AS/NZS 61558.1:2018

Australian/New Zealand Standard™

Safety of transformers, reactors, power supply units and combinations thereof

Part 1: General requirements and tests (IEC 61558-1 Ed 3, MOD)

STANDARDS Australia

STANDARDS® NEW ZEALAND PAEREWA AOTEAROA

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee EL-002, Safety of Household and Similar Electrical Appliances and Small Power Transformers. It was approved on behalf of the Council of Standards Australia on 24 October 2018 and by the New Zealand Standards Approval Board on 6 November 2018.
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Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

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We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Please address your comments to the Chief Executive of Standards Australia or the New Zealand Standards Executive at the address shown on the back cover.

This Standard was issued in draft form for comment as DR 18923.

Australian/New Zealand Standard™

Safety of transformers, reactors, power supply units and combinations thereof

Part 1: General requirements and tests (IEC 61558-1 Ed 3, MOD)

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

AS/NZS 61558.1:2018

Safety of transformers, reactors, power supply units and combinations thereof ––

Part 1: General requirements and tests

Foreword

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-002 - Safety of Household and Similar Electrical Appliances and Small Power Transformers to supersede AS/NZS 61558.1:2008 and its amendments. During this period AS/NZS 61558.1:2008 will also remain current. Regulatory authorities that reference this Standard in regulation may apply these requirements at a different time. Users of this Standard should consult with these authorities to confirm their requirements.

The objective of this Standard is to provide manufacturers, designers, regulatory authorities, testing laboratories and similar organizations with safety requirements designed to give the user protection against hazards that might occur during normal operation and abnormal operation of the appliance and which may be used as the basis for approval for sale or for connection to the electricity supply mains in Australia and New Zealand.

The text of IEC 61558-1 Ed 3, prepared by IEC Technical Committee TC 96, was submitted to the Standards Australia/Standards New Zealand Combined Procedure (dual public comment and committee vote) for adoption of the IEC standard as a Standards Australia/Standards New Zealand joint standard.

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

a) fully insulated winding wires (FIW), new tables and aging tests for FIW constructions,

b) overvoltage categories 1, 2, 3 and 4 for clearances and dielectric strength tests (new tables) are included,

c) development of new symbols for the different overvoltage categories,

d) symbol for maximum altitudes, if higher than 2 000 m,

e) symbol for plug in power supply units, if the pins are damaged (tumbling barrel test),

f) symbol for minimum temperature (even during the transportation),

g) alternative temperature measurement, simulated load and back to back method according to IEC 60076-11,

h) short circuit and overload protection, simulated load and back to back method according to IEC 60076-11,

i) adjustment of temperatures in Table 2 according to IEC Guide 117,

j) establishing partial discharge test above 750 V for FIW constructions,

k) requirements for toroidal core constructions, division for basic and for supplementary isolation,

l) modification of protection indexes for enclosures (IP-code),

m) dimensioning of rectangular cross section connectors for transformers,

n) repetition test, 80 % of required dielectric strength test voltage of Table 14,

o) vibration test for vehicles and railway applications,

p) two Y1 Capacitors for working voltages above 250 V and not exceeding 500 V with overvoltage category 3.

This Standard is an adoption with national modifications of the third edition of IEC 61558-1 *Safety of transformers, reactors, power supply units and combinations thereof – Part 1 General requirements and tests.* It has been varied as indicated to take account of Australian and New Zealand conditions.

This Standard, referred to as Part 1, is to be used in conjunction with the appropriate Part 2, which contains clauses that supplement or modify the corresponding clauses in Part 1, to provide the relevant requirements for each type of product.

This third edition of Part 1 is only to be used in conjunction with parts 2 based on this edition. Titles of existing standards in this series will be updated at the time of their next edition.

This standard may be applied, as far as is reasonable to transformers, reactors, power supply units and combinations not mentioned in the parts 2, and to transformers, reactors, power supply units and combinations designed on new principles.

In this document, the following print types are used:

– proper requirements: in roman type;

– *test specifications: in italic type*;

– explanatory matters: in smaller roman type.

