SVENSK STANDARD SS-EN IEC 61558-1

Fastställd	Utgåva	Sida	Ansvarig kommitté
2019-12-11	3	1 (1+182)	SEK TK 96

Transformatorer, strömförsörjningsdon och liknande samt kombinationer av dessa – Säkerhet – Del 1: Allmänna fordringar och provning

Safety of transformers, reactors, power supply units and combinations thereof – Part 1: General requirements and tests

Som svensk standard gäller europastandarden EN IEC 61558-1:2019. Den svenska standarden innehåller den officiella engelska språkversionen av EN IEC 61558-1:2019.

Nationellt förord

Europastandarden EN IEC 61558-1:2019

består av:

– **europastandardens ikraftsättningsdokument,** utarbetat inom CENELEC
– **IEC 61558-1, Third edition, 2017 - Safety of transformers, reactors, power supply units and combinations thereof - Part 1: General requirements and tests**

utarbetad inom International Electrotechnical Commission, IEC.

Tidigare fastställd svensk standard SS-EN 61558-1, utgåva 2, 2006 och SS-EN 61558-1/A1, utgåva 1, 2009, gäller ej fr o m 2022-06-21.

ICS 29.180.00

Denna standard är fastställd av SEK Svensk Elstandard,
som också kan lämna upplysningar om **sakinnehållet** i standarden.
Postadress: Box 1284, 164 29 KISTA
Telefon: 08 - 444 14 00.
E-post: sek@elstandard.se. Internet: www.elstandard.se

Standarder underlättar utvecklingen och höjer elsäkerheten

Det finns många fördelar med att ha gemensamma tekniska regler för bl a mätning, säkerhet och provning och för utförande, skötsel och dokumentation av elprodukter och elanläggningar.

Genom att utforma sådana standarder blir säkerhetsfordringar tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

SEK är Sveriges röst i standardiseringsarbetet inom elområdet

SEK Svensk Elstandard svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

Stora delar av arbetet sker internationellt

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

SEK Svensk Elstandard
Box 1284
164 29 Kista
Tel 08-444 14 00
www.elstandard.se

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 61558-1

June 2019

ICS 29.180

Supersedes EN 61558-1:2005

English Version

Safety of transformers, reactors, power supply units and combinations thereof - Part 1: General requirements and tests (IEC 61558-1:2017)

Sécurité des transformateurs, bobines d'inductance, blocs d'alimentation et des combinaisons de ces éléments - Partie 1: Exigences générales et essais (IEC 61558-1:2017)

Sicherheit von Transformatoren, Netzgeräten, Drosseln und entsprechenden Kombinationen - Teil 1: Allgemeine Anforderungen und Prüfungen (IEC 61558-1:2017)

This European Standard was approved by CENELEC on 2017-11-03. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

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

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

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Ref. No. EN IEC 61558-1:2019 E

SEK Svensk Elstandard

SS-EN IEC 61558-1, utg 3:2019

European foreword

The text of document 96/466/FDIS, future edition 3 of IEC 61558-1, prepared by IEC/TC 96 "Transformers, reactors, power supply units, and combinations thereof" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 61558-1:2019.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2019-12-21
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2022-06-21

This document supersedes EN 61558-1:2005.

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

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For the relationship with EU Directive(s) see informative Annex ZZ, which is an integral part of this document.

