



SLOVENSKI STANDARD
SIST EN 60076-2:1997

01-oktober-1997

Power transformers - Part 2: Temperature rise (IEC 76-2:1993 modified)

Power transformers -- Part 2: Temperature rise

Leistungstransformatoren -- Teil 2: Übertemperaturen

Transformateurs de puissance -- Partie 2: Echauffement

Ta slovenski standard je istoveten z: EN 60076-2:1997

[SIST EN 60076-2:1997](https://standards.iteh.ai/catalog/standards/sist/20180762-82fc-4b89-887f-d915dea79794/sist-en-60076-2-1997)

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ICS:

29.180 Transformatorji. Dušilke Transformers. Reactors

SIST EN 60076-2:1997

en

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 60076-2

May 1997

ICS 29.180

Supersedes HD 398.2 S1:1980 and its amendment

Descriptors: Power transformers, temperature rise, cooling methods, temperature rise limits, tests of temperature rise

English version

Power transformers
Part 2: Temperature rise
(IEC 76-2:1993, modified)

Transformateurs de puissance
Partie 2: Echauffement
(CEI 76-2:1993, modifiée)

Leistungstransformatoren
Teil 2: Übertemperaturen
(IEC 76-2:1993, modifiziert)

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This European Standard was approved by CENELEC on 1997-03-11. 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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of the International Standard IEC 76-2:1993, prepared by IEC TC 14, Power transformers, together with the common modifications prepared by the Technical Committee CENELEC TC 14 was submitted to the formal vote and was accepted by CENELEC as EN 60076-2 on 1997-03-11.

This European Standard supersedes HD 398.2 S1:1979 and its amendment A1:1988.

Technical differences relate mainly to certain measures to bring the standard in line with actual requirements of User's specifications.

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) 1997-09-01

- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 1997-09-01

Annexes designated "normative" are part of the body of the standard. Annexes designated "informative" are given for information only. In this standard annex ZA is normative and annexes A, B and C are informative.

Annex ZA has been added by CENELEC.

SIST EN 60076-2:1997

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Endorsement notice

The text of the International Standard IEC 76-2:1993 was approved by CENELEC as a European Standard with agreed common modifications as given below.

COMMON MODIFICATIONS

2 Normative references

Delete the year of issue in reference to IEC 606.

3 Identification symbols according to cooling method

Add after "multi-winding transformer" in the last paragraph before the examples the words:

unless otherwise agreed between manufacturer and purchaser,

4 Temperature-rise limits

Add a new paragraph after the fourth paragraph:

Additional temperature-rise tests, as agreed between the manufacturer and the purchaser, may be carried out on transformers having guaranteed ratings related to different cooling conditions, e.g. ONAN/ONAF, to verify the efficiencies of alternative cooling arrangements.

B.3 Variable loading or cooling - Thermal time constants

Add at the end of the clause the following paragraph:

The need for compliance with IEC 354, IEC 905 or other loading conditions shall be stated by the purchaser at tender stage.

Annex ZA (normative)**Normative references to international publications
with their corresponding European publications**

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 76-1 (mod)	1993	Power transformers Part 1: General	EN 60076-1	1997
IEC 85	1984	Thermal evaluation and classification of electrical insulation	HD 566 S1	1990
IEC 279	1969	Measurement of the winding resistance of an a.c. machine during operation at alternating voltage https://standards.iteh.ai/standards/sist/20180762-82fc-4b89-887F-d915dea79794/sist-en-60076-2-1997	-	-
IEC 354	1991	Loading guide for oil-immersed power transformers	-	-
IEC 606	1978 ¹⁾	Application guide for power transformers	-	-
IEC 726 (mod)	1982	Dry-type power transformers	HD 464 S1 ²⁾ + A2 + A3 + A4	1988 1991 1992 1995
IEC 905	1987	Loading guide for dry-type power transformers	-	-
ISO 2592	1973	Petroleum products - Determination of flash and fire points - Cleveland open cup method	EN 22592	1993

1) Under revision, latest edition will apply.

2) HD 464 S1 includes A1:1986 to IEC 726:1982, mod.

INTERNATIONAL STANDARD

IEC
60076-2

Second edition
1993-04

Power transformers –

Part 2: Temperature rise

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International Electrotechnical Commission, 3, rue de Varembe, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



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Publication 60076-2 de la CEI
(Deuxième édition - 1993)
Transformateurs de puissance –
Partie 2: Echauffement

IEC Publication 60076-2
(Second edition - 1993)
Power transformers –
Part 2: Temperature rise

CORRIGENDUM 1

Page 10

Article 4.1:

Dans le cinquième alinéa, commençant par « La température du fluide... », à la troisième ligne, au lieu de

...voir 2.1 de la CEI 76-1...

lire

...voir **1.2** de la CEI 76-1...

