Household and similar electrical appliances – Safety –
Part 1:
General requirements
Household and similar electrical appliances – Safety –
Part 1:
General requirements
## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>FOREWORD</strong></td>
<td>9</td>
</tr>
<tr>
<td></td>
<td><strong>INTRODUCTION</strong></td>
<td>17</td>
</tr>
<tr>
<td>1</td>
<td>Scope</td>
<td>19</td>
</tr>
<tr>
<td>2</td>
<td>Normative references</td>
<td>19</td>
</tr>
<tr>
<td>3</td>
<td>Definitions</td>
<td>27</td>
</tr>
<tr>
<td>4</td>
<td>General requirement</td>
<td>43</td>
</tr>
<tr>
<td>5</td>
<td>General conditions for the tests</td>
<td>43</td>
</tr>
<tr>
<td>6</td>
<td>Classification</td>
<td>49</td>
</tr>
<tr>
<td>7</td>
<td>Marking and instructions</td>
<td>51</td>
</tr>
<tr>
<td>8</td>
<td>Protection against access to live parts</td>
<td>63</td>
</tr>
<tr>
<td>9</td>
<td>Starting of motor-operated appliances</td>
<td>67</td>
</tr>
<tr>
<td>10</td>
<td>Power input and current</td>
<td>67</td>
</tr>
<tr>
<td>11</td>
<td>Heating</td>
<td>71</td>
</tr>
<tr>
<td>12</td>
<td>Void</td>
<td>79</td>
</tr>
<tr>
<td>13</td>
<td>Leakage current and electric strength at operating temperature</td>
<td>79</td>
</tr>
<tr>
<td>14</td>
<td>Transient overvoltages</td>
<td>85</td>
</tr>
<tr>
<td>15</td>
<td>Moisture resistance</td>
<td>87</td>
</tr>
<tr>
<td>16</td>
<td>Leakage current and electric strength</td>
<td>91</td>
</tr>
<tr>
<td>17</td>
<td>Overload protection of transformers and associated circuits</td>
<td>95</td>
</tr>
<tr>
<td>18</td>
<td>Endurance</td>
<td>95</td>
</tr>
<tr>
<td>19</td>
<td>Abnormal operation</td>
<td>97</td>
</tr>
<tr>
<td>20</td>
<td>Stability and mechanical hazards</td>
<td>111</td>
</tr>
<tr>
<td>21</td>
<td>Mechanical strength</td>
<td>113</td>
</tr>
<tr>
<td>22</td>
<td>Construction</td>
<td>117</td>
</tr>
<tr>
<td>23</td>
<td>Internal wiring</td>
<td>137</td>
</tr>
<tr>
<td>24</td>
<td>Components</td>
<td>141</td>
</tr>
<tr>
<td>25</td>
<td>Supply connection and external flexible cords</td>
<td>147</td>
</tr>
<tr>
<td>26</td>
<td>Terminals for external conductors</td>
<td>163</td>
</tr>
<tr>
<td>27</td>
<td>Provision for earthing</td>
<td>167</td>
</tr>
<tr>
<td>28</td>
<td>Screws and connections</td>
<td>171</td>
</tr>
<tr>
<td>29</td>
<td>Clearances, creepage distances and solid insulation</td>
<td>177</td>
</tr>
<tr>
<td>30</td>
<td>Resistance to heat and fire</td>
<td>191</td>
</tr>
<tr>
<td>31</td>
<td>Resistance to rusting</td>
<td>197</td>
</tr>
<tr>
<td>32</td>
<td>Radiation, toxicity and similar hazards</td>
<td>197</td>
</tr>
</tbody>
</table>
Table 1 – Power input deviation............................................................................................67
Table 2 – Current deviation..................................................................................................69
Table 3 – Maximum normal temperature rises.....................................................................75
Table 4 – Voltage for electric strength test.........................................................................83
Table 5 – Characteristics of high-voltage sources...............................................................85
Table 6 – Impulse test voltage.............................................................................................85
Table 7 – Test voltages.........................................................................................................93
Table 8 – Maximum winding temperature ..........................................................................101
Table 9 – Maximum abnormal temperature rise.................................................................111
Table 10 – Dimensions of cables and conduits..................................................................149
Table 11 – Minimum cross-sectional area of conductors .....................................................151
Table 12 – Pull force and torque........................................................................................157
Table 13 – Nominal cross-sectional area of conductors.......................................................165
Table 14 – Torque for testing screws and nuts.....................................................................175
Table 15 – Rated impulse voltage.......................................................................................179
Table 16 – Minimum clearances........................................................................................179
Table 17 – Minimum creepage distances for basic insulation ..............................................187
Table 18 – Minimum creepage distances for functional insulation .......................................189
Table A.1 – Test voltages....................................................................................................221
Table C.1 – Test conditions..................................................................................................229
FOREWORD

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

2) The formal decisions or agreements of 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 IEC National Committees.

3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.

4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.

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

6) All users should ensure that they have the latest edition of this publication.

7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.

8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. 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.


It bears the edition number 4.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

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

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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

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 the countries indicated below.