In the text of the document, the words in **bold** are defined in Clause 3.

NOTE 1 Subclauses, notes and annexes that are additional to those in the IEC standard are prefixed with the letters AZ.

p NOTE 2 In this document, p is used in the margin to indicate instructions for preparing a consolidated version.

The essential safety requirements in AS/NZS 3820[1] that could be applicable to transformers, reactors, power supply units and combinations thereof are covered by this standard taken in conjunction with any other relevant requirements affecting safety requirements for transformers, reactors, power supply units and combinations thereof are covered by this standard.

The national variations to IEC 61558-1 Ed 3 form the Australian and New Zealand national variations for purposes of the IECEE scheme for recognition of results of testing to standards for safety of electrical equipment (the CB scheme).

1 AS/NZS 3820 *Essential safety requirements for electrical equipment*

The text of the International Standard IEC 61558-1 Ed 3 was approved as a joint Australia/New Zealand Standard with the agreed national variations as given below.

AUSTRALIAN NATIONAL VARIATIONS

5 General notes on tests

p **5.5** *Replace* the text with the following variation:

For a.c., test voltages are of substantially sinusoidal wave form, and if not otherwise specified, have a frequency of 50 Hz.

8 Marking and other information

p **8.1** *Insert* as a new second paragraph in Item a) the following variation:

The marking of **rated voltage** or **rated voltage range** of single-phase transformers shall cover 240 V and for polyphase transformers 415 V.

14 Heating

p **Table 2** *Insert* the following entry:

Insulated pins of transformers with pins for insertion into socket-outlets	70

16 Mechanical strength

p **16.4.1** *Insert* the following variation:

Items b) and c), Table 7, and the last three paragraphs of the test specification are not applicable.

p **16.4.2** *Replace* the text with the following variation:

16.4.2 VOID.

19 Construction

p **19.15** *Replace* the first paragraph of the test specification with the following variation:

Compliance is checked by inserting the transformer, as in normal use into a socket-outlet capable of accepting a 10 A plug complying with Figure 2.1(a) of AS/NZS 3112. The socket-outlet has a horizontal pivot at a distance of 8 mm behind the engagement face of the socket-outlet and in the plane of the lower intersection of the centre lines of the contact apertures.

p **AZ.19.201** After 19.23 *insert* the following variation:

AZ.19.201 Transformers having integral pins for insertion into socket outlets shall comply with the appropriate requirements of AS/NZS 3112.

Compliance is checked as specified in Appendix J of AS/NZS 3112.

NOTE 1 Clause J3.4 (Internal connections for plug portions) of AS/NZS 3112 is covered by clause 19.6 and clause 21 of this standard

NOTE 2 Clause J4.2 (High voltage test) of AS/NZS 3112, except for the test of the insulation of the insulated pins, is covered by clause 18 of this standard.

NOTE 3 Clause J4.4 (Temperature rise test) of AS/NZS 3112 is covered by clause 14 of this standard

NOTE 4 Clause J4.7 (Equipment with integral pins intended to be supported by the contacts of a socket-outlet) of AS/NZS 3112 is covered by clause 19.15 of this standard

20 Components

p **20** *Replace* the first paragraph with the following variation*:*

Components shall comply with the safety requirements specified in the relevant IEC or Australian/New Zealand Standards as far as they reasonably apply.

Replace the third paragraph with the following variation:

Compliance with the IEC or Australian/New Zealand Standards for the relevant component does not necessarily ensure compliance with the requirements of this Standard.

p **20.6** *Insert* in the second paragraph in the requirement, before IEC 60906-3 the following variation:

Annex E in AS/NZS 3112 or

22 Supply connect and other external flexible cables or cords

p **22.4** *Replace* the text with the following variation:

p **22.4** VOID.

p **22.6** *Replace* in the requirement, “16” with the following variation: “10”.

p **22.8** *Replace* the second paragraph in the requirement, with the following variation:

Power supply cords of **portable transformers** shall be fitted with an appropriately rated plug complying with AS/NZS 3112 or AS/NZS 3123 or IEC 60309-1.

