IEC 60383-1

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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

Isolateurs pour lignes aériennes de tension nominale supérieure à 1 000 V – Partie 1: Éléments d'isolateurs en matière céramique ou en verre pour systèmes à courant alternatif – Définitions, méthodes d'essai et critères d'acceptation

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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

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IEC 60383 has been prepared by IEC technical committee 36: Insulators. It is an International Standard.

This fifth edition cancels and replaces the fourth edition published in 1993. This edition constitutes a technical revision.

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

a) The complete document has been revised and updated. The layout of the document has been changed in order to increase readability;
b) RIV test has been added (Clause 14);
c) Impulse puncture test in air has been added (15.2);
d) Residual strength test has been added (Clause 21);

e) Zinc sleeve test has been added (Clause 28);

f) Impact test has been added (Clause 30);

g) Annex C, coatings on ceramic and glass insulators has been added;

h) Annex D, impact test has been added.

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

Draft	Report on voting
36/564/FDIS	36/571/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.

A list of all parts in the IEC 60383 series, published under the general title *Insulators for overhead lines with a nominal voltage above 1 000 V*, can be found on the IEC website.

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INTRODUCTION

This part of IEC 60383 deals with four different types of insulators:

- Pin insulators
- Line post insulators
- String insulator units
- Insulators for overhead electric traction lines

Certain clauses of this document contain general requirements and other clauses contain specific tests relevant to each of the above-mentioned insulators.

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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

1 Scope

This part of IEC 60383 applies to insulators of ceramic material or glass for use on AC overhead power lines and overhead traction lines with a nominal voltage greater than 1 000 V and a frequency not greater than 100 Hz. It also applies to insulators for use on DC overhead electric traction lines.

This document applies to string insulator units, rigid overhead line insulators and to insulators of similar design when used in substations.

It does not apply to insulators forming parts of electrical apparatus or to parts used in their construction or to post insulators which are covered by IEC 60168, *Tests on indoor and outdoor post insulators of ceramic material or glass for systems with nominal voltages greater than 1 000 V*.

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Tests on insulator strings and insulator sets (for example, wet switching impulse voltage) are dealt with in IEC 60383-2.

The object of this document is:

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– to define the terms used
– to define insulator characteristics and to prescribe the conditions under which the specified values of these characteristics shall be verified
– to prescribe test methods
– to prescribe acceptance criteria.

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

Specific requirements on the use of coatings on ceramic or glass insulators are described in the informative Annex C.

Numerical values for insulator characteristics are specified in IEC 60305, IEC 60433 and IEC 60720.

NOTE A guide for the choice of insulators under polluted conditions has been published, see IEC 60815-1 and -2.

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

IEC 60120, *Ball and socket couplings of string insulator units – Dimensions*

IEC 60305, *Insulators for overhead lines with a nominal voltage above 1000 V – Ceramic or glass insulator units for AC systems – Characteristics of insulator units of the cap and pin type*

IEC 60372, *Locking devices for ball and socket couplings of string insulator units – Dimensions and tests*

IEC 60433, *Insulators for overhead lines with a nominal voltage above 1000 V – Ceramic insulators for AC systems – Characteristics of insulator units of the long rod type*

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

IEC 60471, *Clevis and tongue couplings of string insulator units – Dimensions*

IEC 61211, *Insulators of ceramic material or glass for overhead lines with a nominal voltage greater than 1 000 V – Impulse puncture testing in air*

ISO 1459:1973, *Metallic coatings – Protection against corrosion by hot dip galvanizing – Guiding principles*

ISO 1460, *Metallic coatings – Hot dip galvanized coatings on ferrous metals – Determination of the mass per unit area – Gravimetric method*

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ISO 1461, *Hot dip galvanized coatings on fabricated iron and steel articles – Specifications and test Methods*

ISO 1463, *Metal and oxide coatings – Measurement of coating thickness – Microscopical method*

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ISO 2064, *Metallic and other non-organic coatings – Definitions and conventions concerning the measurement of thickness*

ISO 2178:2016, *Non-magnetic coatings on magnetic substrates – Measurement of coating thickness – Magnetic method*

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
insulator string
one or more string insulator units coupled together and intended to give flexible support to conductors and stressed mainly in tension

3.2
rigid insulator
insulator intended to give rigid support to an overhead line conductor and to be stressed mainly by bending and compressive loads

3.3
long rod insulator
rigid insulator intended to be subjected to tensile loads, comprising an insulating part having an approximately circular cylindrical shank, with or without sheds, and external or internal fixing devices attached to each end

