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Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests

Isolationskoordination für elektrische Betriebsmittel in Niederspannungsanlagen - Teil 1: Grundsätze, Anforderungen und Prüfungen

Coordination de l'isolement des matériels dans les systèmes (réseaux) a basse tension - Partie 1: Principes, exigences et essais

Ta slovenski standard je istoveten z: EN 60664-1:2007

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29.080.30 Izolacijski sistemi Insulation systems

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English version

**Insulation coordination for equipment
within low-voltage systems -
Part 1: Principles, requirements and tests
(IEC 60664-1:2007)**

Coordination de l'isolement
des matériels dans les systèmes
(réseaux) à basse tension -
Partie 1: Principes, exigences
et essais
(CEI 60664-1:2007)

Isolationskoordination
für elektrische Betriebsmittel
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Teil 1: Grundsätze, Anforderungen
und Prüfungen
(IEC 60664-1:2007)

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This European Standard was approved by CENELEC on 2007-07-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 109/58/CDV, future edition 2 of IEC 60664-1, prepared by IEC TC 109, Insulation co-ordination for low-voltage equipment, was submitted to the IEC-CENELEC parallel Unique Acceptance Procedure and was approved by CENELEC as EN 60664-1 on 2007-07-01.

This European Standard supersedes EN 60664-1:2003.

In addition to a number of editorial improvements, the following main changes have been made with respect to EN 60664-1:2003:

- amendment of Japanese mains conditions with regard to the rated impulse voltages, the rationalized voltages and the nominal voltages of supply systems for different modes of overvoltage control;
- amendment of dimensioning of clearances smaller than 0,01 mm;
- alignment of the table and the corresponding formula regarding test voltages for verifying clearances at different altitudes;
- amendment of interpolation of the creepage distance values for functional insulation;
- amendment of creepage distance dimensioning taking into account ribs;
- revision of the former Clause 4 "Tests and measurements" (now Clause 6) to achieve a more detailed description of the tests and their purpose, the test equipment and possible alternatives;
- change of Annex C "Partial discharge test methods" from a former technical report, Type 2 (now called TS), to a normative Annex C.

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) | 2008-04-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn | (dow) | 2010-07-01 |

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60664-1:2007 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 standards indicated:

ISO/IEC Guide 2	NOTE	Harmonized as EN 45020:1998 (not modified).
IEC 60529 + A1	NOTE	Harmonized as EN 60529:1991 + A1:2000 (not modified).

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

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

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60038	1983	IEC standard voltages ¹⁾	HD 472 S1 + corr. February + A1	1989 2002 1995
IEC 60050-151	2001	International Electrotechnical Vocabulary (IEV) - Part 151: Electrical and magnetic devices	-	-
IEC 60050-212	1990	International Electrotechnical Vocabulary (IEV) - Chapter 212: Insulating solids, liquids and gases	-	-
IEC 60050-604 + A1	1987 1998	International Electrotechnical Vocabulary (IEV) - Chapter 604: Generation, transmission and distribution of electricity - Operation	-	-
IEC 60050-826	2004	International Electrotechnical Vocabulary (IEV) - Part 826: Electrical installations	-	-
IEC 60068-1	1988	Environmental testing - Part 1: General and guidance	EN 60068-1 ²⁾	1994
IEC 60068-2-2	1974	Environmental testing - Part 2: Tests - Tests B: Dry heat	EN 60068-2-2 ³⁾	1993
IEC 60068-2-14	1984	Environmental testing - Part 2: Tests - Test N: Change of temperature	EN 60068-2-14 ⁴⁾	1999
IEC 60068-2-78	2001	Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state	EN 60068-2-78	2001
IEC 60085	2004	Electrical insulation - Thermal classification	EN 60085	2004
IEC 60099-1	1991	Surge arresters - Part 1: Non-linear resistor type gapped surge arresters for a.c. systems	EN 60099-1	1994

¹⁾ The title of HD 472 S1 is: Nominal voltages for low voltage public electricity supply systems.

²⁾ EN 60068-1 includes A1:1992 to IEC 60068-1 + corr. October.

³⁾ EN 60068-2-2 includes supplement A to IEC 60068-2-2.

