

Uskladitev izolacije za opremo v nizkonapetostnih sistemih – 5. del: Celovita metoda za ugotavljanje izolacijskih in plazilnih razdalj, velikih 2 mm ali manj

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

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EUROPEAN STANDARD

EN 60664-5

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2003

ICS 29.080.30

English version

**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
(IEC 60664-5:2003)**

Coordination de l'isolement des matériels
dans les systèmes (réseaux)
à basse tension
Partie 5: Méthode détaillée
de détermination des distances
d'isolement dans l'air et des lignes de fuite
inférieures ou égales à 2 mm
(CEI 60664-5:2003)

Isolationskoordination für elektrische
Betriebsmittel in Niederspannungsanlagen
Teil 5: Ein umfassendes Verfahren zur
Bemessung der Luft- und Kriechstrecken
für Abstände gleich oder unter 2 mm
(IEC 60664-5:2003)

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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.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and 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 109/32/FDIS, future edition 1 of IEC 60664-5, prepared by IEC TC 109, Insulation co-ordination for low-voltage equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60664-5 on 2003-10-01.

This standard shall be read in conjunction with EN 60664-1:2003.

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) 2004-07-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2006-10-01

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, annexes G and ZA are normative and annexes A to F and H and I are informative.

Annex ZA has been added by CENELEC.

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The text of the International Standard IEC 60664-5:2003 was approved by CENELEC as a European Standard without any modification.

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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.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60364-5-51	2001	Electrical installations of buildings Part 5-51: Selection and erection of electrical equipment - Common rules definitions	-	-
IEC 60664-1 + A1 + A2	1992 2000 1994	Insulation coordination for equipment within low-voltage systems Part 1: Principles, requirements and tests	EN 60664-1	2003
IEC 60721-3-3	1994	Classification of environmental conditions Part 3: Classification of groups of environmental parameters and their severities -- Section 3: Stationary use at weatherprotected locations	EN 60721-3-3	1995
A1 A2	1995 1996		- A2	- 1997
IEC 60721-3-7	1995	Section 7: Portable and non-stationary use	EN 60721-3-7	1995
A1	1996		A1	1997
IEC 60721-3-9 A1	1993 1994	Section 9: Microclimates inside products	EN 60721-3-9 A1	1993 1995

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NORME
INTERNATIONALE

CEI
IEC

INTERNATIONAL
STANDARD

60664-5

Première édition
First edition
2003-08

PUBLICATION FONDAMENTALE DE SÉCURITÉ
BASIC SAFETY PUBLICATION

**Coordination de l'isolement des matériels
dans les systèmes (réseaux) à basse tension –**

**Partie 5:
Méthode détaillée de détermination des distances
d'isolement dans l'air et des lignes de fuite
inférieures ou égales à 2 mm**

**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**

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Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

CODE PRIX
PRICE CODE

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**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**

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, 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 60664-5 has been prepared by the IEC technical committee 109: Insulation coordination for low-voltage equipment.

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

It shall be read in conjunction with IEC 60664-1.

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

FDIS	Report on voting
109/32/FDIS	109/34/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.

IEC 60664 consists of the following parts under the general title *Insulation coordination for equipment within low-voltage systems*:

- Part 1: Principles, requirements and tests;
- Part 2: Application guide;
- Part 3: Use of coating, potting or moulding for protection against pollution;
- Part 4: Consideration of high-frequency voltage stress;
- Part 5: A comprehensive method for determining clearances and creepage distances equal to or less than 2 mm.

The committee has decided that the contents of this publication will remain unchanged until 2006. At this date, the publication will be

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

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INTRODUCTION

This part of IEC 60664 can only be used together with Part 1.

This part applies to printed wiring boards and equivalent constructions, where the clearance and the creepage distance are identical and are along the surfaces of solid insulation, such as the paths described in example 1, example 5 and example 11 of Part 1, Subclause 4.2.

This part specifies the humidity levels regarding the effects of humidity on creepage distances.

This part introduces the following dimensioning criteria which have to be taken into account together:

- new minimum clearances having more precise values for dimensions up to 2 mm under pollution degrees 2 and 3 than those specified in Table 2 of Part 1;
- smaller minimum creepage distances for printed wiring boards and equivalent constructions under pollution degree 3 than those specified in Table 4 of Part 1;
- a specification of minimum creepage distances to avoid flashover of the insulating surfaces, the values being based on the water adsorption characteristics of the material;
- a specification of minimum creepage distances to ensure adequate insulation resistance under humid conditions.

NOTE Table F.2 provides information on the dimensioning of creepage distances in order to maintain adequate insulation resistance for r.m.s. voltages up to 10 000 V, corresponding to creepage distances up to 250 mm.

The information in this standard is based on research data published 1989.

The following details from the research provide background information:

- the research was carried out on test samples that were manufactured using the same process as for printed wiring boards with spacing of circuit patterns from 0,16 mm to 6,3 mm;
- ten different materials were used for the test samples. The influence of manufacturing process on the surface of the material, e.g., moulding or machining, was not part of the research project;
- the test samples were placed in different locations, such as city, rural, industrial, desert, and coastal.
- the samples were periodically exposed to a voltage stress and the data accumulated over a long period of time.

Annex G specifies a water adsorption test method for allocating unclassified insulating material to the relevant water adsorption group.

This annex will be reviewed when further experience is gained using the test method for different materials.

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

1 General

1.1 Scope

This part of IEC 60664 specifies the dimensioning of clearances and creepage distances for spacings equal to or less than 2 mm for printed wiring board and equivalent constructions, where the clearance and the creepage distance are identical and are along the surface of solid insulation, such as the paths described in example 1, example 5 and example 11 of 4.2 of Part 1.

The dimensioning is more precise than that provided by Part 1¹.

NOTE 1 If the precision provided by this standard is not required, Part 1 may be applied instead.

This standard can only be used as an entirety. It is not permitted to select one or more clauses from this standard and to use them in place of the corresponding clauses of Part 1.

When this standard is applied to the dimensioning of clearances and creepage distances, all clauses shall be used in place of the corresponding clauses given in Part 1. For clearances and creepage distances larger than 2 mm and for solid insulation in general, Part 1 applies.

NOTE 2 The limitation to distances equal to or less than 2 mm applies to basic or supplementary insulation. The total distance of a reinforced or double insulation may be larger than 2 mm.

This standard is based on the following criteria for dimensioning:

- minimum clearances independent of the micro-environment (see Table 2);
- minimum creepage distances for pollution degrees 1, 2 and 3 to avoid failure due to tracking (see Table 4);
- minimum creepage distances to avoid flashover across the insulating surface (see Table 5).

NOTE 3 For minimum creepage distances to maintain adequate insulation resistance, see Table F.2.

NOTE 4 This standard is not applicable for micro-environmental conditions worse than pollution degree 3 or humidity level 3.

A test method is specified for allocating unclassified insulating material to the relevant water adsorption group.

¹ "Part 1" refers to IEC 60664-1.