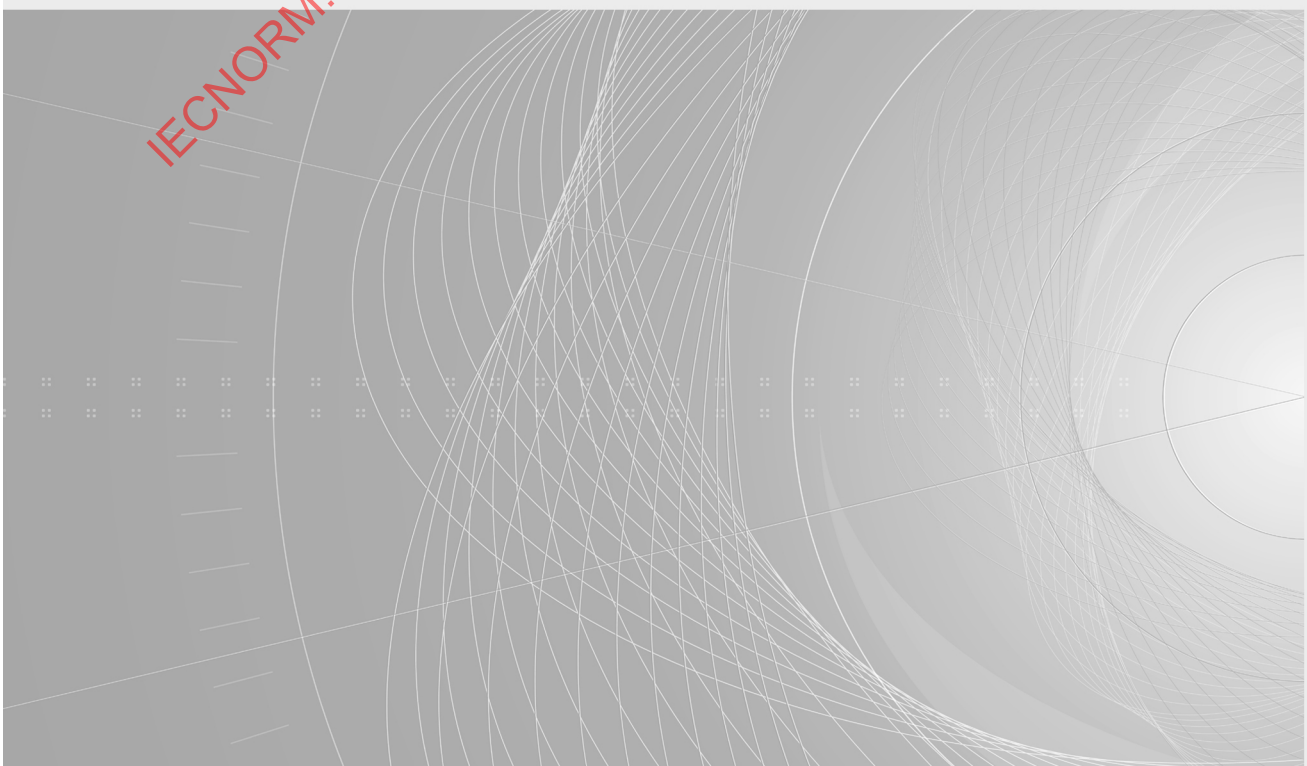
IEC 60433

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)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC online collection - oc.iec.ch
Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 18 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.080.10; 29.240.20

ISBN 978-2-8322-9280-8

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

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

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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

