IEC TS 62896

Edition 1.0 2015-11

TECHNICAL SPECIFICATION

Hybrid insulators for a.c. and d.c. high-voltage applications – Definitions, test methods and acceptance criteria

IEC TS 62896:2015-11(en)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.080.10 ISBN 978-2-8322-3017-6

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HYBRID INSULATORS FOR A.C. AND D.C. HIGH-VOLTAGE APPLICATIONS – DEFINITIONS, TEST METHODS AND ACCEPTANCE CRITERIA

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Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 62896, which is a technical specification, has been prepared by IEC technical committee 36: Insulators.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
36/362/DTS	36/368/RVC

Full information on the voting for the approval of this technical specification 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

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

Hybrid insulators consist of an insulating core, bearing the mechanical load protected by a polymeric housing, the load being transmitted to the core by end fittings. Despite these common features, the materials used and the construction details employed by different manufacturers may be quite different. The core is made of ceramic or glass material.

Hybrid insulators are applied as overhead line, post or hollow core equipment insulators. In order to perform the design tests, IEC 62217 shall be applied for the polymeric housing and the interfaces between core and the housing. For the core, the test standards for the respective ceramic product (IEC 60168, IEC 60383 and IEC 62155) shall be applied.

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 hybrid insulators, the 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 hybrid insulators has been considered in specifying the design tests to ensure a satisfactory life-time under normally known stress conditions in service.

Polymeric housing materials that show the hydrophobicity transfer mechanism (HTM) are preferred for hybrid insulators. They are applied as a countermeasure against severe polluted service conditions. For the time being, no ageing or pollution tests have been developed for the verification of this property, but CIGRE Technical Brochure No. 442 is available for the evaluation of the retention of the hydrophobicity and the HTM of polymeric housing materials.

Artificial pollution tests for insulators with polymeric housings under AC and DC voltage stress are presently under development by CIGRE.

HYBRID INSULATORS FOR A.C. AND D.C. HIGH-VOLTAGE APPLICATIONS – DEFINITIONS, TEST METHODS AND ACCEPTANCE CRITERIA

1 Scope

This technical specification applies to hybrid insulators for a.c. and d.c. applications consisting of a load-bearing insulating solid or hollow core consisting of ceramic or glass, a housing (defined geometry, outside the insulating core) made of polymeric material and end fittings permanently attached to the insulating core.

Hybrid insulators covered by this technical specification are intended for use as suspension/tension line insulators, line post insulators, station post insulators and hollow core insulators for apparatus.

The object of this technical specification is to:

- define the terms used;
- prescribe test methods;
- prescribe acceptance criteria.

Silicone or other functional coatings (CIGRE Technical Brochure No. 478, Appendix B), booster sheds, shed extenders and rain deflectors are not within the scope of this technical specification.

This technical specification does not include requirements dealing with the choice of insulators for specific operating conditions.

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 60050-471:2007, *International Electrotechnical Vocabulary – Part 471: Insulators*

IEC 60168, *Tests on indoor and outdoor post insulators of ceramic material or glass for systems with nominal voltages greater than 1000 V*

IEC 60383-1, *Insulators for overhead lines with a nominal voltage above 1000 V – Part 1: Ceramic or glass insulator units for a.c. systems – Definitions, test methods and acceptance criteria*

IEC 60383-2, *Insulators for overhead lines with a nominal voltage above 1000 V – Part 2: Insulator strings and insulator sets for a.c. systems – Definitions, test methods and acceptance criteria*

IEC 62155, *Hollow pressurized and unpressurized ceramic and glass insulators for use in electrical equipment with rated voltages greater than 1 000 V*

IEC 62217, *Polymeric HV insulators for indoor and outdoor use – General definitions, test methods and acceptance criteria*

3 Definitions

For the purpose of this document the terms and definitions given in IEC 60050-471 and the following apply (some definitions from IEC 62217 are reproduced here for ease of reference).

