IEC 60433

Edition 4.0 2021-01
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

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 60433:2021-01 RLV(en)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.080.10; 29.240.20

ISBN 978-2-8322-9280-8

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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 60433:1998. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

International Standard IEC 60433 has been prepared by IEC technical committee 36: Insulators.

This fourth edition cancels and replaces the third edition published in 1998. This edition constitutes a technical revision.

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

a) wording in Scope changed from "should" to "are intended to";
b) new normative references added;
c) title of Clause 4 amended, new Note 4 added;
d) Table 1 expanded to include more specified mechanical failing loads.

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

FDIS	Report on voting
36/498/FDIS	36/500/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://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- withdrawn,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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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

1 Scope

This International Standard is applicable to string insulator units of the long rod type with insulating parts of ceramic material intended for use in AC overhead power lines with a nominal voltage greater than 1 000 V and a frequency not greater than 100 Hz. It is also applicable to insulators of similar design, used in substations.

This document is applicable to ceramic string insulator units of the long rod type, either with a clevis end fitting at both ends for coupling with a tongue, or with a socket end fitting at both ends for coupling with a pin ball.

The object of this document is to prescribe specified values for electrical and mechanical characteristics, and for the principal dimensions of ceramic string insulator units of the long rod type.

This document is applicable to string insulator units for use on overhead lines situated in lightly polluted areas, and the creepage distances given in Table 1 have been established accordingly, using the IEC TS 60815-2 recommendation of ~~16 mm/kV for pollution level I~~ 27,8 mm/kV for SPS class. However, shorter creepage distances ~~may be used~~ are applicable for use in some non-polluted areas. If specific operating conditions require or allow non-standard (longer or shorter) creepage distances, the mechanical characteristics as well as the lengths L (see Clause 4) of this document ~~should~~ are intended to be used unless the need for exceptionally long creepage distances requires values of L greater than those given in Table 1. In the case of special requirements, e.g. very heavy polluted areas and for other particular or extreme environmental conditions, it may be necessary for certain dimensions to be changed.

~~NOTE~~ As far as reasonably applicable, this document ~~may~~ is also applicable to be applied to similar insulator units outside the scope of this standard, such as insulators for electric traction lines. This document does not include tests on insulators and dimensions of end fittings.

~~NOTE~~ Ball and socket couplings are covered by IEC 60120, clevis and tongue couplings by IEC 60471.

NOTE 1 For the definition of site pollution ~~levels~~ severity, see applicable part of IEC TS 60815.

NOTE 2 The term "ceramic" is used in this document to refer to porcelain materials and, contrary to North American practice, does not include glass~~es~~.

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 60071-1:1993, *Insulation co-ordination – Part 1: Definitions, principles and rules*~~

~~IEC 60120:1984, *Dimensions of ball and socket couplings of string insulator units*~~

IEC 60383-1~~:1993~~, *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*

~~IEC 60471:1977, *Dimensions of clevis and tongue couplings of string insulator units*~~

~~IEC 60672-1:1995, *Ceramic and glass insulating materials – Part 1: Definitions and classification*~~

~~IEC 60672-3:1997, *Ceramic and glass insulating materials – Part 3: Specification for individual materials*~~

~~IEC 60815:1986 *Guide for the selection of insulators in respect of polluted conditions*~~

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
long rod insulator
suspension or tension insulator consisting of an approximately cylindrical insulating part provided with sheds and equipped at the ends with external metal fittings

Note 1 to entry: The insulator is designed in such a manner that the shortest puncture path through solid insulating material is at least equal to half the arcing distance. Therefore it is a class A insulator according to IEC 60383-1.

4 Characteristics, dimensions and type of long rod insulators

String insulator units of the long rod type are characterised by the following specified characteristics:

– the standard lightning impulse withstand voltage (see IEC 60071-1);
– the wet power frequency withstand voltage (see IEC 60071-1);
– the tensile mechanical failing load;
– the maximum nominal length L of the insulator;
– the maximum nominal diameter D of the insulating part;
– the minimum nominal creepage distance;
– the standard coupling.

The corresponding values are specified in Table 1. The minimum nominal creepage distances are based on a unified specific creepage distance of ~~16~~ 27,8 mm/kV for the lowest value of the highest voltage for equipment corresponding to the specified value of the standard lightning impulse withstand (in accordance with IEC 60071-1).

NOTE 1 The tolerances given in IEC 60383-1 are applicable to all the dimensions in Table 1, even if the adjectives "minimum" or "maximum" are used before the term "nominal".

NOTE 2 Dry lightning impulse withstand voltage and wet power frequency withstand voltage are specified in Table 1 for single unit string insulators. Values of withstand voltages of insulator strings consisting of more than one unit are not contained in this document.

NOTE 3 The rod diameter is not specified since it depends on the mechanical characteristics of the insulating material. Information on the definition and classification of ceramic insulating materials can be found in IEC 60672-1 and IEC 60672-3.

NOTE 4 Examples of shed profile are given in Clause 8, “Choice of profile” of IEC TS 60815-2:2008.

