

UL 60335-1

ISBN 0-7629-0903-X

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

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Underwriters Laboratories Inc. (UL)
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UL Standard for Safety for Safety of Household and Similar Electrical Appliances, Part 1: General Requirements, UL 60335-1

Fourth Edition, Dated March 5, 2004

Revisions: This Standard contains revisions through and including April 14, 2006.

Summary of Topics

These editorial revisions to ANSI/UL 60335-1 replace all references to UL 1020, the Standard for Thermal Cutoffs for Use in Electrical Appliances and Components, with reference to UL 60691, the Standard for Thermal-Links – Requirements and Application Guide. UL 1020 was withdrawn and superseded by UL 60691.

Text that has been changed in any manner is marked with a vertical line in the margin. Changes in requirements are marked with a vertical line in the margin and are followed by an effective date note indicating the date of publication or the date on which the changed requirement becomes effective.

The revisions dated April 14, 2006 include a reprinted title page (page1) for this Standard.

The revisions dated April 14, 2006 editorially replace all references to UL 1020 with the reference to UL 60691.

As indicated on the title page (page 1), this UL Standard for Safety is an American National Standard. Attention is directed to the note on the title page of this Standard outlining the procedures to be followed to retain the approved text of this ANSI/UL Standard.

The UL Foreword is no longer located within the UL Standard. For information concerning the use and application of the requirements contained in this Standard, the current version of the UL Foreword is located on ULStandardsInfoNet at: <http://ulstandardsinfo.net/ulforeword.html>.

The master for this Standard at UL's Northbrook Office is the official document insofar as it relates to a UL service and the compliance of a product with respect to the requirements for that product and service, or if there are questions regarding the accuracy of this Standard.

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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.

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8-22D	January 20, 2006
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MARCH 5, 2004
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ANSI/UL 60335-1-2005

1

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, 2002

Fourth Edition

March 5, 2004

The most recent designation of ANSI/UL 60335-1 as an American National Standard (ANSI) occurred on December 12, 2005. The ANSI approval for this standard does not include the cover page, transmittal pages, title page or preface.

This ANSI/UL Standard for Safety, which consists of the Fourth Edition, with revisions through April 14, 2006, is under continuous maintenance, whereby each revision is ANSI approved upon publication. Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at <http://csds.ul.com>.

An effective date is one established by Underwriters Laboratories Inc. and is not part of the ANSI Standard.

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.

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Preface (UL)

This UL Standard is based on IEC Publication 60335-1: fourth edition Safety of Household and Similar Appliances, part 1: General Requirements. 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 2001 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.

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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 2001 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 regulatory requirements**.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for 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 DVB contains appropriate replacement text for some of the IEC text used in this standard. Annex DVA, Glossary of Equivalent Terms, explains the equivalent US terminology to IEC terminology used in UL 60335-1.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

Addition / Add - An addition entails adding a complete new numbered clause, subclause, table or figure. Addition is not meant to include adding select words to the base IEC text.

Modification / Modify - A modification is an altering of the existing base IEC text such as the addition, replacement or deletion of certain words or the replacement of an entire clause, subclause, table, or figure of the base IEC text.

Deletion / Delete - A deletion entails complete deletion of an entire numbered clause, subclause, table or figure without any replacement text.

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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 co-operation 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 express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.

3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, 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.

6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

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

This fourth edition cancels and replaces the third edition published in 1991 and its amendments 1 (1994) and 2 (1999). It constitutes a technical revision.

The text of this part of IEC 60335 is based on the following documents:

FDIS	Report on voting
61/1965/FDIS	61/1998/RVD

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

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

FDIS	Report on voting
61/2569/FDIS	61/2639/RVD

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

Full information on the voting for this amendment can be found in the report on voting in the above table.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until 2006. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

This part is to be used in conjunction with the appropriate part 2 of IEC 60335. The parts 2 contain clauses to supplement or modify the corresponding clauses in this part to provide the relevant requirements for each type of appliance.

