

Insulators for overhead lines with a nominal voltage above 1 000 V — Ceramic or glass insulator units for d.c. systems — Definitions, test methods and acceptance criteria

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- Association of Manufacturers Allied to the Electrical and Electronic Industry (BEAMA Ltd.)
- BEAMA Electrical Cable and Conductor Accessory Manufacturers' Association
- British Industrial Ceramic Manufacturers' Association
- British Railways Board
- Electricity Association
- Electrical and Electronic Insulation Association (BEAMA Ltd.)
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Contents

	Page
Committees responsible	Inside front cover
National foreword	ii
Foreword	2
Text of EN 61325	5
List of references	Inside back cover

National foreword

This British Standard has been prepared by Technical Committee PEL/36 and is the English language version of EN 61325:1995 *Insulators for overhead lines with a nominal voltage above 1 000 V. Ceramic or glass insulator units for d.c. systems. Definitions, test methods and acceptance criteria*, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 1325:1995 published by the International Electrotechnical Commission (IEC).

Cross-references

Publication referred to	Corresponding British Standard
IEC 50 (471):1984	BS 4727 <i>Glossary of electrotechnical, power, telecommunication, electronics, lighting and colour terms</i> Part 1 <i>Terms common to power, telecommunications and electronics</i> Group 12:1991 <i>Insulators</i>
HD 588.1 S1:1991 (IEC 60-1:1989)	BS 923 <i>Guide on high-voltage testing techniques</i> Part 1:1990 <i>General</i>
HD 474 S1:1986 (IEC 120:1984)	BS 3288 <i>Insulator and conductor fittings for overhead power lines</i> Part 3:1989 <i>Dimensions of ball and socket couplings of string insulator units</i>
IEC 305:1978	BS 137 <i>Insulators of ceramic material or glass for overhead lines with a nominal voltage greater than 1 000 V</i> Part 2:1973 <i>Requirements</i>
IEC 372:1984	BS 3288 <i>Insulator and conductor fittings for overhead power lines</i> Part 4:1989 <i>Locking devices for ball and socket couplings of string insulator units: dimensions and tests</i>
IEC 1245:1993	BS 7744:1994 <i>Guide to artificial pollution tests on high voltage insulators to be used on d.c. systems</i> BS 5411 <i>Methods of test for metallic and related coatings</i>
ISO 1463:1982	Part 5:1984 <i>Measurement of local thickness of metal and oxide coatings by the microscopical examination of cross-sections</i>
ISO 2064:1980	Part 1:1980 <i>Definitions and conventions concerning the measurement of thickness</i>
ISO 2178:1982	Part 11:1984 <i>Measurement of coating thickness of non-magnetic metallic and vitreous or porcelain enamel coatings on magnetic basis metals: magnetic method</i>

The graphical signs, symbols and letters used in this standard may be found in the following British Standards:

BS 3939 *Graphical symbols for electrical power, telecommunications and electronics diagrams*

Part 1:1986 *General information, general index*
(Related to IEC 617-1)

Part 2:1985 *Symbol elements, qualifying symbols and other symbols having general application*

(Identical with IEC 617-2)

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, the EN title page, pages 2 to 38, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Insulators for overhead lines with a nominal voltage
above 1 000 V
Ceramic or glass insulator units for d.c. systems
Definitions, test methods and acceptance criteria
(IEC 1325:1995)

Isolateurs pour lignes aériennes de tension
nominale supérieure à 1 000 V
Éléments d'isolateurs en céramique ou en verre
pour systèmes à courant continu
Définitions, méthodes d'essai et critères
d'acceptation
(CEI 1325:1995)

Isolatoren für Freileitungen mit einer
Nennspannung über 1 000 V
Keramik- oder Glasisolatoren für
Gleichspannungssysteme
Begriffe, Prüfverfahren und Annahmekriterien
(IEC 1325:1995)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B-1050 Brussels

Foreword

The text of document 36B(CO)112, future edition 1 of IEC 1325, prepared by SC 36B, Insulators for overhead lines, of IEC TC 36, Insulators, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61325 on 1995-05-15.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1996-02-15
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1996-02-15

Annexes designated “normative” are part of the body of the standard. Annexes designated “informative” are given for information only. In this standard, Annex ZA is normative and Annex A and Annex B are informative. Annex ZA has been added by CENELEC.

