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This full version of IEC 60335-2-40:2024 includes the content of the references made to IEC 60335-1:2020

**Household and similar electrical appliances – Safety –
Part 2-40: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers**



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**Household and similar electrical appliances – Safety –
Part 2-40: Particular requirements for electrical heat pumps, air-conditioners
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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.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-40: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers

FOREWORD

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This extended version (EXV) of the official IEC Standard provides the user with the full content of the Standard.

IEC 60335-2-40:2024 EXV includes the content of IEC 60335-2-40:2024, and the references made to IEC 60335-1:2020.

The specific content of IEC 60335-2-40:2024 is displayed on a blue background.

IEC 60335-2-40 has been prepared by subcommittee 61D: Appliances for air-conditioning for household and similar purposes, of IEC technical committee 61: Safety of household and similar electrical appliances. It is an International Standard.

This eighth edition cancels and replaces the seventh edition published in 2022. This edition constitutes a technical revision.

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

- a) Clause 12 : Part 1, Clause 12 has been made applicable;
- b) Clause 19: requirement added for **double wall heat exchangers** to be resistant against freezing;
- c) Clause 20: requirement modified for when to apply test probe 18;
- d) Clause 21: requirement added for **double wall heat exchangers** to resistant against the pressure of the refrigerant if one of the walls fails;
- e) Clause 22: requirement modified to reflect that appliances can operate continuously and can be operated remotely without giving rise to a hazard, and requirement added for **double wall heat exchangers** to be constructed to avoid refrigerant leaking into the secondary circuit;
- f) Annex LL has been deleted and replaced by a reference to IEC TS 63542:2024.

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

Draft	Report on voting
61D/538/FDIS	61D/542/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 2-40 supplements or modifies the corresponding clauses in IEC 60335-1, so as to convert that publication into the IEC standard: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers.

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;
- *test specifications: in italic type;*
- notes: in small roman type.

Words in **bold** in the text are defined in Clause 3. When a definition concerns an adjective, the adjective and associated noun are also in bold.

The following differences of a less permanent nature exist in the countries indicated below:

- 6.1: Class 0I appliances are allowed (Japan).
- 11.8: The temperature of the wooden walls in the test casing is limited to 85 °C (Sweden).

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.

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.

INTRODUCTION to IEC 60335-2-40:2024

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

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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 instructions. It also covers abnormal situations that can be expected in practice.

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.

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- IEC standards published by TC 111 concerning environmental matters.

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-40: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers

1 Scope

This part of IEC 60335 deals with the safety of electric **heat pumps**, **sanitary hot water heat pumps** and **air-conditioners**, incorporating motor-compressors as well as **hydronic fan coils units**, **dehumidifiers** (with or without motor-compressors), **thermoelectric heat pumps** and **partial units**, their maximum **rated voltage** being not more than 300 V for single phase appliances and 600 V for other appliances 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.

The appliances referenced above can consist of one or more factory-made assemblies. If provided in more than one assembly, the separate assemblies are used together, and the requirements are based on the use of matched assemblies.

NOTE 101 A definition of 'motor-compressor' is given in IEC 60335-2-34, which includes the statement that the term motor-compressor is used to designate either a hermetic motor-compressor or semi-hermetic motor-compressor.

NOTE 102 Requirements for containers intended for storage of the heated water included in **sanitary hot water heat pumps** are, in addition, covered by IEC 60335-2-21.

This standard does not take into account refrigerants other than group A1, A2L, A2 and A3 as defined by ISO 817. **Flammable refrigerants** are limited to those of a molar mass of more than or equal to 42 kg/kmol based on WCF (worst case formulation) as specified in ISO 817.

As far as practical, this standard deals with common hazards presented by appliances that are encountered in normal use and assumes that installation, servicing, decommissioning, and disposal are safely handled by competent persons and accidental release of refrigerants is avoided. However, it does not specify the criteria to ensure competence of persons during installation, servicing and disposal. Safety requirements during disposal are not specified in this standard.