Annexes B, C, D, E, F, G, H, I, J, K, M, N and R form an integral part of this standard.

Annexes A, L, O, P and Q are for information only.

NOTE 1 – The following annexes contain provisions suitably modified from other IEC standards:

Annex E – Needle flame test: IEC 60695-2-2

Annex F – Capacitors: IEC 60384-14

Annex G – Safety isolating transformers: IEC 61558-1 and IEC 61558-2-6

Annex H – Switches: IEC 61058-1

Annex J – Coated printed circuit boards: IEC 60664-3

Annex N – Proof tracking test: IEC 60112

Annex R – Software evaluation: IEC 60730-1

NOTE 2 – The following print types are used:

- Requirements: in roman type
- *Test specifications: in italic type*
- Notes: in small roman type.
- Words in bold in the text are defined in clause 3. When a definition concerns an adjective, the adjective and associated noun are also in bold.

The following differences exist in some countries indicated below.

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- Clause 3: Steady conditions are defined (Poland).
- 3.4.2: SAFETY EXTRA-LOW VOLTAGE shall not exceed 30 V (42,4 V peak) (U.S.A.).
- 5.7: The ambient temperature is $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ (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 parts 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 APPLIANCES AND CLASS 0I APPLIANCES are not allowed (Australia, Austria, Belgium, Czech Republic, Finland, France, Germany, Greece, Hungary, India, Israel, Ireland, Italy, Netherlands, New Zealand, Norway, Poland, Singapore, Slovakia, Sweden, Switzerland, United Kingdom, Yugoslavia).
- 6.2: Protection against harmful ingress of water is determined by methods other than those given in IEC 60529 (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 requirements for full disconnection do not apply (Japan, 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 probe 13 and test probe 41 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.).
- Clause 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 national differences (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 (India, U.S.A.).
- 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.).
- 19.11: Different tests are carried out to evaluate solid state devices used in protective electronic circuits (U.S.A.).
- 19.13: The temperature rise limits of table 9 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.).
- Clause 21.1: Impact force is applied by a falling steel ball instead of the spring hammer (U.S.A.).
- Clause 22: The d.c. component in the appliance neutral is limited (Australia).
- 22.1: The IP system is not used and tests are different (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).
- 22.3: The test is different (U.S.A.).
- 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).
- 22.46: The evaluation of software is different (U.S.A.).
- 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.).
- 24.1.3: The number of cycles is different and the note 1 does not apply (U.S.A.).
- 24.1.4: The numbers of cycles is different and note 1 does not apply (USA).
- 24.3: The requirement for full disconnection does not apply (U.S.A.).
- 25.1: The SUPPLY CORD is not required to be fitted with a plug (Ireland).
- 25.3: A set of SUPPLY LEADS is not permitted (Norway, Sweden, Denmark, Finland, Netherlands).

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- 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.).
- 25.13: Only one separate insulation is required (U.S.A.).
- 25.16: A pull of 35 lbs is applied except for small appliances. Generally the torque test is not applied (U.S.A.).
- 26.3: The tests only apply to terminals for connection to fixed wiring (U.S.A.).
- 26.6: Cross-sectional areas are specified according to American Wire Gauge (AWG) (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.).
- Clause 29: The requirements for CLEARANCES and CREEPAGE DISTANCES are different (U.S.A.).
- 29.1: Different rated impulse voltages are used between 50 V and 150 V (Japan).
- 29.3: The third dashed item of the test specification does not apply (Germany).
- 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.).
- Annex 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).
- Annex B, 21.101: The requirement is different (U.S.A.).
- Annex I: The annex applies to motors having a WORKING VOLTAGE not exceeding 30 V (U.S.A.).

DV.1 DE Replace the fourth paragraph following the second table with the following paragraph:

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

DV.2 DE Replace the first sentence of the fourth dashed paragraph of the second note with the following:

Words in SMALL ROMAN CAPS in the text are defined in clause 3.

