

Method for the determination of the proof and the comparative tracking indices of solid insulating materials

ICS 19.080; 29.035.01

National foreword

This British Standard is the UK implementation of EN 60112:2003+A1:2009. It is identical to IEC 60112:2003, incorporating amendment 1:2009 and corrigendum June 2003. It supersedes BS EN 60112:2003 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee GEL/112, Evaluation and qualification of electrical insulating materials and systems.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Amendments/corrigenda issued since publication

Amd. No.	Date	Comments
14584 Corrigendum No. 1	5 September 2003	Renumbering of Figures B.1 to B.4
	28 February 2010	Implementation of IEC amendment 1:2009 with CENELEC endorsement A1:2009; References to IEC 60589 deleted from 2 , 7.3 and Annex ZA

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 14 May 2003

© BSI 2010

ISBN 978 0 580 66942 2

EUROPEAN STANDARD

EN 60112

NORME EUROPÉENNE

EUROPÄISCHE NORM

March 2003

ICS 19.080; 29.035.01

Supersedes HD 214 S2:1980
Incorporating Corrigendum June 2003

English version

**Method for the determination of the proof
and the comparative tracking indices
of solid insulating materials
(IEC 60112:2003)**

Méthode de détermination des indices
de résistance et de tenue
au cheminement des matériaux isolants
solides
(CEI 60112:2003)

Verfahren zur Bestimmung der Prüfwahl
und der Vergleichszahl
der Kriechwegbildung von festen,
isolierenden Werkstoffen
(IEC 60112:2003)

This European Standard was approved by CENELEC on 2003-03-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

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

© 2003 CENELEC - All rights of exploitation in any form and by any means reserved worldwide for CENELEC members.

Foreword

The text of document 15E/209/FDIS, future edition 4 of IEC 60112, prepared by SC 15E, Methods of test, of IEC TC 15, Insulating materials, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60112 on 2003-03-01.

This European Standard supersedes HD 214 S2:1980.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2003-12-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2006-03-01

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

Endorsement notice

The text of the International Standard IEC 60112:2003 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 60587 NOTE Harmonized as HD 380 S2:1987 (not modified).

Foreword to amendment A1

The text of document 112/116/CDV, future amendment 1 to IEC 60112:2003, prepared by IEC TC 112, Evaluation and qualification of electrical insulating materials and systems, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 60112:2003 on 2009-10-01.

The following dates were fixed:

- latest date by which the amendment has to be
implemented at national level by publication of
an identical national standard or by endorsement (dop) 2010-07-01
- latest date by which the national standards conflicting
with the amendment have to be withdrawn (dow) 2012-10-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of amendment 1:2009 to the International Standard IEC 60112:2003 was approved by CENELEC as an amendment to the European Standard without any modification.

CONTENTS

FOREWORD	2
1 Scope.....	4
2 Normative references	4
3 Terms and definitions	5
4 Principle.....	6
5 Test specimen.....	6
6 Test specimen conditioning	7
6.1 Environmental conditioning.....	7
6.2 Test specimen surface state	7
7 Test apparatus	7
7.1 Electrodes	7
7.2 Test circuit.....	8
7.3 Test solutions	8
7.4 Dropping device.....	9
7.5 Test specimen support platform	9
7.6 Electrode assembly installation.....	9
8 Basic test procedure.....	10
8.1 General	10
8.2 Preparation.....	10
8.3 Test procedure	11
9 Determination of erosion	11
10 Determination of proof tracking index (PTI)	11
10.1 Procedure.....	11
10.2 Report	12
11 Determination of comparative tracking index (CTI)	12
11.1 General	12
11.2 Determination of the 100 drop point	12
11.3 Determination of the maximum 50 drop withstand voltage.....	13
11.4 Report	14
Annex A (informative) List of factors that should be considered by product committees.....	18
Annex B (informative) Electrode material selection.....	19
Annex ZA (normative) Normative references to international publications with their corresponding European publications	21
Bibliography	20
Figure 1 – Electrode	16
Figure 2 – Electrode / specimen arrangement.....	16
Figure 3 – Example of typical electrode mounting and specimen support	17
Figure 4 – Example of test circuit.....	17

METHOD FOR THE DETERMINATION OF THE PROOF AND THE COMPARATIVE TRACKING INDICES OF SOLID INSULATING MATERIALS

1 Scope

This International standard specifies the method of test for the determination of the proof and comparative tracking indices of solid insulating materials on pieces taken from parts of equipment and on plaques of material using alternating voltages.

The standard provides for the determination of erosion when required.

NOTE 1 The proof tracking index is used as an acceptance criterion as well as a means for the quality control of materials and fabricated parts. The comparative tracking index is mainly used for the basic characterization and comparison of the properties of materials.

Test results cannot be used directly for the evaluation of safe creepage distances when designing electrical apparatus.

