

## **Insulation co-ordination - Part 2: Application guide**

Insulation co-ordination - Part 2: Application guide

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

<p>Käesolev Eesti standard EVS-EN 60071-2:2003 sisaldab Euroopa standardi EN 60071-2:1997 ingliskeelset teksti.</p> <p>Käesolev dokument on jõustatud 05.06.2003 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes.</p> <p>Standard on kättesaadav Eesti standardiorganisatsioonist.</p>	<p>This Estonian standard EVS-EN 60071-2:2003 consists of the English text of the European standard EN 60071-2:1997.</p> <p>This document is endorsed on 05.06.2003 with the notification being published in the official publication of the Estonian national standardisation organisation.</p> <p>The standard is available from Estonian standardisation organisation.</p>
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<p><b>Käsitlusala:</b></p> <p>Gives guidance for the determination of the rated withstand voltages for ranges I and II of IEC 60071-1 and justifies the association of these rated values with the standardized highest voltages for equipment. It covers phase-to-phase, phase-to-earth and longitudinal insulation of three-phase systems with nominal voltages above 1kV</p>	<p><b>Scope:</b></p> <p>Gives guidance for the determination of the rated withstand voltages for ranges I and II of IEC 60071-1 and justifies the association of these rated values with the standardized highest voltages for equipment. It covers phase-to-phase, phase-to-earth and longitudinal insulation of three-phase systems with nominal voltages above 1kV</p>
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Descriptors: Insulation co-ordination, a.c. high-voltage network, voltage stress, insulation withstand, protective device, co-ordination between stresses and withstand

English version

**Insulation co-ordination**  
**Part 2: Application guide**  
(IEC 71-2:1996)

Coordination de l'isolement  
Partie 2: Guide d'application  
(CEI 71-2:1996)

Isolationskoordination  
Teil 2: Anwendungsrichtlinie  
(IEC 71-2:1996)

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Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

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### Foreword

The text of document 28/115/FDIS, future edition 3 of IEC 71-2, prepared by IEC TC 28, Insulation co-ordination, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60071-2 on 1996-10-01.

This European Standard supersedes HD 540.2 S1:1991 and, together with EN 60071-1:1995, supersedes HD 540.3 S1:1991.

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) 1997-09-01
- latest date by which the national standards conflicting  
with the EN have to be withdrawn (dow) 1997-09-01

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

Annexes designated "informative" are given for information only.

In this standard, annexes A and ZA are normative and annexes B to J are informative.

Annex ZA has been added by CENELEC.

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### Endorsement notice

The text of the International Standard IEC 71-2:1996 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 56 (mod)	1987	High-voltage alternating-current circuit-breakers	HD 348 S6 <sup>1)</sup>	1995
IEC 60-1	1989	High-voltage test techniques Part 1: General definitions and test requirements	HD 588.1 S1	1991
IEC 71-1	1993	Insulation co-ordination Part 1: Definitions, principles and rules	EN 60071-1	1995
IEC 99-1	1991	Surge arresters Part 1: Non-linear resistor type gapped surge arresters for a.c. systems	EN 60099-1	1994
IEC 99-4	1991	Part 4: Metal-oxide surge arresters without gaps for a.c. systems	EN 60099-4	1993
IEC 99-5 (mod)	1996	Part 5: Selection and application recommendations	EN 60099-5	1996
IEC 505	1975	Guide for the evaluation and identification of insulation systems of electrical equipment	-	-
IEC 507	1991	Artificial pollution tests on high-voltage insulators to be used on a.c. systems	EN 60507	1993
IEC 721-2-3	1987	Classification of environmental conditions Part 2: Environmental conditions appearing in nature - Air pressure	HD 478.2.3 S1	1990
IEC 815	1986	Guide for the selection of insulators in respect of polluted conditions	-	-

1) HD 348 S6 includes A1:1992 + A2:1995 to IEC 56.

# INTERNATIONAL STANDARD

**IEC**  
**60071-2**

Third edition  
1996-12

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**Insulation co-ordination –**

**Part 2:**  
**Application guide**

*This **English-language** version is derived from the original **bilingual** publication by leaving out all French-language pages. Missing page numbers correspond to the French-language pages.*



Reference number  
IEC 60071-2:1996(E)

## Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

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The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

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# INTERNATIONAL STANDARD

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## **Insulation co-ordination –**

### **Part 2: Application guide**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## INSULATION CO-ORDINATION –

## Part 2: Application guide

## 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 cooperation 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 reports or guides and they are accepted by the National Committees in that sense.
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- 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 71-2, has been prepared by IEC technical committee 28: Insulation co-ordination.