DV.3 DE Add the following after the last item in the second 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.

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DV.4 D2 Addition at the end of the clause list:

The USA differences have been reviewed and developed into UL national differences in this part 1 standard or in the applicable part 2 standards.

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INTRODUCTION

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

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 that can be expected in practice and takes into account the way in which electromagnetic phenomena can affect the safe operation of appliances.

This standard takes into account the requirements of IEC 60364 so far as possible so that there is compatibility with the wiring rules when the appliance is connected to the supply mains. However national wiring rules may differ.

If 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.

NOTE 1 – Throughout this publication, when “Part 2” is mentioned, it refers to the relevant part of IEC 60335.

This standard is a product family standard dealing with the safety of appliances and takes precedence over horizontal and generic standards covering the same subject.

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

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

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

NOTE 2 – Standards dealing with non-safety aspects of household appliances are

- IEC Standards published by TC 59 concerning methods of measuring performance;
- CISPR 11, CISPR 14-1, IEC 61000-3-2, and IEC 61000-3-3 concerning electromagnetic emissions;
- CISPR 14-2 concerning electromagnetic immunity.

DV.5 D2 Modification of the second paragraph in the introduction:

Delete the last clause starting with, “...and takes into account...”

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SAFETY OF HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES

– PART 1: GENERAL Requirements

1 Scope

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

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.

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

- 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;
- 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);
- audio, video and similar equipment (IEC 60065);
- appliances for medical purposes (IEC 60601);
- hand-held motor-operated electric tools (IEC 60745);
- personal computers and similar equipment (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 articulated probe of Figure 12DV shall replace test probe B of IEC 61032 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 the 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 Normative references

2.1 The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to or revisions of any of these publications do not apply. However, parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid international Standards.

IEC 60061-1,

Lamp caps and holders together with gauges for the control of interchangeability and safety – Part 1: Lamp caps

IEC 60068-2-2,

Environmental testing – Part 2: Tests. Tests B: Dry heat

IEC 60068-2-32,

Environmental testing – Part 2: Tests – Test Ed: Free fall (Procedure 1)

IEC 60068-2-75,

Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests

IEC/TR3 60083,

Plugs and socket-outlets for domestic and similar general use standardized in member countries of IEC

IEC 60085,

Thermal evaluation and classification of electrical insulation

IEC 60112: 2003,

Method for the determination of the proof and the comparative tracking indices of solid insulating materials

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IEC 60127 (all parts),
Miniature fuses

IEC 60227 (all parts),
Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V

IEC 60238,
Edison screw lampholders

IEC 60245 (all parts),
Rubber insulated cables – Rated voltages up to and including 450/750 V

IEC 60249-2-4: 1987,
Base materials for printed circuits – Part 2: Specifications – Specification No. 4: Epoxide woven glass fabric copper-clad laminated sheet, general purpose grade
Amendment 1 (1989)
Amendment 2 (1992)
Amendment 3 (1993)
Amendment 4 (1994)
Amendment 5 (2000)

IEC 60249-2-5:1987,
Base materials for printed circuits – Part 2: Specification No. 5: Epoxide woven glass fabric copper-clad laminated sheet, of defined flammability (vertical burning test)
Amendment 1 (1989)
Amendment 2 (1992)
Amendment 3 (1993)
Amendment 4 (1994)
Amendment 5 (2000)

IEC 60252,
A.C. motor capacitors

IEC 60320-1,
Appliance couplers for household and similar general purposes – Part 1: General requirements

IEC 60320-2-2,
Appliance couplers for household and similar general purposes – Part 2-2: Interconnection couplers for household and similar equipment

IEC 60320-2-3,
Appliance couplers for household and similar general purposes – Part 2-3: Appliance coupler with a degree of protection higher than IPX0

IEC 60384-14,
Fixed capacitors for use in electronic equipment – Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains

IEC 60417-DB:2002 (all parts),
Graphical symbols for use on equipment

IEC 60529,
Degrees of protection provided by enclosures (IP Code)

