

UL 60335-1

ISBN 0-7629-0755-X

Safety of Household and Similar Electrical Appliances, Part 1: General Requirements

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UL Standard for Safety for Safety of Household and Similar Electrical Appliances, Part 1: General Requirements, UL 60335-1

Third Edition, Dated January 14, 2002

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The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the preface. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.

New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if the applicant elects this option, it should be noted that compliance with all the requirements in this Standard will be required as a condition of continued Listing, Recognition, and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

It should be noted that in an effort to more closely match the IEC text, information in the following checklist related to annexes may not correlate correctly at this time with the annex identification in the annexes themselves. This information will be correct in future revision cycles.

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JANUARY 14, 2002

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UL 60335-1

Standard for Safety of Household and Similar Electrical Appliances,

Part 1: General Requirements

First Edition – November, 1998

Second Edition – March, 2000

Third Edition

January 14, 2002

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

Revisions of this Standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest set of revised requirements.

ISBN 0-7629-0755-X

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Preface (UL)

This UL Standard is based on IEC Publication 60335-1: third edition Safety of Household and Similar Appliances, part 1: General Requirements as revised by Amendments 1 and 2. IEC publication 60335-1 is copyrighted by the IEC.

This is the UL Standard for Safety of Household and Similar Electrical Appliances, Part 1: General Requirements. This UL part 1 is to be used in conjunction with the appropriate UL part 2, which contains clauses to supplement or modify the corresponding clauses in part 1, to provide the relevant requirements for each type of product.

The text, figures and tables of IEC publication 60335-1, Safety of Household and Similar Appliances, part 1: General Requirements copyright 1991 as amended November 1994 and June 1999 are used in this Standard with the consent of the IEC and the American National Standards Institute (ANSI). The IEC copyrighted material has been reproduced with permission from ANSI. ANSI should be contacted regarding the reproduction of any portion of the IEC material. The IEC Foreword and Introduction are not a part of the requirements of this Standard but are included for information purposes only.

Copies of IEC Publication 60335-1 may be purchased from ANSI, 11 West 42nd street, New York, New York, 10036, (212) 642-4900.

Note – Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.

Foreword (UL)

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involves a risk of fire or of electric shock or injury to persons shall be evaluated using appropriate additional component and end-product requirements to maintain the level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard does not comply with this standard. Revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

NATIONAL DIFFERENCES

GENERAL

National Differences from the text of International Electrotechnical Commission (IEC) Publication 60335-1, Safety of Household and Similar Appliances, part 1: General Requirements copyright 1991 as amended November 1994 are indicated by notations (differences) and are presented in bold text.

There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

DR – These are National Differences based on the **National Electrical Code (NEC)** and **other U.S. Regulatory Requirements**.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for U.S. consumers and users of products.

D2 – These are National Differences based on **safety practices**. These are differences for IEC requirements that may be acceptable, but adopting the IEC requirements would require considerable retesting or redesign on the manufacturer's part.

DC – These are National Differences based on the **component standards** and will not be deleted until a particular component standard is harmonized with the IEC component standard.

DE – These are National Differences based on **editorial comments or corrections**.

Annex DVA contains equivalent North American terms for some of the IEC terms used in this standard. Annex DVB contains appropriate replacement text for some of the IEC text used in this standard

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SAFETY OF HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – Part 1: General requirements

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international cooperation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

2) The formal decisions or agreements of 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.

3) They have the form of recommendations for international use published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.

4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.

5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its Standards.

This standard has been prepared by IEC technical committee 61: Safety of household and similar electrical appliances.

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

DIS	Report on voting		Amendment to DIS	Report on voting
61(CO)612	616(CO)649		61(CO)650	61(CO)667

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

This second impression of IEC 60335-1 third edition incorporates many editorial corrections compared to the first impression (1991-04). However, they do not affect the technical content of this standard. Except the foreword, page, clause and subclause numbering is identical to the first impression.

This standard contains amendments No. 1 and No. 2 to IEC 60335-1

These amendments have been prepared by IEC technical committee 61: Safety of household and similar electrical appliances.

The text of these amendments are based on the following documents:

DIS	Report on voting
61(CO)792	61/866/RVD
61/1569/FDIS	61/1623/RVD

Full information on the voting for the approval of these amendments can be found in the reports on voting indicated in the above table.

Annex B contained in amendment No. 1 cancels and replaces IEC 335-2-18 (1984), IEC 335-2-19 (1984) et IEC 335-2-20 (1984).

References to IEC 817 (1984) has been replaced by reference to IEC 68-2-63 which is technically equivalent. Part 2's of IEC 335 which refer to the original impression of this third edition can be used with this second impression.

This part 1 is to be used in conjunction with the appropriate part 2, which contains clauses to supplement or modify the corresponding clauses in part 1, to provide the relevant requirements for each type of product.

Individuals countries may wish to consider its application, so far as is reasonable, to appliances not mentioned in part 2, and to appliances designed on new principles

If the functions of an appliance are covered by different part 2's of IEC 335, the relevant part 2 is applied to each function separately, so far as is reasonable. If applicable, the influence of one function on the other is taken into account.

Normative references to other IEC and ISO standards are given in annex A.

All annexes are normative except annex H.

NOTE – The following print types are used:

- Requirements: in roman type
- *Test specifications: in italic type*
- Notes: in small roman type.
- Words in SMALL CAPITAL LETTERS in the text are defined in clause 2.

The following differences exist in some countries:

- 2: Steady conditions are defined (Poland).
- 2.5.2: The SAFETY EXTRA-LOW VOLTAGE shall not exceed 30 V (42,4 V peak) (U.S.A.).
- Clause 3: The d.c. component in the appliance neutral is limited (Australia).
- 4.7: The ambient testing temperature is 25°C ± 10°C (China, Japan and U.S.A.).
- 4.14: Accessible metal parts that are not liable to become energized (such as a metal nameplate or decorative part on a plastic enclosure) do not need to be earthed. Accessible non-metallic parts need only provide BASIC INSULATION (U.S.A.).

- 6.1: CLASS 0 AND CLASS 0I APPLIANCES are not allowed (Australia, Austria, Czechoslovakia, Finland, France, Germany, Greece, Hungary, Israel, India, Ireland, Italy, Netherlands, New Zealand, Norway, Poland, Singapore, Sweden, Switzerland, United Kingdom, Yugoslavia).
- 6.2: Protection against harmful ingress of water is determined by methods other than those given in IEC 529 (U.S.A.).
- 7.1: The IP number is not required to be marked (U.S.A.).
- 7.6: Some of these symbols are not used (U.S.A.).
- 7.8: Additional methods are permitted for identifying earthing terminals and terminals for neutral conductors (U.S.A.).
- 7.12.2: The 3 mm contact separation does not apply (Australia, Japan, New Zealand, U.S.A.).
- 7.14: Different tests are used (U.S.A.).
- 8.1.1: The test is not necessarily repeated with the 20 N force (U.S.A.).
- 8.1.1: Protection against contact with LIVE PARTS of the lamp cap is not required (U.S.A.).
- 8.1.2 and 8.1.3: The test pin and test probe are not used (U.S.A.).
- 8.1.5: BUILT-IN APPLIANCES, FIXED APPLIANCES and appliances delivered in separate units are not required to be protected by at least BASIC INSULATION before installation (U.S.A.).
- 9: The ability of a motor to start without blowing a quick-acting fuse is required (U.S.A.).
- 10.1 and 10.2: Positive limits of 5% for HEATING APPLIANCES and 10% for MOTOR-OPERATED APPLIANCES are required and in general there are no negative deviations (U.S.A.).
- 11.4, 11.5 and 11.6: HEATING APPLIANCES and heater circuits of COMBINED APPLIANCES are operated at RATED POWER INPUT OR RATED VOLTAGE, whichever is the more severe; all other appliances and circuits are operated at RATED VOLTAGE (U.S.A.).
- 11.8, table 3: Temperature rise limits for certain materials are different (U.S.A.).
- 13.2: The test circuit and some leakage current limits are different (U.S.A., India).
- 13.3: The values of certain test voltages are different depending on the RATED VOLTAGE (U.S.A.).
- 13.3: A 500 VA test transformer is used (U.S.A.).
- 15.1.1 and 15.1.2: The IP system is not used and the tests are different (U.S.A.).
- 15.3: The test is conducted with a relative humidity of $(88 \pm 2) \%$ at a temperature of $32^{\circ}\text{C} \pm 2^{\circ}\text{C}$ (U.S.A.).
- 16.2: The test is conducted at nominal supply voltage and some of the leakage current values are different (U.S.A.).
- 16.3: Some test voltages and methods are different (U.S.A.).
- 19.1: The circuit protection device is permitted to provide necessary protection (U.S.A.).
- 19.2 to 19.4: Generally the tests are conducted at nominal supply voltage or RATED POWER INPUT (U.S.A.).
- 19.13: The temperature rise limits of table 7 are not applicable (U.S.A.).
- 20.1: A stability test at 15 degrees is not conducted and an appliance tested in an overturned position is judged under abnormal test criteria (U.S.A.).

