d.c. voltage of approximately 500 V is applied for 1 min and the insulation resistance between any two strands is measured.*

The insulation resistance shall exceed:

- *0.1 MΩ for Class III appliances;*
- *1 MΩ for other appliances.*

20. Stability

20.1 Control units intended to be placed on a surface such as a table shall have adequate stability.

Compliance is checked by the following test.

Control units provided with an appliance inlet are fitted with an appropriate connector and flexible cord.

The control unit is placed in any normal position of use on a plane inclined at an angle of 10° to the horizontal, the cord resting on the inclined plane in the most unfavourable position.

The control unit shall not overturn.

21. Mechanical strength

21.1 Appliances shall have adequate mechanical strength and be so constructed as to withstand such rough handling that may be expected in normal use.

Compliance for the flexible part is checked as follows:

- *for blankets, by the tests of Sub-clauses 21.2, 21.5 and 21.6 and for blankets* **having a bonded enclosure** *additionally by the test of Sub-clause 21.9;*
- *for mattresses, by the tests of Sub-clauses 21.4, 21.5, 21.6 and if applicable 21.9;*
- *for pads, by the tests of Sub-clauses 21.3, 21.5, 21.6, 21.7 and if applicable 21.9.*

For control units and cord switches, compliance is checked by the test of Sub-clause 21.17 and additionally for control units, by the test of Sub-clause 21.18.

After these tests the flexible part shall comply with the requirements of Sub-clause 21.8.

Moisture-proof pads not subjected to the test of Sub-clause 15.3 additionally have to comply with Sub-clauses 21.10 to 21.16.

Heating elements and internal wiring in the flexible part have to comply with Sub-clauses 21.19 to 21.22.

21.2 *Blankets are securely attached to the apparatus described in Appendix D.*

The blanket is pulled by the driving bar, the driving sprocket operating at a speed of 33 revolutions per min.

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

The test is carried out with the same face of the blanket adjacent to the drum.

1 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.**

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

21.3 *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 force of 0.03 N per millimetre of attached end or 4.45 N, whichever is the greater, is applied by means of a mass suspended from 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.

The test is carried out with the same face of the pad adjacent to the roller.

A cycle is two movements, one in each direction.

The apparatus is adjustable so that pads of various dimensions can be tested.

21.4 *Mattresses are laid flat on a horizontal plywood support. A roller of similar construction to the drum specified in Appendix D and 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. 1 000 cycles are made in the direction of the major axis over the same path, in the most unfavourable place.*

A cycle is two movements, one in each direction.

21.5 *Appliances are operated for 500 hours continuously under the conditions specified in Clause 11. The surface temperature of the flexible part of inherently controlled appliances is measured under steady conditions at the beginning and at the end of this period. The temperature shall not increase by more than 5 K.*

For appliances where the operation of the safety control could be adversely affected by ageing of the temperature sensing system the duration of the test is increased to 1 000 hours.

1 ***For appliances with PTC heating elements, the test is carried out for 1 000 h but with the flexible part fully covered with a sheet of lagging material*** ***having a thickness of approximately 180 mm.*** 3

After 100 h and at the end of the test, the temperature of the PTC heating element is measured under the conditions specified in clause 11. It shall not have increased by more than 5 K.

21.6 *After the test of Sub-clause 21.5 the flexible part is subjected to the following test:*

- *for blankets the test of Sub-clause 21.2 is repeated but with the other face of the flexible part adjacent to the drum;*
- *for pads the test of Sub-clause 21.3 is repeated but with the other face of the flexible part adjacent to the roller;*
- *for mattresses the test of Sub-clause 21.4 is repeated but with the roller moved in the direction of the minor axis. In this case 2000 cycles are made, 1000 in each of two non-overlapping paths.*

21.7 *Pads are subjected to a test in a tumbling barrel as shown in Figure 10, their power supply cords having been cut off at a distance of 100 mm from the flexible part. The barrel is turned at a rate of six to seven revolutions per min, so that the sample falls onto a steel plate twice in each revolution, the number of revolutions being 500.*

21.8 *After the tests the samples shall show:*

- *no damage to the enclosure or displacement of heating elements to such an extent that the safety of the appliance is impaired;*
- *no breakage of the conductors of the heating element and of not more than 10% of strands of internal wiring;*
- *no failure of constructional stitching or breakage of glued or welded joints to such an extent that the safety of the appliance is impaired;*
- *no loosening of a non-detachable flexible cord from the flexible part;*
- *no loosening or breakage of electrical connections;*
- *no open-circuiting in controls incorporated in the flexible part.*

An example of damage to the enclosure which would impair the safety of the appliance is cracking or tearing of the covering, but small holes in textile material not forming electrical insulation or providing protection against moisture are ignored.

Safety is also considered to be impaired if, for example, heating elements have moved in their pockets sufficiently for two parts of the element to come into contact with each other.

21.9 *For appliances* **having a bonded enclosure** *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 sides measuring 100 mm, a strip of the enclosure material having a width of 25 mm is removed 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.

A clamp is attached along the full length of each single layer.

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 an ambient temperature of 20 °C, and then for 1 h at an ambient temperature of 80 °C.*

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

During this test, the layers shall not separate.

21.10 The enclosure of moisture-proof pads consisting of unsupported flexible plastic sheeting shall have adequate flexibility under cold conditions.

Compliance is checked by the following test:

The sheeting, at ambient temperature, is cut into ten rectangular samples, each 145 mm long and 50 mm wide with the longer dimension perpendicular to the striations, if any, resulting from the original forming process.

Each sample is folded about its minor axis and allowed to form a loop without creases. It is stapled to a card twice, with the staples close together, 30 mm from and parallel to the 50 mm edges, as shown in Figure 11.

The test apparatus, which is also shown in Figure 11, has a rolled-steel rectangular-section arm, which 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 ± 0.03) kg and the arm and anvil are 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 compartment the temperature of which is maintained at (−20 ± 1) °C.

When steady conditions are established, all ten samples are placed on the floor of the cold compartment with their loops uppermost. The samples are allowed to cool for 1 h, after which, without removal from the cold compartment, one of the samples is placed with the loop uppermost on the anvil of the test apparatus, with the staples in the slot as shown in Figure 11. Care is taken to ensure that the plastic material is not handled and does not touch anything else during this procedure.

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

If it breaks into separate pieces it is considered to have failed the test.

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

No more than two samples shall fail the test.

21.11 The enclosure of moisture-proof pads shall have adequate resistance to tearing under normal conditions of use.

For enclosures of unsupported flexible plastic sheeting, compliance is checked by the test of Sub-clause 21.12.

For enclosures made of rubberized and similarly treated fabrics, compliance is checked by the tests of Sub-clauses 21.13 to 21.16.

21.12 *Five samples of unsupported flexible plastic sheeting, as shown in Figure 12 are conditioned at an ambient temperature of (23 ± 2) °C. The longer dimension is perpendicular to the striations, if any, resulting from the original forming process.*

The shorter edges of each sample are secured over their full length in 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 per minute until the sample tears. The maximum breaking load, in newtons, is measured.

The average of the breaking load of the five samples shall be not less than 12.5 N.

21.13 *A sample of the treated fabric having a diameter of approximately 76 mm is held betwen two clamps, each having a diameter of not less than 76 mm and a concentric aperture having a diameter of approximately (26 ± 0.7) mm. The assembly of clamps and sample is so mounted that water pressure can be applied to the fabric side of the material.*

The water pressure applied, measured by means of a Bourdon-tube gauge, is gradually increased until leakage occurs through the treated fabric.

This test is made on three samples.

The average of the three values found for the pressure at which leakage occurs shall be at least 490 kPa, and no sample shall show leakage at a pressure less than 410 kPa.

21.14 *Three sets of three samples, as specified in Sub-clause 21.13, are conditioned as follows:*

For the first set, the three samples are immersed in boiling water for 1 h and then aged in a heating cabinet at a temperature of (100 ± 1) °C for 1 000 h. After this treatment the specimens are immersed again for 1 h in boiling water.

For the second set, the three samples are aged in an oxygen bomb for 168 h, the oxygen having a pressure of approximately 2.0 MPa and a temperature of (80 ± 1) °C.

For the third set, the three samples are aged in an air bomb for 20 h, the air having a pressure of approximately 0.55 MPa and a temperature of (127 ± 1) °C.

After conditioning, the test of Sub-clause 21.13 is carried out on each sample. The average of the three values for the pressure at which leakage occurs shall, for each set of three samples, be at least 70% of the value obtained during the test of Sub-clause 21.13.

NOTE - The use of the oxygen bomb presents some danger unless handled with care. Precautions should be taken to avoid the risk of explosion due to sudden oxidization.

21.15 *A set of three samples, as specified in Sub-clause 21.13, is conditioned as specified in Sub-clause 21.14 for the first set, and each sample is then folded backwards and forwards 10 times.*

This test is also carried out on three further samples as specified in Sub-clause 21.13.

After the test, the samples shall show no crack, hard spot or other evidence of deterioration.

21.16 *For seamed fabric, twenty rectangular samples, each 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 Sub-clause 21.14.*

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

The average of the forces necessary to separate the seams for each of the four sets shall be not less than 875 N per metre length of the seam.

21.17 *Blows are applied to control units and cord switches by means of the spring-operated impact-test apparatus shown in Figure 13.*

The apparatus consists of three main parts: the body, the striking element and the spring-loaded release cone.

The body comprises the housing, the striking element guide, the release mechanism and all parts rigidly fixed thereto. The mass of this assembly is 1 250 g.

The striking element comprises the hammer head, the hammer shaft and the cocking knob. The mass of this assembly is 250 g.

The hammer head has a hemispherical face of polyamide having a Rockwell hardness of R 100, with a radius of 10 mm; it is fixed to the hammer shaft in such a way that the distance from its tip to the plane of the front of the cone when the striking element is on the point of release is 20 mm.

The cone has a mass of 60 g and the cone spring is such that it exerts a force of 20 N when the release jaws are on the point of releasing the striking element.

The hammer spring is adjusted so that the product of the compression, in millimetres and the force exerted, in newtons equals 1 000, the compression being approximately 20 mm. With this adjustment, the impact energy is (0.5 ± 0.05) Nm.

The release mechanism springs are adjusted so that they exert just sufficient pressure to keep the release jaws in the engaged position.

The apparatus is cocked by pulling the cocking knob until the release jaws engage with the groove in the hammer shaft.

The blows are applied by pushing the release cone against the sample in a direction perpendicular to the surface at the point to be tested.

The pressure is slowly increased so that the cone moves back until it is in contact with the release bars, which then move to operate the release mechanism and allow the hammer to strike.

The sample as a whole is rigidly supported against a plane surface and three blows are applied to every point of the enclosure that is likely to be weak.

If necessary, the blows are also applied to handles, levers, knobs and the like and to signal lamps and their covers, but only if the lamps or covers protrude from the enclosure by more than 10 mm or if their surface area exceeds 4 cm^2. Lamps within the control unit or cord switches, and their covers, are only tested if they are likely to be damaged in normal use.

After the test, the sample shall show no damage within the meaning of this standard. In particular, live parts shall not have become exposed so as to impair compliance with Sub-clause 8.1, and there shall not have been such distortion as to impair compliance with Sub-clause 29.1.

In case of doubt, supplementary insulation or reinforced insulation is subjected to an electric strength test as specified in Sub-clause 16.6.

To ensure that the sample is rigidly supported, it may be necessary to place it against a solid wall of brick, concrete or the like, covered by a sheet of polyamide which is tightly fixed to the wall, care being taken that there is no appreciable air gap between the sheet and the wall. The sheet must have a Rockwell hardness of R 100, a thickness of at least 8 mm and a surface area such that no part of the sample is mechanically overstressed due to insufficient supporting area.

Damage to the finish, small dents which do not reduce creepage distances and clearances below the values specified in Sub-clause 29.1 and small chips which do not adversely affect the protection against electric shock or moisture are neglected.

Cracks not visible to the naked eye and surface cracks in fibre-reinforced mouldings and the like are ignored.

If a decorative cover is backed by an inner cover, fracture of the decorative cover is neglected if the inner cover withstands the test after removal of the decorative cover.

If there is a doubt as to whether a defect has been promoted by the application of preceding blows, this defect is neglected and the group of three blows which led to the defect is applied to the same place on a new sample, which must then withstand the test.

For the calibration of the spring-operated impact test apparatus see HD 495.

21.18 *The control unit is dropped on its base 100 times from a height of 40 mm onto a rigidly mounted steel plate, at least 15 mm thick and having a mass of at least 15 kg.*

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 connecting cable or cord, so that the control unit has a free fall.

After the test, the control unit shall show no damage within the meaning of this standard. If the control unit still operates, the appliance shall withstand the tests of Clause 11.

This test is not carried out on cord control units.

21.19 If heating elements and internal wiring in the flexible part are insulated with plastic material, this insulation shall retain adequate flexibility and insulating characteristics throughout the life of the appliance.

Compliance is checked by the tests of Sub-clause 21.20 and, where the plastic insulation exceeds:

- *a temperature of 75 °C for inherently 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 inherently controlled appliances or a temperature rise of 110 K for other appliances during the test of Clause 19,*

by the tests of Sub-clauses 21.21 and 21.22.

The tests are made on new samples of heating element or internal wiring. For appliances of glued construction the samples are taken from a new appliance.

For the test of Sub-clause 21.20 one sample is required having a length of 3 m. For the tests of Sub-clause 21.21 at least twelve samples are required, each having a length of 300 mm. For the test of Sub-clause 21.22, twelve samples are required each having a length of 300 mm.

21.20 *The sample of heating element or internal wiring is attached to the apparatus shown in Figure 14. This apparatus has a carrier C with two pulleys A and B, each having a groove with a radius of 4 mm, the diameter at the base of the groove being 25 mm. 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 element or wires leaving the pulleys are parallel to each other.

The restraining clamps D are so positioned that the pull is always applied by the mass in the opposite direction from which the carrier is moving.

The carrier moves 25 000 cycles over a distance of 1 m, with a constant speed of approximately 0.33 m/s.

The sample is supplied with a current not exceeding 50 mA.

During the test, the current shall not be interrupted.

For PTC heating elements, the 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 input has stabilised. The input shall not have increased.

After the test the sample is immersed in saline solution, as specified in Sub-clause 15.1, which is at room temperature. The insulation resistance is measured with a d.c. voltage of approximately 500 V applied between the conductor and saline solution, the measurement being made 1 min after immersion.

The insulation resistance shall be not less than 1 MΩ.

For samples not having a circular cross-section, the form of the groove in the pulley is suitably modified.

A cycle is two movements, one in each direction.

21.21 *The conductors are withdrawn from twelve samples of heating element or internal wiring by pulling, or, if this is not possible, by carefully slitting the insulation longitudinally, removing the conductor and allowing the insulation to close naturally.*

The length of each sample of insulation is measured.

Six of the samples are conditioned by suspending them so that they hang freely in a heating cabinet maintained at a temperature of (125 ± 1) °C for 336 h, after which they are removed from the cabinet and allowed to cool to approximately room temperature.

Not less than 16 h and not more than 96 h after removal from the cabinet, the length of the six samples is measured and in no case shall this length be less than 90% of the original length.

A length of 50 mm is then marked by two lines, centrally on each of the twelve samples, without damaging the material and the samples are placed in a tensile machine as follows.

Each end of the sample is secured to the brass bar of a stirrup as shown in Figure 15. The samples and the stirrups are placed in a tensile machine, with the marked part of the sample located centrally.

The stirrups are separated at a uniform speed of (500 ± 50) mm/min. The force exerted on the sample and the distance between the marked lines are measured at the instant of rupture.

The elongation and the tensile strength of the twelve samples are determined.

Results obtained from any sample which ruptured at a force differing from the average value by more than 10% and from samples which rupture within a distance of 15 mm from the clamp are disregarded.

The elongation of each of the unconditioned samples shall not be less than 100% and the tensile strength shall not be less than 8.75 MPa.

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

Sufficient samples are tested in order to obtain 12 valid results.

The elongation is calculated from the formula:

$$E = 2(S-50)$$

where:

E is the percentage of elongation at rupture;
S is the distance between the centres of the marked lines at rupture, in millimetres.

The tensile strength is calculated from the formula:

$$T = \frac{F}{0.7854(D^2-d^2)}$$

where:

T is the tensile strength, in MPa;
F is the mean force at rupture, in newtons;
D is the initial external diameter of the insulation, in millimetres;
d is the initial internal diameter of the insulation, in millimetres.

21.22 *The insulation is removed from a 10 mm length at 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.

The samples on the mandrel are then placed in a heating cabinet together with the remaining six samples, which are suspended so that they hang freely. The heating cabinet is maintained at a temperature of (125 ± 1) °C for 336 h after which the samples are removed from the cabinet and allowed to cool to approximately room temperature.

Not less than 16 h and not more than 96 h after removal from the cabinet, the six free samples are also wound on a mandrel in the same way.

The 12 samples, on the mandrel, are then immersed for 1 h in a saline solution at room temperature, as specified in Sub-clause 15.1.

After this period, the samples shall withstand an electric strength test, during which a voltage of 1 000 V and a frequency of 50 Hz or 60 Hz is applied for 1 min between the conductors and the solution.

The samples are then unwound from the mandrel and shall show no cracks visible to the naked eye.

21.23 PTC heating elements 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 x 300 mm and a mass of 80 kg is applied for 5 min to the surface in the most unfavourable place. After removing the mass, the appliance is again operated until steady conditions are established and the temperature of the heating element measured. The temperature of the heating element where the mass is applied shall not have increased by more than 10 K.

NOTES

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

2 The most unfavourable place to apply the mass is usually at a loop in the element where the conductors are turned through 90°.

22. Construction

22.1 The appliances shall be of Class II or Class III.

Compliance is checked by inspection and by the relevant tests.

22.2 The flexible part of appliances, other than those of Class III, shall have a degree of protection against moisture as follows:

- Blankets and mattresses shall be moisture-resistant;
- Pads shall be moisture-resistant or moisture-proof.

Compliance is checked by inspection and by the relevant tests.

22.3 It shall not be possible for the user to alter the temperature setting of the flexible part other than by adjusting the control unit or cord switch.

Compliance is checked by inspection.

22.4 Appliances, other than those of Class III, having parts where reliance is placed upon safety extra-low voltage to provide the necessary degree of protection against electric shock, shall be so constructed that the insulation between parts operating at safety extra-low voltage and other live parts complies with the requirements for double insulation or reinforced insulation.

Compliance is checked by the tests specified for double insulation and reinforced insulation.

22.5 Reinforced insulation between live parts and accessible metal parts shall only be used when it is manifestly impracticable to provide separate basic insulation and supplementary insulation.

Compliance is checked by inspection.

22.6 Class II appliances shall be so constructed that creepage distances and clearances over supplementary insulation or reinforced insulation cannot, as a result of wear, be reduced below the values specified in Sub-clause 29.1 They shall be so constructed that, should any wire, screw, nut, washer, spring or similar part become loose or fall out of position, it cannot, in normal use, become so disposed that creepage distances or clearances over supplementary insulation or reinforced insulation are reduced to less than 50% of the value specified in Sub-clause 29.1.

Compliance is checked by inspection, by measurement and by manual test.

For the purpose of this requirement:

- it is not to be expected that two independent fixings will become loose at the same time;
- parts fixed by means of screws or nuts provided with locking washers are regarded as not liable to become loose, provided these screws or nuts are not required to be removed during the replacement of the power supply cord or other routine servicing;
- wires connected by soldering are not considered to be adequately fixed, unless they are held in place near to the termination, independently of the solder;
- wires connected to terminals are not considered to be adequately secured, unless an additional fixing is provided near to the terminal, so that, in the case of stranded conductors, this fixing clamps both the insulation and the conductor;
- short rigid wires are not regarded as liable to come away from a terminal, if they remain in position when the terminal or nut is loosened.

22.7 Wood, cotton, silk, ordinary paper and similar fibrous or hygroscopic material shall not be used as insulation, unless impregnated.

Compliance is checked by inspection.

Insulating material is considered to be impregnated if the interstices between the fibres of the material are substantially filled with a suitable insulant.

22.8 Ceramic material not tightly sintered and similar materials, and beads alone, shall not be used as supplementary insulation or reinforced insulation.

Natural rubber shall not be used as electrical insulation in the flexible part of the appliance.

Parts of natural or synthetic rubber used as supplementary insulation in Class II control units shall be resistant to ageing or be so arranged and dimensioned that creepage distances are not reduced below the values specified in Sub-clause 29.1, even if cracks occur.

Compliance is checked by inspection, if necessary by an identification test such as a burning test, by measurement and, for rubber used in control units, by the following test.

Parts of rubber are aged in an atmosphere of oxygen under pressure. The samples are suspended freely in an oxygen bomb. the effective capacity of the bomb being at least ten

times the volume of the samples. The bomb is filled with commercial oxygen not less than 97% pure, to a pressure of (2.1 ± 0.07) MPa.

The samples are kept in the bomb at a temperature of (70 ± 1) °C, for 96 h. Immediately afterwards they are taken out of the bomb and left at room temperature, avoiding direct daylight, for at least 16 h.

After the test, the samples are examined and shall show no crack visible to the naked eye.

In case of doubt with regard to materials other than rubber, special tests may be made.

The use of the oxygen bomb presents some danger, unless handled with care. All precautions should be taken to avoid the risk of explosion due to sudden oxidation.

Compliance is checked by inspection and, if necessary, by a burning test.

22.10 Current-carrying parts and other metal parts, the corrosion of which might result in a hazard, shall be resistant to corrosion under normal conditions of use.

Compliance is checked by verifying that, after the tests of Clause 19, the relevant parts show no sign of corrosion.

Attention must be paid to the compatibility of the materials of terminals and terminations and to the effect of heating. Stainless steel and similar corrosion-resistant alloys and plated steel are considered to be satisfactory for the purpose of this requirement.

22.11 Heating elements and internal wiring in the flexible part, other than those of Class III, shall be provided with an extruded insulation.

Compliance is checked by inspection.

22.12 Heating elements in the flexible part shall be continuous, except where they are connected to thermostats, thermal cut-outs and the like.

Compliance is checked by inspection.

This requirement precludes the use of random connections in heating elements.

22.13 The flexible part shall be so constructed that heating elements and internal wiring are retained in their intended position.

If the heating element is supported by a separate layer of material, this material shall be firmly secured to the enclosure so as to prevent internal rucking.

Crossing of internal conductors shall be avoided as far as possible; where such crossing is unavoidable the conductors shall be secured in order to prevent any movement relative to each other. Precautions shall be taken to ensure that the insulation between the conductors cannot be damaged in normal use.

Compliance is checked by inspection.

This requirement does not apply to signal conductors dissipating less than 150 mW per metre length.

22.14 The breaking of stitching retaining heating elements in position shall not result in any significant change in the position of heating elements.

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

22.15 Thermostats and thermal cut-outs incorporated in the flexible part shall be individually enclosed in insulating material.

Compliance is checked by inspection.

22.16 Ruck-resistant blankets shall be so constructed that rucking of the flexible part is unlikely.

Compliance is checked by the following test:

Any stiffening means, the construction of which is not representative of the rest of the blanket, is removed.

The blanket is operated at rated input and in accordance with conditions of adequate heat discharge for 3 h, after which it is removed from the sheets of lagging material and while still connected to the supply, laid flat on a horizontal surface. It is positioned so that a diagonal of the flexible part is perpendicular to the edge of the surface.

A wooden board measuring 1 m × 1 m, 20 mm thick, is placed over the blanket and positioned so that the edge of the board aligns with the edge of the surface.

The flexible part and board are then slid together until the edge of the board overhangs the edge of the surface by 300 mm.

The deflection x, in metres, of the overhanging corner of the flexible part is measured as shown in Figure 16.

The force F, in newtons, required to lift the overhanging corner to the lower surface of the board is then measured.

The measurement is repeated on the other corners, with the exception of any corner containing the appliance inlet or cord entry.

The ruck-resistance g is calculated according to the formula $g = F/x$ and shall be not less than 2.5 for each of the corners measured.

