SLOVENSKI STANDARD
SIST EN 61378-1:2012

01-januar-2012

Konvertorski transformatorji - 1. del: Transformatorji za industrijsko uporabo

Converter transformers - Part 1: Transformers for industrial applications

Stromrichtertransformatoren - Teil 1: Transformatoren für industrielle Anwendungen

Transformateurs de conversion - Partie 1: Transformateurs pour applications industrielles

Ta slovenski standard je istoveten z: **EN 61378-1:2011**

ICS:

29.180 Transformatorji. Dušilke Transformers. Reactors

SIST EN 61378-1:2012 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 61378-1

November 2011

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Supersedes EN 61378-1:1998 + corr. Nov.1998

English version

Convertor transformers - Part 1: Transformers for industrial applications

(IEC 61378-1:2011)

Transformateurs de conversion - Partie 1: Transformateurs pour applications industrielles (CEI 61378-1:2011)

Stromrichtertransformatoren - Teil 1: Transformatoren für industrielle Anwendungen (IEC 61378-1:2011)

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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 61378-1:2011 E

Foreword

The text of document 14/686/FDIS, future edition 2 of IEC 61378-1, prepared by IEC/TC 14, "Power transformers", was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61378-1:2011.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2012-05-30
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2014-08-30

This document supersedes EN 61378-1:1998 + corr. Nov.1998.

EN 61378-1:2011 includes the following significant technical changes with respect to EN 61378-1:1998 + corr. Nov.1998:

- addition of winding connections (zig-zag, extended delta, etc.) with phase displacement (<30°);
- addition of transformers with more than one active part in the same tank;
- change of reference power definition (it is now based on fundamental component of the current);
- addition of considerations for guidelines for OLTC selection;
- addition of regulating transformer feeding converter transformer;
- addition of considerations about current sharing and hot spot temperature in high currentwindings for various winding arrangements;
- addition of transductors used for d.c. voltage regulation together with diode rectifiers;
- improved old annexes with several calculation examples;
- addition of new annexes for special measurements setups.

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.

Endorsement notice

The text of the International Standard IEC 61378-1:2011 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 60076-4:2002	NOTE	Harmonized as EN 60076-4:2002 (not modified).
IEC 60076-5:2006	NOTE	Harmonized as EN 60076-5:2006 (not modified).
IEC 60076-10:2001	NOTE	Harmonized as EN 60076-10:2001 (not modified).
IEC 60146-1-3:1991	NOTE	Harmonized as EN 60146-1-3:1993 (not modified).
IEC 61378-2:2001	NOTE	Harmonized as EN 61378-2:2001 (not modified).

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 60050-421	1990	International electrotechnical vocabulary (IEV) - Chapter 421: Power transformers and reactors	-	-
IEC 60076	Series	Power transformers	EN 60076	Series
IEC 60076-1	2011	Power transformers - Part 1: General	EN 60076-1	2011
IEC 60076-2	2011	Power transformers - Part 2: Temperature rise for liquid-immersed transformers	EN 60076-2	2011
IEC 60076-3 + corr. December	2000 2000	Power transformers - Part 3: Insulation levels, dielectric tests and external clearances in air	EN 60076-3	2001
IEC 60076-6	2007	Power transformers - Part 6: Reactors	EN 60076-6	2008
IEC 60076-8	1997	Power transformers - Part 8: Application guide	-	-
IEC 60076-11	2004	Power transformers - Part 11: Dry-type transformers	EN 60076-11	2004
IEC 60146	Series	Semiconductor converters - General requirements and line commutated converters	EN 60146	Series
IEC 60146-1-1	2009	Semiconductor converters - General requirements and line commutated converters - Part 1-1: Specification of basic requirements	EN 60146-1-1	2010
IEC/TR 60146-1-2	2011	Semiconductor converters - General requirements and line commutated converters - Part 1-2: Application guide	-	-
IEC/TR 60616	1978	Terminal and tapping markings for power transformers	-	-

IEC 61378-1

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INTERNATIONAL STANDARD

colour inside

Converter transformers –
Part 1: Transformers for industrial applications

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

CONVERTER TRANSFORMERS –

Part 1: Transformers for industrial applications

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.
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International Standard IEC 61378-1 has been prepared by IEC technical committee 14: Power transformers.

This second edition cancels and replaces the first edition published in 1997. It constitutes a technical revision.

