

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

---

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

**Appareils électrodomestiques et analogues – Sécurité –  
Partie 1: Exigences générales**



## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2010 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland  
Email: [inmail@iec.ch](mailto:inmail@iec.ch)  
Web: [www.iec.ch](http://www.iec.ch)

### About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

### About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

- Catalogue of IEC publications: [www.iec.ch/searchpub](http://www.iec.ch/searchpub)

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: [www.iec.ch/online\\_news/justpub](http://www.iec.ch/online_news/justpub)

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: [www.iec.ch/webstore/custserv](http://www.iec.ch/webstore/custserv)

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: [csc@iec.ch](mailto:csc@iec.ch)  
Tel.: +41 22 919 02 11  
Fax: +41 22 919 03 00

---

### A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

### A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

- Catalogue des publications de la CEI: [www.iec.ch/searchpub/cur\\_fut-f.htm](http://www.iec.ch/searchpub/cur_fut-f.htm)

Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,...). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.

- Just Published CEI: [www.iec.ch/online\\_news/justpub](http://www.iec.ch/online_news/justpub)

Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.

- Electropedia: [www.electropedia.org](http://www.electropedia.org)

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.

- Service Clients: [www.iec.ch/webstore/custserv/custserv\\_entry-f.htm](http://www.iec.ch/webstore/custserv/custserv_entry-f.htm)

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:

Email: [csc@iec.ch](mailto:csc@iec.ch)  
Tél.: +41 22 919 02 11  
Fax: +41 22 919 03 00



IEC 60335-1

Edition 5.0 2010-05

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

---

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

**Appareils électrodomestiques et analogues – Sécurité –  
Partie 1: Exigences générales**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

PRICE CODE XH  
CODE PRIX

---

ICS 13.120; 97.030

ISBN 978-2-88910-925-8

## CONTENTS

|                                                                        |     |
|------------------------------------------------------------------------|-----|
| FOREWORD.....                                                          | 5   |
| INTRODUCTION.....                                                      | 8   |
| 1 Scope.....                                                           | 9   |
| 2 Normative references.....                                            | 9   |
| 3 Terms and definitions.....                                           | 13  |
| 4 General requirement.....                                             | 20  |
| 5 General conditions for the tests.....                                | 21  |
| 6 Classification.....                                                  | 24  |
| 7 Marking and instructions.....                                        | 24  |
| 8 Protection against access to live parts.....                         | 31  |
| 9 Starting of motor-operated appliances.....                           | 32  |
| 10 Power input and current.....                                        | 33  |
| 11 Heating.....                                                        | 34  |
| 12 Void.....                                                           | 39  |
| 13 Leakage current and electric strength at operating temperature..... | 39  |
| 14 Transient overvoltages.....                                         | 42  |
| 15 Moisture resistance.....                                            | 43  |
| 16 Leakage current and electric strength.....                          | 45  |
| 17 Overload protection of transformers and associated circuits.....    | 47  |
| 18 Endurance.....                                                      | 47  |
| 19 Abnormal operation.....                                             | 47  |
| 20 Stability and mechanical hazards.....                               | 55  |
| 21 Mechanical strength.....                                            | 56  |
| 22 Construction.....                                                   | 58  |
| 23 Internal wiring.....                                                | 68  |
| 24 Components.....                                                     | 70  |
| 25 Supply connection and external flexible cords.....                  | 74  |
| 26 Terminals for external conductors.....                              | 82  |
| 27 Provision for earthing.....                                         | 84  |
| 28 Screws and connections.....                                         | 86  |
| 29 Clearances, creepage distances and solid insulation.....            | 88  |
| 30 Resistance to heat and fire.....                                    | 97  |
| 31 Resistance to rusting.....                                          | 102 |
| 32 Radiation, toxicity and similar hazards.....                        | 102 |
| Annex A (informative) Routine tests.....                               | 115 |
| Annex B (normative) Appliances powered by rechargeable batteries.....  | 117 |
| Annex C (normative) Ageing test on motors.....                         | 120 |
| Annex D (normative) Thermal motor protectors.....                      | 121 |
| Annex E (normative) Needle-flame test.....                             | 122 |
| Annex F (normative) Capacitors.....                                    | 123 |
| Annex G (normative) Safety isolating transformers.....                 | 125 |

