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STN	Výkonové transformátory Časť 7: Návod na zaťažovanie výkonových transformátorov ponorených v minerálnom oleji	STN IEC 60076-7 35 1100

Power transformers
Part 7: Loading guide for mineral-oil-immersed power transformers

Transformateurs de puissance
Partie 7: Guide de charge pour les transformateurs de puissance immergés dans l'huile minérale

Táto slovenská technická norma obsahuje anglickú verziu medzinárodnej normy IEC 60076-7: 2018 a má postavenie oficiálnej verzie.

This Slovak standard includes the English version of the International standard IEC 60076-7: 2018 and has the status of the official version.

Nahradenie predchádzajúcich dokumentov

Táto slovenská technická norma nahrádza STN IEC 60076-7 z marca 2009 v celom rozsahu.

obsahuje farebné strany

142599

Anotácia

Táto časť IEC 60076 platí pre transformátory ponorené v minerálnom oleji. Opisuje vplyv prevádzky pri rôznych teplotách okolia a podmienkach zaťaženia na životnosť transformátora.

POZNÁMKA. – Pri pecných transformátoroch sa vzhľadom na osobitný profil zaťaženia konzultuje s výrobcom.

Národný predhovor

Normatívne referenčné dokumenty

Na nasledujúce dokumenty sa odkazuje v texte takým spôsobom, že časť ich obsahu alebo celý obsah predstavuje požiadavky tohto dokumentu. Pri datovaných odkazoch sa používa len citované vydanie. Pri nedatovaných odkazoch sa používa najnovšie vydanie citovaného dokumentu (vrátane akýchkoľvek zmien).

POZNÁMKA 1. – Ak bola medzinárodná publikácia zmenená spoločnými modifikáciami, čo je indikované označením (mod), použije sa príslušná EN/HD.

POZNÁMKA 2. – Aktuálne informácie o platných a zrušených STN možno získať na webovej stránke www.unms.sk.

IEC 60076-2 *prijatá ako STN EN 60076-2 Výkonové transformátory. Časť 2: Oteplenie kvapalinou plnených transformátorov (35 1100)*

IEC 60076-14 *prijatá ako STN EN 60076-14 Výkonové transformátory: Časť 14: Kvapalinou plnené transformátory používajúce vysokotepelné izolačné materiály (35 1100)*

Vypracovanie

Spracovateľ: Úrad pre normalizáciu, metrológiu a skúšobníctvo SR, Bratislava

Technická komisia:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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Part 7: Loading guide for mineral-oil-immersed power transformers

FOREWORD

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International Standard IEC 60076-7 has been prepared by IEC technical committee 14: Power transformers.

This second edition cancels and replaces the first edition published in 2005. It constitutes a technical revision. This edition includes the following significant technical changes with respect to the previous edition:

a) title has been updated from "oil-immersed power transformers" to "mineral-oil-immersed power transformers";
b) insulation life is updated by considering latest research findings;
c) temperature limits have been reviewed and maximum core temperature is recommended;
d) number of fibre optic sensors is recommended for temperature rise test;
e) Q, S and H factors are considered;
f) thermal models are revised and rewritten in generally applicable mathematical form;

g) geomagnetic induced currents are briefly discussed and corresponding temperature limits are suggested;

h) extensive literature review has been performed and a number of references added to bibliography.

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

FDIS	Report on voting
14/933/FDIS	14/942/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, 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 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,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

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

IEC 60076-2 is the basis for contractual agreements and it contains the requirements and tests relating to temperature-rise figures for oil-immersed transformers during continuous rated loading.

This part of IEC 60076 gives mathematical models for judging the consequence of different loadings, 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, in turn, used for evaluation of a relative value for the rate of thermal ageing and the percentage of life consumed in a particular time period. The modelling refers to small transformers, here called distribution transformers, and to power transformers.

A major change from the previous edition is the extensive work on the paper degradation that has been carried out indicating that the ageing may be described by combination of the oxidation, hydrolysis and pyrolysis. Also, providing possibility to estimate the expected insulation life considering different ageing factors, i.e. moisture, oxygen and temperature, and more realistic service scenarios. The title has been updated from "oil-immersed power transformers" to "mineral-oil-immersed power transformers". The temperature and current limits are reviewed and the maximum core temperature is recommended. The use of fibre optic temperature sensors has become a standard practice, however, the number of installed sensors per transformer highly varies. This issue and the description of Q, S and H factors are now considered as well. The thermal models are revised and rewritten in generally applicable mathematical form. The geomagnetic induced currents are briefly discussed and corresponding temperature limits are suggested.

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, normal cyclic undisturbed loading or temporary emergency loading. The recommendations refer to distribution transformers, to medium power transformers and to large power transformers. Clauses 1 to 7 contain definitions, common background information and specific limitations for the operation of different categories of transformers.

Clause 8 contains the determination of temperatures, presents the mathematical models used to estimate the hot-spot temperature in steady state and transient conditions.

Clause 9 contains a short description of the influence of the tap position.

Application examples are given in Annexes A, B, C, D, E, F, G, H, I and K.

POWER TRANSFORMERS –

Part 7: Loading guide for mineral-oil-immersed power transformers

1 Scope

This part of IEC 60076 is applicable to mineral-oil-immersed transformers. It describes the effect of operation under various ambient temperatures and load conditions on transformer life.

NOTE For furnace transformers, the manufacturer is consulted in view of the peculiar loading profile.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60076-14, *Power transformers – Part 14: Liquid-immersed power transformers using high-temperature insulation materials*