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Three phase oil-immersed distribution transformers 50 Hz, from 50 to 2500 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 - Section 1: General requirements

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Descriptors: Transformer, three phase transformer, immersed transformer, distribution transformer, termination in cables boxes, design characteristic, dimension

## ENGLISH VERSION

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  
Section 1: General requirements

Transformateurs triphasés de  
distribution immergés dans  
l'huile, 50 Hz, de 50 à 2500  
kVA, avec une tension la plus  
élevée pour le matériel ne  
dépasant pas 36 kV

Partie 2: Transformateurs de  
distribution raccordés par  
boîtes à câble côté haute  
tension et/ou côté basse  
tension

Section 1: Prescriptions  
générales

Drehstrom-Öl-Verteilungstrans-  
formatoren 50 Hz von 50 bis  
2500 kVA, mit einer höchsten  
Spannung für Betriebsmittel  
bis 36 kV

Teil 2: Verteilungstrans-  
formatoren mit  
Kabelanschlußkästen  
auf der Ober- und/oder  
Unterspannungsseite

Hauptabschnitt 1: Allgemeine  
Anforderungen

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which stipulate the conditions for implementation of this Harmonization Document  
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Up-to-date lists and bibliographical references concerning national implementation  
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This Harmonization Document exists in three official versions (English, French,  
German).

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Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg,  
Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

## CENELEC

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

Central Secretariat: rue de Stassart 35, B-1050 Brussels

### Foreword

This Part 2.1 of HD 428 was prepared by WG 5 of Technical Committee TC 14, Power transformers. It covers the general arrangement of the transformer when intended to be equipped with cable boxes. This feature is commonly used in some countries of Europe for public distribution and in most countries for industrial applications.

The document was submitted to the formal vote and was approved by CENELEC as HD 428.2.1 S1 on 1994-09-22.

The following dates were fixed:

- latest date of announcement of the HD at national level (doa) 1994-04-01
- latest date of publication of a harmonized national standard (dop) 1994-10-01
- latest date of withdrawal of conflicting national standards (dow) 1994-10-01

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## 1 General

HD 428.1 subclause 3.3 states that a distribution transformer could have different termination features.

The following constructional situations are possible:-

- i) Termination in open type (oil-air) bushings without protection. This is covered by HD 428.1, HD 428.3, HD 506, HD 596 and HD 607.
- ii) Termination in plug-in type bushings of inside or outside cone type. This is covered by HD 428.1, HD 428.3 and HD 506.
- iii) Termination in air filled or oil/compound filled cable boxes or protective enclosure using open type and/or oil-oil bushings, as defined in HD 428.2.2.
- iv) Flange boxes and similar solutions using open type bushings can also be used.

This document covers, in conjunction with HD 428.1, distribution transformers under iii) and iv) above, up to 24 kV. An annex may in the future be issued to cover 36 kV. Further documents exist which may be used by agreement between purchaser and manufacturer for cable boxes and enclosures. The dimensional requirements for cable boxes and protective enclosures are not included in this document.

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Unless otherwise stated in this document, HD 428.1 shall be applied.

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## 2 Definitions

For the purposes of this document, distribution transformers shall be classified according to the following definitions:-

### 2.1 transformers with cable boxes, side mounted

A transformer with electrical characteristics in the range defined in HD 428.1 with facings on the transformer's tank side for provision of cable boxes, Type 1. These facings shall be on opposite sides of the transformer (as figure 1).

### 2.2 transformers with cable boxes or similar, cover mounted

A transformer with electrical characteristics in the range defined in HD 428.1, with terminations mounted on the tank cover. The terminations exit in such a way as to provide for cables on opposite sides of the transformer. The type of termination can be either cable box Type 1 or cable box Type 2 (as figures 3,4).

### 2.3 unit substation transformer, side mounted

A transformer with electrical characteristics in the range defined in HD 428.1, having facings on the transformer's tank side for provision of HV switchgear and LV equipment. These facings shall be on the same side of the transformer (as figure 2).

#### **2.4 unit substation transformer, cover mounted**

A transformer with electrical characteristics in the range defined in HD 428.1, with terminations mounted on the tank cover and enclosed in a flange box.

Figure 5 shows a typical arrangement, however, dimension should be agreed between manufacturer and purchaser.

#### **2.5 cable boxes, Type 1**

A metallic box designed for receiving and protecting the ends of HV or LV cables so that the cable dielectric may be effectively sealed against moisture damage. A minimum protection of IP54 is required. These boxes are not specified in this section. A higher protection, IP65, may be necessary to satisfy termination requirements.

#### **2.6 cable boxes, Type 2**

A metallic or non-metallic enclosure designed to prevent accidental contact with live parts. The enclosure can be common to HV and LV terminations or be independent for HV and LV. A protection between IP33 and IP55 is required and is subject to agreement between manufacturer and purchaser.

