

Specification for insulating materials based on mica —

Part 2: Methods of test

The European Standard EN 60371-2:2004 has the status of a
British Standard

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National foreword

This British Standard is the official English language version of EN 60371-2:2004. It is identical with IEC 60371-2:2004. It supersedes BS EN 60371-2:1997, which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee GEL/15, Insulating material, to GEL/15/3, Material specifications, which has the responsibility to:

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English version

Specification for insulating materials based on mica
Part 2: Methods of test
(IEC 60371-2:2004)

Spécification pour les matériaux isolants
à base de mica
Partie 2: Méthodes d'essais
(CEI 60371-2:2004)

Bestimmung für Isoliermaterialien
aus Glimmer
Teil 2: Prüfverfahren
(IEC 60371-2:2004)

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CENELEC

European Committee for Electrotechnical Standardization
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Foreword

The text of document 15C/1610/FDIS, future edition 3 of IEC 60371-2, prepared by SC 15C, Specifications, of IEC TC 15, Insulating materials, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60371-2 on 2004-09-01.

This European Standard supersedes EN 60371-2:1997.

The main changes with respect to EN 60371-2:1997 are as follows:

a) All clauses re-numbered.

b) Relevant template of ISO 67 has been added to this standard as Annex A.

c) Clause 8: Tensile strength and elongation at break

Procedure modified to give "rate of movement" instead of "time limit". Different rate of movement for raw mica as opposed to reinforced and/or impregnated mica.

d) Clause 11: Stiffness

Size of test specimen revised. wording modified so that standard covers materials using carriers other than woven glass cloth and materials that are 3-ply. Revision of terms "machine direction" and "transverse direction".

e) Clause 13: Elastic compression and plastic compression

Tolerance on measurement of height of stack changed to within 0,01 mm.
Times for change in pressure in procedure changed to 1 min.

f) Clause 16: Electric strength

Modified in line with Amendment 1:1994 to IEC 60371-2:1987 (included in EN 60371-2:1997).
Changes relate to latest edition of EN 60243-1.

g) Clause 19: Detection of defects and conductive particles

Revised subclause.

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) | 2005-06-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn | (dow) | 2007-09-01 |

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60371-2:2004 was approved by CENELEC as a European Standard without any modification.

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INTRODUCTION

This part of IEC 60371 is one of a series which deals with insulating materials for use in electrical equipment built up from mica splittings or mica paper, with or without reinforcement, and with mica paper in its pure state.

IEC 60371 consists of three parts under the main title *Specification for insulating materials based on mica*:

Part 1 Definitions and general requirements

Part 2 Methods of test

Part 3 Specifications for individual materials

SPECIFICATION FOR INSULATING MATERIALS BASED ON MICA –

Part 2: Methods of test

1 Scope

This part of IEC 60371 defines the methods of test which are applicable to built-up mica materials, products based on them and mica paper.

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 60216 (all parts), *Electrical insulating materials – Thermal endurance properties*

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

IEC 60250:1969, *Recommended methods for the determination of the permittivity and dielectric dissipation factor of electric insulating materials at power, audio and radio frequencies including metre wavelengths*

IEC 60371-3 (all parts), *Specification for insulating materials based on mica – Part 3: Specifications for individual materials*

ISO 178:2001, *Plastics – Determination of flexural properties*

3 Preparation methods of test specimens for curable materials

3.1 General

Test specimens are prepared in accordance with the following methods which are applicable only to curable materials.

3.2 Method 1

Clean off all loose particles and projecting fibres from sufficient material to provide the test pieces required for the particular test.

Cut and stack the pieces required to form the test laminate. For tape material, build up the laminate to the required thickness using half-lapped layers with successive layers at right angles, where necessary cutting the sides to obtain the required dimensions.

Adjust the press temperature to $160\text{ }^{\circ}\text{C} \pm 5\text{ K}$, unless otherwise specified.

Place the test laminate in the centre of two caul plates not exceeding 1,5 mm in thickness and at a temperature of 15 °C to 35 °C.

Insert stops of a size to provide the required test laminate thickness.

Insert the assembly of plates and the test piece in the centre of the preheated press.

Close the press immediately and apply sufficient pressure to reach stops. Cure the test piece for a minimum of 30 min.

Remove the test piece and post-cure for the length of time and at the temperature given in IEC 60371-3 or according to the recommendation of the supplier.

