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Standards

Irish Standard
I.S. EN 60071-5:2015

Insulation co-ordination - Part 5: Procedures for high-voltage direct current (HVDC) converter stations

I.S. EN 60071-5:2015

Incorporating amendments/corrigenda/National Annexes issued since publication:

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EUROPEAN STANDARD

EN 60071-5

NORME EUROPÉENNE

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January 2015

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English Version

Insulation co-ordination -
Part 5: Procedures for high-voltage direct current (HVDC)
converter stations
(IEC 60071-5:2014)

Coordination de l'isolement -
Partie 5: Procédures pour les stations de conversion à
courant continu haute tension (CCHT)
(IEC 60071-5:2014)

Isolationskoordination -
Teil 5: Verfahren für Hochspannungs-Gleichstrom-
Stromrichterstationen (HGÜ-Stromrichterstationen)
(IEC 60071-5:2014)

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Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Foreword

The text of document 28/218/FDIS, future edition 1 of IEC 60071-5, prepared by IEC/TC 28 "Insulation co-ordination" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60071-5:2015.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2015-08-28
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In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60099-5:1996	NOTE	Harmonized as EN 60099-5:1996 ¹⁾ (modified).
IEC 60505:2011	NOTE	Harmonized as EN 60505:2011 (not modified).
IEC 60721-3-0:1984	NOTE	Harmonized as EN 60721-3-0:1993 (not modified).
IEC/TR 60919-2:2008	NOTE	Harmonized as CLC/TR 60919-2:2010 (not modified).
IEC 60700-1:1998	NOTE	Harmonized as EN 60700-1:1998 (not modified).
IEC 60700-1:1998/A1:2003	NOTE	Harmonized as EN 60700-1:1998/A1:2003 (not modified).
IEC 60700-1:1998/A2:2008	NOTE	Harmonized as EN 60700-1:1998/A2:2008 (not modified).

¹⁾ Superseded by EN 60099-5:2013 (IEC 60099-5:2013) - DOW = 2016-06-26.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60060-1	-	High-voltage test techniques - Part 1: General definitions and test requirements	EN 60060-1	-
IEC 60071-1	2006	Insulation co-ordination - Part 1: Definitions, principles and rules	EN 60071-1	2006
IEC 60071-2	1996	Insulation co-ordination - Part 2: Application guide	EN 60071-2	1997
IEC 60099-4 (mod)	2004	Surge arresters - Part 4: Metal-oxide surge arresters without gaps for a.c. systems	EN 60099-4	2004
IEC 60633	-	Terminology for high-voltage direct current (HVDC) transmission	EN 60633	-
IEC/TS 60815-1	2008	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions - Part 1: Definitions, information and general principles		
IEC/TS 60815-2	2008	Selection and dimensioning of high-voltage- insulators intended for use in polluted conditions - Part 2: Ceramic and glass insulators for a.c. systems		-
IEC/TS 60815-3	2008	Selection and dimensioning of high-voltage- insulators intended for use in polluted conditions - Part 3: Polymer insulators for a.c. systems		-

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NORME INTERNATIONALE



**Insulation co-ordination –
Part 5: Procedures for high-voltage direct current (HVDC) converter stations**

**Coordination de l'isolement –
Partie 5: Procédures pour les stations de conversion à courant continu haute
tension (CCHT)**





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IEC 60071-5

Edition 1.0 2014-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Insulation co-ordination –
Part 5: Procedures for high-voltage direct current (HVDC) converter stations**

**Coordination de l'isolement –
Partie 5: Procédures pour les stations de conversion à courant continu haute
tension (CCHT)**