Annex H

p **H.3.1** *Insert after the existing fourth paragraph the following variation:*

During and after the tests the no-load output voltage of an accessible safety extra-low voltage outlet or connector or Universal Serial Bus (USB) outlet shall not have increased by more than 3 V or 10% of its no-load output voltage in normal use, whichever is higher.

NEW ZEALAND NATIONAL VARIATIONS

5 General notes on tests

p **5.5** *Replace* the text with the following variation:

For a.c., test voltages are of substantially sinusoidal wave form, and if not otherwise specified, have a frequency of 50 Hz.

8 Marking and other information

p **8.1** *Insert* as a new second paragraph in Item a) the following variation:

The marking of **rated voltage** or **rated voltage range** of single-phase transformers shall cover 230 V and for polyphase transformers 400 V.

14 Heating

p **Table 2** *Insert* the following entry:

Insulated pins of transformers with pins for insertion into socket-outlets	70

16 Mechanical strength

p **16.4.1** *Insert* the following variation:

Items b) and c), Table 7, and the last three paragraphs of the test specification are not applicable.

p **16.4.2** *Replace* the text with the following variation:

16.4.2 VOID.

19 Construction

p **19.15** *Replace* the first paragraph of the test specification with the following variation:

Compliance is checked by inserting the transformer, as in normal use into a socket-outlet capable of accepting a 10 A plug complying with Figure 2.1(a) of AS/NZS 3112. The socket-outlet has a horizontal pivot at a distance of 8 mm behind the engagement face of the socket-outlet and in the plane of the lower intersection of the centre lines of the contact apertures.

p **AZ.19.201** After 19.23 *insert* the following variation:

AZ.19.201 Transformers having integral pins for insertion into socket outlets shall comply with the appropriate requirements of AS/NZS 3112.

Compliance is checked as specified in Appendix J of AS/NZS 3112.

NOTE 1 Clause J3.4 (Internal connections for plug portions) of AS/NZS 3112 is covered by clause 19.6 and clause 21 of this standard

NOTE 2 Clause J4.2 (High voltage test) of AS/NZS 3112, except for the test of the insulation of the insulated pins, is covered by clause 18 of this standard.

NOTE 3 Clause J4.4 (Temperature rise test) of AS/NZS 3112 is covered by clause 14 of this standard

NOTE 4 Clause J4.7 (Equipment with integral pins intended to be supported by the contacts of a socket-outlet) of AS/NZS 3112 is covered by clause 19.15 of this standard

20 Components

p **20** *Replace* the first paragraph with the following variation*:*

Components shall comply with the safety requirements specified in the relevant IEC or Australian/New Zealand Standards as far as they reasonably apply.

Replace the third paragraph with the following variation:

Compliance with the IEC or Australian/New Zealand Standards for the relevant component does not necessarily ensure compliance with the requirements of this Standard.

p **20.6** *Insert* in the second paragraph in the requirement, before IEC 60906-3 the following variation:

Annex E in AS/NZS 3112 or

22 Supply connect and other external flexible cables or cords

p **22.4** *Replace* the text with the following variation:

p **22.4** VOID.

p **22.6** *Replace* in the requirement, “16” with the following variation: “10”.

p **22.8** *Replace* the second paragraph in the requirement, with the following variation:

Power supply cords of **portable transformers** shall be fitted with an appropriately rated plug complying with AS/NZS 3112 or AS/NZS 3123 or IEC 60309-1.

Annex H

p **H.3.1** *Insert after the existing fourth paragraph the following variation:*

During and after the tests the no-load output voltage of an accessible safety extra-low voltage outlet or connector or Universal Serial Bus (USB) outlet shall not have increased by more than 3 V or 10% of its no-load output voltage in normal use, whichever is higher.

Annex ANZ
(normative)
Normative references to international publications with their corresponding joint Australia/New Zealand publications

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

NOTE When an international publication has been modified by national variations the relevant joint Australia/New Zealand publications applies if the national variations are needed to ensure the safety of the appliance for Australia/New Zealand conditions. These international publications are indicated by (mod). If an international publication is not so indicated, then either it or the listed Australia/New Zealand publication may be used.