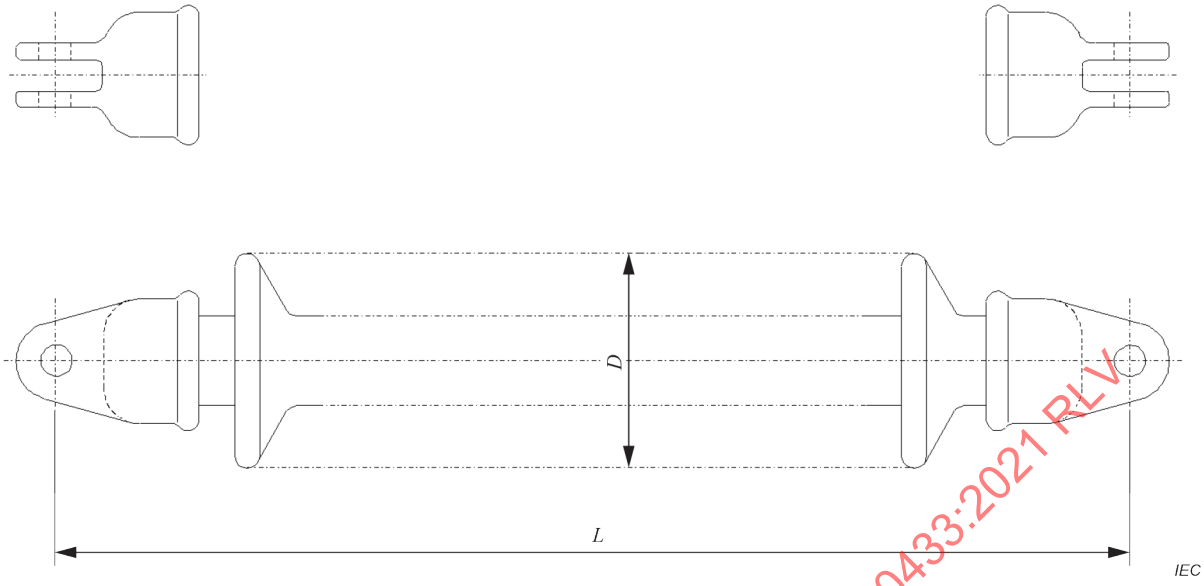


Figure 1 – Long rod insulator with clevis couplings, type C

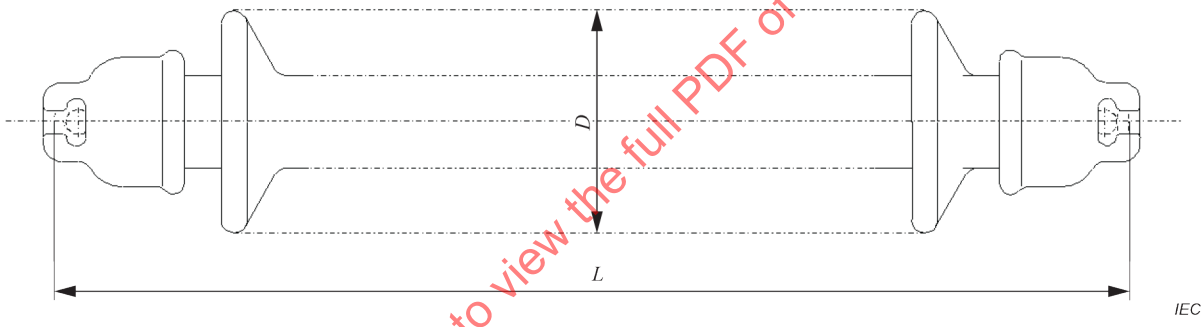


Figure 2 – Long rod insulator with socket couplings, type B

Bibliography

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

[2] IEC 60071-1, *Insulation co-ordination – Part 1: Definitions, principles and rules*

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

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

[5] IEC 60672-1, *Ceramic and glass insulating materials – Part 1: Definitions and classification*

[6] IEC 60672-3, *Ceramic and glass-insulating materials – Part 3: Specifications for individual materials*

[7] IEC TS 60815-1, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 1: Definitions, information and general principles*

[8] IEC TS 60815-2:2008, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 2: Ceramic and glass insulators for AC systems*

