SLOVENSKI STANDARD

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april 2004

Voltage measurement by means of standard air gaps (IEC 60052:2002)

ICS 19.080

Referenčna številka
SIST EN 60052:2004(en)

EUROPEAN STANDARD

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EN 60052

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English version

Voltage measurement by means of standard air gaps
(IEC 60052:2002)

Mesure de tension au moyen des éclateurs à sphères normalisés (CEI 60052:2002)

Spannungsmessungen mit Standard-Luftfunkenstrecken (IEC 60052:2002)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC

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

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Foreword

The text of document 42/173/FDIS, future edition 3 of IEC 60052, prepared by IEC TC 42, High-voltage testing techniques, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60052 on 2002-11-01.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2003-08-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2005-11-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annex ZA is normative and annex A to D are informative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60052:2002 was approved by CENELEC as a European Standard without any modification.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60060-1 + corr. March	1989 1990	High-voltage test techniques Part 1: General definitions and test requirements	HD 588.1 S1	1991
IEC 60060-2	1994	Part 2: Measuring systems	EN 60060-2 A11	1994 1998

NORME INTERNATIONALE

INTERNATIONAL STANDARD

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Troisième édition
Third edition
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Mesure de tension au moyen des éclateurs à sphères normalisés

Voltage measurement by means of standard air gaps

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

VOLTAGE MEASUREMENT BY MEANS OF STANDARD AIR GAPS

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 the 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 National Committees.
3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60052 has been prepared by IEC technical committee 42: High-voltage testing techniques.

This third edition of IEC 60052 cancels and replaces the second edition, published in 1960, and constitutes a technical revision.

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

FDIS	Report on voting
42/173/FDIS	42/175/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 3.

Annexes A, B, C and D are for information only.

The committee has decided that the contents of this publication will remain unchanged until 2012. At this date, the publication will be

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

INTRODUCTION

Sphere-gaps have been used as a simple and reliable method for measurement of peak voltage in many industrial test facilities for 75 years, and the values of tables I and II in the second edition of IEC 60052 have been accepted as an International Consensus Standard of Measurements. These tables appear in this standard as tables 2 and 3.

There is no information in the references (e.g. annex A) with regard to traceability to national standards of measurement. However, the dispersion in the measured values of sparkover voltages upon which tables 2 and 3 are based, does not exceed 3 % for a 95 % confidence level.

In view of the long history of IEC 60052 as an International Consensus Standard of Measurement, the values for disruptive discharge voltage in tables I and II of the second edition of IEC 60052 are reproduced in this publication as tables 2 and 3. They are to be used as mean values with an uncertainty of 3 % for a 95 % confidence level.

The material on rod-rod gaps for reliable measurement of high direct voltages has been included here to form an integrated standard on high voltage measurements using standard air gaps.

Four informative annexes are included:

Annex A gives the limits of voltage and frequency over which tables 2 and 3 have been derived from experiments and can be presumed to be accurate within the limits specified in 4.1.

Annex B gives the procedure by which the values in tables 2 and 3 have been derived from previous national standards and other sources.

Annex C provides information on additional irradiation, which may be needed in certain situations.

Annex D provides information on the uncertainty and calibration of sphere-gaps.

VOLTAGE MEASUREMENT BY MEANS OF STANDARD AIR GAPS

1 Scope

IEC 60052 sets forth recommendations concerning the construction and use of standard air gaps for the measurement of peak values of the following four types of voltage:

a) alternating voltages of power frequencies;

b) full lightning impulse voltages;

c) switching impulse voltages;

d) direct voltages.

Air gaps constructed and used in accordance with this standard represent IEC standard measuring devices in accordance with IEC 60060-2 and are primarily intended for performance checks of high voltage measuring systems.

2 Normative references

The following referenced documents are indispensable for the application 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 60060-1:1989, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60060-2:1994, *High-voltage test techniques – Part 2: Measuring systems*

3 Definitions

vacant

4 Standard sphere-gap

The standard sphere-gap is a peak voltage measuring device constructed and arranged in accordance with this standard. The points on the two spheres which are closest to each other are called the sparking points. Figures 1 and 2 show two arrangements, one of which is typical of sphere-gaps with a vertical axis and the other of sphere-gaps with a horizontal axis.

4.1 Requirements on shape and surface conditions

The standard sphere-gap consists of two metal spheres of the same diameter D, their shanks, operating gear, insulating supports, supporting frame and leads for connection to the point at which the voltage is to be measured. Standard values of D are 2 – 5 – 6,25 – 10 – 12,5 – 15 – 25 – 50 – 75 – 100 –150 and 200 cm. The spacing between the spheres is designated S.

The spheres shall be carefully made so that their surfaces are smooth and their curvature is as uniform as possible.

The tolerances on size and shape need usually only be checked when the spheres are first supplied and any suitable instrument (e.g. spherometer) may be used.

The diameter of each sphere shall not differ by more than 2 % from the nominal value. The spheres shall be reasonably free from surface irregularities in the region of the sparking point. A medium grade mechanical surface finishing (roughness R_{max} below 10 µm) is considered to be adequate. The region of the sparking point is defined by a circle such as would be drawn on the spheres by a pair of dividers set to an opening of 0,3 D and centred in the sparking point.

When the sphere-gap is used, it will normally be sufficient to examine the surface by touch and visual inspection.

NOTE Any minor damage on the non-adjacent hemispherical surfaces does not alter the sphere-gap performance.

4.2 General arrangement of a sphere-gap for measurement

4.2.1 Vertical gap

When the spheres are arranged vertically, the shank of the high-voltage sphere shall be free from sharp edges or corners and the diameter of the shank shall not exceed 0,2 D over a length D. This requirement is made in order to reduce the influence of the high-voltage shank on the disruptive discharge voltage. If a stress distributor (corona shield) is used at the end of the shank, its greatest dimension, perpendicular to the axis of the spheres, shall not exceed 0,5 D and shall be at least 2 D from the sparking point of the high-voltage sphere.

The earthed shank and the operating gear have a smaller effect and their dimensions are therefore less important.

Figure 1 gives the limits of size of the components of a typical vertical sphere-gap.

The sphere shanks should be visually in line.

4.2.2 Horizontal gap

When the spheres are arranged horizontally, the limiting dimensions of a typical sphere-gap are given in figure 2. They are the same for both sides of the gap.

The sphere shanks should be visually in line.

4.2.3 Height of the spheres above the horizontal earth plane

The height A of the sparking point of the high-voltage sphere above the earth plane of the laboratory floor shall be within the limits given in table 1.

If the sphere-gap is mounted with the earthed sphere nearest to the ceiling, and if other surfaces such as walls and the floor are at a considerably greater distance, then the ceiling shall be regarded as the horizontal plane, from which the distance A is measured downwards.