- 21: Impact force is applied with a falling steel ball instead of the spring operated impact test apparatus (U.S.A.).
- 22.1: The IP system is not used and tests are not the same as specified in IEC 529 (U.S.A.).
- 22.2: The second paragraph of this subclause dealing with single-phase CLASS I APPLIANCES with heating elements cannot be complied with because of the supply system (France and Norway).
- 22.2: Double-pole switches or PROTECTIVE DEVICES are required (Norway).
- 22.2: Disconnection of the neutral is not necessary for all STATIONARY APPLIANCES (U.S.A.).
- 22.2: The SUPPLY CORD is not required to be fitted with a plug (Ireland).
- 22.6: This test is not conducted (U.S.A.).
- 22.11: Different criteria for snap-on constructions are required (U.S.A.).
- 22.12: Positive forms of securement are required (U.S.A.).
- 22.14: Sharp edges are evaluated by means of a sharp edge testing device (U.S.A.).
- 22.35 and 22.36: Metal parts are generally not required to be separated by DOUBLE OR REINFORCED INSULATION (U.S.A.).
- 22.44: Appliances may be acceptable based on additional evaluation (USA).
- 23.5: Requirements for insulated internal wiring are different (U.S.A.).
- 23.7: The requirement only applies to wiring that is accessible when making supply connections (U.S.A.).
- 24.1.2: A different number of cycles is required and note 2 does not apply (U.S.A.).
- 24.1.3: The numbers of cycles is different and the note does not apply (USA).
- 24.3: The requirement for 3 mm contact separation does not apply (U.S.A.).
- 25.1: The SUPPLY CORD is not required to be fitted with a plug (Ireland and United Kingdom).
- 25.3: A set of SUPPLY LEADS is not permitted (Norway, Sweden, Denmark, Finland, Netherlands).
- 25.3: The use of a set of terminals for connection of a flexible cord is not generally permitted (U.S.A.).
- 25.8: Conductor cross-sectional areas are different (Australia, New Zealand and U.S.A.).
- 25.8: 0,5 mm² SUPPLY CORDS are not allowed for CLASS I APPLIANCES (Australia and New Zealand).
- 25.10: Green insulation is also permitted (U.S.A.).
- 25.14.2: No more than one separate insulation is required (U.S.A.).
- 25.16: Fully removable cord anchorages are allowable (New Zealand, Australia).
- 25.16: A pull of 35 lbs is applied except for small appliances and generally the torque test is not used (U.S.A.).
- 26.2: Cross-sectional areas are specified according to American Wire Gauge (AWG) (U.S.A.).
- 26.4 and 26.5: The tests only apply to terminals for connection to fixed wiring (U.S.A.).

- 27.2: The requirements for screwless terminals are different (U.S.A.).
- 27.6: The requirement does not apply (U.S.A.).
- 28.1: Generally, tests of this type are not required (U.S.A.).
- 29.1: Different CREEPAGE DISTANCES and CLEARANCES may be applicable (U.S.A.).
- 30.1: The minimum value for the ball-pressure test for parts retaining LIVE PARTS is 95°C or 40 K higher than the clause 11 temperature rise. For enclosures, the minimum value is 75°C or a mold-stress test is conducted at 10 K above the clause 11 temperature (U.S.A.).
- 30.2.1: An ignition test cannot be used to assure a slow burning rate (U.S.A.).
- 30.2.4: Printed circuits boards operated at mains voltage are required to be FV-0 or FV-1 or to meet the needle-flame test (Australia).
- B.7.12: Appliances having non-replaceable batteries shall be marked with an appropriate symbol when the batteries have a content of mercury or cadmium exceeding 0.025% by weight (Sweden and Switzerland).
- B.21.101: The requirement is different (U.S.A.).
- F.1.1: The annex applies to motors having a WORKING VOLTAGE not exceeding 30 V (U.S.A.).

DV.1 DE *Replace the fifth paragraph following the amendment table with the following paragraph:*

This standard must only be used with an appropriate UL 60335 part 2 standard.

DV.2 DE *Delete the sixth paragraph following the amendment table.*

DV.3 DE *Add the following after the last item in the first note:*

The numbering system in the standard uses a space instead of a comma to indicate thousands and uses a comma instead of a period to indicate a decimal point. For example, 1 000 means 1,000 and 1,01 means 1.01

DV.4 DE *Replacement in the country clause list:*

Replace "25.14.2" with "25.13.2".

DV.5 D2 *Addition at the end of the clause list:*

The USA differences have been reviewed and developed into UL deviations in this part one standard or in the applicable part two standards.

INTRODUCTION

It has been assumed in the drafting of this international standard that the execution of its provisions is entrusted to appropriately qualified and experienced people.

Moreover, when elaborating this standard, TC 61 took into account as far as possible the requirements given in IEC 60364* so that an appliance may be installed in accordance with these wiring rules. However national wiring rules may differ.

This standard recognizes the internationally accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of electrical household and similar appliances when operated as in normal use taking into account the manufacturer's instructions; it also covers abnormal situations which can be expected in practice.

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

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

Individual countries may wish to consider the application of the standard, so far as reasonable, to appliances not mentioned in part 2, and to appliances designed on new principles.

If the functions of an appliance are covered by different parts 2 of IEC 60335, the relevant part 2 is applied to each function separately, so far as is reasonable. If applicable, the influence of one function on the other is taken into account.

Standards dealing with non-safety aspects of household appliances are:

- IEC Standards published by TC 59 concerning methods of measuring performance;
- CISPR 11¹⁾ and CISPR 14-1²⁾ concerning electromagnetic emissions;
- CISPR 14-2³⁾ and IEC 61000 series concerning electromagnetic compatibility.

*IEC 60364: *Electrical installation of buildings*

¹⁾CISPR 11: *Electromagnetic disturbance characteristics – Industrial, scientific and medical (ISM) radio-frequency equipment – Limits and methods of measurement*

²⁾CISPR 14-1: *Limits and methods of measurement of radio disturbance characteristics of electrical motor operated and thermal appliances for household and similar purposes, electric tools and electrical apparatus*

³⁾CISPR 14-2: *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 2: Immunity – Product family standard*

SAFETY OF HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES

– PART 1: GENERAL REQUIREMENTS

1 Scope

This standard deals with the safety of electrical appliances for household and similar purposes, the RATED VOLTAGE of the appliances being not more than 250 V for single-phase appliances and 480 V for other appliances.

Appliances may incorporate motors, heating elements or their combination.

Appliances not intended for normal household use but which nevertheless may be a source of danger to the public, such as appliances intended to be used by laymen in shops, in light industry and on farms, are within the scope of this standard.

NOTE 1 – Examples of such appliances are catering equipment, cleaning appliances for industrial and commercial use and appliances for hairdressers.

So far as is practicable, this standard deals with the common hazards presented by appliances which are encountered by all persons in and around the home. However, this standard does not in general take into account

- the use of appliances by young children or infirm persons without supervision;
- playing with the appliance by young children.

NOTES

2 Attention is drawn to the fact that

- for appliances intended to be used in vehicles or on board ships or aircraft, additional requirements may be necessary;
- for appliances intended to be used in tropical countries, special requirements may be necessary;
- in many countries additional requirements are specified by the national health authorities, the national authorities responsible for the protection of labour, the national water supply authorities and similar authorities.

3 This standard does not apply to

- appliances intended exclusively for industrial purposes;
- appliances intended to be used in locations where special conditions prevail, such as the presence of corrosive or explosive atmosphere (dust, vapor or gas);
- radio and television receivers, record players and similar equipment (IEC 60065);
- appliances for medical purposes (IEC 60601);
- hand-held motor-operated electric TOOLS (IEC 60745);

- personal computers and similar equipment I (IEC 60950);
- transportable motor-operated electric TOOLS (IEC 61029).

1DV.1 D1 Add the following text after "playing with the appliances by young children:"

The articulate probe of figure 1DV shall replace the test finger of figure 1 when the product is:

- a) a hand-held product,
- b) a hand-held part of a product,
- c) used by children,
- d) accessible to children while the product is operating, or
- e) one that has special concerns for the accessibility of live parts or mechanical hazards.

1DV.2 DR Add the following below note 3 of last paragraph:

This standard is applicable to household and similar electrical appliances and equipment which are designed to be installed in accordance with the National Electrical Code (NEC), ANSI/NFPA 70. Annex DVD provides examples of and references for regulatory requirements that may apply to appliances.