IEC 60433

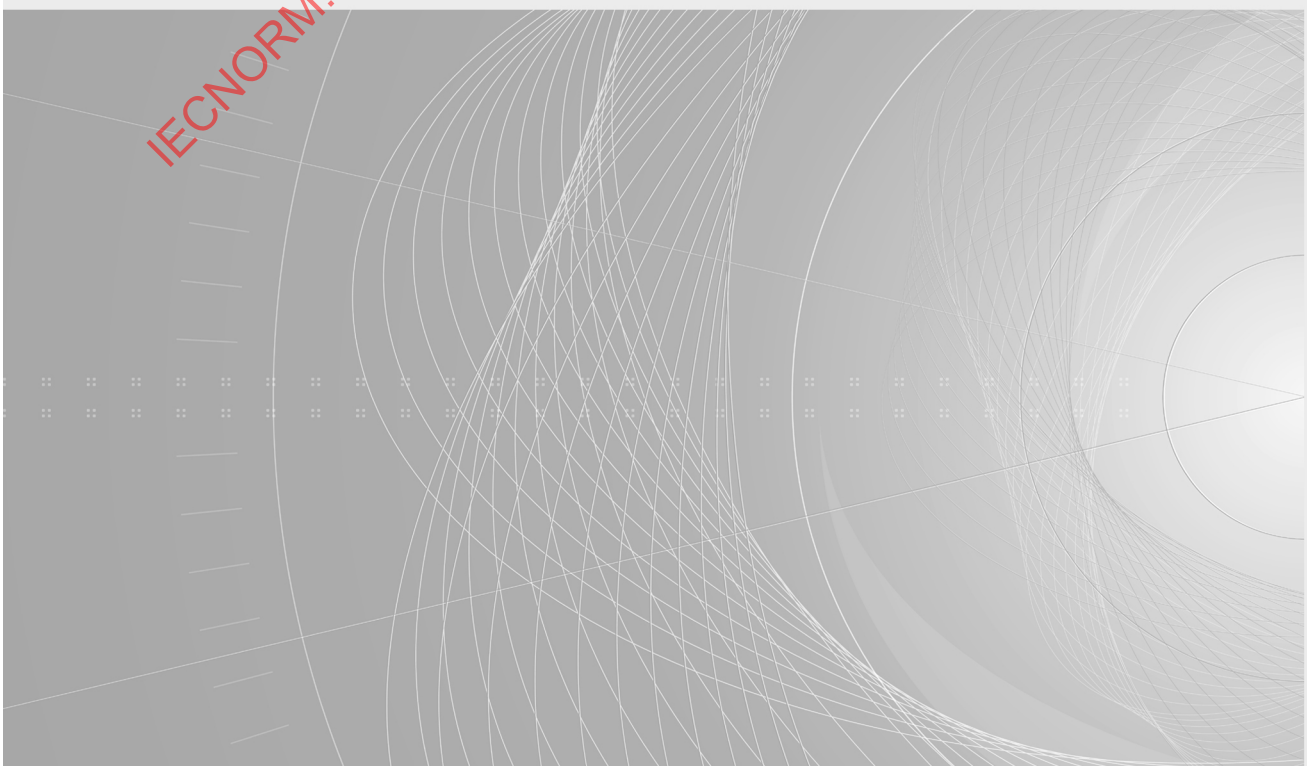
Edition 4.0 2021-01

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

Isolateurs pour lignes aériennes de tension nominale supérieure a 1 000 V – Isolateurs en céramique pour réseaux à tension alternative – Caractéristiques des éléments d'isolateurs du type a long fût



IEC 60433:2021-01(en-fr)

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

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

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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.

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 27,8 mm/kV for SPS class. However, shorter creepage distances 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 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.

As far as reasonably applicable, this document 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.

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

NOTE 1 For the definition of site pollution 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.

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 60383-1, *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*

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 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 socket or clevis 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: 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 (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 (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

