SLOVENSKI STANDARD
oSIST prEN IEC 60477:2021

01-julij-2021

Laboratorijski upori za enosmerni tok

Laboratory DC resistors

Gleichstrom-Meßwiderstände

Résistances de laboratoire à courant continu

Ta slovenski standard je istoveten z: **prEN IEC 60477:2021**

ICS:

17.220.20	Merjenje električnih in magnetnih veličin	Measurement of electrical and magnetic quantities

oSIST prEN IEC 60477:2021 **en,fr,de**

85/771/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: **IEC 60477 ED2**	
DATE OF CIRCULATION: **2021-05-21**	CLOSING DATE FOR VOTING: **2021-08-13**
SUPERSEDES DOCUMENTS: **85/734/CD, 85/757/CC**	

IEC TC 85 : MEASURING EQUIPMENT FOR ELECTRICAL AND ELECTROMAGNETIC QUANTITIES	
SECRETARIAT: China	SECRETARY: Ms Guiju HAN
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: ☒ 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 **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.	☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

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.

TITLE:

Laboratory DC resistors

PROPOSED STABILITY DATE: 2025

NOTE FROM TC/SC OFFICERS:

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

____

LABORATORY DC RESISTORS

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60477 has been prepared by IEC technical committee 85: Measuring equipment for electromagnetic quantities.

This second edition cancels and replaces the first edition published in 1974, Amendment 1: 1997. This edition constitutes a technical revision.

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

– replaced d.c. with DC according IEC 60050-151:2001, 151-15-02;
– extended the resistor accuracy class scope of this document;
– deleted the resistor accuracy class expression in parts per million (ppM);
– excluded the active resistor from scope of this document;
– updated the terms and definition according to new IEC 60050 series;
– changed the term "resistance decade" to "resistance dial" to cover the multi-dial resistors with other resistance step values;
– updated the intrinsic error to intrinsic uncertainty according IEC 60359;
– added the limits of relative stability for resistor of classes 0.00005… 0.01;
– added the requirement of high voltage high resistor;

– updated the safety symbols and requirements according to new IEC 61010 series;
– updated the insulation resistance requirements of resistor;
– added the requirement of temperature coefficient;
– updated the temperature requirements for transport and storage of resistor according to IEC 60051-1.

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 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/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 "http://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.

LABORATORY DC RESISTORS

1 Scope

This document applies to resistors intended for use as laboratory DC resistors (hereinafter referred to as “resistors”) comprising standard resistors, single or multiple resistors of accuracy Classes 0.00005…10 and single or multi-dial resistors of accuracy Classes 0.0005 … 10.

This document does not apply to:

a) resistors which are intended for use solely as permanent mounted circuit components,

b) resistors used on alternating current or on pulsed current,

c) active resistor

d) series resistors and shunts which are considered as accessories of electrical measuring instruments in the relevant IEC publication.

EXAMPLE 1 IEC 60051: Recommendations for Direct Acting Indicting Electrical Instruments and Their Accessories.

EXAMPLE 2 IEC 60258: Direct Recording Electrical Measuring Instruments and Their Accessories.

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 60027(all parts), *Letter symbols to be used in electrical technology*

IEC 60359: 2001, *Electrical and electronic measurement equipment - Expression of performance*

IEC 60417, *Graphical symbols for use on equipment*

IEC 61010-1, Safety requirements for electrical equipment for measurement, control, and laboratory use – Part1: General requirements

IEC 61010-2-30, Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-030: Particular requirements for testing and measuring circuits

3 Terms and definitions

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

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

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

3.1 General terms

3.1.1
terminal
point of interconnection of an electric circuit element, an electric circuit or a network with other electric circuit elements, electric circuits or networks

Note 1 to entry: For an electric circuit element the terminals are the points at which or between which the related integral quantities are defined. At each terminal, there is only one electric current from outside into the element.

[SOURCE: IEC 60050-131:2002,131-11-11]

3.1.2
two-terminal device
device having two terminals, or device having more than two terminals where only the performance at two terminals forming a pair is of interest

[SOURCE: IEC 60050-151:2001, 151-12-13]

3.1.3
resistor
two-terminal device characterized essentially by its resistance

[SOURCE: IEC 60050-151:2001, 151-13-19]

3.1.4
four-terminal resistor
resistor fitted with two current terminals and two voltage terminals

[SOURCE: IEC 60050-313:2001, 313-09-06, modified – deleting the words “injection” and “measuring”.]

3.1.5
single value resistor
device which provides a single definite resistance value between certain terminals

3.1.6
multiple value resistor
assembly comprising a number of resistors which are accessible either singly or in combination and which provides definite resistance values between certain terminals

3.1.7
measuring dial
dial from which the value of the measured quantity is determined, taking into account the range factor, if any

Note 1 to entry: In general, the dial also carries other information characterizing the instrument.

