

© Copyright SEK. Reproduction in any form without permission is prohibited.

Isolationskoordination – Del 1: Definitioner, principer och koordineringsregler

Insulation co-ordination –

Part 1: Definitions, principles and rules

Som svensk standard gäller europastandarden EN 60071-1:2006. Den svenska standarden innehåller den officiella engelska språkversionen av EN 60071-1:2006.

Nationellt förord

Europastandarden EN 60071-1:2006^{*)}

består av:

- **europastandardens ikraftsättningsdokument**, utarbetat inom CENELEC
- **IEC 60071-1, Eighth edition, 2006 - Insulation co-ordination - Part 1: Definitions, principles and rules**

utarbetad inom International Electrotechnical Commission, IEC.

Tidigare fastställd svensk standard SS-EN 60071-1, utgåva 1, 1997, gäller ej fr o m 2009-03-01.

^{*)} EN 60071-1:2006 ikraftsattes 2006-08-21 som SS-EN 60071-1 genom offentliggörande, d v s utan utgivning av något svenskt dokument.

Standarder underlättar utvecklingen och höjer elsäkerheten

Det finns många fördelar med att ha gemensamma tekniska regler för bl a säkerhet, prestanda, dokumentation, utförande och skötsel av elprodukter, elanläggningar och metoder. Genom att utforma sådana standarder blir säkerhetskraven tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

SEK är Sveriges röst i standardiseringsarbetet inom elområdet

SEK Svensk Elstandard svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

Stora delar av arbetet sker internationellt

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

SEK Svensk Elstandard

Box 1284
164 29 Kista
Tel 08-444 14 00
www.elstandard.se

English version

Insulation co-ordination
Part 1: Definitions, principles and rules
(IEC 60071-1:2006)

Coordination de l'isolement
Partie 1: Définitions, principes et règles
(CEI 60071-1:2006)

Isolationskoordination
Teil 1: Begriffe, Grundsätze
und Anforderungen
(IEC 60071-1:2006)

This European Standard was approved by CENELEC on 2006-03-01. 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, 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 28/176/FDIS, future edition 8 of IEC 60071-1, prepared by IEC TC 28, Insulation co-ordination, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60071-1 on 2006-03-01.

This European Standard supersedes EN 60071-1:1995.

The main changes from EN 60071-1:1995 are as follows:

- in the definitions (3.26, 3.28 and 3.29) and in the environmental conditions (5.9) taken into account clarification of the atmospheric and altitude corrections involved in the insulation co-ordination process;
- in the list of standard rated short-duration power frequency withstand voltages reported in 5.6 addition of 115 kV;
- in the list of standard rated impulse withstand voltages reported in 5.7, addition of 200 kV and 380 kV;
- in the standard insulation levels for range I ($1 \text{ kV} < U_m \leq 245 \text{ kV}$) (Table 2) addition of the highest voltage for equipment $U_m = 100 \text{ kV}$;
- in the standard insulation levels for range II ($U_m > 245 \text{ kV}$) (Table 3) replacement of 525 kV by 550 kV and of 765 kV by 800 kV;
- in order to remove that part in the next revision of EN 60071-2, addition of Annex A dealing with clearances in air to assure a specified impulse withstand voltage in installation;
- in Annex B, limitation at two U_m values for the values of rated insulation levels for $1 \text{ kV} < U_m \leq 245 \text{ kV}$ for highest voltages for equipment U_m not standardized by IEC/CENELEC based on current practice in some countries.

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) | 2006-12-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn | (dow) | 2009-03-01 |

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60071-1:2006 was approved by CENELEC as a European Standard without any modification.

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 (mod)	1983	IEC standard voltages ¹⁾	HD 472 S1	1989
+ A1	1994		+ corr. February	2002
+ A2	1997			
IEC 60060-1	1989		HD 588.1 S1	1991
+ corr. March	1990			
IEC 60071-2	- ²⁾	Insulation co-ordination Part 2: Application guide	EN 60071-2	1997 ³⁾
IEC 60099-4 (mod)	- ²⁾	Surge arresters Part 4: Metal-oxide surge arresters without gaps for a.c. systems	EN 60099-4	2004 ³⁾
IEC 60507	- ²⁾	Artificial pollution tests on high-voltage insulators to be used on a.c. systems	EN 60507	1993 ³⁾
IEC 60633	- ²⁾	Terminology for high-voltage direct current (HVDC) transmission	EN 60633	1999 ³⁾

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

²⁾ Undated reference.