Unless otherwise specified, condition the test piece for 24 h in a controlled atmosphere of $(50 \pm 5) \% \text{ r.h.}$ and at $23 \text{ °C} \pm 2 \text{ K}$ before the test.

3.3 Method 2

Clean off all loose particles and projecting fibres from sufficient material to provide the test sheets required for the particular test.

For full-width and sheet material, cut and stack the sheets required to form the test laminate.

There are two suggested ways of producing a laminate from tape material:

- a) Cut the tape in pieces to the length of the laminate. Stack the pieces parallel and half-overlapped. The second and following layers shall be moved sideways, so that the overlapping edges do not lie one upon another. In order to fix the pieces, the use of a hot iron is recommended.
- b) Take a metal sheet of the size of the required laminate and of a thickness of 2 mm to 3 mm. Wind the tape half-overlapped and always in the same direction around this sheet until the required thickness is reached. It is recommended to start each layer separately and to move the second and the following layers sideways, so that the overlapping edges do not lie one upon another. It is necessary to put an interleaving release material between the metal sheet and the tape. Two laminates with the same thickness are formed.

The prepared stacks, having a composition as shown in Figure 1, shall be put in the press.

The following press procedure, illustrated in Figure 2, provides an example:

- Close the cold press and bring it to a pressure of 0,15 MPa.
- Heat the press to 70 °C under pressure of 0,15 MPa.
- Reduce the pressure down to zero, open the press for a short time (ventilate).
- Heat the press to 90 °C under pressure of 0,15 MPa.
- Reduce the pressure down to zero, open the press for a short time (ventilate).
- Heat the press to 110 °C under pressure of 0,15 MPa.
- Reduce the pressure down to zero, open the press for a short time (ventilate).
- Heat the press to $160 \text{ °C} \pm 5 \text{ K}$ under pressure of 0,15 MPa until the resin starts to gel. This point of time is visually controlled by a test rod. As soon as the resin starts to gel, bring the pressure up to 3 MPa.

- Cure under 3 MPa and 160 °C for 60 min or at a temperature otherwise specified.
- Specimen to be cooled under pressure.

After this press procedure, post-cure the laminate for the time and temperature specified in the specification sheets of IEC 60371-3 or according to the recommendation of the supplier.

Other press procedures shall be subject to contract.

4 Thickness

4.1 Test apparatus

Depending on the materials to be tested, the apparatus for measuring thickness is as follows:

4.1.1 A constant pressure measurement device having flat measuring faces of 6 mm to 8 mm diameter, the graduations being in divisions of 0,01 mm and permitting reading to within 0,005 mm. The pressure exerted on the specimen shall be 0,1 MPa $\pm$ 10 %. The accuracy of measurement, when checked by a setting gauge, shall be within 0,005 mm. Measurement shall be made at ambient temperature and at least 5 s after the application of pressure.

4.1.2 A device as described in 4.1.1, but with a pressure of 0,7 MPa $\pm$ 10 % exerted on the specimen.

4.1.3 A device as described in 4.1.1, but with a pressure of 7,0 MPa $\pm$ 10 % exerted on the specimen.

4.1.4 Test apparatus capable of producing a constant pressure of 30 MPa $\pm$ 10 % uniformly distributed over the faces of the test specimen. It shall consist of a press with parallel plates and a system permitting measurement within $\pm$ 0,02 mm.

4.2 Test specimen

4.2.1 Where the material is delivered in plates or in sheets, the test specimen shall consist of an entire plate or sheet.

4.2.2 Where the material is delivered in rolls, the test specimen shall consist of a strip taken across the full width of the roll to give an area of 0,2 m².

4.2.3 Where the material is delivered in the form of tapes, the test specimen shall consist of a strip 2 m long.

4.2.4 For commutator separators with a surface area of 10 cm² or less, the test specimen shall consist of five separators to be measured individually.

4.2.5 For commutator separators with a surface area greater than 10 cm², the test specimen depends on the method given in the specification for the individual material (see relevant sheets of IEC 60371-3):

- a) the test specimen shall consist of one separator;
- b) the test specimen shall consist of one entire press-gauged stack of separators (separated if necessary by intermediate layers), the number of separators in the press-gauged stack to be specified by the purchaser.

4.2.6 For flat pieces cut to shape other than separators, the test specimen shall consist of one piece.