SLOVENSKI STANDARD
oSIST prEN IEC 61109:2024

01-februar-2024

Izolatorji za nadzemne vode - Sestavljeni obesni in strižni izolatorji za izmenične sisteme z nazivno napetostjo nad 1 000 V - Definicije, preskusne metode in prevzemna merila

Insulators for overhead lines - Composite suspension and tension insulators for a.c. systems with a nominal voltage greater than 1 000 V - Definitions, test methods and acceptance criteria

Isolatoren für Freileitungen - Verbund-Hänge- und -Abspannisolatoren für Wechselstromsysteme mit einer Nennspannung über 1 000 V - Begriffe, Prüfverfahren und Annahmekriterien

Isolateurs pour lignes aériennes - Isolateurs composites de suspension et d'ancrage destinés aux systèmes à courant alternatif de tension nominale supérieure à 1 000 v - Définitions, méthodes d'essai et critères d'acceptation

Ta slovenski standard je istoveten z: **prEN IEC 61109:2023**

ICS:

29.080.10	Izolatorji	Insulators
29.240.20	Daljnovodi	Power transmission and distribution lines

oSIST prEN IEC 61109:2024 **en,fr,de**

36/590/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER:	
IEC 61109 ED3	
DATE OF CIRCULATION:	CLOSING DATE FOR VOTING:
2023-12-08	**2024-03-01**
SUPERSEDES DOCUMENTS:	
36/583/RR	

IEC TC 36 : INSULATORS	
SECRETARIAT: Sweden	SECRETARY: Mr Dan Windmar
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 11	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☒ QUALITY ASSURANCE ☐ SAFETY	
☒ SUBMITTED FOR CENELEC PARALLEL VOTING **Attention IEC-CENELEC parallel voting** The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.	☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Recipients of this document are invited to submit, with their comments, notification of any relevant “In Some Countries” clauses to be included should this proposal proceed. Recipients are reminded that the CDV stage is the final stage for submitting ISC clauses. (SEE AC/22/2007 OR NEW GUIDANCE DOC).

TITLE:

Insulators for overhead lines - Composite suspension and tension insulators for a.c. systems with a nominal voltage greater than 1 000 V - Definitions, test methods and acceptance criteria

PROPOSED STABILITY DATE: 2027

NOTE FROM TC/SC OFFICERS:

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

INSULATORS FOR OVERHEAD LINES COMPOSITE SUSPENSION AND TENSION INSULATORS WITH AC VOLTAGE GREATER THAN 1 000 V AND DC VOLTAGE GREATER THAN 1 500 V – DEFINITIONS, TEST METHODS AND ACCEPTANCE CRITERIA

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 provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
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 61109 has been prepared by subcommittee 36B: Insulators for overhead lines, of IEC technical committee 36: Insulators.

This third edition supersedes and replaces the second edition, published in 2008. This edition constitutes a technical revision.

The main technical changes with respect to the previous edition are listed below:

– extended to apply both to AC and DC systems
– modifications of Terms, definitions and abbreviations;
– removal of chapter 7 "Hybrid insulators" from this standard;
– modifications of tests procedures recently included in IEC 62217 (Hydrophobicity transfer test; Stress corrosion, Water diffusion test on the core with housing);
– modifications on environmental conditions;
– modifications on classification of tests and include the relevance of the interfaces;
– clarification and modification of the parameters determining the need to repeat design and type tests, Table 1 revised;
– revision of electrical type tests;

176 – revision of re-testing procedure of sample test;
177 – addition of a new Annex D on electric field control for AC
178 – addition of a new Annex E on typical sketch of for composite insulators assembly
179 – addition of a new Annex F Mechanical evaluation of the adhesion between core and housing
180 – addition of a new Annex G Applicability of design- and type tests for Direct Current (DC)
181

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

FDIS	Report on voting

183
184 Full information on the voting for the approval of this standard can be found in the report on
185 voting indicated in the above table.