IEC 60598-1: 2003,
Luminaries – Part 1: General requirements and tests

IEC 60664-1: 1992,
Insulation coordination for equipment within low voltage systems – Part 1: Principles, requirements and tests
Amendment 1 (2000)
Amendment 2 (2002)

IEC 60664-3: 1992,
Insulation coordination for equipment within low voltage systems – Part 3: Use of coatings to achieve insulation coordination of printed board assemblies

IEC 60695-2-2: 1991,
Fire hazard testing – Part 2: Test methods – Section 2: Needle-flame test

IEC 60695-2-11,
Fire hazard testing – Part 2-11: Glowing/hot wire based test methods – Glow-wire flammability test method for end-products

IEC 60695-2-12,
Fire hazard testing – Part 2-12: Glowing/hot wire based test methods – Glow-wire flammability test method for materials

IEC 60595-2-13,
Fire hazard testing – Part 2-13: Glowing/hot wire based test methods – Glow-wire ignitability test method for materials

IEC 60595-10-2,
Fire hazard testing – Part 10: Guidance and test methods for the minimization of the effects of abnormal heat on electrotechnical products involved in fires – Section 2: Method for testing products made from non-metallic materials for resistance to heat

IEC 60695-11-10,
Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods

IEC 60730-1: 1999,
Automatic electrical controls for household and similar use – Part 1: General requirements

IEC 60730-2-8: 2000,
Automatic electrical controls for household and similar use – Part 2-8: Particular requirements for electrically operated water valves, including mechanical requirements

IEC 60738-1,
Thermistors – Directly heated positive step-function temperature coefficient – Part 1: Generic specification

IEC 60906-1: 1986,
IEC system of plugs and socket-outlets for household and similar purposes – Part 1: Plugs and socket-outlets 16 A 250 V a.c.

IEC 60990: 1999,
Methods of measurement of touch-current and protective conductor current

IEC 60999-1:1999,

Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm² up to 35 mm²(included)

IEC 61000-4-2,

Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test

IEC 61000-4-3,

Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test

IEC 61000-4-4,

Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 4: Electrical fast transient/burst immunity test

IEC 61000-4-5,

Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 5: Surge immunity test

IEC 61000-4-6,

Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields

IEC 61000-4-11: 1994,

*Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 11: Voltage dips, short interruptions and voltage variations immunity tests
Amendment 1 (2000)*

IEC 61000-4-13,

Electromagnetic compatibility (EMC) – Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signaling at a.c. power port, low frequency immunity tests

IEC 61032: 1997,

Protection of persons and equipment by enclosures – Probes for verification

IEC 61058-1: 2000,

*Switches for appliances – Part 1: General requirements
Amendment 1 (2001)*

IEC 61180-1,

High-voltage test techniques for low-voltage equipment – Part 1: Definitions, test and procedure requirements

IEC 61180-2,

High-voltage techniques for low-voltage equipment – Part 2: Test equipment

IEC 61558-1: 1997,

Safety of power transformers, power supply units and similar – Part 1: General requirements and tests

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IEC 61558-2-6: 1997,
Safety of power transformers, power supply units and similar – Part 2: Particular requirements for safety isolating transformers for general use

IEC 61770,
Electric appliances connected to the water mains – Avoidance of backsiphonage and failure of hose-sets

ISO 2768-1,
General tolerances – Part 1: Tolerances for linear and angular dimensions without individual tolerance indications

ISO 7000,
Graphical symbols for use on equipment – index and synopsis

ISO 9772: 2001,
Cellular plastics – Determination of horizontal burning characteristics of small specimens subjected to a small flame

2.1DV D2 Addition:

All IEC component standard requirements in this standard are replaced by the relevant requirements of UL component standards, examples of which are listed in Annex DVC. This list in Annex DVC is not intended to be complete. Products which are determined to comply with clauses 1 to 32 and applicable annexes of this standard and an applicable UL part 2 standard are considered to comply with the UL requirements except that components may require additional evaluation to determine compliance with the applicable UL component standards.

