IEC 62772

Edition 2.0 2023-11
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

Composite hollow core station post insulators ~~for substations~~ with a.c. voltage greater than 1 000 V and d.c. voltage greater than 1 500 V – Definitions, test methods and acceptance criteria

IEC 62772:2023-11 RLV(en)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.080.10

ISBN 978-2-8322-7899-4

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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COMPOSITE HOLLOW CORE STATION POST INSULATORS ~~FOR SUBSTATIONS~~ WITH AC VOLTAGE GREATER THAN 1 000 V AND DC VOLTAGE GREATER THAN 1 500 V – DEFINITIONS, TEST METHODS AND ACCEPTANCE CRITERIA

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 62772:2016. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 62772 has been prepared by IEC technical committee 36: Insulators. It is an International Standard.

This second edition cancels and replaces the first edition published in 2016. This edition constitutes a technical revision.

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

a) modifications of terms and definitions;
b) modifications of tests procedures included in IEC TR 62039 and IEC 62217 (Hydrophobicity transfer test; Water diffusion test on the core with housing);
c) harmonization of Table 1 (Required design and type tests) with other product standards;
d) update of Annex A (Qualification of fillers);
e) addition of a new informative Annex B (Load definitions, relationship of loads).

The text of this International Standard is based on the following documents:

Draft	Report on voting
36/569/FDIS	36/587/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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

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INTRODUCTION

Composite hollow core station post insulators consist of an insulating hollow core (tube), bearing the mechanical load protected by a polymeric housing, the load being transmitted to the core by end fittings. The hollow core is filled entirely with an insulating material. The core is made of resin impregnated fibres.

Composite hollow core station post insulators are typically applied as post insulators in substations. In order to perform the design tests, IEC 62217 is to be applied for materials and interfaces of the insulator. 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 on composite hollow core station post 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 composite hollow core station post insulator has been considered in specifying the design tests to ensure a satisfactory life-time under normally known stress conditions in service.

This document relates to IEC 61462, *Composite hollow insulators – Pressurized and unpressurized insulators for use in electrical equipment with rated voltage greater than 1 000 V – Definitions, test methods, acceptance criteria and design recommendations*, as well as IEC 62231, *Composite station post insulators for substations with AC voltages greater than 1 000 V up to 245 kV – Definitions, test methods and acceptance criteria*. Tests and requirements described in IEC 62231 can be used ~~although this standard has no~~ despite the intended operating voltage limit for substations.

The use of polymeric housing materials that show hydrophobicity and hydrophobicity transfer mechanism (HTM) is preferred for composite hollow core station post insulators. This is due to the fact that the influence of diameter can be significant for hydrophilic surfaces (see also IEC 60815-3). For instance silicone rubber is recognized as successful countermeasure against severe polluted service conditions. ~~The ageing performance of the polymeric housing can be evaluated by the salt fog test standardized in IEC 62217. For the time being, no test is defined to quantify the HTM, but CIGRE SC D.1 deals with this subject intensively and Technical Brochure No. 442 is available for the evaluation of the retention of the hydrophobicity.~~ For the time being, the 1 000 h AC tracking and erosion test of IEC 62217 is used to establish a minimum requirement for the tracking and erosion resistance, for both AC and DC.

Composite hollow core station post insulators are used in both AC and DC applications. Before the appropriate standard for DC applications will be issued, the majority of tests listed in this standard can also be applied to DC insulators. In spite of this, a specific tracking and erosion test procedure for DC applications as a design test is still being considered to be developed. Some information about the difference of AC and DC material erosion test can be found in the CIGRE Technical Brochure 611 [8][1]. For the time being, the 1 000 h AC tracking and erosion test of IEC 62217 is used to establish a minimum requirement for the tracking and erosion resistance.

[1] Numbers in square brackets refer to the Bibliography.

COMPOSITE HOLLOW CORE STATION POST INSULATORS ~~FOR SUBSTATIONS~~ WITH AC VOLTAGE GREATER THAN 1 000 V AND DC VOLTAGE GREATER THAN 1 500 V – DEFINITIONS, TEST METHODS AND ACCEPTANCE CRITERIA

1 Scope

This document, which is an International Standard, applies to composite hollow core station post insulators consisting of a load-bearing insulating tube (core) made of resin impregnated fibres, insulating filler material (~~e.g.~~ solid, liquid~~, foam~~, gaseous – pressurized or unpressurized), a housing (outside the insulating tube) made of polymeric material (for example silicone or ethylene-propylene) and ~~metal~~ fixing devices at the ends of the insulating tube. Composite hollow core station post insulators as defined in this standard are intended for general use in substations in both, outdoor and indoor environments, operating with a rated AC voltage greater than 1 000 V and a frequency not greater than 100 Hz or for use in direct current systems with a rated voltage greater than 1 500 V DC.

The object of this document is:

– to define the terms used;

– to ~~prescribe~~ specify test methods;

– to ~~prescribe~~ specify acceptance criteria.