Contents

			Page
Foreword	2		
Section 1. General			
1 Scope	5		
2 Normative references	5		
3 Definitions	6		
Section 2. Insulators			
4 Insulator classes and type	8		
5 Insulating materials	8		
6 Specified characteristics and features of a d.c. insulator unit	9		
7 Identification of insulators	9		
Section 3. Classification of tests, sampling rules and procedures			
8 Classification of tests	9		
8.1 Type tests	9		
8.2 Sample tests	10		
8.3 Routine tests	10		
9 Quality assurance	10		
10 Procedures for type and sample tests	10		
10.1 Insulator selection for type tests	10		
10.2 Sampling rules and procedures for sample tests	10		
10.3 Re-test procedure for the sample tests	11		
Section 4. Test procedures for electrical tests			
11 General requirements for high-voltage tests	11		
12 Standard atmospheric conditions and correction factors for electrical tests	11		
12.1 Standard reference atmosphere	11		
12.2 Correction factors for atmospheric conditions	12		
13 Mounting arrangements for electrical tests	12		
14 Lightning impulse voltage tests	12		
14.1 Test procedure	12		
14.2 Acceptance criteria	12		
15 Dry d.c. voltage tests	13		
15.1 Test procedure	13		
15.2 Acceptance criteria	13		
16 SF ₆ puncture withstand test	13		
16.1 Test method	13		
16.2 Acceptance criteria	13		
	17	Impulse overvoltage puncture withstand test	13
	18	Ion migration test	14
	18.1	Reference conditions used to calculate the expected charge	14
	18.2	Test validity	14
	18.3	Test procedure	14
	18.4	Acceptance criteria	15
	19	Electrical body resistance test	15
	19.1	Test procedure	15
	19.2	Acceptance criteria	16
	20	Thermal runaway test	16
	20.1	Duration	16
	20.2	Procedure	16
	20.3	Acceptance criteria	16
	21	Routine electrical test	16
		Section 5. Test procedures for mechanical and other tests	
	22	Verification of the dimensions	17
	23	Electromechanical failing load test	17
	23.1	Test procedure	17
	23.2	Acceptance criteria	17
	23.3	Coefficient for type tests	18
	23.4	Coefficients for sample tests	18
	24	Mechanical failing load test	19
	24.1	Test procedure	19
	24.2	Acceptance criteria	19
	25	Thermal-mechanical performance test	19
	25.1	Test procedure	19
	25.2	Acceptance criteria	19
	26	Residual mechanical strength test	19
	26.1	Previous tests	19
	26.2	Preparation of the test pieces	19
	26.3	Test procedure	20
	26.4	Test results	20
	26.5	Acceptance criteria for the type test	20
	26.6	Acceptance criteria for the sample test	20
	26.7	Comparison between type and sample test results	20
	27	Verification of the axial, radial and angular displacements	20
	27.1	Test procedure	20
	27.2	Acceptance criteria for cap and pin insulators	21

		Page		Page
27.3	Acceptance criteria for long rod insulators	21	Annex B (informative) Bibliography	35
28	Verification of the locking system	21	Annex ZA (normative) Normative references to international publications with their corresponding European publications	36
28.1	Conformity of the locking device	21		
28.2	Verification of locking	22	Figure 1 — Suggested mounting arrangement for the SF ₆ puncture withstand test	31
28.3	Position of the locking device	22		
28.4	Procedure for the operation test	22	Figure 2 — Suggested arrangement for body resistance measurements	31
28.5	Acceptance criteria for the operation test	22	Figure 3 — Schematic representation of the thermal-mechanical performance test	32
29	Temperature cycle test	22		
29.1	Test procedure for string insulator units composed of ceramic material	22	Figure 4 — Measurement of axial and radial displacements	32
29.2	Special test procedure for insulators with thick sections or very large insulators	22	Figure 5 — Measurement of the angular displacements	33
29.3	Complementary specifications	23	Figure 6 — Greatest thickness of the insulator	33
29.4	Acceptance criteria	23	Table 1 — Cross-reference table for cap and pin insulators	28
30	Thermal shock test	23	Table 2 — Cross-reference table for long rod insulators	29
30.1	Test procedure	23		
30.2	Acceptance criteria	23		
31	Porosity test	24		
31.1	Test procedure	24		
31.2	Acceptance criteria	24		
32	Galvanizing test	24		
32.1	Test procedures	24		
32.2	Acceptance criteria	24		
33	Routine visual inspection	25		
33.1	Insulators with ceramic insulating parts	25		
33.2	Insulators with glass insulating parts	26		
34	Routine mechanical test	26		
35	Zinc sleeve test	26		
35.1	General requirements concerning the zinc sleeve	26		
35.2	Type test procedure	26		
35.3	Sample test procedure	26		
36	Zinc collar test	26		
36.1	General requirements for zinc collar	26		
36.2	Type and sample test procedure	27		
Section 6. Tests on string insulator units				
37	General	27		
Annex A (informative) Method of comparison of the results of the electromechanical or mechanical failing load type and sample tests				
		34		