2 Definitions

For the purpose of this standard, the following definitions apply.

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

2.2.1 **RATED VOLTAGE:** Voltage assigned to the appliance by the manufacturer.

NOTE – For three-phase supply it is the voltage between phases.

2.2.2 **RATED VOLTAGE RANGE:** Voltage range assigned to the appliance by the manufacturer, expressed by its lower and upper limits.

2.2.3 **WORKING VOLTAGE:** Maximum voltage to which the part under consideration is subjected when the appliance is supplied at its **RATED VOLTAGE** and operating under **NORMAL OPERATION**.

NOTE – When deducing the WORKING VOLTAGE, the effect of transient voltages is ignored.

2.2.4 **RATED POWER INPUT:** Power input assigned to the appliance by the manufacturer.

2.2.5 **RATED POWER INPUT RANGE:** Power input range assigned to the appliance by the manufacturer, expressed by its lower and upper limits.

2.2.6 **RATED CURRENT:** Current assigned to the appliance by the manufacturer.

NOTE – If no current is assigned to the appliance, the RATED CURRENT is:

- for HEATING APPLIANCES, the current calculated from the RATED POWER INPUT and the RATED VOLTAGE;
- for MOTOR-OPERATED APPLIANCES, the current measured when the appliance is supplied at RATED VOLTAGE and operated under NORMAL OPERATION at RATED VOLTAGE.
- For COMBINED APPLIANCES, the current measured when the appliance is operated under NORMAL OPERATION supplied at RATED VOLTAGE.

2.2.7 RATED FREQUENCY: Frequency assigned to the appliance by the manufacturer.

2.2.8 RATED FREQUENCY RANGE: Frequency range assigned to the appliance by the manufacturer, expressed by its lower and upper limits.

2.2.9 NORMAL OPERATION: Conditions under which the appliance is operated in normal use when connected to the supply.

2.3.1 DETACHABLE CORD: Flexible cord, for supply or interconnection, intended to be connected to the appliance by means of a suitable appliance coupler.

2.3.2 INTERCONNECTION CORD: External flexible cord provided as part of a complete appliance for purposes other than connection to the supply mains.

NOTE – A remote hand-held switching device, an external interconnection between two parts of an appliance and a cord connecting an accessory to the appliance or to a separate signaling circuit are example of INTERCONNECTION CORDS.

2.3.3 SUPPLY CORD: Flexible cord, for supply purposes, which is fixed to the appliance.

2.3.4 TYPE X ATTACHMENT: Method of attachment of the SUPPLY CORD such that it can easily be replaced.

NOTES

1 The SUPPLY CORD may be specially prepared and only available from the manufacturer or its service agent.

2 A specially prepared cord may also include a part of the appliance.

2.3.5 TYPE Y ATTACHMENT: Method of attachment of the SUPPLY CORD such that any replacement is intended to be made by the manufacturer, its service agent or similar qualified person.

NOTE – TYPE Y ATTACHMENT may be used either with an ordinary flexible cord or with a special cord.

2.3.6 TYPE Z ATTACHMENT: Method of attachment of the SUPPLY CORD such that it cannot be replaced without breaking or destroying the appliance.

2.3.7 SUPPLY LEADS: Set of wires intended for connecting the appliance to fixed wiring and accommodated in a compartment within or attached to the appliance.

2.4.1 BASIC INSULATION: Insulation applied to LIVE PARTS to provide basic protection against electric shock.

NOTE – BASIC INSULATION does not necessarily include insulation used exclusively for functional purposes.

2.4.2 SUPPLEMENTARY INSULATION: Independent insulation applied in addition to the BASIC INSULATION in order to provide protection against electric shock in the event of a failure of the BASIC INSULATION.

2.4.3 DOUBLE INSULATION: Insulation system comprising both BASIC INSULATION and SUPPLEMENTARY INSULATION.

2.4.4 REINFORCED INSULATION: Single insulation applied to LIVE PARTS, which provides a degree of protection against electric shock equivalent to DOUBLE INSULATION under the conditions specified in this standard.

NOTE – It is not implied that the insulation is one homogeneous piece. The insulation may comprise several layers which cannot be tested singly as SUPPLEMENTARY INSULATION OF BASIC INSULATION.

2.4.5 CLASS 0 APPLIANCE: Appliance in which protection against electric shock relies upon BASIC INSULATION; this implies that there are no means for the connection of conductive ACCESSIBLE PARTS, if any, to the protective conductor in the fixed wiring of the installation, reliance in the event of a failure of the BASIC INSULATION being placed upon the environment.

NOTE – CLASS 0 APPLIANCES have either an enclosure of insulating material which may form a part or the whole of the BASIC INSULATION, or a metal enclosure which is separated from LIVE PARTS by an appropriate insulation. If an appliance with an enclosure of insulating material has provision for earthing internal parts, it is considered to be a CLASS I APPLIANCE OF CLASS 0I APPLIANCE.

2.4.6 CLASS 0I APPLIANCE: Appliance having at least BASIC INSULATION throughout and incorporating an earthing terminal but with a SUPPLY CORD without earthing conductor and a plug without earthing contact.

2.4.7 CLASS I APPLIANCE: Appliance in which protection against electric shock does not rely on BASIC INSULATION only but which includes an additional safety precaution in that conductive ACCESSIBLE PARTS are connected to the PROTECTIVE EARTHING CONDUCTOR in the fixed wiring of the installation in such a way that conductive ACCESSIBLE PARTS cannot become live in the event of a failure of the BASIC INSULATION.

NOTE – This provision includes a protective conductor in the SUPPLY CORD.

2.4.8 CLASS II APPLIANCE: 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.

NOTES

1 Such an appliance may be of one of the following types:

- a) An appliance having a durable and substantially continuous enclosure of insulating material which envelops all metal parts, with the exception of small parts, such as nameplates, screws and rivets, which are isolated from LIVE PARTS by insulation at least equivalent to REINFORCED INSULATION; such an appliance is called an insulation-encased CLASS II APPLIANCE;
- b) an appliance having a substantially continuous metal enclosure, in which DOUBLE INSULATION OR REINFORCED INSULATION is used throughout; such an appliance is called a metal-encased CLASS II APPLIANCE;
- c) an appliance which is a combination of types a) and b).

2 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.

3 If an appliance with DOUBLE INSULATION OR REINFORCED INSULATION throughout has provision for earthing, it is considered to be a CLASS I or a CLASS 0I APPLIANCE.

2.4.9 CLASS II CONSTRUCTION: Part of an appliance for which protection against electric shock relies upon DOUBLE INSULATION OR REINFORCED INSULATION.

2.4.10 CLASS III APPLIANCE: 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.

NOTE – Appliances intended to be operated at SAFETY EXTRA-LOW VOLTAGE and having internal circuits which operate at a voltage other than SAFETY EXTRA-LOW VOLTAGE, are not included in the classification and are subject to additional requirements.

2.4.11 CLASS III CONSTRUCTION: Part of an appliance for which protection against electric shock relies upon SAFETY EXTRA-LOW VOLTAGE and in which voltages higher than those of SAFETY EXTRA-LOW VOLTAGES are not generated.

2.4.12 CREEPAGE DISTANCE: Shortest path between two conductive parts or between a conductive part and the accessible surface of the appliance, measured along the surface of the insulating material.

2.4.13 CLEARANCE: Shortest distance between two conductive parts or between a conductive part and the accessible surface of the appliance, measured through air.

2.5.1 EXTRA-LOW VOLTAGE: Voltage supplied from a source within the appliance which, when the appliance is supplied at RATED VOLTAGE does not exceed 50 V between conductors and between conductors and earth.

2.5.2 SAFETY EXTRA-LOW VOLTAGE: 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 is to be through a SAFETY ISOLATING TRANSFORMER or a convertor with separate windings, the insulation of which complies with DOUBLE INSULATION OR REINFORCED INSULATION requirements.

NOTE – The voltage limits specified are based on the assumption that the SAFETY ISOLATING TRANSFORMER is supplied at its RATED VOLTAGE.

2.5.2DV D1 Replace the first paragraph by the following:

SAFETY EXTRA-LOW VOLTAGE: Voltage not exceeding 30 Vr.m.s. or 42.4 Vpeak or dc between conductors and between conductors and earth. Where wet contact is likely to occur, the limit is 15 Vr.m.s. or 21.2 Vpeak or dc.

2.5.3 SAFETY ISOLATING TRANSFORMER: Transformer, the input winding of which is electrically separated from the output winding by an insulation at least equivalent to DOUBLE INSULATION OR REINFORCED INSULATION and which is intended to supply an appliance or circuit at SAFETY EXTRA-LOW VOLTAGE.