22.17 Under blankets, other than blankets having a factor g greater than 1.2 measured as specified in 22.16, shall be provided with means to prevent rucking. The means used for this purpose shall be permanently attached, ensure that the blanket cannot ruck in any direction, and not cause damage to the blanket in normal use. If tapes or similar means are provided for this purpose, they shall be so positioned and of such a length that the blanket can be readily and effectively secured to the maximum size of mattress for which it is intended. Pins shall not be used.

Compliance is checked by inspection.

22.18 Detachable covers shall be of such a size that the flexible part lies flat after the cover has been fitted.

Compliance is checked by inspection and by manual test, after laundering the cover three times in accordance with the manufacturer's instructions.

22.19 Control units intended to stand on a surface shall be so constructed as to prevent the penetration of objects from the table if this might result in a hazard.

Compliance is checked by inspection.

Control units are considered to comply with this requirement if all live parts are at least 6 mm from the supporting surface, measured through any opening.

22.20 Knobs and the like that are used to indicate the position of switches or similar components shall be fixed in a reliable manner so that they will not work loose in normal use. It shall not be possible to remove them without the aid of a tool, if replacement in a wrong position might result in a hazard.

Compliance is checked by inspection, and by trying to remove the knob and the like by applying an axial force for 1 min.

If the shape of these parts is such that an axial pull is likely to be applied in normal use, the force is 30 N; otherwise it is 15 N.

22.21 Components of control units which may require replacement, such as switches and capacitors, shall be suitably fixed.

Compliance is checked by inspection and, if necessary, by manual test.

Fixing by soldering is only allowed for small resistors, capacitors, inductors and the like, if these components can be suitably fixed by their connecting means. Fixing by means of rivets is allowed.

22.22 Control units for blankets and mattresses that automatically switch from a high to a low heat-output after a given time shall not automatically reset to give the high heat-output.

Compliance is checked during the test of Sub-clause 11.7.

3 Control units for blankets and mattresses that automatically switch from a high to a low heat-output after a given time shall not automatically reset to give the high heat-output.

22.23 Appliances shall be provided with an automatic means for protecting against the effect of localized overheating due to arcing of conductors within the flexible part unless the flexible part is resistant to ignition.

1 *Compliance is checked by the following test or by the test of 30.1.*

1

1 *b)*

a suitable length of the conductor is exposed and the 1

insulation of the conductor is removed over a length of 25 mm. This part of the heating conductor is bent in a radius of 75 mm and immersed in an electrically non-conductive liquid maintained at a temperature of (230 ± 2) °C. Within 30 s the input of the flexible part shall not exceed 1 W.

The conductor is withdrawn from the liquid immediately the supply is interrupted and if, during the cooling period, the input of the flexible part automatically increases above 1 W the test is repeated 100 times or until the input is permanently reduced below 1 W, whichever is the earlier.

22.24 Inside the control unit, the sheath of a flexible cord shall only be used as supplementary insulation where it is not subject to undue mechanical or thermal stresses and if its insulating properties are not less than those specified in HD 21 for sheaths of flexible cords.

Compliance is checked by inspection.

22.25 Parts of Class II control units which serve as supplementary or reinforced insulation and which might be omitted during reassembly after routine servicing, shall either:

- be fixed in such a way that they cannot be removed without being seriously damaged, or
- be so constructed that they cannot be replaced in an incorrect position and that, if they are omitted the control unit is rendered inoperable or manifestly incomplete.

Sleeving may, however, be used as supplementary insulation on internal wiring if the sleeve is retained in position by positive means.

Compliance is checked by inspection and by manual test.

Routine servicing includes replacement of power supply cords, switches and the like.

Lining metal enclosures with a coating of lacquer or with other material in the form of a coating which can be easily removed by scraping is not considered to meet this requirement.

A sleeve is considered to be fixed by positive means if it can only be removed by breaking or cutting or if it is clamped at both ends.

22.26 Any fuse which ruptures when a short circuit is applied shall not be replaceable by the user. It shall only be replaceable by the use of special purpose tools normally available only to the manufacturer or his agents.

Compliance is checked by inspection.

22.27 Asbestos shall not be used.

Compliance is checked by inspection.

22.28 Duvets shall have adequate thermal properties.

Compliance is checked by the following test:

The duvet is placed on a sheet of lagging material having a thickness 2 d, as specified in appendix C. A heat source as specified in appendix C, is placed between the lagging material and the duvet. The heat source is connected to the supply and when steady conditions are established the temperature rise shall exceed 40 K.

23. Internal wiring

23.1 Wireways shall be smooth and free from sharp edges.

Wires shall be protected so that they do not come into contact with burrs and the like which may cause damage to their insulation.

Holes in metal through which insulated wires pass shall have smooth well-rounded surfaces or be provided with bushings.

Compliance is checked by inspection.

23.2 Internal wiring and electrical connections between different parts of the appliance shall be adequately protected or enclosed.

Compliance is checked by inspection.

23.3 Beads and similar ceramic insulators on live wires shall be so fixed or supported that they cannot change their position; they shall not rest on sharp edges or sharp corners.

Compliance is checked by inspection and by manual test.

23.4 Conductors identified by the colour combination green/yellow shall not be used.

Compliance is checked by inspection.

23.5 Aluminium wires shall not be used for internal wiring.

Compliance is checked by inspection.

23.6 Stranded conductors shall not be consolidated by lead-tin soldering where they are subject to contact pressure, unless the clamping means is constructed so that there is no risk of bad contact due to cold flow of the solder.

1

Compliance is checked by inspection.

NOTES

1 Consolidation of stranded conductors by lead-tin soldering is allowed if spring terminals are used; securing the clamping screws alone is not considered adequate.

2 Soldering of the tip of a stranded conductor is allowed.

24. Components

24.1

If components are marked with their operating characteristics, the conditions under which they are used in the appliance shall be in accordance with these markings, unless otherwise specified. ***Switches are tested for 6 000 cycles of operation.***

3

Safety isolating transformers shall comply with EN 60742.

E 10 lampholders shall be so constructed that they will accept a lamp with E 10 cap complying with the current edition of Standard Sheet 7004-22 of HD 65.1 .

Small lampholders similar to E 10 lampholders shall comply with requirements for E 10 lampholders given in EN 60238; they need not accept a lamp with E 10 cap complying with the current edition of Standard Sheet 7004-22 of HD 65.1.

The testing of components which have to comply with other standards is, in general, carried out separately, according to the relevant standard as follows.

If the component is marked and is used in accordance with its marking, it is tested in accordance with its marking, the number of samples being that required by the relevant standard.

Where no standard exists for the relevant component or where the component is not marked, or is used not in accordance with its marking, the component is tested under the conditions occurring in the appliance, the number of samples being, in general, that required by a similar specification.

Switches not marked with individual ratings are tested under the conditions occurring in the appliance as follows:

The currents and their corresponding power factors during switching on and during operation in accordance with conditions of adequate heat discharge are measured.

The switch may then be tested separately, according to IEC Publication 328, the switching-on current and the corresponding power factor as measured above being used for the breaking capacity test specified in Clause 15 of that publication, and the current and power factor measured under conditions of adequate heat discharge being used for the normal operation test specified in Clause 16 of that publication.

Until a European standard for thermostats, thermal cut-outs and the like is issued, this standard, as far as is reasonable, together with Appendix A, is applicable to these controls.

Components incorporated in the appliance are subjected to all the tests of this standard as part of the appliance.

Compliance with the standard for the relevant component does not necessarily ensure compliance with the requirements of this standard.

An exception with regard to the maximum operating temperature of switches and thermostats is made in Note 3 of the table of Sub-clause 11.6 *c)*.

Automatic controls are tested according to this standard and additionally according to subclauses 11.3.5 to 11.3.8 and clause 17 of IEC 730, the number of operations being:

- thermostats and energy regulators	*100 000 cycles*
- temperature limiters	*1 000 cycles*
- self-resetting cut-outs	*10 000 cycles*
- non self-resetting cut-outs	*30 cycles*
- relays operating only once each time the appliance is used	*1 000 cycles*
- relays operating more than once each time the appliance is used	*100 000 cycles*

The tests according to IEC 730 are carried out under the conditions occurring in the appliance.

NOTES

1 Controls may be tested separately from the appliance.

2 Automatic controls which comply with the requirements of IEC 730 and which are used in accordance with their marking, are considered to meet the requirements of this standard (the term "marking" includes documentation and declaration as specified in clause 7 of IEC 730).

3 The tests of clause 17 of IEC 730 are not carried out on automatic controls which operate during clause 11, if the appliance meets the requirements of this standard when they are short-circuited.

4 The number of operations do not apply to electronic controls.

24.2 Appliances shall not be fitted with:

- devices which, in the event of a fault in the appliance, cause the interruption of the supply by rupturing a fuse which is external to the appliance;
- thermal cut-outs which can be reset by a soldering operation.

Compliance is checked by inspection.

24.3 Plugs and socket -outlets for extra-low voltage circuits shall not be interchangeable with plugs and socket-outlets complying with IEC Publication 83, or with connectors and appliance inlets complying with the standard sheets of EN 60320-1.

Compliance is checked by inspection and by manual test.

24.4 Plugs and socket-outlets, and other connecting devices on flexible cords, used for an intermediate connection between different parts of an appliance, shall not be interchangeable with plugs and socket-outlets complying with IEC Publication 83, or with connectors and appliance inlets complying with the standard sheets of EN 60320-1, if direct supply of these parts from the mains could cause danger to persons or surroundings, or damage to the appliance.

Compliance is checked by inspection and by manual test.

24.5 Lampholders shall be used only for the connection of lamps.

Compliance is checked by inspection.

24.6 For glow-discharge lamps with E 10 caps used as indicator lamps, the series resistors shall be incorporated in the appliance.

Compliance is checked by inspection.

This requirement applies only until an IEC standard for glow-discharge lamps with incorporated series resistors is issued.

24.7 Capacitors shall not be connected between the contacts of a thermal cut-out.

Compliance is checked by inspection.

24.8 Class II appliances shall be provided with an all-pole switch in their supply circuit.

Switches shall be provided with means to prevent continuous rotation in the same direction.

Cord switches and cord control units shall have an "off" position at both ends of the travel of the operating means, unless a pilot lamp is provided to indicate when the switch is in an "on" position.

Compliance is checked by inspection.

25. Supply connection and external flexible cords

25.1 Appliances shall be provided with one of the following means of connection to the supply:

- an appliance inlet;
- a power supply cord.

Appliance inlets shall not be fitted to the flexible part of Class II pads.

Power supply cords shall not be fitted to the flexible part of washable blankets.

Compliance is checked by inspection.

25.2 Appliances shall not be provided with more than one means of connection to the supply, except for double bed size blankets having two completely separate heated areas.

Compliance is checked by inspection.

25.3 For control units and cord switches, power supply cords shall be connected by one of the following methods:

- type X attachment;
- type Y attachment;
- type M attachment;
- type Z attachment.

For the flexible part, non-detachable flexible cords shall be connected by type Y or type Z attachments.

Compliance is checked by inspection and, if necessary, by manual test.

25.4 Power supply cords shall be provided with a plug.

Refer snc.

Plugs shall not be fitted with more than one flexible cord.

Compliance is checked by inspection.

25.5 Power supply cords shall be of a construction not lighter than light polyvinyl chloride sheathed flexible cord (code designation H03 VV-F or H03 VVH2-F).

Flexible cords having insulation based on natural rubber shall not be used.

Power supply cords shall have a cross-sectional area not less than that shown in the following table.

Rated current A	Nominal cross-sectional area mm²
up to and including 3	0.5
over 3 up to and including 6	0.75
over 6 up to and including 10	1
over 10 up to and including 16	1.5

Conductors of power supply cords shall not be consolidated by lead-tin soldering where they are subject to contact pressure, unless the clamping means is so designed that there is no risk of a bad contact due to cold flow of the solder.

Compliance is checked by inspection and measurement.

The requirement concerning the consolidation of the conductors of power supply cords may be met by using spring terminals. Securing the clamping screws alone is not considered adequate.

25.6 For type Z attachments, moulding together the enclosure of the appliance and the power supply cord shall not affect the insulation of the cord.

Compliance is checked by inspection.

25.7 Inlet openings of appliances shall be so designed and shaped, or shall be provided with an inlet bushing, such that the protective covering of the power supply cord can be introduced without risk of damage.

The insulation between the conductor and the enclosure of the control unit shall consist of the insulation of the conductor and, in addition at least two separate insulations, unless the enclosure is of insulating material, in which case one separate insulation is sufficient.

A separate insulation shall consist of:

– the sheath of a power supply cord at least equivalent to that of a flexible cord complying with HD 21, or

– a lining of insulating material complying with the requirements for supplementary insulation, or

– a bushing of insulating material complying with the requirements for supplementary insulation in the case of metal enclosures.

Compliance is checked by inspection.

25.8 Inlet bushings of appliances shall:

– be so shaped as to prevent damage to the power supply cord;
– be reliably fixed;
– not be removable without the aid of a tool;
– not, for type X attachment, be integral with the power supply cord;

– not be of rubber.

Compliance is checked by inspection and by manual test.

25.9 **Appliances shall be constructed so that the cord is adequately protected against excessive flexing where it enters the appliance.**

NOTE 1 - This requirement applies to cord switches and cord control units.

Compliance is checked by the following test which is made on an apparatus having an oscillating member as shown in figure 17.

NOTE 2 - The test is not carried out when the cord entry is flexible.

The part of appliance comprising the cord entry, the cord guard, if any, and cord, is fixed to the oscillating member so that, when the latter is at the middle of its travel, the axis of the cord where it enters the cord guard or inlet is vertical and passes through the axis of oscillation. The major axis of the section of flat cords shall be parallel to the axis of oscillation.

The cord is loaded so that the force applied is:

- *10 N for cords having a nominal cross-sectional area exceeding 0,75 mm²;*
- *5 N for other cords.*

The distance A, as shown in the figure, between the axis of oscillation and the point where the cord or cord guard enters the appliance is so adjusted that when the oscillating member moves over its full range the cord and load make the minimum lateral movement.

The oscillating member is moved through an angle of 90° (45° on either side of the vertical), the number of flexings for Type Z attachment being 20 000 and for other attachments 10 000. The rate of flexing is 60/min.

NOTE 3 - A flexing is one movement, either backwards or forwards.

After half the number of flexings specified, samples, except those with flat cords, are turned through an angle of 90°.

During the test, the rated current of the appliance is passed through the conductors, the voltage being equal to the rated voltage of the appliance. Current is not passed through signal conductors.

The test shall not result in:

- *short-circuit between the conductors;*
- *a breakage of more than 10 % of the strands of any conductor;*
- *separation of the conductor from its terminal or termination;*
- *loosening of any cord guard;*
- *damage, within the meaning of this standard, to the cord or any cord guards;*
- *broken strands of the conductors piercing the insulation so as to become accessible.*

NOTE 4 - A short-circuit between conductors of the cord is considered to occur if the current exceeds a value equal to twice the rated current of the appliance.

25.10 Appliances provided with a power supply cord shall have cord anchorages such that the conductors are relieved from strain, including twisting, where they are connected within the appliance, and that the insulation of the conductors is protected from abrasion.

Cord anchorages shall either be so arranged that they are only accessible with the aid of a tool or be so designed that the cord can only be fitted with the aid of a tool.

For type X attachments, glands shall not be used as cord anchorages, unless they have provision for clamping all types and sizes of flexible cord which might be used as the power supply cord; production methods such as moulded-on designs, tying of the cord into a knot or tying the ends with string are not allowed; labyrinths or similar means are permitted provided that it is clear how the power supply cord is to be assembled.

For type X attachments, cord anchorages shall be so designed or located that:

- replacement of the cord is easily possible;
- it is clear how the relief from strain and the prevention of twisting are to be obtained;
- they are suitable for the different types of cord which may be connected, unless the appliance is so designed that only one type of cord can be fitted;
- the cord cannot touch the clamping screws of the cord anchorage, if these screws are accessible or electrically connected to accessible metal parts;
- the cord is not clamped by a metal screw which bears directly on the flexible cord;

- at least one part of the cord anchorage is securely fixed to the appliance;
- screws, if any, which have to be operated when replacing the cord, do not serve to fix any other component, unless when omitted or incorrectly mounted, they render the appliance inoperative or clearly incomplete or unless the parts intended to be fastened by them cannot be removed without the aid of a tool during the replacement of the cord;
- for glands, the cord cannot be released by continuing the tightening action;
- for Class II control units, they are of insulating material, or, if of metal, are insulated from accessible metal parts by insulation complying with the requirements for supplementary insulation.

For type M, type Y and type Z attachments of Class II appliances, the cores of the power supply cord shall be insulated from accessible metal parts by supplementary insulation.

This insulation shall consist of:

- a separate insulating lining fixed to the cord anchorage, or
- a special sleeve or grommet fixed to the cord, or

For type M and type Y attachments, cord anchorages shall be so constructed that:

- the replacement of the power supply cord does not impair compliance with this standard;
- the cord cannot touch clamping screws of the cord anchorage, if these screws are accessible or electrically connected to accessible metal parts;
- the cord is not clamped by a metal screw which bears directly on the cord;
- knots in the cord are not used;
- in the case of labyrinths and similar means it is clear how the power supply cord is to be fitted;
- for type M attachments it is clear how the relief from strain and the prevention of twisting is to be obtained.

Compliance is checked:

- *for control units and cord switches by inspection and by the tests of Sub-clause 25.11;*
- *for the flexible part, by the test of Sub-clause 25.12.*

If, for type X attachments, the cord anchorage comprises one or more clamping members to which pressure is applied by means of one or more nuts engaging with studs which are securely attached to the appliance, the cord anchorage is considered to have one part securely fixed to the unit, even if the clamping members can be removed from the studs.

If, however, the pressure on the clamping members is applied by means of one or more screws engaging either with separate nuts or with a thread in a part which is integral with the control unit, the cord anchorage is not considered to have one part securely fixed to the unit, unless one of the clamping members itself is fixed to the unit or the surface of the unit is of insulating material and so shaped that it is obvious that this surface is one of the clamping members (see Figure 18).

25.11 *For type X attachments, the appliance is fitted with a suitable power supply cord. The conductors are introduced into the terminals, their terminal screws, if any, being tightened just sufficiently to prevent the conductors from easily changing their position. The cord anchorage is used in the normal way, its clamping screws being tightened with a torque equal to two-thirds of that specified in Sub-clause 28.1*

Screws of insulating material bearing directly on the cord are fastened with two-thirds of the torque specified in Column I of the table of Sub-clause 28.1, the length of the slot in the screw head being taken as the nominal diameter of the screw.

The tests are first made with the lightest permissible type of cord of the smallest cross-sectional area specified in Sub-clause 26.2 and then with the next heaviest type of cord of the largest cross-sectional area specified, unless the appliance is so designed that only one type of cord can be fitted.

For other attachments, the test is made with the cord as delivered.

It shall not be possible to push the cord into the control unit or cord switch to such an extent that the cord, or internal parts of the control unit or cord switch, could be damaged.

The cord is then subjected 25 times to a pull of the value shown in the following table. The pulls are applied in the most unfavourable direction without jerks, each time for 1 s.

Immediately afterwards, the cord is subjected for 1 min to a torque of the value shown in the following table.

Type of control	*Pull N*	*Torque Nm*
Cord control units and cord switches	*100*	*0.35*
Other control units:		
– up to and including 1 kg	*30*	***0,1***
– over 1 kg up to and including 4 kg	*60*	*0.25*
– over 4 kg	*100*	*0.35*

1

During the tests, the cord shall not be damaged.

After the tests, the cord shall not have been longitudinally displaced by more than 2 mm and the conductors shall not have moved over a distance of more than 1 mm in the terminals, nor shall there be appreciable strain at the connections.

Creepage distances and clearances shall not be reduced below the values specified in Sub-clause 29.1.

3 ***For the measurement of the longitudinal displacement, a mark is made on the cord while it is subjected to the pull, as close as possible to the cord anchorage.***

After the tests, the displacement of the mark on the cord in relation to the cord anchorage or other point is measured while the cord is subjected to the pull.

25.12 *The enclosure of the flexible part is securely held by means of clamps which grip the entire length of the edge of the appliance opposite to that through which the power supply cord enters. If the cord enters at a corner, the clamps grip the entire length of both edges enclosing the opposite corner.*

A pull of 100 N is then gradually applied to the cord or, where the heating element leaves the flexible part through a sleeve, to the sleeve, at a point approximately 300 mm from the entry to the appliance or, if there is a switch within this distance, as close to the switch as the cord will allow.

The pull is maintained for 1 min and the cord or sleeve is then released.

The pull is applied three times in succession.

Immediately afterwards, the cord is subjected for 1 min to a torque of 0.35 Nm.

After the test, the cord anchorage, the joints and the electrical connections shall show no damage within the meaning of this standard.

If the flexible part is provided with an appliance inlet the test is made with appliance coupler locked in position.

25.13 The space for the connection of the power supply cord within the control unit, for type X, type M and type Y attachments, shall be such that:

- it is possible to check, before fitting the cover, that the conductors are correctly connected and positioned;
- covers can be fitted without risk of damage to the conductors or their insulation;
- the uninsulated end of a conductor, should it become free from the terminal, cannot come into contact with accessible metal parts, unless, for type M and type Y attachments, the cord is provided with terminations that are unlikely to allow the conductor to become free.

For Type X attachments and Type M attachments, in addition: 

- the conductors can be easily introduced and connected;
- covers giving access to terminals shall not require the use of a special tool for their removal.

Compliance is checked by inspection and, for type X attachments, by the following test with flexible cords of the largest cross-sectional area specified in Sub-clause 26.2.

For pillar terminals where the conductors are not separately clamped at a distance of 30 mm or less from the terminal, and for other terminals with screw clamping, the clamping screws or nuts are loosened in turn. Without removing the conductor from the conductor space, a force of 2 N is applied to the wire in any direction and adjacent to the terminal, screw or stud. The uninsulated end of the conductor shall not then come into contact with accessible metal parts or any other metal part connected thereto.

For pillar terminals where the conductors are separately clamped at a distance of 30 mm or less from the terminal, the appliance is considered to meet the requirements that the uninsulated end of the conductor must not come into contact with accessible metal parts.

The conductors may be separately clamped, for example, by a cord anchorage.

25.14 Interconnection cords and their means of connection shall comply with the requirements of this clause except that the cross-sectional area of the conductors is determined on the basis of the maximum current carried by the conductor during the test of Clause 11 and not by the rated current of the appliance.

Interconnection cords for blankets and mattresses are not required to be sheathed. 

If the interconnection cord has more than two cores, the current density of any individual core shall not exceed 12 A/mm^2 and the sum of the cross-sectional areas shall be at least 1 mm^2.

If flexible cords not standardized in HD 21 are used, their electrical and mechanical properties shall be at least equal to those specified in HD 21.

Compliance is checked by inspection, by measurement and, if necessary, by tests, such as an electric strength test as specified in Sub-clause 16.6 and those specified in HD 21.

The cores of signal conductors may have a reduced thickness of insulation, depending upon the voltage of the circuit in which the particular conductor is used.

3 **2 When the interconnection cord consists of a heating element within a sleeve, the requirements related to current density and to IEC 227 do not apply.**

26. Terminals for external conductors

26.1 Appliances provided with type X or type M attachments shall be provided with terminals in which connection is made by means of screws, nuts or equally effective devices.

Screws and nuts which clamp external conductors shall have a metric ISO thread or a thread comparable in pitch and mechanical strength. They shall not serve to fix any other component, except that they may also clamp internal conductors if these are so arranged that they are unlikely to be displaced when fitting the supply conductors.

For appliances with type X and type M attachments and having a rated input not exceeding 250 W, soldered connections may be used for the connection of external conductors, provided that the conductor is so positioned or fixed that reliance is not placed upon the soldering alone to maintain the conductor in position, unless barriers are provided such that creepage distances and clearances between live parts and other metal parts cannot be reduced to less than 50% of the values specified in Sub-clause 29.1 should the conductor break away at the soldered joint.