All the tests in this document, apart from the thermal-mechanical test, are performed at normal ambient temperature. This document does not ~~prescribe~~ specify tests that ~~may be~~ are characteristic of the apparatus of which the composite hollow core station post insulator ultimately may form a part (e.g. disconnector switch, reactor support, HVDC valves). ~~Further technical input is required in this area.~~

~~NOTE 1 "Pressurized" means a permanent gas or liquid pressure greater than 0,05 MPa (0,5 bar) gauge. The gas can be dry air or inert gases, for example sulphur hexafluoride, nitrogen, or a mixture of such gases.~~

~~NOTE 2 "Unpressurized" means a gas or liquid pressure smaller than or equal to 0,05 MPa (0,5 bar) gauge.~~

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60060-1:2010, *High-voltage test techniques – Part 1: General definitions and test requirements*~~

IEC 60168~~:2001~~, *Tests on indoor and outdoor post insulators of ceramic material or glass for systems with nominal voltages greater than 1000 V*

IEC 61109~~:2008~~, *Insulators for overhead lines – Composite suspension and tension insulators for AC systems with a nominal voltage greater than 1 000 V – Definitions, test methods and acceptance criteria*

IEC 61462~~:2007~~, *Composite hollow insulators – Pressurized and unpressurized insulators for use in electrical equipment with rated voltage greater than 1 000 V – Definitions, test methods, acceptance criteria and design recommendations*

IEC 62217~~:2012~~, *Polymeric HV insulators for indoor and outdoor use – General definitions, test methods and acceptance criteria*

IEC 62231:2006, *Composite station post insulators for substations with AC voltages greater than 1 000 V up to 245 kV – Definitions, test methods and acceptance criteria*

IEC TR 62039, *Selection guidelines for polymeric materials for outdoor use under HV stress*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
composite hollow core station post insulator
post insulator, consisting of at least three insulating parts, namely a tube, a housing with or without sheds, and an internal filler ~~and a housing~~

~~Note 1 to entry: The housing may consist either of individual sheds mounted on the tube, with or without an intermediate sheath, or directly applied in one or several pieces onto the tube. A composite hollow core station post insulator unit is permanently equipped with fixing devices.~~

Note 1 to entry: End fittings are attached to the insulating tube. The housing, with or without sheds, may be omitted in case of specific environmental conditions (e.g. indoor).

Note 2 to entry: A hollow insulator can be made from one or more permanently assembled insulating elements

3.2
post insulator
insulator intended to give rigid support to a live part which is to be insulated from earth or from another live part

Note 1 to entry: A post insulator may be an assembly of a number of post insulator units (stack).

Note 2 to entry: Post insulators for substations are also known as station post insulators.

[SOURCE: IEC 60050-471:2007, 471-04-01, modified – addition of "(stack)" in Note 1 to entry]

3.3
tube (core)
central internal insulating part of a composite hollow core station post insulator ~~designed to ensure~~ which provides the mechanical characteristics

Note 1 to entry: ~~The tube is generally cylindrical or conical, but may have other shapes (for example barrel). The tube is made of resin impregnated fibres.~~ The housing, insulating filler material and sheds are not part of the core.

Note 2 to entry: Resin impregnated fibres are structured in such a manner as to achieve sufficient mechanical strength. Layers of different fibres may be used to fulfil special requirements.

3.4
filler
insulating material filling the entire internal space (~~e.g.~~ solid, liquid~~, foam~~, gaseous – pressurized or unpressurized) of the hollow core station post insulator ~~which has no load bearing function~~

3.5
fixing device (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, the term "metal fitting" is normally used.

[SOURCE: IEC 60050-471:2007, 471-01-06, modified – addition of "fixing device" in term]

3.6
coupling
part of the end fitting which transmits the load to the accessories external to the insulator

[SOURCE: IEC 62217:2012, 3.~~13~~14]

3.7
connection zone
zone where the mechanical load is transmitted between the insulating body and the end fitting

[SOURCE: IEC 62217:2012, 3.~~12~~13]

3.8
housing
external insulating part of composite hollow core station post insulator providing necessary creepage distance and protecting the tube from the environment

Note 1 to entry: If an intermediate sheath is used it forms a part of the housing.

[SOURCE: IEC 62217:2012, ~~definition~~ 3.7~~, modified ("composite insulator" replaced by "composite hollow core station post insulator", "protecting core" replaced by "protecting the tube")~~]

3.9
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]

3.10
insulator trunk
central insulating part of an insulator from which the sheds ~~protrude~~ project

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

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

3.11
creepage distance
shortest distance or the sum of the shortest distances along the surface of an insulator between two conductive parts which normally have the operating voltage between them

Note 1 to entry: The surface of any 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, modified – removal of Note 2 to entry]

3.12
arcing distance
shortest distance in the 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]

3.13
interface
contact surface between the different materials

Note 1 to entry: Various interfaces occur in most composite insulators (cf. Annex C), e.g.

– between housing and end fittings,
– between various parts of the housing; e.g. between sheds, or between sheath and sheds,
– between ~~core~~ tube and housing
– between ~~core~~ tube and filler.