Section 1. General

1 Scope

This International Standard is applicable to string insulator units of ceramic material or glass for use on d.c. overhead power lines with a nominal voltage greater than 1 000 V.

It is not applicable to composite insulators.

The application of this standard to insulators for use in other situations under d.c. voltage will be left to the relevant technical committees.

This standard specifies:

- the characteristics of insulators;
- the conditions under which the specified values of these characteristics shall be verified;
- acceptance criteria.

It specifies basic characteristic tests in a manner similar to that of IEC 383-1. Certain additional tests have been found to be necessary to ensure satisfactory long-term performance of d.c. insulators. At present, these additional tests concern only cap and pin insulators.

In view of the lack of significant performance data regarding long rod insulators on d.c. lines, it is not possible at present to define or validate special d.c.-oriented tests for such insulators.

This standard does not include requirements, or special tests, dealing with the choice of insulators for specific operating conditions (e.g. ageing arising from specific operating conditions).

NOTE 1 This standard does not include radio interference tests, artificial pollution tests or tests on insulator sets. These subjects and some relevant test methods are dealt with in the following IEC Publications: IEC 383-2, IEC 437 and IEC 1245.

NOTE 2 Many of the requirements and tests in this standard are relevant to insulators for use on d.c. traction lines, but other tests may be required. Reference can be made to IEC 383-1.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 50(471):1984, *International Electrotechnical Vocabulary (IEV) — Chapter 471: Insulators*.

IEC 60-1:1989, *High-voltage test techniques — General definitions and test requirements*.

IEC 120:1984, *Dimensions of ball and socket couplings of string insulator units*.

IEC 305:1978, *Characteristics of string insulator units of the cap and pin type*.

IEC 372:1984, *Locking devices for ball and socket couplings of string insulator units — Dimensions and tests*.

IEC 383-1:1993, *Insulators for overhead lines with a nominal voltage above 1 000 V — Part 1: Ceramic or glass insulator units for a.c. systems — Definitions, test methods and acceptance criteria*.

IEC 433:1980, *Characteristics of string insulator units of the long rod type*.

IEC 471:1977, *Dimensions of clevis and tongue couplings of string insulator units*.

IEC 797:1984, *Residual strength of string insulator units of glass or ceramic material for overhead lines after mechanical damage to the dielectric*.

IEC 1211:1994, *Insulators of ceramic material or glass for overhead lines with a nominal voltage greater than 1 000 V — Puncture testing*.

IEC 1245:1993, *Artificial pollution tests on high-voltage insulators to be used on d.c. systems*.

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

ISO 1460:1992, *Metallic coatings — Hot dip galvanized coatings on ferrous metals — Gravimetric determination of the mass per unit area*.

ISO 1461:1973, *Metallic coatings — Hot dip galvanized coatings on fabricated ferrous products — Requirements.*

ISO 1463:1982, *Metallic and oxide coatings — Measurement of coating thickness — Microscopical method.*

ISO 2064:1980, *Metallic and other non-organic coatings — Definitions and conventions concerning the measurement of thickness.*

ISO 2178:1982, *Non-magnetic coatings on magnetic substrates — Measurement of coating thickness — Magnetic method.*

3 Definitions

For the purpose of this International Standard the following definitions apply.

The term “insulator” is used in this standard to refer to the object being tested.

The definitions given below are those which either do not appear in IEC 50(471) or differ from those given in IEC 50(471).

3.1

insulator string

one or more connected string insulator units intended to give flexible support to overhead line conductors and stressed mainly in tension

3.2

lot

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

3.3

flashover

a disruptive discharge external to the insulator, connecting those parts which normally have the operating voltage between them

NOTE The term “flashover” used in this standard includes a flashover across the insulator surface as well as disruptive discharge by sparkover through air adjacent to the insulator.

