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INTERNATIONAL STANDARD

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colour inside

Electrical insulating materials used under severe ambient conditions – Test methods for evaluating resistance to tracking and erosion

Matériaux isolants électriques utilisés dans des conditions ambiantes sévères – Méthodes d'essai pour évaluer la résistance au cheminement et à l'érosion

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

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

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTRICAL INSULATING MATERIALS USED UNDER SEVERE AMBIENT CONDITIONS – TEST METHODS FOR EVALUATING RESISTANCE TO TRACKING AND EROSION

FOREWORD

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IEC 60587 has been prepared by IEC technical committee 112: Evaluation and qualification of electrical insulating materials and systems. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2007. This edition constitutes a technical revision.

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

a) an improved description of the experimental methods has been implemented;
b) an improved description of the preparation of the test specimens has been implemented;
c) a more detailed description of the electrode material and of the electrode quality has been added;
d) evaluation criterion B (track length) has been removed for testing according to test method 2 (stepwise tracking voltage) as it is not applicable.

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

Draft	Report on voting
112/561/FDIS	112/564/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.

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- replaced by a revised edition, or
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ELECTRICAL INSULATING MATERIALS USED UNDER SEVERE AMBIENT CONDITIONS – TEST METHODS FOR EVALUATING RESISTANCE TO TRACKING AND EROSION

1 Scope

This document describes two test methods for the evaluation of electrical insulating materials for use under severe ambient conditions at power frequencies (45 Hz to 65 Hz) by the evaluation of the resistance to tracking and erosion, using a liquid contaminant and inclined plane specimens. The two methods are:

– Method 1: test at constant voltage,

– Method 2: test at stepwise increased voltage.

Method 1 is the most widely used method as there is less need for continual inspection.

The test conditions are designed to accelerate the production of the effects, but do not reproduce all the conditions encountered in service.

2 Normative references

There are no normative references in this document.

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
track
partially conducting path created by localized deterioration on the surface of an insulating material

3.2
tracking
progressive formation of conductive paths, which are produced on the surface or within a solid insulating material, due to the combined effects of electric stress and electrolytic contamination

Note 1 to entry: Tracking usually occurs due to surface contamination.

Note 2 to entry: Remaining degraded materials need not necessarily remain conductive, especially after they have cooled.

[SOURCE: IEC 60050-212:2010, 212-11-56, modified – Note 2 to entry has been added.]

3.3
erosion
electrical loss of material by leakage current or electrical discharge

4 Test specimens

4.1 Dimensions

Flat specimens with a size of at least (50 × 120) mm^2 shall be used. The preferred thickness should be 6 mm. Specimens with a different thickness may be used. Thickness shall be mentioned in the test report.