186 This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

187 The committee has decided that the contents of this publication will remain unchanged until the
188 maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data
189 related to the specific publication. At this date, the publication will be

190 • reconfirmed,
191 • withdrawn,
192 • replaced by a revised edition, or
193 • amended.
194

INTRODUCTION

Composite suspension and tension insulators (in the following the term “composite insulator” is used) consist of fibreglass insulating core, bearing the mechanical load protected by a polymeric housing, the load being transmitted to the core by metallic end fittings. Despite these common features, the materials used and the design and manufacturing details used by different manufacturers may differ.

Some tests have been grouped together as "Design tests", to be performed only once on insulators which satisfy the same design conditions. For all design tests of these composite insulators, the appropriate common clauses defined in IEC 62217 are applied. As far as practical, the influence of time on the electrical and mechanical properties of the components (core material, housing, interfaces etc.) and of the complete composite insulators has been considered in specifying the design tests to ensure a satisfactory lifetime under normally known stress conditions of transmission lines. Explanation of the principles of the damage limit, load coordination and testing are presented in Annex A.

It has not been considered useful to specify a power arc test as a mandatory test. The test parameters are manifold and can have very different values depending on the configurations of the network and the supports and on the design of arc-protection devices. The heating effect of power arcs should be considered in the design of metal fittings. Critical damage to the metal fittings resulting from the magnitude and duration of the short-circuit current can be avoided by properly designed arc-protection devices. This standard, however, does not exclude the possibility of a power arc test by agreement between the manufacturer and customer. IEC 61467 [1] gives details of AC power arc testing of complete insulator sets, that shall match their configuration with actual protective and string fittings, to recreate the real electromagnetic field affecting the arc movement.

This standard covers both AC and DC composite insulators. Before the appropriate standard for DC applications will be issued, the majority of tests listed in this standard can also be applicable for DC (Annex G). Due to the difference in AC and DC tracking performance, a specific tracking and erosion test procedure for DC applications as a design test shall be developed. The 1000 h AC tracking and erosion test of IEC 62217 can be used only to establish a minimum requirement for the tracking and erosion resistance. This 1000 h salt fog tracking and erosion test is considered as a screening test intended to reject materials in combination with the design which are inadequate. Tracking and erosion tests are not intended to evaluate long term performance of insulators. Such tests, e.g. the 5 000 h multiple stress test and wheel test in IEC/TR 62730 or other tests, intended for research or sometimes used as a supplementary design test, are not considered in the present standard.

Composite insulators are in general not intended for torsion or other non-tensile loads. However due consideration to non-standard applications (interphase spacers etc.) loads during handling and installation should be considered in the design. Guidance on non-standard loads is given in Annex C.

Wherever possible, IEC Guide 111 [5] has been followed for the drafting of this standard.

INSULATORS FOR OVERHEAD LINES COMPOSITE SUSPENSION AND TENSION INSULATORS WITH AC VOLTAGE GREATER THAN 1 000 V AND DC VOLTAGE GREATER THAN 1 500 V – DEFINITIONS, TEST METHODS AND ACCEPTANCE CRITERIA

1 Scope and object

This International Standard applies to composite insulators for overhead lines consisting of a load-bearing cylindrical insulating solid core consisting of fibres – usually glass – in a resin-based matrix, a housing (surrounding the insulating core) made of polymeric material and metal end fittings permanently attached to the insulating core.

Composite insulators covered by this standard are intended for use as suspension/tension line insulators, but it should be noted that these insulators can occasionally be subjected to compression or bending, for example when used as interphase-spacers. Guidance on such loads is outlined in Annex C.

The object of this standard is to

– define the terms used,

– prescribe test methods,

– prescribe acceptance criteria.

This standard does not include requirements dealing with the choice of insulators for specific operating conditions or environments.

