SLOVENSKI STANDARD
SIST EN 50588-1:2015/A1:2016

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Močnostni transformatorji srednje moči 50 Hz z najvišjo napetostjo naprave do 36 kV - 1. del: Splošne zahteve - Dopolnilo A1

Medium power transformers 50 Hz, with highest voltage for equipment not exceeding 36 kV - Part 1: General requirements

Mittelleistungstransformatoren 50 Hz, mit einer höchsten Spannung für Betriebsmittel nicht über 36 kV - Teil 1: Allgemeine Anforderungen

Transformateurs 50 Hz de moyenne puissance, de tension la plus élevée pour le matériel ne dépassant pas 36 kV - Partie 1: Exigences générales

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English Version

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European Committee for Electrotechnical Standardization
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European foreword

This document (EN 50588-1:2015/A1:2016) has been prepared by CLC/TC 14 "Power transformers".

The following dates are fixed:

-	latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2017-05-23
-	latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2019-05-23

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

For the relationship with Commission Regulation (EU) see informative Annex ZZ, which is an integral part of EN 50588-1:2015.

1 Modification to Clause 1, Scope

After the last item of the bulleted list, "- large power transformers which are like for like replacements in the same physical location/installation for existing large power transformers, where this replacement cannot be achieved without entailing disproportionate costs associated to their transportation and/or installation", *add the following text:*

"In case one of the last two exclusions is claimed, this should be documented at the signature of the contract with a declaration made by the customer.

NOTE 3 This standard covers the transformers under the Commission Regulation (EU) No. 548/2014 and gives additional specific guidance for single phase transformers, multi winding transformers and for transformers with OF or OD cooling systems, necessary for the correct application of energy efficiency requirements to these categories of transformers.".

2 Modifications to Clause 3, Terms and definitions

*After term "*3.6 declared value*", add the following new terms:*

"**3.7 excluded transformers**
3.7.1
instrument transformer
transformer as defined in section 3.1.1 of EN 61869-1:2009, even if it supplies energy for the operation of connected equipment

Note 1 to entry: The difference between the definition in Regulation 548/2014 and the CENELEC one is in the use of the word 'supply' rather than 'transmit an information signal'.

3.7.2
transformer with low-voltage windings specifically designed for use with rectifiers to provide a DC supply

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

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: The term "low-voltage winding" refers to the winding having the lowest rated voltage as per EN 60076-1, whatever its voltage level.

Note 3 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 standard and shall comply with Commission Regulation (EU) No. 548/2014.

3.7.3
transformers 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 of ships and all kind of vessels

3.7.4
transformers specially designed for emergency installations
transformer designed only to 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 materials;
- permanent mounting on a transporter arrangement.

3.7.5
transformers and auto-transformers specifically designed for railway feeding systems
transformer as defined in EN 50329

3.7.6
earthing or grounding transformers, this is, three-phase transformers intended to provide a neutral point for system grounding purposes
transformer as defined in paragraph 3.1.10 of EN 60076-6:2008

3.7.7
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

3.7.8
starting transformers, specifically designed for starting three-phase induction motors so as to eliminate supply voltage dips
transformer that is de energized during normal operation, used for the purpose of starting a rotating machine

3.7.9
Medium Voltage (MV) to Medium Voltage (MV) interface transformers 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 may or maybe not part of a packaged compact substation including also MV Reclosers and protection equipment.".

3 Modifications to 6.1, General

After the 1st paragraph, add the following new paragraphs:

"If different values of apparent power are assigned under different circumstances, for example, with different methods of cooling (ONAN/ONAF, AN/AF, etc…), all values must be reported on the rating plate and the highest of these values is the rated power. This applies also in case a provision for a future value of apparent power is made (for example future ONAF, future AF, etc…).

Any evaluation of losses shall be done on continuous rated power as stated in EN 60076-1. If additional cooling system such as fans or pumps… are used only for temporary overload conditions and not for continuous rating, then such overloading rating cannot be claimed to be as rated power and then not mentioned on the rating plate.".

In the 4th paragraph, replace “loss corrections specified in 6.2.3 and 6.2.4.” *with* “loss corrections specified in 6.2.3, 6.2.4 and 6.2.5.”.

After the 6th paragraph “Several classes of losses are defined in this standard with a ranking of efficiency for no load loss and for load loss. The most efficient class for no load loss is class AAA_0, then AA_0, then A_0. For load loss the same logic is used with the most efficient class is A_k, then B_k, then C_k.”, *add the following new paragraph:*

“The loss classes correspond to the values measured during the factory acceptance test without any tolerances.”.

