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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

High-current test techniques – Definitions and requirements for test currents and measuring systems

Techniques des essais à haute intensité – Définitions et exigences relatives aux courants d'essai et systèmes de mesure

IEC 62475:2010

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

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Email: csc@iec.ch
Tél.: +41 22 919 02 11
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HIGH-CURRENT TEST TECHNIQUES – DEFINITIONS AND REQUIREMENTS FOR TEST CURRENTS AND MEASURING SYSTEMS

FOREWORD

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International Standard IEC 62475 has been prepared by IEC technical committee 42: High-voltage test techniques.

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

FDIS	Report on voting
42/278/FDIS	42/283/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.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to this specific publication. At this date, the publication will be:

- reconfirmed;
- withdrawn;
- replaced by a revised edition; or
- amended.

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HIGH-CURRENT TEST TECHNIQUES – DEFINITIONS AND REQUIREMENTS FOR TEST CURRENTS AND MEASURING SYSTEMS

1 Scope

This International Standard is applicable to high-current testing and measurements on both high-voltage and low-voltage equipment. It deals with steady-state and short-time direct current (as e.g. encountered in high-power d.c. testing), steady-state and short-time alternating current (as e.g. encountered in high-power a.c. testing), and impulse-current. In general, currents above 100 A are considered in this International Standard, although currents less than this can occur in tests.

NOTE This standard also covers fault detection during, for example, lightning impulse testing.

This standard:

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

2 Normative references

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

IEC 60051-2:1984, *Direct acting analogue electrical measuring instruments and their accessories – Part 2: Special requirements* for ammeters and voltmeters

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

IEC 61180-1, *High-voltage test techniques for low-voltage equipment – Part 1: Definitions, test and procedure requirements*

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

NOTE Further related standards, guides, etc. on subjects included in this standard 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 measurements of a quantity to be measured (measurand). Software used to obtain or calculate measurement results also forms a part of the measuring system

NOTE 1 A high-current measuring system usually comprises the following components:

- converting device with either terminals to connect this device in circuit or appropriate coupling to the circuit, and connections to earth;
- transmission system(s) connecting the output terminals of the converting device to the measuring instrument(s) with its attenuating, terminating, and adapting impedances or networks; and
- measuring instrument(s) together with any connections 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 standard.

NOTE 2 The environment in which a measuring system functions, its clearances to live, current carrying, and earthed structures, and the presence of electromagnetic fields may 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. 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 standard

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 current

NOTE A reference measuring system (maintained according to the requirements of this standard) can 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
current-converting shunt
resistor across which the voltage is proportional to the current to be measured

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

[IEC 60050-321:1986, 321-02-01]

NOTE Current transformers are usually defined for a single frequency, but special designs with a wide frequency range are possible.

3.2.4
Rogowski coil
inductive current-converting device without iron; measuring systems based on a Rogowski coil include an integrating circuit (passive, active, or numerical)

NOTE Measuring systems based on a Rogowski coil can be designed for current measurements in a wide range of frequencies.

3.2.5
transmission system
set of devices that transfers the output signal of a converting device to a measuring instrument(s)

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

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

3.2.6
measuring instrument
device intended to make measurements, alone or in conjunction with supplementary devices

[IEC 60050-300:2001, 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 to be multiplied to obtain the value of the input quantity of the complete measuring system

NOTE 1 A measuring system may have multiple scale factors for different current ranges, frequency ranges or waveforms.

NOTE 2 Some measuring systems display the value of the input quantity directly (i.e., the 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 to be multiplied to obtain its input quantity

NOTE The scale factor of a converting device may be dimensionless (for example, the ratio of a current transformer) or may have dimensions (for example, related to the impedance of a current-converting shunt).

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

3.3.4
scale factor of a measuring instrument
factor by which the instrument reading is to be 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 A measuring system may have more than one assigned scale factor; for example, it may have several ranges, each with a different scale factor.

3.4 Rated values

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

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

NOTE The rated current may be higher than the upper limit of the assigned measurement range.

3.4.3
assigned measurement range
range of current of specified frequency or waveform in which a measuring system can be used within the uncertainty limits given in this standard, characterized by a single scale factor

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

NOTE 2 A measuring system may have more than one assigned measurement range, with different scale factors established for the different ranges.

3.4.4
assigned operating time
longest time during which a d.c. or a.c. current measuring system can operate at the upper limit of the assigned measurement range within the uncertainty limits given in this standard

3.4.5
assigned rate of application
highest rate of specified short-time currents or impulse currents that can be applied in a given time interval, at which the measuring system can operate at the upper limit of the assigned measurement range and stay within the uncertainty limits given in this standard

NOTE The assigned rate of application could for example be expressed as the number of applications per minute and the time interval in minutes or hours.

3.5 Definitions related to the dynamic behaviour

3.5.1
response of a measuring system,
g or G
output, as a function of time or frequency, when a specified current 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