IEC 60305

Edition 5.0 2021-01
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

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

IEC 60305:2021-01 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 It also gives information on projects, replaced and withdrawn publications.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 60305

Edition 5.0 2021-01
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.080.10; 29.240.20

ISBN 978-2-8322-9270-9

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

INSULATORS FOR OVERHEAD LINES WITH A NOMINAL VOLTAGE ABOVE 1 000 V – CERAMIC OR GLASS INSULATOR UNITS FOR AC SYSTEMS – CHARACTERISTICS OF INSULATOR UNITS OF THE CAP AND PIN TYPE

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 60305:1995. 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 60305 has been prepared by IEC technical committee 36: Insulators.

This fifth edition cancels and replaces the fourth edition published in 1995. 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 "it is recommended" to "it is applicable";
b) new normative references added;
c) electromechanical or mechanical failing load in Clause 4 specified;
d) new figures added showing profiles;
e) Tables 1, 2, 3, 4 and 5 expanded to include more specified values.

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

FDIS	Report on voting
36/499/FDIS	36/501/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 OR GLASS INSULATOR UNITS FOR AC SYSTEMS – CHARACTERISTICS OF INSULATOR UNITS OF THE CAP AND PIN TYPE

1 Scope ~~and object~~

This International Standard applies to string insulator units of the cap and pin type with insulating parts of ceramic material or glass, intended for AC overhead lines with a nominal voltage greater than 1 000 V and a frequency not greater than 100 Hz. It also applies to insulators of similar design used in substations.

This document applies to string insulator units of the cap and pin type either with ball and socket couplings or with clevis and tongue couplings.

This document applies to string insulator units for use on overhead lines in clean areas and polluted areas. For use in areas characterized by very heavy pollution levels and for other particular or extreme environmental conditions, it may be necessary for certain dimensions to be changed and insulator units having different creepage distances, spacing and forms may be preferred (for example, flat profile, hemispherical etc.). Insulators for use on DC systems may also need different dimensions. In any case, it is ~~recommended~~ applicable that the standardized mechanical characteristics of this document and coupling sizes are retained.

The object of this document is to prescribe specified values for the mechanical characteristics and for the main dimensions of string insulator units of the cap and pin type.

The power frequency, lightning impulse and puncture withstand voltages of string insulator units are not specified in this document. IEC 60383-1 gives the electrical characteristics which define string insulator units; their values ~~shall be~~ are agreed between purchaser and manufacturer.

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

NOTE ~~For the definition of pollution levels see IEC 815.~~ For the definition of site pollution severity see IEC TS 60815-1.

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~~: 1993~~, *Insulators for overhead lines with a nominal voltage above 1000 V – Part 1: Ceramic or glass insulator units for AC systems – Definitions, test methods and acceptance criteria*

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

~~IEC 815: 1986, *Guide for the selection of insulators in respect of polluted conditions*~~

3 Terms and definitions

No terms and definitions are listed in this document.

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

4 Mechanical ~~and dimensional~~ characteristics, dimensions and types

String insulator units of the cap and pin type are standardized by the following specified characteristics:

– Specified electromechanical or mechanical failing load (SFL) according to IEC 60383-1;
– maximum nominal diameter of the insulating part;
– nominal spacing;
– minimum nominal creepage distance;
– standard coupling.

The corresponding values are indicated in Table 1, Table 2, Table 3, Table 4 and Table 5.

NOTE 1 The following points merit attention for insulators for use in polluted areas:

a) even if the creepage distance is the same, the withstand voltage characteristics may change with shed shape of the insulators;

b) even if the string length is the same, the withstand voltage characteristics may decrease with increasing insulator strength due to the lower efficiency of creepage distance for a larger average diameter.

NOTE 2 IEC 60815 gives details on the important parameters of shed profiles for antipollution insulators.

5 Designation and marking with respect to shed profile

Insulators are designated in Table 1, Table 2, Table 3, Table 4 and Table 5 by the letter U followed by a number indicating the specified electromechanical or mechanical failing load in kilonewtons.

The letter B or C which follows specifies a ball and socket or clevis and tongue, respectively.

The following letter S or L, if present, specifies a short or long spacing.