Publication	Year	Title	AS/NZS	Year
		Approval and test specification — Plugs and socket-outlets	3112	
		Plugs, socket-outlets and couplers for general industrial application	3123	
IEC 60065	2014	*Audio, video and similar electronic apparatus – Safety requirements*	60065	2018
IEC 60068-2-6		*Environmental testing – Part 2-6: Tests – Test FC: Vibration (sinusoidal)*		
IEC 60068-2-14		*Environmental testing – Part 2-14: Tests – Test N: Change of temperature*		
IEC 60068-2-31		*Environmental testing – Part 2-31: Tests – Test Ec: Rough handling shocks, primarily for equipment-type specimens*		
IEC 60068-2-75		*Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*		
IEC 60076-1		*Power transformers – Part 1: General*		
IEC 60076-11	2004	*Power transformers – Part 11: Dry-type transformers*		
IEC TR 60083		*Plugs and socket-outlets for domestic and similar general use standardized in member countries of IEC*		
IEC 60085	2011	*Electrical insulation – Thermal evaluation and designation*		
IEC 60112 IEC 60112/AMD1	2003 2009	*Method for the determination of the proof and the comparative tracking indices of solid insulating materials*		
IEC 60127 (all parts)	2014	*Miniature fuses*		
IEC 60127-3		*Miniature fuses – Part 3: Sub-miniature fuse-links*		
IEC 60216 (all parts)		*Electrical insulating materials – Thermal endurance properties*		

IEC 60227 (all parts)		*Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V*		
IEC 60227-5	2011	*Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 5: Flexible cables (cords)*	60227.5 A1	2003 2004
IEC 60245 (all parts)		*Rubber insulated cables – Rated voltages up to and including 450/750 V*		
IEC 60245-4	2011	*Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 4: Cords and flexible cables*	60245.4 A1	2003 2004
IEC 60269 (all parts)		*Low voltage fuses*		
IEC 60269-2	2013	*Low voltage fuses – Part 2: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application) – Examples of standardized systems of fuses A to K*	60269.2	2000
IEC 60269-3	2010	*Low voltage fuses – Part 3: Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household or similar applications) – Examples of standardized systems of fuses A to F*	60269.3	2000
IEC 60309 (all parts)		*Plugs, socket-outlets and couplers for industrial purposes*		
IEC 60317 (all parts)		*Specifications for particular types of windings wires*		
IEC 60317-0-7	2012	*Specifications for particular types of winding wires – Part 0-7: General requirements – Fully insulated (FIW) zero-defect enamelled round copper wire with nominal conductor diameter of 0,040 mm to 1,600 mm*		
IEC 60317-56		*Specifications for particular types of winding wires – Part 56: Solderable fully insulated (FIW) zero-defect polyurethane enamelled round copper wire with nominal conductor diameter 0,040 mm to 1,600 mm, class 180*		
IEC 60320 (all parts)		*Appliance couplers for household and similar general purposes*		
IEC 60320-2-3		*Appliance couplers for household and similar general purposes – Part 2-3: Appliance couplers with a degree of protection higher than IPX0*		

IEC 60335-1		*Household and similar electrical appliances – Safety – Part 1: General requirements*	60335.1
IEC 60384-14	2013	*Fixed capacitors for use in electronic equipment – Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains*	
IEC 60417		*Grapahical symbols for use on equipment* (available at http://www.graphical-symbols.info/equipment)	
IEC 60454 (all parts)		*Pressure-sensitive adhesive tapes for electrical purposes*	
IEC 60529 IEC 60529/AMD1 IEC 60529/AMD2	1989 1999 2013	*Degrees of protection provided by enclosures (IP Code)*	
IEC 60664-1	2007	*Insulation coordination for equipment within low voltage systems – Part 1: Principles, requirements and tests*	
IEC 60664-3	2016	*Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution*	
IEC 60691	2015	*Thermal-links – Requirements and application guide*	
IEC 60695-2-10	2013	*Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*	
IEC 60695-2-11	2014	*Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods –Glow-wire flammability test method for end-products*	
IEC 60721-3-2		*Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 2: Transportation*	
IEC 60730 (all parts)		*Automatic electrical controls*	
IEC 60730-1	2013	*Automatic electrical controls – Part 1: General requirements*	
IEC 60851-3	2009	*Winding wires – Test methods: Part 3: Mechanical properties*	
IEC 60851-5	2008	*Winding wires – Test methods: Part 5: Electrical properties*	
IEC 60851-6	2012	*Winding wires – Test methods: Part 6: Thermal properties*	

