Irish Standard
I.S. EN 50629:2015&A1:2016&A2:2018

Energy performance of large power transformers (Um > 36 kV or Sr ≥ 40 MVA)

I.S. EN 50629:2015&A1:2016&A2:2018

Incorporating amendments/corrigenda/National Annexes issued since publication:

EN 50629:2015/A1:2016
EN 50629:2015/A2:2018

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard — national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation — recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

This document replaces/revises/consolidates the NSAI adoption of the document(s) indicated on the CEN/CENELEC cover/Foreword and the following National document(s):

NOTE: The date of any NSAI previous adoption may not match the date of its original CEN/CENELEC document.

This document is based on:	*Published:*
EN 50629:2015	2015-06-26

This document was published under the authority of the NSAI and comes into effect on:	ICS number:
2018-01-30	NOTE: If blank see CEN/CENELEC cover page

NSAI	T +353 1 807 3800	Sales:
1 Swift Square,	F +353 1 807 3838	T +353 1 857 6730
Northwood, Santry	E standards@nsai.ie	F +353 1 857 6729
Dublin 9	W NSAI.ie	W standards.ie

Údarás um Chaighdeáin Náisiúnta na hÉireann

National Foreword

I.S. EN 50629:2015&A1:2016&A2:2018 is the adopted Irish version of the European Document EN 50629:2015, Energy performance of large power transformers (Um > 36 kV or Sr ≥ 40 MVA)

This document does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with this document does not of itself confer immunity from legal obligations.

In line with international standards practice the decimal point is shown as a comma (,) throughout this document.

This page is intentionally left blank

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 50629:2015/A2

January 2018

ICS 29.180

English Version

Energy performance of large power transformers (U_m > 36 kV or $S_r \geq 40$ MVA)

Performance énergétique des transformateurs de grande puissance (U_m > 36 kV ou $S_r \geq$ 40 MVA)

Energiekennwerte von Großleistungstransformatoren (U_m > 36 kV oder $S_r \geq$ 40 MVA)

This amendment A2 modifies the European Standard EN 50629:2015; it was approved by CENELEC on 2017-11-13. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This amendment exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Ref. No. EN 50629:2015/A2:2018 E

Contents

Page

European foreword

This document (EN 50629:2015/A2:2018) 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)	2017-11-13
-	latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2020-11-13

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

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 50629:2015.

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 50629:2015/A1

June 2016

ICS 29.180

English Version

Energy performance of large power transformers (Um > 36 kV or Sr ≥ 40 MVA)

Performance énergétique des transformateurs de grande puissance (Um > 36 kV ou Sr ≥ 40 MVA)

Energiekennwerte von großen Leistungstransformatoren (Um > 36 kV oder Sr ≥ 40 MVA)

This amendment A1 modifies the European Standard EN 50629:2015; it was approved by CENELEC on 2016-05-23. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This amendment exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

European foreword

This document (EN 50629:2015/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

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

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 50629:2015.

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 50629

June 2015

ICS 29.180

English Version

Energy performance of large power transformers (Um > 36 kV or Sr ≥ 40 MVA)

Performance énergétique des transformateurs de grande puissance (Um > 36 kV ou Sr ≥ 40 MVA)

Energiekennwerte von Großleistungstransformatoren (Um > 36 kV oder Sr ≥ 40 MVA)

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 50629:2015 E

Contents

Page

Foreword

This document (EN 50629:2015) 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)	2016-06-25
- latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2018-06-25

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

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 (EC).

For the relationship with requirements of Commission Regulation (EC) see informative Annex ZZ, which is an integral part of this document.

Introduction

This European Standard has been prepared at the request of the European Commission under the mandate EC 24/2011 and applies to large power transformers covered by the COMMISSION REGULATION (EU) N. 548/2014 of 21 May 2014.

For large power transformers (LPT) the strict definition of efficiency based on transmitted and absorbed active power alone is not useful for evaluating the energy performance because the losses are either fixed (no load loss), or depend on current (load loss) and therefore conventional efficiency would be zero if only reactive power is transmitted (reactive power transmission is very important for network operation). The conventional calculation of efficiency is therefore not helpful for comparing transformer designs which may be used over a range of operating conditions.

In general for LPT it is not possible to give optimal values for load and no load losses for a particular rated power because of the variety of applications which affect the energy performance.