⁴⁾ EN 60068-2-14 includes A1:1986 to IEC 60068-2-14.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60112	2003	Method for the determination of the proof and the comparative tracking indices of solid insulating materials	EN 60112	2003
IEC 60216	Series	Electrical insulating materials - Properties of thermal endurance	EN 60216	Series
IEC 60243-1	1998	Electrical strength of insulating materials - Test methods - Part 1: Tests at power frequencies	EN 60243-1	1998
IEC 60270	2000	High-voltage test techniques - Partial discharge measurements	EN 60270	2001
IEC 60364-4-44 + A1 (mod)	2001 2003	Electrical installations of buildings - Part 4-44: Protection for safety - Protection against voltage disturbances and electromagnetic disturbances	-	-
IEC 60664-4	2005	Insulation coordination for equipment within low-voltage systems - Part 4: Consideration of high-frequency voltage stress	EN 60664-4 + corr. October	2006 2006
IEC 60664-5	- ⁵⁾	Insulation coordination for equipment within low-voltage systems - Part 5: A comprehensive method for determining clearances and creepage distances equal to or less than 2 mm	EN 60664-5	2003 ⁶⁾
IEC 61140 A1 (mod)	2001 2004	Protection against electric shock - Common aspects for installation and equipment	EN 61140 A1	2002 2006
IEC 61180-1	1992	High-voltage test techniques for low-voltage equipment - Part 1: Definitions, test and procedure requirements	EN 61180-1	1994
IEC 61180-2	1994	High-voltage test techniques for low-voltage equipment - Part 2: Test equipment	EN 61180-2	1994
IEC Guide 104	1997	The preparation of safety publications and the use of basic safety publications and group safety publications	-	-

⁵⁾ Undated reference.

⁶⁾ Valid edition at date of issue.



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Edition 2.0 2007-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

BASIC SAFETY PUBLICATION

PUBLICATION FONDAMENTALE DE SÉCURITÉ

**Insulation coordination for equipment within low-voltage systems –
Part 1: Principles, requirements and tests**

**Coordination de l'isolement des matériels dans les systèmes (réseaux)
à basse tension –
Partie 1: Principes, exigences et essais**

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<https://standards.iteh.ai/catalog/standards/sist/22060d14-8f16-4107-846c-6776b38aabb7/sist-en-60664-1-2007>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INSULATION COORDINATION FOR EQUIPMENT
WITHIN LOW-VOLTAGE SYSTEMS –****Part 1: Principles, requirements and tests****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.
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International Standard IEC 60664 has been prepared by technical committee 109: Insulation coordination for low-voltage equipment.

This second edition cancels and replaces the first edition, published in 1992, amendments 1 (2000) and 2 (2002) and a corrigendum (2002).

It has the status of a basic safety publication in accordance with IEC Guide 104.

In addition to a number of editorial improvements, the following main changes have been made with respect to the previous edition:

- Amendment of Japanese mains conditions with regard to the rated impulse voltages, the rationalized voltages and the nominal voltages of supply systems for different modes of overvoltage control
- Amendment of dimensioning of clearances smaller than 0,01 mm

- Alignment of the table and the corresponding formula regarding test voltages for verifying clearances at different altitudes
- Amendment of interpolation of the creepage distance values for functional insulation
- Amendment of creepage distance dimensioning taking into account ribs
- Revision of the former Clause 4 "Tests and measurements" (now Clause 6) to achieve a more detailed description of the tests and their purpose, the test equipment and possible alternatives
- Change of Annex C "Partial discharge test methods" from a former technical report, Type 2 (now called TS), to a normative Annex C.

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

CDV	Report on voting
109/58/CDV	109/62/RVC

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.

A list of all parts in the IEC 60664 series, under the general title *Insulation coordination for equipment within low-voltage systems*, can be found on the IEC website.

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

- reconfirmed; <https://standards.iteh.ai/catalog/standards/sist/22060d14-8f16-4107-846c-6776b38aabb7/sist-en-60664-1-2007>
- withdrawn;
- replaced by a revised edition, or
- amended.

INSULATION COORDINATION FOR EQUIPMENT WITHIN LOW-VOLTAGE SYSTEMS –

Part 1: Principles, requirements and tests

1 Scope and object

This part of IEC 60664 deals with insulation coordination for equipment within low-voltage systems. It applies to equipment for use up to 2 000 m above sea level having a rated voltage up to a.c. 1 000 V with rated frequencies up to 30 kHz, or a rated voltage up to d.c. 1 500 V.

It specifies the requirements for clearances, creepage distances and solid insulation for equipment based upon their performance criteria. It includes methods of electric testing with respect to insulation coordination.

The minimum clearances specified in this standard do not apply where ionized gases occur. Special requirements for such situations may be specified at the discretion of the relevant technical committee.