IEC 60884-1 IEC 60884-1AMD1 IEC 60884-1AMD2	2002 2006 2013	*Plugs and socket-outlets for household and similar purposes – Part 1: General requirements*		
IEC 60884-2-4		*Plugs and socket-outlets for household and similar purposes – Part 2-4: Particular requirements for plugs and socket-outlets for SELV*		
IEC 60898 (all parts)		*Electrical accessories – Circuit-breakers for overcurrent protection for household and similar installations*		
IEC 60906-1		*IEC system of plugs and socket-outlets for household and similar purposes – Part 1: Plugs and socket-outlets 16 A 250 V a.c.*		
IEC 60906-3		*IEC system of plugs and socket-outlets for household and similar purposes – Part 3: SELV plugs and socket-outlets, 16 A 6 V, 12 V, 24 V, 48 V, a.c. and d.c.*		
IEC 60947-7-1		*Low-voltage switchgear and controlgear – Part 7-1: Ancillary equipment – Terminal blocks for copper conductors*	60947.7.1	
IEC 60990	2016	*Methods of measurement of touch current and protective conductor current*		
IEC 60998-2-1		*Connecting devices for low-voltage circuits for household and similar purposes – Part 2-1: Particular requirements for connecting devices as separate entities with screw-type clamping units*	60998.2.1	
IEC 60998-2-2		*Connecting devices for low-voltage circuits for household and similar purposes – Part 2-2: Particular requirements for connecting devices as separate entities with screwless-type clamping units*	60998.2.2	
IEC 60999-1		*Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm^2 up to 35 mm^2 (included)*	60999.1	
IEC 61032		*Protection of persons and equipment by enclosures – Probes for verification*		
IEC 61058-1	2016	*Switches for appliances – Part 1: General requirements*	61058.1	2008
IEC 61058-1-1	2016	*Switches for appliances – Part 1-1: Requirements for mechanical switches*		
IEC 61140	2016	*Protection against electric shock – Common aspects for installation and equipment*		
IEC 61373		*Railway applications – Rolling stock equipment – Shock and vibration tests*		

ISO 8820		*Road vehicles – Fuse-links*
EN 50075	1990	*Specification for flat non-wirable two-pole plugs 2.5 A 250 V, with cord, for the connection of class II-equipment for household and similar purposes*
DIN 43671	1975	*Copper bus bars; design for continuous current*
DIN 43670	1995	*Aluminium bus bars; design for continuous current*
DIN 43670-2	1985	*Aluminium bus bars copper cladding; design for continuous current*

NOTES

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SAFETY OF TRANSFORMERS, REACTORS, POWER SUPPLY UNITS AND COMBINATIONS THEREOF –

Part 1: General requirements and tests

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
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8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61558-1 has been prepared by IEC technical committee 96: Transformers, reactors, power supply units and combinations thereof.

This third edition cancels and replaces the second edition published in 2005 and Amendment 1:2009. This edition constitutes a technical revision.