For type Y and type Z attachments, soldered, welded, crimped and similar connections may be used for the connection of external conductors; moreover, for Class II appliances, the conductor shall be so positioned or fixed that reliance is not placed upon the soldering, crimping or welding alone to maintain the conductor in position, unless barriers are provided such that creepage distances and clearances between live parts and other metal parts cannot be reduced to less than 50% of the values specified in Sub-clause 29.1 should the conductor break away at the soldered or welded joint, or slip out of the crimped connection.

For the purpose of the requirements for power supply cords:

- it is not to be expected that two independent fixings will become loose at the same time;
- conductors connected by soldering are not considered to be adequately fixed, unless they are held in place near to the termination, independently of the solder. However, "hooking in" before the soldering is, in general, considered to be a suitable means for maintaining the conductors of a power supply cord other than a tinsel cord in position, provided the hole through which the conductor is passed is not unduly large;

– conductors connected to terminals or terminations by other means are not considered to be adequately fixed, unless an additional fixing is provided near to the terminals or termination; this additional fixing, in the case of stranded conductors, clamps both the insulation and the conductor.

The terminals of a component (e.g. a switch) built into the appliance may be used as terminals for external conductors if they comply with the requirements of this clause.

Provisionally, SI, BA and Unified threads are deemed to be comparable in pitch and mechanical strength to metric ISO thread.

Requirements for screwless terminals are given in IEC 685-2-1.

26.2 **Terminals for the connection for Type X attachments shall allow the connection of conductors having nominal cross-sectional areas as shown in the following table, unless the appliance is constructed so that only one type of cable or cord can be fitted, in which case the terminals shall be suitable for the connection of that cord.**

Rated current A	Nominal cross-sectional area mm²
up to and including 3	0.5 to 0.75
over 3 up to and including 6	0.75 to 1
over 6 up to and including 10	1 to 1.5
over 10 up to and including 16	1.5 to 2.5

Compliance with the requirements of Sub-clauses 26.1 and 26.2 is checked by inspection, by measurement and by fitting cords of the smallest and largest cross-sectional areas specified.

26.3 Terminals for type M, type Y and type Z attachments shall be suitable for their purpose.

Compliance is checked by inspection and by applying a pull of 5 N to the connection.

After the test, the connections shall show no damage within the meaning of this standard.

26.4 Terminals of appliances with type X or type M attachments shall be so fixed that, when the clamping means is tightened or loosened, the terminal does not work loose, internal wiring is not subjected to stress and creepage distances and clearances are not reduced below the values specified in Sub-clause 29.1.

Compliance is checked by inspection and by measurement after fastening and loosening ten times a conductor of the largest cross-sectional area specified in Sub-clause 26.2, the torque applied being equal to two-thirds of the torque specified in Sub-clause 28.1.

Terminals may, for example, be prevented from working loose by fixing with two screws or by fixing with one screw in a recess such that there is no appreciable play or by other suitable means.

Covering with sealing compound without other means of locking is not considered to be sufficient. Self-hardening resins may, however, be used to lock terminals which are not subject to torsion in normal use.

26.5 Terminals of control units with type X or type M attachments shall be so designed that they clamp the conductor between metal surfaces with sufficient contact pressure and without damage to the conductor.

Compliance is checked by inspection.

26.6 Terminals of control units with type X or type M attachments shall not require special preparation of the conductor in order to effect correct connection, and they shall be so designed or placed that the conductor cannot slip out when the clamping screws or nuts are being tightened.

Compliance is checked by inspection.

The term "special preparation of the conductor" covers soldering of the strands, use of cable lugs, formation of eyelets, etc, but not the twisting of a stranded conductor to consolidate the end.

Conductors are considered to be damaged if they show deep or sharp indentations.

26.7 Terminals of the pillar type shall have dimensions as shown in the following table, except that the length of the thread in the pillar may be reduced, if the mechanical strength is adequate and at least two full threads are in engagement when a conductor of the smallest cross-sectional area specified in Sub-clause 26.2 is tightly clamped.

Rated current A	Minimum nominal thread diameter mm	Minimum diameter of hole for conductor mm	Minimum length of thread in pillar thread mm	Maximum difference between diameter of hole and nominal thread diameter mm
up to and including 10	3.0[1]	3.0	2.0	0.6
over 10 up to and including 16	3.5	3.5	2.5	0.6

[1] For BA threads, this value is reduced to 2.8.

The length of the threaded part of the terminal screw shall not be less than the sum of the diameter of the hole for the conductor and the length of the thread on the pillar.

The surface against which the conductor is clamped shall be free from sharp indentations or projections.

Such terminals shall be so designed and located that the end of a conductor introduced into the hole is visible, or can pass beyond the threaded hole for a distance at least equal to half the nominal diameter of the screw, or 2.5 mm, whichever is the greater.

The length of the thread in the pillar is measured to the point where the thread is first broken by the hole for the conductor.

If the thread in the pillar is recessed, the length of headed screws must be increased accordingly.

The part against which the conductor is clamped need not necessarily be in one piece with the part carrying the clamping screw.

26.8 Screw terminals shall have dimensions not less than those shown in the following table, except that the length of the thread in the screw hole or nut and the length of thread on the screw may be reduced, if the mechanical strength is adequate and at least two full threads are in engagement when a conductor of the largest cross-sectional area specified in Sub-clause 26.2 is lightly clamped.

Rated current A	Nominal thread diameter mm	Length of thread on screw mm	Length of thread on screw hole or nut mm	Nominal difference between diameter of head and shank of screw mm	Height of head of screw mm
up to and including 10	3.0[1]	3.5	1.5	3.0	1.8
over 10 up to and including 16	4.0	5.5	2.5	4.0	2.4

[1] For BA threads, this value is reduced to 2.8.

If the required length of thread in a terminal screw hole is obtained by plunging, the edge of the extrusion shall be reasonably smooth and the length of thread shall exceed the specified minimum value by at least 0.5 mm. The length of the extrusion shall be not more than 80% of the original thickness of the metal, unless the mechanical strength is adequate with a greater length.

If an intermediate part, such as a pressure plate, is used between the head of the screw and the conductor, the length of thread on the screw shall be increased accordingly, but the diameter of the head of the screw may be reduced by 1 mm.

If an intermediate part has more than one screw, screws with a nominal thread diameter of 3.5 mm may be used for appliances having a rated current exceeding 10 A.

If the thread in the screw hole or nut is recessed, the length of headed screws must be increased accordingly.

26.9 Stud terminals shall be provided with washers and shall have dimensions as shown in the following table.

Rated current A	Nominal thread diameter (minimum) mm	Difference between thread diameter and	
		Inner diameter of washers (maximum) mm	Outer diameter of washers (minimum) mm
up to and including 10	3.0[1]	0.4	4.0
over 10 up to and including 16	3.5	0.4	4.5

[1] For BA threads, this value is reduced to 2.8.

Compliance with the requirements of Sub-clauses 26.7 to 26.9 is checked by inspection, by measurement, and, if necessary, by the tests of Sub-clause 26.10. A negative deviation of 0.15 mm is allowed for the nominal thread diameter and for the nominal difference between diameters of head and shank of the screw.

If one or more of the dimensions required in Sub-clauses 26.7 to 26.9 are larger than specified, the other dimensions need not be correspondingly increased, but departures from the specified values must not impair the function of the terminal.

26.10 *If the length of thread in the pillar, screw hole or nut, or the length of thread on the screw, is smaller than that shown in the relevant table, or if the length of the extrusion is more than 80% of the original thickness of the metal, the mechanical strength of the terminal is checked by the following tests.*

Screws and nuts are subjected to the test of Sub-clause 28.1, but with the torque increased to 1.2 times the torque specified.

After this test, the terminal shall show no damage impairing its further use.

A conductor is then fastened, as specified in Sub-clause 26.4, once more and, while clamped, is subjected for 1 min to an axial pull which is applied without jerks. The force applied is 40 N if the rated current of the terminal is not greater than 6 A, and 50 N if the rated current exceeds 6 A.

During this test, the conductor shall not move noticeably in the terminal.

26.11 For appliances with type X and type M attachments, terminals shall be located in close proximity to each other.

Compliance is checked by inspection.

26.12 Terminal devices shall not be accessible without the aid of a tool, even if their live parts are not accessible.

Compliance is checked by inspection and by manual test.

26.13 Terminals of appliances with type X attachments shall be so located or shielded that, should a wire of a stranded conductor escape when the conductors are fitted, there is no risk of accidental connection between live parts and accessible metal parts and, for Class II appliances, between live parts and metal parts separated from accessible metal parts by supplementary insulation only.

Compliance is checked by the following test.

An 8 mm length of insulation is removed from the end of a flexible conductor having a nominal cross-sectional area as specified in Sub-clause 25.6. One wire of the stranded conductor is left free and the other wires are fully inserted into and clamped in the terminal.

The free wire is bent, without tearing the insulation back, in every possible direction, but without making sharp bends round barriers.

The free wire of a conductor connected to a live terminal shall not touch any metal part which is accessible or is connected to an accessible metal part or, for Class II appliances, any metal part which is separated from accessible metal parts by supplementary insulation only.

27. Provision for earthing

27.1 Appliances shall have no provision for earthing.

Compliance is checked by inspection.

28. Screws and connections

28.1 Screwed connections, electrical or otherwise, shall withstand the mechanical stresses occurring in normal use.

Screws which are likely to be tightened by the user and have a nominal diameter less than 3 mm and screws transmitting electrical contact pressure shall screw into metal.

Screws shall not be of metal which is soft or liable to creep, such as zinc or aluminium.

Screws of insulating material shall have a nominal diameter of at least 3 mm; they shall not be used for any electrical connection.

Screws shall not be of insulating material if their replacement by a metal screw could impair supplementary insulation or reinforced insulation, nor shall screws which may be removed when replacing a power supply cord or undertaking other routine servicing be of insulating material if their replacement by a metal screw could impair basic insulation.

Compliance is checked by inspection and, for screws and nuts transmitting contact pressure, or which are likely to be tightened by the user, by the following test.

The screws or nuts are tightened and loosened:

- *ten times for screws in engagement with a thread of insulating material;*
- *five times for other screws and for nuts.*

Screws in engagement with a thread of insulating material are completely removed and reinserted each time.

When testing terminal screws and nuts, a flexible conductor of the largest cross-sectional area specified in Sub-clause 26.2 is placed in the terminal.

The test is made by means of a suitable test screwdriver, spanner or key applying a torque as shown in the following table, the appropriate column being:

- *for metal screws without heads if the screw when tightened does not protrude from the hole* ..... *I*
- *for other metal screws and for nuts* ..... *II*
- *for screws of insulating material:*
  - *having an hexagonal head with the dimension across flats exceeding the overall thread diameter; or*
  - *with a cylindrical head and a socket for a key, the socket having a cross-corner dimension exceeding the overall thread diameter; or*
  - *with a head having a slot or cross slots, the length of which exceeds 1.5 times the overall thread diameter* ..... *II*
- *for other screws of insulating material* ..... *III*

Nominal diameter of screw	*Torque Nm*		
mm	*I*	*II*	*II*
up to and including 2.8	*0.2*	*0.4*	*0.4*
over 2.8 up to and including 3.0	*0.25*	*0.5*	*0.5*
over 3.0 up to and including 3.2	*0.3*	*0.6*	*0.6*
over 3.2 up to and including 3.6	*0.4*	*0.8*	*0.6*
over 3.6 up to and including 4.1	*0.7*	*1.2*	*0.6*
over 4.1 up to and including 4.7	*0.8*	*1.8*	*0.9*
over 4.7 up to and including 5.3	*0.8*	*2.0*	*1.0*
over 5.3	–	*2.5*	*1.25*

1

1 **For screws in engagement with a thread of insulating material and which are likely to be tightened by the user, the torque is increased by 20 %.**

The conductor is moved each time the screw or nut is loosened.

During the test, no damage impairing the further use of the screwed connections shall occur.

Screws or nuts which are likely to be tightened by the user include screws intended to be operated when replacing the power supply cord.

Space threaded screws having a diameter of 2.9 mm are considered to be equivalent to screws having a metric ISO thread of 3 mm diameter.

The shape of the blade of the test screwdriver must suit the head of the screw to be tested. The screws and nuts must not be tightened in jerks.

28.2 Screws in engagement with a thread of insulating material and which are likely to be tightened by the user shall have a length of engagement sufficient to ensure a reliable connection.

Correct introduction of the screw into the screw hole or nut shall be ensured.

1 ***Compliance is checked by inspection.***

The requirement with regard to correct introduction is met if introduction of the screw in a slanting manner is prevented, for example, by guiding the screw by the part to be fixed, by a recess in the female thread or by the use of a screw with the leading thread removed.

28.3 Apart from connections to the heating element, electrical connections shall be so designed that contact pressure is not transmitted through insulating material which is liable to shrink or to distort, unless there is sufficient resiliency in the metallic parts to compensate for any possible shrinkage or distortion of the insulating material.

Compliance is checked by inspection.

Ceramic material is not liable to shrink or to distort.

28.4 Space-threaded (sheet metal) screws shall not be used for the connection of current-carrying parts, unless they clamp these parts directly in contact with each other and are provided with a suitable means of locking.

Thread-cutting (self-tapping) screws shall not be used for the electrical connection of current-carrying parts, unless they generate a full form standard machine screw thread. Such screws shall not, however, be used if they are likely to be operated by the user or installer unless the thread is formed by a swaging action.

Compliance is checked by inspection.

28.5 Screws which make a mechanical connection between different parts of the appliance shall be secured against loosening, if the connection carries current.

Rivets used for current-carrying connections shall be secured against loosening if these connections are subject to torsion in normal use.

Compliance is checked by inspection and by manual test.

Spring washers and the like may provide satisfactory security against loosening.

For rivets, a non-circular shank or an appropriate notch may be sufficient.

Sealing compound which softens on heating provides satisfactory security against loosening only for screw connections not subject to torsion in normal use.

29. Creepage distances, clearances and distances through insulation

29.1 Creepage distances and clearances shall be not less than the values in millimetres shown in the following table.

Compliance is checked by measurement.

For appliances provided with an appliance inlet, the measurements are made with an appropriate connector inserted; for appliances with type X attachments, they are made with supply conductors of the largest cross-sectional area specified in Sub-clause 26.2, fitted, and also without conductors; for other appliances, they are made on the appliance as delivered.

Movable parts are placed in the most unfavourable position; nuts and screws with non-circular heads are assumed to be tightened in the most unfavourable position.

The clearance between terminals and accessible metal parts are also measured with the screws or nuts unscrewed as far as possible, but the clearances shall then be not less than 50% of the values shown in the table.

Distances through slots or openings in external parts of insulating material are measured to metal foil in contact with the accessible surface; the foil is pushed into corners and the like by means of the standard test finger shown in Figure 1, but it is not pressed into openings.

If necessary, a force is applied to any point on bare conductors and to the outside of metal enclosures, in an endeavour to reduce the creepage distances and clearances while taking the measurements.

The force is applied by means of a test finger having a tip as shown in Figure 1 and has a value of:

- *2 N for bare conductors;*
- *30 N for enclosures.*

The way in which creepage distances and clearances are measured is indicated in Appendix E.

If a barrier is interposed, clearances are measured over the barrier or, if the barrier is in two parts with mating surfaces which are not cemented together, through the joint; in the latter case, creepage distances are also measured through the joint.

When assessing creepage distances and clearances, the effect of insulating linings of metal enclosures or covers is taken into consideration.

Internal conductors of control units are considered to be bare conductors, unless their insulation withstands an electric strength test made between the conductor and metal foil wrapped round the insulation, a test voltage of 2000 V being applied for 15 min.

Distance mm	Class III appliances		Other appliances			
			Working voltage up to 130 V		Working voltage over 130 V up to 250 V	
	Creepage distance	Clearance	Creepage distance	Clearance	Creepage distance	Clearance
Between live parts of different polarity[1]*:*						
– if protected against deposition of dirt[2]	1.0	1.0	1.0	1.0	2.0	2.0
– if not protected against deposition of dirt	2.0	1.5	2.0	1.5	3.0	2.5
– if lacquered or enamelled windings	1.0	1.0	1.5	1.5	2.0	2.0
- for positive temperature coefficient (PTC) resistors including their connecting wires if protected against deposition of moisture or dirt [2]	-	-	**1,0**	**1,0**	**1,0**	**1,0**
Between live parts and other metal parts over basic insulation:						
– if protected against deposition of dirt[2]:						
. if of ceramic material or pure mica and the like	1.0	1.0	1.0	1.0	2.5 [3]	2.5 [3]
. if of other material	1.5	1.0	1.5	1.0	3.0	2.5
– if not protected against deposition of dirt	2.0	1.5	2.0	1.5	4.0	3.0
– if the live parts are lacquered or enamelled windings	1.0	1.0	1.5	1.5	2.0	2.0
Between live parts and other metal parts over reinforced insulation:						
– if the live parts are lacquered or enamelled windings	–	–	6.0	6.0	6.0	6.0
– for other live parts	–	–	8.0	8.0	8.0	8.0
Between metal parts separated by supplementary insulation	–	–	4.0	4.0	4.0	4.0

[1] The clearances specified do not apply to the air gap between the contacts of thermal controls, switches of micro-gap construction and the like, or to the air gap between the current-carrying members of such devices where the clearance varies with the movement of the contacts.

[2] In general, the interior of an appliance having a reasonably dust-proof enclosure is considered to be protected against deposition of dirt, provided the appliance does not generate dust within itself; hermetic sealing is not required.

[3] If the parts are rigid and located by mouldings, or if the design is otherwise such that there is no likelihood of a distance being reduced by distortion or movement of the parts, this value may be reduced to 2.0.

For live parts of different polarity separated by basic insulation only, values smaller than those specified are allowed, provided the appliance does not show any defect within the meaning of this standard if these creepage distances and clearances are short-circuited consecutively and the creepage distances are over insulating material withstanding the test of Sub-clause 30.7.

... through insulation between metal parts, for working voltages up to and including 250 V, shall be not less than:

- 1.0 mm if they are separated by supplementary insulation;
- 2.0 mm if they are separated by reinforced insulation.

This requirement does not apply if the insulation is applied in thin sheet form, other than mica or similar scaly material, and consists:

- for supplementary insulation, of at least two layers, provided that at least one of the layers withstands the electric strength test prescribed for supplementary insulation,

- for reinforced insulation, of at least three layers, provided that when two of the layers are placed in contact, they withstand the electric strength test prescribed for reinforced insulation,

the test voltage being applied between the outer surfaces of the layer, or of the two layers, as applicable.

Compliance is checked by inspection and by measurement.

There are no requirements for distances through insulation for the flexible part.

This requirement does not imply that the prescribed distance must be through solid insulation only; it may consist of thickness of solid insulation plus one or more air layers.

Moreover, this requirement does not apply if the supplementary insulation or the reinforced insulation is inaccessible and meets one of the following conditions:

- the maximum temperature rise determined during the tests of clause 19 does not exceed the permissible value specified in 11.6;

- the insulation, after having been conditioned for 168 h in an oven maintained at a temperature the value of which is 50 K in excess of the maximum temperature rise determined during the tests of clause 19, withstands an electric strength test as specified in 16.6, this test being made on the insulation both at the temperature occurring in the oven and at approximately room temperature.

30 Resistance to heat, fire and tracking

NOTES

1 The tests specified in this clause are based on the present IEC standards dealing with this subject. Other concepts for determining the resistance to fire, such as preselection testing, are under consideration by the IEC and will be studied when available.

2 Appendix H shows the selection and sequence of the tests of this clause.

30.1 The enclosure of the flexible part of appliance shall be adequately resistant to ignition.

For appliances other than those meeting the requirements of 22.23, compliance is checked by the following test which is made on six samples.

The samples, having dimensions of 100 mm x 200 mm, are cut from the enclosure so that their shorter sides are parallel with the runs of the heating element. They are selected from parts of the enclosure so that no two samples contain the same warp thread or the same weft thread or 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 and trimming are removed from the samples.

The test apparatus, as shown in figure 20, has two brass electrodes 3 mm in diameter which are supported by brass pillars mounted on a base plate of insulating material so that their axes are aligned. The base plate also supports a platform of insulating material, having dimensions of 100 mm x 100 mm, which is located centrally between the brass pillars. Provision is made for the height of the platform to be adjusted.

The 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. They are selected from parts of the enclosure so that no two samples contain the same warp thread or the same weft thread or 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 and trimming are removed from the samples.

The test apparatus, as shown in Figure 20, has two brass electrodes 3 mm in diameter which are supported by brass pillars mounted on a base plate of insulating material so that their axes are aligned. The base plate also supports a platform of insulating material, having dimensions of 100 mm × 100 mm, which is 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° to its major axis. 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 tip at right angles to its major axis.

The lower member of a two-part hardwood mask, as shown in detail B of Figure 20, is placed on the adjustable platform in the position indicated.

The test apparatus together with the upper member of the mask, is placed in a heating cabinet having a door with an inspection window and where air is circulated by natural convection.

While in the heating cabinet, the electrodes are connected in series with an adjustable non-inductive resistor to a supply having a sinusoidal rated 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 ± 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 six samples are placed in the cabinet, which is maintained at the temperature specified, for a period of 3 h.

Without removing the apparatus from the heating cabinet, the movable electrode is withdrawn and one end of one sample drawn over the fixed electrode so that the electrode is situated centrally in the space normally occupied by the heating element. The sample is adjusted so that its end is approximately level with the edge of the adjustable platform. The movable electrode is then inserted into the other end of the element space and is fixed so that the distance between the electrodes is (6.0 ± 0.1) mm. The sample is then smoothed out, care being taken to ensure that material is not looped or caught between the electrodes; the upper member of the mask, as shown in detail C of Figure 20, is then placed in position. The door of the heating cabinet is then closed for a further period of 5 min in order to stabilize the temperature.

The supply is then 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 lasting not 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 above test is then repeated on the other five samples.

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° to its major axis. 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 tip at right angles to its major axis.

The lower member of a two-part hardwood mask, as shown in detail B of figure 20, is placed on the adjustable platform in the position indicated.

The test apparatus together with the upper member of the mask, is placed in a heating cabinet having a door with an inspection window and where air is circulated by natural convection.

While in the heating cabinet, the electrodes are connected in series with an adjustable non-inductive resistor 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 six samples are placed in the cabinet, which is maintained at the temperature specified, for a period of 3 h.

Without removing the apparatus from the heating cabinet, the movable electrode is withdrawn and one end of one sample drawn over the fixed electrode so that the electrode is situated centrally in the space normally occupied by the heating element. The sample is adjusted so that its end is approximately level with the edge of the adjustable platform. The movable electrode is then inserted into the other end of the element space and is fixed so that the distance between the electrodes is 6,0 mm + 0,1 mm. The sample is then smoothed out, care being taken to ensure that material is not looped or caught between the electrodes; the upper member of the mask, as shown in detail C of figure 20 is then 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 then 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 lasting not 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 above test is then 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. 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 average shall not be less than 80 s.

30.2 The insulation of heating elements and of internal wiring 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 which is inclined at 45°. The grid is formed from parallel wires 0,6 mm in diameter and spaced 20 mm apart. The sample is perpendicular to the wires which are positioned horizontally, and is placed midway between two grid wires which are parallel to it. A second grid of similar dimensions is placed on top of the sample so that its horizontal wires are displaced by 10 mm.

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.

A needle flame, as specified in IEC 695-2-2, is applied to the sample and is maintained until the insulation ceases to burn.

The length of the heating element or internal wiring damaged by fire shall not exceed 65 mm, measured from the point where the flame is applied.

PTC heating elements not complying with this test are alternatively subjected to the following test:

A break is made in the PTC conductor while the appliance is operating at rated voltage. Within 1 s the input of the flexible part shall not exceed 1 W. The broken ends are then brought together. The current shall not increase.

NOTE - The tests of this subclause are under consideration.

30.3 External parts of non-metallic material and parts of insulating material retaining live parts in position, the deterioration of which might cause the appliance to fail to comply with this standard, shall be sufficiently resistant to heat.