#### **2.7 flange box**

An enclosure designed to provide flanges for mounting ancillary equipment on opposite sides of the transformer as figures 5 and 6. The box is mounted on the cover of the transformer. The IP rating is dependent on the mounted equipment and is subject to agreement between manufacturer and purchaser.

### **3 Electrical characteristics**

These shall comply with HD 428.1 - S1 clause 2. In respect of subclause 2.9 a), also List I for impulse withstand voltage is admitted. To derive the insulation and dielectric test level, the impulse withstand voltage shall be taken from HD 398.3 Table II List 1 or List 2 as agreed between manufacturer and purchaser.

### **4 Design characteristics**

#### **4.1 Type of oil preservation and degree of sealing**

These shall comply with subclause 3.1 of HD 428.1.

#### **4.2 Terminal markings**

These shall comply with subclause 3.2 of HD 428.1.

#### 4.3 Provision for cable box Type 1 connections

Facings shall be provided for mounting HV and LV bushing assemblies and cable boxes, as detailed in figures 1, 2 and 3 of this document.

Fixing methods shall be provided on transformer facings positioned as defined on the appropriate drawings given in figures 1, 2 and 3.

#### 4.4 Provision for cable box Type 2

Facings shall be provided for mounting HV and LV bushing assemblies with cable box Type 2 as shown in figures 4 and 5. The use of independent HV and LV enclosure shall be subject to agreement between manufacturer and purchaser.

### 5 Transformer requirements

#### 5.1 Transformers with cable boxes, mounted on both sides

Limiting dimensions are indicated in figure 1.

The underbase is generally in the form of skids, provided with axle holes.

Four jacking lugs shall be provided, if specified by the purchaser.

Two lifting fittings shall be provided of adequate section. These shall be positioned to facilitate lifting in a reasonably upright position, taking into account the cable box weight. These weights to be given by the purchaser if necessary.

Unless otherwise state, cable boxes Type 1 as defined in 2.5 shall be fitted to the high voltage facing and a bushing assembly shall be fitted to the low voltage facing. The termination of the low voltage shall be specified by purchaser at time of enquiry.

Other accessories shall comply with HD 428.1 clause 5 and shall preferably be mounted on one end of the tank and shall not be obstructed by coolers.

Unless otherwise agreed, two earthing terminals shall be fitted on the centre line, one below each connection facing, with the connection hole placed on the lower part of the tank.

#### 5.2 transformers with cable boxes, cover mounted

There are no limiting dimensions.

The accessories shall comply with clause 5 of HD 428.1.

**5.2.1 Cable box Type 1.** A cable box Type 1 shall be fitted to the high voltage flange. The termination of the low voltage shall be as specified by the purchaser at time of enquiry.

One method of cover mounting cable boxes Type 1 is shown in figure 3 of this document which defines its own flange fitting that shall always be maintained.

**5.2.2 Cable box Type 2.** A cable box Type 2 is provided for either both high voltage and low voltage terminations or only one of them. This shall be agreed between manufacturer and purchaser.

One method of cover mounting cable boxes Type 2 is shown in figure 4 of this document.

### **5.3 Unit substation transformer, with cable boxes mounted on the same side**

Limiting dimensions are indicated in figure 2.

A stable fixing for HV switchgear equipment can be requested by the purchaser, in a position as indicated in figure 2. The requirements of this fixing are subject to agreement between purchaser and manufacturer. The fixing shall be capable of supporting an agreed load and designed so as to not load the facing flange.

An LV bushing plate assembly shall be provided on a mounting pocket. The mounting pocket flange face shall lie in the same plane as the face of the pocket provided for the HV ring main equipment. The termination of the low voltage shall be specified by the purchaser.

The flange face of the mounting pockets of HV/LV shall be flat and sufficiently robust to prevent distortion and oil leakage when the agreed equipment is bolted thereto.

The transformer tank with its cover removed shall be capable of withstanding the combined loads of the agreed attached equipment without distortion. The transformer shall not be moved or lifted whilst in this condition and shall be stable.

Lifting fittings shall be provided on the transformer's tank of adequate section to facilitate lifting the transformer and fittings in a reasonably upright position, with or without the agreed attached equipment.

### **5.4 unit substation transformer with flange boxes, cover mounted**

The general arrangement in the case of common HV and LV flange box is shown in figure 5. For independent HV and LV enclosures see Subclause 3.4. A typical flange for interfacing between the flange box and Type 2 cable boxes is shown in figure 6.

The accessories shall comply with clause 5 of HD 428.1.

## **6 Distance between bushings**

The distance between bushings is detailed in further sections of this document.



## 7 Tests

Type and routine tests of the transformer should be in accordance with HD 428.1. The transformer may be tested without cable boxes.

If it is required to test with boxes attached, then in the case of fully insulated air filled boxes it is allowed to perform tests with the cable boxes filled with oil.

The filling with oil is not allowed for the purposes of type testing air filled boxes.

Other test requirements may be required as a consequence of further sections of this document.

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