~~Long creepage distance insulators for polluted areas are designated by a final letter P.~~

The letter P, D, V, or T present for "anti-fog" profile, "aerodynamic" profile, "two-alternating" profile, or "three-alternating" profile, as shown in Figure 1, Figure 2, Figure 3,Figure 4 and Figure 5, respectively.

IEC 60383-1 specifies that insulators shall be marked with the specified electromechanical or mechanical failing load. This load may be indicated by using the first part of the designation given in the first column of Table 1, Table 2, Table 3, Table 4 and Table 5: For instance, the insulator may be marked U 160 for the units U 160 BS, U 160 BL and U 160 BLP.

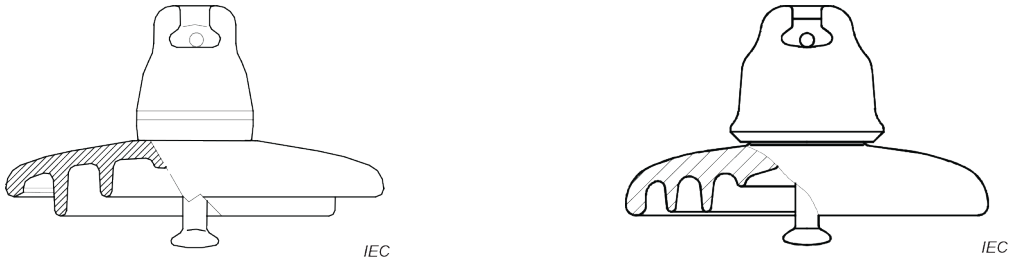


Figure 1 – Typical "standard" profile

Figure 2 – Typical "anti-fog" profile "P"

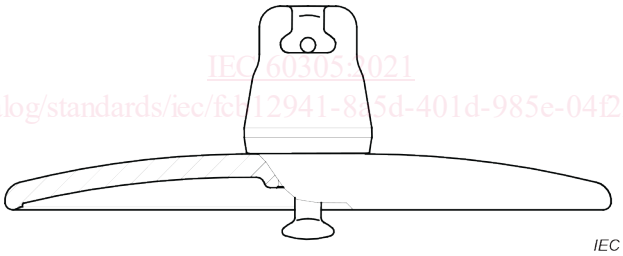


Figure 3 – Typical "aerodynamic" profile "D"

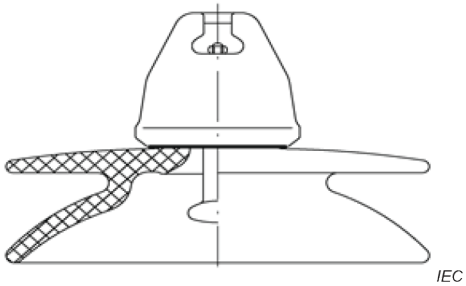


Figure 4 – Typical "two-alternating" profile "V"

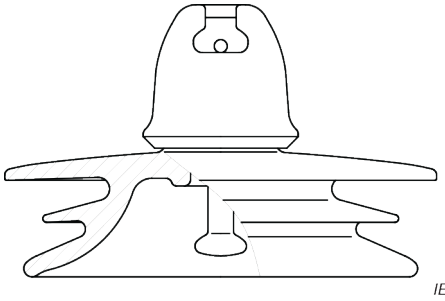


Figure 5 – Typical "three-alternating" profile "T"

