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TECHNICAL SPECIFICATION

Selection and dimensioning of high-voltage insulators intended for use in polluted conditions –
Part 2: Ceramic and glass insulators for a.c. systems

IEC/TS 60815-2:2008(E)

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SELECTION AND DIMENSIONING OF HIGH-VOLTAGE INSULATORS INTENDED FOR USE IN POLLUTED CONDITIONS –

Part 2: Ceramic and glass insulators for a.c. systems

FOREWORD

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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 60815-2, which is a technical specification, has been prepared by technical committee 36: Insulators.

This first edition of IEC/TS 60815-2, together with IEC/TS 60815-1, cancels and replaces IEC/TR 60815, which was issued as a technical report in 1986. It constitutes a technical

revision and now has the status of a technical specification. The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
36/265/DTS	36/271A/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

A list of all the parts in the future IEC 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.

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

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- withdrawn,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

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

SELECTION AND DIMENSIONING OF HIGH-VOLTAGE INSULATORS INTENDED FOR USE IN POLLUTED CONDITIONS –

Part 2: Ceramic and glass insulators for a.c. systems

1 Scope and object

IEC/TS 60815-1, which is a technical specification, is applicable to the selection of ceramic and glass insulators for a.c. systems, and the determination of their relevant dimensions, to be used in high-voltage systems with respect to pollution.

This part of IEC 60815 gives specific guidelines and principles to arrive at an informed judgement on the probable behaviour of a given insulator in certain pollution environments.

The basis for the structure and approach of this part of IEC 60815 is fully explained in IEC/TS 60815-1.

The object of this technical specification is to give the user means to:

- determine the reference unified specific creepage distance (RUSCD) from site pollution severity (SPS) class;
- evaluate the suitability of different insulator profiles;
- determine the necessary USCD by applying corrections for insulator shape, size, position, etc. to the RUSCD;
- if required, determine the appropriate test methods and parameters to verify the performance of the selected insulators.

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

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

IEC/TS 60815-1, *Selection and dimensioning of high-voltage insulators for polluted conditions – Part 1: Definitions information and general principles*

3 Terms, definitions and abbreviations

For the purposes of this document, the following terms, definitions and abbreviations apply. The definitions given below are those which either do not appear in IEC 60050-471 or differ from those given in IEC 60050-471.

3.1 Terms and definitions

3.2
unified specific creepage distance
USCD
creepage distance of an insulator divided by the r.m.s. value of the highest operating voltage across the insulator

NOTE 1 This definition differs from that of specific creepage distance where the line-to-line value of the highest voltage for the equipment is used (for a.c. systems usually $U_m/\sqrt{3}$). For line-to-earth insulation, this definition will result in a value that is √3 times that given by the definition of specific creepage distance in IEC/TR 60815 (1986).

NOTE 2 For 'U_m' see IEV 604-03-01 [1][1].

NOTE 3 It is generally expressed in mm/kV and usually expressed as a minimum.

3.3
reference unified specific creepage distance
RUSCD
initial value of unified specific creepage distance for a pollution site before correction for size, profile, mounting position, etc. according to this technical specification and generally expressed in mm/kV

3.4 Abbreviations

CF	creepage factor
ESDD	equivalent salt deposit density
NSDD	non soluble deposit density
SDD	salt deposit density
SES	site equivalent salinity
SPS	site pollution severity
USCD	unified specific creepage distance
RUSCD	reference unified specific creepage distance

4 Principles

The overall process of insulation selection and dimensioning can be summarized as follows:

Firstly, using IEC/TS 60815-1:

- determine the appropriate approach: 1, 2 or 3 as a function of available knowledge, time and resources;
- collect the necessary input data, notably system voltage, insulation application type (line, post, bushing, etc.);
- collect the necessary environmental data, notably site pollution severity and class.

At this stage, a preliminary choice of possible candidate insulators suitable for the applications and environment may be made.

Then, using this technical specification:

- refine the choice of possible candidate ceramic or glass insulators suitable for the environment;

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1 References in square brackets refer to the bibliography.

- determine the reference USCD for the insulator types and materials, either using the indications given in this technical specification, or from service or test station experience in the case of approach 1 (Clause 7);
- choose suitable profiles for the type of environment (Clause 8);
- verify that the profile satisfies certain parameters, with correction or action according to the degree of deviation (Clause 9);
- modify, where necessary (approaches 2 and 3), of the RUSCD by factors depending on the size, profile, orientation, etc. of the candidate insulator (Clauses 10 and 11);
- verify that the resulting candidate insulators satisfy the other system and line requirements such as those given in Table 2 of IEC/TS 60815-1 (e.g. imposed geometry, dimensions, economics);
- verify the dimensioning, if required in the case of approach 2, by laboratory tests (see Clause 12).

