# IEC 60335-2-45

Edition 4.0 2024-11
EXTENDED VERSION

# INTERNATIONAL STANDARD

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This full version of IEC 60335-2-45:2024 includes the content of the references made to IEC 60335-1:2020

## Household and similar electrical appliances – Safety – Part 2-45: Particular requirements for portable heating tools and similar appliances

IEC 60335-2-45:2024-11 EXV(en)

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## Household and similar electrical appliances – Safety – Part 2-45: Particular requirements for portable heating tools and similar appliances

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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# IEC 60335-1
**Edition 6.0 2020-09**

# HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

## Part 1: General requirements

## INTERPRETATION SHEET 1

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

The text of this Interpretation Sheet is based on the following documents:

| Draft | Report on voting |
|---|---|
| 61/5999/DISH | 61/6009/RVDISH |

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

### INTRODUCTION

Edition 6 of IEC 60335-1:2020 defines and introduces requirements for a detachable power supply part of an appliance. In the document, 24.2 prohibits the use of a power supply in a flexible cord.

### QUESTION:

Does Subclause 24.2 prohibit the use of a detachable power supply part?

### ANSWER

No, a "detachable power supply part" is a defined term and is not captured by the term "power supply" as used in Subclause 24.2.

NOTE A detachable power supply part is captured by the defined term when the output of the power supply part is detachable from the class III construction part of the appliance at:

– the power supply part, or

– the class III construction part of the appliance.

However, the supply cord (if any) does not have to be detachable from the detachable power supply part.

ICS 13.120; 97.030

IEC 60335-1:2020-09/ISH1:2021-11(en)

Documents
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Full document details: IEC 60335-2-45 2024 EXV

CONTENTS

FOREWORD ..... 6
INTRODUCTION to IEC 60335-1:2020 ..... 9
INTRODUCTION to IEC 60335-2-45:2024 ..... 11
1 Scope ..... 12
2 Normative references ..... 13
3 Terms and definitions ..... 18
4 General requirement ..... 31
5 General conditions for the tests ..... 31
6 Classification ..... 35
7 Marking and instructions ..... 36
8 Protection against access to live parts ..... 45
9 Starting of motor-operated appliances ..... 47
10 Power input and current ..... 47
11 Heating ..... 49
12 Charging of metal-ion batteries ..... 55
13 Leakage current and electric strength at operating temperature ..... 57
14 Transient overvoltages ..... 59
15 Moisture resistance ..... 60
16 Leakage current and electric strength ..... 63
17 Overload protection of transformers and associated circuits ..... 65
18 Endurance ..... 65
19 Abnormal operation ..... 65
20 Stability and mechanical hazards ..... 76
21 Mechanical strength ..... 77
22 Construction ..... 80
23 Internal wiring ..... 94
24 Components ..... 96
25 Supply connection and external flexible cords ..... 100
26 Terminals for external conductors ..... 109
27 Provision for earthing ..... 112
28 Screws and connections ..... 113
29 Clearances, creepage distances and solid insulation ..... 116
30 Resistance to heat and fire ..... 124
31 Resistance to rusting ..... 129
32 Radiation, toxicity and similar hazards ..... 129
Annex A (informative) Routine tests ..... 144
Annex B (normative) Battery-operated appliances, separable batteries and detachable batteries for battery-operated appliances ..... 146
Annex C (normative) Ageing test on motors ..... 167
Annex D (normative) Thermal motor protectors ..... 168
Annex E (normative) Needle-flame test ..... 169
Annex F (normative) Capacitors ..... 171

AVA Documents
Document Sharing Hub

Full document details: IEC 60335-2-45 2024 EXV

Annex G (normative) Safety isolating transformers ... 172
Annex H (normative) Switches ... 173
Annex I (normative) Motors having basic insulation that is inadequate for the rated voltage of the appliance ... 175
Annex J (normative) Coated printed circuit boards ... 177
Annex K (informative) Overvoltage categories ... 178
Annex L (informative) Guidance for the measurement of clearances and creepage distances ... 179
Annex M (informative) Pollution degree ... 182
Annex N (normative) Proof tracking test ... 183
Annex O (informative) Selection and sequence of the tests of Clause 30 ... 184
Annex P (informative) Guidance for the application of this standard to appliances used in tropical climates ... 189
Annex Q (informative) Sequence of tests for the evaluation of electronic circuits ... 191
Annex R (normative) Software evaluation ... 194
Annex S (informative) Guidance for the application of this standard on measurement of power input and current based on the requirements of 10.1 and 10.2 concerning the representative period ... 208
Annex T (normative) UV-C radiation effect on non-metallic materials ... 209
Annex U (normative) Appliances intended for remote communication through public networks ... 212
Bibliography ... 216
Index of defined terms ... 219

Figure 1 – Circuit diagram for leakage current measurement at operating temperature for single-phase connection of class II appliances and for parts of class II construction ... 130
Figure 2 – Circuit diagram for leakage current measurement at operating temperature for single-phase connection of other than class II appliances or parts of class II construction ... 131
Figure 3 – Circuit diagram for leakage current measurement at operating temperature for three-phase with neutral class II appliances and for parts of class II construction ... 132
Figure 4 – Circuit diagram for leakage current measurement at operating temperature for three-phase with neutral appliances other than those of class II or parts of class II construction ... 133
Figure 5 – Small part ... 134
Figure 6 – Example of an electronic circuit with low-power points ... 134
Figure 7 – Test finger nail ... 135
Figure 8 – Flexing test apparatus ... 136
Figure 9 – Constructions of cord anchorages ... 137
Figure 10 – An example of parts of an earthing terminal ... 138
Figure 11 – Examples of clearances ... 139
Figure 12 – Example of the placement of the cylinder ... 140
Figure 13 – Small parts cylinder ... 141
Figure 14 – Example of a specified operating region of a lithium-ion cell during charging ... 142
Figure 101 – Probe for measuring surface temperatures ... 143

Documents
Document Sharing Hub
Full document details: IEC 60335-2-45 2024 EXV

Figure B.1 – Examples of battery-operated appliance constructions and application of normative Annex B *(1 of 2)* ..... 164
Figure B.2 – Examples of correct polarity connection marking representing three batteries ..... 166
Figure I.1 – Simulation of faults ..... 176
Figure L.1 – Sequence for the determination of clearances ..... 179
Figure L.2 – Sequence for the determination of creepage distances ..... 180
Figure L.3 – Measurement of clearances ..... 181
Figure O.1 – Tests for resistance to heat ..... 184
Figure O.2 – Selection and sequence of tests for resistance to fire in hand-held appliances ..... 185
Figure O.3 – Selection and sequence of tests for resistance to fire in attended appliances ..... 185
Figure O.4 – Selection and sequence of tests for resistance to fire in unattended appliances ..... 186
Figure O.5 – Some applications of the term "within a distance of 3 mm" ..... 188
Figure Q.1 – Flowchart outlining the sequence of tests for the evaluation of electronic circuits *(1 of 2)* ..... 192
Figure S.1 – Flowchart giving guidance on measurement of power input and current concerning the representative period ..... 208