This standard does not deal with distances

- through liquid insulation,
- through gases other than air,
- through compressed air.

NOTE 1 Insulation coordination for equipment within low-voltage systems with rated frequencies above 30 kHz is given in IEC 60664-4.

NOTE 2 Higher voltages may exist in internal circuits of the equipment.

NOTE 3 Guidance for dimensioning for altitudes exceeding 2 000 m is given in Table A.2.

The object of this basic safety standard is to guide technical committees responsible for different equipment in order to rationalize their requirements so that insulation coordination is achieved.

It provides the information necessary to give guidance to technical committees when specifying clearances in air, creepage distances and solid insulation for equipment.

Care should be taken to see that manufacturers and technical committees are responsible for application of the requirements, as specified in this basic safety publication, or make reference to it, where necessary, in standards for equipment within their scope.

In the case of missing specified values for clearances, creepage distances and requirements for solid insulation in the relevant product standards, or even missing standards, this standard is applicable.

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 60038:1983, *IEC standard voltages*

IEC 60050(151):2001, *International Electrotechnical Vocabulary (IEV) – Chapter 151: Electrical and magnetic devices*

IEC 60050(212):1990, *International Electrotechnical Vocabulary – Chapter 212: Insulating solids, liquids and gases*

IEC 60050(604):1987, *International Electrotechnical Vocabulary (IEV) – Chapter 604: Generation, transmission and distribution of electricity – Operation*
Amendment 1 (1998)

IEC 60050(826):2004, *International Electrotechnical Vocabulary (IEV) – Part 826: Electrical installations*

IEC 60068-1:1988, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-2:1974, *Environmental testing – Part 2: Tests – Tests B: Dry heat*

IEC 60068-2-14:1984, *Environmental testing – Part 2: Tests – Test N: Change of temperature*

IEC 60068-2-78:2001, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60085:2004, *Electrical insulation – Thermal classification*

IEC 60099-1:1991, *Surge arresters – Part 1: Non-linear resistor type gapped surge arresters for a.c. systems*

IEC 60112:2003, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60216, (all parts) *Electrical insulating materials – Properties for thermal endurance*

IEC 60243-1:1998, *Electrical strength of insulating materials – Test methods – Part 1: Tests at power frequencies*

IEC 60270:2000, *High-voltage test techniques – Partial discharge measurements*

IEC 60364-4-44:2001, *Electrical installations of buildings – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances*
Amendment 1 (2003)

IEC 60664-4:2005, *Insulation coordination for equipment within low-voltage systems – Part 4: Consideration of high-frequency voltage stress*

IEC 60664-5, *Insulation coordination for equipment within low-voltage systems – Part 5: A comprehensive method for determining clearances and creepage distances equal to or less than 2 mm¹*

IEC 61140:2001, *Protection against electric shock – Common aspects for installation and equipment*
Amendment 1 (2004)

IEC 61180-1:1992, *High-voltage test techniques for low-voltage equipment – Part 1: Definitions, test and procedure requirements*

¹ A second edition of IEC 60664-5 will be published shortly.

IEC 61180-2:1994, *High-voltage test techniques for low-voltage equipment – Part 2: Test equipment*

IEC Guide 104:1997, *The preparation of safety publications and the use of basic safety publications and group safety publications*

3 Terms and definitions

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

3.1

insulation coordination

mutual correlation of insulation characteristics of electrical equipment taking into account the expected micro-environment and other influencing stresses

NOTE Expected voltage stresses are characterized in terms of the characteristics defined in 3.5 to 3.7.

3.2

clearance

shortest distance in air between two conductive parts

3.3

creepage distance

shortest distance along the surface of a solid insulating material between two conductive parts

(IEV 151-15-50)

3.4

solid insulation

solid insulating material interposed between two conductive parts

3.5

working voltage

highest r.m.s. value of the a.c. or d.c. voltage across any particular insulation which can occur when the equipment is supplied at rated voltage

NOTE 1 Transients are disregarded.

NOTE 2 Both open-circuit conditions and normal operating conditions are taken into account.

3.6

recurring peak voltage

U_{rp}

maximum peak value of periodic excursions of the voltage waveform resulting from distortions of an a.c. voltage or from a.c. components superimposed on a d.c. voltage

NOTE Random overvoltages, for example due to occasional switching, are not considered to be recurring peak voltages.

3.7

overvoltage

any voltage having a peak value exceeding the corresponding peak value of maximum steady-state voltage at normal operating conditions

3.7.1

temporary overvoltage

overvoltage at power frequency of relatively long duration