

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

## **Isolatorer – Isolatorer av keramiskt material eller glas för växelspanning över 1000 V – Provning vid artificiell nedsmutsning**

*Artificial pollution tests on high-voltage ceramic and glass insulators to be used on a.c. systems*

Som svensk standard gäller europastandarden EN 60507:2014. Den svenska standarden innehåller den officiella engelska språkversionen av EN 60507:2014.

### **Nationellt förord**

Europastandarden EN 60507:2014

består av:

- **europastandardens ikraftsättningsdokument**, utarbetat inom CENELEC
- **IEC 60507, Third edition, 2013 - Artificial pollution tests on high-voltage ceramic and glass insulators to be used on a.c. systems**

utarbetad inom International Electrotechnical Commission, IEC.

Tidigare fastställd svensk standard SS-EN 60507, utgåva 1, 1993, gäller ej fr 2017-01-17.

### *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](http://www.elstandard.se)

**Artificial pollution tests on high-voltage ceramic and glass insulators to be used on a.c. systems**  
(IEC 60507:2013)

Essais sous pollution artificielle des  
isolateurs haute tension en céramique et  
en verre destinés aux réseaux à courant  
alternatif  
(CEI 60507:2013)

Fremdschichtprüfungen an  
Hochspannungs-Isolatoren aus Keramik  
und Glas zur Anwendung in  
Wechselspannungssystemen  
(IEC 60507:2013)

This European Standard was approved by CENELEC on 2014-01-17. 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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

**CENELEC**

European Committee for Electrotechnical Standardization  
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 36/337/FDIS, future edition 3 of IEC 60507, prepared by IEC/TC 36 "Insulators" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60507:2014.

The following dates are fixed:

- latest date by which the document has to be (dop) 2014-10-17  
implemented at national level by  
publication of an identical national  
standard or by endorsement
- latest date by which the national (dow) 2017-01-17  
standards conflicting with the  
document have to be withdrawn

This document supersedes EN 60507:1993.

EN 60507:2014 includes the following significant technical changes with respect to EN 60507:1993:

- a) Corrections and the addition of explanatory material;
- b) The addition of Clause 4.4.2 on atmospheric correction;
- c) The change of the upper limit of conductivity of water to 0.1 S/m; and
- d) The extension to UHV voltages.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

## Endorsement notice

The text of the International Standard IEC 60507:2013 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 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 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 60060-1	-	High-voltage test techniques - Part 1: General definitions and test requirements	EN 60060-1	-
IEC 60071-1	-	Insulation co-ordination - Part 1: Definitions, principles and rules	EN 60071-1	-
IEC/TS 60815-1	-	Selection and dimensioning of high-voltage - insulators intended for use in polluted conditions - Part 1: Definitions, information and general principles	-	-
IEC/TS 60815-2	-	Selection and dimensioning of high-voltage - insulators intended for use in polluted conditions - Part 2: Ceramic and glass insulators for a.c. systems	-	-

## CONTENTS

FOREWORD .....	5
1 Scope .....	7
2 Normative references .....	7
3 Terms and definitions .....	7
4 General test requirements .....	10
4.1 General .....	10
4.2 Test method .....	10
4.3 Arrangement of insulator for test .....	10
4.3.1 Test configuration .....	10
4.3.2 Cleaning of insulator .....	11
4.4 Requirements for the testing plant .....	11
4.4.1 Test voltage .....	11
4.4.2 Atmospheric corrections .....	11
4.4.3 Minimum short-circuit current .....	12
5 Salt fog method .....	13
5.1 General information .....	13
5.2 Salt solution .....	13
5.3 Spraying system .....	15
5.4 Conditions before starting the test .....	18
5.5 Preconditioning process .....	18
5.6 Withstand test .....	19
5.7 Acceptance criterion for the withstand test .....	19
6 Solid layer methods .....	19
6.1 General information .....	19
6.2 Main characteristics of inert materials .....	20
6.3 Composition of the contaminating suspension .....	20
6.3.1 General .....	20
6.3.2 Kieselguhr composition .....	20
6.3.3 Kaolin (or Tonoko) composition .....	21
6.4 Application of the pollution layer .....	22
6.5 Determination of the degree of pollution of the tested insulator .....	23
6.5.1 General .....	23
6.5.2 Layer conductivity ( <i>K</i> ) .....	23
6.5.3 Salt deposit density ( <i>SDD</i> ) .....	23
6.6 General requirements for the wetting of the pollution layer .....	24
6.7 Test procedures .....	24
6.7.1 General .....	24
6.7.2 Procedure A – Wetting before and during energization .....	24
6.7.3 Procedure B – Wetting after energization .....	26
6.8 Withstand test and acceptance criterion (common to both Procedures A and B) .....	27
Annex A (informative) Supplementary information on the assessment of the requirement for the testing plant .....	28
Annex B (informative) Determination of the withstand characteristics of insulators .....	29
B.1 General .....	29