Page 11

Clause 4.1:

In the third paragraph, beginning with "The cooling medium temperature...", third line, instead of

...see 2.1 of IEC 76-1...

read

...see **1.2** of IEC 76-1...

Page 14

Article 4.3.1:

Dans la deuxième ligne, au lieu de

...en 2.1 de la CEI 76-1...

lire

...en **1.2** de la CEI 76-1...

Page 15

Article 4.3.1:

In the second line, instead of

...in 2.1 of IEC 76-1...

read

...in **1.2** of IEC 76-1...

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

POWER TRANSFORMERS

Part 2: Temperature rise

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international cooperation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. 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. The 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 the IEC on technical matters, prepared by technical committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
- 3) They have the form of recommendations for international use published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.

This part of International Standard IEC 76 has been prepared by IEC technical committee 14: Power transformers.

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This second edition cancels and replaces the first edition published in 1976.

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

Six Months' Rule	Report on Voting
14(CO)76	14(CO)78

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

IEC 76 consists of the following parts, under the general title: Power transformers.

Part 1: 1993, General.

Part 2: 1993, Temperature rise.

Part 3: 1980, Insulation levels and dielectric tests.

Part 5: 1976, Ability to withstand short circuit.

Annexes A, B and C are for information only.

POWER TRANSFORMERS

Part 2: Temperature rise

1 Scope

This part of International Standard IEC 76 identifies transformers according to their cooling methods, defines temperature-rise limits and details the methods of test for temperature-rise measurements. It applies to transformers as defined in the scope of IEC 76-1.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 76. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 76 are encouraged to investigate the possibility of applying the most recent edition of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 76-1: 1993, *Power transformers – Part 1: General*

IEC 85: 1984, *Thermal evaluation and classification of electrical insulation*

IEC 279: 1969, *Measurement of the winding resistance of an a.c. machine during operation at alternating voltage*

IEC 354: 1991, *Loading guide for oil-immersed power transformers*

IEC 606: 1978, *Application guide for power transformers*

IEC 726: 1982, *Dry-type power transformers*

IEC 905: 1987, *Loading guide for dry-type power transformers*

ISO 2592: 1973, *Petroleum products – Determination of flash and fire points – Cleveland open-cup method*

3 Identification symbols according to cooling method

Transformers shall be identified according to the cooling method employed. For oil-immersed transformers this identification is expressed by a four-letter code as described below. Corresponding codes for dry-type transformers are given in IEC 726.

First letter: Internal cooling medium in contact with the windings:

- O mineral oil or synthetic insulating liquid with fire point* ≤ 300 °C;
- K insulating liquid with fire point* > 300 °C;
- L insulating liquid with no measurable fire point.

Second letter: Circulation mechanism for internal cooling medium:

- N *natural* thermosiphon flow through cooling equipment and in windings;
- F *forced* circulation through cooling equipment, thermosiphon flow in windings;
- D forced circulation through cooling equipment, *directed* from the cooling equipment into at least the main windings.

Third letter: External cooling medium:

- A air;
- W water.

Fourth letter: Circulation mechanism for external cooling medium:

- N natural convection; (standards.iteh.ai)
- F forced circulation (fans, pumps).

NOTE - In a transformer designated as having forced directed oil circulation (second code letter D), the rate of oil flow through the main windings is determined by the pumps and is not, in principle, determined by the loading. A minor fraction of the flow of oil through the cooling equipment may be directed as a controlled bypass to provide cooling for core and other parts outside the main windings. Regulating windings and/or other windings having relatively low power may also have non-directed circulation of bypass oil.

In a transformer with forced, non-directed cooling, on the other hand (second code letter F), the rates of flow of oil through all the windings are variable with the loading, and not directly related to the pumped flow through the cooling equipment.

A transformer may be specified with alternative cooling methods. The specification and the nameplate shall then carry information about the power figures at which the transformer fulfils the temperature-rise limitations when these alternatives apply, see 7.1 m) of IEC 76-1. The power figure for the alternative with the highest cooling capacity is the rated power of the transformer (or of an individual winding of a multi-winding transformer, see 4.1 of IEC 76-1). The alternatives are conventionally listed in rising order of cooling capacity.

* "Cleveland open-cup" test method, see ISO 2592.