NOTE 2 This test discriminates between materials with relatively poor resistance to tracking, and those with moderate or good resistance, for use in equipment which can be used under moist conditions. More severe tests, of longer duration are required for the assessment of performance of materials for outdoor use, utilizing higher voltages and larger test specimens (see the inclined plane test of IEC 60587). Other test methods such as the inclined method may rank materials in a different order from the drop test given in this standard.

2 Normative references

The following referenced documents are indispensable for the application 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 Guide 104:1997, *The preparation of safety publications and the use of basic safety publications and group safety publications*

ISO 293:1986, *Plastics – Compression moulding test specimens of thermoplastic materials*

ISO 294-1:1996, *Plastics – Injection moulding of test specimens of thermoplastic materials – Part 1: General principles, and moulding of multi-purpose and bar test specimens*

ISO 294-3:2002, *Plastics – Injection moulding of test specimens of thermoplastic materials – Part 3: Small plates*

ISO 295:1991, *Plastics – Compression moulding of test specimens of thermosetting materials*

3 Terms and definitions

For the purposes of this International Standard, the following definitions apply:

3.1

tracking

progressive formation of conducting paths, which are produced on the surface and/or within a solid insulating material, due to the combined effects of electric stress and electrolytic contamination

3.2

tracking failure

failure of insulation due to tracking between conducting parts

NOTE In the present test, tracking is indicated by operation of an over-current device due to the passage of a current of at least 0,5 A for at least 2 s across the test surface and/or within the specimen.

3.3

electrical erosion

wearing away of insulating material by the action of electrical discharges

3.4

air arc

arc between the electrodes above the surface of the specimen

3.5

comparative tracking index

CTI

numerical value of the maximum voltage at which five test specimens withstand the test period for 50 drops without tracking failure and without a persistent flame occurring and including also a statement relating to the behaviour of the material when tested using 100 drops (see 11.4)

NOTE 1 The criteria for CTI may also require a statement concerning the degree of erosion.

NOTE 2 Although a non-persistent flame is allowed in the test without constituting failure, materials which generate no flame at all are preferred unless other factors are considered to be more important. See also Annex A.

3.6

persistent flame

in case of dispute – one which burns for more than 2 s

3.7

proof tracking index

PTI

numerical value of the proof voltage in volts at which five test specimens withstand the test period for 50 drops without tracking failure and without a persistent flame occurring

NOTE Although a non-persistent flame is allowed in the test without constituting failure, materials which generate no flame at all are preferred unless other factors are considered to be more important. See also Annex A.

4 Principle

The upper surface of the test specimen is supported in an approximately horizontal plane and subjected to an electrical stress via two electrodes. The surface between the electrodes is subjected to a succession of drops of electrolyte either until the over-current device operates, or until a persistent flame occurs, or until the test period has elapsed.

The individual tests are of short duration (less than 1 h) with up to 50 or 100 drops of about 20 mg of electrolyte falling at 30 s intervals between platinum electrodes, 4 mm apart on the test specimen surface.

An a.c. voltage between 100 V and 600 V is applied to the electrodes during the test.

During the test, specimens may also erode or soften, thereby allowing the electrodes to penetrate them. The formation of a hole through the test specimen during a test is to be reported together with the hole depth (test specimen thickness). Retests may be made using thicker test specimens, up to a maximum of 10 mm.

NOTE The number of drops needed to cause failure by tracking usually increases with decreasing applied voltage and, below a critical value, tracking ceases to occur.

5 Test specimen

Any approximately flat surface may be used, provided that the area is sufficient to ensure that during the test no liquid flows over the edges of the test specimen.

NOTE 1 Flat surfaces of not less than 20 mm × 20 mm are recommended to reduce the probability of electrolyte loss over the specimen edge although smaller sizes may be used, subject to no electrolyte loss, e.g. ISO 3167, 15 mm × 15 mm multi-purpose test specimens.

NOTE 2 It is preferable to use separate test specimens for each test. If several tests are to be made on the same test piece, care should be taken to ensure that the testing points are sufficiently far from each other so that splashes or fumes from the testing point will not contaminate the other areas to be tested.

The thickness of the test specimen shall be 3 mm or more. Individual pieces of material may be stacked to obtain the required thickness of at least 3 mm.

NOTE 3 The values of the CTI obtained on specimens with a thickness below 3 mm may not be comparable with those obtained on thicker specimens because of greater heat transmission to the glass support through thinner test specimens. For this reason, stacked specimens are allowed.

Test specimens shall have nominally smooth and untextured surfaces which are free from surface imperfections such as scratches, blemishes, impurities, etc, unless otherwise stated in the product standard. If this is impossible, the results shall be reported together with a statement describing the surface of the specimen because certain characteristics on the surface of the specimen could add to the dispersion of the results.