Endorsement notice

The text of the International Standard IEC 61558-1:2017 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60038:2009	NOTE	Harmonized as EN 60038:2011
IEC 60051 (series)	NOTE	Harmonized as EN 60051-9:1989/A2 (series)
IEC 60317-43	NOTE	Harmonized as EN 60317-43
IEC 60364-4-41:2005	NOTE	Harmonized as HD 60364-4-41:2017
IEC 60584-1:2013	NOTE	Harmonized as EN 60584-1:2013 (not modified)
IEC 60695-10-2:2014	NOTE	Harmonized as EN 60695-10-2:2014 (not modified)
IEC 60738-1:2006	NOTE	Harmonized as EN 60738-1:2006 (not modified)
IEC 60998-1:2002	NOTE	Harmonized as EN 60998-1:2004
IEC 61000-3-2:2014	NOTE	Harmonized as EN 61000-3-2:2014 (not modified)
IEC 61000-3-3:2013	NOTE	Harmonized as EN 61000-3-3:2013 (not modified)
IEC 61180:2016	NOTE	Harmonized as EN 61180:2016 (not modified)
IEC 61558-2 (series)	NOTE	Harmonized as EN 61558-2 (series)
IEC 61558-2-4	NOTE	Harmonized as EN 61558-2-4
IEC 61558-2-6	NOTE	Harmonized as EN 61558-2-6
IEC 61558-2-23	NOTE	Harmonized as EN 61558-2-23
IEC 62041:2010	NOTE	Harmonized as EN 62041:2010 (not modified)
CISPR 11:2015	NOTE	Harmonized as EN 55011:2016

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60065 (mod)	2014	Audio, video and similar electronic apparatus - Safety requirements	EN 60065	2014
-	-		+ A11	2017
IEC 60068-2-6	-	Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	2008
IEC 60068-2-14	-	Environmental testing - Part 2-14: Tests - Test N: Change of temperature	EN 60068-2-14	2009
IEC 60068-2-31	-	Environmental testing - Part 2-31: Tests - Test Ec: Rough handling shocks, primarily for equipment-type specimens	EN 60068-2-31	2008
IEC 60068-2-75	-	Environmental testing - Part 2-75: Tests - Test Eh: Hammer tests	EN 60068-2-75	2014
IEC 60076-1	-	Power transformers - Part 1: General	EN 60076-1	2011
IEC 60076-11	2004	Power transformers -- Part 11: Dry-type transformers	EN 60076-11	2004
IEC/TR 60083	2015[1]	Plugs and socket-outlets for domestic and similar general use standardized in member countries of IEC	-	-
IEC 60085	2007	Electrical insulation - Thermal evaluation and designation	EN 60085	2008

[1] Dated as no European equivalent exists.

Publication	Year	Title	EN/HD	Year
IEC 60112	2003	Method for the determination of the proof and the comparative tracking indices of solid insulating materials	EN 60112	2003
IEC 60127	series	Miniature fuses	EN 60127	series
IEC 60127-3	-	Miniature fuses - Part 3: Sub-miniature fuse-links	EN 60127-3	2015
IEC 60216	series	Electrical insulating materials - Thermal endurance properties	EN 60216	series
IEC 60227	series	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V	-	-
IEC 60227-5	2011	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V - Part 5: Flexible cables (cords)	-	-
IEC 60245	series	Rubber insulated cables - Rated voltages up to and including 450/750 V -- Part 1: General requirements	-	-
IEC 60245-4	2011	Rubber insulated cables - Rated voltages up to and including 450/750 V - Part 4: Cords and flexible cables	-	-
IEC 60269	series	Low-voltage fuses	EN 60269	series
IEC 60269-2 (mod)	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	HD 60269-2	2013
IEC 60269-3 (mod)	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	HD 60269-3	2010
IEC 60309	series	Plugs, socket-outlets and couplers for industrial purposes	EN 60309	series
IEC 60317	series	Specifications for particular types of winding wires	EN 60317	series

Publication	Year	Title	EN/HD	Year
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	EN 60317-0-7	2012
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	EN 60317-56	2017
IEC 60320	series	Appliance couplers for household and similar general purposes	EN 60320	series
IEC 60320-2-3	2018[1]	Appliance couplers for household and similar general purposes – Part 2-3: Appliance couplers with a degree of protection higher than IPX0	-	-
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	EN 60384-14	2013
IEC 60417	1973[1]	Graphical symbols for use on equipment. Index, survey and compilation of the single sheets.	-	-
IEC 60454	series	Specifications for pressure-sensitive adhesive tapes for electrical purposes	EN 60454	series
IEC 60529	1989	Degrees of protection provided by enclosures (IP Code)	EN 60529	1991
-	-		+ corrigendum May	1993
+ A1	1999		+ A1	2000
+ A2	2013		+ A2	2013
IEC 60664-1	2007	Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests	EN 60664-1	2007