NOTE 103 Annex HH provides informative requirements on competence of personnel. Criteria for competence of personnel for the purpose of certification schemes can be found in ISO 22712.

Unless specifications are covered by this standard, including the annexes, requirements for refrigerating safety are covered by:

- ISO 5149-1:2014, ISO 5149-1:2014/AMD1:2015, and ISO 5149-1:2014/AMD2:2021,
- ISO 5149-2:2014 and ISO 5149-2:2014/AMD1:2020,
- ISO 5149-3:2014 and ISO 5149-3:2014/AMD1:2021.

Supplementary heaters, or a provision for their separate installation, are within the scope of this standard, but only heaters which are designed as a part of the appliance package, the controls being incorporated in the appliance.

NOTE 104 Attention is drawn to the fact that

- 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, for example, by the national health authorities responsible for the protection of labour and the national authorities responsible for storage, transportation, building constructions and installations.

This standard does not apply to

- humidifiers intended for use with heating and cooling equipment (IEC 60335-2-88);
- appliances designed exclusively for industrial processing;
- 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).

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 60068-2-52, *Environmental testing – Part 2: Tests – Test Kb: Salt mist, cyclic (sodium, chloride solution)*

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 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements*

IEC 60079-7:2015, *Explosive atmospheres – Part 7: Equipment protection by increased safety "e"*

IEC 60079-7:2015/AMD1:2017

IEC 60079-14, *Explosive atmospheres – Part 14: Electrical installations design, selection and erection*

IEC 60079-15:2017, *Explosive atmospheres – Part 15: Equipment protection by type of protection "n"*

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

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IEC 60384-14:2013/AMD1:2016³

IEC 60417, *Graphical symbols for use on equipment*

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

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.

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 60529:1989/AMD1:1999

IEC 60529:1989/AMD2:2013⁴

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

IEC 60695-2-13, *Fire hazard testing – Part 2-13: Glowing/hot-wire based test methods – Glow-wire ignition temperature (GWIT) test method for materials*

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IEC 60695-11-5:2016, *Fire hazard testing – Part 11-5: Test flames – Needle-flame test method – Apparatus, confirmatory test arrangement and guidance*

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IEC 60730-1:2013, *Automatic electrical controls – Part 1: General requirements*

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IEC 60730-2-6, *Automatic electrical controls – Part 2-6: Particular requirements for automatic electrical pressure sensing controls including mechanical requirements*

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.

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

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IEC 60730-2-9:2015, *Automatic electrical controls – Part 2-9: Particular requirements for temperature sensing controls*

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

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IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

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IEC 61000-4-13:2002/AMD2:2015⁸

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

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

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IEC 61558-2-16:2009, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V – Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units*
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IEC 62477-1, *Safety requirements for power electronic converter systems and equipment – Part 1: General*

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

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

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ISO 179-1, *Plastics – Determination of Charpy impact properties – Part 1: Non-instrumented impact test*

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ISO 527 (all parts), *Plastics – Determination of tensile properties*

ISO 527-3, *Plastics – Determination of tensile properties – Part 3: Test conditions for films and sheets*

ISO 817, *Refrigerants – Designation and safety classification*

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ISO 5149-3:2014/AMD1:2021

ISO 5151, *Non-ducted air conditioners and heat pumps – Testing and rating for performance*

ISO 7000, *Graphical symbols for use on equipment – Registered symbols*

¹¹ Withdrawn.

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

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ISO 15042, *Multiple split-system air-conditioners and air-to-air heat pumps – Testing and rating for performance*

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.

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**.

Note 101 to entry: If the appliance comprises electrical accessories, including fans, the **rated power input** is based upon the total maximum **electrical power input** with all accessories energized, when operating continuously under the appropriate environmental conditions. If the **heat pump** can be operated in the heating or cooling mode, the **rated power input** is based upon the input in the heating or in the cooling mode, whichever is the greater.

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

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

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;
- 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

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**.

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**

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

Note 101 to entry: Appliances connected to water pipes or refrigerant pipes that are secured to the building are also **fixed appliances**.