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

- addition of winding connections (zig-zag, extended delta, etc.) with phase displacement (<30º);
- addition of transformers with more than one active part in the same tank;
- change of reference power definition (it is now based on fundamental component of the current);
- addition of considerations for guidelines for OLTC selection;
- addition of regulating transformer feeding converter transformer;

- addition of considerations about current sharing and hot spot temperature in high current windings for various winding arrangements;
- addition of transductors used for d.c. voltage regulation together with diode rectifiers;
- improved old annexes with several calculation examples;
- addition of new annexes for special measurements setups.

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

FDIS	Report on voting
14/686/FDIS	14/695/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 61378 series can be found, under the general title *Converter 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.

A bilingual version of this standard may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

CONVERTER TRANSFORMERS –

Part 1: Transformers for industrial applications

1 Scope

This Part of IEC 61378 deals with the specification, design and testing of power transformers and reactors which are intended for integration within semiconductor converter plants; it is not applicable to transformers designed for industrial or public distribution of a.c. power in general.

The scope of this International Standard is limited to application of power converters of any power rating. Typical applications are: thyristor rectifiers for electrolysis; diode rectifiers for electrolysis; thyristor rectifiers for large drives; thyristor rectifiers for scrap melting furnaces, and diode rectifiers feeding inverters for variable speed drives. The standard also covers the regulating unit utilized in such application as step down regulating transformers or autotransformers. The valve winding highest voltage for equipment is limited to 36 kV.

This standard is not applicable to transformers for HVDC power transmission. These are high-voltage transformers, and they are subjected to d.c. voltage tests.

The standards for the complete converter plant (IEC 60146 series, or other publications dedicated to particular fields of application) may contain requirements of guarantees and tests (such as insulation and power loss) for the whole plant, including the converter transformer and possibly auxiliary transformers and reactor equipment. This does not relieve the application of the requirements of this standard concerning the guarantees and tests applicable to the converter transformer itself as a separate component before being assembled with the remainder of the converter plant.

The guarantees, service and type tests defined in this standard apply equally to transformers supplied as part of an overall converter package, or to those transformers ordered separately but for use with converter equipment. Any supplementary guarantee or special verification has to be specifically agreed in the transformer contract.

The converter transformers covered by this standard may be of the oil-immersed or dry-type design. Unless specific exceptions are stated in this standard, the transformers comply with IEC 60076 series for oil-immersed transformers, and with IEC 60076-11 for dry-type transformers.

NOTE For some converter applications, it is possible to use common distribution transformers of standard design. The use of such standard transformers in the special converter applications may require a certain derating. This matter is not specifically covered in this standard, which deals with the requirements to be placed on specially designed units. It is possible to estimate this derating from the formulae given in 5.1, and also from Clause 9 of IEC 60076-8:1997.

This standard deals with transformers with one or more active parts installed in the same tank like regulating (auto)transformer and one or two rectifier transformers. It also covers transformers with transductors and/or one or more interphase transformers.

For any combination not listed above an agreement between the purchaser and manufacturer is necessary regarding the determination and the measurement of the total losses.

This standard deals with transformers star Y and delta D and any other phase shifting connections (like zig-zag, extended delta, polygon etc.). Phase shifting windings can be placed on either the regulating or rectifier transformer.

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 60050-421:1990, *International Electrotechnical Vocabulary (IEV) – Chapter 421: Power transformers and reactors*

IEC 60076 (all parts), *Power transformers*

IEC 60076-1:2011, *Power transformers – Part 1: General*

IEC 60076-2:2011, *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 60076-6:2007, *Power transformers – Part 6: Reactors*

IEC 60076-8:1997, *Power transformers – Part 8: Application guide*

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

IEC 60146 (all parts), *Semiconductor converters – General requirements and line commutated converters*

IEC 60146-1-1:2009, *Semiconductor converters – General requirements and line commutated converters – Part 1-1: Specifications of basic requirements*

IEC/TR 60146-1-2:2011, *Semiconductor converters – General requirements and line commutated converters – Part 1-2: Application guide*

IEC/TR 60616:1978, *Terminal and tapping markings for power transformers*

3 Terms, definitions and acronyms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-421, IEC 60076-1 and IEC 60146-1-1, as well as the following apply.

3.1.1
polygon connection
P
the winding connection in which each phase winding consists of two parts in which phase displaced voltages are induced. One part of each phase is connected in series to the other part of a different phase and then closed in a delta (see Annex I)

3.1.2
extended delta connection
E
the winding connection in which each phase winding consists of two parts in which phase displaced voltages are induced. One part of each phase is delta connected and it is then connected to its appropriate line terminal through the other part (see Annex I)