[SOURCE: IEC 60050-314:2001,314-09-03]

3.1.8
resistance dial
multiple resistor which, by means of a switching device, generally allows the selection of a combination of resistance values rising in equal steps, each step corresponding to an increment of a n-ary resistance value

Note 1 to entry: It is usual resistance decade with each step corresponding to an increment of a decadic resistance value (e.g. 0.1 Ω or 1 Ω or 10 Ω...)

Note 2 to entry: A resistance decade generally allows a selection of 10, 11 or 12 resistance values (including zero).

3.1.9
multi-dial resistor
multiple resistor comprising a number of resistance dials which are generally connected in series

Note 1 to entry: For resistor comprising a number of resistance decades, It is usually called multi-decade resistor.

3.1.10
material measure
device intended to reproduce or supply, in a permanent manner during its use, one or more known values of a given quantity

EXAMPLE Standard electric resistor

Note 1 to entry: The quantity concerned may be called the supplied quantity

Note 2 to entry: The definition covers also those devices, such as signal generators and standard voltage or current generators, often referred to as supply instruments.

Note 3 to entry: The identification of the value and uncertainty of the supplied quantity is given by a number tied to a unit of measurement or a code term, called the nominal value or marked value of the material measure.

[SOURCE: IEC 60359:2001, 3.2.3, modified – EXAMPLE has been added according IEC 60050-311:2001,311-03-03.]

3.1.11
(measurement) standard
material measure, measuring instrument, reference material or measuring system intended to define, represent physically, conserve or reproduce a unit of a quantity, or a multiple or sub-multiple thereof (for example, standard resistance), or a known value of a quantity (for example, standard cell), with a given uncertainty

[SOURCE: IEC 60050-311:2001, 311-04-01]

3.1.12
residual resistance
resistance value between the terminals of a multiple resistor having switching devices with a zero position, when all switching elements are set to the zero position

3.1.13
screen
shield (US)
device intended to reduce the penetration of an electric, magnetic or electromagnetic field into a given region

[SOURCE: IEC 60050-151: 2001, 151-13-09]

3.1.14
(local) earth
(local) ground (US)
part of the Earth which is in electric contact with an earth electrode and the electric potential of which is not necessarily equal to zero

[SOURCE: IEC 60050-195:1998, 195-01-03]

3.1.15
earth(verb)
ground (verb) (US)
make an electric connection between a given point in a system or in an installation or in equipment and a local earth

Note 1 to entry: The connection to local earth may be
– intentional, or
– unintentional or accidental
and may be permanent or temporary.

[SOURCE: IEC 60050-195:1998, 195-01-08]

3.1.16
earthing terminal
grounding terminal (US)
DEPRECATED: earth terminal
terminal provided on equipment or on a device and intended for the electric connection with the earthing arrangement

[SOURCE: IEC 60050-195:1998, 195-02-31]

3.1.17
working voltage
highest RMS value of the AC or DC voltage across any particular insulation which can occur when the equipment is supplied at rated voltage

Note 1 to entry: Transients and voltage fluctuations are not considered to be part of the working voltage.

Note 2 to entry: Both open-circuit conditions and normal operating conditions are taken into account.

[SOURCE: IEC 60050-581:2008, 581-21-19, modified – Note 1 and Note 2 to entry have been added according to IEC 60010-1:2001 3.3.3.]

3.1.18
measurement category
classification of testing and measuring circuits according to the type of MAINS to which they are intended to be connected

Note 1 to entry: Measurement categories take into account overvoltage categories, short-circuit current levels, the location in the building installation where the test or measurement is to be made, and some forms of energy limitation or transient protection included in the building installation. See IEC 61010-2-30:2010 Annex AA for more information.

[SOURCE: IEC 61010-2-30:2010 3.5.101]

3.1.19
insulation resistance
resistance under specified conditions between two conductive bodies separated by the insulating material

[SOURCE: IEC 60050-151:2001, 151-15-43]

3.2 Characteristic values

3.2.1
nominal value
value of a quantity used to designate and identify a component, device, equipment, or system

Note 1 to entry: The nominal value is generally a rounded value.

[SOURCE: IEC 60050-151:2001, 151-16-09]

3.2.2
conventional value
measure-value of a standard used in a calibration operation and known with uncertainty negligible with respect to the uncertainty of the instrument to be calibrated

Note 1 to entry: This definition is adapted to the object of this standard from the definition of "conventional true value (of a quantity)": value attributed to a particular quantity and accepted, sometimes by convention, as having an uncertainty appropriate for a given purpose.