3.5.5**built-in appliance**

fixed appliance intended to be installed in a cabinet, in a prepared recess in a wall or in a similar location

3.5.6**heating appliance**

appliance incorporating heating elements but without any motor

3.5.7**motor-operated appliance**

appliance incorporating motors but without any heating element

Note 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.

3.6 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

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

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**.

3.7 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

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.

3.8 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.

3.8.101**particle foam material**

closed cell material moulded from thermoplastic particles (e.g. beads) with expanding agent

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**.

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
- 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**

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**.

3.101

heat pump

appliance which takes up heat at a certain temperature and releases heat at a higher temperature

Note 1 to entry: When operated to provide heat (e.g., for space heating or water heating), the appliance is said to operate in the heating mode; when operated to remove heat (for example, for space cooling), it is said to operate in the cooling mode.

Note 2 to entry: A **heat pump** can contain a combination of **condensing unit or condenser unit** and an **evaporating unit or evaporator unit** and can be equipped to operate in a reverse cycle mode.

3.102

sanitary hot water heat pump

heat pump intended to transfer heat to water suitable for human consumption

3.103

air-conditioner

encased assembly or assemblies designed as an appliance to provide delivery of conditioned air to an enclosed space, room or zone

Note 1 to entry: It includes an electrically operated **refrigerating system** for cooling and possibly dehumidifying the air.

Note 2 to entry: It can have means for heating, circulating, cleaning and humidifying the air.

Note 3 to entry: An **air-conditioner** can contain a combination of **condensing unit or condenser unit** and an **evaporating unit or evaporator unit**.

3.104**dehumidifier**

encased assembly designed to remove moisture from its surrounding atmosphere

Note 1 to entry: It includes an electrically operated **refrigerating system** and the means to circulate air. It also includes a drain arrangement for collecting and storing and/or disposing of the condensate.

3.108**wet-bulb temperature****WB**

temperature indicated when the temperature-sensitive element in a wetted wick has reached a state of constant temperature (evaporative equilibrium)

3.109**dry-bulb temperature****DB**

temperature indicated by a dry, temperature-sensitive element shielded from the effects of radiation

3.110**evaporator**

heat exchanger in which refrigerant liquid is vaporized by absorption of heat

3.111**heat exchanger**

device specifically designed to transfer heat between two physically separated fluids (gas or liquid)

3.112**indoor heat exchanger**

heat exchanger designed to transfer heat to the indoor parts of the building or to the indoor hot water supplies (e.g. sanitary water) or to remove heat therefrom

3.113**outdoor heat exchanger**

heat exchanger designed to remove or release heat from the heat source (for example, ground water, outdoor air, exhaust air, water or brine)

3.114 Supplementary heaters**3.114.1****supplementary heater**

electric heater that supplements or replaces the output of the refrigerant circuit for the purpose of heating air or water

3.114.2**supplementary water heater**

supplementary heater specifically for the purpose of heating water

3.114.3**supplementary air heater**

supplementary heater specifically for the purpose of heating air in conjunction with, or instead of, the refrigerating circuit

Note 1 to entry: **Supplementary air heaters** include electric heaters provided as part of an appliance with cooling-only refrigerant circuits.

3.115**pressure-limiting device**

mechanism that automatically responds to a predetermined pressure by stopping the operation of the pressure-imposing element

3.116**pressure-relief device**

pressure actuated valve or rupture member which functions to relieve excessive pressure automatically

3.117**appliances accessible to the general public**

appliances intended to be located in residential buildings or in commercial buildings in a location without restricted access

3.118**appliances not accessible to the general public**

appliances which are located in a secured location with restricted access (e.g. machine rooms, rooftop and the like, or at a level above 2,5 m)

3.119**hydronic fan coil unit**

factory-made assembly which provides the function of forced circulation of air for heating and/or cooling, which can also include the function of **dehumidification** and/or filtering of air, but which does not include the source of cooling or heating

Note 1 to entry: **Hydronic fan coil units** can include provision for electric resistance heating. **Heat exchanger coils** are intended for hydronic heating and cooling only.

