

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Combined flexible materials for electrical insulation –
Part 2: Methods of test

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Matériaux combinés souples destinés à l'isolement électrique –
Partie 2: Méthodes d'essai

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**COMBINED FLEXIBLE MATERIALS
FOR ELECTRICAL INSULATION –****Part 2: Methods of test**

FOREWORD

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International Standard IEC 60626-2 has been prepared by IEC technical committee 15: Solid electrical insulating materials.

This third edition cancels and replaces the second edition published in 1995 and constitutes a major technical revision. The main changes from the previous edition are as follows: some tests such as for edge tearing and stiffness, actually not used and not listed in the requirements of Part 3, were deleted.

The text of this standard is based on the following documents:

CDV	Report on voting
15/470/CDV	15/512/RVC

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the parts in the IEC 60626 series, under the general title *Combined flexible materials for electrical insulation*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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INTRODUCTION

This International standard deals with test methods of combined flexible materials consisting of two or more different insulating materials laminated together as described in IEC 60626-1. The components of flexible combined materials are polymer film and fibrous sheet material. This standard does not include materials based on mica paper, as primary component, covered by IEC 60371, but mica paper may be used as complementary material.

The series has three parts describing:

Part 1: Definitions and general requirements (IEC 60626-1)

Part 2: Methods of test (IEC 60626-2)

Part 3: Specifications for individual materials (IEC 60626-3)

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COMBINED FLEXIBLE MATERIALS FOR ELECTRICAL INSULATION –

Part 2: Methods of test

1 Scope

This International Standard provides the test methods for combined flexible materials for electrical insulation. Some properties and relevant test methods, according to the performance requirements of IEC 60626-3, were confirmed. Other test methods are described as a supplement of guidance for further specification that could be agreed between customer and supplier to meet specific needs of the end use.

Materials which conform to this specification meet established levels of performance. However, the selection of material by a user for a specific application should be based on the actual requirements necessary for adequate performance in that application and not based on this specification alone.

SAFETY WARNING

It is the responsibility of the user of the methods contained or referred to in this document to ensure that they are used in a safe manner.

2 Normative references

[IEC 60626-2:2009](https://standards.iteh.ai/catalog/standards/sist/abcde582-134a-4d4c-b77e-4f392140715c/iec-60626-2:2009)

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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 60216-4-1:2006, *Electrical insulating materials – Thermal endurance properties – Part 4: Ageing ovens – Section 1: Single-chamber ovens*

IEC 60243-1:1998, *Electrical strength of insulating materials – Test methods – Part 1: Tests at power frequencies*

IEC 60626-3:2008, *Combined flexible materials for electrical insulation – Part 3: Specifications for individual materials*

ISO 536: 1995, *Paper and board – Determination of grammage*

3 General requirements on tests

Unless otherwise specified, the test specimens, after being cut, shall be conditioned for 24 h at (23 ± 2) °C and (50 ± 5) % relative humidity. If the test is not conducted in this standard atmosphere, the test shall be made within 5 min after removal from the standard atmosphere.

4 Thickness

4.1 Test apparatus

4.1.1 An external screw type micrometer having measuring faces of 6 mm to 8 mm diameter. The measuring faces shall be flat to within 0,001 mm and parallel to within 0,003 mm. The pitch of the screw shall be 0,5 mm and the graduations shall be 50 divisions of 0,01 mm, enabling readings to be estimated to 0,002 mm.

The pressure exerted on the specimens shall be 100 kPa as described in 4.1.2.

4.1.2 A dead-weight dial type micrometer having two ground and lapped concentric circular surfaces flat to within 0,001 mm and parallel to within 0,003 mm. The upper surface shall be 6 mm to 8 mm in diameter. The lower surface shall be larger than the upper one. The upper surface shall move on the axis perpendicular to the surfaces. The dial shall be graduated to read directly to 0,002 mm. The frame of the micrometer shall be of such rigidity that a force of 15 N applied to dial housing, out of contact with either the weight or the presser foot spindle, will produce a deflection of the frame not greater than 0,002 mm as indicated on the micrometer dial. The pressure exerted on the specimen shall be 100 kPa.

