

INTERNATIONAL STANDARD

IEC
60641-2

Second edition
2004-06

**Pressboard and presspaper
for electrical purposes –**

**Part 2:
Methods of tests**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**PRESSBOARD AND PRESSPAPER
FOR ELECTRICAL PURPOSES –****Part 2: Methods of tests**

FOREWORD

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International Standard IEC 60641-2 has been prepared by subcommittee 15C: Specifications, of IEC technical committee 15: Insulating materials.

This second edition cancels and replaces the first edition, published in 1979, and amendment 1 (1993). This edition constitutes a technical revision.

The main changes with respect to the previous edition are listed below:

The following test methods have been cancelled:

- Flexibility
- Conductivity of the organic extract
- Contamination of liquid dielectrics

The following test methods have been rewritten:

- Compressibility
- Conductivity of the aqueous extract
- Cohesion between plies

The following test method has introduced:

- Determination of metallic particles with X-ray.

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

FDIS	Report on voting
15C/1609IFDIS	15C/1642/RVD

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.

IEC 60641 consists of the following parts, under the general title *Pressboard and presspaper for electrical purposes*:

Part 1: Definition and general requirements (IEC 60641-1)

Part 2: Methods of test (IEC 60641-2)

Part 3: Specifications for individual materials (IEC 60641-3)

Sheet 1: Pressboard

Sheet 2: Presspaper

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

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

PRESSBOARD AND PRESSPAPER FOR ELECTRICAL PURPOSES –

Part 2: Methods of tests

1 Scope

This part of IEC 60641 applies to pressboard and presspaper for electrical purposes.

The series does not apply to laminated material.

This part specifies the test methods to be used in testing pressboard and presspaper for electrical purposes to meet the requirements prescribed in the specification sheets of Part 3.

NOTE In this standard, reference is made in several places to ISO standards accompanied by a short description of the method used. It is to be understood that this short description is meant for identification purposes only and that all details should be taken from the ISO standard itself.

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

IEC 60296:2003, *Fluids for electrotechnical applications – Unused mineral insulating oils for transformers and switchgear*

IEC 60554-2:2001, *Cellulosic papers for electrical purposes – Part 2: Methods of test*

ISO 287:1985, *Paper and board – Determination of moisture content – Oven-drying method*

ISO 534:1988, *Paper and board – Determination of thickness and apparent bulk density or apparent sheet density*

ISO 1924-2:1994, *Paper and board – Determination of tensile properties – Part 2: Constant rate of elongation method*

ISO 1974:1990, *Paper – Determination of tearing resistance (Elmendorf method)*

ISO 2144:1997, *Paper, board and pulps – Determination of residue (ash) on ignition at 900 degrees C*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

specimen

rectangle of paper or board cut to given dimensions from sheets or reels drawn from selected units

3.2

test piece

quantity of paper or board on which each single determination is carried out in accordance with the method of test.

NOTE The test piece may be taken from a specimen; in some instances, it may be the specimen itself.

4 General notes on tests

4.1 Conditioning

- a) For materials with a thickness of $<0,5$ mm

Unless otherwise specified, the specimen after being cut, shall be conditioned for not less than 16 h in an atmosphere of $23\text{ °C} \pm 2\text{ K}$ and $(50 \pm 5)\%$ relative humidity. Test pieces shall be cut from the specimen and tested in this atmosphere.

- b) For materials with a thickness of $\geq 0,5$ mm

Unless otherwise specified, the specimen after being cut, shall be conditioned for not less than 16 h in an atmosphere of $23\text{ °C} \pm 2\text{ K}$ and $(50 \pm 5)\%$ relative humidity. Test pieces shall be cut from the specimen and tested in an atmosphere of 20 °C to 30 °C and 40% to 60% relative humidity.

In case of dispute, the conditioning shall be $23\text{ °C} \pm 2\text{ K}$ and $(50 \pm 5)\%$ relative humidity until the moisture content of the specimen reaches $5,5\%$ to 8% . The conditioning shall be approached from the dry side after drying at $70\text{ °C} \pm 5\text{ K}$ for a period sufficient to ensure that the conditioning atmosphere produces a mass increase in the specimen.