Publication	Year	Title	EN/HD	Year
IEC 60664-3	2016	Insulation coordination for equipment within low-voltage systems - Part 3: Use of coating, potting or moulding for protection against pollution	EN 60664-3	2017
IEC 60691	2015	Thermal-links - Requirements and application guide	EN 60691	2016
IEC 60695-2-10	2013	Fire hazard testing - Part 2-10: Glowing/hot-wire based test methods - Glow-wire apparatus and common test procedure	EN 60695-2-10	2013
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 (GWEPT)	EN 60695-2-11	2014
IEC 60721-3-2	-	Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 2: Transportation	EN IEC 60721-3-2	2018
IEC 60730	series	Automatic electrical controls	EN 60730	series
IEC 60730-1 (mod)	2013	Automatic electrical controls - Part 1: General requirements	EN 60730-1	2016
IEC 60851-3	2009	Winding wires - Test methods - Part 3: Mechanical properties	EN 60851-3	2009
IEC 60851-5	2008	Winding wires - Test methods - Part 5: Electrical properties	EN 60851-5	2008
IEC 60851-6	2012	Winding wires - Test methods - Part 6: Thermal properties	EN 60851-6	2012
IEC 60884-1	2002	Plugs and socket-outlets for household and similar purposes -- Part 1: General requirements	-	-
+ A1	2006		-	-
+ A2	2013		-	-
IEC 60884-2-4	2007[1]	Plugs and socket-outlets for household and similar purposes - Part 2-4: Particular requirements for plugs and socket-outlets for SELV	-	-

Publication	Year	Title	EN/HD	Year
IEC 60898	series	Electrical accessories - Circuit-breakers for overcurrent protection for household and similar installations	EN 60898	series
IEC 60906-1	2009[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	1994[1]	IEC System of plugs and socket-outlets for household and similar purposes - Part 3: SELV plugs and socket-outlets, 16 A 6V, 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	EN 60947-7-1	2009
IEC 60990	2016	Methods of measurement of touch current and protective conductor current	EN 60990	2016
IEC 60998-2-1 (mod)	-	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	EN 60998-2-1	2004
IEC 60998-2-2 (mod)	-	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	EN 60998-2-2	2004
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 mm2 up to 35 mm2 (included)	EN 60999-1	2000
IEC 61032	-	Protection of persons and equipment by enclosures - Probes for verification	EN 61032	1998

Publication	Year	Title	EN/HD	Year
IEC 61058-1	2016	Switches for appliances - Part 1: General requirements	EN IEC 61058-1	2018
IEC 61058-1-1	2016	Switches for appliances - Part 1-1: Requirements for mechanical switches	EN 61058-1-1	2016
-	-		EN 61058-1-1: 2016/AC:2019-02	
IEC 61140	2016	Protection against electric shock - Common aspects for installation and equipment	EN 61140	2016
IEC 61373	-	Railway applications - Rolling stock equipment - Shock and vibration tests	EN 61373	2010
ISO 8820	series	Road vehicles - Fuse-links	-	-
-	-	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	EN 50075	1990
DIN 43671	1975	Copper bus bars; design for continuous current	-	-
DIN 43670	1975	Aluminium bus bars; design for continuous current	-	-
DIN 43670-2	1985	Aluminium bus bars copper cladding; design for continuous current	-	-

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

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.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 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.