Compliance is checked by subjecting a specimen of the relevant parts to a ball-pressure test, which is made by means of the apparatus shown in figure 19.

Before starting the test, the specimen is kept for 24 h in an atmosphere having a temperature between 15 °C and 35 °C and a relative humidity between 45 % and 75 %.

The specimen is placed on a support in such a way that its upper surface is horizontal and a steel ball having a diameter of 5 mm is pressed against this surface with a force of 20 N. The thickness of the specimen is at least 2,5 mm, this thickness being obtained, if necessary, by placing two or more specimens together.

The test is made in a heating cabinet at a temperature the value of which is the higher of 40 K plus the maximum temperature rise determined during the test of clause 11, with a tolerance of + 2 K, and:

75 °C + 2 °C for external parts;
125 °C + 2 °C for parts retaining live parts in position.

However, for parts of thermoplastic material providing supplementary insulation or reinforced insulation, the test is made at a temperature the value of which is 25 K in excess of the maximum temperature rise determined during the tests of clause 19, with a tolerance of + 2 K, if this will lead to a higher temperature.

Before the test is started, the ball and the support on which the specimen is placed are brought to the temperature specified.

After 1 h, the ball is removed from the specimen, which is then cooled, within 10 s, to approximately room temperature by immersion in cold water. The diameter of the impression caused by the ball is then measured and shall not exceed 2 mm.

NOTES

1 For coil formers, only those parts which support or retain in position terminals or terminations are subjected to the test.

2 The test is not made on parts of ceramic material.

3 This test does not apply to the enclosure of the flexible part.

30.4 Parts of non-metallic material shall be adequately resistant to ignition and to spread of fire.

This requirement does not apply to decorative trims, knobs and other parts not likely to be ignited or to propagate flames originating from inside.

Compliance is checked by the tests of 30.5 and 30.6.

NOTE - This test does not apply to the enclosure of the flexible part.

30.5 *Separately moulded specimens of the relevant parts are subjected to the burning test referred to in appendix J.*

If separately moulded specimens are not available, or if there is no evidence that the material withstands the burning test, or if the separately moulded specimens do not withstand that test, the glow-wire test referred to in appendix K is made on the relevant parts at a temperature of 550 °C.

30.6 *For pads, parts of insulating material retaining in position connections carrying a current exceeding 0,5 A and which, in the event of a failure, might give rise to fire hazard, are subjected to the glow-wire test referred to in appendix K, the test being made at a temperature of 750 °C.*

For blankets and mattresses, connections retained in position by parts of insulating material and carrying a current exceeding 0,5 A and which, in the event of a failure, might give rise to fire hazard, are subjected to the bad-connection test with heaters referred to in appendix L or, if this test cannot be made due to the design of the connection, the parts of insulating material retaining the connection in position are subjected to the glow-wire test referred to in appendix K, the test being made at a temperature of 850 °C

If the parts do not withstand the glow-wire test or the bad-connection test with heaters, the needle-flame test referred to in appendix M is made on all other parts of non-metallic material which are positioned within a distance of 50 mm from those parts, unless these other parts are shielded by a separate barrier or enclosure from the parts originally tested, in which case the barrier or enclosure is subjected to the needle-flame test.

NOTE - Examples of connections which, in the event of a failure might give rise to fire hazard are screw connections which may be made or remade during installation or user servicing of the appliance.

30.7 Insulating material across which a tracking path may occur between live parts of different polarity shall have adequate resistance to tracking, taking into account the severity of its duty conditions.

For thermal controls in the flexible part of washable blankets, severe duty conditions apply.

For parts of insulating material used under severe duty conditions, compliance is checked by the proof tracking test referred to in appendix N.

For parts of insulating material used under normal duty conditions and parts of ceramic material, no tracking test is made.

For parts of insulating material used under severe duty conditions, the test voltage is 175 V. If the specimens do not withstand this test and there is no hazard other than fire, surrounding parts are subjected to the needle-flame test referred to in appendix M.

The needle-flame test is made on all parts of non-metallic material positioned within a distance of 50 mm from any place where a tracking path may occur, unless these parts are shielded by a separate barrier or enclosure from that tracking path, in which case the barrier or enclosure is subjected to the needle-flame test.

NOTE - For the severity of the duty conditions of insulating material, see appendix P.

The test is made at three places on the sample.

Care is taken that the electrodes are clean, correctly shaped and correctly positioned before each test is started. In case of doubt, the test is repeated, if necessary on a new sample.

31. Resistance to rusting

31.1 Ferrous parts, the rusting of which might cause the appliance to fail to comply with this standard, shall be adequately protected against rusting.

Compliance is checked by the following test.

All grease is removed from the relevant parts by immersion in an appropriate cleansing agent.

The parts are then immersed for 10 min in a 10% solution of ammonium chloride in water at a temperature of (20 ± 5) °C.

Without drying, but after shaking off any drops, the parts are placed for 10 min in a box containing air saturated with moisture at a temperature of (20 ± 5) °C.

After the parts have been dried for 10 min in a heating cabinet at a temperature of (100 ± 5) °C, their surfaces shall show no signs of rust.

When using the liquids specified for the test, adequate precautions must be taken to prevent inhalation of their vapours.

Traces of rust on sharp edges and any yellowish film removable by rubbing are ignored.

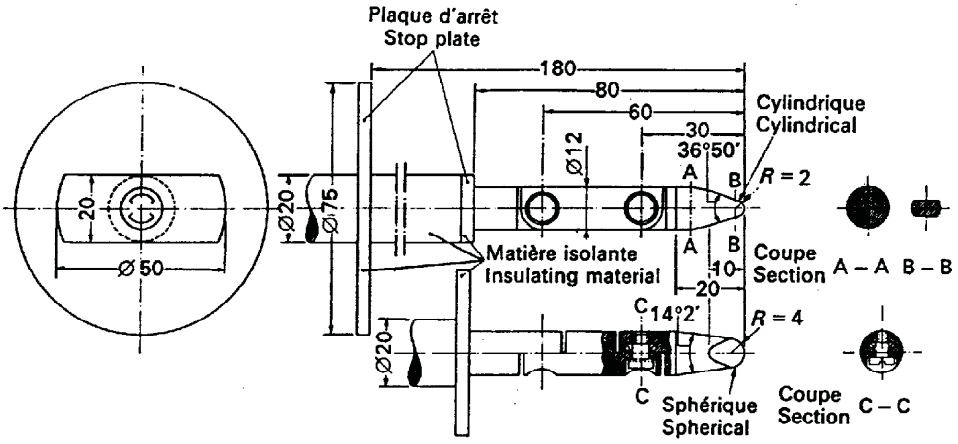
For small helical springs and the like, and for parts exposed to abrasion, a layer of grease may provide sufficient protection against rusting. Such parts are only subjected to the test if there is doubt about the effectiveness of the grease film, and the test is then made without previous removal of the grease.

32. Radiation, toxicity and similar hazards

32.1 Appliances shall not emit harmful radiation or present a toxic or similar hazard.

Compliance is checked by a suitable test if necessary.

A test is not yet available.



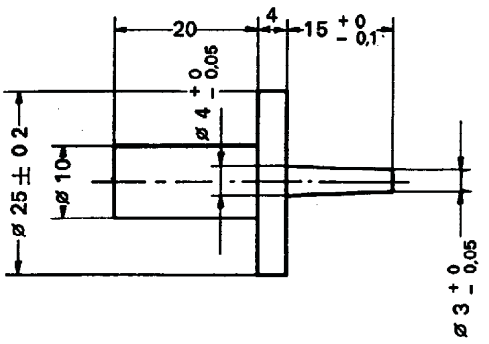
Dimensions en millimètres

Tolérances:
sur les angles ± 5'
sur les dimensions:
inférieures à 25 mm: $^{+0}_{-0,05}$
supérieures à 25 mm: ± 0,2

Dimensions in millimetres

Tolerances:
on angles ± 5'
on linear dimensions:
less than 25 mm: $^{+0}_{-0.05}$
over 25 mm: ± 0.2

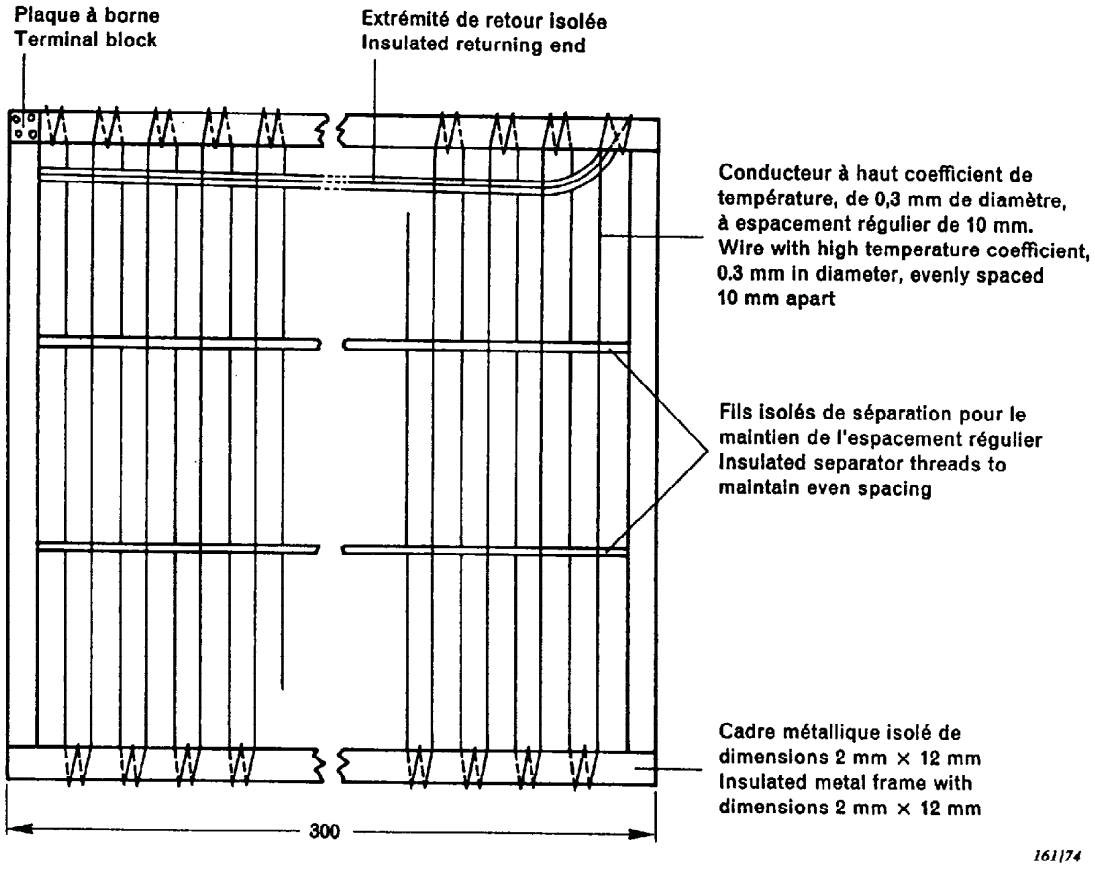
FIG. 1. — Doigt d'épreuve pour l'essai du paragraphe 8.1.
Standard test finger for the test of Sub-clause 8.1.



Dimensions en millimètres

Dimensions in millimetres

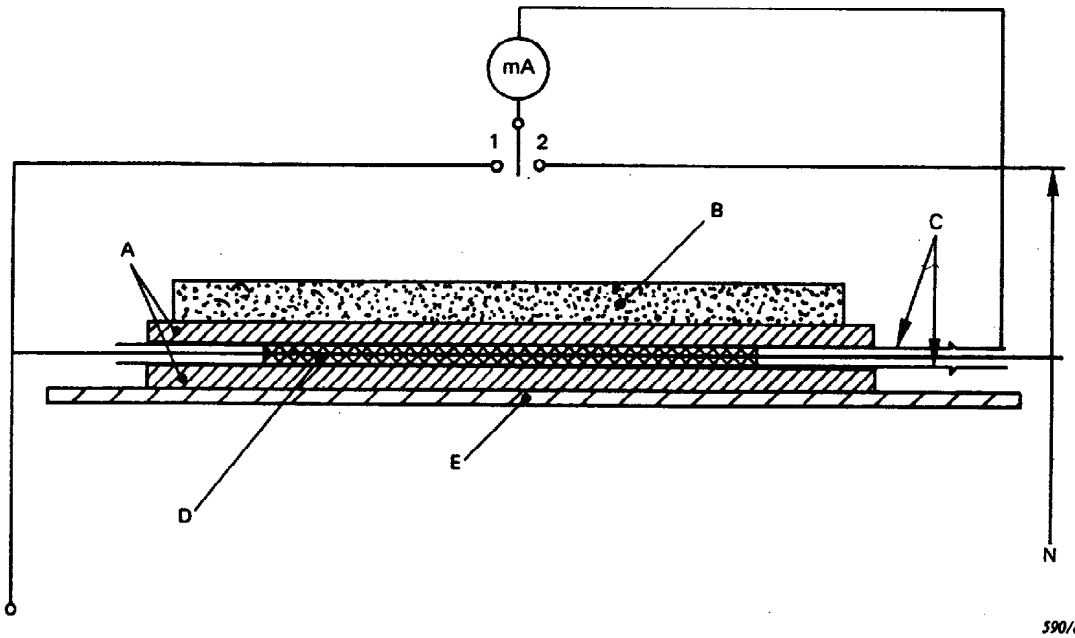
FIG. 2. — Broche d'essai pour l'essai du paragraphe 8.1.
Test pin for the test of Sub-clause 8.1.



Dimensions en millimètres

Dimensions in millimetres

FIG. 3. — Grille pour l'essai de brûlure du paragraphe 11.7.
Grid for the heatstroke test of Sub-clause 11.7.



A – Couches de tissu de recouvrement	A – Sheets of lagging material
B – Masse distribuée uniformément	B – Uniformly distributed mass
C – Feuilles d'aluminium	C – Sheets of aluminium foil
D – Matelas ou coussin en essai	D – Blanket or pad under test
E – Support en contre-plaqué	E – Plywood support

FIG. 4. — Schéma pour la mesure du courant de fuite de la partie souple pour l'essai du paragraphe 13.2.
Diagram for measurement of leakage current of the flexible part for the test of Sub-clause 13.2.

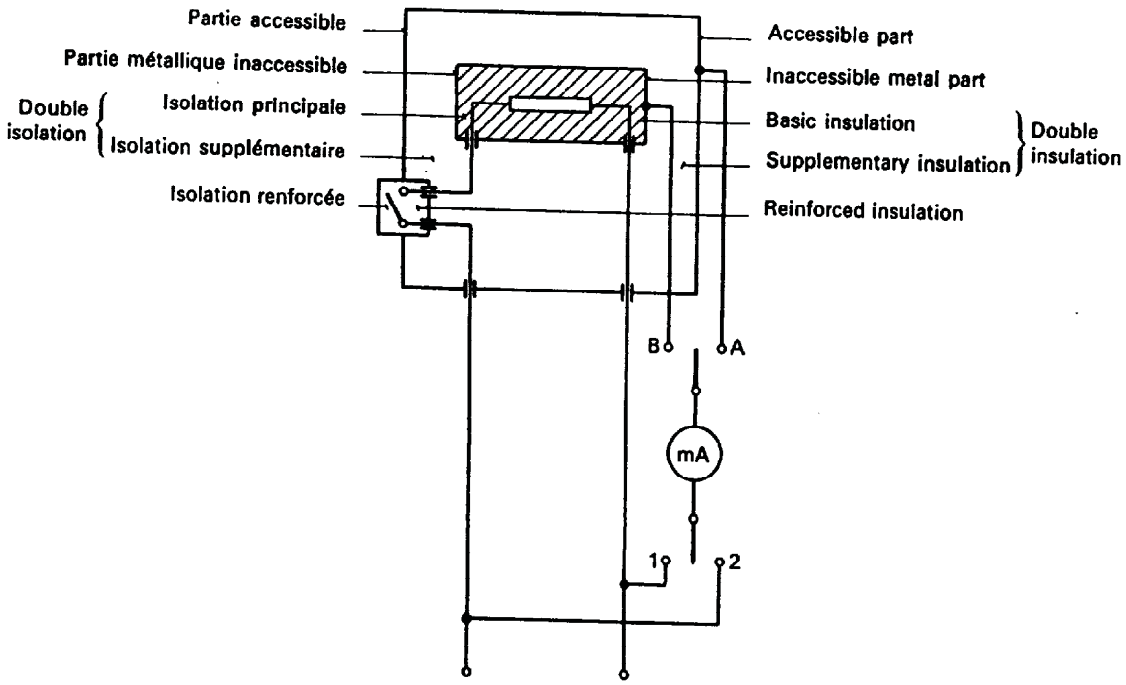


FIG. 5. — Schéma pour la mesure du courant de fuite des unités de commande pour l'essai du paragraphe 13.3.
Diagram for measurement of leakage current of the control unit for the test of Sub-clause 13.3.

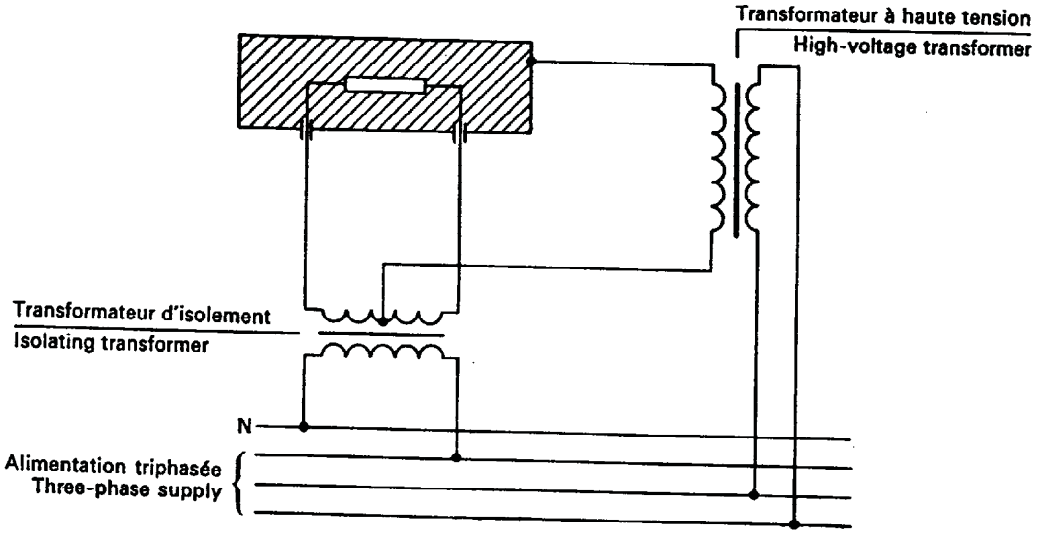
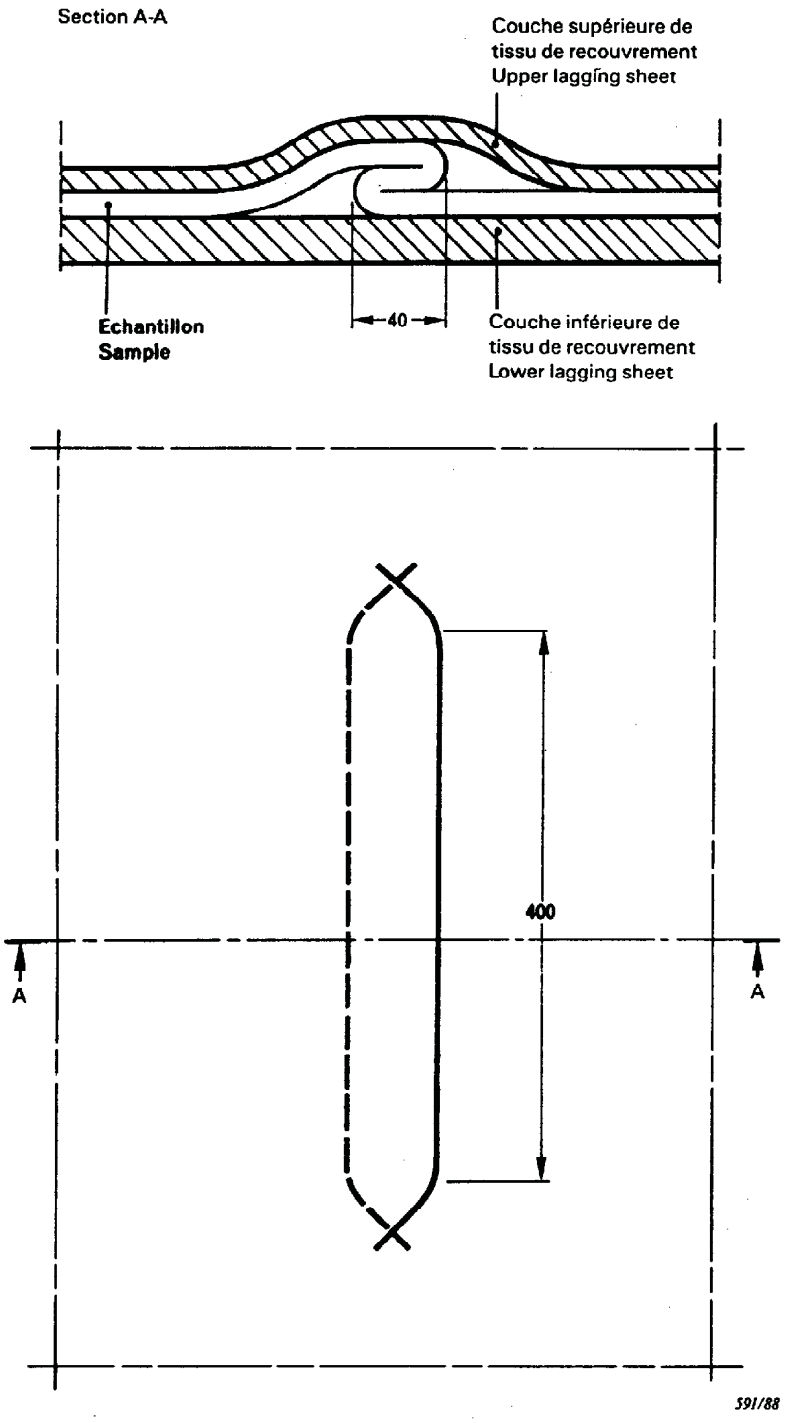


FIG. 6. — Schéma pour l'essai diélectrique pour l'essai du paragraphe 13.4.
Diagram for electric-strength test for the test of Sub-clause 13.4.



Dimensions en millimètres *Dimensions in millimetres*

FIG. 7. — Méthode de pliage pour l'essai du paragraphe 19.2.
Method of folding blankets for the test of Sub-clause 19.2.

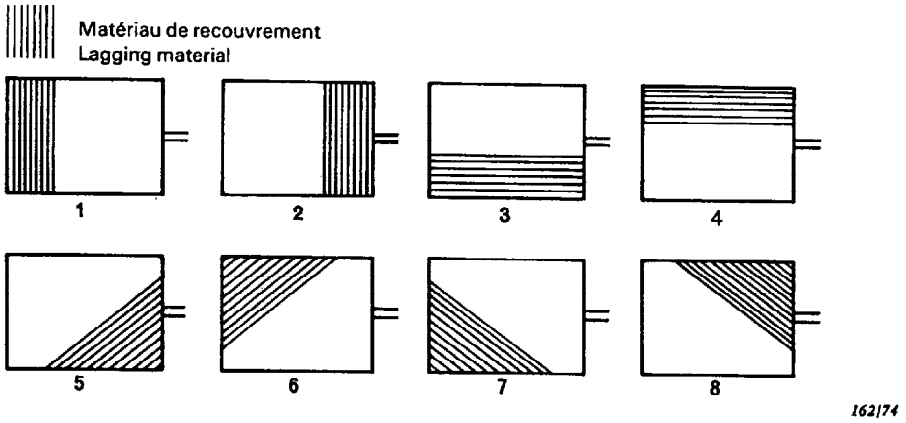


FIG. 8. — Positions de la couche supérieure de matériau de recouvrement pour l'essai du paragraphe 19.5.
Positions of upper sheet of lagging material for the test of Sub-clause 19.5.