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

a) fully insulated winding wires (FIW), new tables and aging tests for FIW constructions,
b) overvoltage categories 1, 2, 3 and 4 for clearances and dielectric strength tests (new tables) are included,
c) development of new symbols for the different overvoltage categories,
d) symbol for maximum altitudes, if higher than 2 000 m,
e) symbol for plug in power supply units, if the pins are damaged (tumbling barrel test),

f) symbol for minimum temperature (even during the transportation),

g) alternative temperature measurement, simulated load and back to back method according to IEC 60076-11,

h) short circuit and overload protection, simulated load and back to back method according to IEC 60076-11,

i) adjustment of temperatures in Table 2 according to CENELEC Guide 29,

j) establishing partial discharge test above 750 V for FIW constructions,

k) requirements for toroidal core constructions, division for basic and for supplementary isolation,

l) modification of protection indexes for enclosures (IP-code),

m) dimensioning of rectangular cross section connectors for transformers,

n) repetition test, 80 % of required dielectric strength test voltage of Table 14,

o) vibration test for vehicles and railway applications,

p) two Y1 Capacitors for working voltages above 250 V and not exceeding 500 V with overvoltage category 3.

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

FDIS	Report on voting
96/466/FDIS	96/468/RVD

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

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

It has the status of a group safety publication in accordance with IEC Guide 104.

A list of all parts of the IEC 61558 series, published under the general title *Safety of transformers, reactors, power supply units and combination thereof,* can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

In this document, the following print types are used:

– proper requirements: in roman type;

– *test specifications: in italic type*;

– explanatory matters: in smaller roman type.

In the text of the document, the words in **bold** are defined in Clause 3.

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

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

INTRODUCTION

This document covers safety requirements for **transformers**. Where the term **transformer** is used, it covers **transformers**, **reactors** and **power supply units** where applicable.

During the development of this document, to the extent possible, the requirements of IEC 60364 (all parts) were taken into consideration, so that a **transformer** can be installed in accordance with the wiring rules contained in that document. However, national wiring rules can differ.

This document recognizes the internationally accepted levels of protection against the possible electrical, mechanical, and fire hazards caused by **transformers** operating under normal conditions in accordance with the manufacturer's instructions. It also covers abnormal conditions which can occur in practice.

A **transformer** complying with this document will not necessarily be judged to comply with the safety principles of this document if, when examined and tested, it is found to have other features that impair the level of safety covered by these requirements.

A **transformer** employing materials or having forms of construction differing from those detailed in this document may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be judged to comply with the safety principles of this document.

The document dealing with non-safety aspects of electromagnetic compatibility (EMC) of **transformers** is IEC 62041. However, that document also includes tests that can subject the **transformer** to conditions involving safety aspects.

The objective of of IEC 61558-1 is to provide a set of requirements and tests considered to be generally applicable to most types of **transformers**, and which can be called up as required by the relevant part of IEC 61558-2. IEC 61558-1 is thus not to be regarded as a specification by itself for any type of **transformer**, and its provisions apply only to particular types of **transformers** to the extent determined by the appropriate part of IEC 61558-2. IEC 61558-1 also contains normative routine tests.

Each part of IEC 61558-2 in conjunction with this document contains all the necessary requirements for the **transformer** being covered and does not contain references to other parts of IEC 61558-2. For **transformers** with a protection index IP00 and associated **transformers**, it is possible to have circuits corresponding to different parts of IEC 61558-2 within the same construction (e.g. SELV output circuit according to IEC 61558-2-6 and a 230 V output circuit according to IEC 61558-2-4). However, if the **transformer** is covered by different parts IEC 61558-2, to the extent reasonable, the relevant part of IEC 61558-2 is applied to each function/application separately. If applicable, the effect of one function on the other is taken into consideration.

If an appropriate part of IEC 61558-2 does not exist for a particular **transformer** or group of **transformer**s, the nearest applicable part may be used as a guide to the requirements and tests.

However, individual countries may wish to consider its application, to the extent reasonable, to transformers not mentioned in the IEC 61558-2 series, and to transformers designed on new principles.

Where the requirements of any of the clauses of a part of IEC 61558-2 refer to IEC 61558-1 by the phrase "This clause of Part 1 is applicable", this phrase means that all the requirements of that clause of IEC 61558-1 are applicable, except those requirements that are clearly not applicable to the particular type of **transformer** covered by that part of IEC 61558-2.

The principle for the preparation of the different parts of IEC 61558-2 is as shown in Figure 1.

