



**SLOVENSKI STANDARD**  
**oSIST prEN 50708-1-1:2023**

**01-oktober-2023**

---

**Močnostni transformatorji - Dodatne evropske zahteve - 1-1. del: Skupni del - Splošne zahteve**

Power transformers - Additional European requirements - Part 1-1: Common part - General requirements

Leistungstransformatoren - Zusätzliche europäische Anforderungen - Teil -1-1: Allgemeiner Teil - Allgemeine Anforderungen

Transformateurs de puissance - Exigences européennes supplémentaires : Partie 1 - Partie commune

<https://standards.iteh.ai/catalog/standards/sist/20e72d44-bcf6-4dc1-8d48-724d1c179fd8/osist-pren-50708-1-1-2023>

**Ta slovenski standard je istoveten z: prEN 50708-1-1:2023**

---

**ICS:**

29.180      Transformatorji. Dušilke      Transformers. Reactors

**oSIST prEN 50708-1-1:2023      en**



EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**DRAFT**  
**prEN 50708-1-1**

August 2023

ICS 29.180

Will supersede EN 50708-1-1:2020; EN 50708-1-1:2020/AC:2020-12

English Version

## Power transformers - Additional European requirements - Part 1-1: Common part - General requirements

Transformateurs de puissance - Exigences européennes  
supplémentaires : Partie 1 - Partie commune

Leistungstransformatoren - Zusätzliche europäische  
Anforderungen - Teil -1-1: Allgemeiner Teil - Allgemeine  
Anforderungen

This draft European Standard is submitted to CENELEC members for enquiry.  
Deadline for CENELEC: 2023-11-03.

It has been drawn up by CLC/TC 14.

If this draft becomes a European Standard, 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.

This draft European Standard was established by CENELEC 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, Türkiye and the United Kingdom.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.



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**

## prEN 50708-1-1:2023 (E)

<b>Contents .....</b>		<b>Page</b>
European foreword.....		4
Introduction.....		5
1 Scope .....		6
2 Normative references .....		6
3 Terms and definitions .....		6
4 Service condition .....		12
5 Ratings and general requirements .....		12
5.1 Rated power .....		12
5.2 Rated frequency .....		13
5.3 Energy performance.....		13
5.3.1 Energy performance requirements.....		13
5.3.2 Exclusion from energy performance requirements .....		13
5.3.3 Reference conditions .....		14
5.4 Material efficiency .....		14
5.4.1 General.....		14
5.4.2 Durability and reliability .....		15
5.4.3 Ability to remanufacture .....		15
5.4.4 Ability to repair, reuse and upgrade .....		15
5.4.5 Recyclability and recoverability.....		16
5.4.6 Proportion of reused major components.....		16
5.4.7 Proportion of recycled content .....		16
5.4.8 Use of critical raw materials .....		17
5.5 Sustainability .....		17
5.6 Technical documentation .....		17
5.6.1 General.....		17
5.6.2 Recyclability and recoverability .....		18
5.6.3 Proportion of recycled content .....		18
5.6.4 CO <sub>2</sub> equivalent emission .....		18
5.6.5 Accessory and major component data.....		18
5.6.6 Critical raw materials (CRMs) .....		19
6 Rating plate .....		19
7 Tolerances.....		19
7.1 Tolerance during acceptance tests .....		19
7.2 Tolerances for market surveillance .....		20
8 Tests.....		20
8.1 General.....		20
8.2 Measurement of cooling consumption .....		20
9 Accessories and fittings .....		20
10 Capitalization of losses .....		20

11	Transformer reprocessing .....	21
	Annex A (normative) Peak efficiency calculation .....	22
	Annex B (informative) Capitalization of losses.....	25
	Annex C (informative) A-deviations .....	31
	Annex D (informative) Additional considerations related to energy performances .....	32
	Annex ZZ (informative) Relationship between this European Standard and the ecodesign requirements of Commission Regulation (EU) No 548/2014 of 21 May 2014 and its amendment No 2019/1783 of 1 October 2019 on implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to small, medium and large power transformers aimed to be covered .....	34

## iTeh STANDARD PREVIEW (standards.iteh.ai)

[oSIST prEN 50708-1-1:2023](https://standards.iteh.ai/catalog/standards/sist/20e72d44-bcf6-4dc1-8d48-724d1c179fd8/osist-pren-50708-1-1-2023)

<https://standards.iteh.ai/catalog/standards/sist/20e72d44-bcf6-4dc1-8d48-724d1c179fd8/osist-pren-50708-1-1-2023>

**prEN 50708-1-1:2023 (E)****European foreword**

This document (prEN 50708-1-1:2023) has been prepared by CLC/TC 14, "Power transformers".