|                                                                                                                                                                   |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Annex H (normative) Switches .....                                                                                                                                | 126 |
| Annex I (normative) Motors having basic insulation that is inadequate for the rated voltage of the appliance .....                                                | 128 |
| Annex J (normative) Coated printed circuit boards .....                                                                                                           | 130 |
| Annex K (normative) Overvoltage categories .....                                                                                                                  | 131 |
| Annex L (informative) Guidance for the measurement of clearances and creepage distances .....                                                                     | 132 |
| Annex M (normative) Pollution degree .....                                                                                                                        | 136 |
| Annex N (normative) Proof tracking test.....                                                                                                                      | 137 |
| Annex O (informative) Selection and sequence of the tests of Clause 30 .....                                                                                      | 138 |
| Annex P (informative) Guidance for the application of this standard to appliances used in warm damp equable climates.....                                         | 144 |
| Annex Q (informative) Sequence of tests for the evaluation of electronic circuits .....                                                                           | 146 |
| Annex R (normative) Software evaluation .....                                                                                                                     | 148 |
| Bibliography.....                                                                                                                                                 | 162 |
| Index of defined words.....                                                                                                                                       | 164 |
| <br>                                                                                                                                                              |     |
| Figure 1 – Circuit diagram for leakage current measurement at operating temperature for single-phase connection of class II appliances.....                       | 103 |
| Figure 2 – Circuit diagram for leakage current measurement at operating temperature for single-phase connection of appliances, other than those of class II ..... | 104 |
| Figure 3 – Circuit diagram for leakage current measurement at operating temperature for three-phase connection of class II appliances.....                        | 105 |
| Figure 4 – Circuit diagram for leakage current measurement at operating temperature for three-phase connection of appliances other than those of class II.....    | 106 |
| Figure 5 – Small part .....                                                                                                                                       | 107 |
| Figure 6 – Example of an electronic circuit with low-power points .....                                                                                           | 108 |
| Figure 7 – Test finger nail .....                                                                                                                                 | 109 |
| Figure 8 – Flexing test apparatus.....                                                                                                                            | 110 |
| Figure 9 – Constructions of cord anchorages .....                                                                                                                 | 111 |
| Figure 10 – An example of parts of an earthing terminal .....                                                                                                     | 112 |
| Figure 11 – Examples of clearances .....                                                                                                                          | 113 |
| Figure 12 – Example of the placement of the cylinder .....                                                                                                        | 114 |
| Figure I.1 – Simulation of faults .....                                                                                                                           | 129 |
| Figure L.1 – Sequence for the determination of clearances .....                                                                                                   | 133 |
| Figure L.2 – Sequence for the determination of creepage distances .....                                                                                           | 135 |
| Figure O.1 – Tests for resistance to heat .....                                                                                                                   | 138 |
| Figure O.2 – Selection and sequence of tests for resistance to fire in hand-held appliances .....                                                                 | 139 |
| Figure O.3 – Selection and sequence of tests for resistance to fire in attended appliances .....                                                                  | 140 |
| Figure O.4 – Selection and sequence of tests for resistance to fire in unattended appliances .....                                                                | 141 |
| Figure O.5 – Some applications of the term "within a distance of 3 mm" .....                                                                                      | 143 |

|                                                                                                                  |     |
|------------------------------------------------------------------------------------------------------------------|-----|
| Table 1 – Power input deviation .....                                                                            | 33  |
| Table 2 – Current deviation.....                                                                                 | 34  |
| Table 3 – Maximum normal temperature rises.....                                                                  | 37  |
| Table 4 – Voltage for electric strength test.....                                                                | 41  |
| Table 5 – Characteristics of high-voltage sources .....                                                          | 42  |
| Table 6 – Impulse test voltage .....                                                                             | 42  |
| Table 7 – Test voltages.....                                                                                     | 46  |
| Table 8 – Maximum winding temperature .....                                                                      | 49  |
| Table 9 – Maximum abnormal temperature rise.....                                                                 | 54  |
| Table 10 – Dimensions of cables and conduits.....                                                                | 75  |
| Table 11 – Minimum cross-sectional area of conductors .....                                                      | 77  |
| Table 12 – Pull force and torque .....                                                                           | 79  |
| Table 13 – Nominal cross-sectional area of conductors .....                                                      | 83  |
| Table 14 – Torque for testing screws and nuts .....                                                              | 87  |
| Table 15 – Rated impulse voltage .....                                                                           | 89  |
| Table 16 – Minimum clearances.....                                                                               | 90  |
| Table 17 – Minimum creepage distances for basic insulation .....                                                 | 94  |
| Table 18 – Minimum creepage distances for functional insulation .....                                            | 95  |
| Table 19 – Minimum thickness for accessible parts of reinforced insulation consisting<br>of a single layer ..... | 96  |
| Table A.1 – Test voltages .....                                                                                  | 116 |
| Table C.1 – Test conditions .....                                                                                | 120 |
| Table R.1 <sup>e</sup> – General fault/error conditions .....                                                    | 150 |
| Table R.2 <sup>e</sup> – Specific fault/error conditions .....                                                   | 153 |
| Table R.3 – Semi-formal methods .....                                                                            | 159 |
| Table R.4 – Software architecture specification .....                                                            | 159 |
| Table R.5 – Module design specification .....                                                                    | 160 |
| Table R.6 – Design and coding standards.....                                                                     | 160 |
| Table R.7 – Software safety validation .....                                                                     | 161 |