Dimensions in millimetres

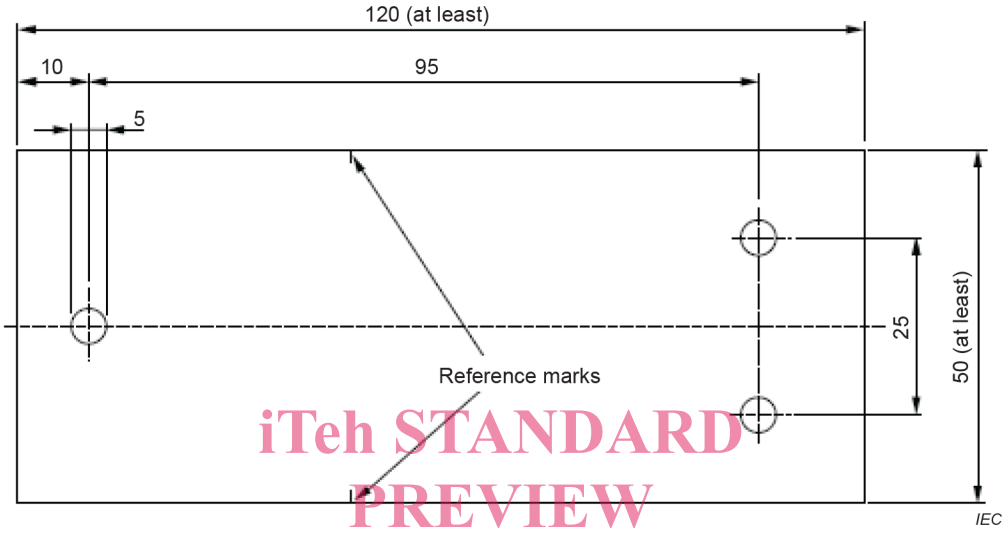


Figure 1 – Test specimen with boreholes for mounting of electrodes

4.2 Preparation

The mechanical processing of the test specimens is as shown in Figure 1, to allow the attachment of electrodes.

The specimens shall be washed with a suitable solvent (e.g. isopropyl alcohol) to remove leftovers such as fatty residues from preparation and handling. The specimens shall then be rinsed with distilled water.

Specimens used for evaluation with criterion B (see Clause 6) shall be marked with reference marks on both long sides 25 mm above the upper edge of the lower electrode (Figure 1 and Figure 8). Unless otherwise specified, the test specimens shall be conditioned for a minimum of 24 h at (23 ± 2) °C, with (50 ± 10) % RH.

When mounting the cleaned and conditioned specimens, ensure they are not contaminated. Good wettability of the specimen surface with the contaminant (see 5.4) is a crucial prerequisite for this test method. The wettability shall be evaluated beforehand. If the contaminant does not wet the surface, the specimens can be slightly abraded. Grinding should be done with a fine (U.S. grade (CAMI): 400 mesh; European grade (FEPA): P800) aluminium-oxide- or zirconia-alumina-abrasive, under water, until the whole surface wets. Specimens shall be properly rinsed with distilled water after grinding. Grinding or any other type of changes of the surface shall be mentioned in the test report.

An alternative to grinding is to increase the flow rate, temporarily, until the specimen's surface is properly wetted prior to switching on the test voltage.

The specimen preparation sequence is shown in Table 1.

Table 1 – Specimen preparation sequence

Step	Activity
1	Mechanical processing
2	Cleaning
3	Marking if necessary
4	Conditioning
5	Mounting
6	Checking of the wettability
6.1	Improving wettability if necessary (either by grinding or by temporarily increasing the flow rate)
6.2	Rinsing with distilled water if the test specimens have been grinded followed by step 5

5 Apparatus

5.1 General

The test apparatus consists of the electrical apparatus and the specimen assemblies. These contain a specimen each, optionally with a mounting support, the electrodes and the filter-paper pad for feeding the contaminant.

5.2 Electrical apparatus

A schematic circuit diagram is given in Figure 2. As the test will be carried out at high voltage, it is obviously necessary to use an earthed safety enclosure. The circuit comprises:

– a (45 to 65) Hz power supply with a sinusoidal voltage with total harmonic distortion of ≤ 5 % and a crest factor of √2 (1 ± 0,05) which can be varied up to about 6 kV at a rated current not less than 0,1 A for each specimen;

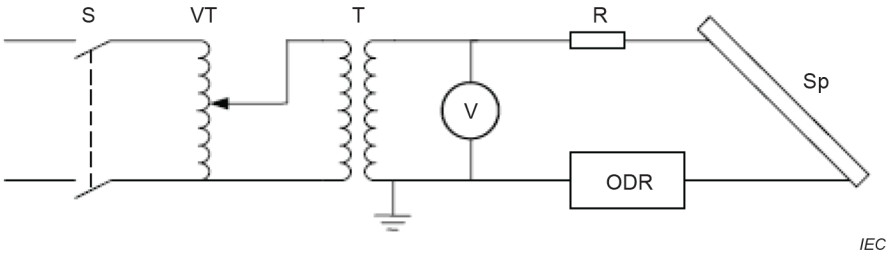
– the output voltage that shall be stabilized to ±5 % at rated current;

– a true RMS voltmeter with an accuracy of 1,5 % of reading;

– a 200 W resistor with ±10 % tolerance in series with each specimen at the high-voltage side of the power supply. The resistance of the resistor shall be taken from Table 2;

– an overcurrent delay relay (see Figure 3) or any other device in series with each specimen, which operates when (60 ± 6) mA has persisted in the high-voltage circuit for (3 ± 1) s.