4.1.3 The setting gauge used to check the instruments shall be accurate to within $\pm 0,001$ mm of the nominal size. The indicated thickness by the instruments shall not differ by more than 0,005 mm from the gauge block.

NOTE For materials with high compressibility and special structure, other values for the area and the pressure of the measuring faces may be specified.

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4.2 Test specimens

4.2.1 General

[IEC 60626-2:2009](#)

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In the "as received" condition. [493043c4f27b/iec-60626-2-2009](#)

4.2.2 Full width and sheet material

Full width material delivered on rolls or sheet material cut to length. One specimen 25 mm wide and whose length is equal to the width of the roll or sheet shall be cut across the entire width of the material.

4.2.3 Slit material (tape)

One specimen 1 m long shall be cut from the roll.

4.3 Procedure

Measure the thickness of the material, when not constrained in any way, at nine points spaced not less than 75 mm apart along the length of the test specimens. All joints (or splices) shall be excluded from the area of the test.

4.4 Results

The values of the nine measurements shall be recorded. The central value is taken as the thickness of the material.

5 Substance (weight per unit area or grammage)

Because of the electrical engineering practice of using the word substance, this has been used here. The substance of combined materials shall be measured in accordance with the method described in ISO 536, with the following exceptions:

- Clauses 5 and 6 of ISO 536 are ignored;
- the test shall be carried out on three specimens in the "as received" condition;
- determine the mass with an accuracy of 0,5 % on specimens of not less than 100 cm²;
- the central value is taken as the result, the two others are reported.

6 Tensile strength and elongation

6.1 Test apparatus

Either a constant rate-of-loading machine or a constant rate-of-traverse machine may be used. The machine preferably shall be power driven and graduated so that a reading of 1 % of the value required by the specification sheet is possible.

6.2 Test specimens

Five specimens are used. The length of the test specimens shall be such that it allows a length of 200 mm between the jaws of the testing machine. When testing full width material, the width shall be 15 mm, five test specimens shall be cut in the machine direction, and five test specimens perpendicular to that direction. When testing specimens containing woven fabric, the test specimens shall be cut so that no two test specimens cut in the same direction contain the same longitudinal threads.

Slit material (tape) is tested in the "as-delivered" width up to a maximum of 30 mm.

6.3 Procedure for unfolded specimens

Fix a test specimen in the testing machine and apply the load in such a way that the time from the commencement of the application of the load to the moment at which the load corresponding to the specified minimum tensile strength is reached is (60 ± 10) s; continue until one of the components of the specimen breaks. Record the breaking force and, if required, the elongation.

If the test specimen breaks in or at the clamps of the testing machine, discard the result and make a further test using another test specimen.

When the tensile strength of a join is to be determined, the position of the join shall be approximately midway between the clamps.

NOTE With certain materials, extra precautions may be required to prevent slipping.

6.4 Procedure for folded specimens

The specimens are bent over by hand in the middle of their lengths and at right angles to the longitudinal edges of the specimens. They are then fed through the rollers of the folding apparatus illustrated in Figure 1 in the longitudinal direction of the specimen, the longitudinal edge of the specimen lying against the guide.

As bending operation is preliminary to the tensile test, the five samples, according to 6.4, shall be examined visually for delamination and other effects caused by folding action: failure should be recorded on test report, and sample discarded and replaced by a new one. In case all five samples delaminate when folded, the tensile strength test cannot be performed and this fact has to be noted on the test report.

After unfolding, the specimen is tested according to 6.3.

6.5 Results

Tensile strength

Take the central value of the five loads at break and calculate the tensile strength of the material expressed in newtons per 10 mm of width.

Elongation at break

Take the central value of the five values as the elongation at break of the first component which breaks, expressed in per cent of the specimen length between the clamps.

7 Effect of heat

During a period of not less than 10 min and not greater than 11 min a test specimen of approximately 100 cm² is exposed to a temperature as agreed upon between purchaser and supplier. In case of dispute, an oven conforming to IEC 60216-4-1 shall be used. Failure is denoted by the presence of bubbles, delamination or other effects.

8 Electric strength

The test shall be carried out in accordance with IEC 60243-1.

8.1 Apparatus

8.1.1 General requirements on the test apparatus

The apparatus shall be in accordance with IEC 60243-1.

