AS/NZS 60076.6:2013
IEC 60076-6, Ed. 1.0 (2007)

AS/NZS 60076.6:2013

Australian/New Zealand Standard™

# Power transformers

# Part 6: Reactors




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 27 September 2013 and on behalf of the Council of Standards New Zealand on 27 September 2013.
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The following are represented on Committee EL-008:

Australasian Railway Association
Australian Chamber of Commerce and Industry
Australian Industry Group
Department of Resources, Energy and Tourism
Electricity Engineers Association, New Zealand
Energy Efficiency and Conversation Authority of New Zealand
Energy Networks Association
Engineers Australia

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Australian/New Zealand Standard™

# Power transformers

# Part 6: Reactors

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# PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-008, Power Transformers, to supersede AS 1028—1992, *Power reactors and earthing transformers*.

The objective of this Standard is to provide designers, suppliers, purchasers and users of reactors with requirements that apply to the specification, testing and application of various types of reactors.

This Standard is identical with, and has been reproduced from, IEC 60076-6, Ed. 1.0 (2007), *Power transformers*, Part 6: *Reactors*.

The previous edition, AS 1028—1992, was an adoption with national modifications of IEC 60289, Ed. 2.0 (1988), *Reactors*. IEC 60076-6, Ed. 1.0 (2007) is a technical revision of IEC 60289, Ed. 2.0 (1998), and includes the following significant changes:

(a) Wide extension of the 'definitions', 'rating' and 'tests' clauses.

(b) More consequent distinction between definition and rating.

(c) 'Tests' clauses take into account the latest revisions of relevant IEC 60076 standards.

(d) Dielectric testing of reactors is now in accordance with the dielectric testing of transformers in AS/NZS 60076.3:2008.

(e) Consequent distinction between oil-immersed and dry-type reactors.

(f) Document offers easier handling and is more of a stand-alone document.

(g) Introduction of the discharge reactor as part of Clause 9.

(h) Introduction of the turn-to-turn overvoltage test for dry-type reactors (Annex E).

(i) Important background information given by the following newly introduced informative annexes:

  (i) Annex A—Information on shunt reactor switching and on special applications.

  (ii) Annex B—Magnetic characteristic of reactors.

  (iii) Annex C—Mutual reactance, coupling factor and equivalent reactances of three-phase reactors.

  (iv) Annex D—Temperature correction of losses for liquid-immersed gapped-core and magnetically shielded air-core reactors.

  (v) Annex F—Short-circuit testing.

  (vi) Annex G—Resistors—Characteristics, specification and tests.

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

(A) In the source text 'this part of IEC 60076' should read 'this Australian/New Zealand Standard'.

(B) A full point should be substituted for a comma when referring to a decimal marker.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the annex to which they apply. A 'normative' annex is an integral part of a Standard, whereas an 'informative' annex is only for information and guidance.

References to International Standards should be replaced by references to Australian or Australian/New Zealand Standards, as follows:

| *Reference to International Standard* | | *Australian/New Zealand Standard* | |
|---|---|---|---|
| IEC | | AS/NZS | |
| 60076 | Power transformers | 60076 | Power transformers |
| 60076-1 | Part 1: General | 60076.1 | Part 1: General (IEC 60076-1, Ed. 2.1 (2000) MOD) |
| 60076-2 | Part 2: Temperature rise for liquid-immersed transformers | 60076.2 | Part 2: Temperature rise for liquid-immersed transformers (IEC 60076-2, Ed. 3.0 (2011) MOD) |
| 60076-3 | Part 3: Insulation levels, dielectric tests and external clearances in air | 60076.3 | Part 3: Insulation levels, dielectric tests and external clearances in air (IEC 60076-3, Ed. 2 (2000) MOD) |
| | | AS | |
| 60076-4 | Part 4: Guide to the lightning impulse and switching impulse testing—Power transformers and reactors | 60076.4 | Part 4: Guide to the lightning impulse and switching impulse testing—Power transformers and reactors |
| | | AS/NZS | |
| 60076-5 | Part 5: Ability to withstand short circuit | 60076.5 | Part 5: Ability to withstand short circuit (IEC 60076-5, Ed. 3.0 (2006) MOD) |
| 60076-7 | Part 7: Loading guide for oil-immersed power transformers | 60076.7 | Part 7: Loading guide for oil-immersed power transformers (IEC 60076-7, Ed. 1.0 (2005) MOD) |
| | | AS | |
| | | 2374 | Power transformers |
| 60076-8 | Part 8: Application guide | 2374.8 | Part 8: Application guide |
| | | AS/NZS | |
| 60076-10 | Part 10: Determination of sound levels | 60076.10 | Part 10: Determination of sound levels |
| | | AS | |
| 60076-11 | Part 11: Dry-type transformers | 60076.11 | Part 11: Dry-type transformers |
| | | AS/NZS | |
| 60137 | Insulated bushings for alternating voltages above 1 000 V | 60137 | Insulated bushings for alternating voltages above 1 000 V (IEC 60137, Ed. 5.0 (2003) MOD) |
| | | AS | |
| 60270 | High-voltage test techniques—Partial discharge measurements | 60270 | High-voltage test techniques—Partial discharge measurements |