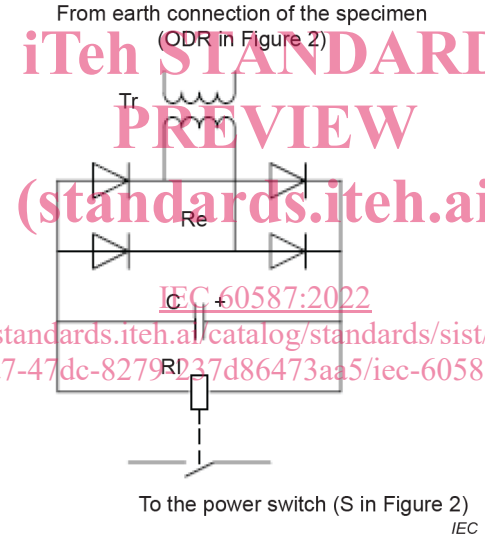
If only one power supply is used for several specimens, each shall have a circuit-breaker or similar device. This is to ensure that failures of a single specimen do not lead to a switch-off of the test-voltage of all other specimens.



Key

S	Power supply switch
VT	Variable ratio transformer
T	High voltage transformer
R	Series resistor
V	Voltmeter
Sp	Specimen
ODR	Overcurrent delay relay

Figure 2 – Schematic diagram of circuit



Key

Re	Rectifier
Tr	Transformer (winding 300/900 turns)
RI	Relay (2 500 Ω/11 000 turns)
C	Capacitor (200 µF)

Figure 3 – Example of typical circuit for an overcurrent delay relay (ODR)

5.3 Specimen assembly

5.3.1 General

A specimen assembly consists of (Figure 4):

– the test specimen, optionally with a mounting support,
– the electrodes with accessories such as screws, washers and nuts,
– a filter-paper stack for feeding the contaminant,
– a mounting.

All electrodes, fixtures and metallic assembly elements associated with the electrodes, such as screws, shall be made of stainless steel, preferably of type 302 (18 % chromium, 8 % nickel austenitic alloy).