2.6.1 PORTABLE APPLIANCE: Either an appliance which is intended to be moved while in operation or an appliance, other than a FIXED APPLIANCE, having a mass less than 18 kg.

2.6.2 HAND-HELD APPLIANCE: PORTABLE APPLIANCE intended to be held in the hand during normal use, the motor, if any, forming an integral part of the appliance.

2.6.3 STATIONARY APPLIANCE: Either a FIXED APPLIANCE or an appliance which is not portable.

2.6.4 **FIXED APPLIANCE:** Appliance which is intended to be used while fastened to a support or otherwise secured in a specific situation.

NOTE – Adhesives are not recognized as a means for fastening a FIXED APPLIANCE to a support.

2.6.5 **BUILT-IN APPLIANCE:** FIXED APPLIANCE intended to be installed in a cabinet, in a prepared recess in a wall or in a similar situation.

2.7.1 **NON-DETACHABLE PART:** Part which can only be removed or opened with the aid of a TOOL or a part which fulfills the test of 22.11.

2.7.2 **DETACHABLE PART:** Part which can be removed without the aid of a TOOL, a part which is removed in accordance with the instructions for use, even if a TOOL is needed for removal, or a part which does not fulfill the test of 22.11.

NOTE 1 – If for installations purposes a part has to be removed, this part is not considered to be detachable even if the instructions state that it is to be removed.

NOTE 2 – Components which can be removed without the aid of a TOOL are considered to be DETACHABLE PARTS.

NOTE 3 – A part which can be opened is considered to be a part which can be removed.

2.7.3 **TOOL:** Screwdriver, coin or any other object which may be used to operate a screw or similar fixing means.

2.8.1 **THERMOSTAT:** Temperature-sensing device, the operating temperature of which may be either fixed or adjustable and which during NORMAL OPERATION keeps the temperature of the controlled part between certain limits by automatically opening and closing a circuit.

2.8.2 **TEMPERATURE LIMITER:** 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 the controlled part reaches a pre-determined value.

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

2.8.3 **THERMAL CUT-OUT:** Device which during abnormal operation limits the temperature of the controlled part by automatically opening the circuit or by reducing the current and constructed so that its setting cannot be altered by the user.

2.8.4 **SELF-RESETTING THERMAL CUT-OUT:** THERMAL CUT-OUT which automatically restores the current after the relevant part of the appliance has cooled down sufficiently.

2.8.5 **NON-SELF-RESETTING THERMAL CUT-OUT:** THERMAL CUT-OUT which requires a manual operation for resetting or replacement of a part, in order to restore the current.

NOTE – Manual operation includes disconnection of the supply.

2.8.6 **PROTECTIVE DEVICE:** Device, the operation of which prevents a hazardous situation under abnormal operation conditions.

2.8.7 **THERMAL LINK:** THERMAL CUT-OUT which operates only once and then requires partial or complete replacement.

2.9.1 ALL-POLE DISCONNECTION: For single-phase appliances disconnection of both supply conductors by a single initiating action or, for three-phase appliances, disconnection of all supply conductors except the earthed (grounded) conductor, by a single initiating action.

NOTE – The PROTECTIVE EARTHING CONDUCTOR is not considered to be a supply conductor.

2.9.2 OFF POSITION: Stable position of a switching device in which the circuit controlled by the switch is disconnected from its supply.

NOTE – The OFF POSITION does not imply an ALL-POLE DISCONNECTION.

2.9.3 ACCESSIBLE PART: Part or surface which can be touched by means of the test finger of figure 1, including any conductive part connected to accessible metal parts.

2.9.4 LIVE PART: Any conductor or conductive part intended to be energized in normal use, including a neutral conductor but, by convention, not a PEN conductor.

NOTES

1 Parts, accessible or not, complying with 8.1.4 are not considered to be LIVE PARTS.

2 A PEN conductor is a protective earthed neutral conductor combining the functions of both protective conductor and neutral conductor.

2.9.5 VISIBLY GLOWING HEATING ELEMENT: Heating element which is partly or completely visible from the outside of the appliance and has a temperature of at least 650°C when the appliance has been operated under NORMAL OPERATION at RATED POWER INPUT until steady conditions have been established.

2.9.6 HEATING APPLIANCE: Appliance incorporating heating elements but without any motor.

2.9.7 MOTOR-OPERATED APPLIANCE: Appliance incorporating motors but without any heating element.

NOTE – Magnetically driven appliances are considered to be MOTOR-OPERATED APPLIANCES.

2.9.8 COMBINED APPLIANCE: Appliance incorporating heating elements and motors.

2.9.9 USER MAINTENANCE: Any maintenance operation stated in the instructions for use or marked on the appliance which the user is intended to perform.

2.10.1 ELECTRONIC COMPONENT: Part in which conduction is achieved principally by electrons moving through a vacuum, gas or semiconductor.

NOTE – Neon indicators are not considered to be ELECTRONIC COMPONENTS.

2.10.2 ELECTRONIC CIRCUIT: Circuit incorporating at least one ELECTRONIC COMPONENT.

2.10.3 PROTECTIVE IMPEDANCE: Impedance connected between LIVE PARTS and accessible conductive parts of CLASS II CONSTRUCTION such that the current, in normal use and under likely fault conditions in the appliance, is limited to a safe value.

2.10.4 PTC HEATING ELEMENT: Element intended for heating consisting mainly of positive temperature coefficient resistors which are thermally sensitive and which have a rapid non-linear increase in resistance when the temperature is raised through a particular range.

2.11DV D2 Addition:

LIMITED POWER SOURCE: **A source complying with subclause 8.3DV.**

2.12DV D2 Addition:

PROTECTIVE EARTHING CONDUCTOR: **A conductor in the building installation wiring, or in the power SUPPLY CORD, connecting a main protective earthing terminal in the equipment to an earth point in the building installation.**

2.13DV D2 Addition:

PROTECTIVE BONDING CONDUCTOR: **A conductor in the equipment, or a combination of conductive parts in the equipment, connecting a main protective earthing terminal to a part of the equipment that is required to be earthed.**

3 General requirement

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

In general this principle is achieved by fulfilling the relevant requirements specified in this standard and compliance is checked by carrying out all the relevant tests.

NOTES

1 A product which complies with the text of this standard will not necessarily be judged to comply with the safety principles of the standard if, when examined and tested, it is found to have other features which impair the level of safety covered by these requirements.

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

3 This standard recognizes the internationally accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of electrical household and similar appliances when operated as in normal use taking into account the instructions for use; it also covers abnormal situations likely to be encountered in practice.

3DV D1 Modification of the first paragraph:

Replace “cause no danger to persons or surroundings.” with “reduce the risk of fire, electric shock, and/or injury to persons.”

4 General conditions for the tests

Unless otherwise specified, the tests are carried out in accordance with this clause.

4.1 Tests according to this standard are type tests.

4.2 The tests are carried out on a single appliance, which shall withstand all the relevant tests. However, the tests of clauses 20, 22 (except 22.11 and 22.18) to 26, 28, 30 and 31 may be carried out on separate appliances.

NOTES

1 Additional samples may be required for example if the appliance can be supplied with different voltages.

If the test of annex C has to be made, six samples of the motor are needed.

The testing of components may require the submission of additional samples of these components.

If the tests of 24.1.3 are carried out, three switches or three additional appliances are needed.

If an intentionally weak part becomes open-circuit during the tests of clause 19, an additional appliance is needed.

If the tests of annex R are carried out, four additional transformers are needed.

2 The cumulative stress resulting from successive tests on ELECTRONIC CIRCUITS 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 ELECTRONIC CIRCUITS.

3 If an appliance has to be dismantled in order to carry out a test, care is to be taken to insure that it is reassembled as originally supplied. In case of doubt subsequent tests may be carried out on a separate sample.

4.2DV D2 Replace the first paragraph with the following:

The tests may be carried out on a number of samples as agreed upon by the parties involved.

4.3 The tests are carried out in the order of the clauses. However, the test of 22.11 on the appliance at room temperature is made before the tests of clause 8.

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

4.3DV D2 Replace the first paragraph with the following:

Unless specified otherwise, the tests may be carried out in any order. However, the test of 13 is conducted when the sample is in a well-heated condition simulating NORMAL OPERATION (clause 11) of the appliance: the test of 16 is conducted immediately after the test of 15 and the test of 22.11 is conducted before the test 8.

4.4 When testing appliances which are also supplied by other energies such as gas, the influence of their consumption has to be taken into account.

4.5 The tests are carried out with the appliance or any movable part of it placed in the most unfavourable position which may occur in normal use.

4.6 Appliances provided with controls or switching devices are tested with these controls or devices adjusted to their most unfavourable setting, if the setting can be altered by the user.

NOTES

1 If the adjusting means of the control is accessible without the aid of a TOOL, this subclause 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.

