BRITISH STANDARD

BS EN 60335-1:2002 +A15:2011

Incorporating corrigenda January 2002, December 2005, January 2007, June 2008, July 2009 March 2010, and May 2010

Household and similar electrical appliances — Safety —

Part 1: General requirements

ICS 97.030

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Full document details: BS EN 60335-1:2002+A15:2011

National foreword

This British Standard is the UK implementation of EN 60335-1:2002+A15:2011, incorporating corrigenda January 2007, July 2009 and May 2010. It is derived from IEC 60335-1:2001 consolidated with amendments 1:2004 and 2:2006 and corrigenda January 2002 and December 2005. It supersedes BS EN 60335-1:2002+A14:2010 which will be withdrawn on 2 May 2014.

BS EN 60335-1:2002 superseded BS EN 60335-1:1995 and its amendments. However, BS EN 60335-1:1995 remains valid until all the Parts 2 that are used in conjunction with it have been withdrawn. No date of withdrawal of conflicting national standards (dow) has therefore been fixed. However, when Part 1 is used for appliances not covered by a Part 2, BS EN 60335-1:1995 is not to be used after 2008-07-01.

Amendments/corrigenda issued since publication

Amd. No.	Date	Comments
15051	22 April 2004	Changes to subclause **24.5**, Annex G and Bibliography (cancelled and replaced by amd15172)
15172 Corrigendum No. 1	10 May 2004	Correction of page numbering
15536	8 February 2005	See national foreword
15626 Corrigendum No. 2	8 March 2005	Correction to Contents pages
16414	30 June 2006	See national foreword
16671	31 January 2007	See national foreword
16973 Corrigendum No. 3	31 August 2007	Correction to **25.8** in Annex ZA
	30 June 2008	Addition of National Annex NB, containing IEC Interpretation Sheet February 2007
	30 April 2009	Implementation of CENELEC amendment A13:2008
	31 December 2009	Implementation of CENELEC corrigendum July 2009
	31 March 2010	Note deleted from Clause **22.44**
	30 June 2010	Implementation of CENELEC corrigendum May 2010; Annex ZZ added
	30 November 2010	Implementation of CENELEC amendment A14:2010
	30 November 2011	Implementation of CENELEC amendment A15:2011

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 October 2002

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ISBN 978 0 580 73698 8

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The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by [A1⟩ ⟨A1].

The CENELEC common modifications have been implemented at the appropriate places in the text. The start and finish of each common modification is indicated in the text by tags [C⟩ ⟨C]. Where a common modification has been introduced by CENELEC amendment, the tags carry the number of the amendment. For example, the common modifications introduced by CENELEC amendment A11 are indicated by [C11⟩ ⟨C11].

The start and finish of text introduced or altered by corrigendum is indicated in the text by tags. Text altered by CENELEC corrigendum July 2009 is indicated in the text by [AC1⟩ ⟨AC1].

IEC Interpretation Sheet February 2007 is reproduced in National Annex NB (informative).

Amendment A12:2006 incorporates changes to subclause **29.3**.

The UK participation in its preparation was entrusted to Technical Committee CPL/61, Safety of household and similar electrical appliances.

A list of organizations represented on this committee can be obtained on request to its secretary.

This part of BS EN 60335 is to be used in conjunction with the appropriate Part 2. The Parts 2 contain clauses to supplement or modify the corresponding clauses in Part 1 to provide the relevant requirements for each type of appliance.

NOTE 1 Subclauses, notes and annexes that are additional to those in IEC 60335-1 are prefixed with the letter Z.

NOTE 2 New editions of all Part 2 documents are in preparation for use with this new edition of BS EN 60335-1.

NOTE 3 This standard includes IEC corrigendum December 2005, which incorporates changes to subclause 30.2.3.2, H.7 and H.11.12.

The previous edition of this standard bore the title Safety of household and similar electrical appliances — Part 1: General requirements. For this edition, the title has been changed to that of the European Standard, which is in turn based on that of the IEC standard.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 60335-1:2002+A15

October 2011

ICS 13.120; 97.030

Incorporating corrigenda January 2007, July 2009 and May 2010
Supersedes EN 60335-:1994 + A11:1995 + A12:1996
+ A1:1996 + A13:1998 + A14:1998 + A2:2000
+ A15:2000 + A16:2001

English version

Household and similar electrical appliances — Safety
Part 1: General requirements

(IEC 60335-1:2001, modified)

Appareils électrodomestiques et analogues — Sécuritié
Partie 1: Prescriptions générales
(CEI 60335-1:2001 modifiée)

Sicherheit elektrischer Geräte für den Hausgebrauch und ähnliche Zwecke
Teil 1: Allgemeine Andforderungen
(IEC 60335-1:2001, modifiziert)

This European Standard was approved by CENELEC on 2002-07-02. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

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

CENELEC members are the national electrotechnical committees of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 61/1965/FDIS, future fourth edition of IEC 60335-1, prepared by the IEC Technical Committee 61, was submitted to the IEC-CENELEC parallel vote in January 2001. The comments were discussed during the Delft meeting of CENELEC TC 61 in May 2001 when it was decided to submit some common modifications to the formal vote (2MV).

This draft was circulated in November 2001, but did not receive sufficient support. The comments were discussed during the Kista meeting of CENELEC TC 61 in May 2002 when it was decided to retain only the common modifications from the previous edition. This new draft was approved by CENELEC as EN 60335-1 on 2002-07-02.

The following date is applicable:

— latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2003-07-01

This European Standard replaces EN 60335-1:1994 and its amendments. However, EN 60335-1:1994 remains valid until all the parts 2 that are used in conjunction with it have been withdrawn. No date of withdrawal of conflicting national standards (dow) has therefore been fixed. However, when Part 1 is used for appliances not covered by a part 2, EN 60335-1:1994 is not to be used after 2008-07-01.

This part of EN 60335 is to be used in conjunction with the appropriate part 2. The parts 2 contain clauses to supplement or modify the corresponding clauses in Part 1 to provide the relevant requirements for each type of appliance.

NOTE 1 Subclauses, notes and annexes that are additional to those in IEC 60335-1 are prefixed with the letter Z.

Special national conditions causing a deviation from this European Standard are listed in Annex ZA. National deviations from this European Standard are listed in Annex ZB.
Annexes B, C, D, E, F, G, H, I, J, K, M, N, ZA and ZC are normative and form an integral part of this standard.

Annexes A, L, O, ZB and ZD are for information only.

NOTE 2 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

NOTE 3 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 the associated noun are also in bold.

The text of the International Standard IEC 60335-1:2001, excluding the corrigendum January 2002, was approved by CENELEC as a European Standard with agreed common modifications.

