SLOVENSKI STANDARD
SIST EN 60076-1:2012

01-januar-2012

Močnostni transformatorji - 1. del: Splošno

Power transformers - Part 1: General

Leistungstransformatoren - Teil 1: Allgemeines

Transformateurs de puissance - Partie 1: Généralités

Ta slovenski standard je istoveten z: **EN 60076-1:2011**

ICS:

29.180	Transformatorji. Dušilke	Transformers. Reactors

SIST EN 60076-1:2012 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60076-1

November 2011

ICS 29.180

Supersedes EN 60076-1:1997 + A1:2000 + A12:2002

English version

Power transformers - Part 1: General

(IEC 60076-1:2011)

Transformateurs de puissance - Partie 1: Généralités (CEI 60076-1:2011)

Leistungstransformatoren - Teil 1: Allgemeines (IEC 60076-1:2011)

This European Standard was approved by CENELEC on 2011-05-25. 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.

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 European Standard 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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Ref. No. EN 60076-1:2011 E

Foreword

The text of document 14/675/FDIS, future edition 2 of IEC 60076-1, prepared by IEC TC 14, Power transformers, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60076-1 on 2011-05-25.

This European Standard supersedes EN 60076-1:1997 + A1:2000 + A12:2002.

EN 60076-1:2011 includes the following significant technical changes with respect to EN 60076-1:1997:

– addition of a definition of harmonic content;

– addition of a subclause on transport;

– addition of functional method of specification;

– addition of connection symbols for single phase transformers;

– addition of safety and environmental requirements;

– addition of requirements for liquid preservation systems;

– addition of a clause on DC currents;

– addition of vacuum, pressure and leak tests on tanks;

– the requirements formerly in Annex A are now incorporated in the text and Annex A is now an informative checklist;

– informative annexes have been added on facilities for condition monitoring and environmental and safety considerations.

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

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2012-05-04
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2014-05-25

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60076-1:2011 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60060 series	NOTE	Harmonized in EN 60060 series (not modified).
IEC 60068-3-3	NOTE	Harmonized as EN 60068-3-3.
IEC 60076-4	NOTE	Harmonized as EN 60076-4.
IEC 60076-6	NOTE	Harmonized as EN 60076-6.
IEC 60076-13	NOTE	Harmonized as EN 60076-13.
IEC 60270	NOTE	Harmonized as EN 60270.
IEC 60310	NOTE	Harmonized as EN 60310.
IEC 60529:1989	NOTE	Harmonized as EN 60529:1991 (not modified).
IEC 61378 series	NOTE	Harmonized in EN 61378 series (not modified).
IEC 61378-1	NOTE	Harmonized as EN 61378-1.
IEC 61378-2	NOTE	Harmonized as EN 61378-2.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60076-2	-	Power transformers - Part 2: Temperature rise for liquid-immersed transformers	EN 60076-2	-
IEC 60076-3	2000	Power transformers - Part 3: Insulation levels, dielectric tests and external clearances in air	EN 60076-3	2001
IEC 60076-5	2006	Power transformers - Part 5: Ability to withstand short circuit	EN 60076-5	2006
IEC 60076-10	2001	Power transformers - Part 10: Determination of sound levels	EN 60076-10	2001
IEC 60076-11	2004	Power transformers - Part 11: Dry-type transformers	EN 60076-11	2004
IEC 60137	2008	Insulated bushings for alternating voltages above 1 000 V	EN 60137	2008
IEC 60214-1	2003	Tap-changers - Part 1: Performance requirements and test methods	EN 60214-1	2003
IEC 60296	2003	Fluids for electrotechnical applications - Unused mineral insulating oils for transformers and switchgear	EN 60296 + corr. September	2004 2004
IEC 60721-3-4	1995	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 4: Stationary use at non-weatherprotected locations	EN 60721-3-4	1995
ISO 9001	2008	Quality management systems - Requirements	EN ISO 9001	2008

IEC 60076-1

Edition 3.0 2011-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Power transformers –
Part 1: General

Transformateurs de puissance –
Partie 1: Généralités

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX XB

ICS 29.180

ISBN 978-2-88912-438-1

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

POWER TRANSFORMERS –

Part 1: General

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60076-1 has been prepared by IEC technical committee 14: Power transformers.

This third edition cancels and replaces the second edition published in 1993, and its Amendment 1(1999). It is a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

– addition of a definition of harmonic content;
– addition of a subclause on transport;
– addition of functional method of specification;
– addition of connection symbols for single phase transformers;
– addition of safety and environmental requirements;
– addition of requirements for liquid preservation systems;

– addition of a clause on DC currents;
– addition of vacuum, pressure and leak tests on tanks;
– the requirements formerly in Annex A are now incorporated in the text and Annex A is now an informative checklist;
– informative annexes have been added on facilities for condition monitoring and environmental and safety considerations.