Table 1 – Power input deviation ..... 47
Table 2 – Current deviation ..... 48
Table 3 – Maximum normal temperature rises ..... 52
Table 101 – Maximum temperature rises for specified external accessible surfaces under normal operating conditions ..... 55
Table 4 – Voltage for electric strength test ..... 59
Table 5 – Characteristics of high-voltage sources ..... 59
Table 6 – Impulse test voltage ..... 60
Table 7 – Test voltages ..... 64
Table 8 – Maximum winding temperature ..... 68
Table 9 – Maximum abnormal temperature rise ..... 74
Table 10 – Dimensions of cables and conduits ..... 102
Table 11 – Minimum cross-sectional area of conductors ..... 104
Table 12 – Pull force and torque ..... 106
Table 13 – Nominal cross-sectional area of conductors ..... 111
Table 14 – Torque for testing screws and nuts ..... 115
Table 15 – Rated impulse voltage ..... 117
Table 16 – Minimum clearances ..... 117
Table 17 – Minimum creepage distances for basic insulation ..... 121
Table 18 – Minimum creepage distances for functional insulation ..... 122
Table 19 – Minimum thickness for accessible parts of reinforced insulation consisting of a single layer ..... 124
Table A.1 – Test voltages ..... 145
Table B.1 – Artificial source characteristics ..... 148
Table B.2 – Total area of openings for metal-ion cells ..... 150

AVA Documents
Document Sharing Hub
Full document details: IEC 60335-2-45 2024 EXV

Table B.3 – Volume of air injected at 2 070 kPa ..... 156
Table C.1 – Test conditions ..... 167
Table R.1 – General fault/error conditions ..... 196
Table R.2 – Specific fault/error conditions ..... 198
Table R.3 – Semi-formal methods ..... 204
Table R.4 – Software architecture specification ..... 204
Table R.5 – Module design specification ..... 205
Table R.6 – Design and coding standards ..... 206
Table R.7 – Software safety validation ..... 206
Table T.1 – Minimum property retention limits after UV-C exposure ..... 210
Table T.2 – Minimum electric strength for internal wiring after UV-C exposure ..... 211
Table U.1 – Examples of acceptable measures against unauthorised access and transmission fault/error modes ..... 214

Documents
Document Sharing Hub
Full document details: IEC 60335-2-45 2024 EXV

INTERNATIONAL ELECTROTECHNICAL COMMISSION

# HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

## Part 2-45: Particular requirements for portable heating tools and similar appliances

## FOREWORD

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**IEC 60335-2-45:2024 EXV includes the content of IEC 60335-2-45:2024, and the references made to IEC 60335-1:2020.**

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IEC 60335-2-45 has been prepared by IEC technical committee 61: Safety of household and similar electrical appliances. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2002, Amendment 1:2008 and Amendment 2:2011. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) alignment with IEC 60335-1:2020;

b) deletion or conversion of some notes to normative text (Clause 1, 5.2, 15.101, 22.105, 25.7);

c) introduction of external accessible surfaces temperature limits, including addition of functional surface and hot surface requirements (3.6.101, 7.1, 7.6, 7.12, 7.14, 7.15, 11.3, 11.8);

The text of this International Standard is based on the following documents:

| Draft | Report on voting |
|---|---|
| 61/7296/FDIS | 61/7341/RVD |

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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

This part 2 is to be used in conjunction with the latest edition of IEC 60335-1 and its amendments unless that edition precludes it; in that case, the latest edition that does not preclude it is used. It was established on the basis of the sixth edition (2020) of that standard.

NOTE 1 When "Part 1" is mentioned in this standard, it refers to IEC 60335-1.

This part 2 supplements or modifies the corresponding clauses in IEC 60335-1, so as to convert that publication into the IEC standard: Particular requirements for portable heating tools and similar appliances.

When a particular subclause of Part 1 is not mentioned in this part 2, that subclause applies as far as is reasonable. When this standard states "addition", "modification", or "replacement", the relevant text in Part 1 is to be adapted accordingly.

NOTE 2 The following numbering system is used:

– subclauses, tables and figures that are numbered starting from 101 are additional to those in Part 1;

– unless notes are in a new subclause or involve notes in Part 1, they are numbered starting from 101, including those in a replaced clause or subclause;

– additional annexes are lettered AA, BB, etc.

NOTE 3 The following print types are used:

– requirements: in roman type;

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– *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 following differences exist in the countries indicated below.

– 6.1: Class 0 appliances are allowed if their rated voltage does not exceed 150 V and class 0I appliances are allowed (Japan).

– 25.7: The modification does not apply (Japan).

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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# INTRODUCTION to IEC 60335-1:2020

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.

Guidance documents concerning the application of the safety requirements for appliances can be accessed via TC 61 supporting documents on the IEC website –

www.iec.ch/tc61/supportingdocuments

This information is given for the convenience of users of this International Standard and does not constitute a replacement for the normative text in this standard.

This standard recognizes the internationally accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of appliances when operated as in normal use taking into account the manufacturer's instructions. It also covers abnormal situations that can be expected in practice and takes into account the way in which electromagnetic phenomena can affect the safe operation of appliances.

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

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

Throughout this publication, when "part 2" is mentioned, it refers to the relevant part of IEC 60335.

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

NOTE 1 This means that the technical committees responsible for the part 2 standards have determined that it is not necessary to specify particular requirements for the appliance in question over and above the general requirements.

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

NOTE 2 Horizontal publications, basic safety publications and group safety publications covering a hazard are not applicable since they have been taken into consideration when developing the general and particular requirements for the IEC 60335 series of standards.

Individual countries may wish to consider the application of this standard, as far as is reasonable, to appliances not mentioned in a part 2, and to appliances designed on new principles. In this case, consideration should be given to defining normal operation, specifying the classification of the appliance according to Clause 6 and specifying whether the appliance is operated attended or unattended. Consideration should also be given to particular categories of likely users and to related specific risks such as access to live parts, hot surfaces or hazardous moving parts.

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

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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 this standard.

NOTE 3 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 and relevant IEC 61000-3 series standards concerning electromagnetic emissions;
– CISPR 14-2 concerning electromagnetic immunity;
– IEC standards published by TC 111 concerning environmental matters.

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Guidance documents concerning the application of the safety requirements for appliances can be accessed via TC 61 supporting documents on the IEC website

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This information is given for the convenience of users of this International Standard and does not constitute a replacement for the normative text in this standard.

This standard recognizes the internationally accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of appliances when operated as in normal use taking into account the manufacturer's instructions. It also covers abnormal situations that can be expected in practice and takes into account the way in which electromagnetic phenomena can affect the safe operation of appliances.

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

If an appliance within the scope of this standard also incorporates functions that are covered by another part 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.

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

NOTE 1 This means that the technical committees responsible for the part 2 standards have determined that it is not necessary to specify particular requirements for the appliance in question over and above the general requirements.

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

NOTE 2 Horizontal publications, basic safety publications and group safety publications covering a hazard are not applicable since they have been taken into consideration when developing the general and particular requirements for the IEC 60335 series of standards.

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 that 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 3 Standards dealing with non-safety aspects of household appliances are:

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# HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

## Part 2-45: Particular requirements for portable heating tools and similar appliances

## 1 Scope

This part of IEC 60335 deals with the safety of **portable electric heating tools** and similar appliances, their **rated voltage** being not more than 250 V including direct current (DC) supplied appliances and **battery-operated appliances**.

