

TRAFODE, REAKTORITE, ELEKTRITOITEPLOKKIDE JA
NENDE KOMBINATSIOONIDE OHUTUS. OSA 1:
ÜLDNÕUDED JA KATSETUSED

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

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN IEC 61558-1:2019 sisaldab Euroopa standardi EN IEC 61558-1:2019 ingliskeelset teksti.	This Estonian standard EVS-EN IEC 61558-1:2019 consists of the English text of the European standard EN IEC 61558-1:2019.
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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.

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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

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- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2022-06-21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.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC (mod)	600652014	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.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
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 60269-22013 (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 60269-32010 (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

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
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

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
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	-	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
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 mm ² up to 35 mm ² (included)	EN 60999-1	2000
IEC 61032	-	Protection of persons and equipment by enclosures - Probes for verification	EN 61032	1998

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
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	-	-

Annex ZZ (informative)

Relationship between this European standard and the safety objectives of Directive 2014/35/EU [2014 OJ L96] aimed to be covered

This European Standard has been prepared under a Commission's standardization request relating to harmonized standards in the field of the Low Voltage Directive, M/511, to provide one voluntary means of conforming to safety objectives of Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits [2014 OJ L96].

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZZ.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding safety objectives of that Directive, and associated EFTA regulations.

For other hazards not covered by IEC 61558-1 (e.g. EMF functional safety linked to electric, magnetic and electromagnetic disturbances) the manufacturer has to perform a risk assessment.

Table ZZ.1 – Correspondence between this European standard and Annex I of Directive 2014/35/EU [2014 OJ L96]

Safety objectives of Directive 2014/35/EU	Clause(s) / sub-clause(s) of this EN	Remarks / Notes
1 General conditions		
a) the essential characteristics, the recognition and observance of which will ensure that electrical equipment will be used safely and in applications for which it was made, shall be marked on the electrical equipment, or, if this is not possible, on an accompanying document	Clause 8	
b) the electrical equipment, together with its component parts, shall be made in such a way as to ensure that it can be safely and properly assembled and connected	Clauses 5; 8; 10; 20; 22; 23; 24; 25	
c) the electrical equipment shall be so designed and manufactured as to ensure that protection against the hazards set out in points 2 and 3 is assured, providing that the equipment is used in applications for which it was made and is adequately maintained	Clauses 1; 3; 7; 13; 19	See also Basic Protection Requirements in points 2 and 3 in this table
2 Protection against hazards arising from the electrical equipment		
Measures of a technical nature shall be laid down in accordance with point 1, in order to ensure that: a) persons and domestic animals are adequately protected against the danger of physical injury or other harm which might be caused by direct or indirect contact	Clauses 4; 5; 7; 9; 17; 18; 19; 20; 21; 24; 26; Annex H	

Safety objectives of Directive 2014/35/EU	Clause(s) / sub-clause(s) of this EN	Remarks / Notes
Measures of a technical nature shall be laid down in accordance with point 1, in order to ensure that: b) temperatures, arcs or radiation which would cause a danger, are not produced	Clauses 4; 5; 14; 15; 18; 27	
Measures of a technical nature shall be laid down in accordance with point 1, in order to ensure that: c) persons, domestic animals and property are adequately protected against non- electrical dangers caused by the electrical equipment which are revealed by experience	Clauses 4; 5; 19; Annex H	
Measures of a technical nature shall be laid down in accordance with point 1, in order to ensure that: d) the insulation is suitable for foreseeable conditions	Clauses 4; 5; 17; 18; 19; 20; 26; 27	
3 Protection against hazards which may be caused by external influences on the electrical equipment		
Technical measures shall be laid down in accordance with point 1, in order to ensure that the electrical equipment: a) meets the expected	Clauses 4; 5; 16; 22; 25; 28	
mechanical requirements in such a way that persons, domestic animals and property are not endangered		
Technical measures shall be laid down in accordance with point 1, in order to ensure that the electrical equipment: b) is resistant to non-mechanical influences in expected environmental conditions, in such a way that persons, domestic animals and property are not endangered	Clauses 4; 5; 11; 12; 17; 24; 28	
Technical measures shall be laid down in accordance with point 1, in order to ensure that the electrical equipment: c) does not endanger persons, domestic animals and property in foreseeable conditions of overload	Clause 4; 5; 15; 26; Annex H	

WARNING 1 — Presumption of conformity stays valid only as long as a reference to this European standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2 — Other Union legislation may be applicable to the product(s) falling within the scope of this standard.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SAFETY OF TRANSFORMERS, REACTORS,
POWER SUPPLY UNITS AND COMBINATIONS THEREOF –****Part 1: General requirements and tests**

FOREWORD

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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 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 **transformers**, 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.