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Foreword to amendment A11

EN 60335-1:2002 was approved and published without corrigendum 1 to IEC 60335-1:2001.
A proposal to realign the European Standard with the International Standard was discussed during the
Brussels meeting of CENELEC TC 61 in November 2002. It was decided to submit the text of the corrigendum to the formal vote for acceptance as an amendment to EN 60335-1.
The draft was circulated in April 2003 and was approved by CENELEC as amendment A11 to EN 60335-1 on 2003-09-23.
The following dates are applicable:

— latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2004-10-01

— date on which the national standards conflicting with the amendment have to be withdrawn (dow) 2006-10-01

Foreword to amendment A1

The text of document 61/2569/FDIS, future amendment 1 to IEC 60335-1:2001, prepared by the IEC Technical Committee 61, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 60335-1:2002 on 2004-09-22.
The following dates are applicable:

— latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2005-07-01

— date on which national standards conflicting with the amendment have to be withdrawn (dow) 2007-10-01

This amendment supplements or modifies the corresponding clauses of EN 60335-1:2002.
Annex R is normative and forms an integral part of this standard.
Annexes P and Q are for information only.
There are no special national conditions causing a deviation from this amendment.
National deviations from this amendment are listed in Annex ZB and are in addition to those in EN 60335-1.

Endorsement notice

The text of amendment 1:2004 to the International Standard IEC 60335-1:2001 was approved by CENELEC as an amendment to the European Standard without any modification.

Foreword to amendment A12

This amendment to EN 60335-1:2002 was prepared by the Technical Committee CENELEC TC 61 based on a decision at the Balsthal meeting in June 2004.

The text of the draft was submitted to the Unique Acceptance Procedure in May 2005 and was approved by CENELEC as amendment A12 to EN 60335-1:2002 on 2005-12-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2006-12-01

- date on which national standards conflicting with the amendment have to be withdrawn (dow) 2007-10-01

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Foreword to amendment A2

The text of document 61/2996/FDIS, future amendment 2 to IEC 60335-1:2001, prepared by the IEC Technical Committee 61, Safety of household and similar electrical appliances, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A2 to EN 60335-1:2002 on 2006-07-01.

The following dates are applicable:

– latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2007-04-01
– date on which national standards conflicting with the amendment have to be withdrawn	(dow)	2009-07-01

This amendment supplements or modifies the corresponding clauses of EN 60335-1:2002.

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

There are no national deviations from this amendment.

Endorsement notice

The text of amendment 2:2006 to the International Standard IEC 60335-1:2001 and its corrigendum August 2006 was approved by CENELEC as an amendment to the European Standard without any modification.

Foreword to amendment A13

A proposal to amend EN 60335-1:2002, document TC61/DE0596/NP, was discussed during the Malaga meeting of CENELEC TC 61 in June 2006, when it was decided to submit a draft for an amendment to the formal vote.

The draft was circulated in May 2008 and was approved by CENELEC as amendment A13 to EN 60335-1:2002 on 2008-10-01.

The following dates were fixed:

– latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2009-07-01
– date on which national standards conflicting with the amendment have to be withdrawn	(dow)	2009-07-01

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Foreword to amendment A14

This amendment to the European Standard EN 60335-1:2002 was prepared by the Technical Committee CENELEC TC 61, Safety of household and similar electrical appliances.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as amendment A14 to EN 60335-1:2002 on 2010-04-14.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

The following dates were fixed:

– latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2010-11-01
– latest date by which the national standards conflicting with the amendment have to be withdrawn	(dow)	2013-05-01

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and covers essential requirements of EC Directive 2006/42/EC. See Annex ZZ.

Foreword to amendment A15

This amendment was prepared by the CLC/TC 61, "Safety of household and similar electrical appliances" (cf. Brussels meeting of CLC/TC 61 in July 2010).

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as amendment A15 to EN 60335-1:2002 on 2011-05-02.

The following dates were fixed:

– latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2012-05-02
– latest date by which the national standards conflicting with the amendment have to be withdrawn	(dow)	2014-05-02

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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 appliances when operated as in normal use taking into account the manufacturer's instructions. ⟦A1⟩ 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. ⟨A1⟧

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.

⟦C⟩ The principal objectives of the Low Voltage Directive, ⟦C14⟩2006/95/EC⟨C14⟧, are covered by this standard. The essential safety requirements of the following directives, which can be applicable to some household and similar appliances, have also been taken into account:

– ⟦C14⟩2006/42/EC*) ⟨C14⟧ – Machinery directive;

– 89/106/EEC – Construction products directive;

– 97/23/EC – Pressure equipment directive. ⟨C⟧

⟦C14⟩ *) Annex ZE has also to be applied for the verification of compliance of the relevant product to the Essential Health and Safety Requirements (EHSR) of Directive 2006/42/EC. The application of EN 60335-1 alone does not give presumption of conformity for a product. This is achieved by complying with the requirements of EN 60335-1 and the relevant Part 2, when this Part 2 is also listed in the OJ under the Directive. ⟨C14⟧

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HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 1: General requirements

1 Scope

[C14⟩ This European Standard deals with the safety of electrical appliances and machines for household environment and commercial purpose, their rated voltage being not more than 250 V for single-phase appliances and machines and 480 V for other appliances and machines.

NOTE Z1 Examples of appliance for household environment are appliances for typical housekeeping functions used in the household environment that may also be used by non expert users for typical housekeeping functions:

- in shops, offices and other similar working environments;
- in farm houses;
- by clients in hotels, motels and other residential type environments;
- in bed and breakfast type environments.

NOTE Z2 Household environment includes the dwelling and its associated buildings, the garden, etc.

Appliances and machines intended to be used by expert or trained users in shops, in light industry and on farms, and appliances and machines which are declared to be for commercial use by lay persons are within the scope of this standard.

Additional requirements for such appliances are given in Annex ZE.

NOTE Z3 Examples of such appliances and machines are catering equipment, cleaning machines for commercial use, and appliances for hairdressers.

NOTE Z4 Criteria applied for the allocation of products covered by standards in the EN 60335 series under either the Low Voltage Directive (LVD) or the Machinery Directive (MD) are given for information in Annex ZF.

This standard deals with the reasonably foreseeable hazards presented by appliances and machines that are encountered by all persons. ⟨C14] However, in general, it does not take into account

– [A2⟩ persons (including children) whose
  - physical, sensory or mental capabilities; or
  - lack of experience and knowledge

  prevents them from using the appliance safely without supervision or instruction;
– children playing with the appliance. ⟨A2]

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;

[A1⟩ *Text deleted* ⟨A1]

– 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).

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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.