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

Appliances that can also be used when mounted on a support are within the scope of this standard.

Examples of appliances that are within the scope of this standard are

– **branding tools**;
– **burning-in pens**;
– **conduit-soldering tools**;
– **dehorning tools**;
– **desoldering irons**;
– **firelighters**;
– glue guns;
– **heat guns**;
– **household film-welding appliances**;
– **paint strippers**;
– plastic-cutting tools;
– **soldering guns**;
– **soldering irons**;
– stripping pliers;
– **thermoplastic conduit-welding tools**.

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

– 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.

Attention is drawn to the fact that

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

This standard does not apply to:

– hand-held motor-operated electric tools (IEC 60745 series, IEC 62841 series);
– transportable motor-operated electric tools (IEC 61029 series, IEC 62841 series);
– 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);
– tools using high-frequency heating other than **induction soldering irons**;
– arc-welding equipment.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60034-1, *Rotating electrical machines – Part 1: Rating and performance*

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

IEC 60065:2014, *Audio, video and similar electronic apparatus – Safety requirements*

IEC 60068-2-2, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-31, *Environmental testing – Part 2-31: Tests – Test Ec: Rough handling shocks, primarily for equipment-type specimens*

IEC 60068-2-75, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC TR 60083, *Plugs and socket-outlets for domestic and similar general use standardized in member countries of IEC*

IEC 60085:2007, *Electrical insulation – Thermal evaluation and designation*

IEC 60112:2003, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*
IEC 60112:2003/AMD1:2009[1]

IEC 60127 (all parts), *Miniature fuses*

[1] There exists a consolidated edition 4.1:2009 that includes edition 4 and its Amendment 1.

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

IEC 60227-5:2011, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 5: Flexible cables (cords)*

IEC 60238, *Edison screw lampholders*

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

IEC 60252-1:2010, *AC motor capacitors – Part 1: General – Performance, testing and rating – Safety requirements – Guidance for installation and operation*
IEC 60252-1:2010/AMD1:2013[2]

IEC 60309-2, *Plugs, socket-outlets and couplers for industrial purposes – Part 2: Dimensional interchangeability requirements for pin and contact-tube accessories*

IEC 60320 (all parts), *Appliance couplers for household and similar general purposes*

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

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

IEC 60320-3, *Appliance couplers for household and similar general purposes – Part 3: Standard sheets and gauges*

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[2] There exists a consolidated edition 2.1:2013 that includes edition 2 and its Amendment 1.

[3] There exists a consolidated edition 4.1:2016 that includes edition 4 and its Amendment 1.

[4] There exists a consolidated edition 2.2:2013 that includes edition 2 and its Amendment 1 and Amendment 2.

[5] There exists a consolidated edition 8.1:2017 that includes edition 8 and its Amendment 1.

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[6] There exists a consolidated edition 5.1:2015 that includes edition 5 and its Amendment 1.

[7] There exists a consolidated edition 4.1:2018 that includes edition 4 and its Amendment 1.

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8 There exists a consolidated edition 1.2:2015 that includes edition 1 and its Amendment 1 and Amendment 2.

9 There exists a consolidated edition 1.1:2009 that includes edition 1 and its Amendment 1.

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[10] There exists a consolidated edition 1.1:2013 that includes edition 1 and its Amendment 1.

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ISO 9773, *Plastics – Determination of burning behaviour of thin flexible vertical specimens in contact with a small-flame ignition source*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

When the terms "voltage" and "current" are used, they are RMS values, unless otherwise specified.

When the term "earthing" is used, it means "protective earthing", unless otherwise specified.

### 3.1 Definitions relating to physical characteristics

**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**, with controls and switching devices positioned so as to maximize the value

Note 1 to entry: **Working voltage** takes into account resonant voltages.

Note 2 to entry: When deducing the **working voltage**, the effect of transient voltages is ignored.

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Full document details: IEC 60335-2-45 2024 EXV

**3.1.4**
**rated power input**
power input assigned to the appliance by the manufacturer

Note 1 to entry: If no power input is assigned to the appliance, the **rated power input** for **heating appliances** and **combined appliances** is the power input measured when the appliance is supplied at **rated voltage** and operated under **normal operation**.

**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 1 to entry: If no current is assigned to the appliance, the **rated current** is the current measured when the appliance is supplied at **rated voltage** and operated under **normal operation.**

**3.1.7**
**rated frequency**
frequency assigned to the appliance by the manufacturer

**3.1.8**
**rated frequency range**
frequency range assigned to the appliance by the manufacturer, expressed by its lower and upper limits

**3.1.9**
**normal operation**
operation of appliances under the following conditions:

Appliances having a stand are operated on the stand, unless otherwise specified.

Other appliances are operated in accordance with the instructions, unless otherwise specified.

**Soldering guns** and plastic-cutting tools incorporating a **biased-off switch** are operated in cycles in accordance with the instructions but they are switched on for at least 12 s with rest periods not exceeding 48 s. For **soldering guns**, the on-period is such that the temperature at the tip reaches at least 300 °C at the end of the first on-period.

**Household film-welding appliances** are operated in cycles in accordance with the instructions but they are switched on at least for the time necessary to weld together two sheets of plastic film with rest periods not exceeding 2 min. The plastic film is high pressure (low density) polyethylene, each sheet having a thickness of 50 µm.

**Heat guns** are operated with the airflow horizontal.

**Firelighters** are operated to ignite charcoal placed in a tray having a diameter of 600 mm and a side 50 mm high. The pile of charcoal is 500 mm in diameter and 100 mm high at its centre.

**Contact firelighters** are positioned with the heating element horizontal and inserted in the centre of the charcoal.

**Hot-air firelighters** are positioned with the airflow horizontal or directed downwards up to 45° if allowed by the construction, whichever is more unfavourable.

Appliances operated with **integral batteries** or **separable batteries** not disconnected from the appliance for charging purposes:

– the **battery** that is **fully discharged** is charged with the **battery-operated appliance** performing its intended function, if allowed by the construction of the appliance;

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Full document details: IEC 60335-2-45 2024 EXV

– the **battery** that is **fully discharged** is charged without the **battery-operated appliance** performing its intended function

Note 1 to entry: Operation of a **battery-operated appliance** to perform its intended function is considered to be **normal operation**.

**3.1.10**
**rated impulse voltage**
voltage derived from the **rated voltage** and the overvoltage category of the appliance, characterizing the specified withstand capability of its insulation against transient overvoltages

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

**3.1.12**
**outlet load**
load that can be connected to appliance outlets accessible to the user and socket-outlets accessible to the user

Note 1 to entry: Outlets with a voltage not exceeding **SELV** are not considered to be an appliance outlet.

## 3.2 Definitions relating to means of connection

**3.2.1**
**supply leads**
set of wires intended for connecting the appliance to fixed wiring and accommodated in a compartment within or attached to the appliance

**3.2.2**
**interconnection cord**
external flexible cord between two parts of an appliance, provided as part of a complete appliance for purposes other than connection to the supply mains

Note 1 to entry: In **battery-operated appliances**, if the **battery** is placed in a separate box, the flexible lead or flexible cord connecting the box with the appliance is considered to be an **interconnection cord**.

Note 2 to entry: The output cord from a **charging system** or a **detachable power supply part** is an **interconnection cord**.