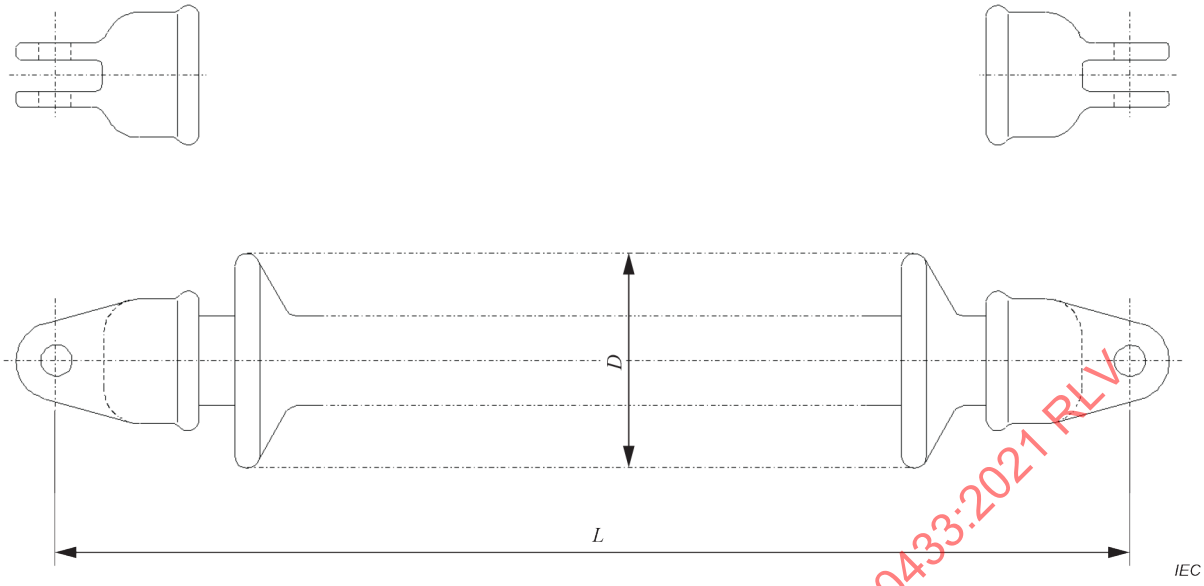


Figure 1 – Long rod insulator with clevis couplings, type C

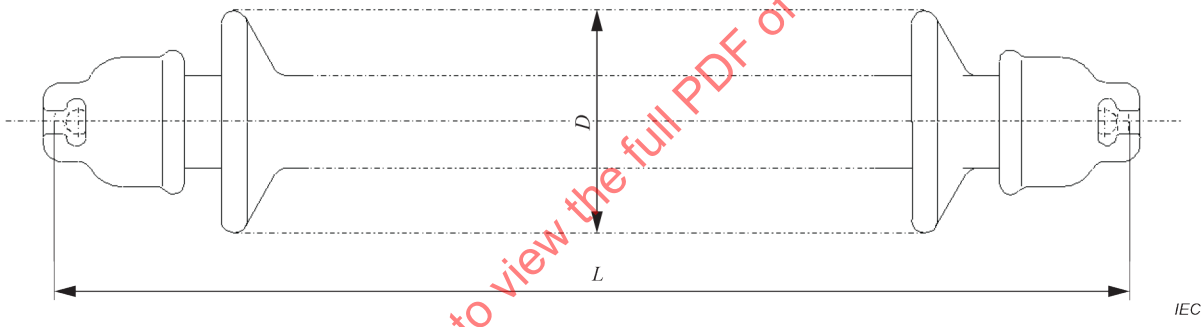


Figure 2 – Long rod insulator with socket couplings, type B

Bibliography

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

[2] IEC 60071-1, *Insulation co-ordination – Part 1: Definitions, principles and rules*

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

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

[5] IEC 60672-1, *Ceramic and glass insulating materials – Part 1: Definitions and classification*

[6] IEC 60672-3, *Ceramic and glass-insulating materials – Part 3: Specifications for individual materials*

[7] IEC TS 60815-1, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 1: Definitions, information and general principles*

[8] IEC TS 60815-2:2008, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 2: Ceramic and glass insulators for AC systems*

SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

_____

ISOLATEURS POUR LIGNES AÉRIENNES DE TENSION NOMINALE SUPÉRIEURE A 1 000 V – ISOLATEURS EN CÉRAMIQUE POUR RÉSEAUX À TENSION ALTERNATIVE – CARACTÉRISTIQUES DES ÉLÉMENTS D'ISOLATEURS DU TYPE A LONG FÛT

AVANT-PROPOS

1) La Commission Electrotechnique Internationale (IEC) est une organisation mondiale de normalisation composée de l'ensemble des comités électrotechniques nationaux (Comités nationaux de l'IEC). L'IEC a pour objet de favoriser la coopération internationale pour toutes les questions de normalisation dans les domaines de l'électricité et de l'électronique. À cet effet, l'IEC – entre autres activités – publie des Normes internationales, des Spécifications techniques, des Rapports techniques, des Spécifications accessibles au public (PAS) et des Guides (ci-après dénommés "Publication(s) de l'IEC"). Leur élaboration est confiée à des comités d'études, aux travaux desquels tout Comité national intéressé par le sujet traité peut participer. Les organisations internationales, gouvernementales et non gouvernementales, en liaison avec l'IEC, participent également aux travaux. L'IEC collabore étroitement avec l'Organisation Internationale de Normalisation (ISO), selon des conditions fixées par accord entre les deux organisations.
2) Les décisions ou accords officiels de l'IEC concernant les questions techniques représentent, dans la mesure du possible, un accord international sur les sujets étudiés, étant donné que les Comités nationaux de l'IEC intéressés sont représentés dans chaque comité d'études.
3) Les Publications de l'IEC se présentent sous la forme de recommandations internationales et sont agréées comme telles par les Comités nationaux de l'IEC. Tous les efforts raisonnables sont entrepris afin que l'IEC s'assure de l'exactitude du contenu technique de ses publications; l'IEC ne peut pas être tenue responsable de l'éventuelle mauvaise utilisation ou interprétation qui en est faite par un quelconque utilisateur final.
4) Dans le but d'encourager l'uniformité internationale, les Comités nationaux de l'IEC s'engagent, dans toute la mesure possible, à appliquer de façon transparente les Publications de l'IEC dans leurs publications nationales et régionales. Toutes divergences entre toutes Publications de l'IEC et toutes publications nationales ou régionales correspondantes doivent être indiquées en termes clairs dans ces dernières.
5) L'IEC elle-même ne fournit aucune attestation de conformité. Des organismes de certification indépendants fournissent des services d'évaluation de conformité et, dans certains secteurs, accèdent aux marques de conformité de l'IEC. L'IEC n'est responsable d'aucun des services effectués par les organismes de certification indépendants.
6) Tous les utilisateurs doivent s'assurer qu'ils sont en possession de la dernière édition de cette publication.
7) Aucune responsabilité ne doit être imputée à l'IEC, à ses administrateurs, employés, auxiliaires ou mandataires, y compris ses experts particuliers et les membres de ses comités d'études et des Comités nationaux de l'IEC, pour tout préjudice causé en cas de dommages corporels et matériels, ou de tout autre dommage de quelque nature que ce soit, directe ou indirecte, ou pour supporter les coûts (y compris les frais de justice) et les dépenses découlant de la publication ou de l'utilisation de cette Publication de l'IEC ou de toute autre Publication de l'IEC, ou au crédit qui lui est accordé.
8) L'attention est attirée sur les références normatives citées dans cette publication. L'utilisation de publications référencées est obligatoire pour une application correcte de la présente publication.
9) L'attention est attirée sur le fait que certains des éléments de la présente publication de l'IEC peuvent faire l'objet de droits de brevet. L'IEC ne saurait être tenue pour responsable de ne pas avoir identifié de tels droits de propriété et averti de leur existence.