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CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 General	9
1.1 Scope	9
1.2 Additional background.....	9
2 Normative references.....	10
3 Terms and definitions.....	10
4 Symbols and abbreviations	16
4.1 General.....	16
4.2 Subscripts.....	16
4.3 Letter symbols.....	16
4.4 Abbreviations	17
5 Typical HVDC converter station schemes	17
6 Principles of insulation co-ordination	21
6.1 General.....	21
6.2 Essential differences between a.c. and d.c. systems.....	21
6.3 Insulation co-ordination procedure.....	21
6.4 Comparison of withstand voltage selection in a.c. and d.c. systems	22
7 Voltages and overvoltages in service.....	24
7.1 Continuous operating voltages at various locations in the converter station	24
7.2 Peak continuous operating voltage (PCOV) and crest continuous operating voltage (CCOV).....	28
7.3 Sources and types of overvoltages	30
7.4 Temporary overvoltages	31
7.4.1 General	31
7.4.2 Temporary overvoltages on the a.c. side	31
7.4.3 Temporary overvoltages on the d.c. side	31
7.5 Slow-front overvoltages	31
7.5.1 General	31
7.5.2 Slow-front overvoltages on the a.c. side	31
7.5.3 Slow-front overvoltages on the d.c. side	32
7.6 Fast-front, very-fast-front and steep-front overvoltages.....	33
8 Arrester characteristics and stresses.....	34
8.1 Arrester characteristics	34
8.2 Arrester specification.....	35
8.3 Arrester stresses.....	35
8.3.1 General	35
8.3.2 AC bus arrester (A).....	36
8.3.3 AC filter arrester (FA).....	37
8.3.4 Transformer valve winding arresters (T).....	37
8.3.5 Valve arrester (V).....	37
8.3.6 Bridge arrester (B)	40
8.3.7 Converter unit arrester (C)	41
8.3.8 Mid-point d.c. bus arrester (M)	41
8.3.9 Converter unit d.c. bus arrester (CB).....	42
8.3.10 DC bus and d.c. line/cable arrester (DB and DL/DC).....	42

8.3.11	Neutral bus arrester (E, EL, EM in Figure 3, EB, E1, EL, EM in Figure 1)	42
8.3.12	DC reactor arrester (DR).....	43
8.3.13	DC filter arrester (FD)	44
8.3.14	Earth electrode station arrester	44
8.4	Protection strategy	44
8.4.1	General	44
8.4.2	Insulation directly protected by a single arrester	44
8.4.3	Insulation protected by more than one arrester in series	45
8.4.4	Valve side neutral point of transformers	45
8.4.5	Insulation between phase conductors of the converter transformer	45
8.4.6	Summary of protection strategy.....	45
8.5	Summary of events and stresses	47
9	Design procedure of insulation co-ordination	49
9.1	General.....	49
9.2	Arrester requirements.....	49
9.3	Characteristics of insulation.....	51
9.4	Representative overvoltages (U_{rp}).....	51
9.5	Determination of the co-ordination withstand voltages (U_{cw}).....	52
9.6	Determination of the required withstand voltages (U_{rw}).....	52
9.7	Determination of the specified withstand voltage (U_w)	54
10	Study tools and system modelling	54
10.1	General.....	54
10.2	Study approach and tools	54
10.3	System details.....	55
10.3.1	Modelling and system representation.....	55
10.3.2	AC network and a.c. side of the HVDC converter station.....	57
10.3.3	DC overhead line/cable and earth electrode line details	58
10.3.4	DC side of an HVDC converter station details	58
11	Creepage distances	59
11.1	General.....	59
11.2	Base voltage for creepage distance	59
11.3	Creepage distance for outdoor insulation under d.c. voltage	59
11.4	Creepage distance for indoor insulation under d.c. or mixed voltage	60
11.5	Creepage distance of a.c. insulators	60
12	Clearances in air.....	60
Annex A (informative) Example of insulation co-ordination for conventional HVDC converters.....		62
A.1	General.....	62
A.2	Arrester protective scheme.....	62
A.3	Arrester stresses, protection and insulation levels.....	62
A.3.1	General	62
A.3.2	Slow-front overvoltages transferred from the a.c. side	63
A.3.3	Earth fault between valve and upper bridge transformer bushing	63
A.4	Transformer valve side withstand voltages.....	66
A.4.1	Phase-to-phase	66
A.4.2	Upper bridge transformer phase-to-earth (star).....	67
A.4.3	Lower bridge transformer phase-to-earth (delta).....	67
A.5	Air-insulated smoothing reactors withstand voltages	67
A.5.1	Terminal-to-terminal slow-front overvoltages	67