This third edition cancels and replaces the second edition published in 1976 and constitutes a technical revision.

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

FDIS	Report on voting
28/115/FDIS	28/117/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.

Annex A forms an integral part of this standard.

Annexes B to J are for information only.

## INSULATION CO-ORDINATION –

### Part 2: Application guide

#### 1 General

##### 1.1 Scope

This part of IEC 71 constitutes an application guide and deals with the selection of insulation levels of equipment or installations for three-phase electrical systems. Its aim is to give guidance for the determination of the rated withstand voltages for ranges I and II of IEC 71-1 and to justify the association of these rated values with the standardized highest voltages for equipment.

This association is for insulation co-ordination purposes only. The requirements for human safety are not covered by this application guide.

It covers three-phase systems with nominal voltages above 1 kV. The values derived or proposed herein are generally applicable only to such systems. However, the concepts presented are also valid for two-phase or single-phase systems.

It covers phase-to-earth, phase-to-phase and longitudinal insulation.

This application guide is not intended to deal with routine tests. These are to be specified by the relevant product committees.

The content of this guide strictly follows the flow chart of the insulation co-ordination process presented in figure 1 of IEC 71-1. Clauses 2 to 5 correspond to the squares in this flow chart and give detailed information on the concepts governing the insulation co-ordination process which leads to the establishment of the required withstand levels.

The guide emphasizes the necessity of considering, at the very beginning, all origins, all classes and all types of voltage stresses in service irrespective of the range of highest voltage for equipment. Only at the end of the process, when the selection of the standard withstand voltages takes place, does the principle of covering a particular service voltage stress by a standard withstand voltage apply. Also, at this final step, the guide refers to the correlation made in IEC 71-1 between the standard insulation levels and the highest voltage for equipment.

The annexes contain examples and detailed information which explain or support the concepts described in the main text, and the basic analytical techniques used.

##### 1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 71. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 71 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 56: 1987, *High-voltage alternating-current circuit-breakers*

IEC 60-1: 1989, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 71-1: 1993, *Insulation co-ordination – Part 1: Definitions, principles and rules*

IEC 99-1: 1991, *Surge arresters – Part 1: Non-linear resistor type gapped surge arresters for a.c. systems*

IEC 99-4: 1991, *Surge arresters – Part 4: Metal-oxide surge arresters without gaps for a.c. systems*

IEC 99-5: 1996, *Surge arresters – Part 5: Selection and application recommendations – Section 1: General*

IEC 505: 1975, *Guide for the evaluation and identification of insulation systems of electrical equipment*

IEC 507: 1991, *Artificial pollution test on high-voltage insulators to be used on a.c. systems*

IEC 721-2-3: 1987, *Classification of environmental conditions – Part 2: Environmental conditions appearing in nature – Air pressure*

IEC 815: 1986, *Guide for the selection of insulators in respect of polluted conditions*

### 1.3 List of symbols and definitions

For the purpose of this part of IEC 71, the following symbols and definitions apply. The symbol is followed by the unit to be normally considered, dimensionless quantities being indicated by (-).

Some quantities are expressed in p.u. A per unit quantity is the ratio of the actual value of an electrical parameter (voltage, current, frequency, power, impedance, etc.) to a given reference value of the same parameter.

$A$	(kV)	parameter characterizing the influence of the lightning severity for the equipment depending on the type of overhead line connected to it.
$a_1$	(m)	length of the lead connecting the surge arrester to the line.
$a_2$	(m)	length of the lead connecting the surge arrester to earth.
$a_3$	(m)	length of the phase conductor between the surge arrester and the protected equipment.
$a_4$	(m)	length of the active part of the surge arrester.
$B$	(-)	factor used when describing the phase-to-phase discharge characteristic.
$C_e$	(nF)	capacitance to earth of transformer primary windings.
$C_s$	(nF)	series capacitance of transformer primary windings.
$C_2$	(nF)	phase-to-earth capacitance of the transformer secondary winding.
$C_{12}$	(nF)	capacitance between primary and secondary windings of transformers.
$C_{1in}$	(nF)	equivalent input capacitance of the terminals of three-phase transformers.
$C_{2in}$	(nF)	equivalent input capacitance of the terminals of three-phase transformers.
$C_{3in}$	(nF)	equivalent input capacitance of the terminals of three-phase transformers.
$c$	(m/μs)	velocity of light.