3 Definitions

An index of the defined terms is provided at the end of this publication.

3.1 When the terms “voltage” and “current” are used, they are r.m.s. values, unless otherwise specified.

3.1.1 RATED VOLTAGE: Voltage assigned to the appliance by the manufacturer.

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

3.1.3 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 1 – The different positions of controls and switching devices are taken into account.

NOTE 2 – WORKING VOLTAGE takes into account resonant voltages.

NOTE 3 – When deducing the WORKING VOLTAGE, the effect of transient voltages is ignored.

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

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

3.1.6 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 and COMBINED APPLIANCES, the current measured when the appliance is supplied at RATED VOLTAGE and operated under NORMAL OPERATION.

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

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

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

3.1.10 RATED IMPULSE VOLTAGE: Voltage derived from the RATED VOLTAGE and the overvoltage category of the appliance, characterizing the specified withstand capability of its insulation against transient overvoltages.

3.1.11 DANGEROUS MALFUNCTION: Unintended operation of the appliance that may impair safety.

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

3.2.2 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.

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

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

NOTE – The SUPPLY CORD may be specially prepared and only available from the manufacturer or its service agent. A specially prepared cord may also include a part of the appliance.

3.2.5 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.

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

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

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

3.3.2 SUPPLEMENTARY INSULATION: 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.

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

3.3.4 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.

3.3.5 FUNCTIONAL INSULATION: Insulation between conductive parts of different potential which is necessary only for the proper functioning of the appliance.

3.3.6 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.

3.3.7 CLASS 0 APPLIANCE: Appliance in which protection against electric shock relies upon BASIC INSULATION only, there being 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.

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

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3.3.9 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.

3.3.10 CLASS II APPLIANCE: Appliance in which protection against electric shock does not rely on BASIC INSULATION only but in which additional safety precautions are provided, such as DOUBLE INSULATION OR REINFORCED INSULATION, 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:

- 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;
- 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;
- an appliance which is a combination of an insulation-encased CLASS II APPLIANCE and a metal-encased CLASS II APPLIANCE.

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.

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

3.3.12 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.

3.3.13 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 VOLTAGE are not generated.

3.3.14 CLEARANCE: Shortest distance in air between two conductive parts or between a conductive part and the accessible surface.

3.3.15 CREEPAGE DISTANCE: Shortest distance along the surface of insulation between two conductive parts or between a conductive part and the accessible surface.

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

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3.4.2 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 1 – The voltage limits specified are based on the assumption that the SAFETY ISOLATING TRANSFORMER is supplied at its RATED VOLTAGE.

NOTE 2 – SAFETY EXTRA-LOW VOLTAGE is also known as SELV.

3.4.2DV D1 Replace the first paragraph by the following:

SAFETY EXTRA-LOW VOLTAGE: Voltage not exceeding 30 Vr.m.s. or 42.4 V peak 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 V peak or dc.

3.4.3 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 that is intended to supply an appliance or circuit at SAFETY EXTRA-LOW VOLTAGE.

3.4.4 PROTECTIVE EXTRA-LOW VOLTAGE CIRCUIT: Earthed circuit operating at SAFETY EXTRA-LOW VOLTAGE which is separated from other circuits by BASIC INSULATION and protective screening, DOUBLE INSULATION OR REINFORCED INSULATION.

NOTE 1 – Protective screening is the separation of circuits from LIVE PARTS by means of an earthed screen.

NOTE 2 – A PROTECTIVE EXTRA-LOW VOLTAGE CIRCUIT is also known as a PELV circuit.

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

3.5.2 HAND-HELD APPLIANCE: PORTABLE APPLIANCE intended to be held in the hand during normal use.

3.5.3 STATIONARY APPLIANCE: FIXED APPLIANCE or an appliance which is not a PORTABLE APPLIANCE.

3.5.4 FIXED APPLIANCE: Appliance that is intended to be used while fastened to a support or while secured in a specific situation.