Dimensions in millimetres

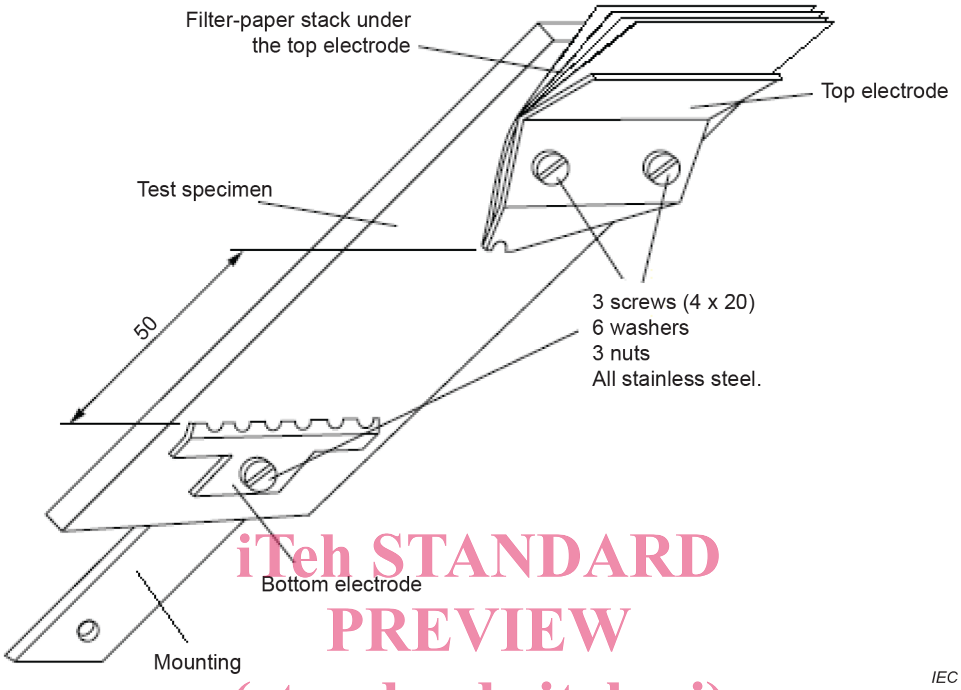


Figure 4 – Schematic diagram of specimen assembly

5.3.2 Electrodes

Electrodes shall be made of stainless steel, preferably of type 302 (18 % chromium, 8 % nickel austenitic alloy). The thickness of the electrode material shall be 0,5 mm. The top electrode is shown in Figure 5. The bottom electrode is shown in Figure 6.

New electrodes shall be used for each test. For screening testing, used and reworked electrodes can be utilized. The edges of the electrodes, especially those oriented towards the stressed area of the specimen between the electrodes, shall be well deburred.

Dimensions in millimetres

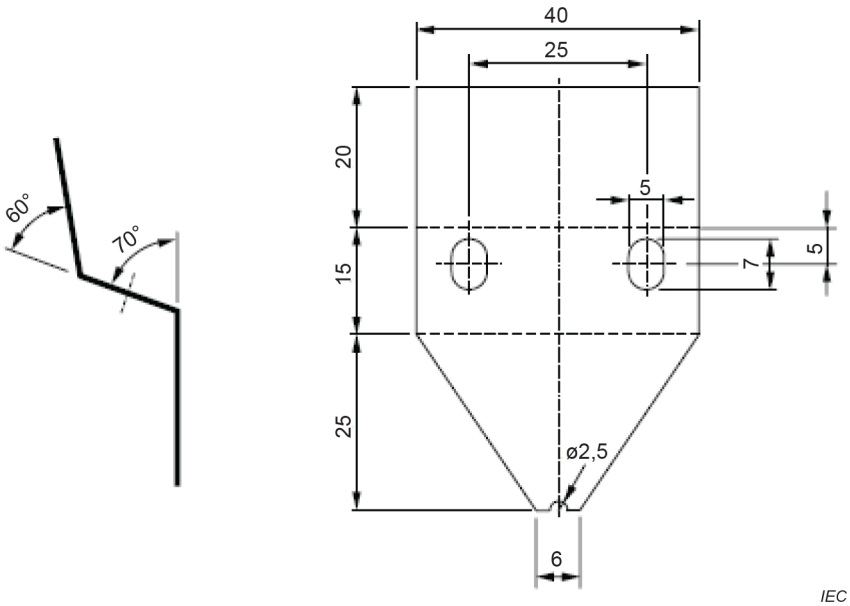


Figure 5 – Top electrode

Dimensions in millimetres

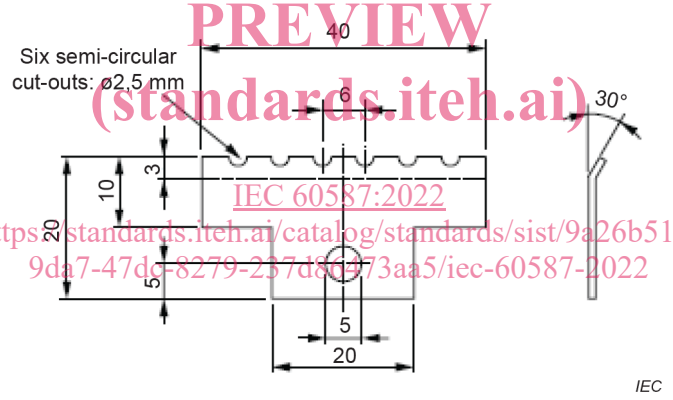


Figure 6 – Bottom electrode

5.3.3 Filter-paper stack

Eight layers of filter-paper with a thickness of (0,2 ± 0,02) mm, of the approximate dimensions given in Figure 7, are clamped between the top electrode and the specimen to act as a reservoir for the contaminant.