- Clause 3: Steady conditions are defined (Poland).
- 3.4.2: Safety extra-low voltage shall not exceed 30 V (42,4 V peak) (USA).
- 5.7: The ambient temperature is 25 °C ± 10 °C (China, Japan and USA).
- 5.14: Accessible metal parts that are not liable to become energized (such as metal nameplates or decorative parts on a plastic enclosure) do not need to be earthed. Accessible non-metallic parts need only provide basic insulation (USA).
- 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 (USA).
- 7.1: The IP number is not required to be marked (USA).
- 7.6: Some of these symbols are not used (USA).
- 7.8: Additional methods are permitted for identifying earthing terminals and terminals for neutral conductors (USA).
- 7.12.2: The requirements for full disconnection do not apply (Japan, USA).
- 7.14: Different tests are used (USA).
- 8.1.1: The test is not necessarily repeated with the 20 N force (USA).
- 8.1.1: Protection against contact with live parts of the lamp cap is not required (USA).
- 8.1.2 and 8.1.3: The test probe 13 and test probe 41 are not used (USA).
- 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 (USA).
- Clause 9: The ability of a motor to start without blowing a quick-acting fuse is required (USA).
- 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 (USA).
- 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 (USA).
- 11.8, table 3: Temperature rise limits for certain materials are different (USA).
- 13.2: The test circuit and some leakage current limits are different (India, USA).
- 13.3: The values of certain test voltages are different depending on the rated voltage (USA).
- 13.3: A 500 VA test transformer is used (USA).
- 15.1.1 and 15.1.2: The IP system is not used and the tests are different (USA).
- 15.3: The test is conducted with a relative humidity of $(88 \pm 2)$% at a temperature of $32\,^\circ C \pm 2\,^\circ C$ (USA).
- 16.2: The test is conducted at nominal supply voltage, and some of the leakage current values are different (USA).
- 16.3: Some test voltages and methods are different (USA).
- 19.1: The circuit protection device is permitted to provide necessary protection (USA).
- 19.2 to 19.4: Generally the tests are conducted at nominal supply voltage or rated power input (USA).
- 19.11: Different tests are carried out to evaluate solid state devices used in protective electronic circuits (USA).
- 19.13: The temperature rise limits of table 9 are not applicable (USA).
- Clause 22: The d.c. component in the appliance neutral is limited (Australia).
- 22.1: The IP system is not used and the tests are different (USA).
- 22.2: Double-pole switches or protective devices are required (Norway).
- 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: The supply cord is not required to be fitted with a plug (Ireland).
- 22.3: The test is different (USA).
- 22.44: Appliances may be acceptable based on additional evaluation (USA).
- 22.46: The evaluation of software is different (USA).
- 23.5: Requirements for insulated internal wiring are different (USA).
- 23.7: The requirement only applies to wiring that is accessible when making supply connections (USA).
- 24.1.3: The number of cycles is different and the note does not apply (USA).
- 24.1.4: The number of cycles is different and note 1 does not apply (USA).
- 24.3: The requirement for full disconnection does not apply (USA).
- 25.1: The supply cord is not required to be fitted with a plug (Ireland).
- 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 (USA).
- 25.13: Only one separate insulation is required (USA).
- 25.16: A pull of 35 lbs is applied except for small appliances. Generally the torque test is not applied (USA).
- 26.3: The tests only apply to terminals for connection to fixed wiring (USA).
- 26.6: Cross-sectional areas are specified according to American Wire Gauge (AWG) (USA).
- 27.6: The requirement does not apply (USA).
- 28.1: Generally, tests of this type are not required (USA).
- Clause 29: The requirements for clearances and creepage distances are different (USA).
- 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 mould-stress test is conducted at 10 K above the clause 11 temperature (USA).
- 30.2.1: An ignition test cannot be used to assure a slow burning rate (USA).
- 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 (USA).
- Annex I: The annex applies to motors having a working voltage not exceeding 30 V (USA).
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 appliances when operated as in normal use taking into account the manufacturer's instructions. It also covers abnormal situations that can be expected in practice and takes into account the way in which electromagnetic phenomena can affect the safe operation of appliances.

This standard takes into account the requirements of IEC 60364 as far as possible so that there is compatibility with the wiring rules when the appliance is connected to the supply mains. However, national wiring rules may 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, as 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.
HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

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.

NOTE 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.

NOTE 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 a corrosive or explosive atmosphere (dust, vapour or gas);
– audio, video and similar electronic apparatus (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).

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.
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 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

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

  Amendment 1 (1989)
  Amendment 2 (1992)
  Amendment 3 (1993)
  Amendment 4 (1994)
  Amendment 5 (2000)

  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 60417-DB:2002¹, Graphical symbols for use on equipment
IEC 60529, Degrees of protection provided by enclosures (IP Code)
IEC 60598-1:2003, Luminaires – 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)²
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 60695-2-12, Fire Hazard testing – Part 2-12: Glowing/hot wire based test methods – Glow-wire flammability test method for materials
IEC 60695-10-2, 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 using the ball pressure test
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, 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)

¹ DB refers to the IEC on-line database.
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 61000-4-13, Electromagnetic compatibility (EMC) – Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signalling at a.c. power port, low frequency immunity tests

IEC 61032:1997, Protection of persons and equipment by enclosures – Probes for verification


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

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