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

4.7 The tests are carried out in a draught free location and in general at an ambient temperature of $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$.

If the temperature attained by any part is limited by a temperature sensitive device or is influenced by the temperature at which a change of state occurs, for example when water boils, the ambient temperature is maintained at $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ in case of doubt.

4.8.1 Appliances for a.c. only are tested with a.c. at RATED FREQUENCY, if marked, and those for a.c./d.c. are tested at the more unfavourable supply.

Appliances for a.c. which are not marked with RATED FREQUENCY or marked with a frequency range of 50 Hz to 60 Hz are tested with either 50 Hz or 60 Hz, whichever is the more unfavourable.

4.8.2 Appliances having more than one RATED VOLTAGE are tested on the basis of the most unfavourable voltage.

When it is specified, for MOTOR-OPERATED APPLIANCES and COMBINED 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 a factor is not specified, the supply voltage is the most unfavourable within the RATED VOLTAGE RANGE.

NOTES

1 If a HEATING APPLIANCE has a RATED VOLTAGE RANGE, the upper limit of the voltage range will usually be the most unfavourable voltage within the range.

2 For COMBINED APPLIANCES and MOTOR-OPERATED APPLIANCES and for appliances having more than one RATED VOLTAGE OR RATED VOLTAGE RANGE, it may be necessary to make some of the tests at the minimum, the mean and the maximum values of the RATED VOLTAGE OR the RATED VOLTAGE RANGE in order to establish the most unfavourable voltage.

4.8.3 When it is specified, for HEATING APPLIANCES and COMBINED APPLIANCES marked with a RATED POWER INPUT RANGE, that the power input is equal to the RATED POWER INPUT multiplied by a factor, the power input is equal to

- the upper limit of the RATED POWER INPUT RANGE multiplied by this factor, if greater than 1;
- the lower limit of the RATED POWER INPUT RANGE multiplied by this factor, if smaller than 1.

When a factor is not specified, the power input is the most unfavourable within the RATED POWER INPUT RANGE.

4.8.4 For appliances marked with a RATED VOLTAGE RANGE and RATED POWER INPUT corresponding to the mean of the RATED VOLTAGE RANGE, when it is specified that the power input is equal to RATED POWER INPUT multiplied by a factor, the power input is equal to:

- the calculated power input corresponding to the upper limit of the RATED VOLTAGE RANGE multiplied by this factor if greater than 1;
- the calculated power input corresponding to the lower limit of the RATED VOLTAGE RANGE multiplied by this factor if smaller than 1.

When a factor is not specified, the power input corresponds to the power input at the most unfavourable voltage within the RATED VOLTAGE RANGE.

4.9 When alternative heating elements or accessories are made available by the appliance manufacturer, the appliance is tested with those elements or accessories which give the most unfavourable results.

4.10 The tests are made on the appliance as supplied. However, an appliance constructed as a single appliance but supplied in a number of units is tested after assembly in accordance with the instructions provided with the appliance.

BUILT-IN APPLIANCES and FIXED APPLIANCES are installed in accordance with the instructions provided with the appliance before testing.

4.11 Appliances intended to be supplied by means of a flexible cord are tested with the appropriate flexible cord connected to the appliance.

4.12 When, for COMBINED APPLIANCES and HEATING APPLIANCES, it is specified that the appliance has to operate at a power input multiplied by a factor, this applies only to heating elements without appreciable positive temperature coefficient of resistance.

For other heating elements, other than PTC HEATING ELEMENTS, the supply voltage is determined by supplying the appliance at RATED VOLTAGE until the heating element reaches its operating temperature. The supply voltage is then rapidly increased to the value necessary to give the power input required for the relevant test, this value of the supply voltage being maintained throughout the test.

NOTE – In general, the temperature coefficient is considered to be appreciable if, at RATED VOLTAGE, the power input of the appliance in cold condition differs by more than 25% from the power input at operating temperature.

4.13 The tests for appliances with PTC HEATING ELEMENTS are made at a voltage corresponding to the specified power input. When a power input greater than the RATED POWER INPUT is specified, the factor for multiplying the voltage is equal to the square root of the factor for multiplying the power input.

4.14 If CLASS 0I APPLIANCES OR CLASS I APPLIANCES have ACCESSIBLE METAL PARTS which are not earthed and are not separated from LIVE PARTS by an intermediate metal part which is earthed, such parts are checked for compliance with the appropriate requirements specified for CLASS II CONSTRUCTION.

If CLASS 0I APPLIANCES OR CLASS I APPLIANCES have ACCESSIBLE NON-METALLIC PARTS, such parts are checked for compliance with the appropriate requirements specified for CLASS II CONSTRUCTION unless these parts are separated from LIVE PARTS by an intermediate metal part which is earthed.

4.15 If appliances have parts operating at SAFETY EXTRA-LOW VOLTAGE, such parts are checked for compliance with the appropriate requirements specified for CLASS III CONSTRUCTION.

4.16 When testing ELECTRONIC CIRCUITS, the supply is to be free from perturbations from external sources that can influence the results of the tests.

4.17 Appliances powered by rechargeable batteries are tested according to annex B.

5 Void

6 Classification

6.1 Appliances shall be of one of the following classes with respect to protection against electric shock:

CLASS 0, CLASS 0I, CLASS I, CLASS II, CLASS III.

Compliance is checked by inspection and by the relevant tests.

6.2 Appliances shall have the appropriate degree of protection against harmful ingress of water.

Compliance is checked by inspection and by the relevant tests.

NOTE – The degrees of protection against harmful ingress of water are given in IEC 60529.

7 Marking and instructions

7.1 Appliances shall be marked with the

- RATED VOLTAGE OR RATED VOLTAGE RANGE in volts;
- symbol for nature of supply, unless the RATED FREQUENCY is marked;
- RATED POWER INPUT in watts or kilowatts or RATED CURRENT in amperes;
- name, trade mark or identification mark of the manufacturer or responsible vendor;
- model or type reference;
- symbol for CLASS II CONSTRUCTION, for CLASS II APPLIANCES only;

- IP number according to degree of protection against ingress of water, other than IPX0.

Compliance is checked by inspection.

NOTES

- 1 The first numeral of the IP number need not be marked on the appliance.
- 2 Additional markings are allowed provided they do not give rise to misunderstanding.
- 3 If components are marked separately, the marking of the appliance and that of the components is to be such that there can be no doubt with regard to the marking of the appliance itself.

7.2 STATIONARY APPLIANCES for multiple supply shall be marked with the substance of the following:

Warning: Before obtaining access to terminals, all supply circuits must be disconnected.

This warning shall be placed in the vicinity of the terminal cover.

Compliance is checked by inspection.

7.3 Appliances having a range of rated values and which can be operated without adjustment throughout the range, shall be marked with the lower and upper limits of the range separated by a hyphen.

NOTE 1 – Example: 115-230 V: The appliance is suitable for any value within the marked range (a curling iron with a PTC HEATING ELEMENT).

Appliances having different rated values and which have to be adjusted for use at a particular value by the user or installer, shall be marked with the different values separated by an oblique stroke.

NOTES

- 2 Example: 115/230 V: The appliance is only suitable for the marked values (a shaver with a selector switch).
 - 3 This requirement is also applicable to appliances with provision for connection to both single-phase and multi-phase supplies.
- Example: 230 V/400 V: The appliance is only suitable for the voltage values indicated where 230 V is for single-phase operation and 400 V for three-phase operation (a dishwasher with terminals for both supplies).

Compliance is checked by inspection.

7.4 If the appliance can be adjusted for different RATED VOLTAGES, the voltage to which the appliance is adjusted shall be clearly discernible.

NOTE – For appliances where frequent changes in voltage setting are not required, this requirement is considered to be met if the RATED VOLTAGE to which the appliance is to be adjusted can be determined from a wiring diagram fixed to the appliance. The wiring diagram may be on the inside of a cover which has to be removed to connect the supply conductors. It is not to be on a label loosely attached to the appliance.

Compliance is checked by inspection.

7.5 For appliances marked with more than one RATED VOLTAGE or with more than one RATED VOLTAGE RANGE, the RATED POWER INPUT for each of these voltages or ranges shall be marked. However, if the difference between the limits of a RATED VOLTAGE RANGE does not exceed 10 % of the mean value of the range, the marking for RATED POWER INPUT may be related to the mean value of the range.

The upper and lower limits of the RATED POWER INPUT shall be marked on the appliance so that the relation between input and voltage is clear.

Compliance is checked by inspection.