# INTERNATIONAL ELECTROTECHNICAL COMMISSION

---

## HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

### Part 1: General requirements

#### 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 itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 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.

International Standard IEC 60335-1 has been prepared by IEC technical committee 61: Safety of household and similar electrical appliances.

This fifth edition cancels and replaces the fourth edition published in 2001 including its Amendment 1 (2004) and amendment 2 (2006). It constitutes a technical revision.

The principal changes in this edition as compared with the fourth edition of IEC 60335-1 are as follows (minor changes are not listed):

- updated the text of the standard to align with the most recent editions of the dated normative references;
- modified the functional safety requirements using programmable electronic circuits including software validation requirements;
- updated Clause 29 to cover insulation requirements subjected to high frequency voltages as in switch mode power supply circuits;

- updated Subclause 30.2 to further align the pre-selection option with the end-product test option;
- deleted some notes and converted many other notes to normative text;
- clarified requirements for class III appliances and class III constructions.

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

| FDIS         | Report on voting |
|--------------|------------------|
| 61/3974/FDIS | 61/4014/RVD      |

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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.

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

- |           |                               |                               |
|-----------|-------------------------------|-------------------------------|
| – Annex E | Needle-flame test             | IEC 60695-11-5                |
| – 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.

A list of all parts of the IEC 60335 series, under the general title: *Household and similar electrical appliances – Safety*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability 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 3 The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 12 months or later than 36 months from the date of publication.

The following differences exist in the countries indicated below.

- Introduction: The Part 1 standard (UL60335-1) is only used in combination with a part 2 (UL60335-2-x). National differences are specified in these standards (USA).
- 5.7: The ambient temperature is  $25\text{ °C} \pm 10\text{ °C}$  (Japan).
- 5.7: The ambient temperature is  $27\text{ °C} \pm 5\text{ °C}$  (India).
- 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).
- 7.12.2: The requirements for full disconnection do not apply (Japan).
- 13.2: The test circuit and some leakage current limits are different (India).
- 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).
- 22.35 Accessible metal parts separated from live parts by earthed metal parts are not regarded as likely to become live in the event of an insulation fault (USA).
- 24.1: IEC component standard requirements are replaced by the relevant requirements of component standards specified in UL60335-1 and parts 2 (UL60335-2-x) (USA).
- 25.3: A set of supply leads is not permitted (Norway, Denmark, Finland, Netherlands).
- 25.8:  $0,5\text{ mm}^2$  supply cords are not allowed for class I appliances (Australia and New Zealand).
- 26.6: Conductor cross-sectional areas are different (USA).
- 29.1: Different rated impulse voltages are used between 50 V and 150 V (Japan).

## 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.

When a part 2 standard does not include additional requirements to cover hazards dealt with in Part 1, Part 1 applies.

NOTE 2 This means that the technical committees responsible for the part 2 standards have determined that it is not necessary to specify particular requirements for the appliance in question over and above the general requirements.

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

NOTE 3 Horizontal and generic standards covering a hazard are not applicable since they have been taken into consideration when developing the general and particular requirements for the IEC 60335 series of standards. For example, in the case of temperature requirements for surfaces on many appliances, generic standards, such as ISO 13732-1 for hot surfaces, are not applicable in addition to Part 1 or part 2 standards.

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 4 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;
- IEC standards published by TC 111 concerning environmental matters.

# 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.

NOTE 1 Battery-operated appliances and other d.c. supplied appliances are within the scope of this standard.

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 2 Examples of such appliances are catering equipment, cleaning appliances for 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

- persons (including children) whose
  - physical, sensory or mental capabilities; or
  - lack of experience and knowledgeprevents them from using the appliance safely without supervision or instruction;
- children playing with the appliance.

NOTE 3 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 4 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 60950-1);
- 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.