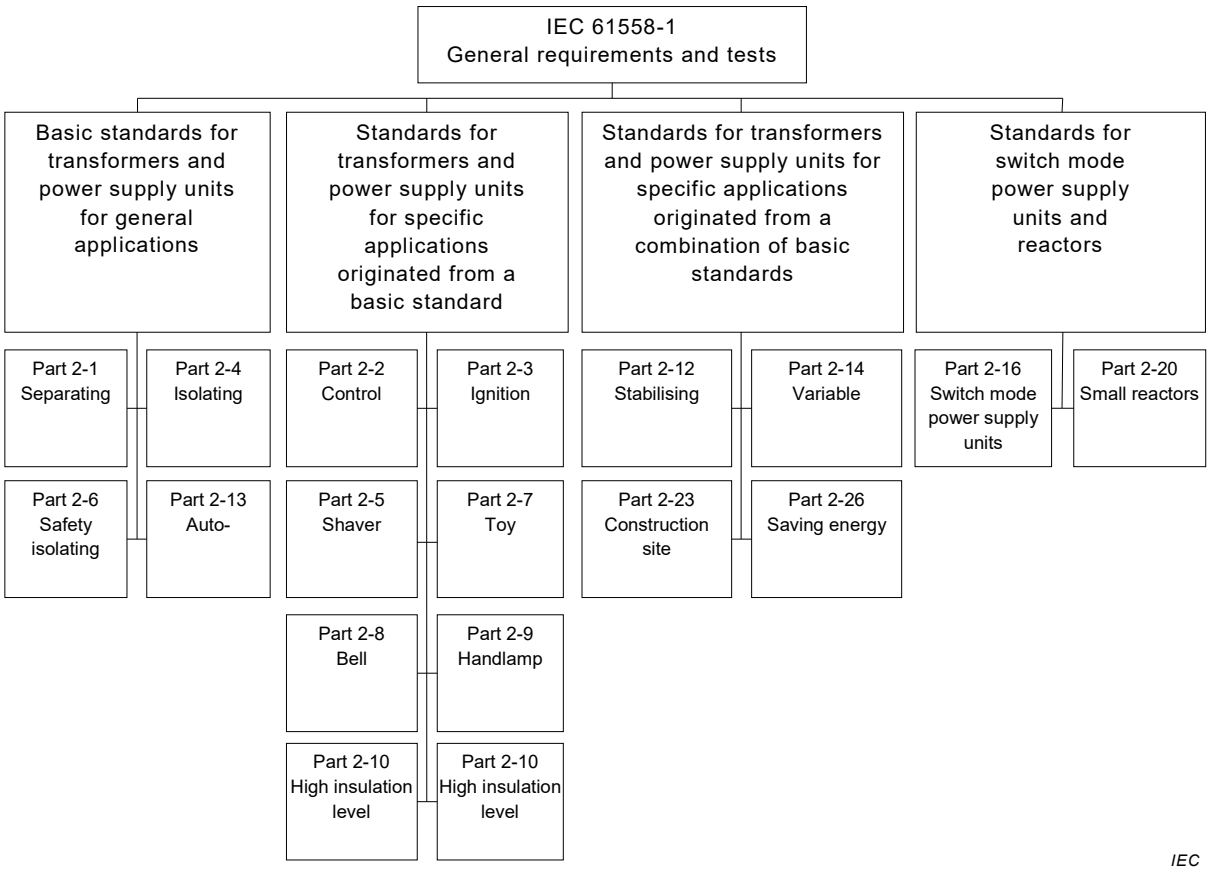

Figure 1 – IEC 61558 principle

Relevant clauses of this document (e.g. clauses dealing with thermal endurance test for windings) apply also to **transformers** forming an integral part of an appliance and which cannot be tested separately.