The following dates are proposed:

- latest date by which the existence of this document has to be announced at national level (doa) dor + 6 months
- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) dor + 12 months
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) dor + 36 months (to be confirmed or modified when voting)

This document will supersede EN 50708-1-1:2020 and all of its amendments and corrigenda (if any).

EN 50708-1-1:2023 includes the following significant technical changes with respect to EN 50708-1-1:2020:

- The EN 50708-1-1:2020/AC:2020 Corrigendum has been included in the standard.
- The comments received from NCs not allowed in the corrigendum have been taken into account.
- The new topic 'Material efficiency' has been added side to energy performance in the prospective of power transformer 'Sustainability'.

This document has been prepared under a Standardization Request given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s) / Regulation(s). [ic179fd8/osist-pren-50708-1-1-2023](https://osist.europa.eu/osist-pren-50708-1-1-2023)

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

## Introduction

The EN 50708 series, “Power transformers – Additional European requirements”, has been prepared by CENELEC TC 14 to address specific European requirements of power transformers related EU Regulations and local practices.

Technical requirements set by the EN 50708 series supplement, modify or replace certain requirements of the other EN standards derived from equivalent IEC international standards.

This series contains general requirements on energy performance, accessories, fittings, tests, mechanical requirements etc. structured as follows:

- Part 1 series - Common requirements;
- Part 2 series - Medium power transformers;
- Part 3 series - Large power transformers.

The EN 50708-X parts with X greater than 1 contain particular requirements for a different category of transformers or transformer applications which are based on the requirements of the general parts of EN 50708-1-1.

The EN 50708-X parts should be considered in conjunction with the requirements of the general part.

The particular requirements of these subparts of EN 50708 supplement, modify or replace certain requirements of the general parts of EN 50708-1-1 and/or EN 50708-1-X being valid at the time of publication of this part. The absence of references to the exclusion of a part or a clause of a general part means that the corresponding clauses of the general part are applicable (undated reference).

Requirements of other -X parts with X greater than 1 being eventually relevant for cases covered by this part also apply. This part therefore possibly supplements, modifies or replaces certain of these requirements valid at the time of publication of this document.

The main clause numbering of each subpart follows the pattern and corresponding references of EN 50708-1-1. The numbers following the particular number of this part are those of the corresponding parts, or clauses of the other parts of the EN 50708 series, valid at the time of publication of this part, as indicated in the normative references of this document (dated reference).

In the case where new or amended general parts with modified numbering were published after the subpart was issued, the clause numbers referring to a general part in subparts might no longer align with the latest edition of the general part. Dated references should be observed.

It is acknowledged that environmental requirements including energy in the use phase are a significant aspect that can be addressed through product design. As the material content increases to improve energy performance, it is advisable to make a proper life cycle assessment including recycling of the extra raw material and the overall energy used to produce and transport transformers. Some guidelines are given in EN 60076-1.

## prEN 50708-1-1:2023 (E)

### 1 Scope

This document is part of the EN 50708 series which applies to transformers in compliance with EN 60076-1.

### 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.

EN 60076-1:2011, *Power transformers - Part 1: General*

EN IEC 62474, *Material declaration for products of and for the electrotechnical industry*

EN 50708-2-1:2020, *Power transformers - Additional European requirements: Part 2-1 Medium power transformer - General requirements*

EN 60076-1:2011, *Power transformers - Part 1: General*

EN 60076-22 series, *Power transformers - Part 22: Power transformer and reactor fittings*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 60076-1:2011 and the following apply.

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

— ISO Online browsing platform: available at <https://www.iso.org/obp/>

— IEC Electropedia: available at <https://www.electropedia.org/>

#### 3.1

##### medium power transformer

MPT

power transformer with all windings having a rated power lower than or equal to 3 150 kVA, and highest voltage for equipment greater than 1,1 kV and lower than or equal to 36 kV

Note 1 to entry: The definitions of power transformer and winding are given in EN 60076-1.

