SLOVENSKI STANDARD
SIST EN IEC 60076-4:2026

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Nadomešča:

SIST EN 60076-4:2004

Močnostni transformatorji - 4. del: Testiranje atmosferske udarne napetosti in preklopnega impulza za močnostne transformatorje in reaktorje (IEC 60076-4:2026)

Power transformers - Part 4: Lightning impulse and switching impulse tests of power transformers and reactors (IEC 60076-4:2026)

Leistungstransformatoren - Teil 4: Leitfaden zur Blitz- und Schaltstoßspannungsprüfung von Leistungstransformatoren und Drosselspulen (IEC 60076-4:2026)

Transformateurs de puissance - Partie 4: Essais au choc de foudre et au choc de manœuvre des transformateurs de puissance et bobines d'inductance (IEC 60076-4:2026)

Ta slovenski standard je istoveten z: **EN IEC 60076-4:2026**

ICS:

29.180	Transformatorji. Dušilke	Transformers. Reactors

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English Version

Power transformers - Part 4: Lightning impulse and switching impulse tests of power transformers and reactors (IEC 60076-4:2026)

Transformateurs de puissance - Partie 4: Essais au choc de foudre et au choc de manœuvre des transformateurs de puissance et bobines d'inductance (IEC 60076-4:2026)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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European foreword

The text of document 14/1204/FDIS, future edition 2 of IEC 60076-4, prepared by TC 14 "Power transformers" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60076-4:2026.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2027-09-30
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2029-09-30

This document supersedes EN 60076-4:2002 and all of its amendments and corrigenda (if any).

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Endorsement notice

The text of the International Standard IEC 60076-4:2026 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standard indicated:

IEC 60076-1:2011	NOTE	Approved as EN 60076-1:2011 (not modified)
IEC 61083-2:2013	NOTE	Approved as EN 61083-2:2013 (not modified)

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cencenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60060-1	2010	High-voltage test techniques - Part 1: General definitions and test requirements	EN 60060-1	2010
IEC 60060-2	-	High-voltage test techniques - Part 2: Measuring systems	EN IEC 60060-2	-
IEC 60076-3	2013	Power transformers - Part 3: Insulation levels, dielectric tests and external clearances in air	EN 60076-3	2013
IEC 60076-6	-	Power transformers - Part 6: Reactors	EN 60076-6	-
IEC 61083-1	-	Instruments and software used for measurements in high-voltage and high-current tests - Part 1: Requirements for instruments for impulse tests	-	-

IEC 60076-4

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Power transformers -
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

Power transformers - Part 4: Lightning impulse and switching impulse tests of power transformers and reactors

FOREWORD

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IEC 60076-4 has been prepared by IEC technical committee 14: Power transformers. It is an International Standard.

This second edition cancels and replaces the first edition published in 2002. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) lightning impulse tests in the presence of a relative overshoot value of 5 % or more (8.1.2). The 2002 edition did not specified how to proceed when the overshoot exceeds 5 %. In this revision, the testing laboratory is permitted to carry out the tests provided that the voltage function calculation, as defined in IEC 60060-1:2010, is applied;
b) newly introduced test voltage for tail-chopped lightning impulse tests (8.2.2);

c) switching impulse tests on 3 phase transformers, test connections (see Figure 5 and Figure 6);

d) new Glaninger circuit in Clause A.3 about low-impedance windings (L_t < 20 mH);

e) new Annex C with examples of oscillograms with peak voltage overshoot.

The text of this International Standard is based on the following documents:

Draft	Report on voting
14/1204/FDIS	14/1208/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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 document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

– reconfirmed,
– withdrawn, or
– revised.

1 Scope

This part of IEC 60076 applies to lightning and switching impulse tests on power transformers and reactors.

Information is given on waveforms, test circuits including test connections, earthing practices, failure detection methods, test procedures, measuring techniques and interpretation of results.

Where applicable, the test techniques are as described in IEC 60060-1 and IEC 60060-2.

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 60060-1:2010, *High-voltage test techniques - Part 1: General definitions and test requirements*

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

IEC 60076-3:2013, *Power transformers - Part 3: Insulation levels, dielectric tests and external clearances in air*

IEC 60076-6, *Power transformers - Part 6: Reactors*

IEC 61083-1, *Instruments and software used for measurements in high-voltage and high-current tests - Part 1: Requirements for instruments for impulse tests*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

– IEC Electropedia: available at https://www.electropedia.org/
– ISO Online browsing platform: available at https://www.iso.org/obp

4 General

This document is primarily based on the use of conventional impulse generators for both lightning and switching impulse tests of transformers and reactors. The practice of switching impulse generation with discharge of a separate capacitor into an intermediate or low-voltage winding is also applicable. However, the method which employs an additional inductance in series with the capacitor to provide slightly damped oscillations transferred into the high-voltage winding is not applicable.

Alternative means of switching impulse generation or simulation such as DC current interruption on an intermediate or low-voltage winding or the application of a part-period of power frequency voltage are not discussed since these methods are not as generally applicable.

Different considerations in the choice of test circuits (terminal connections) for lightning and switching impulse tests apply for transformers and reactors. On transformers, all terminals and windings can be lightning impulse tested to specific and independent levels. In switching impulse test, however, because of the induced voltage transferred, a specified test level can only be obtained on one winding (see IEC 60076-3).

Whilst, on reactors, lightning impulse tests is similar to that on transformers, i.e., all terminals can be tested separately, different considerations apply and different problems arise in switching impulse tests. Hence, in this document, lightning impulse tests are covered by a common text for both transformers and reactors whilst switching impulse test is dealt with separately for the two types of equipment.

5 Specified waveforms

The voltage waveforms to be used normally during lightning and switching impulse tests of transformers and reactors are given in IEC 60076-3, IEC 60076-6 and the methods for their determination shall refer to IEC 60060-1.

6 Test circuit

The physical arrangement of test equipment, test object and measuring circuits can be divided into three major circuits:

– the main circuit including the impulse generator, additional waveshaping components and the test object;
– the voltage measuring circuit;
– the chopping circuit where applicable.

This basic arrangement is shown in Figure 1.

The following parameters influence the impulse waveform:

a) the effective capacitance C_t, and inductance of the test object, L_t; C_t is constant for any given design and any given waveform, L_t is also a constant for any given design. The effective L_t, however, can be influenced by the terminal treatment. It varies between the leakage inductance L_s for short-circuited terminals and L_o for open-circuited terminals. More details in this respect are given in 8.1 and 8.3 and in Annex A;
b) the generator capacitance C_g;
c) waveshaping components, both internal and external to the generator, R_{si}, R_{se}, R_p, C_L (plus, where applicable, the impedance of a voltage divider Z_1);
d) the stray inductance and capacitance of the generator and the complete test circuit;
e) chopping equipment, where applicable;
f) non-linear elements in the transformer, which can cause differences between impulses at different voltage levels.

The front time T_1 is determined mainly by combination of the effective surge capacitance of the test object, including C_L, and the generator internal and external series resistances.

The time to half-value T_2 is, for lightning impulses, primarily determined by the generator capacitance, the inductance of the test object and the generator discharge resistance or any other parallel resistance. However, there are cases, for example, windings of extremely low inductance, where the series resistance will have a significant effect also on the wavetail. For switching impulses, other parameters apply; these are dealt with in Clause 9.