3.120**flammable refrigerant**

refrigerant classified as safety group A2L, A2 or A3 according to ISO 817

3.121**refrigerating system**

combination of interconnected refrigerant containing parts constituting one closed refrigerant circuit in which the refrigerant is circulated for the purpose of extracting heat at the low temperature side to reject heat at the high temperature side by changing the state of the refrigerant

3.122**maximum allowable pressure**

maximum pressure for which the equipment is designed, as specified by the manufacturer

Note 1 to entry: **Maximum allowable pressure** constitutes a limit to the operating pressure of a **refrigerating system**, hydronic circuit or sanitary hot water tank whether the equipment is working or not, see Clause 21.

3.123**low-pressure side**

part(s) of a **refrigerating system** operating at the **evaporator** pressure

3.124**high-pressure side**

part(s) of a **refrigerating system** operating at the **condenser** pressure

3.125**service port**

means to access the refrigerant in a **refrigerating system** for the purpose of charging or servicing the system, typically a valve, tube extension or entry location

3.126**factory sealed single package unit**

factory assembly of components of **refrigerating system** fixed on a common mounting to form a discrete unit in which all **refrigerating system** parts have been sealed tight by welding, brazing or a similar permanent connection during the manufacturing process

3.127**pre-charged pipe sets**

interconnecting refrigerant lines which are supplied with the unit and supplied with a **refrigerant charge** for the purpose of completing the **refrigerating system** in the field for appliances that are made up of more than one subassembly and are assembled in the field to complete the **refrigerating system**

3.128**condenser**

heat exchanger in which refrigerant vapour is condensed by removal of heat

3.129**condensing unit**

factory-made assembly that includes one or more motor-compressors, **condenser** in cooling mode and motor-driven fan, blower or pump to circulate the heat transfer fluid through the **condenser** with associated operational controls in addition to the necessary wiring

Note 1 to entry: These units are intended for field connection to an **evaporator unit**. A **condensing unit** can also be equipped to operate in the reverse cycle mode. A **condensing unit** can include expansion device(s).

3.130**condenser unit**

factory-made assembly that includes one or more **condensers** in cooling mode and motor-driven fan, blower or pump to circulate the heat transfer fluid through the **condenser** with associated operational controls in addition to the necessary wiring

Note 1 to entry: These units are intended for field connection to an **evaporating unit**. A **condenser unit** can also be equipped to operate in the reverse cycle mode.

Note 2 to entry: A **condenser unit** does not include a motor-compressor or expansion device.

3.131**evaporating unit**

factory-made assembly that includes one or more motor-compressors, **evaporator** in cooling mode, expansion device(s), and motor-driven fan, blower or pump to circulate fluid through the **evaporator** with associated operational controls in addition to the necessary wiring

Note 1 to entry: These units are intended for field connection to a **condenser unit**. An **evaporating unit** can also be equipped to operate in the reverse cycle mode and can include provision for electric resistance heating or similar sources of auxiliary heat.

3.132**evaporator unit**

factory-made assembly that includes one or more **evaporators** in cooling mode, and can include a motor-driven fan, blower or pump to circulate fluid through the **evaporator** with associated operational controls in addition to the necessary wiring

Note 1 to entry: These units are intended for field connection to a **condensing unit**. An **evaporator unit** can also be equipped to operate in the reverse cycle mode and can include provision for electric resistance heating or similar sources of auxiliary heat. An **evaporator unit** can include expansion device(s).

Note 2 to entry: An **evaporator unit** does not include a motor-compressor.

3.133**partial unit**

condensing unit, evaporating unit, condenser unit, or evaporator unit which are part of a total assembly of a **heat pump, air-conditioner, or sanitary hot water heat pumps** where not all assemblies to create the complete **refrigerating system** are specified by the manufacturer

Note 1 to entry: **Partial units** are evaluated for safety as stand-alone.