3.4
cap and pin insulator
insulator comprising an insulating part usually having the form of a disk or bell, with or without ribs on its surface, and end fittings consisting of an outside cap and an inside pin attached axially

3.5
pin insulator
rigid insulator consisting of an insulating component intended to be mounted rigidly on a supporting structure by means of a pin passing up inside the insulating component which consists of one or more pieces of insulating material permanently connected together

Note 1 to entry: The pin can have two basic shapes. With one shape, the insulating component is fixed to the end of the pin and does not allow contact of the insulating component with the supporting structure. With the other shape, the insulating component is fixed by means of the pin in contact with the supporting structure either directly or with a plate in between, the plate being either a separate washer or part of the pin (sometimes referred to as a pin post insulator).

3.6
line post insulator
rigid insulator intended to be subjected to cantilever, tensile and compressive loads, constructed with one or more insulating materials and assembled on a metal base that is intended to be mounted rigidly on a supporting structure

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3.7
traction insulator
insulator or insulator set intended to give flexible or rigid support for overhead electric traction lines. All types of overhead line insulators may be used for this purpose.

3.8
annealed glass
glass which has been treated to eliminate internal stresses

3.9
toughened glass
glass in which pre-stresses have been created in order to improve its mechanical characteristics

3.10
lot
group of insulators offered for acceptance from the same manufacturer, of the same design and manufactured under presumed similar conditions of production

Note 1 to entry: One or more lots may be offered together for acceptance; the lot(s) offered may consist of the whole, or part, of the quantity ordered.

3.11
flashover (of an insulator)
disruptive discharge external to the insulator, and over its surface, connecting those parts which normally have the operating voltage between them

3.12
impulse withstand voltage
highest peak value of impulse voltage of prescribed form and polarity which does not cause breakdown of insulation under specified conditions

3.13
power frequency withstand voltage
RMS value of sinusoidal power frequency voltage that the insulation of the given equipment can withstand during tests made under specified conditions and for a specified duration

3.14
electromechanical failing load
maximum load reached when a string insulator unit is tested under the prescribed conditions of the test

3.15
mechanical failing load
maximum load reached when an insulator is tested under the prescribed conditions of test

3.16
specified mechanical failing load, SFL
mechanical load that causes the loss of mechanical characteristics of any part of an insulator, when tested according to the relevant standard

Note 1 to entry: SFL can also be used for specified electromechanical failing load.

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

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3.18
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

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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.

Note 3 to entry: Insulators with grooves e.g. pin insulators, the creepage measurements shall start at the centre of the side groove.

3.19
minimum creepage distance
defined minimum allowed creepage distance which cannot be subject to a specified negative tolerance

3.20
nominal creepage distance
value of the creepage distance which can also be subject to a specified positive or negative tolerance

3.21
minimum nominal creepage distance
defined minimum allowed creepage distance which can also be subject to a specified negative tolerance

Note 1 to entry: Minimum nominal creepage distance is a definition that normally applies to cap and pin insulators.

3.22
displacements
axial displacement
maximum positional variation, parallel to the insulator axis, of a definite point on the circumference of the considered insulator during one complete revolution around the insulator axis

radial displacement
maximum positional variation, perpendicular to the insulator axis, of a definite point on the circumference of the considered insulator during one complete revolution around the insulator axis

angular displacement
angular deviation around the insulator axis between corresponding planes of the two coupling pieces

3.23
short standard string
string used to verify characteristics of a unit which are significant only to an insulator string

<for cap and pin units> insulator string of 5 insulator units

<for long rod insulator units> insulator string between 1 m and 2 m in length for long rod insulator units intended to be assembled in a string

Note 1 to entry: For long rod insulators less than 1 m long intended to be used as a string, the unit itself is considered as a short standard string.

Note 2 to entry: The definition short standard string is different to the definition of short string in IEC 61467.

Note 3 to entry: For systems with insulator string with less than 5 insulators, must be considered the string with the real number of insulators.

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3.24
specified characteristic
<domain> numeric value of a voltage or of a mechanical load or any other characteristic specified in an IEC international standard

<domain> numeric value of any such characteristic agreed between the purchaser and the manufacturer

4 Classification, types of insulators and insulating materials

4.1 Insulator classes

Insulators for overhead lines are divided into two classes according to their design:

Class A: an insulator or string insulator unit in which the length of the shortest puncture path through solid insulating material is at least equal to half the arcing distance. An example of a class A insulator is a long rod insulator with external fittings.

Class B: an insulator or string insulator unit in which the length of the shortest puncture path through solid insulating material is less than half the arcing distance. An example of a class B insulator is a cap and pin insulator.