La Norme internationale IEC 60433 a été établie par le comité d'études 36 de l'IEC: Isolateurs.

Cette quatrième édition annule et remplace la troisième édition parue en 1998. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) reformulation du domaine d'application: "il convient d'utiliser les caractéristiques mécaniques ainsi que les longueurs *L* (voir Article 4) de la présente norme " remplacé par "les caractéristiques mécaniques ainsi que les longueurs *L* (voir Article 4) de la présente norme sont prévues pour être utilisées";
b) ajout de nouvelles références normatives;

c) modification du titre de l'Article 4, ajout d'une nouvelle Note 4;

d) Le Tableau 1 a été étoffé pour intégrer un plus grand nombre de charges de rupture mécanique spécifiées.

Le texte de cette Norme internationale est issu des documents suivants:

FDIS	Rapport de vote
36/498/FDIS	36/500/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette Norme internationale.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2.

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous "http://webstore.iec.ch" dans les données relatives au document recherché. A cette date, le document sera

- reconduit,
- supprimé,
- remplacé par une édition révisée, ou
- amendé.

ISOLATEURS POUR LIGNES AÉRIENNES DE TENSION NOMINALE SUPÉRIEURE A 1 000 V – ISOLATEURS EN CÉRAMIQUE POUR RÉSEAUX À TENSION ALTERNATIVE – CARACTÉRISTIQUES DES ÉLÉMENTS D'ISOLATEURS DU TYPE A LONG FÛT

1 Domaine d'application

La présente Norme internationale s'applique aux éléments de chaînes d'isolateurs du type à long fût ayant des parties isolantes en matière céramique destinés aux lignes aériennes fonctionnant en courant alternatif à une tension nominale supérieure à 1 000 V et à une fréquence au plus égale à 100 Hz. Elle s'applique également aux isolateurs du même type utilisés dans les postes.

Le présent document s'applique aux éléments de chaînes d'isolateurs en céramique du type à long fût ayant à chaque extrémité soit une chape destinée à recevoir un tenon, soit un logement de rotule pour assemblage avec une tige à rotule.

Le présent document a pour objet de prescrire des valeurs spécifiées pour les caractéristiques électriques et mécaniques et pour les principales dimensions des éléments de chaînes d'isolateurs en céramique du type à long fût.

Le présent document s'applique aux éléments de chaînes d'isolateurs destinés aux lignes aériennes situées dans des régions dont l'atmosphère est peu polluée, et les lignes de fuite du Tableau 1 ont été établies en conséquence à l'aide de la recommandation IEC TS 60815-2, à savoir 27,8 mm/kV pour la classe SPS. Cependant, des lignes de fuite plus courtes sont applicables dans certaines zones sans pollution. Si des conditions de service spécifiques exigent ou permettent des lignes de fuite "non standards" (plus longues ou plus courtes), les caractéristiques mécaniques ainsi que les longueurs L (voir Article 4) du présent document sont prévues pour être utilisées, à moins qu'il ne soit nécessaire, pour des lignes de fuite exceptionnellement longues, d'avoir des valeurs de L supérieures à celles données dans le Tableau 1. Dans le cas d'exigences spéciales, par exemple pour les zones très polluées, et pour d'autres conditions d'environnement particulières ou extrêmes, il peut être nécessaire de changer certaines dimensions.