Note 2 to entry: The national practice of the Czech Republic could require the use of the highest voltages for equipment in AC three-phase systems of 38,5 kV instead of 36 kV and 25 kV instead of 24 kV. These units have a rated power lower than or equal to 3 150 kVA:

— with  $U_m = 38,5$  kV are considered as  $U_m = 36$  kV (ref. to EN 50708-2-1:2020);

— with  $U_m = 25$  kV are considered as  $U_m = 24$  kV (ref. to EN 50708-2-1:2020).

#### 3.2

##### large power transformer

LPT

power transformer with at least one winding having either a rated power greater than 3 150 kVA or highest voltage for equipment greater than 36 kV

Note 1 to entry: The definitions of power transformer and winding is given in EN 60076-1.



Note 2 to entry: The national practice of Czech Republic requires the use of the highest voltages for equipment in AC three-phase systems of 38,5 kV instead of 36 kV and 25 kV instead of 24 kV. These units have a rated power greater than 3 150 kVA:

- with  $U_m = 38,5$  kV are considered as  $U_m = 36$  kV (ref. to EN 50708-3-1:2020)
- with  $U_m = 25$  kV are considered as  $U_m = 24$  kV (ref. to EN 50708-3-1:2020).

### 3.3

#### medium power pole-mounted transformer

medium power transformer with a rated power of up to 400 kVA suitable for outdoor service and specifically designed to be mounted on the support structures of overhead power lines

Note 1 to entry: The definitions of power transformer and winding are given in EN 60076-1.

Note 2 to entry: For definitions of pole see IECV [466–07–01].

### 3.4

#### load factor

k

ratio of actual current over the rated current of transformer

Note 1 to entry: Normally the ratio is  $0 \leq k \leq 1$ .

### 3.5

#### transmitted apparent power

$k_{Sr}$

product of the load factor and rated power

### 3.6

#### Efficiency Index

EI

ratio of the transmitted apparent power of a transformer minus electrical losses to the transmitted apparent power of the transformer

### 3.7

#### Peak Efficiency Index

PEI

maximum value of the ratio of the transmitted apparent power of a transformer minus the electrical losses to the transmitted apparent power of the transformer

Note 1 to entry: PEI is the maximum value of EI that can be achieved at the optimum value of load factor.

### 3.8

#### load factor of Peak Efficiency Index

$k_{PEI}$

load factor at which Peak Efficiency Index occurs

Note 1 to entry: Alternative cooling modes can require an iterative calculation of the  $k_{PEI}$ . In any case, the  $k_{PEI}$  is defined at the point where the highest PEI occurs.

### 3.9

#### declared value

value given in the technical documentation and where applicable, the value used to calculate this value

Note 1 to entry: The values given are pursuant to point 2 of Directive 2009/125/EC, Annex IV.

**prEN 50708-1-1:2023 (E)****3.9.1****declared value of loss**

loss measured by the manufacturer and written in the test report part of technical documentation and on the rating plate

Note 1 to entry: This definition applies both to no-load loss and to load loss.

Note 2 to entry: Declared values and guaranteed values according to EN 60076-1 are two different concepts. Guaranteed values are related to contract, whereas declared values are related to compliance verifications with Commission Regulation (EU) No 548/2014.

Note 3 to entry: This definition complies with item g) of point 2 of Directive 2009/125/EC, Annex IV.

**3.9.2****declared value of no-load loss**

$P_0$

no-load loss measured by the manufacturer and written in the test report part of technical documentation and on the rating plate

Note 1 to entry: For definition of no-load loss, see EN 60076-1.

**3.9.3****declared value of load loss**

$P_k$

load loss measured by the manufacturer and written in the test report part of technical documentation and on the rating plate

Note 1 to entry: For definition of load loss, see EN 60076-1.

**3.9.4****declared value of electrical power required by the cooling system for no-load operation**

$P_{c0}$

electrical power required by fan and liquid pump motors for no-load operation as derived from the transformer type test certificates

Note 1 to entry: The electrical power required by the cooling system for no-load operation is not measured all the time because this is a type test according to EN 60076-1.

**3.9.5****declared value of additional electrical power required by the cooling system for the load factor of k**

$P_{ck}(k)$

additional electrical power required (in addition to  $P_{c0}$ ) by the cooling system for continuous operation at k times the rated load ensuring the compliance with the temperature rise derived from the transformer type test measurements of the power taken by the fan and liquid pump motors

Note 1 to entry: The electrical power required by the cooling system for k times the rated load operation is not measured all the time, because this is a type test according to EN 60076-1. It can be extrapolated from the temperature rise test.