**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 1 to entry: 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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Full document details: IEC 60335-2-45 2024 EXV

### 3.3 Definitions relating to protection against electric shock

**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 1 to entry: 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 1 to entry: **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

**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 1 to entry: This provision includes a protective earthing conductor in the **supply cord**.

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Full document details: IEC 60335-2-45 2024 EXV

**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 to entry: 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 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 to entry: 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 to entry: **Class II appliances** may incorporate an earth for functional purposes.

**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

Note 1 to entry: **Basic insulation** may be required in addition to supply at **SELV**. Refer to 8.1.4.

Note 2 to entry: **Class III appliances** may incorporate an earth for functional purposes.

**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

Note 1 to entry: **Basic insulation** may be required in addition to supply at **SELV**. Refer to 8.1.4.

**3.3.14**
**clearance**
shortest distance in air between two conductive parts or between a conductive part and the **accessible surface**

**3.3.15**
**creepage distance**
shortest distance along the surface of insulation between two conductive parts or between a conductive part and the **accessible surface**

### 3.4 Definitions relating to extra-low voltage

**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 or functional earth when the appliance is supplied at **rated voltage**

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**3.4.2**
**safety extra-low voltage**
voltage not exceeding 42 V between conductors and between conductors and earth or functional earth, the no-load voltage not exceeding 50 V

Note 1 to entry: 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 2 to entry: The voltage limits specified are based on the assumption that the **safety isolating transformer** is supplied at its **rated voltage**.

Note 3 to entry: **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 **extra-low voltage** that is separated from other circuits, except circuits operating at **safety extra-low voltage**, by **basic insulation** and protective screening, **double insulation** or **reinforced insulation**

Note 1 to entry: Protective screening is the separation of circuits from **live parts** by means of an earthed screen.

Note 2 to entry: A **protective extra-low voltage circuit** is also known as a **PELV circuit**.

## 3.5 Definitions relating to types of appliances

**3.5.1**
**portable appliance**
appliance that is intended to be moved while in operation or an appliance, other than a **fixed appliance,** having a mass less than 18 kg

**3.5.2**
**hand-held appliance**
**portable appliance** intended to be held in the hand during normal use

**3.5.3**
**stationary appliance**
**fixed appliance** or an appliance which is not a **portable appliance**

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

**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

Documents
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Full document details: IEC 60335-2-45 2024 EXV

**3.5.7**
**motor-operated appliance**
appliance incorporating motors but without any heating element

Note 1 to entry: Magnetically driven appliances are considered to be **motor-operated appliances**.

**3.5.8**
**combined appliance**
appliance incorporating heating elements and motors

**3.5.9**
**battery-operated appliance**
appliance deriving its energy from **batteries** enabling the appliance to perform its intended function without a supply connection

Note 1 to entry: A **battery-operated appliance** can have a supply connection.

**3.5.101**
**branding tool**
appliance for marking wood, leather and other materials by means of a heated metal stamp

**3.5.102**
**burning-in pen**
appliance for scribing on wood, leather and other materials by means of a heated tip

**3.5.103**
**conduit-soldering tool**
appliance used for joining metal piping by means of solder

**3.5.104**
**dehorning tool**
appliance for burning out horn buds

**3.5.105**
**desoldering iron**
appliance for melting and removing solder

**3.5.106**
**firelighter**
appliance for igniting solid fuel such as charcoal or wood

**3.5.107**
**contact firelighter**
**firelighter** incorporating a heating element that is in direct contact with the fuel

**3.5.108**
**hot-air firelighter**
**firelighter** that incorporates a fan and a heating element and blows hot air at the fuel

**3.5.109**
**heat gun**
appliance that produces a jet of hot air

Note 1 to entry: **Heat guns** can be used for fusing materials or for softening paint or plastics.

**3.5.110**
**household film-welding appliance**
appliance for household use only, used for welding or cutting thin thermoplastic sheets by means of electrically heated parts between which the material is clamped

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Full document details: IEC 60335-2-45 2024 EXV

Note 1 to entry: **Household film-welding appliances** can have a suction device to remove air from a bag before welding.

**3.5.111**
**paint stripper**
appliance for softening paint using hot air

Note 1 to entry: **Paint strippers** can incorporate a scraper.

**3.5.112**
**soldering gun**
appliance incorporating a transformer, the soldering tip being part of the secondary circuit

**3.5.113**
**soldering iron**
appliance having a heated tip for soldering

**3.5.114**
**thermoplastic conduit-welding tool**
appliance for welding conduit by partly melting the thermoplastic material of a separate fitting

Note 1 to entry: The fitting has an integral heating wire and is used only once.

**3.5.115**
**induction soldering iron**
**soldering iron** that heats the soldering tip by means of high frequency induction eddy currents

Note 1 to entry: Eddy currents are induced in the soldering tip or heating element by the electromagnetic field of a coil.

## 3.6 Definitions relating to parts of an appliance

**3.6.1**
**non-detachable part**
part that can only be removed or opened with the aid of a **tool** or part that fulfils the test of 22.11

**3.6.2**
**detachable part**
part that can be removed or opened without the aid of a **tool**, part that is removed or opened in accordance with the instructions for use, even if a **tool** is needed for removal, or part that does not fulfil the test of 22.11

Note 1 to entry: If for installation purposes a part has to be removed, this part is not considered to be a **detachable part** even if the instructions state that it is to be removed.

Note 2 to entry: Components that can be removed without the aid of a **tool** are considered to be **detachable parts**.

Note 3 to entry: If a part has to be removed solely to discard a **battery** before scrapping the appliance, this part is not considered to be a **detachable part** even if the instructions state that it is to 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

Note 1 to entry: **Accessible non-metallic parts** with conductive coatings are considered to be **accessible metal parts**.

**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

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

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

Note 3 to entry: Parts, whether they are **accessible parts** or not, of **battery-operated appliances** and **batteries** not exceeding the electrical limits of B.22.3 and B.22.4, are not considered to be **live parts**.

**3.6.5**
**tool**
screwdriver, coin or any other object that may be used to operate a screw or similar fixing means

**3.6.6**
**small part**
part, where each surface lies completely within a circle of 15 mm diameter, or part where some of the surface lies outside a 15 mm diameter circle but in such a way that it is not possible to fit a circle of 8 mm diameter on any of the surfaces

Note 1 to entry: A part that is too small to grip and at the same time to be able to apply the glow-wire tip is shown in example A in Figure 5. A part that is large enough to grip but that is too small to be able to apply the glow-wire tip is shown in example B in Figure 5. A part that is not a **small part** is shown in example C in Figure 5.

**3.6.7**
**detachable power supply part**
part of the appliance the output of which is intended to be detachable from the **class III construction** part of the appliance

Note 1 to entry: Means of detachment are a flexible cord and connector or an appliance outlet fitted to the **detachable power supply part**.

**3.6.8**
**cell**
basic functional unit, consisting of an assembly of electrodes, electrolyte, container, terminals, and usually separators that is a source of electric energy obtained by direct conversion of chemical energy

[SOURCE: IEC 60050-482:2004, 482-01-01]

**3.6.9**
**battery**
assembly of one or more **cells** ready for use as a source of electrical energy, characterised by its voltage, size, terminal arrangement, capacity and rate capability

Note 1 to entry: A **detachable battery** and **separable battery** have an enclosure that is equivalent in properties to that of the appliance itself, but **integral batteries** may have no enclosure or an enclosure less substantial than that of the appliance, as they are protected by the enclosure of the appliance.