[A1] *Text deleted* [A1]

[C14] CLC/TR 50417, *Safety of household and similar electrical appliances – Interpretations related to European Standards within the scope of CENELEC/TC 61*

EN 50366:2003 [1], *Household and similar electrical appliances - Electromagnetic fields - Methods for evaluation and measurement*

EN 62233, *Measurement methods for electromagnetic fields of household appliances and similar apparatus with regard to human exposure* (IEC 62233) [C14]

IEC 60061-1, *Lamp caps and holders together with gauges for the control of interchangeability and safety – Part 1: Lamp caps*

[A1] *Text deleted* [A1]

[A1] IEC 60068-2-2, *Environmental testing – Part 2 Tests. Tests B: Dry heat* [A1]

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*

[A2] IEC 60085, *Electrical insulation – Thermal classification* [A2]

[A1] IEC 60112:2003, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials* [A1]

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*

[A2] *Text deleted* [A2]

[A2] IEC 60252-1, *AC motor capacitors – Part 1: General – Performance testing and rating – Safety requirements – Guide for installation and operation* [A2]

[A1] IEC 60320-1, [A1] *Appliance couplers for household and similar general purposes – Part 1: General requirements*

[A1] IEC 60320-2-2, *Appliance couplers for household and similar general purposes – Part 2-2: Interconnection couplers for household and similar equipment* [A1]

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*

[A2] IEC 60384-14:2005 [A2], *Fixed capacitors for use in electronic equipment – Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains*

[1] EN 50366:2003 will be superseded by EN 62233:2008 on 2012-12-01.

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[A1] IEC 60417-DB:2002[1], *Graphical symbols for use on equipment* [A1]

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

[A1] IEC 60598-1:2003, [A1] *Luminaires – Part 1: General requirements and tests*

[A1] 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] [A1]

[A2] IEC 60664-3:2003, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution* [A2]

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 60695-2-13, *Fire Hazard testing – Part 2-13: Glowing/hot wire based test methods – Glow-wire ignitability 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*

[A2] IEC 60695-11-5:2004, *Fire hazard testing – Part 11-5: Test flames – Needle-flame test method – Apparatus, confirmatory test arrangement and guidance* [A2]

[A1] IEC 60695-11-10, [A1] *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*

[A2] IEC 60730-1:1999, *Automatic electrical controls for household and similar use – Part 1: General requirements*
Amendment 1 (2003)[3] [A2]

[A2] 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*
Amendment 1 (2002) [4] [A2]

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*

[A1] *Text deleted* [A1]

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[1] DB refers to the IEC online database.

[2] There exists a consolidated edition 1.2 (2002) that includes edition 1 and its amendments 1 and 2.

[3] There exists a consolidated edition 3.1 (2003) that includes edition 3 and its amendment 1.

[4] There exists a consolidated edition 2.1 (2003) that includes edition 2 and its amendment 1.

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A1 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)* A1

A1 IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test* A1

A1 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* A1

A2 IEC 61000-4-11:2004, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests* A2

A1 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* A1

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

A1 IEC 61058-1:2000, *Switches for appliances – Part 1: General requirements*
Amendment 1 (2001)[5] A1

A1 *Text deleted* A1

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*

A2 IEC 61558-1:1997, *Safety of power transformers, power supply units and similar – Part 1: General requirements and tests*
Amendment 1(1998)[6] A2

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*

A1 IEC 61770, *Electric appliances connected to the water mains – Avoidance of backsiphonage and failure of hose-sets* A1

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

A2 ISO 7000-DB:2004 A2, *Graphical symbols for use on equipment – Index and synopsis*

A2 ISO 9772:2001, *Cellular plastics – Determination of horizontal burning characteristics of small specimens subjected to a small flame*
Amendment 1 (2003) A2

A2 IEC 60691:2002, *Thermal-links – Requirements and application guide* A2

A2 IEC 62151, *Safety of equipment electrically connected to a telecommunication network* A2

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[5] There exists a consolidated edition 3.1 (2001) that includes edition 3 and its amendment 1.

[6] There exists a consolidated edition 1.1 (1998) that includes edition 1 and its amendment 1.

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3 Definitions

[A1] An Index of the defined terms is provided at the end of this publication. [A1]

3.1

[C14] When the term “appliance” is used, it is intended to cover appliances and/or machines for household use and appliances and/or machines for commercial use. [C14]

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

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3.1.9
normal operation
conditions under which the appliance is operated in normal use when it is connected to the supply mains

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 over-voltages

A1 **3.1.11**
dangerous malfunction
unintended operation of the appliance that may impair safety A1

A2 **3.1.12**

remote operation
control of an appliance by a command that can be initiated out of sight of the appliance using means such as telecommunications, sound controls or bus systems

NOTE An infra-red control by itself is not considered one used for **remote operation**. However, it may be incorporated as part of a system such as a telecommunication, sound control or bus system. A2

3.2

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 signalling circuit are examples of **interconnection cords**.

3.2.3
supply cord
flexible cord, for supply purposes, that 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 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

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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

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**

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**, that 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** or **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 constructions** so 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** or **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 earthing 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

NOTE 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**.

NOTE 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**.

NOTE 3 If an appliance with **double insulation** or **reinforced insulation** throughout has provision for earthing, it is considered to be a **class I appliance** 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**

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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

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**

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.

3.4.3
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

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**

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3.5.4
fixed appliance
appliance that is intended to be used while fastened to a support or while secured in a specific location

[A1⟩ *Note deleted* ⟨A1]

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 location

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

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 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 fulfil the test of 22.11

NOTE 1 If for installation 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 that can be removed without the aid of a **tool** are considered to be **detachable parts**.

NOTE 3 A part that can be opened is considered to be a part that 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

[A2⟩ NOTE **Accessible non-metallic parts** with conductive coatings are considered to be **accessible metal parts.** ⟨A2]

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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

NOTE 1 Parts, accessible or not, complying with 8.1.4 are not considered to be **live parts.**

NOTE 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

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 predetermined 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

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3.8

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 ⟨A1⟩ or, for electronic disconnection, the circuit is de-energized ⟨A1⟩

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

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**

⟨A1⟩ **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. ⟨A1⟩

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[A1] **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** [A1]

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.

[C14] The interpretations included in CLC/TR 50417 shall be taken into consideration together with the relevant requirements in the standards listed therein. [C14]

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.*

NOTE Routine tests are described in annex A.

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.*

NOTE 1 Additional samples may be required 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 may be needed.

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

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

[A1] If the test of annex D has to be carried out, an additional appliance may be used. [A1]

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

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

NOTE 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.**

NOTE 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.* [A1] *The tests of clause 14 and 21.2 and 22.4 are carried out after the tests of clause 29.* [A1] [A2] *The test of 19.14 is carried out before the tests of 19.11.* [A2]

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

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5.4 *When testing appliances that 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 that 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.*

NOTE 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.

NOTE 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 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**.*

NOTE 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.

NOTE 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**.*

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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.*

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.*

A1 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. A1

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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 in accordance with 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:

[C⟩ *text deleted* ⟨C] **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.

[C⟩ The marking of **rated voltage** or **rated voltage range**, for appliances intended to be connected to the supply mains, shall cover:

– 230 V for single-phase appliances;
– 400 V for multi-phase appliances. ⟨C]

Compliance is checked by inspection.

NOTE 1 The first numeral of the IP number need not be marked on the appliance.

NOTE 2 Additional markings are allowed provided they do not give rise to misunderstanding.

NOTE 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.

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

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[A1] 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**. [A1]

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.