The text of this standard is based on the following documents:

FDIS	Report on voting
14/675/FDIS	14/682/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 60076 series can be found, under the general title *Power transformers*, on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

POWER TRANSFORMERS –

Part 1: General

1 Scope

This part of IEC 60076 applies to three-phase and single-phase power transformers (including auto-transformers) with the exception of certain categories of small and special transformers such as:

– single-phase transformers with rated power less than 1 kVA and three-phase transformers less than 5 kVA;
– transformers, which have no windings with rated voltage higher than 1 000 V;
– instrument transformers;
– traction transformers mounted on rolling stock;
– starting transformers;
– testing transformers;
– welding transformers;
– explosion-proof and mining transformers;
– transformers for deep water (submerged) applications.

When IEC standards do not exist for such categories of transformers (in particular transformer having no winding exceeding 1000 V for industrial applications), this part of IEC 60076 may still be applicable either as a whole or in part.

This standard does not address the requirements that would make a transformer suitable for mounting in a position accessible to the general public.

For those categories of power transformers and reactors which have their own IEC standards, this part is applicable only to the extent in which it is specifically called up by cross-reference in the other standard. Such standards exist for:

– reactors in general (IEC 60076-6);
– dry-type transformers (IEC 60076-11);
– self-protected transformers (IEC 60076-13);
– gas-filled power transformers (IEC 60076-15);
– transformers for wind turbine applications (IEC 60076-16);
– traction transformers and traction reactors (IEC 60310);
– converter transformers for industrial applications (IEC 61378-1);
– converter transformers for HVDC applications (IEC 61378-2).

At several places in this part it is specified or recommended that an 'agreement' should be reached concerning alternative or additional technical solutions or procedures. Such agreement is made between the manufacturer and the purchaser. The matters should preferably be raised at an early stage and the agreements included in the contract specification.

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.

IEC 60076-2, *Power transformers – Part 2: Temperature rise for liquid-immersed transformers*

IEC 60076-3:2000, *Power transformers – Part 3: Insulation levels, dielectric tests and external clearances in air*

IEC 60076-5:2006, *Power transformers – Part 5: Ability to withstand short circuit*

IEC 60076-10:2001, *Power transformers – Part 10: Determination of sound levels*

IEC 60076-11:2004, *Power transformers – Part 11: Dry-type transformers*

IEC 60137:2008, *Insulated bushings for alternating voltages above 1 000 V*

IEC 60214-1:2003, *Tap-changers – Part 1: Performance requirements and test methods*

IEC 60296:2003, *Fluids for electrotechnical applications – Unused mineral insulating oils for transformers and switchgear*

IEC 60721-3-4:1995, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 4: Stationary use at non-weatherprotected locations*

ISO 9001:2008, *Quality management systems – Requirements*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE Other terms use the meanings ascribed to them in the International Electrotechnical Vocabulary (IEV).

3.1 General

3.1.1
power transformer
a static piece of apparatus with two or more windings which, by electromagnetic induction, transforms a system of alternating voltage and current into another system of voltage and current usually of different values and at the same frequency for the purpose of transmitting electrical power

[IEC 60050-421:1990, 421-01-01, modified]

3.1.2
auto-transformer
a transformer in which at least two windings have a common part

[IEC 60050-421:1990, 421-01-11]

NOTE Where there is a need to express that a transformer is not auto-connected, use is made of terms such as separate winding transformer, or double-wound transformer (see IEC 60050-421:1990, 421-01-13).

3.1.3
series transformer
a transformer, other than an autotransformer, of which one winding is intended to be connected in series with a circuit in order to alter its voltage and/or shift its phase. The other winding is an energizing winding

[IEC 60050-421:1990, 421-01-12, modified]

NOTE Series transformers were called booster transformers in earlier editions of this standard.

3.1.4
liquid-immersed type transformer
a transformer in which the magnetic circuit and windings are immersed in liquid

3.1.5
dry-type transformer
a transformer in which the magnetic circuit and windings are not immersed in an insulating liquid

[IEC 60050-421:1990, 421-01-16]

3.1.6
liquid preservation system
system in a liquid-filled transformer by which the thermal expansion of the liquid is accommodated.

NOTE Contact between the liquid and external air may sometimes be diminished or prevented.

3.1.7
specified value
the value specified by the purchaser at the time of order

3.1.8
design value
the expected value given by the number of turns in the design in the case of turns ratio or calculated from the design in the case of impedance, no-load current or other parameters

3.1.9
highest voltage for equipment U_m applicable to a transformer winding
the highest r.m.s. phase-to-phase voltage in a three-phase system for which a transformer winding is designed in respect of its insulation

3.2 Terminals and neutral point

3.2.1
terminal
a conducting element intended for connecting a winding to external conductors

3.2.2
line terminal
a terminal intended for connection to a line conductor of a network

[IEC 60050-421:1990, 421-02-01]

3.2.3
neutral terminal
a) for three-phase transformers and three-phase banks of single-phase transformers:

the terminal or terminals connected to the common point (the neutral point) of a star-connected or zigzag connected winding