

FINAL VERSION

VERSION FINALE

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

**Transformateurs de puissance –
Partie 3: Niveaux d'isolement, essais diélectriques et distances d'isolement
dans l'air**

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references.....	7
3 Terms and definitions	7
4 General	8
5 Highest voltage for equipment and rated insulation level.....	10
6 Transformers with re-connectable windings.....	11
7 Dielectric tests.....	12
7.1 Overview	12
7.2 Test requirements.....	13
7.2.1 General	13
7.2.2 Test voltage levels	14
7.2.3 Test sequence	17
7.3 Test requirements for specific transformers	17
7.3.1 Tests for transformers with $U_m \leq 72,5$ kV.....	17
7.3.2 Tests on transformers with $72,5$ kV < $U_m \leq 170$ kV	18
7.3.3 Tests on Transformers with $U_m > 170$ kV.....	19
7.4 Assigning U_m and test voltages to the neutral terminal of a winding	20
7.4.1 Transformers with $U_m \leq 72,5$ kV	20
7.4.2 Transformers with $U_m > 72,5$ kV	20
8 Dielectric tests on transformers that have been in service	20
9 Insulation of auxiliary wiring (AuxW).....	21
10 Applied voltage test (AV).....	21
11 Induced voltage tests (IVW and IVPD)	22
11.1 General	22
11.2 Induced voltage withstand test (IVW)	22
11.3 Induced voltage test with partial discharge measurement (IVPD)	23
11.3.1 General	23
11.3.2 Test duration and frequency.....	23
11.3.3 Test sequence	23
11.3.4 Partial discharge (PD) measurement.....	24
11.3.5 Test acceptance criteria.....	25
12 Line terminal AC withstand test (LTAC).....	25
13 Lightning impulse tests (LI, LIC, LIN, LIMT).....	26
13.1 Requirements for all lightning impulse tests	26
13.1.1 General	26
13.1.2 Tap positions	26
13.1.3 Records of tests.....	26
13.1.4 Test connections.....	27
13.2 Full wave lightning impulse test (LI)	28
13.2.1 Wave shape, determination of test voltage value and tolerances	28
13.2.2 Tests on transformers without non-linear elements.....	29
13.2.3 Tests on transformers with non-linear elements.....	30
13.3 Chopped wave lightning impulse test (LIC).....	31

13.3.1	Wave shape.....	31
13.3.2	Tests on transformers without non-linear elements.....	31
13.3.3	Tests on transformers with non-linear elements.....	32
13.4	Lightning impulse test on a neutral terminal (LIN).....	33
13.4.1	General	33
13.4.2	Waveshape.....	33
13.4.3	Test sequence	34
13.4.4	Test criteria	34
14	Switching impulse test (SI).....	34
14.1	General	34
14.2	Test connections	34
14.3	Waveshape	35
14.4	Test sequence.....	35
14.5	Test criteria	35
15	Action following test failure	36
16	External clearances in air.....	36
16.1	General	36
16.2	Clearance requirements.....	37
Annex A (informative)	Application guide for partial discharge measurements on transformers	40
Annex B (informative)	Overtoltage transferred from the high-voltage winding to a low-voltage winding	45
Annex C (informative)	Information on transformer insulation and dielectric tests to be supplied with an enquiry and with an order.....	47
Annex D (informative)	Neutral insulation voltage level calculation	50
Annex E (informative)	Basis for dielectric tests, insulation levels and clearances	53
Bibliography	56
Figure 1	– Time sequence for the application of test voltage for induced voltage test with partial discharge measurement (IVPD)	24
Figure A.1	– Calibration circuit for partial discharge measurement using the test tap of condenser type bushing.....	41
Figure A.2	– Circuit for partial discharge measurement using a high-voltage coupling capacitor.....	42
Figure B.1	– Equivalent circuit for capacitive transfer of overvoltage	46
Table 1	– Requirements and tests for different categories of transformers based on the U_m of the highest voltage winding	14
Table 2	– Test voltage levels (1 of 2).....	15
Table 3	– Test voltage levels used in special cases	16
Table 4	– Minimum clearances in air (1 of 2)	38

INTERNATIONAL ELECTROTECHNICAL COMMISSION

POWER TRANSFORMERS –**Part 3: Insulation levels, dielectric tests
and external clearances in air**

FOREWORD

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This Consolidated version is not an official IEC Standard and has been prepared for user convenience. Only the current versions of the standard and its amendment(s) are to be considered the official documents.

This Consolidated version of IEC 60076-3 bears the edition number 3.1. It consists of the third edition (2013-07) [documents 14/745/FDIS and 14/749/RVD] and its amendment 1 (2018-03) [documents 14/947/FDIS and 14/952/RVD]. The technical content is identical to the base edition and its amendment.

This Final version does not show where the technical content is modified by amendment 1. A separate Redline version with all changes highlighted is available in this publication.

International Standard IEC 60076-3 has been prepared by IEC technical committee 14: Power transformers.

This third edition of IEC 60076-3 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 $U_m > 72,5\text{kV}$.
- 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 $U_m > 800\text{kV}$.
- A new Annex E has been introduced, which sets out the principles used in assigning the tests, test levels and clearances in air.

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 the base publication and its amendment 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 U_m .

POWER TRANSFORMERS –

Part 3: Insulation levels, dielectric tests and external clearances in air

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