NOTE 2 Example: 115/230 V: The appliance is only suitable for the marked values (a shaver with a selector switch).

NOTE 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 **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 [A2] arithmetic mean value [A2] of the range, the marking for **rated power input** or **rated current** may be related to the [A2] arithmetic mean value [A2] 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.

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7.6 When symbols are used, they shall be as follows

⎓	[symbol 5031 of IEC 60417]	direct current
∼	[symbol 5032 of IEC 60417]	alternating current
A2 3 ∼	[symbol IEC 60417-5032-1 (DB:2002-10)]	three-phase alternating current
3N ∼	[symbol IEC 60417-5032-2 (DB:2002-10)]	three-phase alternating current with neutral A2
	[symbol 5016 of IEC 60417]	fuse-link

NOTE 1 The rated current of the fuse link may be indicated in association with this symbol.

x		time-lag miniature fuse-link where X is the symbol for the time/current characteristic as given in IEC 60127
⏚	[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.

A2	[symbol ISO 7000-1641 (DB:2004-01)]	operator's manual; operating instructions A2
⚠	[symbol 0434 of ISO 7000]	caution
A1	[symbol IEC 60417-5021 (DB:2002-10)]	equipotentiality
ϟ	[symbol IEC 60417-5036 (DB:2002-10)]	dangerous voltage A1
A2	[symbol ISO 7000-0790 (DB:2004-01)]	read operator's manual A2

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

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

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

Compliance is checked by inspection.

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

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

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.

NOTE 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.

NOTE 2 Marking in words is an acceptable means of indicating the correct mode of connection.

NOTE 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 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 or cooling effect, shall be indicated by a higher figure.

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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, 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.

A2 The instructions shall state the substance of the following:

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.

Children should be supervised to ensure that they do not play with the appliance. A2

Compliance is checked by inspection.

7.12.1 If it is necessary to take precautions during installation of the appliance, appropriate details shall be given.

Compliance is checked by inspection.

7.12.2 If a **stationary appliance** is not fitted with a **supply cord** and a plug, or with other means for disconnection from the supply mains having a contact separation in all poles that provide full disconnection under overvoltage category III conditions, the instructions shall state that means for disconnection must be incorporated in the fixed wiring in accordance with the wiring rules.

Compliance is checked by inspection.

7.12.3 If the insulation of the fixed wiring supplying an appliance for permanent connection to the supply mains can come into contact with parts having temperature rise exceeding 50 K during the test of clause 11, the instructions shall state that the fixed wiring insulation must be protected, for example, by insulating sleeving having an appropriate temperature rating.

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

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7.12.4 The instructions for **built-in appliances** shall include information with regard to the following:

– dimensions of the space to be provided for the appliance;

– dimensions and position of the means for supporting and fixing the appliance within this space;

– minimum distances between the various parts of the appliance and the surrounding structure;

– minimum dimensions of ventilating openings and their correct arrangement;

– connection of the appliance to the supply mains and the interconnection of any separate components;

A1 – necessity to allow disconnection of the appliance from the supply after installation, unless the appliance incorporates a switch complying with 24.3. The disconnection may be achieved by having the plug accessible or by incorporating a switch in the fixed wiring in accordance with the wiring rules. A1

Compliance is checked by inspection.

7.12.5 For appliances with **type X attachment** having a specially prepared cord, the instructions shall contain the substance of the following.

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

For appliances with **type Y attachment**, the instructions shall contain the substance of the following.

If the supply cord is damaged, it must be replaced by the manufacturer, its service agent or similarly qualified persons in order to avoid a hazard.

For appliances with **type Z attachment**, the instructions shall contain the substance of the following.

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

Compliance is checked by inspection.

A1 **7.12.6** The instructions for **heating appliances** incorporating a **non-self-resetting thermal cut-out** that is reset by disconnection of the supply mains shall contain the substance of the following:

CAUTION: In order to avoid a hazard due to inadvertent resetting of the thermal cutout, this appliance must not be supplied through an external switching device, such as a timer, or connected to a circuit that is regularly switched on and off by the utility.

Compliance is checked by inspection.

7.12.7 The instructions for **fixed appliances** shall state how the appliance is to be fixed to its support.

NOTE The method of fixing is not to depend on the use of adhesives since they are not considered to be a reliable fixing means.

Compliance is checked by inspection. A1

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A1 **7.12.8** The instructions for appliances connected to the water mains shall state

– the maximum inlet water pressure, in pascals;
– the minimum inlet water pressure, in pascals, if this is necessary for the correct operation of the appliance.

The instructions for appliances connected to the water mains by **detachable hose-sets** shall state that the new hose-sets supplied with the appliance are to be used and that old hose-sets should not be reused.

Compliance is checked by inspection. A1

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

Compliance is checked by inspection.

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

Compliance is checked by inspection and by rubbing the marking by hand for 15 s with a piece of cloth soaked with water and again for 15 s with a piece of cloth soaked with petroleum spirit.

After all the tests of this standard, the marking shall be clearly legible. It shall not be easily possible to remove marking plates nor shall they show curling.

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

NOTE 2 The petroleum spirit to be used for the test is aliphatic solvent hexane having a maximum aromatics content of 0,1 % by volume, a kauri-butanol value of 29, an initial boiling point of approximately 65 °C, a dry point of approximately 69 °C and a specific mass of approximately 0,66 kg/l.

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

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

For **stationary appliances** at least the name or trade mark or identification mark of the manufacturer or responsible vendor and the model or type reference shall be visible when the appliance is installed as in normal use. These markings may be beneath a **detachable cover**. Other markings may be beneath a cover only if they are near to the terminals. For **fixed appliances**, this requirement applies after the appliance has been installed according to the instructions provided with the appliance.

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

Compliance is checked by inspection.

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

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

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

Compliance is checked by inspection.

8 Protection against access to live parts

8.1 Appliances shall be constructed and enclosed so that there is adequate protection against accidental contact with **live parts**.

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

8.1.1 *The requirement of 8.1 applies for all positions of the appliance when it is operated as in normal use, and after the removal of **detachable parts**.*

A2 NOTE 1 A2 This excludes the use of screw-type fuses and screw-type miniature circuit breakers which are accessible without the aid of a **tool**.

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

Test probe B of IEC 61032 is applied without appreciable force, the appliance being in every possible position except that appliances normally used on the floor and having a mass exceeding 40 kg are not tilted. Through openings, the test probe is applied to any depth that the probe will permit and is rotated or angled before, during and after insertion to any position. If the opening does not allow the entry of the probe, the force on the probe in the straight position is increased to 20 N. If the probe then enters the opening, the test is repeated with the probe in the angled position.

A2 NOTE 2 "Without appreciable force" is considered to be a force not exceeding 1 N. A2

*It shall not be possible to touch **live parts** or **live parts** protected only by lacquer, enamel, ordinary paper, cotton, oxide film, beads, or sealing compound except self-hardening resins, with the probe.*

8.1.2 *Test probe 13 of IEC 61032 is applied without appreciable force through openings in **class 0 appliances**, **class II appliances** and **class II constructions**, except for those giving access to lamp caps and **live parts** in socket-outlets.*

A2 NOTE 1 A2 Appliance outlets are not considered to be socket-outlets.

