

PD IEC/TS 60076-19:2013
Incorporating Corrigendum April 2013



BSI Standards Publication

Power transformers

Part 19: Rules for the determination of uncertainties in the measurement of the losses on power transformers and reactors

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The UK participation in its preparation was entrusted to Technical Committee PEL/14, Power transformers.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Published by BSI Standards Limited 2013.

ISBN 978 0 580 83075 4

ICS 29.180

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This Published Document was published under the authority of the Standards Policy and Strategy Committee on 30 April 2013.

Amendments/corrigenda issued since publication

Date	Text affected
30 April 2013	Cover page title corrected



TECHNICAL SPECIFICATION

SPÉCIFICATION TECHNIQUE

Power transformers –

Part 19: Rules for the determination of uncertainties in the measurement of the losses on power transformers and reactors

Transformateurs de puissance –

Partie 19: Règles pour la détermination des incertitudes de mesure des pertes des transformateurs de puissance et bobines d'inductance

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

W

ICS 29.180

ISBN 978-2-83220-693-5

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POWER TRANSFORMERS –

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- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 60076-19, which is a technical specification, has been prepared by IEC technical committee 14: Power transformers.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
14/726/DTS	14/736A/RVC

Full information on the voting for the approval of this technical specification 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 in the IEC 60076 series, published 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 web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- transformed into an International Standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

The losses of the transformers (no-load and load losses) are object of guaranty and penalty in the majority of the contracts and play an important role in the evaluation of the total (service) costs and therefore in the investments involved.

According to ISO/IEC 17025 the result of any measurement should be qualified with the evaluation of its uncertainty. A further requirement is that known corrections shall have been applied before evaluation of uncertainty.

Corrections and uncertainties are also considered in IEC 60076-8 where some general indications are given for their determination.

This Technical Specification deals with the measurement of the losses that from a measuring point of view consist of the estimate of a measurand and the evaluation of the uncertainty that affects the measurand itself.

The uncertainty range depends on the quality of the test installation and measuring system, on the skill of the staff and on the intrinsic measurement difficulties presented by the tested objects.

The submitted test results are to be considered the most correct estimate and therefore this value has to be accepted as it stands.

In the annexes to this document, two examples of uncertainty calculations are reported for load loss measurements on large power and distribution transformers.

Standards, technical reports and guides mentioned in the text are listed at the end of the document.

It is stated that guaranty and penalty calculations should refer to the best estimated values of the losses without considering the measurement uncertainties.

POWER TRANSFORMERS –

Part 19: Rules for the determination of uncertainties in the measurement of the losses on power transformers and reactors

1 Scope

This part of IEC 60076, which is a Technical Specification, illustrates the procedures that should be applied to evaluate the uncertainty affecting the measurements of no-load and load losses during the routine tests on power transformers.

Even if the attention is especially paid to the transformers, when applicable the specification can be also used for the measurements of reactor losses, except large reactors with very low power factor.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60076-1:2011, *Power transformers – Part 1: General*

IEC 60076-2:2011, *Power transformers – Part 2: Temperature rise for liquid-immersed transformers*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60076-1 and 60076-2, as well as the following apply.

NOTE The following terms and definitions were taken from ISO/IEC Guide 98-3:2008.

3.1

uncertainty (of measurement)

parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand

[SOURCE: ISO/IEC Guide 98-3:2008, 2.2.3]

3.2

standard uncertainty

uncertainty of the result of a measurement expressed as a standard deviation

[SOURCE: ISO/IEC Guide 98-3:2008, 2.3.1]

3.3

type A evaluation (of uncertainty)

method of evaluation of uncertainty by the statistical analysis of series of observations

[SOURCE: ISO/IEC Guide 98-3:2008, 2.3.2]