3.1
high voltage
HV
voltage over 1 000 V a.c. or over 1 500 V d.c. or over 1 500 V peak value

3.2
polymeric insulator
insulator whose insulating body consists of only polymer containing materials, to the ends of which coupling devices may be attached

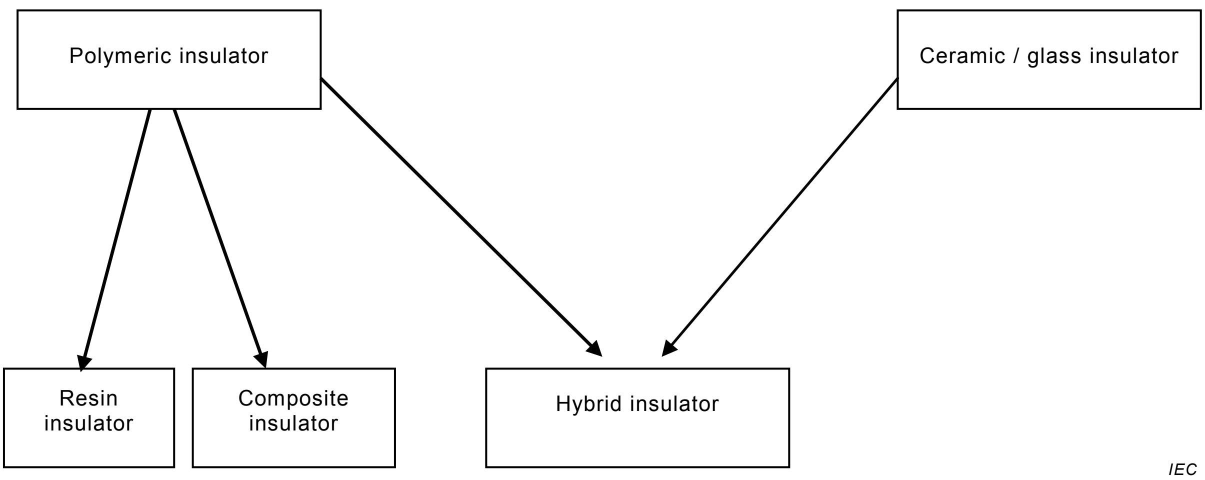
Note 1 to entry: Polymeric insulators are also known as non-ceramic insulators.

3.2.1
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)

3.2.2
composite insulator
polymeric insulator made of at least two polymeric insulating parts, namely a core and a housing, equipped with metal fittings

Note 1 to entry: 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.

3.3
hybrid insulator
insulator that consists of a ceramic or glass core and a polymeric housing, equipped with one or more metal fittings



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Note 1 to entry: The mechanical functions are mainly characterised by the core, the electrical functions are mainly characterised by the polymeric housing. The housing may cover the core completely or partly. In the latter case the exposed portions of the ceramic core are usually covered by glaze.

3.4
core of a hybrid insulator
the internal insulating part, consisting of ceramic or glass, of a hybrid insulator which is designed to ensure the mechanical characteristics

Note 1 to entry: The core for composite insulators is defined in IEC 62217.

3.5
shank of a hybrid insulator
the section between two adjacent sheds (also known as trunk on larger insulators)

3.6
housing
external insulating part which is made of polymeric material providing necessary creepage distance and protecting the core from environment

3.7
shed
insulating part, projecting from the insulator trunk, intended to increase the creepage distance

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

[SOURCE: IEC 60050-471:2007, 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 to entry: The surface of cement or of any other non-insulating jointing material is not considered as forming part of the creepage distance.

Note 2 to entry: 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.

[SOURCE: IEC 60050-471:2007, 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

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

3.10
interfaces
surface between the different materials. Various interfaces occur in most hybrid insulators, e.g.:

- between housing and fixing devices;
- between various parts of the housing; e.g. between sheds, or between sheath and sheds;
- between core and housing;

3.11
end fitting
fixing device
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, the term “metal fitting” is normally used.

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

3.12
connection zone
zone where the mechanical load is transmitted between the insulating body and the fixing device

3.13
coupling
part of the fixing device 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 1 to entry: Tracking 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 1 to entry: Light surface traces, commonly tree-shaped, can occur on hybrid insulators as on ceramic and glass 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
permanent loss of dielectric strength due to a disruptive discharge passing through the solid insulating material of an insulator

[SOURCE: IEC 60050-471:2007, 471-01-14]

4 Identification

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 applicable IEC product standards for ceramic or glass insulators. 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 in IEC 62217.

6 Tolerances

Unless otherwise agreed, a tolerance of

- $\pm(0{,}04 \times d + 1{,}5)$ mm when $d \leq 300$ mm,