

Three phase dry-type distribution transformers 50 Hz, from 100 to 3 150 kVA, with highest voltage for equipment not exceeding 36 kV - Part 2: Determination of the power rating of a transformer loaded with non-sinusoidal current

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 50541-2:2013 sisaldab Euroopa standardi EN 50541-2:2013 ingliskeelset teksti.	This Estonian standard EVS-EN 50541-2:2013 consists of the English text of the European standard EN 50541-2:2013.
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English version

**Three phase dry-type distribution transformers 50 Hz, from 100 kVA to 3 150 kVA, with highest voltage for equipment not exceeding 36 kV -
Part 2: Determination of loadability of a transformer loaded with non-sinusoidal current**

Transformateurs triphasés de distribution de type sec 50 Hz, de 100 kVA à 3 150 kVA, avec une tension la plus élevée pour le matériel ne dépassant pas 36 kV -
Partie 2: Détermination de la caractéristique de puissance d'un transformateur avec des courants de charge non-sinusoïdaux

Drehstrom-Trocken-Verteilungstransformatoren, 50 Hz, 100 kVA bis 3 150 kVA, mit einer höchsten Spannung für Betriebsmittel kleiner oder gleich 36 kV -
Teil 2: Bestimmung der Bemessungsleistung eines Transformators bei nicht sinusförmigen Lastströmen

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

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Foreword

This document (EN 50541-2:2013) 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) 2014-04-15
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2016-04-15

The EN 50541 series consists of the following parts, under the general title: "*Three phase dry-type distribution transformers 50 Hz, from 100 kVA to 3 150 kVA, with highest voltage for equipment not exceeding 36 kV*":

- *Part 1: General requirements*
- *Part 2: Determination of loadability of a transformer loaded with non-sinusoidal current*

This document supersedes HD 538.3 S1:1997.

1 Scope

This European Standard gives to the user guidance to determine the loadability of dry type distribution transformers, as defined in and covered by EN 50541-1, in the case of load current with harmonic factors exceeding the maximum values allowed.

2 Application

For normal electrical energy distribution, the allowable total harmonic factor¹⁾ and even harmonic factor due to the load current are assumed to be limited to 5 % and 1 % respectively.

For electrical distribution with higher harmonic factors, it has to be taken into account that the load loss increases and, by consequence, the temperature rises in the transformer exceed those corresponding to sinusoidal currents having the same r.m.s. value.

If the transformer is intended for converter operation or the harmonic factor is higher than 5 %, the matter is discussed between purchaser and manufacturer.

3 Equivalent power rating

The equivalent power rating is related to sinusoidal current which causes the same losses as those occurring with the non-sinusoidal current imposed.

The equivalent power rating is equal to the power based on the r.m.s. value of the non-sinusoidal current multiplied by the factor K .

The rated power of the transformer to be used shall be equal to or higher than the equivalent power rating.

In case a transformer in service is subsequently loaded with harmonic currents, a derating factor $1/K$ shall be applied to the rated power.

4 Calculation of the factor K to obtain the equivalent power rating

The factor K is given by the following formula²⁾:

$$K = \left[1 + \frac{e}{1+e} \left(\frac{I_1}{I} \right)^2 \sum_{n=2}^{n=N} n^q \left(\frac{I_n}{I_1} \right)^2 \right]^{\frac{1}{2}}$$

where

1) The harmonic factor H , in percentage, is defined by:

$$H\% = 100 \left[\sum_{n=2}^{n=N} \left(\frac{I_n}{I_1} \right)^2 \right]^{\frac{1}{2}}$$

2) In the formula, it is assumed that both power ratings are based on the same r.m.s. value of the load current.