4.2 Drying

Unless otherwise specified, the following drying procedure shall be used.

Dry the test pieces in a ventilated oven at $105\text{ °C} \pm 5\text{ K}$.

The minimum drying time as a function of the thickness s expressed in millimetres shall be as follows:

Nominal thickness s (mm)	$\leq 0,5$	$0,5 < s \leq 1,5$	$1,5 < s \leq 5$	> 5
Time (h)	12	24	48	72

4.3 Tolerances

When tolerances are not specified for the dimensions of the test piece, it is understood that these dimensions are taken to the nearest millimetre.

4.4 Results

As a general rule, the central value is reported as the result. When agreed between parties, the mean value may be reported. This must be noted in the test report.

5 Thickness

For material with a grammage of less than 224 g/m², use the procedure as described in ISO 534. For materials with a grammage of 224 g/m² or more, use the following test:

5.1 Test apparatus

One of the test apparatus described below shall be used.

NOTE In case of dispute, the test apparatus should be the one described in 5.1.2.

5.1.1 Screw type micrometer

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 0,01 mm, enabling readings to be estimated to 0,002 mm. The pressure exerted on the test piece shall be 0,1 MPa to 0,3 MPa.

NOTE For thin, soft material (for instance, board type B.5.1, 1 mm) the error due to the pressure of the micrometer can be as great as 2 % of the measured value.

5.1.2 Dead weight micrometer

A dead weight dial type micrometer having two ground and lapped measuring 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 diameter. The lower surface shall be larger than the upper surface. 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 the dial housing, out of contact with either the weight or the presser foot spindle, will produce a deflection of frame not greater than 0,002 mm as indicated on the micrometer dial. The pressure exerted on the test piece shall be 0,1 MPa to 0,3 MPa.

5.1.3 Dial gauge micrometer

As an alternative to 5.1.2, a "Dial gauge type micrometer" with the following characteristics may be used:

Diameter of the upper measuring surface: $(14,3 \pm 0,5)$ mm.

Diameter of the lower measuring surface: bigger than the upper one.

Pressure exerted on the test piece: $(0,055 \pm 0,005)$ MPa.

The two measuring surfaces shall be parallel to within 0,005 mm or 1 %.

NOTE The values recorded with this apparatus could be significantly different from the ones recorded with the two other types.

5.2 Setting gauge

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

5.3 Procedure

Measure the thickness of the pressboard or the presspaper in the as received condition using one of the instruments described in 5.1 at points not less than 20 mm from the edges.

For the pressboard, the number of measurements shall be eight, two along each edge. For presspaper in reels, 5.1 of IEC 60554-2 must be followed. When measuring across the width of a reel, the number of measurements shall be five per metre.

In case of dispute, cut a strip 40 mm wide across the full width of the material and, from this strip, at eight equally spaced positions, cut eight test pieces, each not less than 40 mm long. Condition the test pieces in accordance with 4.1 and measure the thickness of each specimen at a point near the centre of each test piece using the instrument described in 5.1.2.

5.4 Results

The central value is taken as the result and reported together with the minimum and maximum values.

6 Apparent density

The test shall be carried out on three conditioned test pieces; one determination is made on each of the three test pieces.

Use rectangular test pieces of an area not less than 100 cm² and determine the mass to an accuracy of 10⁻⁴ × mass of test piece.

Make two measurements of the length and two of the width of each test piece to an accuracy of 0,1 mm at points at least 12 mm from the corners.

Determine the thickness by making eight measurements as indicated in 5.3 and calculate the mean value of the measurements.

Express the apparent density ρ (the mass to volume ratio) as g/cm³.

$$\rho = \frac{m}{s \times l \times w} \times 10^3$$

where

m is the mass, in g;

s is the mean of the eight thickness measurements, in mm;

l is the mean of the two length measurements, in mm;

w is the mean of the two width measurements, in mm.

Report all three values. The central value shall be taken as the result.