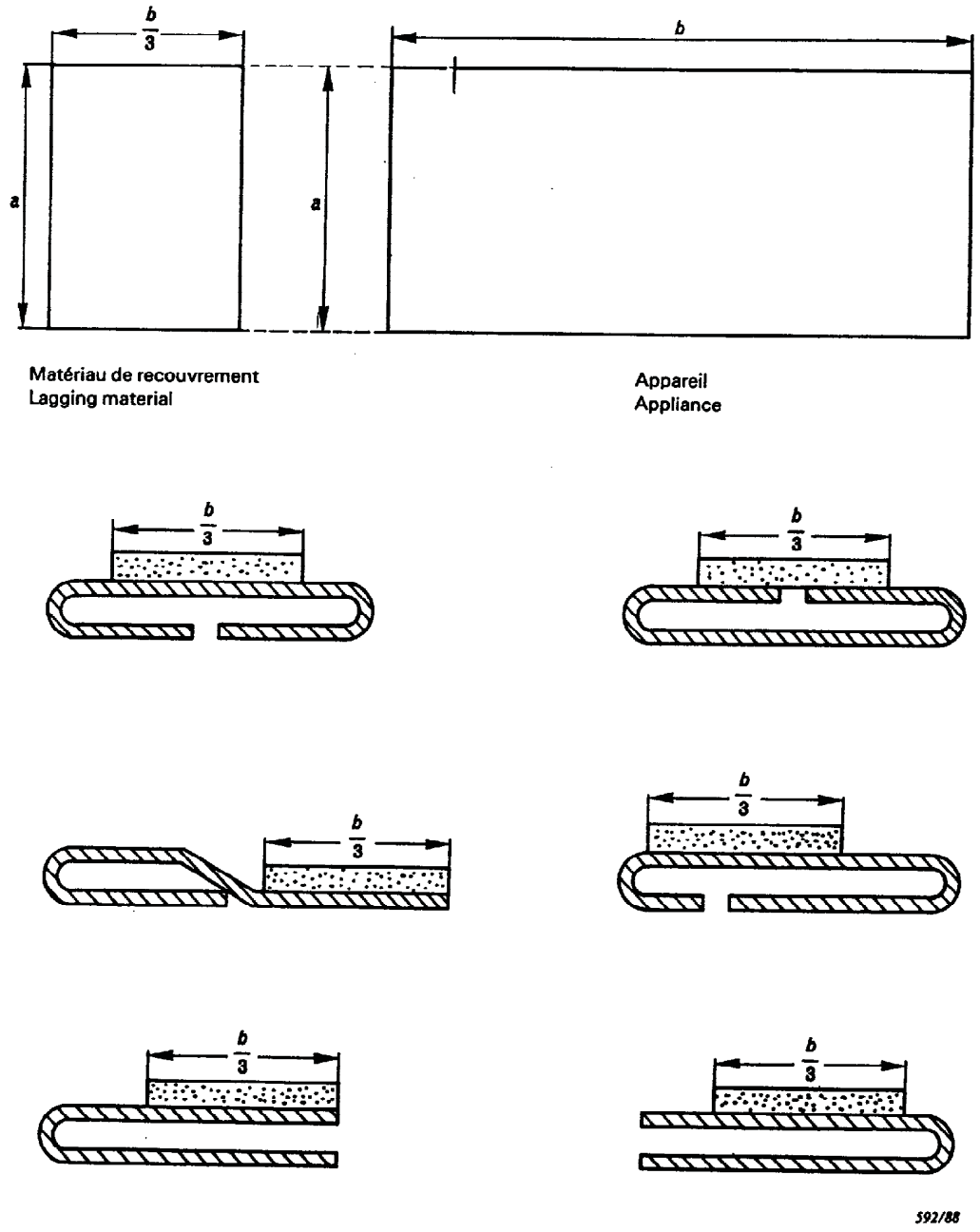
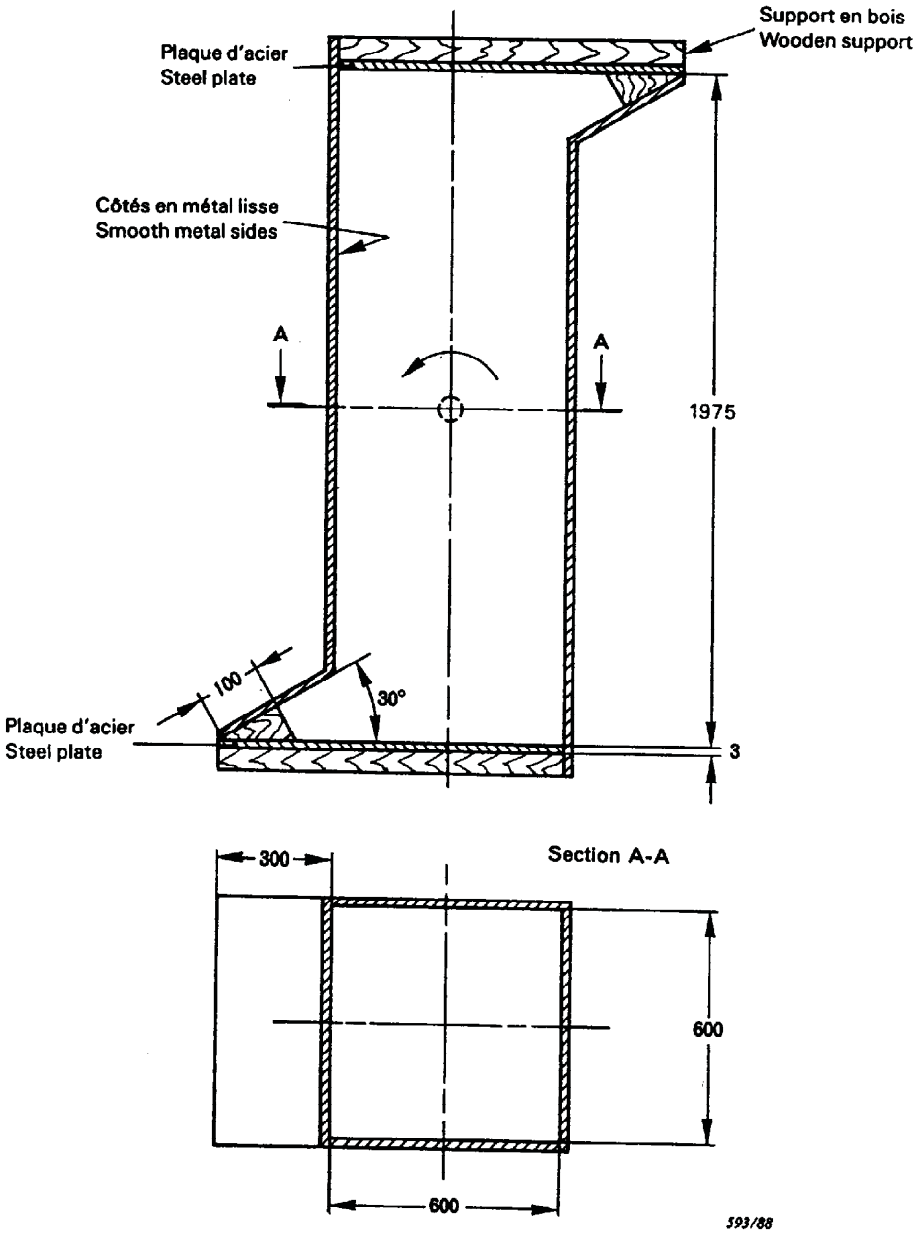


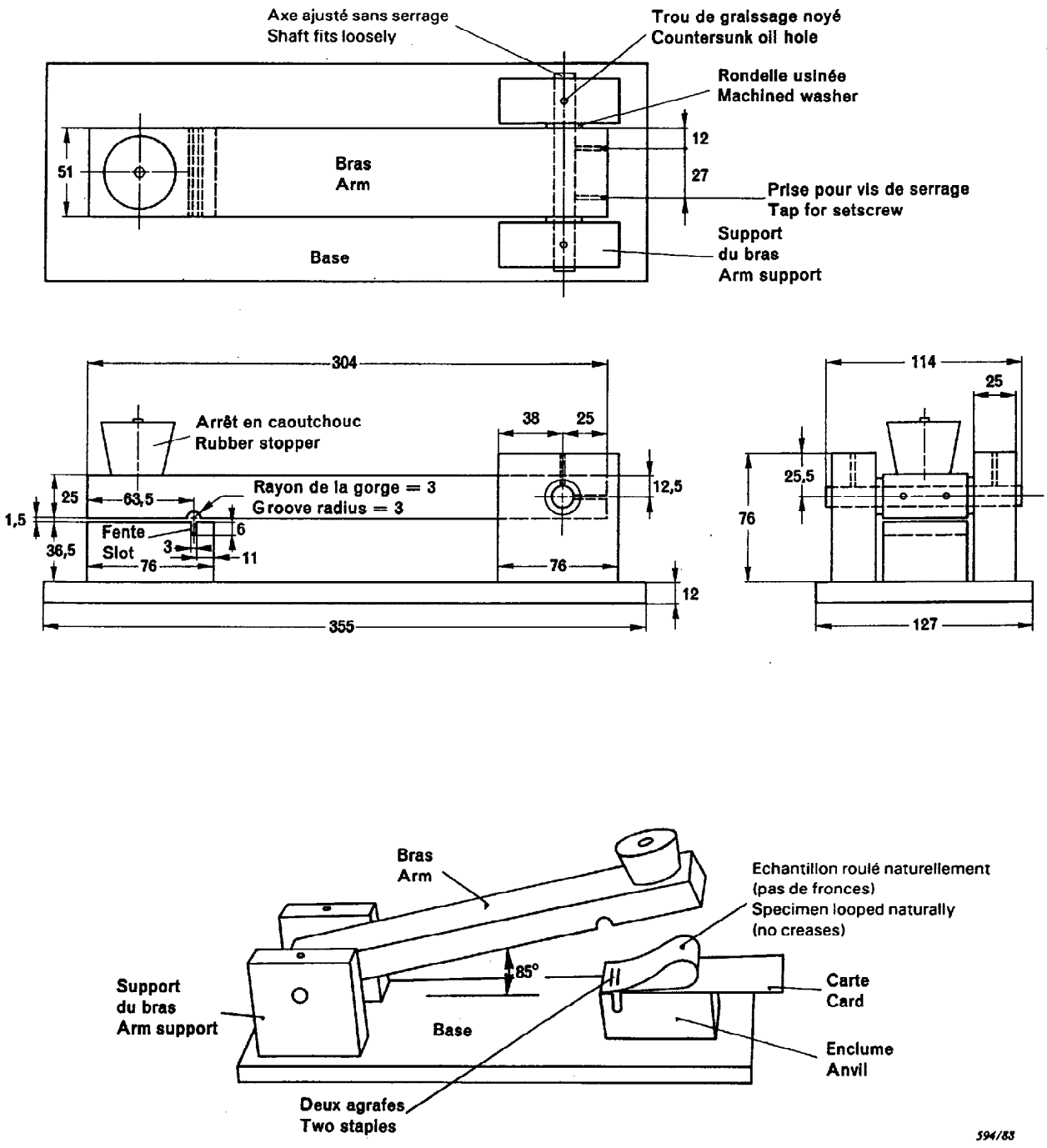
FIG. 9. — Exemples de plis réalisés pour l'essai du paragraphe 19.6.
Examples of folds for the test of Sub-clause 19.6.



Dimensions en millimètres

Dimensions in millimetres

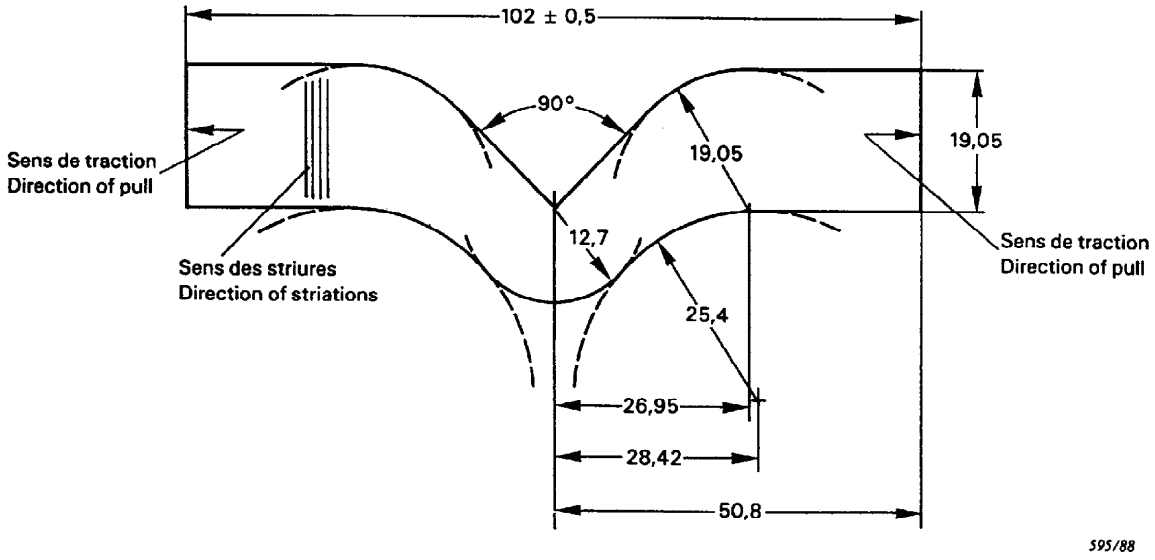
FIG. 10. — Tambour tournant pour l'essai des coussins du paragraphe 21.7.
Tumbling barrel for testing pads to Sub-clause 21.7.



Dimensions en millimètres
Tolérances ±0,5

Dimensions in millimetres
Tolerances ±0.5

FIG. 11. — Dispositif de chocs pour l'essai des housses de coussins à l'épreuve de l'humidité du paragraphe 21.10.
Impact apparatus for testing enclosures of moisture-proof pads tested to Sub-clause 21.10.



Dimensions en millimètres
Tolérances ± 0,05 sauf indication contraire

Dimensions in millimetres
Tolerances ± 0.05 unless otherwise shown

FIG. 12. — Forme de l'échantillon pour l'essai de résistance au déchirement du paragraphe 21.12.
Specimen shape for tear resistance test of Sub-clause 21.12.

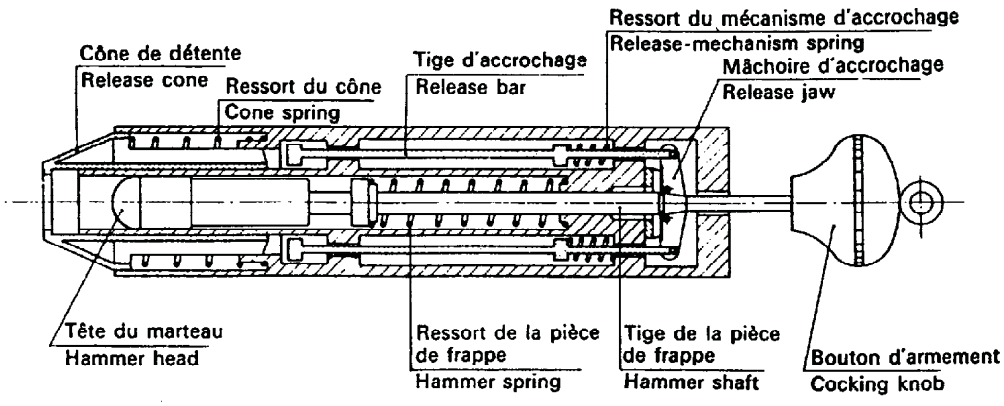
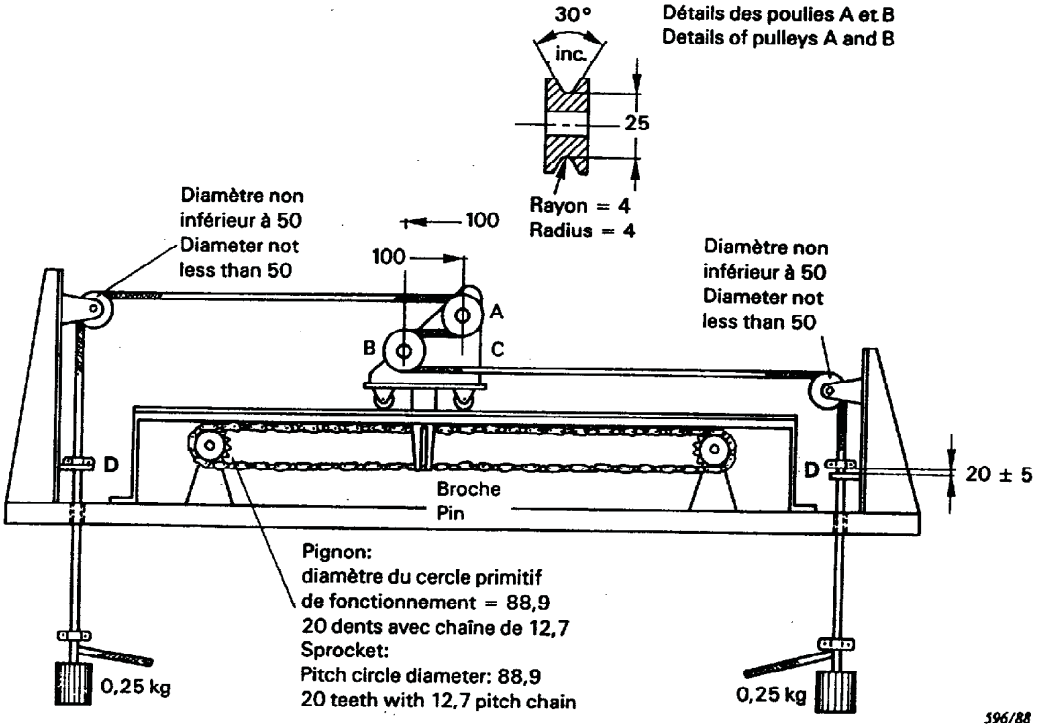


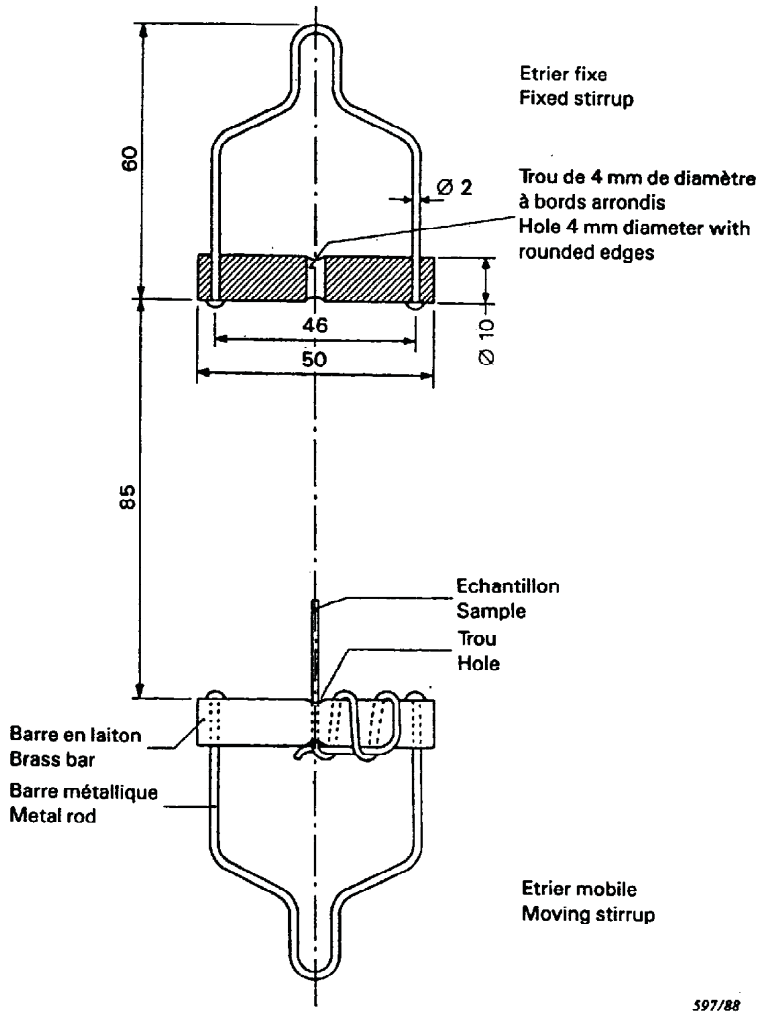
FIG. 13. — Appareil d'essai de choc à ressort pour l'essai du paragraphe 21.17.
Spring-operated impact-test apparatus for the test of Sub-clause 21.17.



Dimensions en millimètres

Dimensions in millimetres

FIG. 14. — Appareil de pliage des éléments chauffants et des conducteurs internes du paragraphe 21.20.
Apparatus for the flexing test on heating elements and internal wiring of Sub-clause 21.20.



Dimensions en mm *Dimensions in mm*

FIG. 15. — Etriers pour l'essai de traction du paragraphe 21.21.
Stirrups for the tensile test of Sub-clause 21.21.

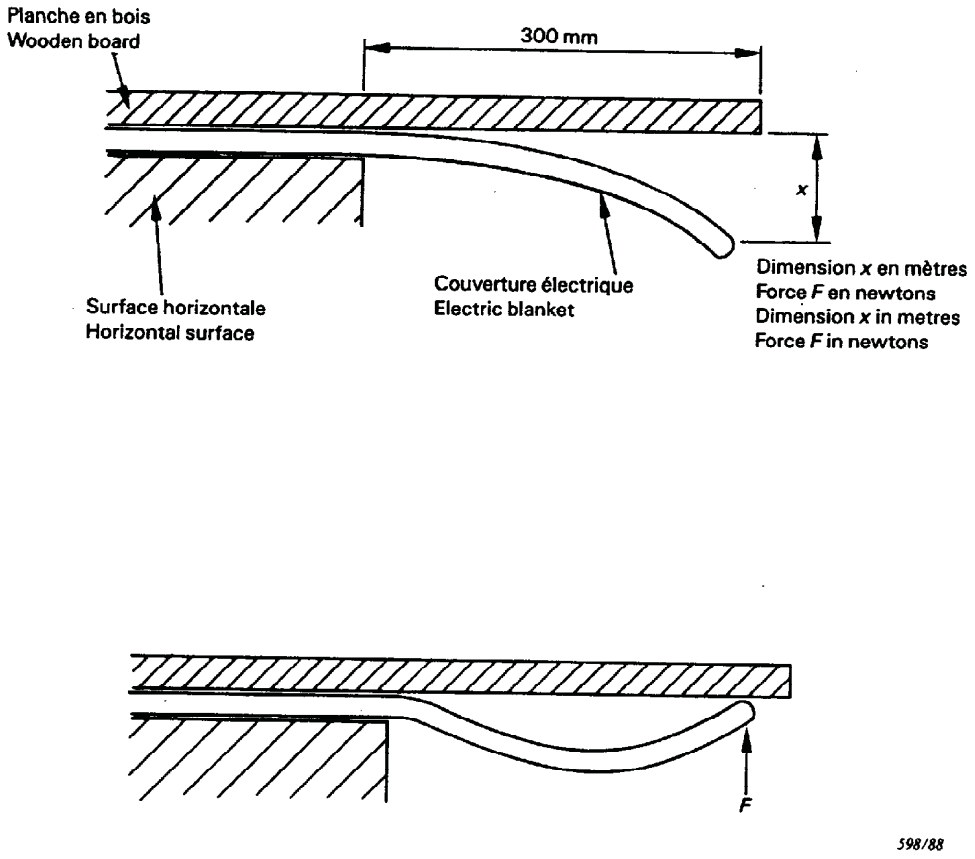


FIG. 16. — Positions de la couverture pendant l'essai de résistance au froissage du paragraphe 22.16.
Positions of blanket for ruck-resistance test of Sub-clause 22.16.

