Power transformers – Application guide

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Power transformers – Application guide

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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 co-operation 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 express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.

3) The documents produced have the form of recommendations for international use and are 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.

5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.

6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60076-8 has been prepared by IEC technical committee 14: Power transformers.

This first edition of IEC 60076-8 cancels and replaces IEC 60606 published in 1978. This edition constitutes a technical revision.

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

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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 60076 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
- Part 8: 1997, Application guide

Annex A is for information only.
POWER TRANSFORMERS – APPLICATION GUIDE

1 General

1.1 Scope and object

This Standard applies to power transformers complying with the series of publications IEC 60076.

It is intended to provide information to users about:

- certain fundamental service characteristics of different transformer connections and magnetic circuit designs, with particular reference to zero-sequence phenomena;
- system fault currents in transformers with YNynd and similar connections;
- parallel operation of transformers, calculation of voltage drop or rise under load, and calculation of load loss for three-winding load combinations;
- selection of rated quantities and tapping quantities at the time of purchase, based on prospective loading cases;
- application of transformers of conventional design to convertor loading;
- measuring technique and accuracy in loss measurement.

Part of the information is of a general nature and applicable to all sizes of power transformers. Several chapters, however, deal with aspects and problems which are of the interest only for the specification and utilization of large high-voltage units.

The recommendations are not mandatory and do not in themselves constitute specification requirements.

Information concerning loadability of power transformers is given in IEC 60354, for oil-immersed transformers, and IEC 60905, for dry-type transformers.

Guidance for impulse testing of power transformers is given in IEC 60722.

1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this International Standard 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 60076: Power transformers

Characteristics of different three-phase winding combinations and magnetic circuit designs

This chapter is an overview of the subject. Additional information is given in clause 4 on zero-sequence properties.

2.1 Y-, D-, and Z-connected windings

There are two principal three-phase connections of transformer windings: star (Y-connection) and delta (D-connection). For special purposes, particularly in small power transformers, another connection named zigzag or Z is also used. Historically, several other schemes have been in use (such as “truncated delta”, “extended delta”, “T-connection”, “V-connection”, etc.). While such connections are used in transformers for special applications, they no longer appear in common power transmission systems.

2.1.1 Advantages of a Y-connected winding

This type of winding:

- is more economical for a high-voltage winding;
- has a neutral point available;
- permits direct earthing or earthing through an impedance;
- permits reduced insulation level of the neutral (graded insulation);
- permits the winding taps and tapchanger to be located at the neutral end of each phase;
- permits single-phase loading with neutral current (see 2.2 and 4.8).

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