6 Tolerances

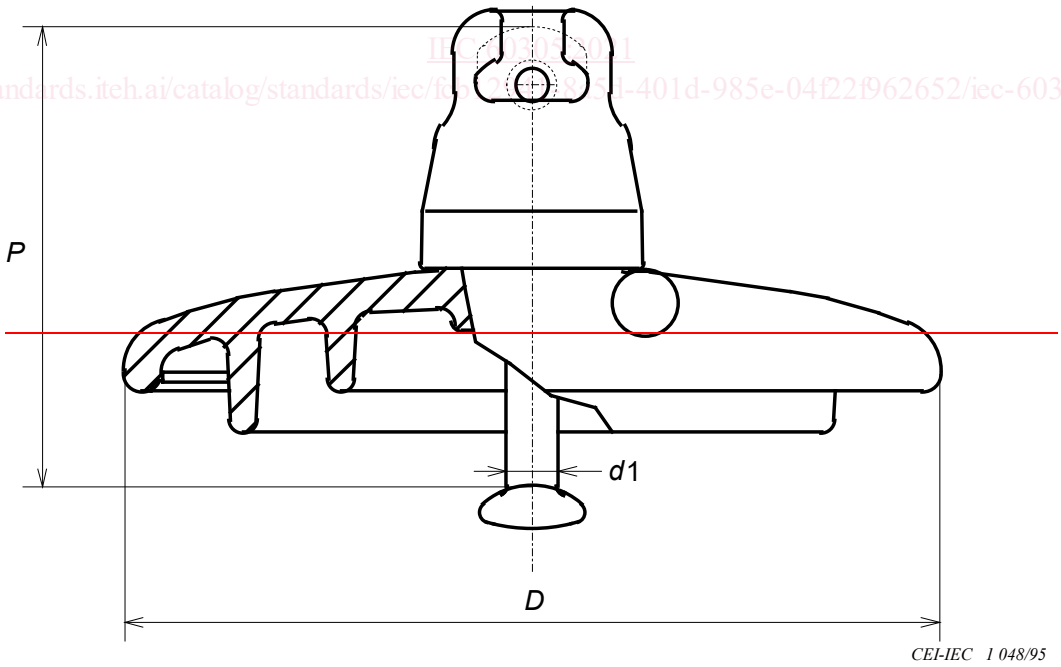
Except for nominal spacing, tolerances for dimensions indicated in IEC 60383-1 are applicable to all nominal values including maximum nominal diameter and minimum nominal creepage distance values given in Table 1, Table 2, Table 3, Table 4 and Table 5.

Diagram of Table 1, Table 2, Table 3, Table 4 and Table 5 is shown in Figure 6, Figure 7, Figure 8, Figure 9 and Figure 10, respectively.

Nominal spacing tolerance shall be:

± (0,03 P + 0,3) mm

P being spacing expressed in millimetres.



~~Figure 1 – String insulator unit with ball and socket coupling~~

Table 1 – Specified values of mechanical and dimensional characteristics for string insulator units with ball and socket couplings

Designation	Electromechanical or mechanical failing load kN	Maximum nominal diameter of the insulating part D mm	Nominal spacing P mm	Minimum nominal creepage distance mm	Standard coupling according to IEC 120 d1
U 40 B	40	175	110	190	11
U 40 BP	40	210	110	295	11
U 70 BS	70	255	127	295	16
U 70 BL	70	255	146	295	16
U 70 BLP	70	280	146	440	16
U 100 BS	100	255	127	295	16
U 100 BL	100	255	146	295	16
U 100 BLP	100	280	146	440	16
U 120 B	120	255	146	295	16
U 120 BP	120	280	146	440	16
U 160 BS	160	280	146	315	20
U 160 BSP	160	330	146	440	20
U 160 BL	160	280	170	340	20
U 160 BLP	160	330	170	525	20
U 210 B	210	300	170	370	20
U 210 BP	210	330	170	525	20
U 300 B	300	330	195	390	24
U 300 BP	300	400	195	590	24
U 400 B	400	380	205	525	28
U 530 B	530	380	240	600	32

