



# SLOVENSKI STANDARD

## SIST HD 398.3 S1:1997

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### Power transformers - Insulation levels and dielectric tests

Power transformers -- Part 3: Insulation levels and dielectric tests

Leistungstransformatoren -- Teil 3: Isolationspegel und Spannungsprüfungen

Transformateurs de puissance -- Partie 3: Niveaux d'isolement et essais diélectriques

Ta slovenski standard je istoveten z: **HD 398.3 S1:1986**

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#### **ICS:**

29.180      Transformatorji. Dušilke      Transformers. Reactors

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## ENGLISH VERSION

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Key words: Power transformers - requirements - testing - properties - definitions - insulation levels - dielectric tests

### POWER TRANSFORMERS INSULATION LEVELS AND DIELECTRIC TESTS

Transformateurs de puissance  
Niveaux d'isolement et essais  
diélectriques

Transformatoren  
Isolationspegel und Spannungs-  
prüfungen

#### BODY OF HD

The Harmonization Document consists of:

- IEC 76-3 (1980) edition 1 and Amendment No.1 (1981), not appended
- common modifications prepared by CENELEC TC 14

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This Harmonization Document was approved by CENELEC on 3 December 1985.

The English and French versions of this HD are provided by the text of the IEC publication and the German version is the official translation of the IEC text. All texts prepared by CENELEC exist in three official versions (English, French, and German).

According to the CENELEC Internal Regulations the CENELEC member National Committees are bound:

to announce the existence of this Harmonization Document at national level

by or before 1986-06-01

to publish their new harmonized national standard

by or before 1987-01-01

to withdraw all conflicting national standards

by or before 1987-01-01.

Harmonized national standards are listed on the HD information sheet, which is available from the CENELEC National Committees or from the CENELEC General Secretariat.

The CENELEC National Committees are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

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## FOREWORD

### 1) GENERAL

This Harmonization Document was prepared by CENELEC TC 14, following the decisions taken at the meeting in Paris on 9-10th December 1982, in Milan on 6th June 1984 and in Frankfurt am Main on 4th June 1985, on the results of a CENELEC questionnaire on IEC Publication 76.3 (1980) and Amendment No. 1 (1981). The complete text of this IEC Standard, modified as stated in Amendment No. 1, is endorsed as HD 398.3 with the exception of the commonly agreed CENELEC modifications to clauses 2, 3, 5 (including table II), 6, 11, 13, 14, A3.

The text takes into account the decisions taken at the 43rd and 44th meetings of the Technical Board, with some editorial variations decided unanimously during Frankfurt meeting of TC 14.

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### 2) NATIONAL DEVIATIONS

B - deviations, to be removed within 5 years, have been requested:

- for Table II of sub-clause 5.2 and 5.3 by FRANCE and NETHERLANDS,
- for sub-clause 11.1 by the NETHERLANDS.

They are listed in the list of national deviations which does not form part of the Harmonization Document.

## COMMON MODIFICATIONS

### Clause 2 "General"

#### Modification :

Modify the 8th paragraph as follows :

"The transformer shall be completely assembled as in service, except that for oil-immersed transformers the fitting of external cooling is not necessary while some supervisory equipment may be desirable.

#### Justification :

During the dielectric tests the various Buchholz relays provided for supervising the formation of gas in the event of an internal fault should be fitted.

### Clause 3 "Highest voltage for equipment and insulation level"

#### Modification :

In the first group of notes, add:

Note 3. - In certain applications with very special system conditions the specification of other combinations of withstand voltages may be justified. In such cases general guidance shall be obtained from Publication 71-1.