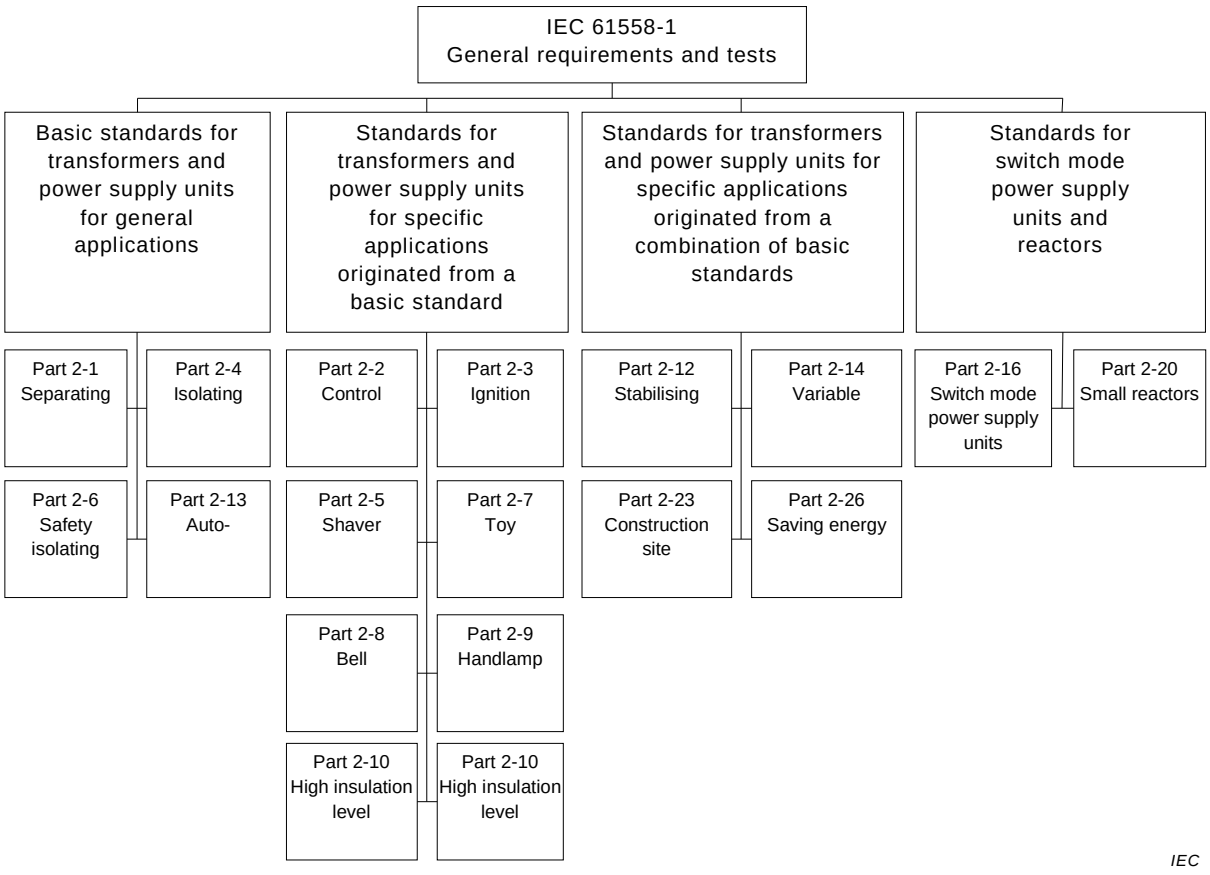

Figure 1 – IEC 61558 principle

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;

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

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

– no-load output voltage or a rated output voltage for both independent and associated **transformers** not exceeding 15 kV AC, and for independent **transformers**, a rated output voltage not less than 50 V AC;

– **rated output** not exceeding the following values:

- 1 kVA for single-phase **transformers**;
- 2 kVAR for single-phase **reactors**;
- 5 kVA for polyphase **transformers**;
- 10 kVAR for polyphase **reactors**.

NOTE 3 **Separating transformers** are used where **double** or **reinforced insulation** between circuits is not required by the installation rules or by the appliance specification.