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

V	volts
A	amperes
Hz	hertz
W	watts
F	farads
l	liters
g	grammes
Pa	pascals
bar	bars (see note 4)
h	hours
min	minutes
s	seconds
 or d.c.	direct current
 or a.c.	alternating current
2~	two-phase alternating current
2N~	two-phase alternating current with neutral
3~	three-phase alternating current
3N~	three-phase alternating current with neutral
	RATED CURRENT of the appropriate fuse-link in amperes
	time-lag miniature fuse-link where X is the symbol for the time/current characteristic as given in IEC 60127
	protective earth
	CLASS II APPLIANCE
IPXX	IP number
	information symbol
	caution

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If the first numeral for the IP numbering is omitted, the omitted numeral shall be replaced by the letter X, for example IPX3.

The symbol for nature of supply shall be placed next to the marking for RATED VOLTAGE.

The dimensions for the symbol for CLASS II APPLIANCES shall be such that the length of the sides of the outer square is about twice the length of the sides of inner square.

The symbol for CLASS II APPLIANCES shall be placed so that it will be obvious that it is a part of the technical information and is unlikely to be confused with any other marking.

When other units are used the units and their symbols shall be those of the international standardized system.

Compliance is checked by inspection and by measurement.

NOTES

- 1 Multiple or submultiple units are also allowed.
- 2 Additional symbols are allowed provided they do not give rise to misunderstanding.
- 3 Symbols specified in IEC 60417 may be used.
- 4 Bars may be used but only together with pascals and placed in brackets.

7.6DV D2 Addition

See 27.5DV.11 for additional requirements covering the CLASS II APPLIANCE symbol.

7.7 Appliances to be connected to more than two supply conductors and appliances for multiple supply shall have a connection diagram fixed to them, unless the correct mode of connection is obvious.

Compliance is checked by inspection.

NOTES

- 1 The correct mode of connection is considered to be obvious if for three-phase appliances the terminals for the supply conductors are indicated by arrows pointing towards the terminals. The earthing conductor is not a supply conductor.
- 2 Marking in words is an acceptable means of indicating the correct mode of connection.
- 3 The connection diagram may be the wiring diagram referred to in 7.4.

7.8 Except for TYPE Z ATTACHMENT, terminals used for connection to the supply mains shall be indicated as follows:

- terminals intended exclusively for the neutral conductor shall be indicated by the letter N;
- protective earthing terminals shall be indicated by the symbol



IEC417, Symbol 5019

These indications shall not be placed on screws, removable washers or other parts which can be removed when conductors are being connected.

If, for single-phase CLASS I APPLIANCES intended to be permanently connected to fixed wiring, a single-pole PROTECTIVE DEVICE is inserted in the phase conductor inside the appliance, the corresponding terminal shall be clearly indicated.

Compliance is checked by inspection.

7.9 Unless it is obviously unnecessary, switches which may give rise to a hazard when operated 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 or national standards.

Compliance is checked by inspection.

7.10 The different positions of switches on STATIONARY APPLIANCES and the different positions of controls on all appliances shall be indicated by figures, letters or other visual means.

NOTE 1 – This requirement also applies to switches which are part of a control.

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 output, input, speed, cooling effect, etc., shall be indicated by a higher figure.

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

Compliance is checked by inspection.

NOTE 2 – The figure 0 may, for example, also be used on a digital programming keyboard.

7.11 Controls intended to be adjusted during installation or in normal use shall be provided with an indication for the direction of adjustment.

Compliance is checked by inspection.

NOTE – An indication of + and - is sufficient.

7.12 Instructions for use shall be provided with the appliance so that the appliance can be used safely.

Compliance is checked by inspection.

NOTE – Instructions for use may be marked on the appliance as long as they are visible in normal use.

7.12.1 If it is necessary to take special precautions for installation or USER MAINTENANCE, details of these shall be supplied.

Compliance is checked by inspection.

7.12.2 If a STATIONARY APPLIANCE is not provided with a SUPPLY CORD and a plug or with other means for disconnection from the supply having a contact separation of at least 3 mm in all poles, the instructions shall state that means for disconnection must be incorporated in the fixed wiring according to the wiring rules.

Compliance is checked by inspection.

7.12.3 If the insulation of the supply wires of an appliance intended to be permanently connected to fixed wiring can come into contact with parts which have a temperature rise exceeding 50 K during the test of clause 11, the instructions shall state that the appliance must be connected by means of wires having an appropriate temperature rating (T-marking).

Compliance is checked by inspection and during the test of clause 11.

NOTE – This requirement will become applicable as soon as there is an IEC standard for high temperature cords and wires.

7.12.4 The instructions for BUILT-IN APPLIANCES shall include clear information with regard to the following:

- dimensions of the space to be provided for the appliance;
- dimensions and position of the means for supporting and fixing the appliance within this space;
- minimum distances between the various parts of the appliance and the surrounding parts of the fitment;
- minimum dimensions of ventilating openings and their correct arrangement;
- connection of the appliance to the supply and the interconnection of any separate components;
- necessity to have the plug accessible after installation, unless the appliance is provided with a switch complying with 24.3.

Compliance is checked by inspection.

7.12.5 The instructions shall contain the substance of the following:

- for appliances with TYPE X ATTACHMENT having a specially prepared cord:

If the SUPPLY CORD is damaged, it must be replaced by a special cord or assembly available from the manufacturer or its service agent;

- for appliances with TYPE Y ATTACHMENT:

If the SUPPLY CORD is damaged, it must be replaced by the manufacturer or its service agent or a similarly qualified person in order to avoid a hazard;

- for appliances with TYPE Z ATTACHMENT:

The SUPPLY CORD cannot be replaced. If the cord is damaged the appliance should be scrapped.

Compliance is checked by inspection.

7.13 Instructions and other texts required by this standard shall be written in the official language of the country in which the appliance is to be sold.

Compliance is checked by inspection.

7.14 The markings required by the standard shall be clearly legible and durable.

Compliance is checked by inspection 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 petroleum spirit.

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

NOTES

1 In considering the durability of the marking, the effect of normal use is taken into account. For example, marking by means of paint or enamel, other than vitreous enamel, on containers that are likely to be cleaned frequently, is not considered to be durable.

2 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 0,66 kg/l.

7.15 The markings specified in 7.1 to 7.5 shall be on a main part of the appliance.

Markings on the appliance shall be clearly discernible from the outside of the appliance but if necessary after removal of a cover. For PORTABLE APPLIANCES it shall be possible to remove or open this cover without the aid of a TOOL.

For STATIONARY APPLIANCES at least the name or trade mark or identification mark of the manufacturer or responsible vendor and the model or type reference shall be visible when the appliance is installed as in normal use. These markings may be beneath a detachable cover. Other markings may be beneath a cover only if they are near to the terminals.

For FIXED APPLIANCES, this requirement applies after the appliance has been installed according to the instructions provided with the appliance.

Indications for switches and controls shall be placed on or near these components. They shall not be placed on parts which can be positioned or repositioned in such a way that the marking is misleading.

Compliance is checked by inspection.

7.16 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 at such a place that it is clearly visible when the appliance has been dismantled to the extent necessary for replacing the link.

NOTE – Marking on the link is allowed as long as the marking is legible after the link has functioned.

This requirement does not apply to links which can only be replaced together with a part of the appliance.

Compliance is checked by inspection.

8 Protection against access to LIVE PARTS

8.1 Appliances shall be constructed and enclosed so that there is adequate protection against accidental contact with LIVE PARTS.

Compliance is checked by inspection and by the tests of 8.1.1 to 8.1.3 as applicable, taking into account 8.1.4 and 8.1.5.

8.1.1 The requirement of 8.1 applies for all positions of the appliance when it is operated as in normal use, even after opening lids and doors and removal of DETACHABLE PARTS.

NOTE – This excludes the use of screw-type fuses and screw-type miniature circuit breakers which are accessible without the aid of a **TOOL**.

*Lamps located behind a detachable cover are not removed, provided the appliance can be isolated from the supply by means of a plug or an all-pole switch. However, during insertion or removal of lamps which are located behind a detachable cover, protection against contact with **LIVE PARTS** of the lamp cap shall be ensured.*

The test finger of figure 1 is applied without appreciable force, the appliance being in every possible position except that appliances normally used on the floor and having a mass exceeding 40 kg are not tilted. Through openings, the test finger is applied to any depth that the finger will permit and is rotated or angled before, during and after insertion to any position. If the opening does not allow the entry of the finger, the force on the finger in the straight position is increased to 20 N. If the finger then enters the opening, the test is repeated with the finger in the angled position.