³⁾ Valid edition at date of issue.

CONTENTS

FOREWORD	7
1 Scope	11
2 Normative references	11
3 Terms and definitions	13
4 Symbols and abbreviations	27
4.1 General	27
4.2 Subscripts	27
4.3 Letter symbols	27
4.4 Abbreviations	29
5 Procedure for insulation co-ordination	29
5.1 General outline of the procedure	29
5.2 Determination of the representative voltages and overvoltages (U_{rp})	33
5.3 Determination of the co-ordination withstand voltages (U_{cw})	35
5.4 Determination of the required withstand voltage (U_{rw})	37
5.5 Selection of the rated insulation level	37
5.6 List of standard rated short-duration power frequency withstand voltages	39
5.7 List of standard rated impulse withstand voltages	39
5.8 Ranges for highest voltage for equipment	39
5.9 Environmental conditions	41
5.10 Selection of the standard insulation level	41
5.11 Background of the standard insulation levels	49
6 Requirements for standard withstand voltage tests	51
6.1 General requirements	51
6.2 Standard short-duration power-frequency withstand voltage tests	53
6.3 Standard impulse withstand voltage tests	53
6.4 Alternative test situation	55
6.5 Phase-to-phase and longitudinal insulation standard withstand voltage tests for equipment in range I	55
6.6 Phase-to-phase and longitudinal insulation standard withstand voltage tests for equipment in range II	57
Annex A (normative) Clearances in air to assure a specified impulse withstand voltage installation	59
Annex B (informative) Values of rated insulation levels for $1\text{ kV} < U_m \leq 245\text{ kV}$ for highest voltages for equipment U_m not standardized by IEC based on current practice in some countries	67
Bibliography	69
Figure 1 – Flow chart for the determination of rated or standard insulation level	31

Table 1 – Classes and shapes of overvoltages, Standard voltage shapes and Standard withstand voltage tests	33
Table 2 – Standard insulation levels for range I ($1\text{ kV} < U_m \leq 245\text{ kV}$).....	45
Table 3 – Standard insulation levels for range II ($U_m > 245\text{ kV}$)	47
Table A.1 – Correlation between standard rated lightning impulse withstand voltages and minimum air clearances	61
Table A.2 – Correlation between standard rated switching impulse withstand voltages and minimum phase-to-earth air clearances.....	63
Table A.3 – Correlation between standard rated switching impulse withstand voltages and minimum phase-to-phase air clearances	65
Table B.1- Values of rated insulation levels for $1\text{ kV} < U_m \leq 245\text{ kV}$ for highest voltages for equipment U_m not standardized by IEC based on current practice in some countries	67

INSULATION CO-ORDINATION –

Part 1: Definitions, principles and rules

1 Scope

This part of IEC 60071 applies to three-phase a.c. systems having a highest voltage for equipment above 1 kV. It specifies the procedure for the selection of the rated withstand voltages for the phase-to-earth, phase-to-phase and longitudinal insulation of the equipment and the installations of these systems. It also gives the lists of the standard withstand voltages from which the rated withstand voltages should be selected.

This standard recommends that the selected withstand voltages should be associated with the highest voltage for equipment. This association is for insulation co-ordination purposes only. The requirements for human safety are not covered by this standard.

Although the principles of this standard also apply to transmission line insulation, the values of their withstand voltages may be different from the standard rated withstand voltages.

The apparatus committees are responsible for specifying the rated withstand voltages and the test procedures suitable for the relevant equipment taking into consideration the recommendations of this standard.

NOTE In IEC 60071-2, Application Guide, all rules for insulation co-ordination given in this standard are justified in detail, in particular the association of the standard rated withstand voltages with the highest voltage for equipment. When more than one set of standard rated withstand voltages is associated with the same highest voltage for equipment, guidance is provided for the selection of the most suitable set.

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 60038:2002, *IEC standard voltages*

IEC 60060-1:1989, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60071-2, *Insulation co-ordination – Part 2: Application guide*

IEC 60099-4, *Surge arresters – Part 4: Metal-oxide surge arresters without gaps for a.c. systems*

IEC 60507, *Artificial pollution tests on high-voltage insulators to be used on a.c. systems*

IEC 60633, *Terminology for high-voltage direct current (HVDC) transmission*