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

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

POLYMERIC INSULATORS FOR INDOOR AND OUTDOOR USE WITH A NOMINAL VOLTAGE >1 000 V – GENERAL DEFINITIONS, TEST METHODS AND ACCEPTANCE CRITERIA

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International Standard IEC 62217 has been prepared by IEC technical committee 36: Insulators.

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

FDIS	Report on voting
36/244/FDIS	36/245/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 maintenance result 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- withdrawn,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.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

Polymeric insulators consist either of one insulating material (resin insulators) or two or several insulating materials (composite insulators). The insulating materials are generally cross-linked organic materials synthesized from carbon or silicon chemistry and form the insulating body. Insulating materials can be composed from organic materials containing various inorganic and organic ingredients, such as fillers and extenders. End fittings are often used at the ends of the insulating body to transmit mechanical loads. Despite these common features, the materials used and the construction details employed by different manufacturers may be widely different.

Some tests have been grouped together as "design tests", to be performed only once for insulators of the same design. The design tests are intended to eliminate insulator designs, materials or manufacturing technologies which are not suitable for high-voltage applications. The influence of time on the electrical properties of the complete polymeric insulator and its components (core material, housing, interfaces, etc.) has been considered in specifying the design tests in order to ensure a satisfactory life-time under normal operating and environmental conditions.

Pollution tests, according to IEC 60507 or IEC 61245, are not included in this International Standard, their applicability to composite insulators not having been proven. The results of such pollution tests performed on insulators made of polymeric materials do not correlate with experience obtained from service. Specific pollution tests for polymeric insulators are still under consideration.

The tracking and erosion tests given in this standard are considered as screening tests intended to reject materials or designs which are inadequate. These tests are not intended to predict long-term performance for insulator designs under cumulative service stresses. For more information, see Annex C.

Composite insulators are used in both a.c. and d.c. applications. In spite of this fact a specific tracking and erosion test procedure for d.c. applications as a design test has not yet been defined and accepted. The 1 000 h a.c. tracking and erosion test described in this standard is used to establish a minimum requirement for the tracking resistance of the housing material.

IEC Guide 111 has been followed during preparation of this standard wherever possible.

POLYMERIC INSULATORS FOR INDOOR AND OUTDOOR USE WITH A NOMINAL VOLTAGE >1 000 V – GENERAL DEFINITIONS, TEST METHODS AND ACCEPTANCE CRITERIA

1 Scope and object

This International Standard is applicable to polymeric insulators whose insulating body consists of one or various organic materials. Polymeric insulators covered by this standard include both solid core and hollow insulators. They are intended for use on overhead lines and in indoor and outdoor equipment with a rated voltage greater than 1 000 V.

The object of this standard is

– to define the common terms used for polymeric insulators,

– to prescribe common test methods for design tests on polymeric insulators,

– to prescribe acceptance or failure criteria, if applicable,

– to give recommendations for polymeric insulator test standards or product standards, complemented by specific requirements as needed.

These tests, criteria and recommendations are intended to ensure a satisfactory life-time under normal operating and environmental conditions (see Clause 5).

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

IEC 60068-2-11, *Basic environmental testing procedures – Part 2: Tests, Test KA: Salt mist*

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

IEC 60695-11-10, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*

IEC 60721-1, *Classification of environmental conditions – Part 1: Environmental parameters and their severities*

IEC 60815, *Guide for the selection of insulators in respect of polluted conditions*

IEC Guide 111, *Electrical high-voltage equipment in high-voltage substations – Common recommendations for product standards*

ISO 868, *Plastics and ebonite – Determination of indentation hardness by means of a durometer (Shore hardness)*

ISO 4287, *Geometrical Product Specifications (GPS) – Surface texture: Profile method – Terms, definitions and surface texture parameters*

ISO 4892-1, *Plastics – Methods of exposure to laboratory light sources – Part 1: General Guidance*

ISO 4892-2, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc sources*

ISO 4892-3, *Plastics – Methods of exposure to laboratory light sources – Part 3: Fluorescent UV lamps*

3 Terms and definitions

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

3.1
polymeric insulator
insulator whose insulating body consists of at least one organic based material.