[SOURCE: IEC 62217:2012, 3.11, modified – addition of "contact"]

3.14
damage limit of the tube under mechanical stress
limit below which mechanical loads can be applied, at normal ambient temperature, without micro damage to the composite tube

Note 1 to entry: Applying such loads means that the tube is in a reversible elastic phase. If the damage limit of the tube is exceeded, the tube is in an irreversible plastic phase, which means permanent damage to the tube which may not be visible at a macroscopic level (for a quantitative definition see Annex C of IEC 61462~~:1997~~).

3.15
maximum mechanical load
MML
highest cantilever bending load which is expected to be applied to the composite hollow core station post insulators in accordance with IEC 61462

Note 1 to entry: The MML of the composite hollow core station post insulator is specified by the insulator manufacturer.

3.16
specified mechanical load
SML
cantilever bending load specified by the manufacturer that is used in the mechanical tests, ~~in accordance with IEC 61462~~ and which is verified during a type test at normal ambient temperature

~~Note 1 to entry The load is normally applied by bending at normal ambient temperature.~~

Note ~~2~~ 1 to entry: The SML forms the basis of the selection of composite hollow station post insulators with regard to external loads.

3.17
specified cantilever load
SCL
cantilever load ~~which can~~ to be withstood by the insulator when tested under the ~~prescribed~~ specified conditions in accordance with IEC 62231

3.18
maximum design cantilever load
MDCL
load level above which damage to the insulator begins to occur and that should not be exceeded in service in accordance with IEC 62231

Note 1 to entry: ~~In the context of this standard (IEC 62772) MDCL is considered to be equal to 1,25 times MML as determined in IEC 61462:1997, Clause 8 or 0,5 times of SML.~~ For more information to load philosophies and relationships, see Annex B.

3.19
specified torsion load
SToL
torsion load level which can be withstood by the insulator when tested under the ~~prescribed~~ specified conditions in accordance with IEC 62231

3.20
maximum design torsion load
MDToL
load level above which damage to the insulator begins to occur and that should not be exceeded in service in accordance with IEC 62231

3.21
specified tension load
STL
tension load which can be withstood by the insulator when tested under the ~~prescribed~~ specified conditions in accordance with IEC 62231

3.22
maximum design tension load
MDTL
load level above which damage to the insulator begins to occur and that should not be exceeded in service in accordance with IEC 62231

3.23
specified compression load
SCoL
compression load ~~which can~~ to be withstood by the insulator when tested under the ~~prescribed~~ specified conditions in accordance with IEC 62231

3.24
buckling load
compression load that induces buckling of the insulator core in accordance with IEC 62231

3.25
maximum design compression load
MDCoL
load level above which damage to the insulator begins to occur and that should not be exceeded in service in accordance with IEC 62231 ~~and IEC 61462~~

3.26
failing load of a composite hollow core station post insulator
load at ultimate failure of the insulator, maximum load that can be reached when the insulator is tested under the ~~prescribed~~ specified conditions (valid for bending or pressure tests)

Note 1 to entry: Damage to the ~~core and / or the connection zone~~ tube is likely to occur at loads lower than the insulator failing load.

3.27
deflection under cantilever load
displacement of a point on an insulator, measured perpendicularly to its axis, under the effect of a load applied perpendicularly to this axis

Note 1 to entry: Deflection/load relationships are determined by the manufacturer.

3.28
residual deflection
difference between the initial deflection of a composite hollow core station post insulator prior to bending load application, and the final deflection after release of the load

~~Note 1 to entry: The measurement of residual deflection serves for qualitative comparison with strain gauge measurements.~~

3.29
residual angular displacement
difference between the initial angular displacement, if any, of one of the insulator end fitting with respect to the other insulator end fitting measured prior to the application of the torsion load and the final angular displacement measured after torsion load release

Note 1 to entry: The residual angular displacement may depend on the duration of application of the torsion load and on the time duration between the torsion load release and the measurement of the displacement.

3.30
overpressure
pressure above ambient pressure within a pressurized enclosure

[SOURCE: IEC 60050-426:2020, 426-09-16]

3.31
maximum service pressure
MSP
~~difference between the maximum absolute internal pressure at maximum operational temperature and the normal outside pressure~~

maximum overpressure in service which is specified by the equipment manufacturer

3.32
specified internal pressure
SIP
internal overpressure specified by the manufacturer which is verified during a type test at normal ambient temperature

~~Note 1 to entry: The SIP forms the basis of the selection of composite hollow station post insulators with respect to internal pressure.~~

~~Note 1 to entry The MSP of the composite hollow core station post insulator is specified by the insulator manufacturer.~~

~~Note 2 to entry The MSP is equivalent to "design pressure" as used for ceramic hollow insulators (see IEC 62155).~~

Note 1 to entry: The SIP is specified as the short-time withstand design limit, under which the insulator structure stays intact, but damages may already occur. It can be higher than 4 × MSP.

3.33
pressurized insulator
insulator permanently filled with gas or liquid whose maximum service pressure is greater than 0,05 MPa overpressure