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

A2 NOTE 2 "Without appreciable force" is considered to be a force not exceeding 1 N. A2

*It shall not be possible to touch **live parts** with the test probe.*

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8.1.3 *Instead of test probe B and test probe 13, for appliances other than those of* ***class II****, test probe 41 of IEC 61032 is applied without appreciable force to* ***live parts*** *of* ***visibly glowing heating elements****, all poles of which can be disconnected by a single switching action. It is also applied to parts supporting such elements, provided that it is obvious from the outside of the appliance, without removing covers and similar parts, that these supporting parts are in contact with the element.*

It shall not be possible to touch these ***live parts****.*

A2 NOTE 1 "Without appreciable force" is considered to be a force not exceeding 1 N. A2

A2 NOTE 2 A2 For appliances provided with a **supply cord** and without a switching device in their supply circuit, the withdrawal of the plug from a socket-outlet is considered to be a single switching action.

8.1.4 An **accessible part** is not considered to be live if

– the part is supplied at **safety extra-low voltage**, provided that
  - for a.c., the peak value of the voltage does not exceed 42,4 V,
  - for d.c., the voltage does not exceed 42,4 V,

or

– the part is separated from **live parts** by **protective impedance**.

– A2 for voltages having a peak value over 15 kV, the energy in the discharge shall not exceed 350 mJ. A2

A2 *The quantity of electricity and energy in the discharge is measured using a resistor having a nominal non-inductive resistance of 2 000 Ω.* A2

If **protective impedance** is used, the current between the part and the supply source shall not exceed 2 mA for d.c., its peak value shall not exceed 0,7 mA for a.c. and

– for voltages having a peak value over 42,4 V up to and including 450 V, the capacitance shall not exceed 0,1 µF,

– for voltages having a peak value over 450 V up to and including 15 kV, the discharge shall not exceed 45 µC.

Compliance is checked by measurement, the appliance being supplied at ***rated voltage****.*

Voltages and currents are measured between the relevant parts and each pole of the supply source. Discharges are measured immediately after the interruption of the supply. The quantity of electricity in the discharge is measured using a resistor having a nominal non-inductive resistance of 2 000 Ω.

A1 NOTE 1 A1 Details of a suitable circuit for measuring the current are given in figure 4 of IEC 60990.

A1 NOTE 2 The quantity of electricity is calculated from the sum of all areas recorded on the voltage/time graph without taking voltage polarity into account. A1

8.1.5 **Live parts** of **built-in appliances, fixed appliances** and appliances delivered in separate units, shall be protected at least by **basic insulation** before installation or assembly.

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

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8.2 **Class II appliances** and **class II constructions** shall be constructed and enclosed so that there is adequate protection against accidental contact with **basic insulation** and metal parts separated from **live parts** by **basic insulation** only.

It shall only be possible to touch parts which are separated from **live parts** by **double insulation** or **reinforced insulation**.

A2 Compliance is checked by inspection and by applying test probe B of IEC 61032 in accordance with the conditions specified in 8.1.1. A2

A2 Note deleted A2

A2 NOTE A2 **Built-in appliances** and **fixed appliances** are tested after installation.

9 Starting of motor-operated appliances

NOTE Requirements and tests are specified in part 2 when necessary.

10 Power input and current

10.1 If an appliance is marked with **rated power input**, the power input at normal operating temperature shall not deviate from the **rated power input** by more than the deviation shown in table 1. A2 The permissible deviations apply for both limits of the range for appliances marked with a **rated voltage range** having limits differing by more than 10 % of the arithmetic mean value of the range. A2

Table 1 – Power input deviation

Type of appliance	Rated power input W	Deviation
All appliances	≤25	+20 %
Heating appliances and **combined appliances**	>25 and ≤200	±10 %
	>200	+5 % or 20 W (whichever is the greater) –10 %
Motor-operated appliances	>25 and ≤300	+20 %
	>300	+15 % or 60 W (whichever is the greater)

The deviation for **motor-operated appliances** applies for **combined appliances** if the power input of the motors is more than 50 % of the **rated power input**.

A2 NOTE A2 In case of doubt, the power input of motors may be measured separately.

Compliance is checked by measurement when the power input has stabilized

- *all circuits which can operate simultaneously being in operation;*
- *the appliance being supplied at **rated voltage**;*
- *the appliance being operated under **normal operation**.*

If the power input varies throughout the operating cycle, the power input is determined as the A2 arithmetic mean value A2 of the power input occurring during a representative period.

A2 Notes deleted A2

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*[A2) The test is carried out at both the upper and lower limits of the ranges for appliances marked with one or more **rated voltage ranges**, unless the marking of the **rated power input** is related to the arithmetic mean value of the relevant voltage range, in which case the test is carried out at a voltage equal to the arithmetic mean value of that range. (A2]*

10.2 If an appliance is marked with **rated current**, the current at normal operating temperature shall not deviate from the **rated current** by more than the deviation shown in table 2. [A2) The permissible deviations apply for both limits of the range for appliances marked with a **rated voltage range** having limits differing by more than 10 % of the arithmetic mean value of the range. (A2]

Table 2 – Current deviation

Type of appliance	Rated current A	Deviation
All appliances	≤0,2	+20 %
Heating appliances and **combined appliances**	>0,2 and ≤1,0	±10 %
	>1,0	+5 % or 0,10 A (whichever is the greater) –10 %
Motor-operated appliances	>0,2 and ≤1,5	+20 %
	>1,5	+15 % or 0,30 A (whichever is the greater)

The deviation for **motor-operated appliances** applies for **combined appliances** if the current of the motors is more than 50 % of the **rated current**.

[A2) NOTE (A2] In case of doubt, the current of the motors may be measured separately.

Compliance is checked by measurement when the current has stabilized

- *all circuits which can operate simultaneously being in operation;*
- *the appliance being supplied at **rated voltage**;*
- *the appliance being operated under **normal operation**.*

If the current varies throughout the operating cycle, the current is determined as the [A2) arithmetic (A2] mean value of the current occurring during a representative period.

*[A2) The test is carried out at both the upper and lower limits of the ranges for appliances marked with one or more **rated voltage ranges**, unless the marking of the **rated current** is related to the arithmetic mean value of the relevant voltage range, in which case the test is carried out at a voltage equal to the arithmetic mean value of that range. (A2]*

[A2) Notes deleted (A2]

11 Heating

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

Compliance is checked by determining the temperature rise of the various parts under the conditions specified in 11.2 to 11.7.

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11.2 ***Hand-held appliances*** *are held in their normal position of use.*

Appliances with pins for insertion into socket-outlets are plugged into an appropriate wall-mounted socket-outlet.