3.134**installed height**
 h_{inst}

height of the bottom of the appliance relative to the floor of the room after installation

Note 1 to entry: The **installed height** is given in metres.

3.135**release offset**
 h_{rel}

distance from the bottom of the appliance to an opening where the refrigerant can leave the appliance in the event of a refrigerant leak

Note 1 to entry: The **release offset** is given in metres.

3.136**refrigerant charge**
 m_{c}

actual **refrigerant charge** of a single **refrigerating system**

Note 1 to entry: The **refrigerant charge** is expressed in kg.

3.137**maximum refrigerant charge**
 m_{max}

maximum refrigerant charge for a single **refrigerating system** as result from a calculation for room area or similar

Note 1 to entry: The **maximum refrigerant charge** is expressed in kg.

3.138**refrigerant detection system**

sensing system which gives an output signal in response to a pre-set concentration of refrigerant in the environment

Note 1 to entry: A **refrigerant detection system** can have multiple **refrigerant sensors**.

3.139**auto ignition temperature**

AIT

lowest temperature at or above which a chemical can spontaneously ignite in a normal atmosphere, without an external source of ignition, such as a flame or spark

[SOURCE: ISO 5149-1:2014, 3.7.7, modified – the abbreviated term "AIT" has been added and "of a substance" has been deleted].]

3.140**hot surface ignition temperature**

highest temperature at which a refrigerant does not ignite when tested in accordance with Annex KK

3.141**A2L refrigerant**

refrigerant classified as safety group A2L according to ISO 817

3.142**lower flammability limit****LFL**

minimum concentration of the refrigerant that is capable of propagating a flame through a homogeneous mixture of the refrigerant and air

Note 1 to entry: Data is listed in Annex BB.

[SOURCE: ISO 817:2014, 3.1.24, modified – "under the specified test conditions at 23,0 °C and 101,3 kPa" and Notes to entry deleted.]

3.143**enhanced tightness refrigerating system**

refrigerating system in which the indoor units are designed and fabricated to ensure a high level of confidence that large refrigerant leak rates will not occur in **normal operation** and abnormal operation

3.144**refrigerant distribution assembly**

separate refrigerant assembly which is installed in the interconnecting refrigerant lines for the purpose of distributing refrigerant flow to one or more indoor units

3.145**Void****3.146****circulation airflow**

mechanically induced airflow movement within the space or duct-connected spaces

3.147**Void****3.148****Void****3.149****Void****3.150****UV-C lamp**

source made to produce ultraviolet radiation in the range of 100 nm to 280 nm wavelengths

Note 1 to entry: There are several types of such lamps used for photobiological, photochemical and biomedical purposes.

3.151**Void****3.152****UV-C germicidal lamp system**

auxiliary device which utilizes **UV-C lamps** that directly generate germicidal radiation

Note 1 to entry: **UV-C germicidal lamp systems** are typically used to supplement the normal unit air filters for enhanced air purification and surface cleaning of the evaporator coil and surrounding area.

3.153**UV-C spectral irradiance**

measured electromagnetic radiation power density at a particular wavelength of 254 nm at a specified distance

Note 1 to entry: The spectral irradiance E_{254} is measured in $\mu\text{W}/\text{cm}^2$.

3.154

UV-C barrier

additional guard or shield that prevents UV-C light from exiting the unit or damaging internal non-metallic materials

3.155

transcritical refrigerating system

refrigerating system where evaporation occurs below the critical point and heat rejection can occur above the critical point of the refrigerant (e.g. R744)

3.156

releasable charge

m_{rl}

mass of refrigerant that can be released into the indoor space from a **refrigerating system** in the event of a leak

Note 1 to entry: Any part of the **refrigerant charge** that leaks to the outdoor is excluded from the **releasable charge**.

3.157

operating state

function that the appliance is in at a specific time during **normal operation**

Note 1 to entry: Examples include standby, cooling mode, heating mode and defrosting.

3.158

releasable charge limited system

refrigerating system in which the **releasable charge** is limited by design measures

EXAMPLE 1 Systems relying on closing **safety shut-off valves** when the compressor is off are examples of **releasable charge limited systems** not relying on **leak detection systems**.