*It shall not be possible to touch **LIVE PARTS** OR **LIVE PARTS** protected only by lacquer, enamel, ordinary paper, cotton, oxide film, beads or sealing compound except self-hardening resins, with the test finger.*

8.1.1DV D1 Add the following after the third paragraph:

The articulate probe of figure 1DV shall replace the test finger of figure 1 when the product is:

- a) a hand-held product,**
- b) a hand-held part of a product,**
- c) used by children,**
- d) accessible to children while the product is operating, or**
- e) one that has special concerns for the accessibility of **LIVE PARTS** or mechanical hazards.**

*8.1.2 The test pin of figure 2 is applied without appreciable force through openings in **CLASS 0 APPLIANCES, CLASS II APPLIANCES OR CLASS II CONSTRUCTIONS**, except for those giving access to lamp caps and **LIVE PARTS** in socket-outlets.*

The test pin is also applied though openings in earthed metal enclosures having a non conductive coating such as enamel or lacquer.

*It shall not be possible to touch **LIVE PARTS** with the test pin.*

NOTE – Appliance outlets are not considered to be socket-outlets.

*8.1.3 Instead of the test finger and the test pin, for appliances other than those of **CLASS II**, the test probe of figure 3 is applied without appreciable force to **LIVE PARTS** of **VISIBLY GLOWING HEATING ELEMENTS**, all poles of which can be disconnected by a single switching action. It is also applied to parts supporting such elements, provided that it is obvious from the outside of the appliance, without removing covers and similar parts, that these supporting parts are in contact with the element.*

*It shall not be possible to touch these **LIVE PARTS**.*

NOTE – For appliances provided with a SUPPLY CORD and without a switching device in their supply circuit, the withdrawal of the plug from a socket-outlet is considered to be a single switching action.

8.1.4 An ACCESSIBLE PART is not considered to be live if

– the part is supplied at SAFETY EXTRA-LOW VOLTAGE 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 V;

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 2mA 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 μ F;
- for voltages having a peak value over 450 V up to and including 15 kV, the discharge shall not exceed 45 μ C.

Compliance is checked by measurement with the appliance supplied at RATED VOLTAGE.

Voltages and currents are measured between the relevant parts and each pole of the supply source. Discharges are measured immediately after the interruption of the supply.

NOTE – Details of a suitable measuring circuit for leakage current are given in annex G.

8.1.5 LIVE PARTS of BUILT-IN APPLIANCES, FIXED APPLIANCES and appliances delivered in separate units, shall be protected at least by BASIC INSULATION before installation or assembly.

Compliance is checked by inspection and by the test of 8.1.1.

8.2 CLASS II APPLIANCES and CLASS II CONSTRUCTIONS shall be constructed and enclosed so that there is adequate protection against accidental contact with BASIC INSULATION and metal parts separated from LIVE PARTS by BASIC INSULATION only.

It shall only be possible to touch parts which are separated from LIVE PARTS by DOUBLE INSULATION OR REINFORCED INSULATION.

Compliance is checked by inspection and by applying the test finger of figure 1, as described in 8.1.1.

NOTES

1 This requirement applies for all positions of the appliance when it is operated as in normal use, even after opening lids and doors and removal of DETACHABLE PARTS.

2 BUILT-IN APPLIANCES and FIXED APPLIANCES are tested after installation.

8.3DV D1 Addition of 8.3DV.1 to 8.3DV.1.5:

8.3DV.1 Limited power sources

8.3DV.1.1 A LIMITED POWER SOURCE operated from an a.c. mains supply, or a battery operated limited power source that is recharged from an a.c. mains supply while supplying the load, shall incorporate an isolating transformer.

8.3DV.1.2 A LIMITED POWER SOURCE shall have a SAFETY EXTRA-LOW VOLTAGE output and comply with one of the following:

- the output is inherently limited in compliance with table 8.3DV.1.2.1; or
- an impedance limits the output in compliance with table 8.3DV.1.2.1. If a positive temperature coefficient device is used, it shall pass the tests specified in the third edition of UL 60730-1A, annex J; or
- an overcurrent PROTECTIVE DEVICE is used and the output is limited in compliance with table 8.3DV.1.2.2. Measurement of VA and I_{SC} is conducted with the overcurrent protective device bypassed in accordance with table 8.3DV.1.2.2; or
- a regulating network limits the output in compliance with table 8.3DV.1.2.1, both under normal operating conditions and after any single fault in the regulating network (open circuit or short circuit).

Table 8.3DV.1.2.1 D1 Addition:

Table 8.3DV.1.2.1 – Limits for inherently LIMITED POWER SOURCES (see 8.3DV)

Output voltage ¹⁾ (U_{OC})		Output current ²⁾ (I_{SC})	Apparent power ³⁾ (S) VA
V a.c.	V d.c.		
≤ 20	≤ 20	$\leq 8,0$	$\leq 5 \times U_{OC}$
$20 < U_{OC} \leq 30$	$20 < U_{OC} \leq 30$	$\leq 8,0$	≤ 100
–	$30 < U_{OC} \leq 42,4$	$\leq 150 / U_{OC}$	≤ 100

1) U_{OC} : Output voltage measured with all load circuits disconnected. Voltages are for substantially sinusoidal a.c. and ripple free d.c. For non-sinusoidal a.c. and d.c. with ripple greater than 10% of the peak, the peak voltage shall not exceed 42,4 V.

2) I_{SC} : Maximum output current with any non-capacitive load, including a short circuit measured 60 s after application of the load.

3) S (VA): Maximum output VA with any load. Initial transients lasting less than 60 s are permitted to exceed the limit.

Table 8.3DV.1.2.2 D1 Addition:

**Table 8.3DV.1.2.2 – Limits for power sources not inherently limited
(Overcurrent PROTECTIVE DEVICE required)**

Output Voltage ¹⁾ (U _{OC})		Output current ²⁾ (I _{SC}) A	Apparent power ³⁾ (S) VA	Current rating of overcurrent PROTECTIVE DEVICE A
V a.c.	V d.c.			
≤ 20	≤ 20	1 000/U _{OC}	250	5,0
20 < U _{OC} ≤ 30	20 < U _{OC} ≤ 30			100/U _{OC}
–	30 < U _{OC} ≤ 42,4			100/U _{OC}

1) U_{OC}: Output voltage measured with all load circuits disconnected. Voltages are for substantially sinusoidal a.c. and ripple free d.c. For non-sinusoidal a.c. and for d.c. with ripple greater the 10% of the peak, the peak voltage shall not exceed 42,4 V.

2) I_{SC}: Maximum output current with any non-capacitive load, including a short circuit, measured 60 s after application of the load. Current limiting impedances in the equipment remain in the circuit during measurement, but overcurrent PROTECTIVE DEVICES are bypassed.

3) VA: Maximum output VA with any load. Current limiting impedances in the equipment remain in the circuit during measurement, but overcurrent PROTECTIVE DEVICES are bypassed. Initial transients lasting less than 60 s are permitted to exceed the limit.

NOTE – The reason for making measurements with overcurrent PROTECTIVE DEVICES bypassed is to determine the amount of energy that is available to cause the possible overheating during the operating time of the overcurrent PROTECTIVE DEVICES.

8.3DV.1.3 Where an overcurrent PROTECTIVE DEVICE is used, it shall be a fuse which is not accessible to the user or a non-adjustable, non-autoreset, electromechanical device.

8.3DV.1.4 Compliance is checked by inspection and measurement and, where appropriate, by examination of the manufacturer's data for batteries. Batteries are to be fully charged when conducting the measurements for U_{OC} and I_{SC} according to tables 8.3DV.1.2.1 and 8.3DV.1.2.2.

8.3DV.1.5 The load referenced in items 2) and 3) of tables 8.3DV.1.2.1 and 8.3DV.1.2.2, is adjusted to develop maximum current and power transfer respectively. Single Faults in a regulating network are applied under these current and power conditions.

9 Starting of motor-operated appliances

Requirements and tests are specified in part 2 when necessary.

10 Power input and current

10.1 The power input of the appliance at RATED VOLTAGE and at normal operating temperature shall not deviate from the RATED POWER INPUT by more than the deviation shown in table 1.

The deviation for MOTOR-OPERATED APPLIANCES applies for COMBINED APPLIANCES if the power input of the motors is more than 50% of the total RATED POWER INPUT.

NOTE 1 – In case of doubt the power input of the motors is measured separately.

Compliance is checked by measurement when the power input has stabilized:

- all circuits which can operate simultaneously being in operation;
- the appliance being supplied at RATED VOLTAGE;

– the appliance being operated under *NORMAL OPERATION*.

If the power input varies throughout the operating cycle, the power input is determined as the mean value of the power input occurring during a representative period

NOTES

2 The test is made at both the upper and lower limits of the ranges for appliances marked with one or more **RATED VOLTAGE RANGES**, unless the marking of the **RATED POWER INPUT** is related to the mean value of the relevant voltage range, in which case the test is made at a voltage equal to the mean value of that range.

3 The permissible deviations apply for both limits of the range for appliances marked with a **RATED VOLTAGE RANGE** having limits differing by more than 10% of the mean value of the range.