A.5.2	Terminal-to-earth	68
A.6	Results	68
Annex B (informative)	Example of insulation co-ordination for capacitor commutated converters (CCC) and controlled series capacitor converters (CSCC)	72
B.1	General	72
B.2	Arrester protective scheme	72
B.3	Arrester stresses, protection and insulation levels	72
B.3.1	General	72
B.3.2	Transferred slow-front overvoltages from the a.c. side	73
B.3.3	Earth fault between valve and upper bridge transformer bushing	74
B.4	Transformer valve side withstand voltages	77
B.4.1	Phase-to-phase	77
B.4.2	Upper bridge transformer phase-to-earth (star)	77
B.4.3	Lower bridge transformer phase-to-earth (delta)	77
B.5	Air-insulated smoothing reactors withstand voltages	78
B.5.1	Slow-front terminal-to-terminal overvoltages	78
B.5.2	Terminal-to-earth	78
B.6	Results	79
Annex C (informative)	Considerations for insulation co-ordination of some special converter configurations	87
C.1	Procedure for insulation co-ordination of back-to-back type of HVDC links	87
C.2	Procedure for insulation co-ordination of parallel valve groups	87
C.2.1	General	87
C.2.2	AC bus arrester (A)	88
C.2.3	AC filter arrester (FA)	88
C.2.4	Valve arrester (V)	88
C.2.5	Bridge arrester (B) and converter unit arrester (C)	88
C.2.6	Mid-point arrester (M)	88
C.2.7	Converter unit d.c. bus arrester (CB)	88
C.2.8	DC bus and d.c. line/cable arrester (DB and DL)	89
C.2.9	Neutral bus arrester (E)	89
C.2.10	DC reactor arrester (DR)	89
C.2.11	DC filter arrester (FD)	89
C.2.12	New converter stations with parallel valve groups	89
C.3	Procedure for insulation co-ordination of upgrading existing systems with series-connected valve groups	89
C.3.1	General	89
C.3.2	AC bus arrester (A)	90
C.3.3	AC filter arrester (FA)	90
C.3.4	Valve arrester (V)	90
C.3.5	Bridge arrester (B) and converter unit arrester (C)	90
C.3.6	Mid-point arrester (M)	90
C.3.7	Converter unit d.c. bus arrester (CB), d.c. bus and d.c. line/cable arrester (DB and DL)	91
C.3.8	Neutral bus arrester (E)	91
C.3.9	DC reactor arrester (DR)	91
C.3.10	DC filter arrester (FD)	91
C.4	Overvoltages in the a.c. network due to closely coupled HVDC links	91
C.5	Effect of gas-insulated switchgear on insulation co-ordination of HVDC converter stations	92

Annex D (informative) Typical arrester characteristics	93
Bibliography	94
Figure 1 – Possible arrester locations in a pole with two 12-pulse converters in series	19
Figure 2 – Possible arrester locations for a back-to-back converter station	20
Figure 3 – HVDC converter station with one 12-pulse converter bridge per pole	25
Figure 4 – Continuous operating voltages at various locations (location identification according to Figure 3)	27
Figure 5 – Operating voltage of a valve arrester (V), rectifier operation	29
Figure 6 – Operating voltage of a mid-point arrester (M), rectifier operation	29
Figure 7 – Operating voltage of a converter bus arrester (CB), rectifier operation	30
Figure 8 – One pole of an HVDC converter station	57
Figure A.1 – AC and d.c. arresters	69
Figure A.2 – Valve arrester stresses for slow-front overvoltages from a.c. side	69
Figure A.3 – Arrester V2 stress for slow-front overvoltage from a.c. side	70
Figure A.4 – Valve arrester stresses for earth fault between valve and upper bridge transformer bushing	70
Figure A.5 – Arrester V1 stress for earth fault between valve and upper bridge transformer bushing	71
Figure B.1 – AC and d.c. arresters for CCC and CSCC converters	80
Figure B.2 – Valve arrester stresses for slow-front overvoltages from a.c. side	81
Figure B.3 – Arrester V2 stress for slow-front overvoltage from a.c. side	82
Figure B.4 – Valve arrester stresses for earth fault between valve and upper bridge transformer bushing	84
Figure B.5 – Arrester V1 stress for earth fault between valve and upper bridge transformer bushing	85
Figure B.6 – Stresses on capacitor arresters C_{CC} and C_{SC} during earth fault between valve and upper bridge transformer bushing	86
Figure C.1 – Expanded HVDC converter with parallel valve groups	88
Figure C.2 – Upgraded HVDC converter with series valve group	90
Figure D.1 – Typical arrester V-I characteristics	93
Table 1 – Classes and shapes of overvoltages, standard voltage shapes and standard withstand voltage tests	11
Table 2 – Symbol description	20
Table 3 – Comparison of the selection of withstand voltages for a.c. equipment with that for HVDC converter station equipment	23
Table 4 – Arrester protection on the d.c. side: Single 12-pulse converter (Figure 3)	46
Table 5 – Arrester protection on the d.c. side: Two 12-pulse converters (Figure 1)	46
Table 6 – Events stressing arresters: Single 12-pulse converter (Figure 3)	48
Table 7 – Types of arrester stresses for different events: Single 12-pulse converter (Figure 3)	48
Table 8 – Arrester requirements	50
Table 9 – Representative overvoltages and required withstand voltages	51
Table 10 – Indicative values of ratios of required impulse withstand voltage to impulse protective level	54
Table 11 – Origin of overvoltages and associated frequency ranges	56

INTERNATIONAL ELECTROTECHNICAL COMMISSION

INSULATION CO-ORDINATION –

Part 5: Procedures for high-voltage direct current (HVDC) converter stations

FOREWORD

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International Standard IEC 60071-5 has been prepared by IEC technical committee 28: Insulation co-ordination.

