

# 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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WITHIN LOW-VOLTAGE SYSTEMS –****Part 1: Principles, requirements and tests****FOREWORD**

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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;
- 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 mm*<sup>1</sup>

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*

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<sup>1</sup> 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