

**Trifazni oljni distribucijski transformatorji od 50 do 2500 kVA, 50 Hz z najvišjo napetostjo naprave do 36 kV - 1. del: Splošne zahteve**

Three-phase oil-immersed distribution transformers 50 Hz, from 50 kVA to 2500 kVA with highest voltage for equipment not exceeding 36 kV – Part 1: General requirements



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Will supersede HD 428.1 S1:1992 + A1:1995 & HD 428.3 S1:1994

English version

**Three-phase oil-immersed distribution transformers 50 Hz, from 50 kVA to 2 500 kVA with highest voltage for equipment not exceeding 36 kV**  
**Part 1: General requirements**

Transformateurs triphasés de distribution immergés dans l'huile, 50 Hz, de 50 kVA à 2 500 kVA, de tension la plus élevée pour le matériel ne dépassant pas 36 kV  
Partie 1: Prescriptions générales

Drehstromverteilungstransformatoren der Energieversorgung, mit Ölfüllung, 50 Hz, 50 kVA bis 2 500 kVA, mit einer höchsten Spannung für Betriebsmittel kleiner oder gleich 36 kV  
Teil 1: Allgemeine Anforderungen

This draft European Standard is submitted to CENELEC members for CENELEC enquiry.  
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It has been drawn up by Technical Committee CENELEC/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.

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**CENELEC**

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

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### Foreword

This draft European Standard was prepared by CENELEC TC 14 "Power transformers". It is submitted to CENELEC enquiry.

This draft European standard will supersede HD 428.1 S1:1992 and HD 428.3 S1:1994.

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Draft for Enquiry

## 1 General

### 1.1 Scope

This document covers transformers from 50 kVA to 2 500 kVA intended for operation in three-phase distribution networks, for indoor or outdoor continuous service, 50 Hz, immersed in mineral oil, natural cooling, with two windings:

- a primary (high-voltage) winding with a highest voltage for equipment from 3,6 kV to 36 kV;
- a secondary (low-voltage) winding with a highest voltage for equipment not exceeding 1,1 kV.

NOTE 1 This document may be applied, either as a whole or in part, to transformers immersed in a synthetic insulating liquid.

NOTE 2 This document may be applied, either as whole or in part, to transformers having windings with more than one rated voltage. In this case the rated power for each rated voltage shall be specified by the purchaser.

The object of this document is to lay down requirements related to electrical characteristics and design of three phases distribution transformers immersed in mineral oil.

### 1.2 Normative references

The following referenced documents are indispensable for the application 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 50180		Bushings above 1 kV up to 36 kV and from 250 A to 3,15 kA for liquid filled transformers
EN 50181		Plug-in type bushings above 1 kV up to 36 kV and from 250 A to 1,25 kA for equipment other than liquid filled transformers
EN 50216	series	Power transformer and reactor fittings
EN 50386		Bushings up to 1 kV and from 250 A to 5 kA for liquid filled transformers
EN 50387		Busbar bushings up to 1 kV and from 1,25 kA to 5 kA, for liquid filled transformers
EN 60076	series	Power transformers (IEC 60076)
HD 428.2	series	Three-phase oil-immersed distribution transformers 50 Hz, from 50 to 2 500 kVA with highest voltage for equipment not exceeding 36 kV - Part 2: Distribution transformers with cable boxes on the high-voltage and/or low-voltage side
IEC/TR 60616		Terminal and tapping markings for power transformers

## 2 Electrical characteristics

### 2.1 Rated power

The values of the rated power are

50 kVA – 100 kVA – 160 kVA – 250 kVA – 315 kVA – 400 kVA – 500 kVA – 630 kVA –  
800 kVA – 1 000 kVA – 1 250 kVA – 1 600 kVA – 2 000 kVA – 2 500 kVA

The underlined values are preferred.

## 2.2 Highest voltages for equipment of windings

Insulation levels and dielectric tests shall be in accordance with the requirements of EN 60076-3,

The values of the highest voltage for equipment are

- for the high-voltage winding:

3,6 kV – 7,2 kV – 12 kV – 17,5 kV – 24 kV – 36 kV

- for the low-voltage winding:

1,1 kV

## 2.3 Rated voltages of windings

### 2.3.1 For the high-voltage winding

The rated value of the high voltage winding is above 1,1 kV, up to and including 36 kV.