This International Standard cancels and replaces IEC TS 60071-5 published in 2002. On the basis of technical experience gained since the Technical Specification was published, sufficient consensus has emerged for transformation of the Technical Specification into an International Standard.

The technical content is essentially the same as that contained in the Technical Specification with amendments mainly for user convenience. The structure of the document has been changed to allow division and subdivision into complete integral parts to facilitate comprehension and ease of referencing.

In addition to the high level revisions above, the following main technical changes have been made with respect to the previous edition:

- arresters have been added to several locations to reflect some recent 800 kV HVDC scheme practice, along with their justifications, expected voltages, overvoltages and arrester stresses in service;
- significant changes have been made in Clause 8 – all subclauses on the characteristics, schemes, stresses and specification of arresters have been consolidated into a single entity, Clause 8;
- the implications of a smoothing reactor and of a neutral blocking filter located on the neutral bus (as on some recent 800 kV schemes), on coordination of arresters connected to the neutral end have been added;
- possible use of sacrificial arresters on the neutral bus is introduced to cater for excessive arrester energy in the rather unlikely event of a particular rare fault;
- all subclauses dealing with study tools and modelling details have been consolidated into Clause 10;
- creepage distances and clearances have been consolidated into Clauses 11 and 12, respectively, with more details added.

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

FDIS	Report on voting
28/218/FDIS	28/221/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.

A list of all parts in the IEC 600071 series, published under the general title *Insulation co-ordination* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability 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

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INTRODUCTION

The IEC 60071 series consists of the following parts under the general title *Insulation co-ordination*:

Part 1: Definitions, principles and rules

Part 2: Application guide

Part 4: Computational guide to insulation co-ordination and modelling of electrical networks

Part 5: Procedures for high-voltage direct current (HVDC) converter stations

INSULATION CO-ORDINATION –

Part 5: Procedures for high-voltage direct current (HVDC) converter stations

1 General

1.1 Scope

This part of IEC 60071 provides guidance on the procedures for insulation co-ordination of high-voltage direct current (HVDC) converter stations, without prescribing standardized insulation levels.

This standard applies only for HVDC applications in high-voltage a.c. power systems and not for industrial conversion equipment. Principles and guidance given are for insulation co-ordination purposes only. The requirements for human safety are not covered by this standard.

1.2 Additional background

The use of power electronic thyristor valves in a series and/or parallel arrangement, along with the unique control and protection strategies employed in the conversion process, has ramifications requiring particular consideration of overvoltage protection of equipment in converter stations compared with substations in a.c. systems. This standard outlines the procedures for evaluating the overvoltage stresses on the converter station equipment subjected to combined d.c., a.c. power frequency, harmonic and impulse voltages. The criteria for determining the protective levels of series and/or parallel combinations of surge arresters used to ensure optimal protection are also presented.

The basic principles and design objectives of insulation co-ordination of converter stations, in so far as they differ from normal a.c. system practice, are described.

Concerning surge arrester protection, this standard deals only with metal-oxide surge arresters, without gaps, which are used in modern HVDC converter stations. The basic arrester characteristics, requirements for these arresters and the process of evaluating the maximum overvoltages to which they may be exposed in service, are presented. Typical arrester protection schemes and stresses of arresters are presented, along with methods to be applied for determining these stresses.

This standard includes insulation co-ordination of equipment connected between the converter a.c. bus (including the a.c. harmonic filters, the converter transformer, the circuit breakers) and the d.c. line side of the smoothing reactor. The line and cable terminations in so far as they influence the insulation co-ordination of converter station equipment are also covered.

Although the main focus of the standard is on conventional HVDC systems where the commutation voltage bus is at the a.c. filter bus, outlines of insulation co-ordination for the capacitor commutated converter (CCC) as well as the controlled series compensated converter (CSCC) and some other special converter configurations are covered in the annexes.

This standard discusses insulation co-ordination related to line commutated converter (LCC) stations. The insulation coordination of voltage sourced converters (VSC) is not part of this standard.

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