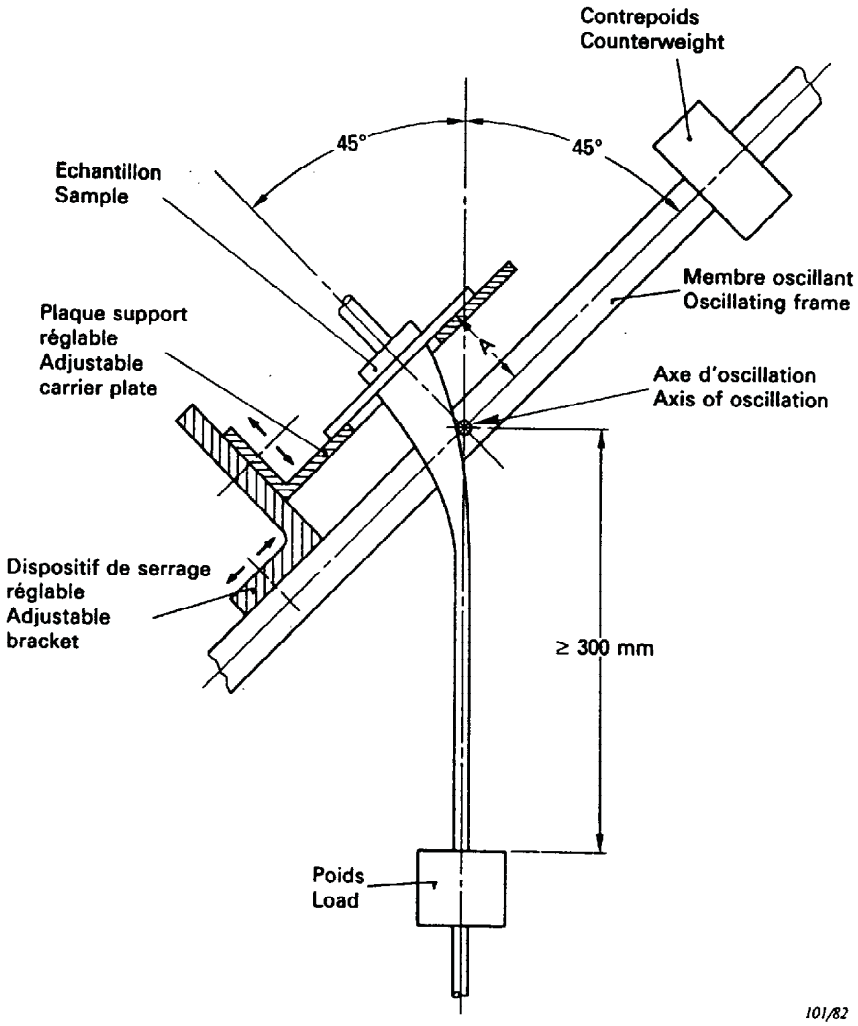
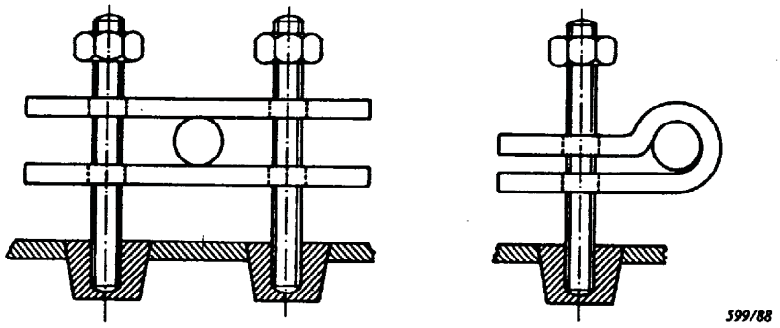
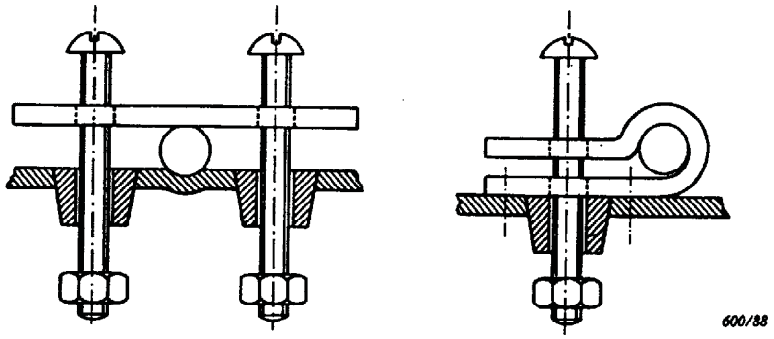


FIG. 17. — Appareil pour l'essai de flexion du paragraphe 25.9.
Apparatus for the flexing test of Sub-clause 25.9.

CONSTRUCTIONS SATISFAISANTES – ACCEPTABLE CONSTRUCTIONS



Goujons fixés de façon sûre à l'appareil
Studs securely attached to the appliance



Partie de l'appareil en matière isolante et de forme telle qu'il est évident qu'elle fait partie du dispositif de serrage du câble.

Part of appliance of insulating material and so-shaped that it obviously forms part of a cord clamp.

Dispositif de serrage du câble fixé à l'appareil ou les collerettes qui en font partie.

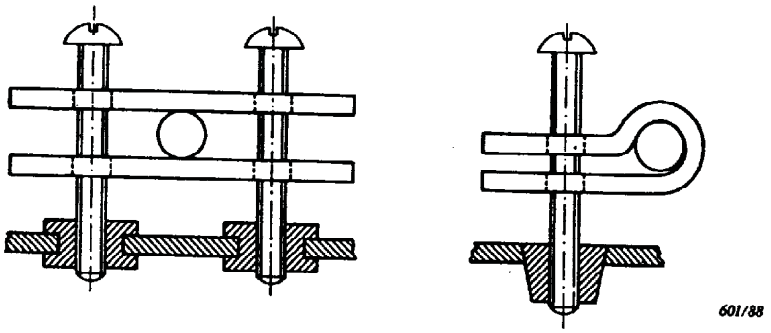
One of the clamping members is fixed to the appliance.

Les vis de serrage peuvent traverser dans des trous filetés dans l'appareil, ou des trous libres pour être fixées par des écrous.

Clamping screws may pass into threaded holes in the appliance or through clearance holes, where they are secured by nuts.

FIG. 18. — Exemples de dispositifs d'arrêt de traction et de tension (voir paragraphe 25.10) (constructions satisfaisantes).
Schematic representation of cord anchorages (see Sub-clause 25.10) (acceptable constructions).

CONSTRUCTIONS NON SATISFAISANTES – UNACCEPTABLE CONSTRUCTIONS



Les vis traversant des trous filetés dans l'appareil (ou les vis traversant des trous libres dans l'appareil et fixés par des écrous) ne sont pas non plus acceptables.

Screws passing through threaded holes in the appliance (or screws passing through clearance holes in the appliance and secured by nuts) are equally unacceptable.

FIG. 18. — *Fin* (constructions non satisfaisantes).
Concluded (unacceptable constructions).

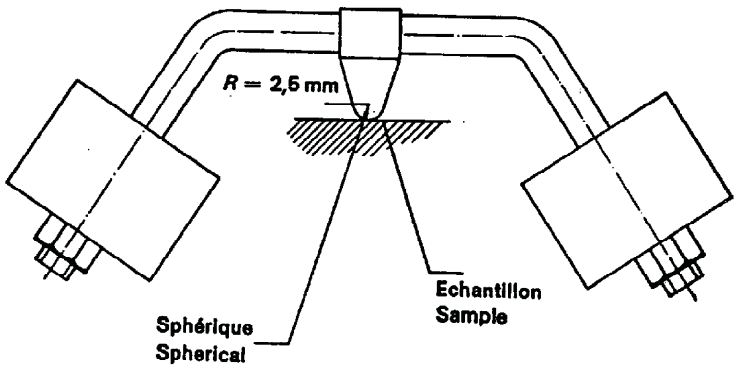


FIG. 19. — Appareil pour l'essai à la bille du paragraphe 30.3
Ball-pressure apparatus for the test of Sub-clause 30.3

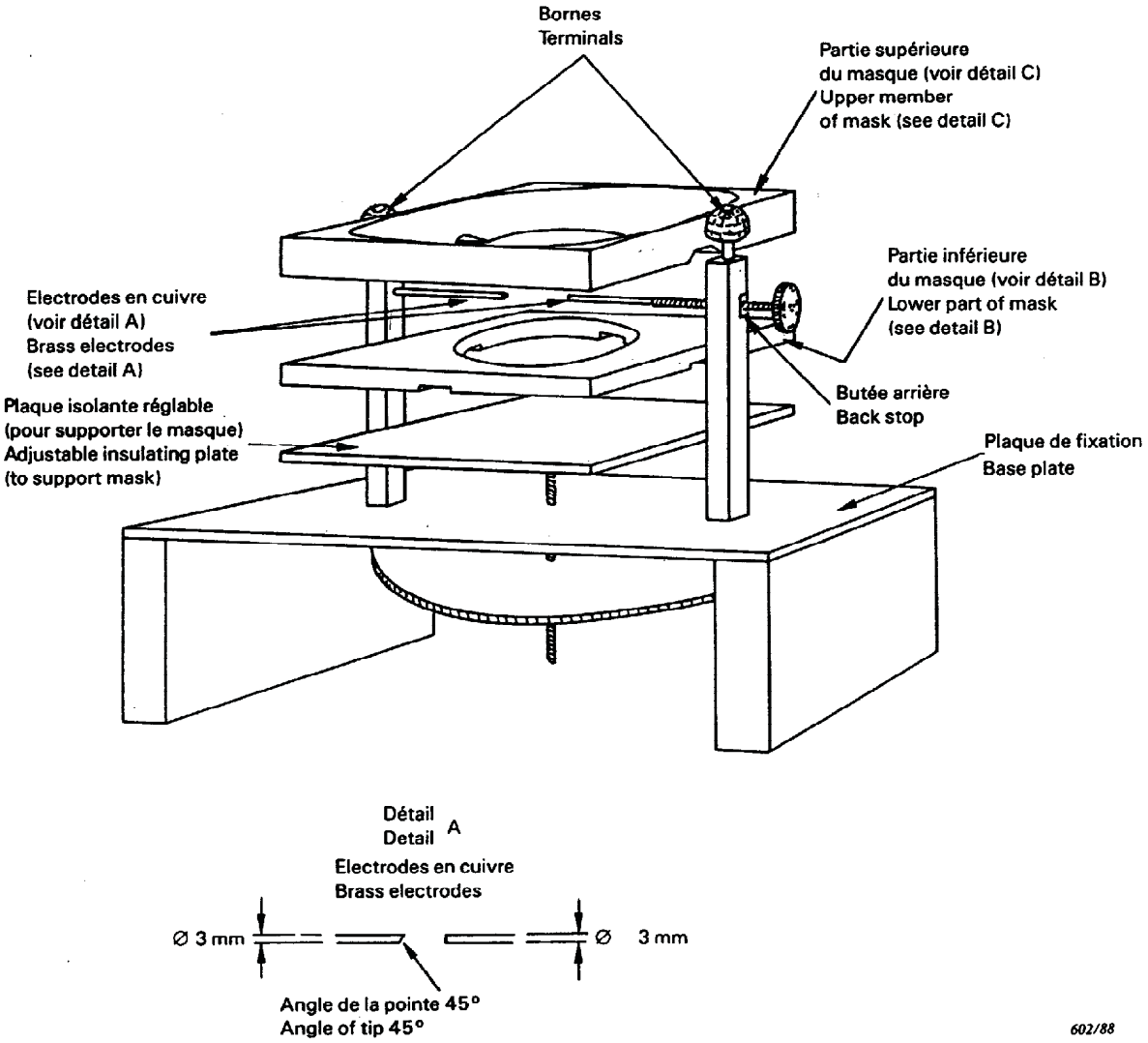
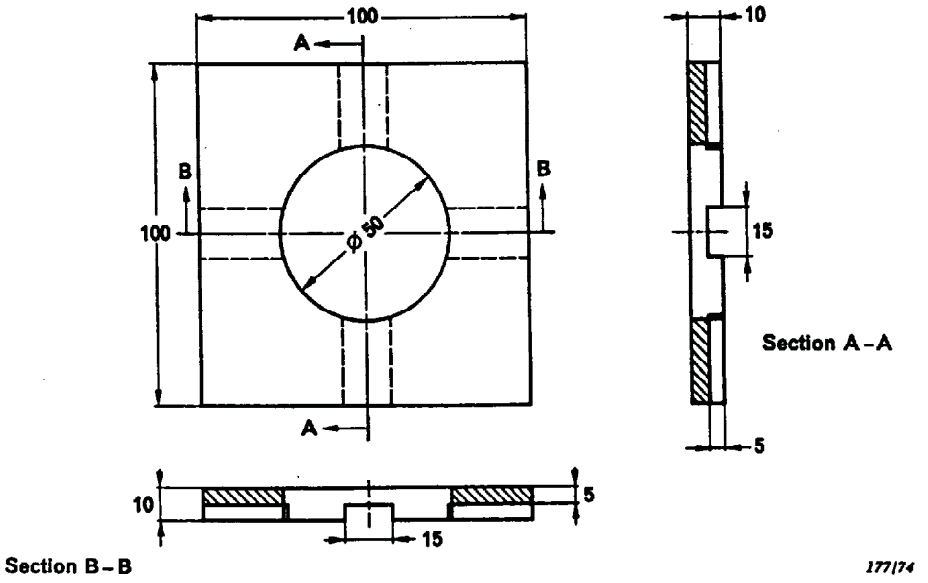


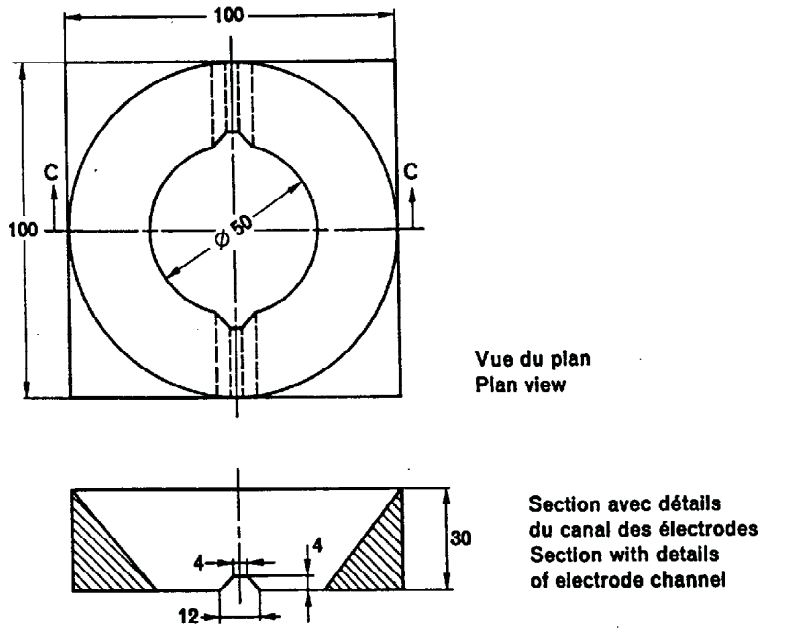
FIG. 20. — Appareil pour l'essai d'amorçage d'étincelles du paragraphe **30.1** *(suite page suivante).*
Apparatus for spark-iginition test of Sub-clause **30.1** *(continuation on next page).*



Dimensions en millimètres

Dimensions in millimetres

Detail B — Partie inférieure du masque
Lower member of mask



Dimensions en millimètres

Dimensions in millimetres.

Poids approximatif 100 g. Si nécessaire, la hauteur peut être réduite ou des poids ajoutés en prenant soin de ne pas ménager un chemin basse résistance entre les électrodes.

Weight approximately 100 g. If necessary, the height may be reduced or weights added, care being taken not to provide a low-resistance path between the electrodes.

Detail C — Partie supérieure du masque
Upper member of mask

FIG. 20. — *Fin/Concluded*

APPENDIX B

ELECTRONIC CIRCUITS

B1. Scope

This appendix applies to circuits comprising at least one electronic component.

B2. Definitions

Additional definitions:

B2.101 *Electronic component* denotes a part in which conduction is achieved principally by electrons moving through a vacuum, gas or semi-conductor.

B2.102 *Protective impedance* denotes an impedance connected between live parts and accessible conductive parts and of a value such that the current, in normal use and under likely fault conditions in the appliance, is limited to a safe value.

B4. General notes on tests

Addition:

B4.1 *All clauses of this standard, as modified in this appendix, apply to electronic circuits.*

Addition:

B4.2 *The accumulation of stress resulting from successive tests is to be avoided. It may be necessary to replace components or to use additional samples.*

The number of additional samples should be kept to a minimum by an evaluation of the relevant circuits.

Additional sub-clause:

B4.101 *Care is to be taken that the supply is free from such perturbations from external sources that can influence the results of the tests.*

B8. Protection against electric shock

B8.1 The explanation concerning safety extra-low voltage is not applicable.

Addition:

An accessible part is not considered to be live if:

- the part is supplied from a safety isolating transformer, provided that:
  - for a.c. the peak value of the voltage does not exceed 42.4 V;
  - for d.c. the voltage does not exceed 42.4;

or,

- the part is separated from live parts by protective impedance.

In the case of protective impedance, the current between the part and the supply source shall not exceed 2 mA for d.c. and its peak value shall not exceed 0.7 mA for a.c., and moreover:

- for voltages having a peak value over 42.4 V up to and including 450 V the capacitance shall not exceed 0.1 μF;
- for voltages having a peak value over 450 V up to and including 15 kV the discharge shall not exceed 45 μC.

Voltages and currents are measured between the relevant parts and either pole of the supply source. Discharges are measured immediately after the interruption of the supply.

The circuit for measuring the current has a total resistance of 1750 ± 250 Ω and is shunted by a capacitor such that the time constant of the circuit is 225 ± 15 μs. Details of a suitable circuit are given in Appendix G.

The measuring circuit has an accuracy within 5% for all frequencies in the range of 20 Hz to 5 000 Hz.

For voltages having a peak value over 15 kV other requirements are under consideration.

B8.4 *Addition:*

This requirement does not apply to capacitors complying with the requirement for protective impedance.

B11. Heating

B11.6 *Addition to the table:*

	Temperature rise (K)
Capacitors complying with IEC Publication 384-14 or Sub-clause 14.2 of HD 195	50
Printed circuits boards bonded with epoxy resin	120

Addition:

There is no limit for the temperature rise of capacitors which are short-circuited in Clause B19..

B13. Electrical insulation and leakage current at operating temperature

B13.1 *Addition:*

Protective impedance is disconnected from live parts before carrying out the tests.

B16. **Insulation resistance and electric strength**

B16.1 *Addition:*

Protective impedance is disconnected from live parts before carrying out the tests.

B16.4 *Addition:*

The electric strength test between parts of different polarity is not made if the requirements of Clause B19 are met with the parts short-circuited.

B19. **Abnormal operation**

Additional sub-clauses:

B19.101 Electronic circuits shall be so designed and applied that a fault condition will not render the appliance unsafe with regard to electric shock, fire hazard, mechanical hazard or dangerous malfunction.

Compliance is checked by evaluation of the fault conditions specified in Sub-clause B19.103 for all circuits or parts of circuits, unless they comply with the conditions specified in Sub-clause B19.102.

If the safety of the appliance under any of the fault conditions depends on the operation of a miniature fuse-link complying with HD 109, the test of Sub-clause B19.104 is made.

During and after each test, the temperature of windings shall not exceed the values specified in the table of Sub-clause 17.1 and the appliance shall comply with the conditions specified in Sub-clause 19.9. In particular, live parts shall not be accessible to the standard test finger or the test pin, as specified in Sub-clause 8.1. Any current flowing through protective impedance shall not exceed the limits specified in Sub-clause B8.1.

If a conductor of a printed circuit board becomes open-circuited, the appliance is considered to have withstood the particular test, provided all three of the following conditions are met:

- *the material of the printed circuit board withstands the burning test of Sub-clause 20.1 of HD 195;*

- *any loosened conductor does not reduce the creepage distances or clearances between live parts and accessible metal parts below the values specified in Clause B29;*

- *the appliance withstands the tests of Sub-clause B19.103 with the open-circuited conductor bridged.*

Unless it is necessary to replace components after any of the tests, the electric strength test of Sub-clause 19.9 need only be carried out after the final test on the electronic circuit.

In general, examination of the appliance and its circuit diagram will reveal the fault conditions which have to be simulated, so that testing can be limited to those cases which may be expected to give the most unfavourable result.

In certain cases, it may be preferable to simulate all fault conditions rather than to analyse the circuit diagram.

B19.102 *Fault conditions 1) to 6) specified in Sub-clause B19.103 are not applied to circuits or parts of circuits where both of the following conditions are met:*

- *the electronic circuit is a low-power circuit as described below;*
- *the protection against electric shock, fire hazard, mechanical hazard or dangerous malfunction in other parts of the appliance does not rely on the correct functioning of the electronic circuit.*

A low-power circuit is determined as follows; an example is shown in Figure B1.

The appliance is operated at rated voltage or at the upper limit of the rated voltage range and a variable resistor, adjusted to its maximum resistance, is connected between the point to be investigated and the opposite pole of the supply source.

The resistance is then decreased until the power consumed by the resistor reaches a maximum. Any point nearest to the supply at which the maximum power delivered to this resistor does not exceed 15 W at the end of 5 s is called a low power point. The part of the circuit farther from the supply source than a low power point is considered to be a low-power circuit.

The measurements are made from only one pole of the supply source, preferably the one that gives the fewest low power points.

When determining the low power points, it is recommended to start with points close to the supply source.

The power consumed by the variable resistor is measured by a wattmeter.

B19.103 *The following fault conditions are considered and, if necessary, applied one at a time. Consequential faults are taken into consideration.*

1) Short-circuit of creepage distances and clearances between live parts of different polarity, if these distances are less than the values specified in Clause B29, unless the relevant part is adequately encapsulated.

2) Short-circuit between live parts of different polarity across insulation which does not withstand the tests of Clause 16.

3) Open-circuit at the terminals of any component.

4) Short-circuit of capacitors, unless they comply with IEC Publication 384-14 or Sub-clause 14.2 of HD 195

5) Short-circuit of any two terminals of an electronic component, other than integrated circuits.

6) Failure of an integrated circuit. In this case the possible hazardous situations of the appliance are assessed to ensure that safety does not rely on the correct functioning of such a component.

1 *7) Failure of triacs in the diode mode.*

All possible output signals are considered under fault conditions within the integrated circuit. If it can be shown that a particular output signal is unlikely to occur, then the relevant fault is not considered.

Microprocessors are regarded as integrated circuits.

In addition, each low-power circuit is short-circuited by connecting the low power point to the pole of the supply from which the measurements were made.

For simulation of the fault conditions, the appliance is operated under the conditions specified in Clause 11, but at rated voltage or at the most unfavourable voltage within the rated voltage range.

When any of the fault conditions are simulated, the test is carried out until steady conditions are established.

In each case, the test is ended if interruption of the supply occurs within the appliance.

Fault condition 5) is not applied between the two circuits of an optocoupler.

If the appliance incorporates an electronic circuit which operates to ensure compliance with Clause 19, other than Sub-clause 19.3, the relevant test is repeated with a single fault simulated, as indicated in 1) to 6) above.

Fault condition 6) is applied to encapsulated and similar components if the circuit cannot be assessed by other methods.

Positive Temperature Coefficient resistors (PTC's), Negative Temperature Coefficient resistors (NTC's) and Voltage Dependent Resistors (VDR's) are not short-circuited if they are used within their manufacturer's declared specification.

B19.104 *If, for any of the fault conditions specified in Sub-clause B19.103, the safety of the appliance depends on the operation of a miniature fuse-link complying with HD 109, the test is repeated but with the miniature fuse-link is replaced by an ammeter.*

If the current measured does not exceed 2.1 times the rated current of the fuse-link, the circuit is not considered to be adequately protected and the test is carried out with the fuse-link short-circuited.