Only international references that have been adopted as Australian or Australian/New Zealand Standards have been listed.

CONTENTS

# INTRODUCTION

Wherever possible, references to technical Clauses in the other parts of IEC 60076 which are relevant to power transformers have been made. However, because reactors have some fundamental differences to transformers there are special considerations that apply to the specification, testing and application of reactors. These are included in this part of IEC 60076.

Clauses 1 to 6 form the general parts of the document, which apply to all types of reactor. Clauses 7 to 12 deal individually with each different type of reactor. Generally, only one of the Clauses 7 to 12 will apply to a specific reactor.

This part of IEC 60076 has more than one definition Subclause. The general definitions given in Clause 3 apply to the whole document. Each of the Clauses 7 to 12 dealing with a certain type of reactor includes a definition Subclause relevant and applying only to that Clause.

Clauses 7 to 12 have been given a uniform structure. Within this structure, the Rating Subclause sets out the minimum information that a purchaser shall supply with the reactor specification. The test Subclause in each Clause defines the relevant tests that can be applied to that particular type of reactor and may include some additional items that shall be agreed on at the time of order.

Annexes A, B, C, D, F and G provide further information for certain reactor applications and testing. Annex E describes the dielectric turn-to-turn test.

This part of IEC 60076 covers both dry-type and liquid-immersed reactors and where Clauses or Subclauses apply to only one type this is made clear.

Where possible, the requirements of this part of IEC 60076 have been harmonised with the equivalent IEEE standard.

AUSTRALIAN/NEW ZEALAND STANDARD

# Power transformers

## Part 6: Reactors

### 1 Scope

This part of IEC 60076 applies to the following types of reactors:

- shunt reactors;
- series reactors including current-limiting reactors, neutral-earthing reactors, power flow control reactors, motor starting reactors, arc-furnace series reactors;
- filter (tuning) reactors;
- capacitor damping reactors;
- capacitor discharge reactors;
- earthing transformers (neutral couplers);
- arc-suppression reactors;
- smoothing reactors for HVDC and industrial application;

with the exception of the following reactors:

- reactors with a rating less than 1 kvar single-phase and 5 kvar three-phase;
- reactors for special purposes such as high-frequency line traps or reactors mounted on rolling stock.

Where IEC standards do not exist for small or special reactors, this part of IEC 60076 may be applicable as a whole or in part.

### 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 60060-1:1989, *High-Voltage test techniques – Part 1: General definitions and test requirements*

IEC 60076-1:1993, *Power transformers – Part 1: General*
Amendment 1 (1999)

IEC 60076-2:1997, *Power transformers – Part 2: Temperature rise*

IEC 60076-3:2000, *Power transformers – Part 3: Insulation levels, dielectric tests and external clearances in air*

IEC 60076-4:2002, *Power transformers – Part 4: Guide to lightning impulse and switching impulse testing – Power transformers and reactors*

IEC 60076-5:2006, *Power transformers – Part 5: Ability to withstand short-circuit*