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

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

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

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

3.5.8 COMBINED APPLIANCE: Appliance incorporating heating elements and motors.

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

3.6.2 DETACHABLE PART: Part that can be removed or opened without the aid of a TOOL, a part that is removed in accordance with the instructions for use, even if a TOOL is needed for removal, or a part that 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.

3.6.3 ACCESSIBLE PART: Part or surface that can be touched by means of test probe B of IEC 61032, and if the part or surface is metal, any conductive part connected to it.

3.6.4 LIVE PART: 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 a protective conductor and a neutral conductor.

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

3.7.1 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.

3.7.2 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.

3.7.3 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 is constructed so that its setting cannot be altered by the user.

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

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

NOTE – Manual operation includes disconnection of the appliance from the supply mains.

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

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

3.8.1 ALL-POLE DISCONNECTION: Disconnection of both supply conductors by a single initiating action or, for three-phase appliances, disconnection of the three supply conductors by a single initiating action.

NOTE – For three-phase appliances the neutral conductor is not considered to be a supply conductor.

3.8.2 OFF POSITION: Stable position of a switching device in which the circuit controlled by the switch is disconnected from its supply or, for electronic disconnection, the circuit is de-energized.

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

3.8.3 VISIBLY GLOWING HEATING ELEMENT: Heating element that 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.

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

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

3.9.1 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.

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

3.9.3 PROTECTIVE ELECTRONIC CIRCUIT: ELECTRONIC CIRCUIT that prevents a hazardous situation under abnormal operating conditions.

NOTE – Parts of the circuit may also be used for functional purposes.

3.9.4 SOFTWARE CLASS B: Software that includes code intended to prevent hazards if a fault, other than a software fault, occurs in the appliance.

3.9.5 SOFTWARE CLASS C: Software that includes code intended to prevent hazards without the use of other PROTECTIVE DEVICES.

3.10DV D2 Addition:

LIMITED POWER SOURCE: A power source whose output voltage is SELV and the maximum output current and other parameters are limited in accordance with subclause 8.3DV.

3.11DV 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.

3.12DV 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.

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3.13DV D2 Addition:

PROTECTIVE ELECTRONIC CIRCUIT: ELECTRONIC CIRCUIT **used to control a** PROTECTIVE DEVICE.

NOTE – Parts of the circuit may also be used for functional purpose.

4 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.

4DV 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.”

5 General conditions for the tests

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

5.1 Tests according to this standard are type tests.

5.2 The tests are carried out on a single appliance that 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. The test of 22.3 is carried out on a new appliance.

NOTES

1 Additional samples may be required for example if the appliance has to be tested under different conditions, for example if it can be supplied with different voltages.

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

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

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

If the tests of annex D are carried out, an additional appliance may be used.

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

If the tests of annex H are carried out, three switches or three additional appliances 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.

5.3 The tests are carried out in the order of the clauses. However, the test of 22.11 on the appliance at room temperature is carried out before the tests of clause 8. The tests of clause 14, and 21.2 and 22.24 are carried out after the tests of clause 29.

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

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

5.5 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.

5.6 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.

5.7 The tests are carried out in a draught free location and in general at an ambient temperature of 20°C ± 5°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°C ± 2°C in case of doubt.

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

Appliances for a.c. that are not marked with RATED FREQUENCY or are 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.

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

For *MOTOR-OPERATED APPLIANCES*, and *COMBINED APPLIANCES*, marked with a *RATED VOLTAGE RANGE*, when it is specified that the supply voltage is equal to the *RATED VOLTAGE* multiplied by a factor, the appliance is supplied at

- 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 *MOTOR-OPERATED APPLIANCES*, *COMBINED APPLIANCES* and 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.

5.8.3 For *HEATING APPLIANCES* and *COMBINED APPLIANCES*, marked with a *RATED POWER INPUT RANGE*, when it is specified that the power input is equal to the *RATED POWER INPUT* multiplied by a factor, the appliance is operated at

- 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*.