If the current measured is at least 2.75 times the rated current of the fuse-link, the circuit is considered to be adequately protected.

If the current measured exceeds 2.1 times the rated current of the fuse-link, but does not exceed 2.75 times the rated current, the fuse-link is short-circuited and the test is carried out

– for quick acting fuse-links for 30 min;

– for time lag fuse-links for 2 min.

In case of doubt, the maximum resistance of the fuse-link has to be taken into account when determining the current.

The verification whether the fuse-link acts as a protecting device is based on the fusing characteristics specified in HD 109 which also gives the information necessary to calculate the maximum resistance of the fuse-link.

Other fuses are considered as intentionally weak parts in accordance with Sub-clause 19.1.

B22. **Construction**

B22.4 *Addition:*

Parts separated by protective impedance shall comply with the requirements for double or reinforced insulation.

B22.5 *Addition:*

Reinforced insulation is allowed for parts separated by a SELV transformer or protective impedance and for parts separated by an optocoupler.

Additional sub-clause:

B22.101 Protective impedance shall consist of at least two separate components the impedance of which is unlikely to change significantly during the lifetime of the appliance. If one of the components is short-circuited or open-circuited, the values specified in Sub-clause B8.1 shall not be exceeded.

Compliance is checked by inspection and by measurement.

Resistors complying with Sub-clause 14.1 and capacitors complying with Sub-clause 14.2 of HD 195 are considered to comply with this requirement.

B29. **Creepage distances, clearances and distances through insulation**

B29.1 *Addition:*

For conductive patterns on printed circuit boards, except at their edges, the values in the table between parts of different polarity may be reduced as long as the peak value of the voltage stress does not exceed:

- *150 V per mm with a minimum distance of 0.2 mm, if protected against the deposition of dirt;*
- *100 V per mm with a minimum distance of 0.5 mm, if not protected against the deposition of dirt.*

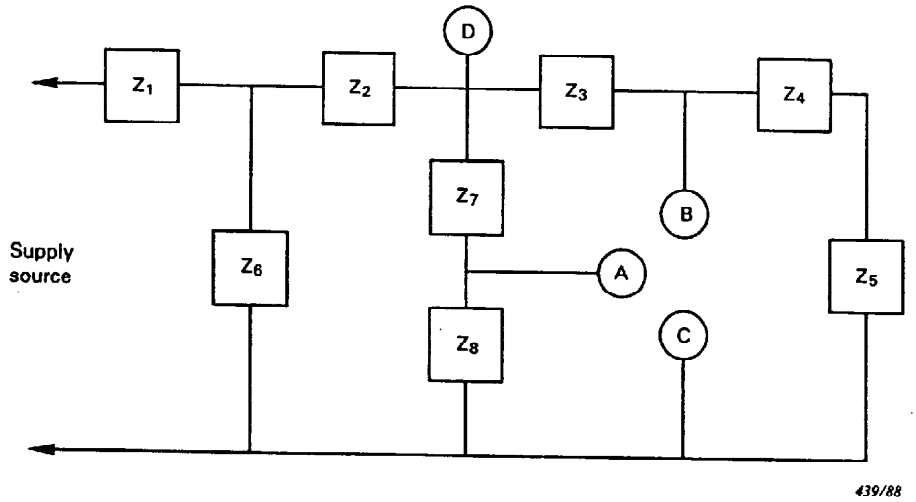
For peak voltages exceeding 50 V the reduced creepage distances only apply if the Proof Tracking Index (PTI) of the printed circuit board measured according to HD 214 is greater than 175.

These distances may be reduced further provided that the appliance complies with the requirements of Clause B19 when the distances are short-circuited in turn.

When the limits mentioned above lead to higher values than those of the table, the values of the table apply.

For live parts of different polarity separated by basic insulation only, creepage distances and clearances smaller than those specified in the table are allowed provided the requirements of Clause B19 are met if these creepage distances and clearances are short-circuited in turn.

Creepage distances and clearances within optocouplers are not measured if the individual insulations are adequately sealed and if air is excluded between individual layers of the material.



D is a point farthest from the supply source where the maximum power delivered to external load exceeds 15 W.

A and B are points closest to the supply source where the maximum power delivered to external load does not exceed 15 W. These are low-power points.

Points A and B are separately short-circuited to C.

The fault conditions 1) to 6) specified in Sub-clause B19.103 are applied individually to Z_1, Z_2, Z_3, Z_6 and Z_7 where applicable.

FIG. B1. — Example of an electronic circuit with low power points.

APPENDIX C

Specification for the lagging material

The lagging material has the following composition:

Open-cell polyether;

Cell count	*18 + 2 per cm;*
Specific mass	*30 kg/m³ + 10 %;*
Hardness	*120 N - 170 N at 40 % impression measured according to ISO 2439.*

For determining the thickness of the sheets of lagging material to be used, an evenly distributed heat source having dimensions of 1 m x 1 m and an input of 100 W ± 2 W, is placed centrally between two layers of lagging material.

An oxidized copper plate, 65 mm x 65 mm and 0,5 mm thick to which a fine wire thermocouple is attached, is placed at the centre of the upper surface of the heat source.

The size of the sheets of lagging material is at least 1,2 m x 1,2 m.

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

- *25 K ± 1 K for over blankets for clause 11;*
- *60 K ± 2 K for under-blankets, pads and mattresses for clause 11 and 19.2, 19.4, 19.5 and 19.6;*

If the thickness of the lagging material below the heat source is regarded as 2 d, the approximate thickness of the lagging material 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;*

NOTES

1 The dimension d is approximately 36 mm.

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

3 If slight adjustments of the heat discharge are necessary, these can be achieved by adding a few sheets of suitable textile material.

4 No additional load is applied to the upper surface of the lagging material.

APPENDIX D

APPARATUS FOR THE MECHANICAL STRENGTH TEST FOR BLANKETS

The apparatus, as shown in Figure D1, 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 ± 2.5) mm and an ISO Standard Hardness of 40/50 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 D2. The drum is free to rotate about its carrier shaft.

Below the drum a square section bar 25 mm × 25 mm is attached so that it can freely rotate in carriers mounted in guide rails which 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 which 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 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, which carry a driving bar, pass over these sprockets and round the square-section bar in its lowest position.

The clamping bar, as shown in Figure D3, 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 which is tensioned by adding weights to the carriers so that the total mass of the bar assembly and carriers is 6 kg per metre of attached edge of the blanket or 6.5 kg, whichever is the greater. The webbing straps are adjusted so that the square section 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 power 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, so as to avoid damage to the apparatus.

The driving bar is separately driven. Both the drum and square sectional bar are rotated by means of the blanket passing over.

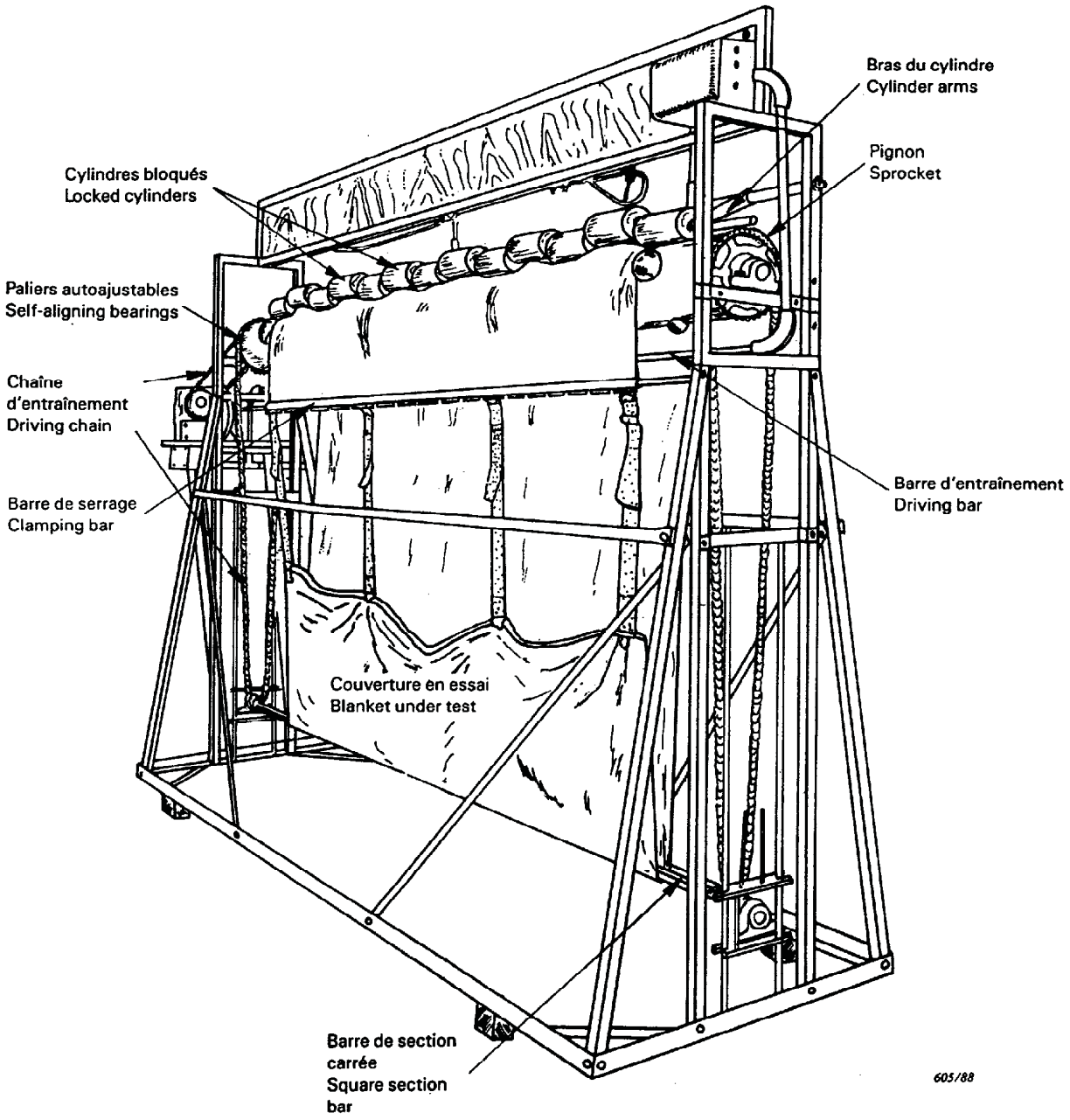


FIG. D1. — Appareil pour l'essai de résistance mécanique des couvertures.
Apparatus for mechanical strength test on blankets.

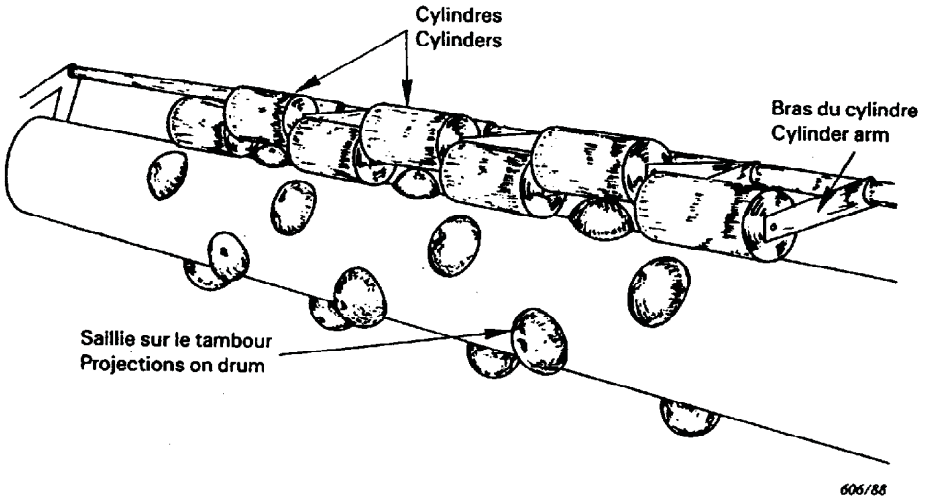
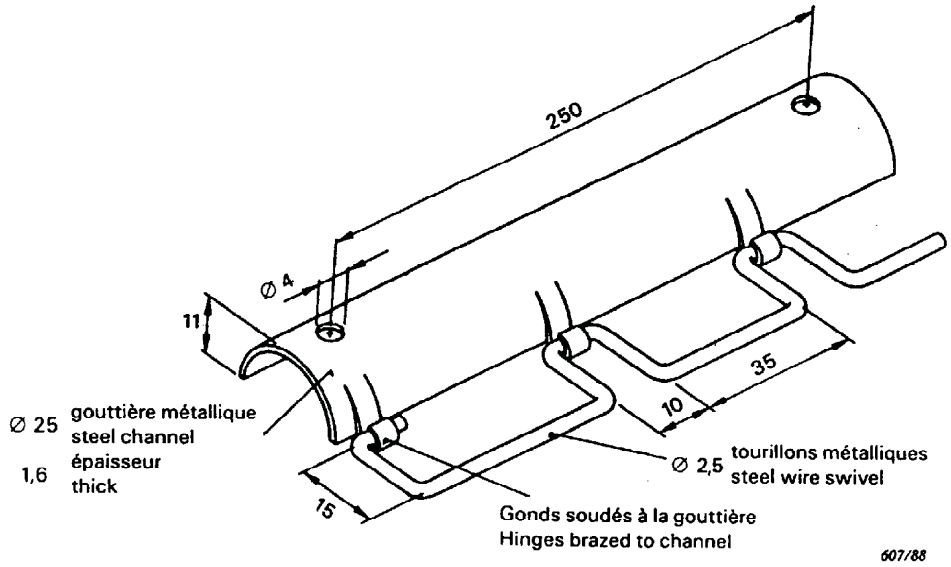


FIG. D2. — Détails du tambour et des cylindres.
Details of drum and cylinders.



Dimensions en millimètres *Dimensions in millimetres*

FIG. D3. — Détails de la barre de serrage.
Details of clamping bar.

APPENDIX E

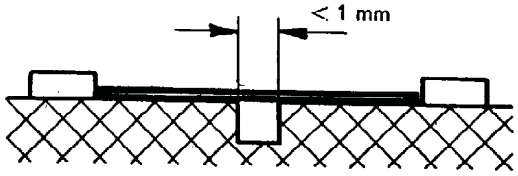
MEASUREMENT OF CREEPAGE DISTANCES AND CLEARANCES

The methods of measuring creepage distances and clearances to be used to interpret the requirements of Sub-clause 29.1 are indicated in Cases 1 to 10 of this appendix.

These cases do not differentiate between gaps and grooves or between types of insulation.

The following assumptions are made:

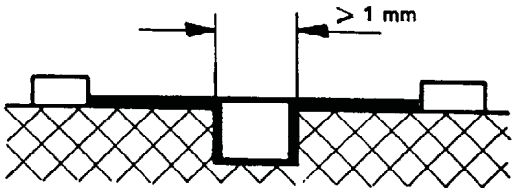
1. *A groove may have parallel, converging or diverging sides.*
2. *Any groove having diverging sides, a minimum width exceeding 0.25 mm, a depth exceeding 1.5 mm and a width at the bottom equal to or greater than 1 mm, is regarded as an air gap (see Case 8).*
3. *Any corner including an angle less than 80° is assumed to be bridged with an insulating link of 1 mm width (0.25 mm for dirt-free situations) moved into the most unfavourable position (see Case 3).*
4. *Where the distance across the top of a groove is 1 mm (0.25 mm for dirt-free situations) or more, no creepage distance exists across the air space (see Case 2).*
5. *A creepage path is assumed not to exist if there is an air gap as defined in Item 2 above exceeding 0.25 mm.*
6. *Creepage distances and clearances measured between parts moving relative to each other are measured when these parts are in their most unfavourable stationary positions.*
7. *A computed creepage distance is never less than a measured clearance.*
8. *Any air gap less than 1 mm (0.25 mm for dirt-free situations) is ignored in computing the total clearance.*



Condition: Path under consideration includes a parallel- or converging-sided groove of any depth with a width less than 1 mm.

Rule: Creepage distance and clearance are measured directly across the groove as shown.

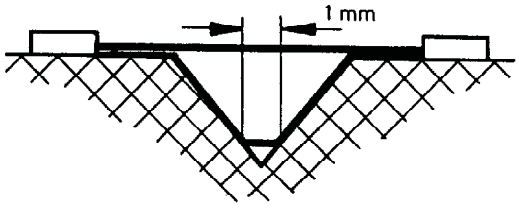
Case 1



Condition: Path under consideration includes a parallel-sided groove of any depth and equal to or more than 1 mm wide.

Rule: Clearance is the "line of sight" distance. Creepage path follows the contour of the groove.

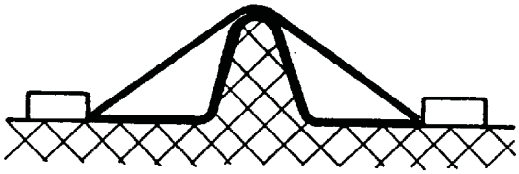
Case 2



Condition: Path under consideration includes a V-shaped groove with internal angle of less than 80° and with a width greater than 1 mm.

Rule: Clearance is the "line of sight" distance. Creepage path follows the contour of the groove but "short-circuits" the bottom of the groove by 1 mm (0.25 mm for dirt-free situations) link.

Case 3

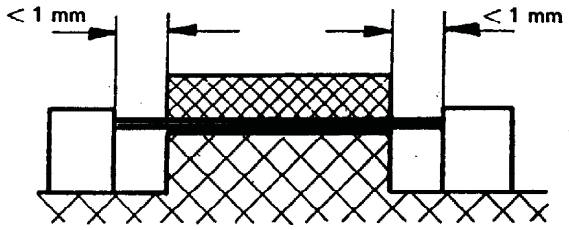


Condition: Path under consideration includes a rib.

Rule: Clearance is the shortest direct air path over the top of the rib. Creepage path follows the contour of the rib.

Case 4

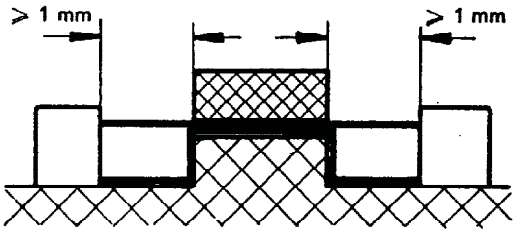
Clearance
Creepage distance



Condition: Path under consideration includes an uncemented joint with grooves less than 1 mm (0.25 mm for dirt-free situations) wide on either side.

Rule: Creepage and clearance path is the "line of sight" distance shown.

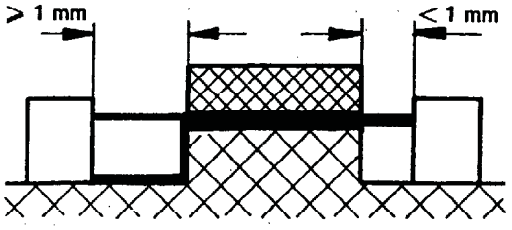
Case 5



Condition: Path under consideration includes an uncemented joint with grooves equal to or more than 1 mm wide each side.

Rule: Clearance is the "line of sight" distance. Creepage path follows the contour of the grooves.

Case 6

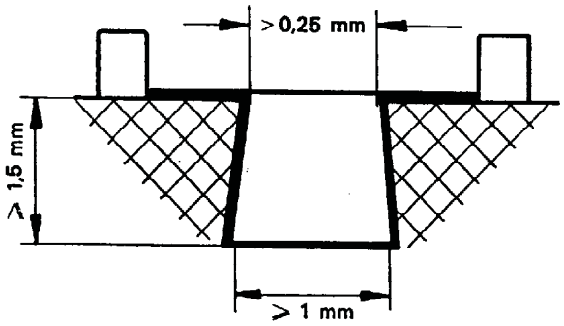


Condition: Path under consideration includes an uncemented joint with a groove on one side less than 1 mm wide and the groove on the other side equal to or more than 1 mm wide.

Rule: Clearance and creepage path are as shown.

Case 7

Clearance
Creepage distance

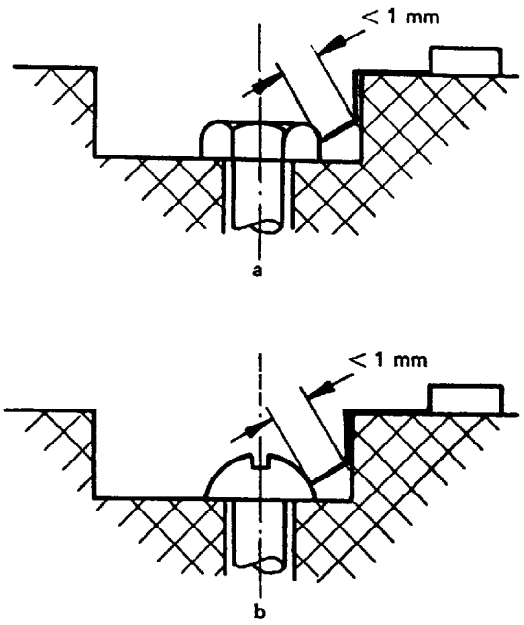


Condition: Path under consideration includes a diverging-sided groove equal to or greater than 1.5 mm deep and greater than 0.25 mm wide at the narrowest part and equal to or greater than 1 mm at the bottom.

Rule: Clearance is the "line of sight" distance. Creepage path follows the contour of the groove.

Case 3 applies as well to an internal corner if the angle is less than 80°.

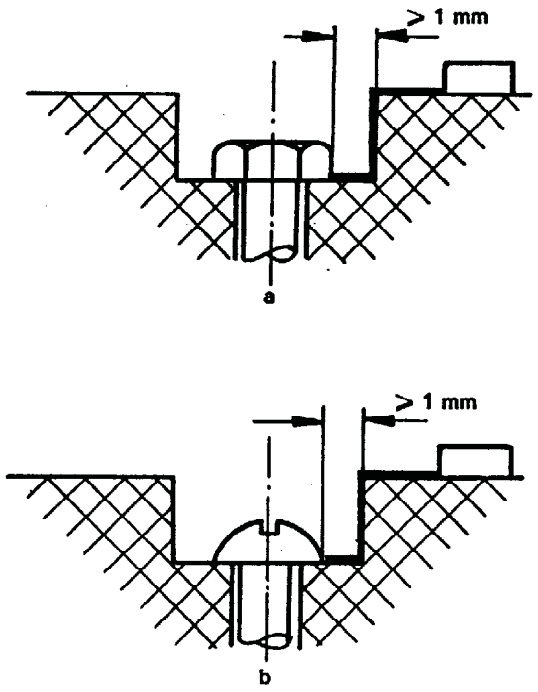
Case 8



Gap between head of screw and wall of recess too narrow to be taken into account.

Case 9

Clearance
Creepage distance



Gap between head of screw and wall of recess wide enough to be taken into account.

Case 10

Creepage distance

APPENDIX F

Void

APPENDIX G

CIRCUIT FOR MEASURING LEAKAGE CURRENTS

A suitable circuit for measuring leakage currents in accordance with Sub-clause 13.2 is shown in Figure G1.

The circuit comprises a rectifier arrangement with germanium diodes D and a moving-coil meter M, resistors and a capacitor C for adjusting the characteristics of the circuit, and a "make-before-break" switch S for adjusting the current range of the instrument.

The most sensitive range of the complete instrument must not exceed 1.0 mA, higher ranges being obtained by shunting the coil of the meter by non-inductive resistors R_s and simultaneously adjusting the series resistors RV so as to maintain the total resistance R_1 + RV + R_m of the circuit at the value specified.

The basic calibration points, at a sinusoidal frequency of 50 Hz or 60 Hz, are 0.25 mA, 0.5 mA and 0.75 mA.

The circuit may be protected against overcurrents, but the method chosen must not affect the characteristics of the circuit.

The resistance R_m is calculated from the voltage drop measured across the rectifier arrangement at 0.5 mA, the resistance RV being then adjusted so as to give the total resistance of the circuit for each range.