3.4

dry lightning impulse withstand voltage

the lightning impulse voltage which the insulator withstands dry, under the prescribed conditions of test

3.5

50 % dry lightning impulse flashover voltage

the value of the lightning impulse voltage which, under the prescribed conditions of test, has a 50 % probability of producing flashover on the insulator, dry. Represented by U_{50}

3.6

dry d.c. withstand voltage

the d.c. voltage which the insulator withstands dry, under the prescribed conditions of test

3.7

electromechanical failing load

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

3.8

mechanical failing load

the maximum load reached when a string insulator unit or a rigid insulator is tested under the prescribed conditions of test

3.9

residual mechanical strength

the maximum mechanical load which can be reached when an insulator unit, which has had its insulating part mechanically damaged in the prescribed manner, is tested under the prescribed conditions

3.10**SF₆ puncture withstand voltage**

the d.c. voltage which a string insulator unit withstands in SF₆ under the prescribed conditions of test

3.11**ion migration**

the migration of ions in the dielectric of an insulator under d.c. voltage, which may or may not lead to a change in the electrical or mechanical characteristics of the insulator

3.12**expected charge Q_{50}**

the total charge expected to flow through an insulator during 50 years under the reference ambient conditions and applied voltage. Q_{50} depends on the electrical resistance characteristic of the insulator dielectric

3.13**electrical body resistance**

the d.c. resistance of an insulator unit measured in the zone between the cap and the pin

3.14**thermal runaway**

the phenomenon which occurs when the internal heat generated within a solid with a negative resistance/temperature coefficient is greater than the heat dissipated externally

3.15**zinc sleeve**

a piece of zinc metal fused to an insulator pin shank to protect it from electrolytic corrosion by acting as a sacrificial electrode

3.16**zinc collar**

a piece of zinc metal fused to the base of an insulator cap to protect it from electrolytic corrosion by acting as a sacrificial electrode

3.17**impulse overvoltage puncture withstand voltage**

the peak value of the impulse voltage which the insulator withstands without puncture under the prescribed conditions of test

3.18**creepage distance**

the shortest distance or the sum of the shortest distances along the ceramic or glass insulating parts of the insulator between those parts which normally have the operating voltage between them

NOTE The surface of cement or other non-insulating jointing material is not considered as forming part of the creepage distance. If 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.

3.19 Displacements**3.19.1****axial or radial displacement**

the maximum positional variation of a definite point of the considered insulator during one complete revolution about the insulator axis

3.19.2**angular displacement**

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

3.20

short standard string

a short standard string is used to verify characteristics of a unit which are significant only for an insulator string. It consists of:

- *for cap and pin units*: an insulator string of a least five insulator units and not more than 1,5 m in length;
- *for long rod insulator units*: an insulator string between 1 m and 2 m in length for long rod insulator units intended to be assembled in a string. For long rod insulator units less than 1 m long intended to be used singly as a string, the unit itself is considered as a short standard string.

3.21

mechanically equivalent design

a mechanically equivalent insulator design is a type made in the same factory, with the same materials and by the same process, and having the same strength class, the same coupling size and the same design of connection between insulating components and metal parts, and has in addition the following characteristics:

- for long rod insulators:
 - nominal core diameter is the same;
 - nominal shed spacing is the same or larger;
 - nominal shed projection is the same or smaller;
 - nominal creepage distance is the same or smaller;
 - nominal arcing distance is the same or smaller;
- for cap and pin insulators:
 - nominal diameter is the same or smaller;
 - nominal creepage distance is the same or smaller.

3.22

specified characteristics

a specified characteristic is:

- either the numeric value of a voltage or of a mechanical load or any other characteristic specified in an IEC standard,
- or the numeric value of any such characteristic agreed between the purchaser and the manufacturer.

Specified withstand and flashover voltages are referred to standard atmospheric conditions (see clause 12)

Section 2. Insulators

4 Insulator classes and type

Overhead line string insulator units are divided into two classes according to their design.

Class A is an insulator or 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 is an insulator or 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.

5 Insulating materials

The insulating materials of d.c. overhead line insulators covered by this standard are:

- ceramic material, porcelain;
- toughened glass, being glass in which controlled mechanical stresses have been induced by thermal treatment.

NOTE 1 Further information on the definition and classification of ceramic and glass insulating materials can be found in IEC 672-1 and IEC 672-3.