In order to define an index that is specific to the transformer design, but applicable to a wide range of uses, rather than a figure that varies from second to second depending on system conditions, it is essential to characterize the energy performance of power transformers. For this reason a metric – Peak Efficiency Index (PEI) – has been developed which is based on real power losses and total power transmitted and is independent of load phase angle, load factor and rated power.

This document provides a standard method for evaluating the energy performance of power transformers through the use of the Peak Efficiency Index, gives benchmark figures for PEI and the reasons why certain transformers may have efficiencies which are higher or lower than the benchmark.

Setting a reasonable value of minimum Peak Efficiency Index will be effective in improving the overall efficiency of the installed transformer population by eliminating transformers with poor efficiency, with the exception of some transformers subject to specific limitations.

The use of a minimum value of Peak Efficiency Index sets a floor for transformer efficiency performance, but the use of proper loss capitalisation for purchasing transformers is essential to select a transformer with the optimal economically justified level of efficiency. Users not using loss capitalisation are strongly encouraged to investigate the benefits of doing so.

For large units above 100 MVA the economically achievable efficiency of a transformer may be limited by the technical parameters of the network (e.g. impedance), and specific transport and installation constraints. As the units concerned are usually purchased by large transmission system owners, who typically use high values of loss capitalization, those units above 100 MVA already tend to be state of the art as far as efficiency is concerned.

For transformers with unusual configurations and/or very severe size or weight limitations it may be unreasonable to meet the minimum efficiency requirement for either technical or economic reasons. In these cases it will be acceptable to demonstrate that the highest reasonable level of efficiency has been achieved (see Clause 6).

It is considered that the approach to energy performance set out in this document could also be applicable in principle to transformers outside the scope of this standard.

1 Scope

This European Standard applies to new three-phase and single-phase power transformers with a highest voltage for equipment exceeding 36 kV and a rated power equal or higher than 5 kVA, or a rated power equal to or higher than 40 MVA regardless of the highest voltage for equipment.

The scope of this European Standard is the following:

- Defining the appropriate energy efficiency criteria;
- Setting of benchmark minimum efficiency levels for new transformers based on an assessment of the energy efficiency of the European transformer population installed in the last 10 years;
- Proposing higher minimum efficiency levels for improving the energy efficiency of new transformers;
- Providing guidance for consideration of Total Cost of Ownership.

This European Standard provides also a form for efficiency data collection to inform future efficiency benchmark levels.

NOTE 1 This standard covers the transformers under the EU Regulation N. 548/2014 and gives additional specific guidance for single phase transformers, autotransformers, multi winding transformers and for transformers with OD and OF cooling systems, necessary for the correct application of energy efficiency requirements to these categories of transformers.

Transformers considered to be out of the scope of this document are the following:

- instrument transformers, specifically designed to supply measuring instruments, meters, relays and other similar apparatus,
- transformers with low-voltage windings specifically designed for use with rectifiers to provide a DC supply,
- transformers specifically designed to be directly connected to a furnace,
- transformers specifically designed for offshore applications and floating offshore applications,
- transformers specially designed for emergency installations,
- transformers and auto-transformers specifically designed for railway feeding systems,
- earthing or grounding transformers, this is, three-phase transformers intended to provide a neutral point for system grounding purposes,
- traction transformers mounted on rolling stock, this is, transformers connected to an AC or DC contact line, directly or through a converter, used in fixed installations of railway applications,
- starting transformers, specifically designed for starting three-phase induction motors so as to eliminate supply voltage dips,
- testing transformers, specifically designed to be used in a circuit to produce a specific voltage or current for the purpose of testing electrical equipment,
- welding transformers, specifically designed for use in arc welding equipment or resistance welding equipment,
- transformers specifically designed for explosion-proof and underground mining applications,
- transformers specifically designed for deep water (submerged) applications,
- medium Voltage (MV) to Medium Voltage (MV) interface transformers up to 5 MVA,
- large power transformers where it is demonstrated that for a particular application, technically feasible alternatives are not available to meet the minimum efficiency requirements set out by EU REGULATION N. 548/2014,
- 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.

For dry type large power transformers Minimum PEI values have been published in European Regulation and these values are included in Annex A.

NOTE 2 To retain consistency, the same list of exclusions in the EU Regulation N. 548/2014, has also been reproduced here. Within the above EU exclusion list, some had been excluded simply because no PEI data was available to CENELEC at the time on which to base appropriate PEI levels. Consequently, as such information becomes available in the future, it may be possible to derive suitable PEI Levels. Accordingly these particular categories are listed in Clause 6 as suitable for future consideration.