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 60383-1, *Insulators for overhead lines with a nominal voltage above 1 000 V – Part 1: Ceramic or glass insulator units for AC systems – Definitions, test methods and acceptance criteria*

IEC 60383-2, *Insulators for overhead lines with a nominal voltage above 1 000 V – Part 2: Insulator strings and insulator sets for AC systems – Definitions, test methods and acceptance criteria.*

IEC 60437, *Radio interference test on high-voltage insulators*

IEC 61466-1, *Composite string insulator units for overhead lines with a nominal voltage greater than 1 000 V – Part 1: Standard strength classes and end fittings*

IEC 61467, *Insulators for overhead lines – Insulator strings and sets for lines with a nominal voltage greater than 1 000 V – AC power arc tests*

IEC 61284, *Overhead lines- Requirements and tests for fittings*

IEC 62217, *Polymeric insulators for indoor and outdoor use with a nominal voltage > 1 000 V – General definitions, test methods and acceptance criteria*

ISO 3452 (all parts), *Non-destructive testing – Penetrant testing*

3 Terms, definitions and abbreviations

For the purposes of this document, the following terms, definitions and abbreviations apply.

NOTE 1 to entry: Certain terms from IEC 62217 are reproduced here for ease of reference. Additional definitions applicable to insulators can be found in IEC 60050-471 [6].

3.1 Terms and definitions

3.2 3.1.1
polymeric insulator
insulator whose insulating body consists of at least one organic based material

Note 1 to entry: Polymeric insulators are also known as non-ceramic insulators.

Note 2 to entry: Coupling devices may be attached to the ends of the insulating body.

[SOURCE: IEC 60050-471:2007, 471-01-13]

3.3 3.1.2
composite insulator
insulator made of at least two insulating parts, namely a core and a housing equipped with end fittings

Note 1 to entry: Composite insulators can consist either of individual sheds mounted on the core, with or without an intermediate sheath, or alternatively, of a housing directly moulded or cast in one or several pieces on to the core.

[SOURCE: IEC 60050-471:2007, 471-01-02]

3.4 3.1.3
core of a composite insulator
central insulating part of an insulator which provides the mechanical characteristics

Note 1 to entry: The housing and sheds are not part of the core.

[SOURCE: IEC 60050-471:2007, 471-01-11]

3.5 3.1.4
insulator trunk
central insulating part of an insulator from which the sheds project

Note 1 to entry: Also known as shank on smaller insulators.

[SOURCE: IEC 60050-471:2007, 471-01-11]

3.6 3.1.5
housing
external insulating part of composite insulator providing the necessary creepage distance and protects the core from the environment

Note 1 to entry: An intermediate sheath made of insulating material may be part of the housing.

[SOURCE: IEC 60050-471:2007, 471-01-09]

3.1.6
shed of an insulator
insulating part, projecting from the insulator trunk, intended to increase the creepage distance

Note 1 to entry: The shed can be with or without under-ribs.

[SOURCE: IEC 60050-471:2007, 471-01-15]

3.7 3.1.7
interfaces
contact surface between the different materials (see also Annex E)

Note 1 to entry: Various interfaces exist in composite insulators, e.g.:

- between housing and end fittings;
- between various parts of the housing; e.g. between separately manufactured sheds, or between sheath and sheds;
- between core and housing.
- between sealant and core
- between sealant and end fittings

3.8 see Annex E: Principles sketch of for composite insulator assembly, for more details

[Definition 3.15 of IEC 62217, modified]

3.9 3.1.8
end fitting
integral component or formed part of an insulator intended to connect it to a supporting structure, or to a conductor, or to an item of equipment, or to another insulator

Note 1 to entry: Where the end fitting is metallic, in general the term “metal fitting” is used.