Built-in appliances *are installed in accordance with the instructions.*

Other ***heating appliances*** *and other* ***combined appliances*** *are placed in a test corner as follows:*

– *appliances normally placed on a floor or table in use, are placed on the floor as near to the walls as possible;*

– *appliances normally fixed to a wall are fixed to one of the walls, as near to the other wall and floor or ceiling as is likely to occur, taking into account the instructions;*

– *appliances normally fixed to a ceiling are fixed to the ceiling as near to the walls as is likely to occur, taking into account in the instructions.*

Other ***motor-operated appliances*** *are positioned as follows:*

– *appliances normally placed on a floor or table in use are placed on a horizontal support;*

– *appliances normally fixed to a wall are fixed to a vertical support;*

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

Dull black-painted plywood approximately 20 mm thick is used for the test corner, the supports and for the installation of ***built-in appliances****.*

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

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

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

NOTE 1 Thermocouples having wires with a diameter not exceeding 0,3 mm are considered to be fine-wire thermocouples.

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

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

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The temperature rise of electrical insulation, other than that of windings, is determined on the surface of the insulation at places where failure could cause

- *a short circuit;*
- *contact between **live parts** and **accessible metal parts;***
- *bridging of insulation;*
- *a reduction of **clearances** or **creepage distances** below the values specified in clause 29.*

NOTE 2 If it is necessary to dismantle the appliance to position thermocouples, care has to be taken to ensure that the appliance has been correctly reassembled. In case of doubt, the power input is remeasured.

NOTE 3 The point of separation of the cores of a multicore cord and the point where insulated wires enter lampholders are examples of places where thermocouples are positioned.

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

NOTE 4 The temperature rise of a winding is calculated from the formula:

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

where

Δt is the temperature rise of the winding;

R_1 is the resistance at the beginning of the test;

R_2 is the resistance at the end of the test;

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

t_1 is the room temperature at the beginning of the test;

t_2 is the room temperature at the end of the test.

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

11.4 ***Heating appliances*** *are operated under* ***normal operation*** *and at 1,15 times* ***rated power input****.*

11.5 ***Motor-operated appliances*** *are operated under* ***normal operation*** *and supplied with the most unfavourable voltage between 0,94 times and 1,06 times the* ***rated voltage****.*

11.6 ***Combined appliances*** *are operated under* ***normal operation*** *and supplied with the most unfavourable voltage between 0,94 times and 1,06 times the* ***rated voltage****.*

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

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

11.8 *During the test, the temperature rises are monitored continuously and shall not exceed the values shown in table 3. However, if the temperature rise of the motor winding exceeds the value specified in table 3 or if there is doubt with regard to the temperature classification of the insulation of the motor, the tests of annex C are carried out.*

Protective devices *shall not operate and sealing compound shall not flow out.* ▌A1⟩ *However, components in* ***protective electronic circuits*** *are allowed to operate provided they are tested for the number of cycles of operation specified in 24.1.4.* ⟨A1▌

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Table 3 – Maximum normal temperature rises

Part	*Temperature rise* *K*
Windings [a]*, if the winding insulation according to IEC 60085 is:*	
[A2] *– class 105*	*75 (65)*
– class 120	*90 (80)*
– class 130	*95 (85)*
– class 155	*115*
– class 180 [A2]	*140*
– class 200	*160*
– class 220	*180*
– class 250	*210*
Pins of appliance inlets:	
– for very hot conditions	*130*
– for hot conditions	*95*
– for cold conditions	*45*
Terminals, including earthing terminals, for external conductors of ***stationary appliances****, unless they are provided with a* ***supply cord***	*60*
Ambient of switches, ***thermostats*** *and* ***temperature limiters*** [b]*:*	
– without T-marking	*30*
– with T-marking	*T-25*
[A2] *Rubber, polychloroprene or polyvinyl chloride insulation of internal and external wiring, including* ***supply cords****:*	
– without temperature rating or with a temperature rating not exceeding 75 °C	*50*
– with temperature rating (T) J where T exceeds 75 °C	*T-25* [A2]
Cord sheaths used as ***supplementary insulation***	*35*
Sliding contacts of cord reels	*65*
Points where the insulation of wires can come into contact with parts of a terminal block or compartment for fixed wiring, for a ***stationary appliance*** *not provided with a* ***supply cord****.*	*50* [c]
Rubber, other than synthetic, used for gaskets or other parts, the deterioration of which could affect safety:	
– when used as ***supplementary insulation*** *or as* ***reinforced insulation***	*40*
– in other cases	*50*
Lampholders with T-marking [d]	
– B15 and B22 marked T1	*140*
– B15 and B22 marked T2	*185*
– other lampholders	*T-25*
Lampholders without T-marking [d]	
– E14 and B15	*110*
– B22, E26 and E27	*140*
– other lampholders and starter holders for fluorescent lamps	*55*

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Table 3 *(continued)*

Part	***Temperature rise*** *K*
Material used as insulation, other than that specified for wires and windings [e]*:*	
– *impregnated or varnished textile, paper or press-board*	*70*
– *laminates bonded with:*	
• *melamine-formaldehyde, phenol-formaldehyde or phenol-furfural resins*	*85 (175)*
• *urea-formaldehyde resin*	*65 (150)*
– *printed circuit boards bonded with epoxy resin*	*120*
– *moulding of:*	
• *phenol-formaldehyde with cellulose fillers*	*85 (175)*
• *phenol-formaldehyde with mineral fillers*	*100 (200)*
• *melamine-formaldehyde*	*75 (150)*
• *urea-formaldehyde*	*65 (150)*
– *polyester with glass reinforcement*	*110*
– *silicone rubber*	*145*
– *polytetrafluoroethylene*	*265*
– *pure mica and tightly sintered ceramic material when such materials are used as* ***supplementary insulation*** *or* ***reinforced insulation***	*400*
– *thermoplastic material* [f]	–
Wood, in general [g]	*65*
– *Wooden supports, walls, ceiling and floor of the test corner and wooden cabinet:*	
• ***stationary appliances*** *liable to be operated continuously for long periods*	*60*
• *other appliances*	*65*
Outer surface of capacitors [h]*:*	
– *with marking of maximum operating temperature (T)* [i]	*T-25*
– *without marking of maximum operating temperature:*	
• *small ceramic capacitors for radio and television interference suppression*	*50*
• *capacitors complying with IEC 60384-14*	*50*
• *other capacitors*	*20*
External enclosure of ***motor-operated appliances****, except handles held in normal use*	*60*
Surfaces of handles, knobs, grips and similar parts which are continuously held in normal use (e.g. soldering irons)	
– *of metal*	*30*
– *of porcelain or vitreous material*	*40*
– *of moulded material, rubber or wood*	*50*
Surfaces of handles, knobs, grips and similar parts which are held for short periods only in normal use (e.g. switches):	
– *of metal*	*35*
– *of porcelain or vitreous material*	*45*
– *of moulded material, rubber or wood*	*60*
Parts in contact with oil having a flash-point of t °C	*t-50*