NOTE 4 Normally, the **transformers** of type b) are intended to be associated with the equipment to provide voltages different from the supply voltage for the functional requirements of the equipment. The protection against electric shock can be provided or completed by other features of the equipment, such as the **body**. Parts of **output circuits** can be connected to the **input circuit** or to the protective earthing.

c) **Stationary** or **portable**, single-phase or polyphase, air-cooled (natural or forced), **independent** or **associated power supply units** and **switch mode power supply units** incorporating one or more **transformer(s)** of type a) or b) with the following characteristics:

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

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

– internal operational frequency for power supply units not exceeding 500 Hz and for switch mode power supply units not exceeding 100 MHz;

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

- for power supply units and switch mode power supply units incorporating isolating **transformers**:
  - **rated output** for single- phase or polyphase **power supply units** or **switch mode power supply units** not exceeding 1 kVA;
  - **no-load output voltage** and the **rated output voltage** exceeding 50 V AC or 120 V ripple-free DC, and not exceeding 500 V AC or 708 V ripple-free DC, or 1 000 V AC or 1 415 V ripple- free DC to be in accordance with national wiring rules or for a special application;
- for **power supply units** and **switch mode power supply units** incorporating **safety isolating transformers:**
  - **rated output** for single- phase or polyphase **power supply units** and **switch mode power supply units** not exceeding 1 kVA;
  - **no-load output voltage** and **rated output voltage** not exceeding 50 V AC or 120 V ripple-free DC between conductors, or between any conductor and protective earthing.

  NOTE 5 **Power supply units** and **switch mode power supply units** incorporating **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).
- for **power supply units** and **switch mode power supply units** incorporating **separating transformers**, auto-**transformers** , and variable **transformers**:
  - **rated output** for single-phase or polyphase **power supply units** and **switch mode power supply units** not exceeding 1 kVA;

– **no-load output voltage** and **rated output voltage** for both, **independent** and **associated transformers** not exceeding 15 kV AC, and for **independent transformers**, a **rated output voltage** not less than 50 V AC.

NOTE 6 **Power supply units** and **switch mode power supply units** incorporating **separating transformers** are used where **double** or **reinforced insulation** between circuits is not required by the installation rules or by the appliance specification.

This document also applies to **transformers**, **power supply units, switch mode power supply units** and **reactors** incorporating electronic circuits.

This document is applicable to **transformers** without limitation of the **rated output** subject to an agreement between the purchaser and the manufacturer.

This document does not apply to external circuits and their components intended to be connected to the input or output terminals or socket-outlets of the **transformers, power supply units** and **switch mode power supply units,** and **reactors**.

Attention is drawn to the following:

– for **transformers** intended to be used in vehicles, on board ships, and aircraft, additional requirements (from other applicable standards, national rules, etc...) may be necessary;

– measures to protect the **enclosure** and the components inside the enclosure against external influences like fungus, vermin, termites, solar-radiation, and icing are considered;

– the different conditions for transportation, storage, and operation of the **transformers** should also be considered;

– additional requirements in accordance with other appropriate standards and national rules can be applicable to **transformers** intended for use in special environments, such as tropical environments.

Future technological development of **transformers** can necessitate a need to increase the upper limit of the frequencies; until then this document can be used as a guidance document.

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

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

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

IEC 60127 (all parts), *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)*

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*

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*

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*

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 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 60529:1989, *Degrees of protection provided by enclosures (IP Code)*
IEC 60529:1989/AMD1:1999
IEC 60529:1989/AMD2:2013

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 60884-1:2002, *Plugs and socket-outlets for household and similar purposes – Part 1: General requirements*
IEC 60884-1:2002/AMD1:2006
IEC 60884-1:2002/AMD2:2013

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*

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*

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*

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)*

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

IEC 61058-1:2016, *Switches for appliances – Part 1: General requirements*

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 (all parts), *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 43670:1975*, Aluminium bus bars; design for continuous current*

DIN 43670-2:1985*, Aluminium bus bars copper cladding; design for continuous current*