**3.6.10**
**detachable battery**
rechargeable **battery** in an enclosure separate from the **battery-operated appliance**, intended for use with specific appliances and intended to be removed from the appliance for charging purposes

Note 1 to entry: A standard automotive **battery** is not considered a **detachable battery**.

Note 2 to entry: A **detachable battery** is not considered a **battery** that is replaceable.

**3.6.11**
**separable battery**
**battery** contained in an enclosure separate from the **battery-operated appliance,** intended for use with specific appliances and connected to the appliance by a cord external to the enclosure of the appliance

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Note 1 to entry: A standard automotive **battery** is not considered a **separable battery**.

Note 2 to entry: A **separable battery** is not considered a **battery** that is replaceable.

**3.6.12**
**integral battery**
**battery** contained within the **battery-operated appliance** and not removed from the appliance for charging purposes

Note 1 to entry: A **battery** that is only to be removed from the **battery-operated appliance** for disposal or recycling is still considered to be an **integral battery**.

**3.6.101**
**functional surface**
surface that is intentionally heated by an internal heat source and has to be hot to carry out the function for which the appliance is intended

Note 1 to entry: An example is the heated tip of a soldering iron.

## 3.7 Definitions relating to safety components

**3.7.1**
**thermostat**
temperature-sensing device, the operating temperature of which may be either fixed or adjustable and which during **normal operation** keeps the temperature of the controlled part between certain limits by automatically opening and closing a circuit

**3.7.2**
**temperature limiter**
temperature-sensing device, the operating temperature of which may be either fixed or adjustable and which during **normal operation** operates by opening or closing a circuit when the temperature of the controlled part reaches a pre-determined value

Note 1 to entry: A **temperature limiter** 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 1 to entry: 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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**3.7.8**
**intentionally weak part**
part intended to rupture under conditions of abnormal operation to prevent the occurrence of a condition which could impair compliance with this standard

Note 1 to entry: Such a part may be a replaceable component, such as a resistor or a capacitor, or a part of a component to be replaced, such as a **thermal link** that is not an **accessible part** incorporated in a motor.

**3.7.101**
**biased-off switch**
switch that automatically returns to the off position when its actuating member is released

## 3.8 Definitions relating to miscellaneous matters

**3.8.1**
**all-pole disconnection**
disconnection of both supply conductors by a single initiating action or, for multi-phase appliances, disconnection of all supply conductors by a single initiating action

Note 1 to entry: For multi-phase appliances, the neutral conductor is not considered to be a supply conductor.

**3.8.2**
**off position**
stable position of a switching device in which the circuit controlled by the switch is disconnected from its supply or, for electronic disconnection, the circuit is de-energized

Note 1 to entry: 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

**3.8.6**
**room temperature**
ambient temperature specified in the general conditions for the tests

Note 1 to entry: The ambient temperature is specified in 5.7.

## 3.9 Definitions relating to electronic circuits

**3.9.1**
**electronic component**
part in which conduction is achieved principally by electrons moving through a vacuum, gas or semiconductor

Note 1 to entry: Neon indicators are not considered to be **electronic components**.

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**3.9.2**
**electronic circuit**
circuit incorporating at least one **electronic component**

**3.9.3**
**protective electronic circuit**
**electronic circuit** that prevents a hazardous situation under abnormal operating conditions

Note 1 to entry: Parts of the circuit may also be used for functional purposes.

### 3.10 Definitions relating to battery charging and discharging

**3.10.1**
**battery system**
system that includes a **battery**, **charging system** and the **battery-operated appliance**

Note 1 to entry: The **battery system**, including interfaces, may contain more than one **battery** and **charging system.**

**3.10.2**
**charging system**
circuitry that charges and maintains the state of charge of the **battery**

Note 1 to entry: Parts of the **charging system** may perform other functions such as charge balancing and may be separately enclosed.

**3.10.3**
**specified operating region for charging**
region during charging in which a **cell** operates within its voltage and current range as specified by the **cell** manufacturer

Note 1 to entry: An example of a specified operating region of a lithium-ion **cell** during charging is shown in Figure 14.

**3.10.4**
**upper limit charging voltage**
highest charging voltage in the **specified operating region for charging**

**3.10.5**
**venting**
condition intended by design that occurs when a **cell** provides a controlled release of excessive internal pressure without expulsion of major components of the **cell**

**3.10.6**
**fully charged**
at the maximum state of charge

Note 1 to entry: For **cells** and **batteries** that are rechargeable, this is the maximum state of charge permitted by the **charging system**.

Note 2 to entry: The maximum state of charge for **non-rechargeable batteries** and **batteries** that are rechargeable is specified in the artificial source characteristics of Table B.1.

**3.10.7**
**fully discharged**
discharged at a steady rate of current to attain, at 5 h of steady discharge ($C_5$ rate), or the fastest discharge rate allowed by the **cell** manufacturer or **battery** manufacturer if it is slower than the $C_5$ rate, until

– discharge terminates due to operation of discharge termination circuitry; or

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Document Sharing Hub
Full document details: IEC 60335-2-45 2024 EXV

– the **battery** (or **cell**) reaches a total voltage with an average voltage per **cell** equal to the end-of-discharge voltage for the **cell** chemistry being used, unless a different end of discharge voltage is specified by the **cell** manufacturer

Note 1 to entry: Examples of the end-of-discharge voltages for **fully discharged** common **cell** chemistries are typically

- 0,9 V/**cell** for nickel cadmium;
- 0,9 V/**cell** for nickel metal-hydride;
- 1,75 V/**cell** for lead-acid;
- 2,5 V/**cell** for lithium iron-phosphate;
- 3,0 V/**cell** for lithium cobalt-oxide.

## 3.11 Definitions relating to remote functionality

**3.11.1**
**entity**
person, device, appliance, product, or service that interacts with an appliance

**3.11.2**
**message**
data which is transmitted from a sender (data source) to one or more receivers (data sink)

**3.11.3**
**public network**
network carrying digital data or analogue signals or both where access to the data and signals is not restricted by the physical space within the household or similar use environment of the appliance

Note 1 to entry: Determination of confinement to the physical space includes consideration of the network's range of communication, configuration, or construction.

For the purposes of this standard, examples of **public networks** include but are not limited to:

- PAN (personal area network);
- LAN (local area network) connected devices which may or may not be connected to a gateway,
- PLC (power line communication);
- SRD (short range devices);
- WAN (wide area network);

For the purposes of this standard, examples of networks which are not considered as being **public networks** include but are not limited to:

- NFC (near field communication);
- optical communication with line of sight (infra-red rays or visual rays);
- hardwired configurations constructed of physical media;

without connection to a **public network**.

**3.11.4**
**remote communication**
transmission of data between the appliance and an **entity** that can be initiated out of sight of the appliance, using communication means such as radio wave modulation, sound wave modulation or bus systems

Note 1 to entry: Examples of transmission of data includes but are not limited to remote monitoring, software downloading or control parameter modifications.