NOTE Coupling devices may be attached to the ends of the insulating body

NOTE Polymeric insulators are also known as non-ceramic insulators.

[IEV 471-01-13]

3.2
resin insulator
polymeric insulator whose insulating body consists of a solid shank and sheds protruding from the shank made from only one organic based housing material (e.g. cycloaliphatic epoxy)

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

NOTE Composite insulators, for example, 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.

[IEV 471-01-02]

3.4
core (of an insulator)
central insulating part of an insulator which provides the mechanical characteristics

NOTE The housing and sheds are not part of the core.

[IEV 471-01-03]

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

NOTE Also known as shank on smaller insulators.

[IEV 471-01-11]

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

NOTE An intermediate sheath made of insulating material may be part of the housing.

[IEV 471-01-09]

3.7
shed (of an insulator)
insulating part, projecting from the insulator trunk, intended to increase the creepage distance. The shed can be with or without ribs

[IEV 471-01-15]

3.8
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

NOTE 1 The surface of cement or of any other non-insulating jointing material is not considered as forming part of the creepage distance.

NOTE 2 If a high resistance coating is applied to parts of the insulating part of an insulator, such parts are considered to be effective insulating surfaces and the distance over them is included in the creepage distance.

[IEV 471-01-04]

3.9
arcing distance
shortest distance in air external to the insulator between the metallic parts which normally have the operating voltage between them

[IEV 471-01-01]

3.10
interfaces
surface between the different materials

NOTE Various interfaces occur in most composite insulators, e.g.

– between housing and end fittings,

– between various parts of the housing, e.g. between sheds, or between sheath and sheds,

– between core and housing.

3.11
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 Where the end fitting is metallic, the term "metal fitting" is normally used.

[IEV 471-01-06, modified]

3.12
connection zone
zone where the mechanical load is transmitted between the insulating body and the end fitting

3.13
coupling (of an insulator)
part of the end fitting which transmits load to the hardware external to the insulator

3.14
tracking
process which forms irreversible degradation by formation of conductive paths (tracks) starting and developing on the surface of an insulating material

NOTE These paths are conductive even under dry conditions.

3.15
erosion
irreversible and non-conducting degradation of the surface of the insulator that occurs by loss of material which can be uniform, localized or tree-shaped

NOTE Light surface traces, commonly tree-shaped, can occur on composite insulators as on ceramic insulators, after partial flashover. These traces are not considered to be objectionable as long as they are non-conductive. When they are conductive they are classified as tracking

3.16
crack
any internal fracture or surface fissure of depth greater than 0,1 mm

3.17
puncture (of an insulator)
permanent loss of dielectric strength due to a disruptive discharge passing through the solid insulating material of an insulator

[IEV 471-01-14]

4 Identification

The manufacturer's drawing shall show the relevant dimensions and information necessary for identifying and testing the insulator in accordance with this standard and the applicable IEC product standard(s). The drawing shall also show applicable manufacturing tolerances.

Each insulator shall be marked with the name or trade mark of the manufacturer and the year of manufacture. In addition, each insulator shall be marked with the rated characteristics specified in the relevant IEC product standards. These markings shall be legible, indelible and their fixings (if any) weather- and corrosion-proof.

5 Environmental conditions

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

When special environmental conditions prevail at the location where insulators are to be put in service, they shall be specified by the user by reference to IEC 60721-1.

Table 1 – Normal environmental conditions

Condition	Indoor insulation	Outdoor insulation
Maximum ambient air temperature	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	–25 °C	–40 °C
Vibration	Negligible vibration due to causes external to the insulators or to earth tremors [a]	
Solar radiation [b]	To be neglected	Up to a level of 1 000 W/m^2
Pollution of the ambient air	No significant pollution by dust, smoke, corrosive and/or flammable gases, vapours, or salt	Pollution by dust, smoke, corrosive gases, vapours or salt may occur. Pollution does not exceed "heavy" as defined in IEC 60815
Humidity	The average value of the relative humidity, measured over a period of 24 h, does not exceed 95 %; measured over a period of one month, does not exceed 95 %. For these conditions, condensation may occasionally occur	

[a] Vibration due to external causes can be dealt with in accordance to IEC 60721-1.

[b] Details of solar radiation are given in IEC 60721-1.