NOTE Without sufficient time and resources (i.e. using approach 3), the determination of the necessary USCD will have less accuracy.

5 Materials

This technical specification is applicable to ceramic and glass insulators. The guidance given here assumes that the insulators are of standard manufacture without any surface modification or treatment.

Technologies exist intended to improve the performance of such insulators under pollution, for example, semi-conducting glaze and hydrophobic coatings. At present it is not possible to give specific information on the degree and durability of the improvement given by such technologies.

As far as the relative performance of ceramic and glass insulators under pollution is concerned, there is no notable consistent difference between these materials; hence the choice of either glass or ceramic material with respect to the other depends purely on factors (e.g. ageing, operating experience, maintenance procedures) which are out of the scope of this technical specification.

6 Site severity determination

For the purposes of standardization, five classes of pollution characterizing the site severity are qualitatively defined in IEC/TS 60815-1, from very light pollution to very heavy pollution, as follows:

a – Very light;

b – Light;

c – Medium;

d – Heavy;

e – Very heavy.

NOTE These letter classes do not correspond directly to the previous number classes of IEC/TR 60815:1986.

The SPS class for the site is determined according to IEC/TS 60815-1 and is used to determine the reference USCD for glass and ceramic insulators.

7 Determination of the reference unified specific creepage distance (RUSCD)

Figure 1 shows the relation between SPS class and RUSCD for glass and ceramic insulators. The bars are preferred values representative of a minimum requirement for each class and

are given for use with approach 3 as described in IEC/TS 60815-1. If the estimation of SPS class tends towards the neighbouring higher class, then the curve may be followed.

If exact SPS measurements are available (approach 1 or 2), it is recommended to take a RUSCD which corresponds to the position of the SPS measurements within the class by following the curve in Figure 1.

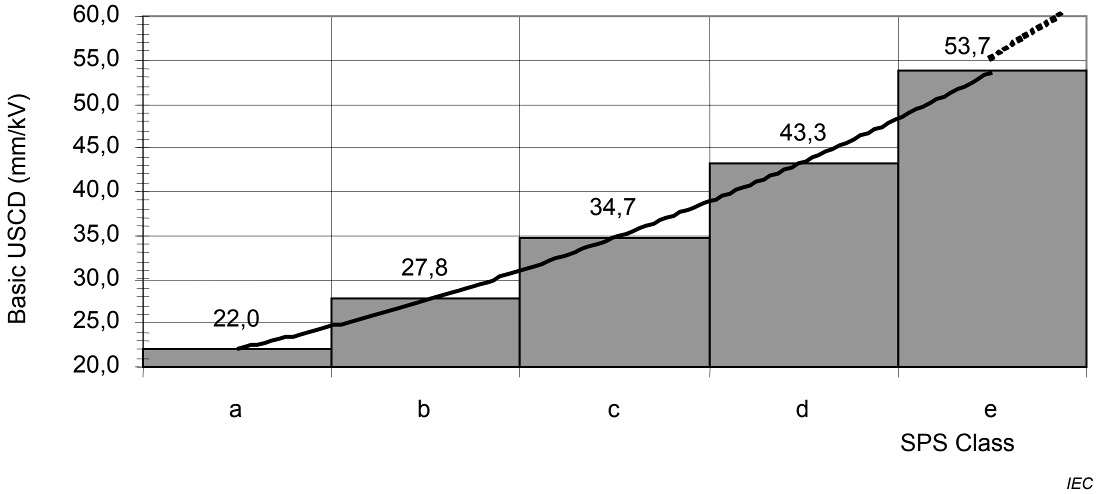

Figure 1 – RUSCD as a function of SPS class

In cases of exceptionally high SPS in, or beyond, class e (see IEC/TS 60815-1, 8.2) the minimum RUSCD may not be adequate. Depending on service experience and/or laboratory test results a higher USCD can be used; in some instances mitigation may be useful (see IEC/TS 60815-1, 9.5.5).

NOTE It is assumed that the final USCD resulting from the application of the corrections given hereafter to the RUSCD will not correspond exactly to a creepage distance available for catalogue insulators. Hence it is preferred to work with exact figures and to round up to an appropriate value at the end of the correction process.

8 Choice of profile

8.1 General recommendations for porcelain and glass profiles

Table 1 below shows a brief summary of the principal advantages and disadvantages of the main profile types with respect to pollution performance.

For standard profiles see Figure 2.

NOTE In the case of long rods, posts and hollows, the typical standard profile shed inclinations are 14° - 24° for the shed top angle α and 8° – 16° for the shed bottom angle β (illustrated in Figure 2b). Smaller angles are generally considered as being aerodynamic, while larger angles are considered as being anti-fog.