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Table 3 *(continued)*

NOTE 1 If other materials than those mentioned in the table are used, they are not to be subjected to temperatures in excess of their thermal capabilities as determined by ageing tests. NOTE 2 The values in the table are based on an ambient temperature not normally exceeding 25 °C but occasionally reaching 35 °C. However, the temperature rise values specified are based on 25 °C. NOTE 3 The temperature rise limit for metal applies to parts having a metal coating at least 0,1 mm thick and to metal parts having a plastic coating less than 0,3 mm thick. NOTE 4 The temperature of the terminals of switches is measured if the switch is tested in accordance with annex H.
[a] *To allow for the fact that the average temperature of windings of universal motors, relays, solenoids and similar components is usually above the temperature at the points on the windings where thermocouples are placed, the figures without parentheses apply when the resistance method is used and those within parentheses apply when thermocouples are used. For windings of vibrator coils and a.c. motors, the figures without parentheses apply in both cases.* *For motors constructed so that the circulation of air between the inside and the outside of the case is prevented but which are not necessarily sufficiently enclosed to be considered airtight, the temperature rise limits may be increased by 5 K.* [A2⟩ The temperature rise limit of windings in transformers and inductors mounted on printed circuit boards is equal to the thermal class of the winding insulation reduced by 25 K provided the largest dimension of the winding does not exceed 5 mm in cross section or length. ⟨A2] [b] *T means the maximum ambient temperature in which the component or its switch head can operate.* *The ambient is the temperature of the air at the hottest point at a distance of 5 mm from the surface of the component concerned. However, if a **thermostat** or a **temperature limiter** is mounted on a heat-conducting part, the declared temperature limit of the mounting surface (Ts) is also applicable. Therefore, the temperature rise of the mounting surface has to be measured.* [A1⟩ *The temperature rise limit does not apply to switches or controls tested in accordance with the conditions occurring in the appliance.* ⟨A1] [c] *This limit may be exceeded if the instruction specified in 7.12.3 is supplied.* [d] *Locations for measuring the temperature rises are specified in table 12.1 of IEC 60598-1.* [e] *The values in parentheses apply to locations where the part is fixed to a hot surface.* [f] *There is no specific limit for thermoplastic material. However, the temperature rise has to be determined in order that the tests of 30.1 can be carried out.* [g] *The limit specified concerns the deterioration of wood and it does not take into account deterioration of surface finishes.* [h] *There is no limit for the temperature rise of capacitors that are short-circuited in 19.11.* [i] Temperature marking for capacitors mounted on printed circuit boards may be given in the technical sheet. [A2⟩ [j] *IEC 60245 Types 53, 57 and 87 **supply cords** have a T rating of 60 °C;* *IEC 60227 Types 52 and 53 **supply cords** have a T rating of 70 °C;* *IEC 60227 Types 56 and 57 **supply cords** have a T rating of 90 °C.* ⟨A2]

12 Void

13 Leakage current and electric strength at operating temperature

13.1 At operating temperature, the leakage current of the appliance shall not be excessive and its electric strength shall be adequate.

Compliance is checked by the tests of 13.2 and 13.3.

*The appliance is operated under **normal operation** for the duration specified in 11.7.*

***Heating appliances** are operated at 1,15 times the **rated power input**.*

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Motor-operated appliances *and* ***combined appliances*** *are supplied at 1,06 times* ***rated voltage****.*

Three-phase appliances which, according to the instructions for installation, are also suitable for single-phase supply are tested as single-phase appliances with the three circuits connected in parallel.

Protective impedance *and radio interference filters are disconnected before carrying out the tests.*

13.2 *The leakage current is measured by means of the circuit described in figure 4 of IEC 60990 between any pole of the supply and* ***accessible metal parts*** *connected to metal foil having an area not exceeding 20 cm × 10 cm which is in contact with* ***accessible surfaces*** *of insulating materials.*

NOTE 1 The voltmeter shown in figure 4 of IEC 60990 is to be capable of measuring the true r.m.s. value of the voltage.

For single-phase appliances, the measuring circuit is shown in the following figures:

– *if of* ***class II****, figure 1;*

– *if other than* ***class II****, figure 2.*

The leakage current is measured with the selector switch in each of the positions a and b.

For three-phase appliances, the measuring circuit is shown in the following figures:

– *if of* ***class II****, figure 3;*

– *if other than* ***class II****, figure 4.*

For three-phase appliances, the leakage current is measured with the switches a, b and c in the closed position. The measurements are then repeated with each of the switches a, b and c open in turn, the other two switches remaining closed. For appliances intended to be connected in star connection only, the neutral is not connected.

After the appliance has been operated for a duration as specified in 11.7, the leakage current shall not exceed the following values:

– *for* ***class II appliances***	*0,25 mA*
– *for* ***class 0****,* ***class 0I and class III appliances***	*0,5 mA*
– *for* ***portable class I appliances***	*0,75 mA*
– *for* ***stationary class I motor-operated appliances***	*3,5 mA*
– *for* ***stationary class I heating appliances***	*0,75 mA or 0,75 mA per kW* ***rated power input*** *of the appliance with a maximum of 5 mA, whichever is higher*

For ***combined appliances****, the total leakage current may be within the limits specified for* ***heating appliances*** *or* ***motor-operated appliances****, whichever is the greater, but the two limits are not added.*

If the appliance incorporates capacitors and is provided with a single-pole switch, the measurements are repeated with the switch in the ***off position****.*

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If the appliance incorporates a thermal control which operates during the test of clause 11, the leakage current is measured immediately before the control opens the circuit.

NOTE 2 The test with the switch in the **off position** is carried out to verify that capacitors connected behind a single-pole switch do not cause an excessive leakage current.

NOTE 3 It is recommended that the appliance is supplied through an isolating transformer; otherwise it is to be insulated from earth.

NOTE 4 The metal foil has the largest area possible on the surface under test without exceeding the dimensions specified. If its area is smaller than the surface under test, it is moved to test all parts of the surface.

The heat dissipation of the appliance is not to be affected by the metal foil.

13.3 A1 *The appliance is disconnected from the supply and the insulation is immediately subjected to a voltage having a frequency of 50 Hz or 60 Hz for 1 min, in accordance with IEC 61180-1.*

The high-voltage source used for the test is to be capable of supplying a short circuit current I_s between the output terminals after the output voltage has been adjusted to the appropriate test voltage. The overload release of the circuit is not to be operated by any current below the tripping current I_r. The values of I_s and I_r are given in Table 5 for various high-voltage sources. A1

*The test voltage is applied between **live parts** and **accessible parts**, non-metallic parts being covered with metal foil. For **class II constructions** having intermediate metal between **live parts** and **accessible parts**, the voltage is applied across the **basic insulation** and the **supplementary insulation.***

NOTE 1 Care should be taken to avoid overstressing the components of **electronic circuits.**

The values of the test voltages are specified in table 4.