4 The negative deviation is not limited for **MOTOR-OPERATED APPLIANCES** and for all appliances having a **RATED POWER INPUT** of 25 W or less.

Table 1 – Power input deviation

Type of appliance	RATED POWER INPUT W	Deviation
All appliances	≤ 25	+ 20%
HEATING APPLIANCES and COMBINED APPLIANCES	> 25 and ≤ 200	± 10%
	> 200	+ 5% or 20 W (whichever is the greater) - 10%
MOTOR-OPERATED APPLIANCES	> 25 and ≤ 300	+ 20%
	> 300	+ 15% or 60 W (whichever is the greater)

10.2 If an appliance is marked with **RATED CURRENT**, the current at normal operating temperature shall not deviate from **RATED CURRENT** by more than the corresponding deviation shown in table 2.

Compliance is checked by measurement when the current has stabilized:

- all circuits which can operate simultaneously being in operation;
- the appliance being supplied at *RATED VOLTAGE*;
- the appliance being operated under *NORMAL OPERATION*.

If the current varies throughout the operating cycle, the current is determined as the mean value of the current occurring during a representative period.

NOTES

1 The test is made at both the upper and lower limits of the ranges for appliances marked with one or more **RATED VOLTAGE RANGES**, unless the marking of the **RATED CURRENT** is related to the mean value of the relevant voltage range, in which case the tests are made at a voltage equal to the mean value of that range.

2 The permissible deviations apply for both limits of the range for appliances marked with a **RATED VOLTAGE RANGE** having limits differing by more than 10% of the mean value of the range.

3 The negative deviation is not limited for MOTOR-OPERATED APPLIANCES and for all appliances having a RATED CURRENT of 0,2 A or less.

Table 2 – Current deviation

Type of appliance	RATED CURRENT A	Deviation
All appliances	$\leq 0,2$	+ 20%
HEATING APPLIANCES and COMBINED APPLIANCES	$> 0,2$ and $\leq 1,0$	$\pm 10\%$
	$> 1,0$	+ 5% or 0,10 A (whichever is the greater) - 10%
MOTOR-OPERATED APPLIANCES	$> 0,2$ and $\leq 1,5$	+ 20%
	$> 1,5$	+ 15% or 0,30 A (whichever is the greater)

11 Heating

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

Compliance is checked by determining the temperature rise of the various parts under the conditions specified in 11.2 to 11.7 but if the temperature rise of the motor winding exceeds the value specified in table 3 or if there is doubt with regard to the classification of the insulation system employed in a motor, by the tests of annex C.

11.2 HAND-HELD APPLIANCES are held in their normal position of use.

BUILT-IN APPLIANCES are installed in accordance with the instructions for installation.

Other HEATING APPLIANCES and other COMBINED APPLIANCES are placed in a test corner as follows:

- appliances normally placed on a floor or table in use, are placed on the floor as near to the walls as possible;
- appliances normally fixed to a wall are fixed on one of the walls, as near to the other wall and to the floor or ceiling as is likely to occur in normal use, unless otherwise stated in the instructions for installation;
- appliances normally fixed to a ceiling are fixed to the ceiling as near to the walls as is likely to occur in normal use, unless otherwise stated in the instructions for installation.

Other MOTOR-OPERATED APPLIANCES are positioned as follows:

- appliances normally placed on a floor or table in use, are placed on a horizontal support;
- appliances normally fixed to a wall are fixed to a vertical support;

– appliances normally fixed to a ceiling are fixed underneath a horizontal support.

Dull black-painted plywood approximately 20 mm thick is used for the test corner, the supports and for the installation of BUILT-IN APPLIANCES.

For appliances provided with an automatic cord reel, one-third of the total length of the cord is unreeled. The temperature rise of the cord sheath is determined as near as possible to the hub of the reel and also between the two outermost layers of the cord on the reel.

For cord storage devices other than automatic cord reels, which are intended to accommodate the SUPPLY CORD partially while the appliance is in operation, 50 cm of the cord is unwound. The temperature rise of the stored part of the cord is determined at the most unfavourable place.

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

NOTE – Thermocouples having wires with a diameter not exceeding 0,3 mm are considered to be fine-wire thermocouples.

Thermocouples used for determining the temperature rise of the surface of walls, ceiling and floor are attached to the back of small blackened disks of copper or brass, 15 mm in diameter and 1 mm thick. The front of the disk is flush with the surface of the board.

So far as is possible, the appliance is positioned so that the thermocouples detect the highest temperatures.

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 29.1.

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

NOTES

1 If it is necessary to dismantle the appliance to position thermocouples, care is taken to ensure that the appliance has been correctly reassembled and the power input is measured again.

2 The point of separation of the cores of a multicore cord and the point where insulated wires enter lampholders, are examples of places where thermocouples are positioned.

11.3DV D2 Modification of the first paragraph of 11.3 to add the following:

Measuring motor winding temperatures by thermocouples is not prohibited.

11.4 HEATING APPLIANCES are operated under NORMAL OPERATION, at 1,15 times the RATED POWER INPUT.

11.5 MOTOR-OPERATED APPLIANCES are operated under NORMAL OPERATION, supplied with the most unfavourable voltage between 0,94 times and 1,06 times the RATED VOLTAGE.

11.6 COMBINED APPLIANCES are operated under NORMAL OPERATION, supplied with the most unfavourable voltage between 0,94 times and 1,06 times the RATED VOLTAGE.

11.7 The appliance is operated for a duration corresponding to the most unfavourable conditions of normal use.

NOTE – The duration of the test may consist of more than one cycle of operation.

11.8 During the test the temperature rises are monitored continuously and shall not exceed the values shown in table 3, PROTECTIVE DEVICES shall not operate and sealing compound shall not flow out.

NOTES

1 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 25°C.

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

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

where

Δt is the temperature rise of the winding;

R_1 is the resistance at the beginning of the test;

R_2 is the resistance at the end of the test;

k is equal to 234,5 for copper windings and 225 for aluminum windings;

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 are to 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.

NOTE 3 – The temperature rise limit for metal applies to parts having a metal coating at least 0,1 mm thick and to metal parts having a plastic coating less than 0,3 mm thick.

NOTE 4 – The temperature of the terminals of switches is measured if the switch is tested in accordance with annex S.

Table 3 – Maximum normal temperature rises

<i>Part</i>	<i>Temperature rise K</i>
<i>Windings¹⁾, if the winding insulation according to IEC 60085 is:</i>	
– class A	75 (65)
– class E	90 (80)
– class B	95 (85)
– class F	115
– class H	140
– class 200	160
– class 220	180
– class 250	210
<i>Pins of appliance inlets:</i>	
– for very hot conditions	130
– for hot conditions	95
– for cold conditions	45
<i>Terminals, including earthing terminals, for external conductors of STATIONARY APPLIANCES, unless they are provided with a SUPPLY CORD</i>	60
<i>Ambient of switches, THERMOSTATS and TEMPERATURE LIMITERS²⁾:</i>	
– without T-marking	30
– with T-marking	T-25
<i>Rubber or polyvinyl chloride insulation of internal and external wiring including SUPPLY CORDS:</i>	
– without temperature rating ³⁾	50
– with temperature rating (T)	T-25
<i>Cord sheaths used as SUPPLEMENTARY INSULATION</i>	35
<i>Sliding contacts of cord reels</i>	65

Table 3 – Maximum normal temperature rises Continued on Next Page



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Table 3 – Maximum normal temperature rises Continued

Part	Temperature rise K
<i>Rubber, other than synthetic, used for gaskets or other parts, the deterioration of which could affect safety:</i>	
– when used as SUPPLEMENTARY INSULATION or as REINFORCED INSULATION	40
– in other cases	50
<i>Lampholders with T-marking⁹⁾:</i>	
– B15 and B22 marked T1	140
– B15 and B22 marked T2	185
– other lampholders	T-25
<i>Lampholders without T-marking⁹⁾:</i>	
– E14 and B15	110
– B22, and E26 and E27	140
– other lampholders and starter holders for fluorescent lamps	55
<i>Material used as insulation other than that specified for wires and windings⁴⁾</i>	
– impregnated or varnished textile, paper or press board	70
– laminates bonded with:	
• melamine-formaldehyde, phenol-formaldehyde or phenol-furfural resins	85 (175)
• urea-formaldehyde resin	65 (150)
– printed circuit boards bonded with epoxy resin	120
– Moulding of:	
• phenol-formaldehyde with cellulose fillers	85 (175)
• phenol-formaldehyde with mineral fillers	100 (200)
• melamine-formaldehyde	75 (150)
• urea-formaldehyde	65 (150)
– polyester with glass-fibre reinforcement	110
– silicone rubber	145