**3.9.6****declared value of PEI**

PEI calculated from the declared values of no-load loss, load loss and power required by the cooling system for load operation at  $k_{PEI}$  according to the above definitions

**3.10****dual voltage transformer**

transformer with one or more windings with two voltages available in order to be able to operate and supply rated power at either of two different voltage values

**3.11****acceptance test**

contractual test to prove to the customer that the item meets certain conditions of its specification

Note 1 to entry: The test may be witnessed by the purchaser or/and a third party.

Note 2 to entry: The common IEC acceptance tests do not require witnesses. Routine tests are performed on every transformer; for this reason, the factory acceptance test shall be agreed between purchaser and supplier at the order stage.

[SOURCE: IEC ref 151-16-23]

**3.12****witnessed testing**

active observance of the physical testing of the product under investigation by another party, to draw conclusions on the validity of the test and the test results and which may include conclusions on the compliance of testing and calculations methods used with applicable standards and legislation

**3.13****instrument transformer**

transformer intended to transmit an information signal to measuring instruments, meters and protective or control devices or similar apparatus even if it supplies energy for the operation of connected equipment

Note 1 to entry: The difference between the definition in Commission Regulation (EU) No. 548/2014 and the CENELEC one is in the use of the word 'supply' rather than 'transmit an information signal'.

[SOURCE: EN 61869-1:2009, 3.1.1, modified]

**3.14****transformer specifically designed and intended to provide a DC power supply to electronic or rectifier loads**

transformer specifically designed and intended to supply power electronic or rectifier loads specified according to EN 61378-1:2011

Note 1 to entry: This definition covers transformers designed for use with rectifiers to provide a DC supply in certain applications.

Note 2 to entry: This definition does not include:

- transformers which are intended to provide AC from DC sources such as transformers for wind turbine and photo voltaic applications;
- transformers designed for DC transmission and distribution applications.

Therefore, they are part of the scope of this document and are expected to comply with Commission Regulation (EU) No. 548/2014.

**3.15****transformer specifically designed for offshore applications and floating offshore applications**

transformer to be installed on fixed or floating offshore platforms, offshore wind turbines or on board ships and all kinds of vessels

## prEN 50708-1-1:2023 (E)

## 3.16

**transformer specially designed for emergency installations**

transformer designed to only provide cover for a specific time limited situation when the normal power supply is interrupted either due to an unplanned occurrence such as failure or a station refurbishment, but not to permanently upgrade an existing substation

Note 1 to entry: Such transformer could have some specific features that make it suitable for emergency or temporary use as opposed to normal use. Example of some specific features:

- multiple windings making it suitable for use at several locations;
- special low weight or dimensions for easy transport, or special capability to be disassembled into smaller units for transport;
- increased overload capability achieved by the use of special material;
- permanent mounting on a transporter arrangement.

## 3.17

**transformer and auto-transformer specifically designed for railway feeding systems**

traction transformer

Note 1 to entry: The definition of traction transformer given by EN 50329 is a transformer (with separate or auto-connected windings) connected to an a.c. or d.c. contact line, directly or through a converter, used in fixed installations of railway applications.

## 3.18

**earthing or grounding transformer**

three-phase transformer or reactor connected in a power system to provide a neutral connection for earthing either directly or via an impedance

[SOURCE: EN 60076-6:2008, 3.1.10, modified]

## 3.19

**traction transformer**

transformer installed on board of rolling stock inserted in the traction and auxiliary circuits of rolling stock and in the scope of EN 60310:2016

## 3.20

**starting transformer specifically designed for starting three-phase induction motors so as to eliminate supply voltage dips**

transformer that is de-energized during normal operation, and used for the purpose of starting a rotating machine

## 3.21

**Medium Voltage (MV) to Medium Voltage (MV) interface transformer up to 5 MVA**

transformer used in network voltage conversion program and placed at the junction between two voltage levels of two MV networks and which needs to be able to cope with emergency overloads

Note 1 to entry: Such units might or might not be part of a packaged compact substation including also MV Reclosers and protection equipment.

## 3.22

**durability**

<of a part or a product> ability to function as required, under defined condition of use, maintenance and repair, until a limiting state is reached

Note 1 to entry: The degree to which maintenance and repair are within the scope of durability will vary by product or product-group.