### 2.3.2 For the low-voltage winding

The rated voltage shall be chosen among the following preferred values:

400 V – 410 V – 415 V – 420 V – 433 V

NOTE This document may be applied, either as a whole or in part, to transformers with rated low voltages below 400 V and above 433 V.

## 2.4 Tapping

The HV winding can be provided with tapping. The preferred tapping ranges are  $\pm 2,5\%$  or  $\pm 2 \times 2,5\%$  unless otherwise specified, but in any case maximum taps shall not exceed 7 positions and the total maximum range shall not exceed 15 %.

The tapping range has to be specified by the purchaser or by agreement between manufacturer and purchaser.

These taps shall be connected to an off-circuit tapping switch.

## 2.5 Connections

Connections shall be made in accordance with the provisions of Table 1.

**Table 1 – Connections for distribution transformers**

Rated power kVA	50 and 100	$\geq 160$
$U_m \leq 24$ kV	Y zn or D yn	D yn
$U_m = 36$ kV	Y zn or D yn	D yn

The clock hour figure shall be 5 or 11.

Connection symbol Y zn 5 ; Y zn 11 ; D yn 5 ; D yn 11.

Connections and clock figure shall be specified by the purchaser.

NOTE This document may be applied, either as a whole or in part, to transformers having connections other than those mentioned above

## 2.6 Dimensioning of neutral connection of the low-voltage winding

The neutral conductor and terminal of the low-voltage winding shall be dimensioned for rated current and earth fault current, unless otherwise specified.

## 2.7 Short-circuit impedance

The preferred values of the short-circuit impedance at a reference temperature of 75 °C are

- for rated voltage  $\leq 24$  kV (refer to Table 2),
- for rated voltage = 36 kV (refer to Table 4).

NOTE Other values of short-circuit impedance may be specified by the purchaser for particular system service conditions, e.g. in the case of parallel options.

## 2.8 Losses and sound power level

For transformers having listed values of rated power and preferred value of short-circuit impedance in accordance with 2.1 and 2.7, the values of losses and sound power levels are stated, for  $U_m \leq 24$  kV, in Table 2 (load losses) and Table 3 (no load losses and sound power levels), for  $U_m = 36$  kV in Table 4 (load losses) and Table 5 (no load losses and sound power levels).

The sound power levels given in Table 3 for  $U_m \leq 24$  kV and in Table 5 for  $U_m = 36$  kV are the maximum admitted (no tolerance). Lower sound power levels can be specified by the purchaser.

To choose the correct load losses (Table 2 or Table 4) and no load losses (Table 3 or Table 5) or when the loss values stated in the tables do not correspond to the actual evaluation of the energy cost, the transformers can be requested and offered with losses differing from the tabled losses; the capitalisation formula given in annex is applicable.

### 2.8.1 Load losses, no load losses and sound power level for $U_m \leq 24$ kV

In the following tables, column A values correspond to the lowest losses as commonly used in EU for electrical devices.

Transformers can be requested and offered with  $L_{WA}$  lower than the tabled values.

A "low noise" series with no load losses  $E_o$ ,  $D_o$ ,  $C_o$  or  $B_o$  can be proposed with the  $L_{WA}$  from the tabled values of  $D_o$ ,  $C_o$ ,  $B_o$  or  $A_o$  respectively.

Table 2 - Load losses  $P_k$  (W) at 75 °C for  $U_m \leq 24$  kV

Rated power KVA	$D_k$ W	$C_k$ W	$B_k$ W	$A_k$ W	Short-circuit impedance %
50	1 350	1 100	875	750	4
100	2 150	1 750	1 475	1 250	
160	3 100	2 350	2 000	1 700	
250	4 200	3 250	2 750	2 350	
315	5 000	3 900	3 250	2 800	
400	6 000	4 600	3 850	3 250	
500	7 200	5 500	4 600	3 900	
630	8 400	6 500	5 400	4 600	
630	8 700	6 750	5 600	4 800	6
800	10 500	8 400	7 000	6 000	
1 000	13 000	10 500	9 000	7 600	
1 250	16 000	13 500	11 000	9 500	
1 600	20 000	17 000	14 000	12 000	
2 000	26 000	21 000	18 000	15 000	
2 500	32 000	26 500	22 000	18 500	