

INTERNATIONAL STANDARD

NORME INTERNATIONALE



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

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



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2023 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Secretariat
3, rue de Varembe
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 It also gives information on projects, replaced and withdrawn publications.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 Products & Services Portal - products.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 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC -

webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 300 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 19 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



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

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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.080.10, 29.240.20

ISBN 978-2-8322-7128-5

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
2 Normative references	9
3 Terms and definitions	10
4 Classification, types of insulators and insulating materials.....	13
4.1 Insulator classes.....	13
4.2 Insulator types	14
4.3 Insulating materials.....	14
5 Identification of insulators.....	14
6 Classification of tests.....	14
6.1 Type tests.....	14
6.2 Sample tests.....	15
6.3 Routine tests.....	15
7 Cross-reference tables for tests to be performed	15
7.1 Pin insulators.....	15
7.2 Line post insulators.....	17
7.3 String insulator units	19
7.3.1 General	19
7.3.2 Specified type tests on string insulator units	20
7.4 Insulators for overhead electric traction lines	24
8 Procedures for type and sample tests.....	24
8.1 Insulator selection for type tests	24
8.2 Sampling rules and procedures for sample tests	24
8.3 Re-test procedure for sample tests	25
9 General requirements for electrical tests	25
10 Artificial rain parameters for wet tests.....	26
11 Mounting arrangements for electrical tests	26
12 Dry lightning impulse voltage tests	26
12.1 General.....	26
12.2 Test procedure.....	26
12.3 Acceptance criteria	26
13 Wet power frequency withstand voltage tests	27
13.1 Test procedure.....	27
13.2 Acceptance criteria	27
14 RIV test	27
14.1 Test procedure.....	27
14.2 Acceptance criteria	28
15 Puncture withstand test	28
15.1 General.....	28
15.2 Impulse puncture testing in air	28
15.3 Power frequency puncture withstand test	29
16 Routine electrical test.....	29
17 Verification of the dimensions	30
18 Electromechanical failing load test.....	30

18.1	Test procedure.....	30
18.2	Acceptance criteria	31
19	Mechanical failing load test.....	31
19.1	Test procedure for pin and line post insulators	31
19.2	Test procedure for string insulator units	31
19.3	Acceptance criteria for pin insulators	31
19.4	Acceptance criteria for string insulator units and line post insulators	31
20	Thermal-mechanical performance test	32
20.1	Test procedure.....	32
20.2	Acceptance criteria	33
21	Residual strength test.....	33
21.1	General.....	33
21.2	Previous tests	33
21.3	Preparation of the test pieces	33
21.4	Test procedure.....	34
21.5	Test results	34
21.6	Acceptance criteria	34
22	Verification of the axial, radial and angular displacements	34
22.1	Test procedure.....	34
22.2	Acceptance criteria	35
23	Verification of the locking system.....	36
23.1	General.....	36
23.2	Conformity of the locking device	36
23.3	Verification of locking.....	36
23.4	Position of the locking device.....	36
23.5	Procedure for the operation test.....	36
23.6	Acceptance criteria for the operation test	37
24	Temperature cycle test	37
24.1	Test procedure for ceramic or toughened glass material	37
24.2	Test procedure for of annealed glass	38
24.3	Special test procedure for insulators with thick sections or very large insulators	38
24.4	Complementary specifications.....	38
24.5	Acceptance criteria	38
25	Thermal shock test	39
25.1	Sample test.....	39
25.1.1	Test procedure	39
25.1.2	Acceptance criteria	39
25.2	Routine thermal shock test.....	39
25.2.1	Test procedure	39
25.2.2	Acceptance criteria	39
26	Porosity test	39
26.1	Test procedure.....	39
26.2	Acceptance criteria	39
27	Galvanizing test.....	40
27.1	General.....	40
27.2	Test procedure.....	40
27.2.1	General	40

27.2.2	Appearance	40
27.2.3	Determination of the coating mass by the magnetic test method	40
27.3	Acceptance criteria	40
27.3.1	Acceptance criteria for the appearance test	40
27.3.2	Acceptance criteria for the value of coating mass	41
28	Zinc sleeve test (if applicable)	41
28.1	General requirements concerning the zinc sleeve	41
28.2	Type test procedure	41
28.3	Sample test procedure	42
29	Routine visual inspection	42
29.1	General.....	42
29.2	Insulators with ceramic insulating parts	42
29.3	Insulators with glass insulating parts.....	43
30	Impact test	44
30.1	Test procedure.....	44
30.2	Acceptance criteria	44
31	Routine mechanical test	44
31.1	Routine mechanical test on line post insulators.....	44
31.2	Routine mechanical test on string insulator units.....	45
32	Mounting arrangements for tests on pin insulators	45
32.1	Standard mounting arrangement for electrical tests	45
32.2	Mounting arrangements for electrical tests reproducing service conditions.....	46
32.3	Mounting arrangement for the mechanical failing load test.....	46
33	Coefficients for statistical analysis of the test results on line post Insulators	46
33.1	Coefficient for type tests	46
33.2	Coefficients for sample tests	46
34	Mounting arrangements for tests on line post insulators	46
34.1	Standard mounting arrangement for electrical tests	46
34.2	Mounting arrangements for electrical tests reproducing service conditions.....	47
34.3	Mounting arrangement for the mechanical failing load test.....	47
35	Coefficients for statistical analysis of the test results on string insulator units	47
35.1	Coefficient for type tests	47
35.2	Coefficients for sample tests	48
36	Mounting arrangements for electrical tests on string insulator units	48
37	Mounting arrangements for electrical tests on Insulators for overhead electric traction lines.....	48
37.1	Standard mounting arrangement	48
37.2	Mounting arrangement representing service conditions	49
Annex A (informative) Method of comparison of the results of electromechanical or mechanical type and sample tests		52
Annex B (informative) Illustration of the mechanical and electromechanical test acceptance procedure for string insulator units and line post insulators		54
B.1	Flow charts	54
B.2	Calculated examples of acceptance and rejection	56
Annex C (informative) Coatings on ceramic or glass insulators		59
C.1	General.....	59
C.2	Material fingerprinting and ageing performance.....	59
C.3	Type testing	59