5 Designation and marking

Long rod insulators are designated in Table 1 by the letter L, followed by a figure indicating the specified mechanical failing load in kilonewtons. Then follows the letter B or C indicating ~~ball and~~ socket or clevis ~~and tongue~~ coupling respectively, followed by the value of the lightning impulse withstand voltage in kilovolts.

EXAMPLE:

L 160 B 550 indicates:

L: long rod insulator;

160: specified mechanical failing load, tension, 160 kN;

B: ~~ball and~~ socket coupling;

550: dry lightning impulse withstand voltage 550 kV.

The insulators shall be marked either on the upper shed or on the metal parts with the name or trade mark of the manufacturer and the year of manufacture. In addition, each unit shall be marked with the specified mechanical failing load, by using the first part of the designation; for instance, the insulator shall be marked L 160 for the units with 160 kN specified mechanical failing load.

These markings shall be legible and indelible.

Figure 1 shows a long rod insulator with clevis couplings. Figure 2 shows a long rod insulator with socket couplings.

Table 1 – Specified values for long rod insulators

Designation	Standard lightning impulse withstand voltage	Wet power frequency withstand voltage	Specified mechanical failing load	Maximum nominal diameter D on the insulating part	Minimum nominal creepage distance (~~16~~ 27.8 mm/kV, see Clause 4)	Coupling B		Coupling C	
						Maximum nominal length L	Standard coupling size (pin diameter, see IEC 60120)	Maximum nominal length L	Standard coupling size (coupling pin diameter, see IEC 60471 – non-preferred sizes in brackets)
	kV	kV	kN	mm	mm	mm		mm	
L 40 B/C 170	170	70	40	160	576	380	11	400	13L
L 60 B/C 170	170	70	60	160	576	400	11	420	13L
L 100 B/C 170	170	70	100	180	576	450	16	475	19L (16L)
L 100 B/C 250	250	95	100	180	832	580	16	605	19L (16L)
L 100 B/C 325	325	140	100	180	1 160	870	16	900	19L (16 L)
L 100 B/C 450	450	185	100	180	1 968	1 085	16	1 120	19L (16L)
L 100 B/C 550	550	230	100	180	1 968	1 240	16	1 270	19L (16L)
L 120 B/C 325	325	140	120	200	1 160	870	16	905	19L (16L)
L 120 B/C 450	450	185	120	200	1 968	1 085	16	1 120	19L (16L)
L 120 B/C 550	550	230	120	200	1 968	1 240	16	1 275	19L (16L)
L 120 B/C 650	650	275	120	200	2 320	1 430	16	1 465	19L (16L)
L 160 B/C 325	325	140	160	210	1 160	885	20	920	19L
L 160 B/C 450	450	185	160	210	1 968	1 100	20	1 135	19L
L 160 B/C 550	550	230	160	210	1 968	1 255	20	1 290	19L
L 160 B/C 650	650	275	160	210	2 320	1 445	20	1 465	19L
L 210 B/C 325	325	140	210	220	1 160	905	20	940	22L
L 210 B/C 450	450	185	210	220	1 968	1 120	20	1 155	22L
L 210 B/C 550	550	230	210	220	1 968	1 275	20	1 310	22L
L 210 B/C 650	650	275	210	220	2 320	1 465	20	1 500	22L

Designation	Standard lightning impulse withstand voltage	Wet power frequency withstand voltage	Specified mechanical failing load	Maximum nominal diameter D on the insulating part	Minimum nominal creepage distance (~~16~~ 27.8 mm/kV, see Clause 4)	Coupling B		Coupling C	
						Maximum nominal length L	Standard coupling size (pin diameter, see IEC 60120)	Maximum nominal length L	Standard coupling size (coupling pin diameter, see IEC 60471 – non-preferred sizes in brackets)
	kV	kV	kN	mm	mm	mm		mm	
L 250 B/C 550	550	230	250	230	1 968	1 305	24	1 335	22L
L 250 B/C 650	650	275	250	230	2 320	1 500	24	1 530	22L
L 300 B/C 550	550	230	300	240	1 968	1 330	24	1 365	25L
L 300 B/C 650	650	275	300	240	2 320	1 520	24	1 560	25L
L 330 B/C 550	550	230	330	250	1 968	1 360	28	1 400	28L
L 330 B/C 650	650	275	330	250	2 320	1 550	28	1 595	28L
L 360 B/C 550	550	230	360	250	1 968	1 360	28	1 410	28L
L 360 B/C 650	650	275	360	250	2 320	1 550	28	1 600	28L
L 400 B/C 550	550	230	400	260	1 968	1 400	28	1 460	28L
L 400 B/C 650	650	275	400	260	2 320	1 600	28	1 660	28L
L 420 B/C 550	550	230	420	260	1 968	1 400	28	1 460	28L
L 420 B/C 650	650	275	420	260	2 320	1 600	28	1 660	28L
L 530 B/C 550	550	230	530	270	1 968	1 450	32	1 520	32L
L 530 B/C 650	650	275	530	270	2 320	1 650	32	1 720	32L
L 550 B/C 550	550	230	550	270	1 986	1 450	32	1 520	32L
L 550 B/C 650	650	275	550	270	2 320	1 650	32	1 720	32L