B.2	Determination of the maximum withstand salinity at a given test voltage .....	29
B.3	Determination of the maximum withstand voltage, or of the 50 % withstand voltage, at a given reference layer conductivity, or at a given reference salt deposit density .....	29
B.3.1	Maximum withstand voltage .....	29
B.3.2	50 % withstand voltage .....	30
B.4	Withstand values of reference suspension insulators .....	30
Annex C (informative)	Measurement of layer conductivity for checking the uniformity of the layer .....	32
Annex D (informative)	Additional recommendations concerning the solid layer method procedures .....	34
D.1	General .....	34
D.2	Contamination practice .....	34
D.3	Drying of the pollution layer .....	34
D.4	Check of the wetting action of the fog .....	34
D.5	Checking fog uniformity for large or complex test objects .....	35
D.6	Fog input in the test chamber .....	35
D.7	Minimum duration of the withstand test .....	35
D.8	Evaluation of the reference salt deposit density ( <i>SDD</i> ) .....	36
Annex E (informative)	Supplementary information on artificial pollution tests on insulators for voltage systems of 800 kV and above (solid layer method procedure B) .....	37
E.1	Introduction .....	37
E.2	Test chamber .....	37
E.3	Fog generator .....	37
E.4	Wetting action and uniformity of fog density .....	37
Bibliography	.....	38
Figure 1	– Minimum short-circuit current, $I_{sc \min}$ , required for the testing plant as a function of the unified specific creepage distance (USCD) of the insulator under test .....	13
Figure 2	– Value of factor $b$ as a function of solution temperature .....	15
Figure 3	– Typical construction of fog spray nozzle .....	17
Figure 4	– Test layout for inclined insulators .....	18
Figure 5	– Typical arrangement of steam-fog generator .....	26
Figure C.1	– Arrangement of the probe electrodes (all dimensions in mm) .....	32
Figure C.2	– Circuit diagram of the meter .....	33
Figure D.1	– Control of the wetting action of the steam fog: Layer conductance recording during the test on the chosen dummy insulator (standard type of Table B.1) .....	36
Table 1	– Salt-fog method: correspondence between the value of salinity, volume conductivity and density of the solution at a temperature of 20 °C .....	14
Table 2	– Main characteristics of the inert materials used in solid layer suspensions .....	20
Table 3	– Kieselguhr composition: approximate correspondence between the reference degrees of pollution on the insulator and the volume conductivity of the suspension at a temperature of 20 °C .....	21
Table 4	– Kaolin (or Tonoko) composition: approximate correspondence between the reference degrees of pollution on the insulator and the volume conductivity of the suspension at a temperature of 20 °C .....	22
Table A.1	– Expected $I_{h \max}$ values related to different USCD values .....	28

Table B.1 – Ranges of values of withstand characteristics of reference suspension insulators in artificial pollution tests .....	31
--	----



## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ARTIFICIAL POLLUTION TESTS ON HIGH-VOLTAGE CERAMIC  
AND GLASS INSULATORS TO BE USED ON A.C. SYSTEMS**

## 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, Publicly Available Specifications (PAS) 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.
- 2) The formal decisions or agreements of 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 IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60507 has been prepared by IEC technical committee 36: Insulators.

This third edition cancels and replaces the second edition published in 1991. This third edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Corrections and the addition of explanatory material;
- b) The addition of Clause 4.3.2 on atmospheric correction;
- c) The change of the upper limit of conductivity of water to 0.1 S/m; and
- d) The extension to UHV voltages.

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

FDIS	Report on voting
36/337/FDIS	36/342/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. 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

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

## ARTIFICIAL POLLUTION TESTS ON HIGH-VOLTAGE CERAMIC AND GLASS INSULATORS TO BE USED ON A.C. SYSTEMS

### 1 Scope

This International Standard is applicable for the determination of the power frequency withstand characteristics of ceramic and glass insulators to be used outdoors and exposed to polluted atmospheres, on a.c. systems with the highest voltage of the system greater than 1 000 V.

These tests are not directly applicable to polymeric insulators, to greased insulators or to special types of insulators (insulators with semiconducting glaze or covered with any organic insulating material).

The object of this International Standard is to prescribe procedures for artificial pollution tests applicable to insulators for overhead lines, substations and traction lines and to bushings

It may also be applied to hollow insulators with suitable precautions to avoid internal flashover. In applying these procedures to apparatus incorporating hollow insulators, the relevant technical committees should consider their effect on any internal equipment and the special precautions which may be necessary.

### 2 Normative references

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.

IEC 60071-1, *Insulation co-ordination – Part 1: Definitions, principles and rules*

IEC/TS 60815-1, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 1: Definitions, information and general principles*

IEC/TS 60815-2, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 2: Ceramic and glass insulators for a.c. systems*

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