Dimensions in millimetres

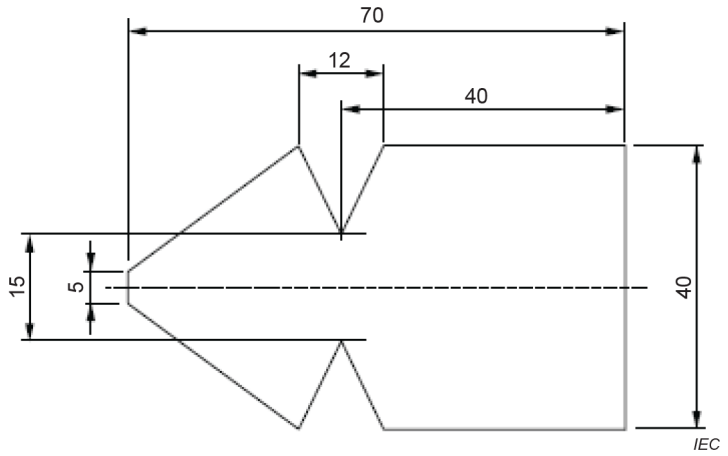


Figure 7 – Filter-paper

5.3.4 Mounting of the specimen assembly

Mount the specimen with the surface that is to be exposed to the contaminant towards the lower side of the specimen assembly, at an angle of (45 ± 2)° from the horizontal as shown in Figure 8, with the electrodes (50 ± 0,5) mm apart.

Dimensions in millimetres

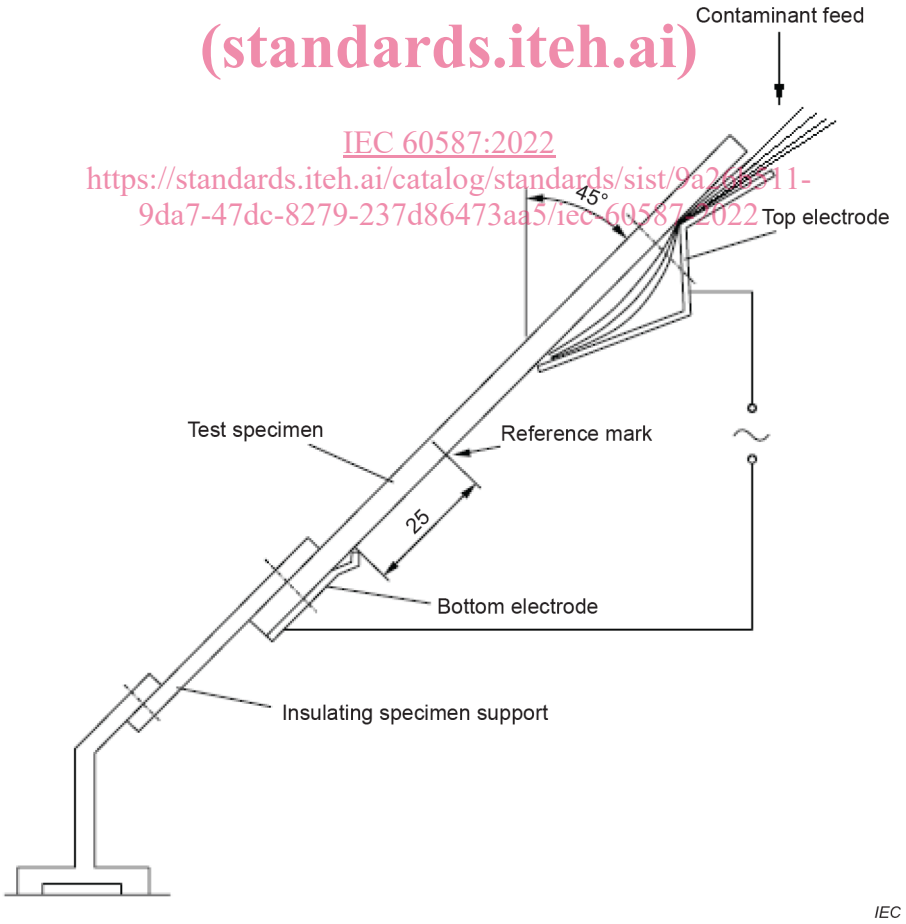


Figure 8 – Schematic diagram of specimen assembly