Note 2 to entry: standard end fittings are defined in IEC 61466-1

[SOURCE: IEC 60050-471:2007, 471-01-06]

3.10 3.1.9
connection zone
zone where the mechanical load is transmitted between the core and the end fitting

[Definition 3.17 of IEC 62217, modified]

3.11 3.1.10
coupling
part of the end fitting which transmits the load to the accessories external to the insulator

[Definition 3.17 of IEC 62217, modified]

3.12 3.1.11
creepage distance

shortest distance or the sum of the shortest distances along the surface on an insulator between two conductive parts which normally have the operating voltage between them

[SOURCE: IEC 60050-471:2007, 471-01-04]

3.13 3.1.12
arcing distance
shortest distance in the air external to the insulator between the metallic parts which normally have the operating voltage between them

Note 1 to entry – The term “dry arcing distance” is also used.

[IEV 471-01-01]

3.14 3.1.13
specified mechanical load
SML
load, specified by the manufacturer, which is used for mechanical tests in this standard

3.15 3.1.14
routine test load
RTL
load applied to all assembled composite insulators during a routine mechanical test

3.16 3.1.15
mechanical failing load
maximum load that is reached when the insulator is tested under the prescribed conditions

3.17 [IEV 471-01-12]

3.18 3.1.16
insulator set
assembly of one or more insulator strings suitably connected together, complete with end fittings and protective devices as required in service

Note 1 to entry – The terms “arcing and field grading devices” is also used for protective devices.

[IEV 471-03-02]

3.19 3.1.17
string insulator unit
cap and pin insulator or long rod insulator of which the end fittings are suitable for flexible attachment to other similar string insulator units or to connecting accessories

Note 1 to entry – cap and pin insulators are not composite insulators and are not part of this document.

[IEV 471-03-08]

3.20 3.1.18

sealing

method for providing the ability of a component to resist the ingress of contaminants

[IEV 581-23-16]

Note 1 to entry – contaminants include pollution and moisture.

3.21 3.1.19

sealant (sealing-agent)

Additional material used for sealing, typically RTV-silicones are used for composite insulators

Note 1 to entry: see sealant in Annex E: Typical principles sketch for composite insulators assembly

3.22 Abbreviations

The following abbreviations are used in this standard:

E1, E2 Sample sets for sample tests

M_{AV} Average 1 min failing load of the core assembled with fittings

RTL Routine test load

SML Specified mechanical load

4 Identification

In addition to the requirements of IEC 62217, each insulator shall be marked with the SML.

It is recommended that each insulator be marked or labelled by the manufacturer to show that it has passed the routine mechanical test.

5 Environmental conditions

Table 1 is copied from IEC 62217 for reader`s convenience.

The normal environmental conditions to which insulators are submitted in service are defined according to Table 1. Terms are defined as follows:

- Indoor environment: installation within a building or other construction where the insulators are protected against wind, rain, snow, periodical fast-built pollution deposits, abnormal condensation, ice and hoar frost.

- Outdoor environment: installation in open air outside any building or shelter, where the insulators are submitted to wind, rain, snow, periodical fast-built pollution deposits, high condensation, ice and hoar frost.

If service conditions of polymeric insulators deviate significantly from the parameters in Table 1, the insulator is to designed or evaluated according to agreement between the customer and manufacturer. Alternatively, if positive service experience is available for a specific environment and specific insulator design (including material and profile), the insulator can be used for this specific environment, deviating from normal conditions.

Table 1 – Normal environmental conditions

	Indoor insulation	Outdoor insulation
Maximum ambient air temperature [a]	Does not exceed 40 °C and its average value measured over a period of 24 h does not exceed 35 °C	
Minimum ambient air temperature [b]	-25 °C	-40 °C
Maximum ambient air temperature [a]	Does not exceed 40 °C and its average value measured over a period of 24 h does not exceed 35 °C	
Minimum ambient air temperature [b]	-25 °C	-40 °C
Vibration	Negligible vibration due to causes external to the insulators or to earth tremors c.	
Solar radiation [d]	Not applicable	Up to a level of 1 120 W/m^2