Dans la limite de ce qui est raisonnablement applicable, le présent document peut également être utilisé pour des éléments d'isolateurs semblables qui ne relèvent pas de son domaine d'application, tels que les isolateurs pour lignes de traction électrique. Le présent document ne comprend ni les essais des isolateurs ni les dimensions des assemblages d'extrémité.

Les assemblages à rotule sont couverts par l'IEC 60120, et les assemblages à chape et tenon par l'IEC 60471.

NOTE 1 Pour la définition des niveaux de pollution des sites, se reporter à la partie applicable de l'IEC TS 60815.

NOTE 2 Le terme "céramique" est utilisé dans le présent document pour faire référence aux porcelaines qui, contrairement à la pratique nord-américaine, ne comprend pas le verre.

2 Références normatives

Les documents suivants sont cités dans le texte de sorte qu'ils constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60383-1, *Isolateurs pour lignes aériennes de tension nominale supérieure à 1 000 V – Partie 1: Eléments d'isolateurs en matière céramique ou en verre pour systèmes à courant alternatif - Définitions, méthodes d'essai et critères d'acceptation*

3 Termes et définitions

Pour les besoins du présent document, les termes et définitions suivants s'appliquent.

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse http://www.electropedia.org/
- ISO Online browsing platform: disponible à l'adresse http://www.iso.org/obp

3.1
Isolateur à long fût
isolateur de suspension ou d'ancrage, constitué par un corps isolant de forme sensiblement cylindrique, équipé d'ailettes et à chaque extrémité d'une armature métallique externe

Note 1 à l'article: L'isolateur est conçu pour que la plus courte distance du canal de perforation à travers le corps isolant soit au moins égale à la moitié de la ligne d'arc. Un isolateur à long fût long est par conséquent un isolateur de la classe A selon l'IEC 60383-1.

4 Caractéristiques, dimensions et type des isolateurs à long fût

Les éléments de chaînes d'isolateurs du type à long fût sont définis par les caractéristiques spécifiées suivantes:

– tension de tenue normalisée aux chocs de foudre (voir l'IEC 60071-1);
– tension de tenue à fréquence industrielle sous pluie (voir l'IEC 60071-1);
– charge de rupture mécanique en traction;
– longueur nominale maximale L de l'isolateur;
– diamètre nominal maximal D de la partie isolante;
– ligne de fuite nominale minimale;
– norme d'assemblage.

Les valeurs correspondantes sont spécifiées dans le Tableau 1. Les lignes de fuite nominales minimales reposent sur une ligne de fuite spécifique unifiée de 27,8 mm/kV pour la valeur la plus basse de la tension la plus élevée pour le matériel, qui correspond à la valeur spécifiée de la tension de tenue normalisée aux chocs de foudre (conformément à l'IEC 60071-1).

NOTE 1 Les tolérances données dans l'IEC 60383-1 s'appliquent à toutes les dimensions du Tableau 1, même si les adjectifs "minimal" or "maximal" sont précédés du terme "nominal".

NOTE 2 La tension de tenue normalisée aux chocs de foudre à sec et la tension de tenue à fréquence industrielle sous pluie sont spécifiées dans le Tableau 1 pour une chaîne d'isolateurs constituée par un seul élément. Les valeurs des tensions de tenue des chaînes d'isolateurs de plus d'un élément ne sont pas incluses dans le présent document.

NOTE 3 Le diamètre du fût n'est pas spécifié, car il dépend des caractéristiques mécaniques de la matière isolante. Des informations sur la définition et la classification des matières isolantes en céramique sont données dans l'IEC 60672-1 et dans l'IEC 60672-3.

NOTE 4 L'Article 8, "Choix de profils" de l'IEC TS 60815-2:2008 donnent des exemples de profils d'ailettes.

5 Désignation et marquage

La désignation des isolateurs à long fût dans le Tableau 1 est constituée de la lettre L suivie d'un nombre qui indique la charge de rupture mécanique spécifiée en kilonewtons. La lettre B