The IEC 61558 series consists of the following parts, under the general title *Safety of transformers, reactors, power supply units and combination thereof:*[1]

Part 1: General requirements and tests

Part 2-1: Particular requirements and tests for separating transformers for general applications

Part 2-2: Particular requirements and tests for control transformers

Part 2-3: Particular requirements and tests for ignition transformers for gas and oil burners

Part 2-4: Particular requirements and tests for isolating transformers

Part 2-5: Particular requirements and tests for shaver transformers and shaver supply units

Part 2-6: Particular requirements and tests for safety isolating transformers

Part 2-7: Particular requirements and tests for transformers for toys

Part 2-8: Particular requirements and tests for transformers for bells and chimes

Part 2-9: Particular requirements and tests for transformers for class III handlamps for tungsten filament lamps

[1] Some of the parts of this series published earlier appeared under the general title *Safety of power transformers, power supplies, reactors and similar products or Safety of power transformers, power supply units and similar or Safety of power transformers, power supply units and similar devices*. Future editions of these parts will be issued under the new general title indicated above.

Part 2-10: Particular requirements and tests for separating transformers with high insulation level and separating transformers with output voltages exceeding 1 000 V

Part 2-12: Particular requirements and tests for constant voltage transformers

Part 2-13: Particular requirements and tests for auto transformers

Part 2-14: Particular requirements and tests for variable transformers

Part 2-15: Particular requirements and tests for isolating transformers for the supply of medical locations

Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units

Part 2-20: Particular requirements and tests for small reactors

Part 2-23: Particular requirements and tests for transformers and power supply units for construction sites

Part 2-26: Particular requirements and tests for transformers and power supply units all for saving energy and other purposes

Other parts are under consideration.

SAFETY OF TRANSFORMERS, REACTORS, POWER SUPPLY UNITS AND COMBINATIONS THEREOF –

Part 1: General requirements and tests

1 Scope

This part of IEC 61558 deals with safety aspects of **transformers**, reactors, power supply units and combinations thereof such as electrical, thermal and mechanical safety.

This document covers the following **independent** or **associated** stationary or portable types of **dry-type transformers**, **power supply units**, including **switch mode power supply units, reactors** and combinations thereof in the field of safety. The windings can be encapsulated or non-encapsulated. They are not forming a part of the distribution network.

NOTE 1 The distinction between transformers, power supply units and switch mode power supply units is as follows:

– for **transformers**, there is no change in frequency. However, **transformers** (e.g. constant voltage **transformers**) can have an internal resonance frequency not exceeding 30 kHz;

– for **power supply units**, the **internal operational frequency** and waveform are different from the **supply frequency** and waveform, and the **internal operational frequency** does not exceed 500 Hz (see definition 3.1.19);

– for **switch mode power supply units**, the **internal operational frequency** and waveform are different from the **supply frequency** and waveform and the **internal operational frequency** exceeds 500 Hz and does not exceed 100 MHz.

The relevant parts of IEC 61558-2 can be found in the introduction of this document.

a) Stationary or portable, single-phase or poly-phase, air-cooled (natural or forced), **isolating** and **safety isolating transformers**, **independent** or **associated** with the following characteristics:

   – **rated supply voltage** not exceeding 1 000 V AC;

   – **rated supply frequency** not exceeding 500 Hz;

   and complying with the following values, unless otherwise specified in the relevant part of IEC 61558-2:

   - for **isolating transformers**:

     – rated output for single phase **transformers**, not exceeding 25 kVA, and for poly-phase **transformers** not exceeding 40 kVA;

     – **no-load output voltage** and the **rated output voltage** exceeding 50 V AC, and not exceeding 500 V a.c, or 1 000 V AC to be in accordance with the national wiring rules or for a special application.

   - for **safety isolating transformers**:

     – **rated output** for single phase **transformers** not exceeding 10 kVA, and for poly-phase **transformers** not exceeding 16 kVA;

     – **no-load output voltage** and the **rated output voltage** not exceeding 50 V AC between conductors, or between any conductor and protective earthing.

NOTE 2 **Isolating** and **safety isolating transformers** are used where **double** or **reinforced insulation** between circuits is required by the installation rules or by the appliance specification (for example toys, bells, portable **tools**, handlamps).

b) **Stationary** or **portable**, single-phase or polyphase, air-cooled (natural or forced) **separating transformers**, **auto-transformers**, **variable transformers** and small **reactors**, **independent** or **associated** with the following characteristics:

   – **rated supply voltage** not exceeding 1 000 V AC;