Note 2 to entry: Transmission of data can be one-way (simplex) or two-way (duplex).

**3.11.5**
**remote operation**
control of an appliance by **remote communication**

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Document Sharing Hub
Full document details: IEC 60335-2-45 2024 EXV

Note 1 to entry: **Remote communication** that results in a change of appliance operation, such as change of rotational speed, temperature, spatial movement, start/stop of the intended function, is considered **remote operation**. It is possible to have **remote communication** that does not lead to **remote operation.**

Note 2 to entry: A line of sight infra-red signal by itself is not considered one used for **remote operation**.

## 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.*

## 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 informative 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 12, 20, 22 (except 22.10, 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.*

*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 normative Annex C has to be carried out, six samples of the motor are needed.*

*If the test of normative Annex D has to be carried out, an additional appliance may be used.*

*If the tests of normative Annex G are carried out, four additional transformers are needed.*

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

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

*The cumulative stress resulting from successive tests on **electronic circuits** shall be avoided. It may be necessary to replace components or to use additional samples. The number of additional samples shall be kept to a minimum by an evaluation of the relevant **electronic circuits**.*

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

An additional sample of a **contact firelighter** is required for the test of 21.102.

**5.3** *The tests are carried out in the order of the clauses. However, the test of 22.11 on the appliance at **room temperature** is carried out before the tests of Clause 8. The tests of*

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*Clause 14, 21.2 and 22.24 are carried out after the tests of Clause 29. The test of 19.14 is carried out before the tests of 19.11.*

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

**5.4** *When testing appliances 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.*

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

*For appliances fitted with a voltage selector switch, the tests are carried out with the switch in the position corresponding to the **rated voltage** value used for the tests.*

**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 Test conditions relating to frequency and voltage**

**5.8.1** *Appliances for alternating current (AC) only are tested with AC at **rated frequency**, and those for AC and DC are tested at the more unfavourable supply.*

*Appliances for AC that are not marked with **rated frequency** or are marked with a **rated 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**.*

*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. For **motor-operated appliances**, **combined appliances** and appliances having more than one **rated voltage** or **rated voltage**

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***range**, it may be necessary to make some of the tests at the minimum, the mean and the maximum values of the **rated voltage** or the **rated voltage range** in order to establish the most unfavourable voltage.*

**5.8.3** *For **heating appliances**, and **combined appliances**, marked with a **rated power input range**, when it is specified that the power input is equal to the **rated power input** multiplied by a factor, the appliance is operated at*

- *the upper limit of the **rated power input range** multiplied by this factor, if greater than 1;*
- *the lower limit of the **rated power input range** multiplied by this factor, if smaller than 1.*

*When a factor is not specified, the power input is the most unfavourable within the **rated power input range**.*

**5.8.4** *For appliances marked with a **rated voltage range** and **rated power input** corresponding to the mean of the **rated voltage range**, when it is specified that the power input is equal to **rated power input** multiplied by a factor, the appliance is operated at:*

- *the calculated power input corresponding to the upper limit of the **rated voltage range** multiplied by this factor, if greater than 1;*
- *the calculated power input corresponding to the lower limit of the **rated voltage range** multiplied by this factor, if smaller than 1.*

*When a factor is not specified, the power input corresponds to the power input at the most unfavourable voltage within the **rated voltage range**.*

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

**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.*

*A **class III construction** part of the appliance is tested connected to its **detachable power supply part** taking into account 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.*

*If **batteries** intended for use with the appliance use metal-ion chemistry, the manufacturer or responsible agent shall provide the following information for each type of **battery***

- *end-of-discharge voltage;*
- ***upper limit charging voltage**, for **batteries** comprising series connected **cells**;*
- *rated capacity of the **battery** ($C_5$ Ah).*

*If **cells** intended for use with the appliance use metal-ion chemistry, the manufacturer or responsible agent shall provide the **specified operating region for charging** for each type of **cell**.*

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**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** and for **heating appliances** and **combined appliances** where the heating elements are supplied via a switch mode power supply are carried out at a voltage corresponding to the specified power input.*

*When a power input greater than the **rated power input** is specified, the factor for multiplying the voltage is equal to the square root of the factor for multiplying the power input.*

**5.14** *If **class 0I appliances** or **class I appliances** have **accessible metal parts** that are not earthed and are not separated from **live parts** by an intermediate metal part that is earthed, such parts are checked for compliance with the appropriate requirements specified for **class II construction**.*

*If **class 0I appliances** or **class I appliances** have **accessible non-metallic parts**, such parts are checked for compliance with the appropriate requirements specified for **class II construction** unless these parts are separated from **live parts** by an intermediate metal part that is earthed.*

NOTE Guidance is given in informative Annex P for enhanced requirements that can 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 tropical climates.

**5.15** *If appliances have parts operating at **safety extra-low voltage**, such parts are checked for compliance with the appropriate requirements specified for **class III construction**.*

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

**5.17** ***Battery-operated appliances** and remote controls containing **batteries** are tested in accordance with normative Annex B.*

***Battery-operated appliances** having a functional earth connection or a supply connection are tested in accordance with the relevant clauses of the main part of this standard and normative Annex B.*

NOTE A supply connection can include a mains connection.

***Battery-operated appliances** having a supply connection are considered dual supply appliances. Dual supply appliances are regarded as **battery-operated appliances** when deriving their energy from **batteries**.*

***Separable batteries** and **detachable batteries** for **battery-operated appliances** are tested in accordance with normative Annex B.*

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Full document details: IEC 60335-2-45 2024 EXV

**5.18** *To condition **batteries** that are rechargeable, the **batteries** shall be **fully discharged** and then **fully charged** in accordance with the appliance manufacturer's instructions. The sequence shall be repeated at least 2 h after the **battery** was charged.*

*For **batteries** where there is a series arrangement of parallel clusters of **cells**, the cluster shall be treated as a single **cell** for those tests that require altering the amount of charge on a single **cell** prior to conducting the test.*

**5.19** *Measurements of **cell** voltages or **battery** voltages shall be made using a single pole resistive-capacitive low pass filter with a –3 dB roll off frequency of 5 kHz ± 0,5 kHz. To determine if the **upper limit charging voltage** has been exceeded, the peak value of the filtered voltage shall be measured with a tolerance of ±1 %.*

*When measuring **cell** voltages or **battery** voltages, the peak value of any superimposed ripple exceeding 10 % of the average value shall be included. Transient voltages are ignored, such as a temporary increase of voltage, for example, after the **battery** is removed from the **charging system**.*

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

**5.21** *Probes are applied with a force not exceeding 1 N.*

**5.22** *If a component or part of the appliance has both a **self-resetting feature** and a **non-self-resetting feature** and if the **non-self-resetting feature** is not required in order to comply with this standard, then appliances incorporating such a component or part shall be tested with the **non-self-resetting feature** rendered inoperative.*

## 6 Classification

**6.1** **Dehorning tools** shall be **class II** or **class III.**

Other appliances shall be **class I**, **class II** or **class III**.

If an appliance consists of a part of **class III construction** and a **detachable power supply part**, the complete appliance is classified as a **class I appliance** or **class II appliance** in accordance with the classification applicable to its **detachable power supply part**.

*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.

