SLOVENSKI STANDARD
oSIST prEN IEC 60060-2:2023

01-junij-2023

Tehnike visokonapetostnega preskušanja - 2. del: Merilni sistemi

High-voltage test techniques - Part 2: Measuring systems

Hochspannungs-Prüftechnik - Teil 2: Messsysteme

Techniques des essais à haute tension - Partie 2: Systèmes de mesure

Ta slovenski standard je istoveten z: **prEN IEC 60060-2:2023**

ICS:

17.220.20	Merjenje električnih in magnetnih veličin	Measurement of electrical and magnetic quantities
19.080	Električno in elektronsko preskušanje	Electrical and electronic testing

oSIST prEN IEC 60060-2:2023 **en**

42/416/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER:	
IEC 60060-2 ED4	
DATE OF CIRCULATION:	CLOSING DATE FOR VOTING:
2023-04-21	**2023-07-14**
SUPERSEDES DOCUMENTS:	
42/401/CD, 42/415/CC	

IEC TC 42 : HIGH-VOLTAGE AND HIGH-CURRENT TEST TECHNIQUES	
SECRETARIAT:	SECRETARY:
Canada	Mr Howard G. Sedding
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD:
TC 14,TC 17,TC 36,TC 37,TC 38,TC 122	☒
	Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.

FUNCTIONS CONCERNED:

☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY

☒ SUBMITTED FOR CENELEC PARALLEL VOTING	☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING
Attention IEC-CENELEC parallel voting The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.	

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of

- any relevant patent rights of which they are aware and to provide supporting documentation,
- any relevant “in some countries” clauses to be included should this proposal proceed. Recipients are reminded that the enquiry stage is the final stage for submitting "in some countries" clauses. See AC/22/2007.

TITLE:

High-voltage test techniques - Part 2: Measuring systems

PROPOSED STABILITY DATE: 2026

NOTE FROM TC/SC OFFICERS:

CONTENTS

195 ## Introduction relevant for CD only

196 A sweeping review has been made on usage of “may” incorrectly being used as indication of
197 possibility: The review is based on ISO/IEC Directives Part 2: 2018, which in Table 5 states
198 "May" signifies permission expressed by the document, whereas "can" refers to the ability of a
199 user of the document or to a possibility open to him/her.

200 All internal clause references etc. in the document have been changed from pure text into active
201 Hyperlinks. This makes it possible to look up references by simply clicking the reference. This
202 feature can be carried over into pdf versions.

203 A review of definitions has been made in order to align, where applicable, to IEC 60050 as
204 published in electropedia.org

205 The requirement that “Note to entry” (in definitions) shall always be numbered even if only one,
206 has been implemented

207

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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HIGH-VOLTAGE TEST TECHNIQUES

Part 2: Measuring systems

FOREWORD

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IEC 60060-2 has been prepared by IEC technical committee 42: High-voltage test techniques. It is an International Standard.

This fourth edition of IEC 60060-2 cancels and replaces the third edition, published in 2010, and constitutes a technical revision.

The significant technical changes with respect to the previous edition are as follows:

a) The general layout and text were updated and improved to make the standard easier to use.
b) The standard was revised to align it with IEC 60060-1 Edition 4.
c) The treatment of measurement uncertainty estimation has been expanded.
d) This document is now applicable to measuring systems used in testing at all standard insulation levels specified in IEC 60071-1.
e) The measurement uncertainty requirement for the front time of the standard lighting impulse voltage has been changed from 10% to 15%, for testing at all standard insulation levels specified in IEC 60071-1.

f) Parameter “time-to-peak” of the switching impulse defined in IEC 60060-1 Ed.3 has now been replaced by “front time” in IEC 60060-1 Ed.4. Necessary changes have been made in this document to accommodate this change in IEC 60060-1.

g) Annex B.1 has been significantly revised to align more closely with the provisions of Clause 5, including using the same nomenclature.

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

Draft	Report on voting
XX/XX/FDIS	XX/XX/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.

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/standardsdev/publications.

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,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

HIGH-VOLTAGE TEST TECHNIQUES

Part 2: Measuring systems

1 Scope

This part of IEC 60060 is applicable to complete measuring systems, and to their components, used for the measurement of high voltages during laboratory and factory tests with direct voltage, alternating voltage and lightning and switching impulse voltages as specified in IEC 60060-1. For measurements during on-site tests see IEC 60060-3.

The limits on uncertainties of measurements stated in this standard apply to test levels stated in IEC 60071-1. The principles of this standard apply also to higher levels but the uncertainty can be greater.

This standard:

- defines the terms used;
- describes methods to estimate the uncertainties of high-voltage measurements;
- states the requirements which the measuring systems shall meet;
- describes the methods for approving a measuring system and checking its components;
- describes the procedures by which the user shall show that a measuring system meets the requirements of this standard, including the limits set for the uncertainty of measurement.

2 Normative references

The following referenced documents are indispensable for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60052, *Voltage measurement by means of standard air gaps*

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

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

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

IEC 61083-2, *Digital recorders for measurement in high-voltage impulse tests – Part 2: Evaluation of software used for the determination of the parameters of impulse waveforms*

ISO/IEC Guide 98-3:2008, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurements (GUM: 1995)*

NOTE Further related standards, guides, etc. on subjects included in this Document are given in the bibliography.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 Measuring systems

3.1.1
measuring system
complete set of devices suitable for performing a high-voltage measurement; software, used to obtain or calculate measuring results, also forms a part of the measuring system

NOTE 1 to entry A measuring system usually comprises the following components:

– a converting device with the leads required for connecting this device to the test object or into the circuit and the connections to earth;

– a transmission system connecting the output terminals of the converting device to the measuring instruments with its attenuating, terminating and adapting impedances or networks;

– a measuring instrument together with any connection to the power supply. Measuring systems which comprise only some of the above components or which are based on non-conventional principles are acceptable if they meet the uncertainty requirements specified in this document;

– and in some cases the measuring chain can include software to calculate the measurand.