Germanium diodes are used, because these have a lower voltage drop than other types of diode, thus resulting in a more linear scale; preference is given to gold bonded types. The rating of the diodes must be chosen so as to suit the desired maximum range of the complete instrument; however, this range must not exceed 25 mA, because diodes suitable for higher currents have a high voltage drop.

It is recommended that the switch be so arranged that it automatically returns to the position giving the highest current range, in order to prevent inadvertent damage to the instrument.

The capacitor may be made up by selecting capacitors having preferred values and using a series/parallel arrangement.

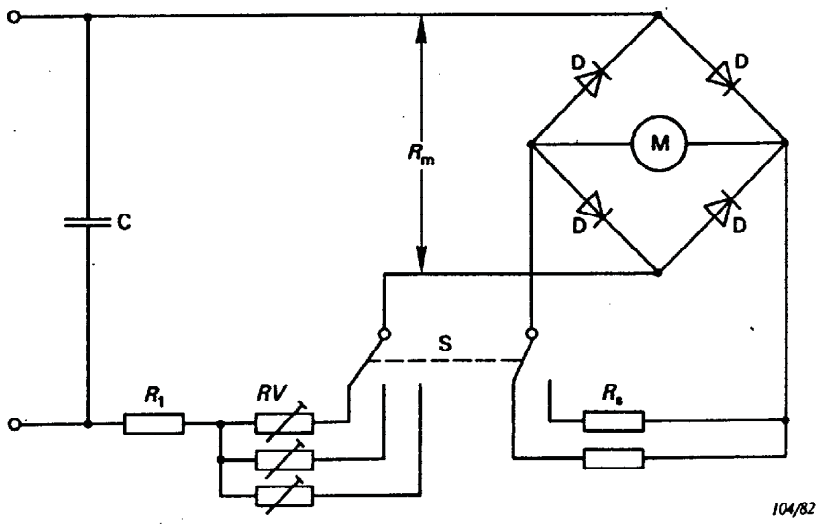


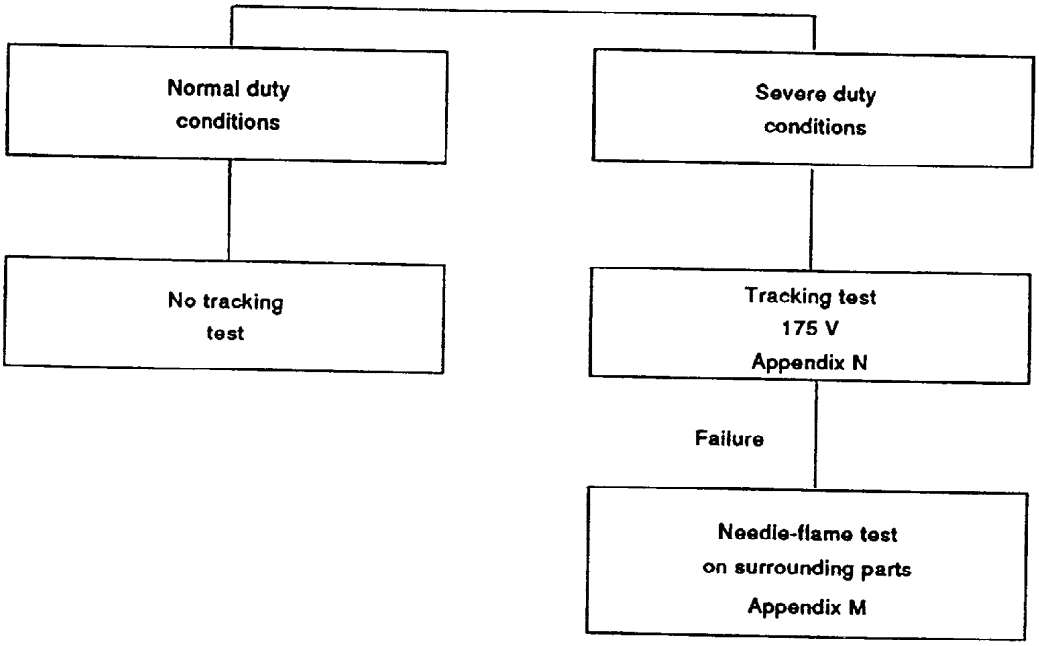
FIG. G1. — Circuit for measuring leakage currents.

Appendix H

Selection and sequence of the tests of clause 30

Resistance to tracking

All equipments



Appendix J

Burning test

The burning test is made in accordance with IEC 707.

For the purpose of this standard, method FH: Flame-Horizontal specimen, is used.

For the evaluation of the test results, category FH3 applies, the maximum burning rate being 40 mm/min.

If more than one specimen does not withstand the test, the material is rejected.

If one specimen does not withstand the test, the test is repeated on another set of five specimens, all of which shall then withstand the test.

Appendix K

Glow-wire test

The glow-wire test is made in accordance with IEC 695-2-1.

For the purpose of this standard, the following applies.

4 Description of test apparatus

The last paragraph before the note is replaced by:

In cases where burning or glowing particles might fall from the specimen onto an external surface underneath the appliance, the test is made with a piece of white pine-wood board, approximately 10 mm thick and covered with a single layer of tissue paper, positioned at a distance of 200 mm ± 5 mm below the place where the tip of the glow-wire is applied to the specimen. If the appliance as a whole is tested, it is placed in its normal position of use above the pine-wood board which is covered with a single layer of tissue paper. Before starting the test, the board is conditioned as described in clause 7 for the specimen.

5 Severities

The duration of application of the tip of the glow-wire to the specimen is 30 s ± 1 s.

10 Observations and measurements

Item c) does not apply.

Appendix L

Bad-connection test with heaters

The bad-connection test with heaters is made in accordance with IEC 695-2-3.

For the purpose of this standard, the following applies.

3 General description of the test

Add the following:

Crimped connections are not subjected to the test if

- *a bad connection cannot give rise to a fire hazard;*
- *the continuous current is less than 0,5 A;*
- *the conductors are chosen in accordance with the following table and are used together with the correct matching connector:*

Continuous current A					Cross-sectional area mm^2	
					a	b
≥	0,5	and	≤	4,0	–	0,5
>	4,0	and	≤	6,0	0,75	1,0
>	6,0	and	≤	10,0	1,0	1,5
>	10,0	and	≤	16,0	1,5	2,5
>	16,0	and	≤	25,0	2,5	4,0

Column a applies to tinned stranded connectors
Column b applies to other stranded connectors

Crimped connections are not considered to give rise to a fire hazard if the insulation which retains the connections withstands the glow-wire test of annex K at the test temperatures specified in 30.2.2 or 30.2.3 as applicable.

Sleeves on the ends of stranded conductors intended for insertion into screw terminals are not regarded as crimped connections.

When establishing the value of the continuous current, in-rush currents are disregarded.

4 Description of test apparatus

The last paragraph concerning the evaluation of the possibility of spread of fire including the three dashed paragraphs and the first paragraph of the note are replaced by:

In cases where burning or glowing particles might fall from the specimen onto an external surface underneath the appliance, the test is made with a piece of white pine-wood board, approximately 10 mm thick and covered with a single layer of tissue paper, positioned at a distance of 200 mm ± 5 mm below the place where the test heater is applied to the specimen. If the appliance as a whole is tested, it is placed in its normal position of use above the pine-wood board which is covered with a single layer of tissue paper. Before starting the test, the board is conditioned as described in clause 6 for the specimen.

5 Severities

The duration of application of the test power is 30 min ± 1 min.

8 Test procedure

Replace subclause 8.6 by:

The test is made on one specimen. If the specimen does not withstand the test, the test is repeated on two further specimens, both of which shall then withstand the test.

11 Information to be given in the relevant specification

The first dashed paragraph under item h) does not apply.

Appendix M

Needle-flame test

The needle-flame test is made in accordance with IEC 695-2-2.

For the purpose of this standard, the following applies.

4 Description of the apparatus

The sixth paragraph is replaced by:

In cases where burning or glowing particles might fall from the specimen onto an external surface underneath the appliance, the test is made with a piece of white pine-wood board, approximately 10 mm thick and covered with a single layer of tissue paper, positioned at a distance of 200 mm ± 5 mm below the place where the test flame is applied to the specimen. If the appliance as a whole is tested it is placed in its normal position of use above the pine-wood board which is covered with a single layer of tissue paper. Before starting the test, the board is conditioned as described in clause 6 for the specimen.

5 Severities

The duration of application of the test flame is 30 s ± 1 s.

8 Test procedure

8.4 *In the first paragraph the words "or from any source of ignition accidentally applied" do not apply.*

Replace the last two paragraphs by:

At the beginning of the test, the test flame is applied in such a way that at least the tip of the flame is in contact with the surface of the specimen.

During the application of the test flame the burner is not to be moved. The test flame is removed immediately after the specified period has elapsed. For examples of test positions, see figure 1.

Replace subclause 8.5 by:

The test is made on one specimen. If the specimen does not withstand the test, the test is repeated on two further specimens, both of which shall then withstand the test.

10 Evaluation of test results

Add:

When a layer of tissue paper is used, there is to be no ignition of the tissue paper or scorching of the white pine-wood board, a slight discoloration of the white pine-wood board being neglected.

Appendix N

Proof tracking test

The proof tracking test is made in accordance with IEC 112.

For the purpose of this standard, the following applies.

3 Test specimen

The last sentence of the first paragraph does not apply.

5 Test apparatus

The note in subclause 5.1 does not apply.

Note 4 in subclause 5.3 does not apply and the test solution A described in subclause 5.4 is used.

6 Procedure

The voltage referred to in subclause 6.1 is adjusted to 175 V or 250 V as appropriate .

Subclause 6.2 does not apply and the proof tracking test of subclause 6.3 is made five times. For the latter test, notes 2 and 3 of clause 3 also apply.

Appendix P

Severity of duty conditions of insulating material with respect to the risk of tracking

The severity of the duty conditions of insulating material with respect to the risk of tracking depends upon the rate of accumulation of any conductive deposit and upon the period of time during which the insulating material is subjected to electrical stress.

For the purpose of the requirement, the following duty conditions are recognized.

1. *Normal duty conditions:* there is virtually no deposition of conductive material and a long period of electrical stress or a light deposition of conductive material and a short period of electrical stress.

The insulating materials used in many household appliances are not considered to be subject to deposition of conductive material.

The insulating materials used in motors which produce carbon dust or in switching devices which are subject to deposition of conductive material but withstand the relevant electric strength test after an appropriate endurance test, are considered to be subject to a light deposition of conductive material.

Insulating materials having a proof tracking index below 175 are considered to be adequate for use under normal duty conditions.

2. *Severe duty conditions:* there is a light deposition of conductive material and a long period of electrical stress or a heavy deposition of conductive material and a short period of electrical stress.

The insulating materials used in heating appliances where air from household premises is caused to blow over these materials, for example in fan heaters, are considered to be subject to a light deposition of conductive material and a long period of electrical stress.

NOTE - A long period of electrical stress is considered to exist between live parts of different potential and betweeen live parts and earthed metal parts in the case of:

- appliances intended for continuous operation;
- the input side of the supply switch of appliances not intended for continuous operation;
- appliances provided with a single-pole switch or similar device and connected to the supply by a non-polarized plug.

If there is no single-pole switch, it is assumed that appliances not intended for continuous operation are disconnected in all poles from the supply by means of a switch in the fixed wiring or a plug and therefore a long period of electric stress will not occur.

ANNEX ZX (normative)

SPECIAL NATIONAL CONDITIONS

The following special national conditions exist in the countries mentioned; in general, they are due to the electricity supply system and the wiring rules.

4.6 FINLAND AND NORWAY

The tests are based on the most unfavourable system voltage between 220 V and 230 V.

5.501 SPAIN

A rated voltage covering the use at 127 V is also allowed.

UNITED KINGDOM

A rated voltage covering the use at 240 V is required.

7.7 UNITED KINGDOM

For Class II appliances fitted with a power supply cord, the instruction sheet shall give instructions for the correct connection of a plug, making it clear that neither wire is to be connected to the earth terminal of a three-pin plug.

For appliances fitted with a 13 A non-rewireable plug, the following information shall be included in the instruction sheet:

1. Instruction to dispose of a plug that has been cut from the power supply cord and a warning of the shock hazard should such a plug be inserted in a 13 A socket-outlet elsewhere in the house.

2. Instructions that the fuse cover must be refitted when changing the fuse and that, if the fuse cover is lost, the plug must not be used until a replacement is obtained.

   Alternatively, instruction to never use the plug without the fuse cover fitted may be used instead.

3. Information that the correct replacement for a detachable fuse carrier is identified by marking or colour coding (as applicable to the design of the plug fitted).

4. Sources of supply of replacement fuse covers.

5. The correct value of the rated current of the fuse and instructions that replacement fuses that are ASTA approved to BS 1362 should be fitted.

25.4 SWITZERLAND

Power supply cords of single-phase portable appliances having a rated current not exceeding 10 A, shall be provided with a plug complying with SEV/ASE 1011.

UNITED KINGDOM

Plugs according to the Standards of Group C in IEC 83 are not allowed.

Appliances delivered with a power supply cord are not required to be fitted with a plug, but if a plug is fitted, it shall comply with BS 1363.

In the case of a flat twin tinsel cord, the plug shall be non-rewireable and shall comply with an appropriate standard, for example BS 4573.

ANNEX ZY (informative)

NATIONAL DEVIATIONS

This document was compiled by CENELEC Technical Committee 61. It contains national deviations from the content of the European Standard EN 60967. These deviations could not yet be removed and are only applicable in the countries concerned.

1. NATIONAL DEVIATIONS DUE TO LEGAL REQUIREMENTS

7.7 **FINLAND** (Resolution of the Ministry of Trade and Industry on Electrical Safety Regulations 205/74)

The instruction sheet shall also contain the substance of the following information:

- for appliances with type M attachment:

  If the power supply cord of this appliance is damaged, it must be replaced by the special cord (quote the appropriate reference);

- for appliances with type Y attachment:

  If the power supply cord of this appliance is damaged, it must only be replaced in a repair shop appointed by the manufacturer, because special purpose tools are required.

National appendix NA (informative)

Deletions from and IEC text amended by Common Modifications to IEC Publication 967 (1988) first edition

Foreword

The foreword has been deleted. It read as follows.

1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.

2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.

3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

Preface

The preface has been deleted. It read as follows.

This standard has been prepared by IEC Technical Committee No. 61: Safety of Household and Similar Electrical Appliances.

It forms the first edition of this standard and replaces IEC Publication 335-17 (1974).

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

Six Months' Rule	Report on Voting
61(CO)480	61(CO)529

Further information can be found in the Report on Voting indicated in the table above.

In this standard, the following print types are used:

- requirements proper: in roman type;
- *test specifications, in italic type;*
- explanatory matter: in smaller roman type.

The following IEC publications are quoted in this standard:

Publications Nos. 61-1: Lamp caps and holders together with gauges for the control of interchangeability and safety. Part 1: Lamp caps.
65 (1985): Safety requirements for mains operated electronic and related apparatus for household and similar general use.
83 (1975): Plugs and socket-outlets for domestic and similar general use. Standards.
85 (1984): Thermal evaluation and classification of electrical insulation.
112 (1979): Method for determining the comparative and the proof-tracking indices of solid insulating materials under moist conditions.
127-3 (1984): Cartridge fuse-links for miniature fuses, Part 3: Sub-miniature fuse-links.
227: Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V.
238 (1987): Edison screw lampholders.
320: Appliance couplers for household and similar general purposes.
328 (1972): Switches for appliances.
335-1 (1976): Safety of household and similar electrical appliances, Part 1: General requirements.
335-2-32 (1987): Part 2: Particular requirements for massage appliances.
384-14 (1981): Fixed capacitors for use in electronic equipment, Part 14: Sectional specification: Fixed capacitors for radio interference suppression. Selection of methods of test and general requirements.
742 (1983): Isolating transformers and safety isolating transformers. Requirements.
817 (1984): Spring-operated impact-test apparatus and its calibration.

1. Scope

In 1.1, 'IEC Publication 335-2-32' has been replaced by 'EN 60335-2-32'.

2. Definitions

The text of 2.2.28 has been replaced by 'Void'. It read as follows.

Class 0 appliance denotes an appliance in which protection against electric shock relies upon basic insulation; this implies that there are no means for the connection of accessible conductive parts, if any, to the protective conductor in the fixed wiring of the installation, reliance in the event of a failure of basic insulation being placed upon the environment.

Class 0 appliances may have parts with double insulation or reinforced insulation.

4. General notes on tests

In 4.11, line 1 the words 'Class 0 or' have been deleted.

5. Rating

In 5.1, line 2 the words 'Class 0 and' have been deleted.

6. Classification

In 6.1, 1, line 2 has been deleted. It read as follows.

– Class 0 appliances;

11. Heating

In 11.6 *c)* line 1 of note 2 to the table, 'IEC Publication 85' has been replaced by 'HD 566'.

In 11.6 *c)* line 1 of note 4 to the table, 'relevant IEC standards' has been replaced by 'relevant European or IEC standards'.

13. **Electrical insulation and leakage current at operating temperature**

In 13.4, line 4 has been deleted. It read as follows.

– *for Class O flexible parts, between live parts and the metal foil* ..... *1 000 V*

16. **Insulation resistance and electric strength**

In 16.3, line 5 has been deleted. It read as follows.

– *1 250 V for Class 0 appliances;*

21. **Mechanical strength**

In the last line of 21.17, 'IEC Publication 817' has been replaced by 'HD 495'.

22. **Construction**

The text of 22.1 has been replaced. It read as follows.

Appliances shall be of Class 0, Class II or Class III with respect to protection against electric shock.

Control units shall be of Class II or Class III.

Compliance is checked by inspection and by the relevant tests.

In Sweden Class 0 appliances are not allowed.

In 22.15, the last paragraph has been deleted. It read as follows.

In the U.S.A. a minimum number of thermostats is required for the flexible part of over-blankets incorporating thermostats.

In 22.17, the first sentence has been replaced. It read as follows.

Under-blankets, other than ruck-resistant blankets, shall be provided with means to prevent rucking.

In 22.24, 'IEC Publication 227' has been replaced by 'HD 21'.

24. **Components**

In 24.1 paragraph 1, 'IEC standards' has been replaced by 'European or IEC standards'.

In 24.1 paragraph 3, 'IEC Publication 742' has been replaced by 'EN 60742'.

In 24.1 paragraph 4, 'IEC Publication 61-1' has been replaced by 'HD 65.1'.

In 24.1 paragraph 5, 'IEC Publication 238' has been replaced by 'EN 60238' and 'IEC Publication 61-1' has been replaced by 'HD 65.1'.

In 24.1 paragraph 8, line 1, 'IEC standard' has been replaced by 'standard'.

In 24.1 paragraph 12, 'an IEC standard' has been replaced by 'a European standard'.

In 24.1 paragraph 14, 'IEC standard' has been replaced by 'standard'.

In 24.3, 'IEC Publication 320' has been replaced by 'EN 60320-1'.

In 24.4, 'IEC Publication 320' has been replaced by 'EN 60320-1'.

In 24.8, paragraph 1 has been replaced. It read as follows.

24.8 Appliances other than those of Class III shall be provided with a switch in their supply circuit.

25. **Supply connection and external flexible cords**

In 25.1, line 5 has been replaced. It read as follows.

Appliance inlets shall not be fitted to the flexible part of Class 0 or Class II pads.

In 25.5, '227 IEC 52' has been replaced by 'H03 VV-F or H03 VVH2-F'.

In 25.7, 'IEC Publication 227' has been replaced by 'HD 21'.

In 25.10, paragraph 14 has been replaced. It read as follows.

For type M, type Y and type Z attachments the cores of the power supply cord shall be insulated from accessible metal parts by insulation complying with the requirements for basic insulation for Class 0 appliances and, for Class II appliances, complying with the requirements for supplementary insulation.

In 25.10, paragraph 18 has been deleted. It read as follows.

– the sheath of the cord for Class 0 appliances.

In 25.14, 'IEC Publication 227' has been replaced by 'HD 21' in three places.

30. **Resistance to heat, fire and tracking**

In 30.6, paragraph 7 has been deleted. It read as follows.

A revision of this test is under consideration.

Appendix A. **Thermal controls**

In A4, line 5 has been deleted. It read as follows.

A revision of this test is under consideration.

Appendix B. **Electronic circuits**

In B11.6, 'IEC Publication 65' has been replaced by 'HD 195'.

1 In B19.101, *IEC 127* has been replaced by 'HD 109' and 'IEC Publication 65' has been replaced by 'HD 195'.

In B19.103, 'IEC Publication 65' has been replaced by 'HD 195'.

1 In B19.104, *IEC 127* has been replaced by 'HD 109' in two places.

In B22.101, 'IEC Publication 65' has been replaced by 'HD 195'.

In B29.1, 'IEC Publication 112' has been replaced by 'HD 214'.

National appendix NB (informative)

The preparation of this British Standard was entrusted by the Light Electrical Engineering Standards Policy Committee (LEL/-) to Technical Committee LEL/161, upon which the following bodies were represented:

Association for Consumer Research (ACRE)
Association of Consulting Scientists
Association of Control Manufacturers (TACMA, BEAMA Ltd.)
Association of Manufacturers of Domestic Electrical Appliances
British Cable Makers' Confederation
British Electrotechnical Approvals Board
British Gas plc
British Lawnmower Manufacturers' Federation
British Retailers' Association
Catering Equipment Manufacturers' Association
Consumer Policy Committee of BSI
Department of Trade and Industry (Consumer Safety Unit, CA Division)
Electrical Installation Equipment Manufacturers' Association (BEAMA Ltd.)
Electricity Supply Industry in United Kingdom
Home Office
Institute of Trading Standards Administration
Institution of Electrical Engineers
Lighting Industry Federation Ltd.
Loss Prevention Council
Portable Electric Tool Manufacturers' Association
Rotating Electrical Machines Association (BEAMA Ltd.)
Royal Society for the Prevention of Accidents
Small Electrical Appliances Marketing Association

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

Department of the Environment (Building Research Establishment)
Institution of Fire Engineers

National appendix NC (informative)

The British Standards which are identical or technically equivalent to the international standards referred to in EN 60967 are as follows:

International standard	British Standard
EN 60238	BS 6776 : 1990 Specification for Edison screw lampholders (Identical)
EN 60320-1	BS 4491 Appliance couplers for household and similar general purposes Part 1 : 1989 Specification of general requirements (Identical)
EN 60335-2-32	BS EN 60335 Safety of household and similar electrical appliances Part 2 Particular requirements Section 2.32 : 1991 Massage appliances (Identical)
EN 60730-1	BS EN 60730-1 Specification for automatic electrical controls for household and similar use Part 1 : 1992 General requirements Part 2 Particular requirements
EN 60730-2-1	Section 2.1 : 1992 Electrical controls for electrical household appliances.
EN 60742	BS 3535 Isolating transformers and safety isolating transformers Part 1 : 1990 General requirements (Identical)
HD 21	BS 6500 : 1990 Specification for insulated flexible cords and cables
Code designation HO3 VV-F	Table 15 (Technically equivalent)
Code designation HO3 VVH2-F	Table 15 (Technically equivalent)
HD 65.1	BS 5101 Specification for lamp caps and holders together with gauges for the control of interchangeability and safety Part 1 : 1975 Lamp caps (Identical)
HD 109	BS 4265 : 1977 Specification for cartridge fuse links for miniature fuses (Technically equivalent)
HD 195	BS 415 : 1990 Specification for safety requirements for mains-operated electronic and related apparatus for household and similar general use (Technically equivalent)
HD 214	BS 5901 : 1980 Method of test for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions (Identical)
HD 441	BS 6334 : 1983 Methods of test for the determination of the flammability of solid electrical insulating materials when exposed to an igniting source BS 6458 Fire hazard testing for electrotechnical products Part 2 : Methods of test
HD 444.2.1	Section 2.1 : 1984 Glow-wire test
HD 444.2.2	Section 2.2 : 1984 Needle-flame test
HD 444.2.3	Section 2.3 : 1985 Bad-connection test with heaters.

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MK14 6LE