[SOURCE: IEC 60359:2001,3.1.13]

3.2.3
(measure-) value
mid element of the set assigned to represent the measurand

Note 1 to entry: The measure-value is no more representative of the measurand than any other element of the set. It is singled out merely for the convenience of expressing the set in the format $V \pm U$, where V is the mid element and U the half-width of the set, rather than by its extremes. The qualifier "measure-" is used when deemed necessary to avoid confusion with the reading-value or the indicated value.

Note 2 to entry: For a multiple resistor with switching devices having a zero position, the measure-value for a given setting is the value obtained for that setting minus the residual resistance (see Sub-clause 3.1.12)

[SOURCE: IEC 60359:2001,3.1.3, modified – Note 2 to entry has been added.]

3.2.4
indication
reading-value
output signal of the instrument

Note 1 to entry: The indicated value can be derived from the indication by means of the calibration curve

Note 2 to entry: For a material measure, the indication is its nominal or stated value

Note 3 to entry: The indication depends on the output format of the instrument:

– for analogue outputs it is a number tied to the appropriate unit of the display;
– for digital outputs it is the displayed digitized number;
– for code outputs it is the identification of the code pattern.

Note 4 to entry: For analogue outputs meant to be read by a human observer (as in the index-on-scale instruments) the unit of output in the unit of scale numbering; for analogue outputs meant to be read by another instrument (as in calibrated transducers) the unit of output is the unit of measurement of the quantity supporting the output signal.

Note 5 to entry: It is the assigned value for a resistor, the measure-value stated in document (see Sub-clause 9.1 p)) for a single or a multiple resistor of classes 0.00005... 0.01, or the nominal value for a single or a multiple resistor of classes 0.01...10.

[SOURCE: IEC 60359:2001, 3.1.5, modified – Note 5 to entry has been added.]

3.2.5
indicated value
value given by an indicating instrument on the basis of its calibration curve

Note 1 to entry: The indicated value is the measure-value of the measurand when the instrument is used in a direct measurement under all the operating conditions for which the calibration diagram is valid.

[SOURCE: IEC 60359:2001, 3.1.9,]

3.2.6
stability of measuring instrument
stability
property of a measuring instrument, whereby its metrological properties remain constant in time

EXAMPLE 1 In terms of the duration of a time interval over which a metrological property changes by a stated amount.

EXAMPLE 2 In terms of the change of property over a stated time interval.

Note 1 to entry: Stability may be quantified in several ways.

Note 2 to entry: For resistor, stability is quantified in the change of resistance measure-value over a year. In this document, it is expressed in relative form divided by the resistance measure-value.

[SOURCE: ISO/IEC GUIDE 99:2007, 4.19, modified – Note 2 to entry has been added.]

3.3 Accuracy class, class index

3.3.1
accuracy class
category of measuring instruments, all of which are intended to comply with a set of specifications regarding uncertainty

Note 1 to entry: An accuracy class always specifies a limit of uncertainty (for a given range of influence quantities), whatever other metrological characteristics it specifies.

Note 2 to entry: An instrument may be assigned to different accuracy classes for different rated operating conditions.

Note 3 to entry: Unless otherwise specified, the limit of uncertainty defining an accuracy class is meant as an interval with coverage factor 2.

Note 4 to entry: Accuracy class of a resistor is defined by the limits of intrinsic relative uncertainty, the limits of relative stability and the limits of variations due to influence quantities.

[SOURCE: IEC 60359:2001, 3.3.7, modified - Note 4 to entry has been added.]

3.3.2
class index
conventional designation of an accuracy class by a number or symbol

[SOURCE: IEC 60050-311:2001, 311-06-10]

3.4 Influence quantities, reference conditions, nominal range of use

3.4.1
influence quantity
quantity which is not the subject of the measurement and whose change affects the relationship between the indication and the result of the measurement

Note 1 to entry: Influence quantities can originate from the measured system, the measuring equipment or the environment.

Note 2 to entry: As the calibration diagram depends on the influence quantities, in order to assign the result of a measurement it is necessary to know whether the relevant influence quantities lie within the specified range.

Note 3 to entry: An influence quantity is said to lie within a range C' to C" when the results of its measurement satisfy the relationship: $C' \leq V - U < V + U \leq C"$.

[SOURCE: IEC 60359:2001,3.1.14]

3.4.2
reference conditions
appropriate set of specified values and/or ranges of values of influence quantities under which the smallest permissible uncertainties of a measuring instrument are specified

Note 1 to entry: The ranges specified for the reference conditions, called reference ranges, are not wider, and are usually narrower, than the ranges specified for the rated operating conditions.

[SOURCE: IEC 60359:2001, 3.3.10]

3.4.3
reference value
specified value of one of a set of reference conditions