5.8.4 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 appliance is operated at:

- 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*.

5.9 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.

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5.10 The tests are carried out 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.

5.11 Appliances intended to be connected to fixed wiring by means of a flexible cord are tested with the appropriate flexible cord connected to the appliance.

5.12 For HEATING APPLIANCES and COMBINED APPLIANCES when 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 heating elements with appreciable positive temperature coefficient of resistance, 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.

5.13 The tests for appliances with PTC HEATING ELEMENTS are carried out 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.

5.14 If CLASS 0I APPLIANCES OR CLASS I APPLIANCES have ACCESSIBLE METAL PARTS that are not earthed and are not separated from LIVE PARTS by an intermediate metal part that 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 that is earthed.

NOTE – Guidance is given in Annex P for enhanced requirements that may be used to ensure an acceptable level of protection against electrical and thermal hazards for particular types of appliances used in an installation without a protective earthing conductor in countries that have warm damp equable climates.

5.15 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.

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

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

5.18 If linear and angular dimensions are specified without a tolerance, ISO 2768-1 is applicable.

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 RATED CURRENT in amperes;
- name, trade mark or identification mark of the manufacturer or responsible vendor;
- model or type reference;
- symbol 5172 of IEC 60417, for CLASS II APPLIANCES only;
- IP number according to degree of protection against ingress of water, other than IPX0.

Compliance is checked by inspection.

The enclosure of electrically-operated water valves incorporated in external hose-sets for connection of an appliance to the water mains shall be marked with symbol IEC 60417-5036 (DB:2002-10) if their WORKING VOLTAGE exceeds EXTRA-LOW VOLTAGE.

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.
- 4 If the appliance is marked with rated pressure, the units used may be bars but only together with pascals and placed in brackets.

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.

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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, 230 V being 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 – If 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 that 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 one or more than one RATED VOLTAGE RANGES, the RATED POWER INPUT or RATED CURRENT 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 or RATED CURRENT may be related to the mean value of the range.

The upper and lower limits of the RATED POWER INPUT or RATED CURRENT 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:

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	[symbol 5019 of IEC 60417]	protective earth
	[symbol 5172 of IEC 60417]	class II equipment
	[symbol 5012 of IEC 60417]	lamp
NOTE 2 The rated wattage of the lamp may be indicated in association with this symbol.		
	[symbol 1641 of ISO 7000]	read the instructions
	[symbol 0434 of ISO 7000]	caution
	[symbol 5031 of IEC 60417]	direct current
	[symbol 5032 of IEC 60417]	alternating current
		three-phase alternating current
		three-phase alternating current with neutral
	[symbol 5016 of IEC 60417]	fuse-link
NOTE 1 The rated current of the fuse link may be indicated in association with this symbol.		
		time-lag miniature fuse-link where X is the symbol for the time/current characteristic as given in IEC 60217
	[symbol IEC 60417-5021 (DB:2002-10)]	equipotentiality
	[symbol IEC 60417-5036 (DB:2002-10)]	dangerous voltage

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

Units of physical quantities and their symbols shall be those of the international standardized system.

Compliance is checked by inspection.

NOTES

3 Additional symbols are allowed provided that they do not give rise to misunderstanding.

4 Symbols specified in IEC 60417 and ISO 7000 may be used.

7.6DV D2 Modification of 7.6 by adding the following text:

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 for three-phase appliances is considered to be obvious if the terminals for the supply conductors are indicated by arrows pointing towards the terminals.

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 5019 of IEC 60417.

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

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 higher value, such as output, input, speed, cooling effect, 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.

NOTE 2 – For example, the figure 0 may be used on a digital programming keyboard.

Compliance is checked by inspection.

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

NOTE – An indication of + and – is considered to be sufficient.

Compliance is checked by inspection.

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

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

If it is necessary to take precautions during USER MAINTENANCE, appropriate details shall be given.

Compliance is checked by inspection.