8.1.2 Electrodes

For sheet material use the 25/75 mm electrodes according to IEC 60243-1. For slit material (tape), the 6 mm electrodes according to IEC 60243-1 are used.

The faces of the electrodes shall be parallel and free from pits or other imperfections.

8.1.3 Apparatus for folding

See Figures 2 and 3.

8.2 Test specimens and number of test

For sheet material, the test specimens shall be at least 250 mm × 250 mm, always of sufficient size to accommodate the electrode arrangement to avoid flashovers. The test specimens up to 0,5 mm thickness are tested not folded and folded. On the same test specimens, five tests are carried out along the longitudinal, five along the transverse fold lines and five on the not folded area. Test specimens of more than 0,5 mm thickness are tested not folded only (five tests). For slit material (tape) the test specimen shall be 450 mm in length and 25 mm in width. The number of tests shall be five and they can be done on the same specimen.

NOTE When testing material narrower than 25 mm, an arrangement should be made to avoid flashover.

8.3 Procedure

8.3.1 Folding

The test specimens are bent over by hand at a distance of about 40 mm from and parallel to the edge.

NOTE For bending the test pieces by hand, it is recommended that a device as shown in Figure 2 be used. The test specimen is inserted as far as it will go into the slit of the device, bent through 90° to one side and then in the same direction after first removing it from the slit.

The folded test specimen is fed through the roller of the folding apparatus as shown in Figure 3, the fold lying against the guide. Next, the folded test specimen is bent back by hand through 360° and again passed through the roller of the folding apparatus. This double folding action is performed on all four edges of the test specimens. After unfolding, the number of tests given in 8.2 is made according to 8.3.2.

8.3.2 Testing

The specimens are tested after conditioning in accordance with Clause 3. The application of voltage shall be in accordance with IEC 60243-1. When the weight of the 25 mm electrode is not sufficient to flatten the folded specimen, additional pressure shall be applied so as to just flatten the specimen. Breakdown criterion according to IEC 60243-1. The central value shall be taken as the result. The results shall be reported in kilovolts.

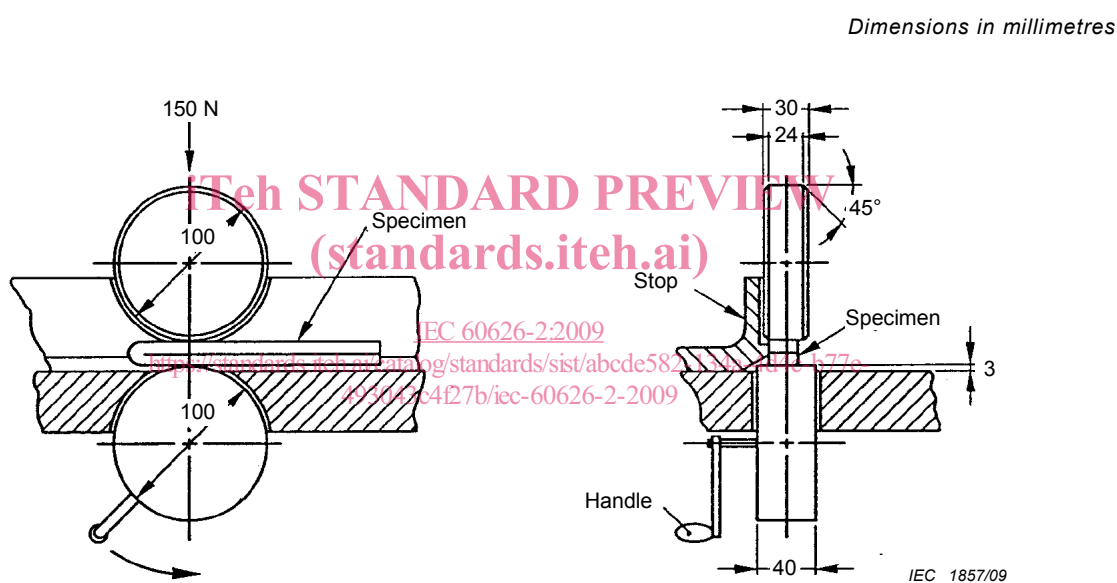


Figure 1 – Device for folding specimens