AS/NZS 60076.3:2017

Australian/New Zealand Standard™

Power transformers

Part 3: Insulation levels, dielectric tests and external clearances in air (IEC 60076-3:2013 (ED.3.0) MOD)

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This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee EL-008, Power Transformers. It was approved on behalf of the Council of Standards Australia on 9 August 2017 and by the New Zealand Standards Approval Board on 4 October 2017.
This Standard was published on 31 October 2017.

The following are represented on Committee EL-008:

Australian Chamber of Commerce and Industry
Australian Industry Group
Australian Institute of Petroleum
Electricity Engineers Association (New Zealand)
Energy Networks Association
Engineers Australia
Rail Industry Safety and Standards Board

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This Standard was issued in draft form for comment as DR AS/NZS 60076.3:2017.

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Originally in Australia as AS 2374.3.0—1982 and AS 2374.3.1—1992.
Previous and first New Zealand edition AS/NZS 60076.3:2008.
Second edition 2017.

Jointly published by SAI Global Limited under licence from Standards Australia Limited, GPO Box 476, Sydney, NSW 2001 and by Standards New Zealand, PO Box 1473, Wellington 6140.

ISBN 978 1 76035 929 4

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-008, Power Transformers, to supersede *Power transformers*, Part 3: *Insulation levels, dielectric tests and external clearances in air (IEC 60076-3, Ed. 2 (2000) MOD)*.

The objective of this Standard is to provide designers, suppliers, purchasers and users of oil-immersed power transformers with requirements for insulation levels, dielectric tests and minimum external clearances in air between live parts of bushings and to objects at earth potential.

This Standard is an adoption with national modifications; it has been reproduced from IEC 60076-3:2013 (ED.3.0), *Power transformers—Part 3: Insulation levels, dielectric tests and external clearances in air*, and has been varied as indicated in the normative Appendix ZZ to take account of Australian/New Zealand conditions.

The variations described in Appendix ZZ form the Australian and New Zealand variations for the purpose of the IECEE CB Scheme for recognition of testing to standards for safety of electrical equipment.

This Standard is structured as follows:

(a) Preface.

(b) IEC 60076-3:2013 (ED.3.0) (unedited from the contents page to the final clause of the source document).

(c) Appendix ZZ—Australian/New Zealand variations to the source document.

The variations listed in Appendix ZZ address issues including the following:

(i) Additional notes to clarify some requirements.

(ii) Clarification of the scope of testing for transformers of different voltage classes.

(iii) Addition of a final reduced voltage application during lightning impulse testing.

(iv) An additional reduced voltage test level for U_m = 123 kV.

Major differences between the third edition of IEC 60076-3 compared with the previous edition are indicated in the IEC Foreword following the list of contents.

As this Standard is reproduced from an International Standard, the following applies:

(A) In the source text 'this International Standard' should read 'this Australian/New Zealand Standard'.

(B) A full point substitutes for a comma when referring to a decimal marker.

The terms 'normative' and 'informative' are used to define the application of the annex or appendix to which they apply. The 'normative' appendix is an integral part of this Standard, whereas the 'informative' annexes are only for information and guidance.

NOTES

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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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8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
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International Standard IEC 60076-3 has been prepared by IEC technical committee 14: Power transformers.

This third edition of IEC 60076-3 cancels and replaces the second edition published in 2000, and constitutes a technical revision. The main changes from the previous edition are as follows:

– Three categories of transformer are clearly identified together with the relevant test requirements, these are summarised in Table 1.
– Switching impulse levels are defined for all $U_m > 72,5$kV.
– The procedure for Induced voltage tests with PD has been revised to ensure adequate phase to phase test voltages.
– The AC withstand test has been redefined (LTAC instead of ACSD).
– Induced voltage tests are now based on U_r rather than U_m.
– New requirements for impulse waveshape (k factor) have been introduced.

– Tables of test levels have been merged and aligned with IEC 60071-1:2010.
– Additional test levels have been introduced for U_m > 800kV.
– A new Annex E has been introduced, which sets out the principles used in assigning the tests, test levels and clearances in air.

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

FDIS	Report on voting
14/745/FDIS	14/749/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 the parts in 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 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 specifies the insulation requirements and the corresponding insulation tests with reference to specific windings and their terminals. It also recommends external clearances in air (Clause 16).

The insulation levels and dielectric tests which are specified in this standard apply to the internal insulation only. Whilst it is reasonable that the rated withstand voltage values which are specified for the internal insulation of the transformer should also be taken as a reference for its external insulation, this may not be true in all cases. A failure of the non-self-restoring internal insulation is catastrophic and normally leads to the transformer being out of service for a long period, while an external flashover may involve only a short interruption of service without causing lasting damage. Therefore, it may be that, for increased safety, higher test voltages are specified by the purchaser for the internal insulation of the transformer than for the external insulation of other components in the system. When such a distinction is made, the external clearances should be adjusted to fully cover the internal insulation test requirements.

Annex E sets out some of the principles used in assigning the tests, test levels and clearances in air to the transformer according to the highest voltage for equipment (Um).

AUSTRALIAN/NEW ZEALAND STANDARD

Power transformers

Part 3:
Insulation levels, dielectric tests and external clearances in air
(IEC 60076-3:2013 (ED.3.0) MOD)

1 Scope

This International Standard applies to power transformers as defined by and in the scope of IEC 60076-1. It gives details of the applicable dielectric tests and minimum dielectric test levels. Recommended minimum external clearances in air between live parts and between live parts and earth are given for use when these clearances are not specified by the purchaser.

For categories of power transformers and reactors which have their own IEC standards, this standard is applicable only to the extent in which it is specifically called up by cross reference in the other standards.

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 60050-421, *International Electrotechnical Vocabulary (IEV) – Chapter 421: Power transformers and reactors*

IEC 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60060-2, *High-voltage test techniques – Part 2: Measuring systems*

IEC 60071-1, *Insulation co-ordination – Part 1: Definitions, principles and rules*

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

IEC 60137, *Insulated bushings for alternating voltages above 1 000 V*

IEC 60270, *High-voltage test techniques – Partial discharge measurements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60076-1, IEC 60050-421 and the following apply.

3.1
highest voltage for equipment applicable to a transformer winding
U_m
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