IEC TS 60815-1

Edition 2.0 2025-11

TECHNICAL SPECIFICATION

Selection and dimensioning of high-voltage insulators intended for use in polluted conditions -
Part 1: Definitions, information and general principles

ICS 29.080.10

ISBN 978-2-8327-0759-3

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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Selection and dimensioning of high-voltage insulators intended for use in polluted conditions - Part 1: Definitions, information and general principles

FOREWORD

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IEC TS 60815-1 has been prepared by IEC technical committee 36: Insulators. It is a Technical Specification.

This second edition cancels and replaces the first edition of IEC TS 60815-1 published in 2008. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition[1]:

a) In the Scope, it is clarified that this specification is applicable to AC and DC conditions while it mainly refers to AC conditions. Detailed application indications refer to AC only. The

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[1] IEC TS 60815-2 and IEC TS 60815-3 are being revised synchronously with this document. It is the intention of the technical committee to revise IEC TS 60815-4 in the future, and these technical changes will also apply, where applicable, to that document.

RUSCD is determined based on the SPS class of reference insulators, and this document does not deal with the effects of ice and snow on polluted insulators;

b) Some terms and definitions are modified or introduced in this document, such as RUSCD, creepage factor, average diameter, SPS value and SPS class, hydrophobicity transfer and HTM, etc.;

c) Clause 5 is re-organized and revised regarding input parameters for the selection and dimensioning of insulators, including system requirements and environmental conditions;

d) Clause 6 "Determination of site pollution severity (SPS) class" is re-organized and re-written. A distinction was made between SPS value and SPS class. The measurement of pollution that is made on the de-energized reference insulator is valid for AC only;

e) A new pollution class, extremely heavy class f, is added. It is applicable only to the special situations of extremely heavy pollution when the RUSCD of class e cannot meet the requirements. The RUSCD value for class f is not specified;

f) The parameters of reference insulators were defined;

g) The profiles of reference insulators for type B pollution, both cap-and-pin and long rod insulators were added in this revision. The severity interval for pollution class definition was differentiated for cap and pin insulators and long rod insulators for type B pollution, as already foreseen for type A pollution;

h) The DDDG measurement method was also revised;

i) From RUSCD of reference insulator to USCD of candidate insulator, the correction factors are introduced and revised, such as altitude correction, diameter correction, shed profile correction and parallel insulator number correction;

j) Profile suitability on ceramic and glass insulators was simplified;

k) The general guidance on materials is revised. The concept of hydrophobicity transfer and hydrophobicity transfer material (HTM) are introduced, recognising that a reduced creepage distance may be used for HTM insulators;

l) In the laboratory artificial pollution test for solid layer, the relation between SDD and ESDD is revised;

m) The statistical method is updated.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
36/614/DTS	36/634/RVDTS

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 Technical Specification 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 the parts in the future IEC TS 60815 series, under the general title *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions*, can be found on the IEC website.

NOTE The following print types are used in Table 2:

– *non pollution related parameters: in italic type.*

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, or
– revised.

1 Scope

This part of IEC 60815, which is a technical specification, is applicable to the selection of insulators, and the determination of their relevant dimensions, to be used in outdoor high-voltage systems with respect to pollution. For the purposes of this technical specification series, the insulators are divided into the following broad categories, each dealt with in a specific part as follows:

– IEC TS 60815-2 – Ceramic and glass insulators for AC systems;
– IEC TS 60815-3 – Polymer insulators for AC systems;
– IEC TS 60815-4 – Insulators for DC systems.

This document provides general definitions, gives methods for the evaluation of site pollution severity (SPS) and outlines the principles to arrive at an informed judgement on the probable behaviour of a given insulator in certain pollution environments. The general principles described are applicable to both AC and DC systems. However, the applicability part mainly refers to AC. More information about DC can be found in IEC TS 60815-4.

This document is applicable to all types of external insulation, including insulation forming part of other apparatus. The term "insulator" is used hereafter to refer to any type of insulator.

The objective of this technical specification series is to:

– understand and identify parameters of the system, application, equipment and site influencing the pollution behaviour of insulators,
– understand and choose the appropriate approach to the design and selection of the insulator solution, based on available data, time and resources.
– characterise the type of pollution at a site and determine the site pollution severity (SPS) value and the SPS class,
– determine the reference unified specific creepage distance (RUSCD) of "reference" insulator based on the SPS class,
– select candidate insulators and determine corrections to apply to RUSCD to arrive at the USCD of the "candidate" insulators by taking into account their specific properties (notably their shed profiles), conditions of the site, the application and the type of system,
– evaluate the relative advantages and disadvantages of the possible solutions, using HTM or non-HTM insulators,
– assess the need and merits of "hybrid" solutions or mitigative measures.

The IEC 60815 series does not deal with the effects of ice and snow on polluted insulators.

CIGRE documents [1], [2], [3], [4], [5], [6] and [7][2] form a useful complement to this technical specification for those wishing to study in greater depth the performance of insulators under pollution.

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 60038, *IEC standard voltages*

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

IEC 60050-471, *International Electrotechnical Vocabulary (IEV) – Part 471: Insulators*

IEC 60071-11, *Insulation co-ordination – Part 11 : Definitions, principles and rules for HVDC system*

IEC 60305:2021, *Insulators for overhead lines with a nominal voltage above 1 000 V – Ceramic or glass insulator units for AC systems – Characteristics of insulator units of the cap and pin type*

IEC 60433:2021, *Insulators for overhead lines with a nominal voltage above 1 000 V – Ceramic insulators for AC systems – Characteristics of insulator units of the long rod type*

IEC 60507:2013, *Artificial pollution tests on high-voltage ceramic and glass insulators to be used on AC systems*

IEC TS 61245, *Artificial pollution tests on high-voltage ceramic and glass insulators to be used on DC systems*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-471 and the following apply.

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

– ISO Online browsing platform: available at https://www.iso.org/obp

– IEC Electropedia: available at http://www.electropedia.org/

3.1.1
reference standard cap and pin insulator
U120B, U160BS or U160BL cap and pin insulator (according to IEC 60305:2021) normally used in strings of 7 units to measure site pollution severity value

Note 1 to entry: For U120B, U160BS and U160BL cap and pin insulator, the nominal spacing is 146 mm, 146 mm and 170 mm, the maximum nominal diameter of the insulating part is 255 mm, 280 mm and 280 mm, and the minimum nominal creepage distance is 320 mm, 315 mm and 340 mm, respectively.

3.1.2
reference long rod insulator
L100 long rod insulator (according to IEC 60433:2021) with plain sheds without ribs used to measure site pollution severity having a top angle of the shed between 14° and 24° and a bottom angle between 8° and 16° and at least 14 sheds

3.1.3
shed
projection from the trunk of an insulator intended to increase the creepage distance

Note 1 to entry: Some typical shed profiles are illustrated in 7.3.