NOTE 2 to entry The environment in which a measuring system functions, its clearances to live and earthed structures and the presence of electric or magnetic fields can significantly affect the measurement result and its uncertainty.

3.1.2
record of performance
detailed record, established and maintained by the user, describing the measuring system and containing evidence that the requirements given in this standard have been met

NOTE 1 to entry This evidence includes the results of the initial performance test and the schedule and results of each subsequent performance test and performance check.

3.1.3
approved measuring system
measuring system that is shown to comply with one or more of the sets of requirements set out in this document

3.1.4
reference measuring system
measuring system with its calibration traceable to relevant national and/or international standards, and having sufficient accuracy and stability for use in the approval of other systems by making simultaneous comparative measurements with specific types of waveform and ranges of voltage

NOTE 1 to entry A reference measuring system (maintained according to the requirements of this standard) may be used as an approved measuring system but the converse is not true.

3.2 Components of a measuring system

3.2.1
converting device
device for converting the quantity to be measured (measurand) into a quantity, compatible with the measuring instrument

3.2.2
voltage divider
device comprising resistors, inductors, capacitors, transformer(s) or a combination of these components such that, between two points of the device, a desired fraction of the voltage applied to the device as a whole can be obtained

[SOURCE: IEC 60050-312:2001, 312-02-32]

3.2.3
voltage transformer
an instrument transformer consisting of a transformer in which the secondary voltage, in normal conditions of use, is substantially proportional to the primary voltage and differs in phase from it by an angle which is approximately zero for an appropriate direction of the connections

[SOURCE: IEC 60050-321:1986, 321-03-01]

3.2.4
voltage converting impedance
converting device which carries a current proportional to the applied voltage to be measured with a current measuring instrument

3.2.5
electric-field probe
converting device for the measurement of the amplitude and waveform of an electric field

NOTE 1 to entry An electric-field probe can be used to measure the waveform of the voltage producing the field provided that the measurement is not affected by corona or space charges.

3.2.6
transmission system
set of devices that transfers the output signal of a converting device to a measuring instrument

NOTE 1 to entry A transmission system usually consists of a coaxial cable with its terminating impedance, but it can include attenuators, amplifiers, or other devices connected between the converting device and the measuring instrument. For example, an optical link includes a transmitter, an optical cable and a receiver as well as related amplifiers.

NOTE 2 to entry A transmission system can be partially or completely included in the converting device or in the measuring instrument.

3.2.7
measuring instrument
device intended to make measurements, alone or in conjunction with supplementary devices

[SOURCE IEC 60050-311:2001, 311-03-01]

3.3 Scale factors

3.3.1
scale factor of a measuring system
factor by which the value of the measuring-instrument reading is multiplied to obtain the value of the input quantity of the complete measuring system

NOTE 1 to entry A measuring system can have multiple scale factors for different assigned measurement ranges, frequency ranges or waveforms.

NOTE 2 to entry For measuring systems that display the value of the input quantity directly, the nominal scale factor of the measuring system is unity.

3.3.2
scale factor of a converting device
factor by which the output of the converting device is multiplied to obtain its input quantity

NOTE 1 to entry The scale factor of a converting device can be dimensionless (for example, the ratio of a divider) or can have dimensions (for example, the impedance of a voltage converting impedance).

3.3.3
scale factor of a transmission system
factor by which the output of a transmission system is multiplied to obtain its input quantity

3.3.4
scale factor of a measuring instrument
factor by which the instrument reading is multiplied to obtain its input quantity

3.3.5
assigned scale factor
F
scale factor of a measuring system determined at the most recent performance test

NOTE 1 to entry A measuring system can have more than one assigned scale factor; for example, it can have several ranges and/or nominal epochs, each with a different scale factor.

3.4 Rated values

3.4.1
operating conditions
specified ranges of conditions under which a measuring system will operate within the specified uncertainty limits

3.4.2
rated operating voltage
maximum level of voltage of specified frequency or waveform at which a measuring system is designed to be used

NOTE 1 to entry The rated operating voltage can be higher than the upper limit of the assigned measurement range.

3.4.3
assigned measurement range
range of voltage of specified frequency or waveform, characterized by a single scale factor, in which a measuring system can be used

NOTE 1 to entry The limits of the assigned measurement range are chosen by the user and verified by the performance tests specified in this standard.

NOTE 2 to entry A measuring system can have more than one assigned measurement range with different scale factors.

3.4.4
assigned operating time
longest time during which a measuring system for direct or alternating voltages can operate at the upper limit of the assigned measurement range

3.4.5
assigned rate of application
highest rate of specified voltage impulses for a specified time interval, at which the measuring system can operate at its upper limit of the assigned measurement range

NOTE 1 to entry The rate is usually given as applications per minute and the time interval in minutes or hours.

3.5 Definitions related to dynamic behaviour

3.5.1
response of a measuring system,
G
output, as a function of time or frequency, when a specified voltage is applied to the input of the system

3.5.2
amplitude-frequency response,
$G(f)$
ratio of the output to the input of a measuring system as a function of frequency f, when the input is sinusoidal (see Figure 1)