#### Justification :

Further to the requests of NCs of Austria and Germany concerning special national conditions for generator transformers of given voltage levels, the decisions of BT and the additional comments given by Swiss NC during Frankfurt meeting of TC 14, the above wording was unanimously agreed to solve particular network situations actually existing in some Countries

Table II of Sub-clauses 5.2 and 5.3 "Rated withstand voltages for transformer windings with highest voltage for equipment  $U_m < 300$  kV"

#### Modification :

-Between  $U_m = 72.5$  kV and  $U_m = 123$  kV add the value  $U_m = 100$  kV as follows:

Column 1	Column 2	Column 3
72.5	140	325
	150	380
100	185	450
123	230	550

Justification :

It has been deemed that it is justified to keep the level  $U_m = 100$  kV which was in IEC Publication 76 (1967) because one CENELEC country, namely FRANCE, has 90 kV networks which are expanding. For the transformers connected to these networks, the level  $U_m = 123$  kV would be too high.

Sub-clause 5.5.3 "Neutral terminal to be not directly earthed"

Modification :

- Delete the second paragraph.
- Modify as follows the last sentence of the third paragraph :

"It should be checked that the power-frequency withstand voltage is greater than the maximum power-frequency voltage arising under the considered fault conditions of the system."

Justification :

The second paragraph dealing with the rated voltage of the surge arrester is not needed since it is the responsibility of the purchaser to select the overvoltage protective device.

The second paragraph being deleted, the last sentence of the third paragraph, which referred to it, needs a modification.

Clause 6 "Tests on a transformer having a tapped winding"Modification :

At the end of the last paragraph add the following sentence:

"(If non-linear elements or surge arresters are used within the transformer, see also the last paragraph of Clause 2 and the 5th paragraph of Sub-clause 12.1)."

Justification :

This paragraph needed some complements for the case of use of non-linear elements or surge arresters within the transformer, and this may be made by referring to already existing Clauses.

Sub-clause 11.2 "Induced overvoltage withstand test for transformers with uniformly insulated high-voltage windings"Modification :

In the second paragraph, first line, delete "preferably".

Justification :

The test is always made with symmetrical three-phase voltages.

Sub-clause 11.3 "Induced phase-to-earth overvoltage withstand test for transformers with non-uniformly insulated H.V. windings :

$U_m < 300$  kV, or  $U_m \geq 300$  kV, specified according to method 1"

Modification :

- In the title, delete "phase-to-earth".
- Add at the end of the Sub-clause, on page 37, just after the existing Note which will become "Note 1", a second Note as follows :  
Note 2 : An additional induced overvoltage withstand test with symmetrical three-phase voltages according to sub-clause 11.2 may be agreed as a special test".

Justification :

The special test considered in this additional Note may be useful in some cases, in particular for generator transformers.

The addition of this note concerning such a test leads to delete "phase-to-earth" in the title. These words would not be appropriate and the rest of the title is sufficient for defining the scope of the Sub-clause.



Sub-clause 11.4 "Induced overvoltage withstand test for transformers with non-uniformly insulated H.V. windings,  $U_m \geq 300$  kV, specified according to method 2" :

Modification :

Add on page 41, after the existing Note which becomes "Note 1", a second Note as follows:

"Note 2 : If a three-phase transformer is to be tested in symmetrical three-phase connection, the test voltage between phases is higher than in single-phase connection. This may influence the phase-to-phase insulation design."

Justification :

This additional text draws attention to certain differences between single-phase and three-phase tests. These must be taken into account when designing the transformer.

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Sub-clause 13.3 "Test with lightning impulse chopped on the tail - Test sequence and test criteria":

Modification :

Add at the end of the Sub-clause the following text :

"If a rod-gap is used as the chopping device, times to chopping will often be very close but need not necessarily be so. An acceptable alternative test sequence is to omit the reduced chopped impulses and the test criteria are then the comparisons of the records of all the 100% full and reduced full impulses and those parts of the chopped impulses up to the time of chop.

There should be no variations between these records in excess of what would normally be allowed between records of full wave tests only."

Justification :

Useful addition concerning the test sequence and criteria which may be used when the chopping device is a rod-gap.

Sub-clause 14.3 "Switching impulse test - Test connections"

Modification :

Modify as follows the end of the second paragraph :

- delete the words between brackets,
- after "the two remaining terminals" add "which may be connected