After the 11th paragraph “For liquid immersed transformer and for dry-type transformer, load loss, Peak Efficiency Index and short circuit impedance shall be given at the reference temperature defined in EN 60076-1.”, *add the following:*

“More specifically:

a) The reference temperature for liquid immersed transformers with rated average winding temperature rise less than or equal to 65 K for OF or ON, or 70 K for OD is 75 °C;

b) For transformers with other rated average winding temperature rise, the reference temperature is equal to the rated average winding temperature rise + 20 °C, or rated winding temperature rise + yearly external cooling medium average temperature, whichever is higher.

If a purchaser needs to compare transformer with different insulation systems and different average winding temperature rises, the reference temperature should be according to b) above.”.

In the last paragraph, after “L_{WA}: A weighted sound power level of transformers according to EN 60076-10.”, *add the following note:*

“NOTE Loss levels and correction factors defined in paragraphs 6.2 and 6.4 refer to two winding medium power transformers. Loss levels for three winding medium power transformers are not defined due to lack of data at the time of the publication of this standard. PEI definition for three winding transformers with rated power 3 150 kVA < S_r < 40 000 kVA is given in paragraph 6.3.”.

4 Modifications to 6.2, Transformers with rated power Sr ≤ 3 150 kVA

In 6.2.4, delete the second paragraph.

In Table 6, 1st row, 3rd column, after “In the case where the full rated power is available regardless of the combination of voltages, the levels of losses indicated in Table 2, Table 3 and Table 4 can be increased by 15 % for no load loss and by 10 % for load loss.”, *add* “Such levels of losses shall refer to the highest voltage.”.

In Table 6, 2nd row, 3rd column, replace “The levels of losses indicated in Table 2, Table 3 and Table 4 shall be increased by 20 % for no load loss and by 20 % for load loss in case of dual voltage on both windings. These levels of losses are given on the basis that the rated power is the same regardless of the combination of voltages.” *with* “The maximum allowable losses indicated in Table 2, Table 3 and Table 4 can be increased by 20 % for no load losses and by 20 % for load losses for transformers with dual voltage on both windings if the rated power is the same regardless of the combination of voltages. The level of losses shall refer to the highest voltages of both windings. This remains valid even if further voltage combinations are available.”.

After Table 6, add the following paragraphs:

“For transformers having dual voltage on both windings for which both voltages on one winding are fully rated in combination with one of the voltages on the other winding, the levels of losses shall be based on the highest power and the values indicated in Table 2, Table 3 and Table 4 can be increased by 15 % for no load losses and by 10 % for load losses. The level of losses shall refer to the highest voltages of both windings. This remains valid even if further voltage combinations are available.

For transformer having insulation level according to Table 5 and having dual voltage according to Table 6 the loss level shall take into account both corrections.”.

After 6.2.4, add the following new subclause:

“**6.2.5 Three winding transformers for PV applications**

Dual voltage correction factors given in Table 6, Ref A, apply also to transformers for photovoltaic applications, which have two low voltage windings that each have half the rated power of the high voltage winding.”.

5 Modification to 6.3, Transformers with rated power 3 150 kVA < Sr < 40 000 kVA

At the end of 6.3, after “The value of noise and short circuit impedance shall be defined during enquiry stage.", *add the following new paragraphs:*

"The PEI requirements in Table 7 and Table 8 apply to autotransformers and separate winding transformers having three windings as follows. Assuming that ratings are x/y/z, then:

- if x and y are equal and z is lower or equal than one third of x or y, the PEI shall be the one corresponding to x or y rating and the losses of winding z shall not be considered for PEI calculation;

- if x is equal to the sum of y and z, the PEI shall be the one corresponding to x rating and the three winding losses shall be considered for PEI calculation;

- in all other cases, the PEI shall be the one corresponding to maximum of the three ratings. Load loss must be measured for each winding pairs and the load combination to be used for PEI calculation is:

$$x \Big/ y\frac{x}{y+z} \Big/ z\frac{x}{y+z}$$

NOTE 1 In general, transformers of similar design criteria, but with more than two windings, have higher total losses and lower PEI values. This formula also allows for the verification of PEI requirements in transformers other than two winding transformers, such as three winding transformers and autotransformers. For the computation of the load loss for each winding, the criteria given in IEC 60076-8 can be taken as reference.

NOTE 2 For example, for a 6 000/6 000/3 000 kVA, the PEI limit shall be that of 6 000 kVA and the load combination for load loss calculation shall be:

$$6000 \Big/ 6000\frac{6000}{6000+3000} \Big/ 3000\frac{6000}{6000+3000} \Rightarrow 6000/4000/2000$$

The approach used for three winding transformers can be applied in principle to transformers with more than three windings.

For transformers with re-connectable windings PEI calculation shall be made based on loss measurements taken at the highest rated voltage(s).".