**Class II dehorning tools** and transformers for **class III dehorning tools** shall be at least IPX4.

**Conduit-soldering tools** and **thermoplastic conduit-welding tools** shall be at least IPX4.

**Hand-held paint strippers** for outdoor use shall be at least IPX4, unless the instructions state they are not to be stored or left outdoors, in which case they may be IPX0.

*Compliance is checked by inspection and by the relevant tests.*

NOTE The degrees of protection against harmful ingress of water are given in IEC 60529:1989 including IEC 60529:1989/AMD1:1999 and IEC 60529:1989/AMD2:2013.

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## 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 IEC 60417-5172 (2003-02) for **class II appliances** only;
– IP number according to degree of protection against ingress of water, other than IPX0;
– symbol IEC 60417-5180 (2003-02), for **class III appliances**. This marking is not necessary for appliances operated only by **batteries** (primary **batteries** or secondary **batteries** recharged outside of the appliance) or appliances powered by **rechargeable batteries** recharged in the appliance.

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

Appliance outlets accessible to the user and socket-outlets accessible to the user:

– that are incorporated in appliances connected to the supply mains; and
– that operate at **rated voltage**

shall be marked with their **outlet load** in watts or amperes.

Appliances intended to be supplied from a **detachable power supply part** for the purposes of recharging the **battery** shall be marked with symbol ISO 7000-0790 (2004-01). They shall also be marked with symbol IEC 60417-6181 (2016-01) and the model or type reference of the **detachable power supply part** or with the substance of the following:

Use only with <model or type reference> supply unit

**Class II appliances** and **class III appliances** incorporating a functional earth shall be marked with the symbol IEC 60417-5018 (2011-07).

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 (2002-10) if their **working voltage** exceeds **extra-low voltage**.

**Contact firelighters** shall be marked with the limit of insertion into the fuel.

**Contact firelighters** that are not at least IPX4 shall be marked with the substance of the following:

Do not expose to rain or moisture.

**Thermoplastic conduit-welding tools** shall be marked with the types of fittings with which they are to be used and with the corresponding settings. Each fitting shall be marked with the type of appliance with which it is to be used and with its own type reference.

If appliances have external **accessible surfaces**, for which temperature rise limits are specified in Table 101 and for which the provisions of footnote b to Table 101 apply, then the appliance shall be marked with symbol IEC 60417-5041(2002-10), or with the substance of the following:

CAUTION: Hot surfaces.

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Document Sharing Hub
Full document details: IEC 60335-2-45 2024 EXV

*Compliance is checked by inspection.*

**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 V – 230 V: The appliance is suitable for any value within the marked range (a curling iron with a **PTC heating element** or an appliance incorporating an input switch mode power supply).

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. This requirement is also applicable to appliances with provision for connection to both single-phase and multi-phase supplies.

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

NOTE 3 Example: 230 V ∼/400 V 3N∼: The appliance is only suitable for the voltage values indicated, 230 V∼ being for single-phase, AC operation and 400 V 3N∼ for three-phase, AC with neutral operation (an appliance with terminals for both supplies).

*Compliance is checked by inspection.*

**7.4** If the appliance can be adjusted for different **rated voltages** or **rated frequencies**, the voltage or the frequency to which the appliance is adjusted shall be clearly discernible. If frequent changes in voltage setting or frequency setting are not required, this requirement is considered to be met if the **rated voltage** or **rated frequency** 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 shall not 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 arithmetic mean value of the range, the marking for **rated power input** or **rated current** may be related to the arithmetic mean value of the range.

The upper and lower limits of the **rated power input** or **rated current** shall be marked on the appliance so that the relation between input and voltage is clear.

*Compliance is checked by inspection.*

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

| | | |
|---|---|---|
| ⎓ | [symbol IEC 60417-5031 (2002-10)] | direct current |

Documents
Document Sharing Hub
Full document details: IEC 60335-2-45 2024 EXV

| | | |
|---|---|---|
| ~ | [symbol IEC 60417-5032 (2002-10)] | alternating current |
| 3 ~ | [symbol IEC 60417-5032-1 (2002-10)] | three-phase alternating current |
| 3N ~ | [symbol IEC 60417-5032-2 (2002-10)] | three-phase alternating current with neutral |
| | [symbol IEC 60417-5016 (2002-10)] | fuse-link |

NOTE 1 The current rating of the fuse link can 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 IEC 60417-5019 (2006-08)] | protective earth |
| | [symbol IEC 60417-5018 (2011-07)] | functional earthing |
| | [symbol IEC 60417-5172 (2003-02)] | **class II equipment** |
| | [symbol IEC 60417-5012 (2002-10)] | Lamp |

NOTE 2 The rated wattage of the lamp can be indicated in association with this symbol.

| | | |
|---|---|---|
| | [symbol ISO 7000-0434A (2004-01)] | Caution |
| | [symbol ISO 7000-0790 (2004-01)] | read operator's manual |
| | [symbol IEC 60417-5021 (2002-10)] | Equipotentiality |
| | [symbol IEC 60417-5036 (2002-10)] | dangerous voltage |
| III | [symbol IEC 60417-5180 (2003-02)] | **Class III appliance** |
| | [symbol IEC 60417-6181 (2016-01)] | **detachable power supply part** |
| | [symbol IEC 60417-5041 (2002-10)] | caution, hot surface |

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Full document details: IEC 60335-2-45 2024 EXV

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

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

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

*Compliance is checked by inspection.*

**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.

The correct mode of connection for multi-phase appliances is considered to be obvious if the terminals for the supply conductors are

– indicated by arrows pointing towards the terminals; or
– marked in words.

The connection diagram may be the wiring diagram referred to in 7.4.

*Compliance is checked by inspection.*

**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 IEC 60417-5019 (2006-08);
– functional earthing terminals shall be indicated by symbol IEC 60417-5018 (2011-07).

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. 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.

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**. The figure 0 may be used on a digital programming keyboard.

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*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 shall be provided in hard copy form with the appliance so that the appliance can be used safely.

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

NOTE If the instructions are marked on the appliance they are considered to be provided in hard copy form.

If it is necessary to take precautions during **user maintenance**, appropriate details shall be given.

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.

The instructions for appliances having a part of **class III construction** supplied from a **detachable power supply part** shall state that the appliance is only to be used with the power supply unit provided with the appliance.

The instructions for **class III appliances** shall state that it must only be supplied at safety extra-low voltage corresponding to the marking on the appliance. This instruction is not necessary for **battery-operated appliances** if the **battery** is a primary **battery** or secondary **battery** charged outside of the appliance.

For appliances intended for use at altitudes exceeding 2 000 m, the maximum altitude of use shall be stated.

The instructions for appliances incorporating a functional earth shall state the substance of the following:

This appliance incorporates an earth connection for functional purposes.

For appliances intended to be connected to a supply for the purposes of recharging the **battery**, the instructions shall state the substance of the following:

WARNING: Use only an external supply with the following specifications: <voltage and nature of supply> <power / current of supply>

For appliances intended to be supplied from a **detachable power supply part** for the purposes of recharging the **battery**, the type reference of the **detachable power supply part** shall be stated along with the substance of the following:

WARNING: Only use the supply unit provided with this appliance.

For appliances intended for use with **batteries** that use metal-ion chemistries, the instructions shall state the normal temperature range for charging the **battery**.

