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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Power transformers –
Part 12: Loading guide for dry-type power transformers

Transformateurs de puissance –
Partie 12: Guide de charge pour transformateurs de puissance de type sec

IEC 60076-12:2008

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POWER TRANSFORMERS –

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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 60076-12 has been prepared by IEC technical committee 14: Power transformers.

This standards cancels and replaces IEC 60905 (1987). This first edition constitutes a technical revision.

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

FDIS	Report on voting
14/584/FDIS	14/590/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 IEC 60076 series, under the general title *Power transformers,* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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- withdrawn: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.

INTRODUCTION

This part of IEC 60076 provides guidance for the specification and loading of dry type power transformers from the point of view of operating temperatures and thermal ageing. It provides the consequence of loading above the nameplate rating and guidance for the planner to choose appropriate rated quantities and loading conditions for new installations.

IEC 60076-11 is the basis for contractual agreements and it contains the requirements and tests relating to temperature-rise figures for dry type power transformers during continuous rated loading. It should be noted that IEC 60076-11 refers to the average winding temperature rise while this part of IEC 60076 refers mainly to the hot-spot temperature and the latter stated values are provided only for guidance.

This part of IEC 60076 gives mathematical models for judging the consequence of different loading, with different temperatures of the cooling medium, and with transient or cyclical variation with time. The models provide for the calculation of operating temperatures in the transformer, particularly the temperature of the hottest part of the winding. This hot-spot temperature is used for estimation of the number of hours of life time consumed during a particular time period.

This part of IEC 60076 further presents recommendations for limitations of permissible loading according to the results of temperature calculations or measurements. These recommendations refer to different types of loading duty – continuous loading, short-time and long time emergency loading. An explanation of ageing fundamentals is given in Annex A.

POWER TRANSFORMERS –

Part 12: Loading guide for dry-type power transformers

1 Scope

This part of IEC 60076 is applicable to dry-type transformers according to the scope of IEC 60076-11. It provides the means to estimate ageing rate and consumption of lifetime of the transformer insulation as a function of the operating temperature, time and the loading of the transformer.

NOTE For special applications such as wind turbine application transformers, furnace transformers, welding machine transformers, and others, the manufacturer should be consulted regarding the particular loading profile.

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

IEC 60216-1, *Electrical insulating materials – Properties of thermal endurance – Part 1: Ageing procedures and evaluation of test results*

IEC 61378-1:1997, *Convertor transformers – Part 1: Transformers for industrial applications*

3 Terms and definitions

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

3.1
long-time emergency loading
loading resulting from the prolonged outage of some system elements that will not be reconnected before the transformer reaches a new and higher steady state temperature

3.2
short-time emergency loading
unusually heavy loading of a transient nature (less than one time constant of the coil) due to the occurrence of one or more unlikely events which seriously disturb normal system loading

3.3
hot-spot
if not specifically defined, “hot-spot” means the hottest-spot of the winding

3.4
relative thermal ageing rate
for a given hot-spot temperature, the rate at which transformer insulation ageing is reduced or accelerated compared with the ageing rate at a reference hot-spot temperature