IEC 60076-1

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Power transformers –
Part 1: General

Transformateurs de puissance –
Partie 1: Généralités

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

POWER TRANSFORMERS –

Part 1: General

FOREWORD

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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- withdrawn,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