EXAMPLE 2 Systems relying on measuring temperature, pressure, ultrasonic leak detection, or other working parameters to detect a leak are examples of **releasable charge limited systems** not relying on **refrigerant detection systems**.

3.159

safety shut-off valve

valve for the purpose of limiting the amount of **releasable charge**

3.160

leak detection system

sensing system which responds to refrigerant leaking from a **refrigerating system**

EXAMPLE A **refrigerant detection system** is an example of a **leak detection system**.

Note 1 to entry: A **leak detection system** can include gas sensing, ultrasonic or other such methods demonstrated to be sufficiently effective.

3.161

potential leak point

any point in the **refrigerating system** that can be a weak point due to manufacturing processes, exposure to damage, sharpness of a bend, or similar stresses

EXAMPLE **Potential leak points** can include parts under stress or vibration.

3.162

pressure vessel

any refrigerant-containing part of a refrigerating system other than

– compressors,

- pumps,
- component parts of sealed absorption systems,
- evaporators, each separate section of which does not exceed 15 l of refrigerant-containing volume,
- coils,
- piping and its valves, joints, and fittings,
- control devices, and
- pressure-containing components (including headers) having an internal diameter or largest cross-sectional dimension not greater than 152 mm

[SOURCE: ISO 5149-1:2014, 3.4.7]

3.163

refrigerant sensor

assembly in which the sensing element is housed and that can also contain associated circuit components

[SOURCE: IEC 60079-29-1:2016, 3.3.2, modified – "sensor" replaced by "refrigerant sensor".]

3.164

limited life refrigerant sensor

refrigerant sensor which is expected to fail within the life of the appliance

3.165

thermoelectric heat pump

solid-state **heat pump**, activated by an electric current, which takes up heat at a certain temperature and releases heat at a higher temperature

Note 1 to entry: A Peltier element is an example of such technology.

3.166

double wall heat exchanger

heat exchanger with two walls between the refrigerant and a secondary fluid

Note 1 to entry: **Double wall heat exchangers** avoid ingress of refrigerant into the secondary circuit or secondary fluid into the refrigeration circuit in case of leakage in one separating wall.

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.

*The testing of Clause 21 may be carried out on separate samples. The testing of Clause 11, Clause 19 and Clause 21 shall require that pressure measurements be made at various points in the **refrigerating system**.*

NOTE 101 For reference purposes, the temperatures on the refrigerant piping can be measured during the test of Clause 11.

*If the tests of Annex FF (leak simulation tests) and Annex QQ (methods for determining **releasable charge**) are carried out, at least one additional specially prepared sample is required.*

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

Tests of Clause 15 may be conducted on a separate sample. The test of 19.104.2 through 19.104.8 may be run in any sequence within Clause 19.

5.3 The tests are carried out in the order of the clauses. However, the test of 22.11 on the appliance at **room temperature** is carried out before the tests of Clause 8. The tests of Clause 14, 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.*

Any controls which regulate the temperature or humidity of the conditioned space are rendered inoperative during the test.

5.7 The tests are carried out in a draught-free location at an ambient temperature of $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$.

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 $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ in case of doubt.

The tests and test conditions of Clause 10 and Clause 11 are carried out under the most severe operating conditions within the operating temperature range specified by the manufacturer. Annex AA provides examples of such temperature conditions.

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 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**.

For split units, the refrigerant lines shall be installed in accordance with the installation instructions. The length of the pipe shall be between 5 m and 7,5 m. Where the installation instructions specify a maximum pipe length of less than 5 m, the length of pipe shall be the maximum length specified in the installation instructions, and where the installation instructions specify a minimum pipe length of more than 7,5 m, the length of pipe shall be the minimum length specified in the installation instructions. The thermal insulation of the refrigerant lines shall be applied in accordance with the installation instructions.

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.*

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 $5\text{ kHz} \pm 0,5\text{ kHz}$. 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 $\pm 1\%$.