C.4	Sample testing	60
C.5	Routine testing.....	60
C.6	Pollution performance	60
C.7	Acceptance criteria	60
Annex D (informative)	Impact test	62
Figure 1	– Schematic representation of the thermal-mechanical performance test	49
Figure 2	– Measurement of axial and radial displacements	50
Figure 3	– Measurement of angular displacement	50
Figure 4	– Greatest thickness of the insulator	51
Figure B.1	– Acceptance flow chart for mechanical or electromechanical type tests	54
Figure B.2	– Acceptance flow chart for mechanical or electromechanical sample tests	55
Figure B.3	– Flow chart of the comparison of type and sample tests	56
Figure C.1	– Example of thickness criteria based on current experience	60
Figure C.2	– Example of adherence test criteria.....	61
Figure D.1	– Example of equipment for impact testing	62
Table 1	– Cross-reference table for pin insulators	17
Table 2	– Cross-reference table for line post insulators	19
Table 3	– Cross-reference table for string insulator units – cap and pin	21
Table 4	– Cross-reference table for string insulator units – long rod.....	23
Table 5	– Sample sizes for sample tests	25
Table 6	– Acceptance criteria for impact test.....	44
Table 7	– Coefficients for sample tests (line post insulators).....	46
Table 8	– Coefficients for sample tests (string insulator units).....	48
Table A.1	– Values for constants a, b and c	52
Table A.2	– Values for constants a, b and c (re-test).....	53
Table B.1	– Examples for mechanical and electromechanical sample tests	57
Table B.2	– Blank form for calculation for mechanical and electromechanical sample tests	58

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**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**

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.

IEC 60383 has been prepared by IEC technical committee 36: Insulators. It is an International Standard.

This fifth edition cancels and replaces the fourth edition published in 1993. This edition constitutes a technical revision.

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

- a) The complete document has been revised and updated. The layout of the document has been changed in order to increase readability;
- b) RIV test has been added (Clause 14);
- c) Impulse puncture test in air has been added (15.2);
- d) Residual strength test has been added (Clause 21);

- e) Zinc sleeve test has been added (Clause 28);
- f) Impact test has been added (Clause 30);
- g) Annex C, coatings on ceramic and glass insulators has been added;
- h) Annex D, impact test has been added.

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

Draft	Report on voting
36/564/FDIS	36/571/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 60383 series, published under the general title *Insulators for overhead lines with a nominal voltage above 1 000 V*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under 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 document 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.

INTRODUCTION

This part of IEC 60383 deals with four different types of insulators:

- Pin insulators
- Line post insulators
- String insulator units
- Insulators for overhead electric traction lines

Certain clauses of this document contain general requirements and other clauses contain specific tests relevant to each of the above-mentioned insulators.

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

1 Scope

This part of IEC 60383 applies to insulators of ceramic material or glass for use on AC overhead power lines and overhead traction lines with a nominal voltage greater than 1 000 V and a frequency not greater than 100 Hz. It also applies to insulators for use on DC overhead electric traction lines.

This document applies to string insulator units, rigid overhead line insulators and to insulators of similar design when used in substations.

It does not apply to insulators forming parts of electrical apparatus or to parts used in their construction or to post insulators which are covered by IEC 60168, *Tests on indoor and outdoor post insulators of ceramic material or glass for systems with nominal voltages greater than 1 000 V*.

Tests on insulator strings and insulator sets (for example, wet switching impulse voltage) are dealt with in IEC 60383-2.

The object of this document is:

- to define the terms used
- to define insulator characteristics and to prescribe the conditions under which the specified values of these characteristics shall be verified
- to prescribe test methods
- to prescribe acceptance criteria.

This document does not include requirements dealing with the choice of insulators for specific operating conditions.

Specific requirements on the use of coatings on ceramic or glass insulators are described in the informative Annex C.

Numerical values for insulator characteristics are specified in IEC 60305, IEC 60433 and IEC 60720.

NOTE A guide for the choice of insulators under polluted conditions has been published, see IEC 60815-1 and -2.

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 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements*