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Power transformers - Part 57-1202: Liquid immersed phase-shifting transformers

Leistungstransformatoren - Teil 57-1202: Ölgefüllte Phasenschieber

Transformateurs de puissance - Partie 57-1202: Transformateurs déphaseurs immergés dans un liquide

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English Version

**Power transformers - Part 57-1202: Liquid immersed phase-shifting transformers
(IEC/IEEE 60076-57-1202:2017)**

Transformateurs de puissance - Partie 57-1202:
Transformateurs déphaseurs immergés dans un liquide
(IEC/IEEE 60076-57-1202:2017)

Leistungstransformatoren - Teil 57-1202: Ölgefüllte
Phasenschieber
(IEC/IEEE 60076-57-1202:2017)

This draft European Standard is submitted to CENELEC members for enquiry.
Deadline for CENELEC: 2023-09-22.

The text of this draft consists of the text of IEC/IEEE 60076-57-1202:2017 (14/892/FDIS).

If this draft becomes a European Standard, 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.

This draft European Standard was established by CENELEC in three official versions (English, French, German).
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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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European Committee for Electrotechnical Standardization
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Europäisches Komitee für Elektrotechnische Normung

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

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European foreword

This document (prEN IEC/IEEE 60076-57-1202:2023) consists of the text of document IEC/IEEE 60076-57-1202:2017, prepared by IEC/TC 14 "Power Transformers".

This document is currently submitted to the Enquiry.

The following dates are proposed:

- latest date by which the existence of this document (doa) dor + 6 months has to be announced at national level
- latest date by which this document has to be (dop) dor + 12 months implemented at national level by publication of an identical national standard or by endorsement
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NORME INTERNATIONALE



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Part 57-1202: Liquid immersed phase-shifting transformers**

**Transformateurs de puissance –
Partie 57-1202: Transformateurs déphaseurs immergés dans un liquide**

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POWER TRANSFORMERS –**Part 57-1202: Liquid immersed phase-shifting transformers****FOREWORD**

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International Standard IEC/IEEE 60076-57-1202 has been prepared by IEC technical committee 14: Power transformers, in cooperation with the Transformers Committee of the IEEE Power & Energy Society¹, under the IEC/IEEE Dual Logo Agreement.

This publication is published as an IEC/IEEE Dual Logo standard.

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FDIS	Report on voting
14/892/FDIS	14/902/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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The IEC Technical Committee and IEEE Technical Committee have decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
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¹ A list of IEEE participants can be found at the following URL: http://standards.ieee.org/downloads/60076/60076-57-1202-2017/60076-57-1202-2017_wg-participants.pdf

POWER TRANSFORMERS –

Part 57-1202: Liquid immersed phase-shifting transformers

1 Scope

This part of IEC 60076 covers the requirements for phase-shifting transformers of all types. The scope excludes transformers with an unregulated phase shift.

This document is limited to matters particular to phase-shifting transformers and does not include matters relating to general requirements for power transformers covered in existing standards in the IEC 60076 series or IEEE Std C57.12.00™ and IEEE Std C57.12.10™.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

2.1 IEC references

IEC 60050-421, *International Electrotechnical Vocabulary – Chapter 421: Power transformers and reactors* (available at: www.electropedia.org)

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

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

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

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

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

IEC 60076-18, *Power transformers – Part 18: Measurement of frequency response*

ISO 2178, *Non-magnetic coatings on magnetic substrates – Measurement of coating thickness – Magnetic method*

ISO 2409, *Paints and varnishes – Cross-cut test*

2.2 IEEE references

IEEE Std C57.12.00™, *IEEE Standard for General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers*

IEEE Std C57.12.10™, *IEEE Standard Requirements for Liquid-Immersed Power Transformers*

IEEE Std C57.12.70™, *IEEE Standard for Standard Terminal Markings and Connections for Distribution and Power Transformers*

IEEE Std C57.12.80™, *IEEE Standard Terminology for Power and Distribution Transformers*

IEEE Std C57.12.90™, *IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

For the purposes of this document, the terms and definitions given in IEC 60050-421 and IEC 60076-1 apply to IEC specified phase shifting transformers. For IEEE specified phase shifting transformers the terms and definitions given in IEEE Std C57.12.80 apply. For all phase shifting transformers the following apply and take precedence.

3.1

phase-shifting transformer PST

transformer (or combination of transformers designed to work together) with two sets of line terminals (S and L) which is capable of varying the voltage phase-angle relationship between the S terminals and the L terminals

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Note 1 to entry: The rated voltage of the S terminals and the L terminals may be the same or different. In addition the PST may also be capable of varying the in-phase voltage.

Note 2 to entry: This note applies to the French language only.

3.2

S terminal

terminal that is used as the fixed reference point when measuring the voltage phase angle of a phase-shifting transformer

3.3

L terminal

terminal that is used to measure the voltage phase angle when compared to the S terminal of the phase-shifting transformer

Note 1 to entry: The designations of S and L to the terminals do not imply any particular direction of power flow.

3.4

zero phase shift tap position

tap position at which the no-load voltage phase angle is zero

3.5

rated power

output power at rated voltage and rated frequency that can be delivered at the L terminal continuously without exceeding the specified temperature rise

3.6**excitation winding**

winding of a phase-shifting transformer (PST) that draws power from the source to energize the PST

3.7**excited winding**

winding of the series unit that is excited from the exciting winding

3.8**quadrature booster**

asymmetric design phase-shifting transformer with the excitation winding connected to the S terminal

3.9**symmetric design**

phase-shifting transformer where the no-load voltage ratio between the S and L terminals is constant

3.10**asymmetric design**

phase-shifting transformer where the no-load voltage ratio between the S and L terminals changes with the phase angle variation tap position

3.11**single-core PST**

phase-shifting transformer that has all windings mounted on a single core

3.12**two-core PST**

phase-shifting transformer consisting of a series unit and an exciting unit, located on two separate cores

3.13**extreme tap**

tap for maximum absolute value of no-load phase angle in the advance or retard direction

3.14**phase angle**

electrical phase angle expressed in degrees between the S and L terminals with a sign such that the angle is positive when the voltage at the L terminal leads the voltage at the S terminal

3.15**boost operation**

operation when the PST is acting to increase the power flow in the circuit

3.16**buck operation**

operation when the PST is acting to reduce or reverse the power flow in the circuit

Note 1 to entry: For example, in retard operation the load phase angle between the S and L terminals is made more negative in buck operation relative to the no-load phase angle at the same tap position because both the no-load phase angle and the phase angle change caused by the load are negative (see Annex E).

3.17**advance**

mode of operation where the L terminal no-load voltage leads the S terminal no-load voltage, giving a positive no-load phase angle