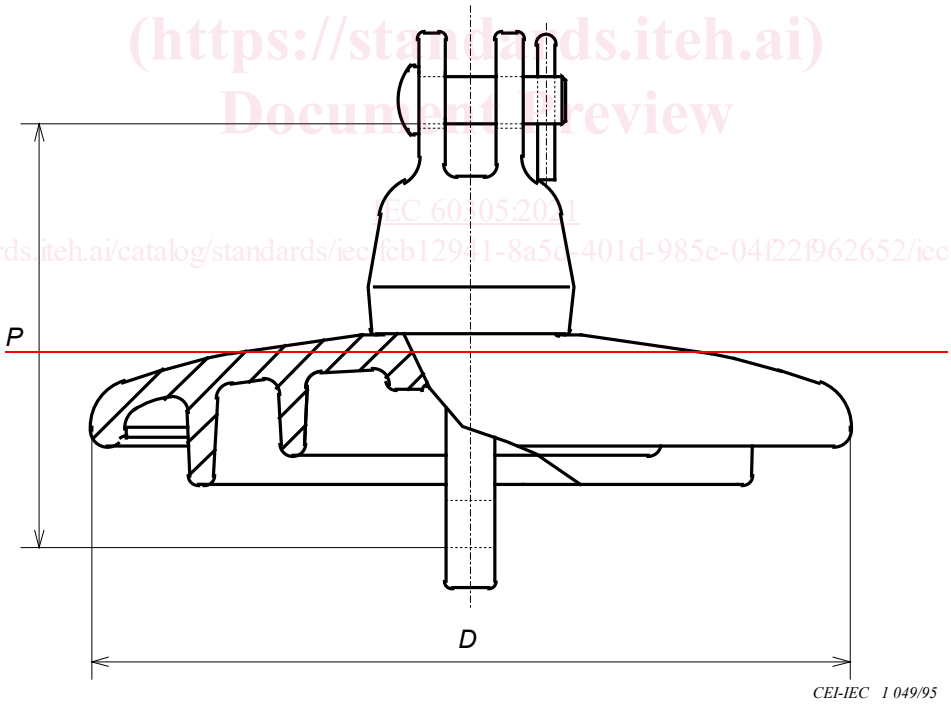


Figure 2 – String insulator unit with clevis and tongue couplings

Table 2 – Specified values of mechanical and dimensional characteristics for string insulator units with clevis and tongue couplings

Designation	Electromechanical or mechanical failing load kN	Maximum nominal diameter of the insulating part D mm	Nominal spacing P mm	Minimum nominal creepage distance mm	Standard coupling according to IEC 471
U 70 C	70	255	146	295	16 C
U 70 CP	70	280	146	440	16 C
U 100 C	100	255	146	295	16 C
U 100 CP	100	280	146	440	16 C
U 120 C	120	255	146	295	16 C
U 120 CP	120	280	146	440	16 C
U 160 C	160	280	170	340	19 C
U 160 CP	160	330	170	525	19 C
U 210 C	210	300	178	370	22 C
U 210 CP	210	330	178	525	22 C

NOTE – Insulators having an electromechanical or mechanical failing load exceeding 210 kN are not specified. If necessary, the insulators with ball and socket coupling defined in table 1 shall preferably be used.

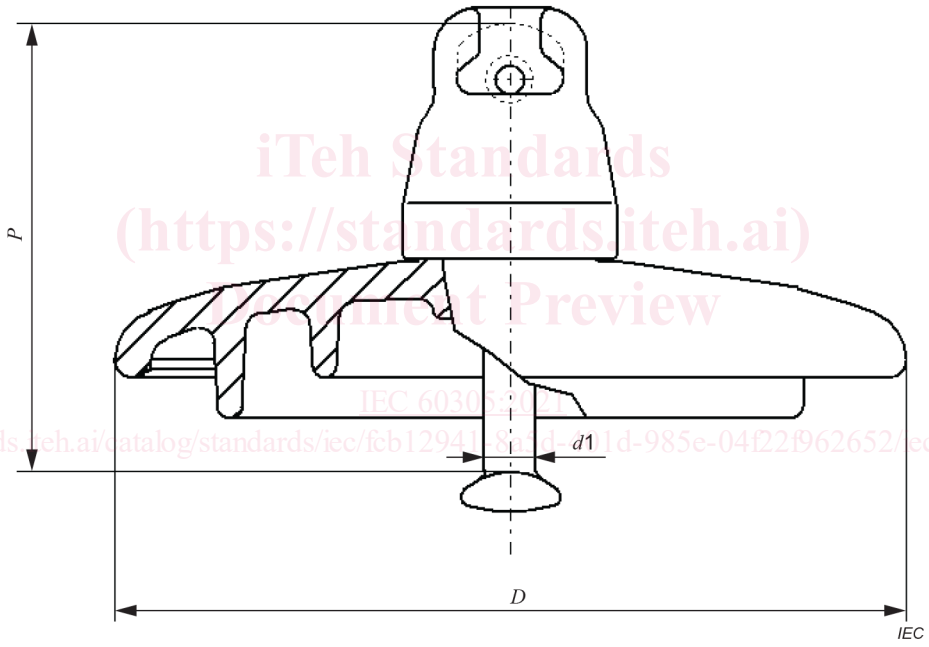


Figure 6 – String insulator unit of standard and anti-fog profile with ball and socket coupling