A1 **Table 4 – Voltage for electric strength test**

Insulation	***Test voltage*** *V*			
	Rated voltage [a]			***Working voltage (U)***
	SELV	*≤150 V*	*>150 V and ≤250 V* [b]	*>250 V*
Basic insulation	*500*	*1 000*	*1 000*	*1,2 U + 700*
Supplementary insulation		*1 250*	*1 750*	*1,2 U + 1 450*
Reinforced insulation		*2 500*	*3 000*	*2,4 U + 2 400*

[a] *For multi-phase appliances, the line to neutral or line to earth voltage is used for **rated voltage**. The test voltage for 480 V multi-phase appliances is that specified for a **rated voltage** in the range > 150 V and ≤ 250 V.*

[b] *For appliances having a **rated voltage** ≤ 150 V, these test voltages apply to parts having a **working voltage** > 150 V ≤ 250 V.*

A1

A1 *Text deleted* A1

No breakdown shall occur during the test.

NOTE 2 Glow discharges without drop in voltage are neglected.

A1 *Note deleted* A1

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[A1] Table 5 – Characteristics of high-voltage sources

Test voltage V	*Minimum current* mA	
	I_s	I_r
≤4 000	200	100
>4 000 and ≤10 000	80	40
>10 000 and ≤20 000	40	20
NOTE The currents are calculated on the basis of the short circuit and release energies of 800 VA and 400 VA respectively at the upper end of the voltage ranges.		

[A1]

14 Transient overvoltages

Appliances shall withstand the transient overvoltages to which they may be subjected.

Compliance is checked by subjecting each ***clearance*** *having a value less than those specified in table 16 to an impulse voltage test.*

[A2] The impulse test voltage has a no-load waveshape corresponding to the 1,2/50 µs standard impulse specified in IEC 61180-1. It is supplied from a generator having a conventional impedance not exceeding 42 Ω. The impulse test voltage is applied three times for each polarity with intervals of at least 1 s. [A2]

NOTE 1 The generator is specified in IEC 61180-2.

The impulse test voltage is specified in table 6 for ***rated impulse voltages*** *given in table 15.*

[A1] Table 6 – Impulse test voltage

Rated impulse voltage V	*Impulse test voltage* V
330	350
500	550
800	910
1 500	1 750
2 500	2 950
4 000	4 800
6 000	7 300
8 000	9 800
10 000	12 300

[A1]

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*There shall be no flashover. However, flashover of **functional insulation** is allowed if the appliance complies with clause 19 when the **clearance** is short-circuited.*

[A1] NOTE 2 The impulse test voltages have been calculated using correction factors for testing at locations situated at sea level. It is considered that they are appropriate for any location between sea level and 500 m. If tests are carried out at other locations, other correction factors should be used as noted in subclause 4.1.1.2.1.2 of IEC 60664-1. [A1]

[A2] *Note deleted* [A2]

15 Moisture resistance

15.1 The enclosure of the appliance shall provide the degree of protection against moisture in accordance with the classification of the appliance.

Compliance is checked as specified in 15.1.1 taking into account 15.1.2, the appliance not being connected to the supply mains.

*The appliance shall then withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation which could result in a reduction of **clearances** and **creepage distances** below the values specified in clause 29.*

NOTE The external enclosure is carefully wiped to remove any surplus water before inspection. Care has to be taken when dismantling to avoid displacing any water within the appliance.

15.1.1 *Appliances other than those classified IPX0 are subjected to the tests of IEC 60529 as follows:*

- *IPX1 appliances as described in subclause 14.2.1;*
- *IPX2 appliances as described in subclause 14.2.2;*
- *IPX3 appliances as described in subclause 14.2.3a;*
- *IPX4 appliances as described in subclause 14.2.4a;*
- *IPX5 appliances as described in subclause 14.2.5;*
- *IPX6 appliances as described in subclause 14.2.6;*
- *IPX7 appliances as described in subclause 14.2.7. For this test the appliance is immersed in water containing approximately 1 % NaCl.*

NOTE The **hand-held spray nozzle** may be used for testing appliances that cannot be placed under the oscillating tube specified in IEC 60529.

[A1] *Water valves containing **live parts** and that are incorporated in external hoses for connection of an appliance to the water mains are subjected to the test specified for IPX7 appliances.* [A1]

15.1.2 ***Hand-held appliances** are turned continuously through the most unfavourable positions during the test.*

***Built-in appliances** are installed in accordance with the instructions.*

Appliances normally used on the floor or table are placed on a horizontal unperforated support having a diameter of twice the oscillating tube radius minus 15 cm.

Appliances normally fixed to a wall and appliances with pins for insertion into socket-outlets are mounted as in normal use in the centre of a wooden board having dimensions which are 15 cm ± 5 cm in excess of those of the orthogonal projection of the appliance on the board. The wooden board is placed at the centre of the oscillating tube.

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For IPX3 appliances, the base of wall-mounted appliances is placed at the same level as the pivot axis of the oscillating tube.

For IPX4 appliances, the horizontal centre line of the appliance is aligned with the pivot axis of the oscillating tube. However, for appliances normally used on the floor or table, the movement is limited to two times 90° from the vertical for a period of 5 min, the support being placed at the level of the pivot axis of the oscillating tube.

If the instructions for wall-mounted appliances state that the appliance is to be placed close to the floor level and specifies a distance, a board is placed under the appliance at that distance. The dimensions of the board are 15 cm more than the horizontal projection of the appliance.

A1 Appliances normally fixed to a ceiling are mounted underneath a horizontal unperforated support that is constructed to prevent water spraying onto its top surface. The pivot axis of the oscillating tube is located at the same level as the underside of the support and aligned centrally with the appliance. The spray is directed upwards.

For IPX4 appliances, the movement of the tube is limited to two times 90° from the vertical for a period of 5 min. A1

*Appliances with **type X attachment**, except those having a specially prepared cord, are fitted with the lightest permissible type of flexible cord of the smallest cross-sectional area specified in table 13.*

***Detachable parts** are removed and subjected, if necessary, to the relevant treatment with the main part. However, if the instructions state that a part has to be removed for **user maintenance** and a **tool** is needed, this part is not removed.*

15.2 Appliances subject to spillage of liquid in normal use shall be constructed so that such spillage does not affect their electrical insulation.

Compliance is checked by the following test.

*Appliances with **type X attachment**, except those having a specially prepared cord, are fitted with the lightest permissible type of flexible cord of the smallest cross-sectional area specified in table 13.*

Appliances incorporating an appliance inlet are tested with or without an appropriate connector in position, whichever is most unfavourable.

***Detachable parts** are removed.*

The liquid container of the appliance is completely filled with water containing approximately 1 % NaCl and a further quantity, equal to 15 % of the capacity of the container or 0,25 l, whichever is the greater, is poured in steadily over a period of 1 min.

*The appliance shall then withstand the electric strength test of 16.3 and inspection shall show that there is no trace of water on insulation that could result in a reduction of **clearances** or **creepage distances** below the values specified in clause 29.*

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