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 Appliances shall be of one of the following classes with respect to protection against electric shock:

class 0, class 0I, class I, class II, class III.

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.

Modification:

Appliance shall be of **class I, class II or class III.**

6.2 Appliances shall have the appropriate degree of protection against harmful ingress of water.

Compliance is checked by inspection and by the relevant tests.

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

Appliances shall be classified according to degree of protection against harmful ingress of water in accordance with IEC 60529:

- appliances or parts of appliances intended for outdoor use shall be at least IPX4;
- appliances intended only for indoor use (excluding laundry rooms) may be IPX0;
- appliances intended to be used in laundry rooms shall be at least IPX1.

6.101 Appliances shall be classified according to the accessibility either as **appliance accessible to the general public** or as **appliance not accessible to the general public**.

Compliance is checked by inspection.

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 including number of phases, unless for single phase operation;
- **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.
- **rated frequency**;
- **refrigerant charge** for each **refrigerating system**;
- refrigerant designation in accordance with ISO 817;
- **maximum allowable pressure** for the storage tank (for **sanitary hot water heat pumps**);
- **maximum allowable pressure** in the water and/or brine circuit for the **heat exchanger** for **hydronic fan coil units**;
- **maximum allowable pressure** for the refrigerant circuit; if the **maximum allowable pressures** for the suction and discharge side differ, a separate marking is required;
- for **pre-charged pipe sets**
 - refrigerant designation in accordance with ISO 817;
 - the **refrigerant charge** in the line set;
 - **maximum allowable pressure**;
 - if charged with a flammable refrigerant, the flame symbol ISO 7010-W021 (2011-05) including the safety group per ISO 817;
- ratings in watts and voltage of a **UV-C germicidal lamp system** if employed.

Appliances shall be marked with all of the designations and the rated inputs of the **supplementary heaters** for which they are intended to be used and shall have provision for identifying the actual heater that is field installed.

Unless it is evident from the design, the enclosure of the appliance shall be marked, by words or by symbols, with the direction of the fluid flow.

If a **flammable refrigerant** is used, a warning symbol (flame symbol: ISO 7010-W021 (2011-05)) including the safety group per ISO 817 as described in 7.6 shall be placed within sight of the marking of the refrigerant designation on the appliance. The height of the symbol shall be at least 10 mm, and it is not necessary for the symbol to be in colour.

NOTE 101 The refrigerant designation is typically found on the *name plate of the appliance*.

Appliances using **flammable refrigerants** shall be marked with the flame symbol ISO 7010-W021 (2011-05) including the safety group per ISO 817. The height of the triangle used for the symbol shall be at least 30 mm. The required markings shall be provided on all units which contain compressors.

If not already visible when accessing a **service port** and if a **service port** is provided, the **service port** shall be marked to identify the type of refrigerant. If the refrigerant is flammable, symbol ISO 7010-W021 (2011-05) including the safety group per ISO 817 shall be included, without specifying the colour.

If a **flammable refrigerant** is used, the symbols for "read operator's manual" (symbols ISO 7000-0790 (2004-01)) and "service indicator; read technical manual" (ISO 7000-1659 (2004-01)) shall be placed on the appliance in locations visible to the persons required to know the information. The height of the symbol shall be at least 10 mm.

Appliances which are not **fixed appliances**, using a **flammable refrigerant** with a **refrigerant charge** (m_c) of the appliance greater than m_1 according to GG.1.2, shall be marked with symbol ISO 7000-0434A (2004-01) immediately followed by the minimum room floor area symbol IEC 60417-6412 (2019-03), where "A" is the minimum room area in m² as determined according to Annex GG. The markings shall be placed on the outside of the appliance such that it is visible during normal operation.

Appliances employing **refrigerating systems** with **maximum allowable pressures** greater than 7 MPa shall be marked with symbol ISO 7000-1701 (2004-01) followed by the text "(X) MPa" and the "read operator's manual", ISO 7000-0790 (2004-01), where: "X" is the **maximum allowable pressure**.

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**.

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