Documents
Document Sharing Hub
Full document details: IEC 60335-2-45 2024 EXV

If the symbol for **detachable power supply part** is used, its meaning shall be explained.

The instructions for appliances having a separate stand and not incorporating a **biased-off switch** shall include the substance of the following:

WARNING: This tool must be placed on its stand when not in use.

The instructions for **class III dehorning tools** shall include the substance of the following:

WARNING: Only use the transformer provided.

The instructions for **heat guns** and **hand-held paint strippers** shall include the substance of the following:

A fire can result if the appliance is not used with care, therefore

– be careful when using the appliance in places where there are combustible materials;
– do not apply to the same place for a long time;
– do not use in presence of an explosive atmosphere;
– be aware that heat can be conducted to combustible materials that are out of sight;
– place the appliance on its stand after use and allow it to cool down before storage;
– do not leave the appliance unattended when it is switched on.

The instructions for **firelighters** shall include the substance of the following:

– ensure that the f**irelighter** is properly positioned;
– unplug the **firelighter** before removal from the fire;
– allow the **firelighter** to cool before storage;
– do not allow the hot parts of the **firelighter** to touch the cord or other flammable materials.

The instructions for **thermoplastic conduit-welding tools** shall state that a welding operation must not be repeated on a fitting since this can result in **live parts** becoming accessible.

If symbol IEC 60417-5041(2002-10) is marked on the appliance, its meaning shall be explained.

*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.

If an appliance is intended to be permanently connected to the water mains and not connected by a hose-set, this shall be stated.

For appliances marked with different **rated voltages** or different **rated frequencies** (separated by a /), instructions shall be included to indicate to the user or installer what action must be taken to adjust the appliance for operation at the required **rated voltage** or **rated frequency**.

*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.*

Documents
Document Sharing Hub

Full document details: IEC 60335-2-45 2024 EXV

**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.*

**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;
– 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.

*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.

If a cord set is required to be provided with the appliance according to Subclause 22.58, the instructions shall contain the substance of the following:

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

*Compliance is checked by inspection.*

**7.12.6** If a **non-self-resetting thermal cut-out** is required in order to comply with this standard, then the instructions for 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 cut-out, 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.

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Document Sharing Hub

Full document details: IEC 60335-2-45 2024 EXV

*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. The method of fixing stated 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.*

**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.*

**7.12.9** For each language, the instructions specified in 7.12 and from 7.12.1 to 7.12.8 shall be in hard copy form and shall appear together before any other instructions supplied with the appliance. Alternatively, these instructions may be supplied with the appliance separately from any functional use booklet. They may follow the description of the appliance that identifies parts, or follow the drawings/sketches common to the languages of the instructions.

In addition, instructions shall also be available in an alternative format such as on a website or on request from the user in a format such as a DVD.

*Compliance is checked by inspection.*

**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 this standard shall be clearly legible.

The signal words WARNING, CAUTION, DANGER if in the Latin alphabet shall be in uppercase having a height not less than:

– 3,5 mm for appliances normally used on the floor;
– 2,0 mm for **portable appliances** with a printable surface of less than 10 $cm^2$; and
– 3,0 mm for other appliances.

NOTE A height of 3,5 mm is similar to Arial 14 pt, 3,0 mm is similar to 12 pt Arial and 2,0 mm is similar to 8 pt Arial. Other typefaces might differ in the pt value.

Uppercase letter of the text explaining the signal word shall be no smaller than 1,6 mm, with other letters according to the font size of the uppercase letter.

Countries that do not use the Latin alphabet need to specify the minimum size of the script to be used taking into account what is specified for the Latin alphabet.

Unless contrasting colours are used, moulded in, engraved, or stamped markings shall be either raised above or have a depth below the surface of at least 0,25 mm.

Documents
Document Sharing Hub

Full document details: IEC 60335-2-45 2024 EXV

The markings required by this standard shall be durable. On containers that are likely to be cleaned frequently, the markings shall not be by means of paint or enamel, other than vitreous enamel.

The height of the triangle in symbol IEC 60417-5041 (2002-10) shall be at least 8 mm.

*Compliance is checked by inspection, by measurement 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. The petroleum spirit to be used for the test is aliphatic solvent hexane.*

*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.*

**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 trademark 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.

The symbol IEC 60417-5018 (2011-07) shall be placed next to the symbol IEC 60417-5172 (2003-02) or the symbol IEC 60417-5180 (2003-02) as appropriate.

The type reference of the **detachable power supply part** shall be placed next to symbol IEC 60417-6181 (2016-01).

The marking of the **outlet load** shall be on the appliance close to the appliance outlet or socket-outlet.

The marking specified for external **accessible surfaces** shall be visible when the appliance is operated as in normal use, including when actuating any switch, adjusting any control or opening a lid or door. It shall not be placed on a **functional surface**.

*Compliance is checked by inspection.*

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

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

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

*Compliance is checked by inspection.*

Documents
Document Sharing Hub

Full document details: IEC 60335-2-45 2024 EXV

## 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**, unless otherwise specified.*

*Test probe B and test probe 18 of IEC 61032 are applied with a force not exceeding 1 N, 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 when probe B is used or 10 N when probe 18 is used. If the probe then enters the opening, the test is repeated with the probe in the angled position.*

*During the tests with test probe B, all **detachable parts** are removed except 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.*

*During the tests with test probe 18, the appliance shall be fully assembled as in normal use without any parts removed.*

*Test probe 18 is not applied to appliances for commercial use unless they are intended to be installed in an area open to the public.*

*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 with a force not exceeding 1 N 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.*

NOTE 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.*

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

**8.1.3** *Instead of test probe B, test probe 18 and test probe 13, for appliances other than those of **class II**, test probe 41 of IEC 61032 is applied with a force not exceeding 1 N 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**.*

*If a single switching action is obtained by a switching device, the switching device shall provide full disconnection and the **clearances** for full disconnection specified in 20.3.3 of*

AVA Documents
Document Sharing Hub

Full document details: IEC 60335-2-45 2024 EXV

*IEC 61058-1:2016 shall be obtained from Table 12 of IEC 61058-1:2016 using the next higher step for rated impulse withstand voltage.*

*For appliances provided with a **supply cord** and without a switching device in their supply circuit, a single switching action may be obtained by the withdrawal of the plug from a socket-outlet.*

*Compliance is checked by inspection and by manual test.*

**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 AC, the peak value of the voltage does not exceed 42,4 V;
  - for DC, the voltage does not exceed 42,4 V;

or

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

If **protective impedance** is used, the current between the part and the supply source shall not exceed 2 mA for DC, its peak value shall not exceed 0,7 mA for AC 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;
– for voltages having a peak value over 15 kV, the energy in the discharge shall not exceed 350 mJ.

Parts of **thermoplastic conduit-welding tools** operating at **safety extra-low voltage** exceeding 12 V are also considered to be **live parts**.

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

*The quantity of electricity is calculated from the sum of all areas recorded on the voltage/time graph without taking voltage polarity into account. Details of a suitable circuit for measuring the current are given in Figure 4 of IEC 60990:2016.*

**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 applying test probe B of IEC 61032 as specified in 8.1.1.*

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

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

Documents
Document Sharing Hub
Full document details: IEC 60335-2-45 2024 EXV