SLOVENSKI STANDARD
oSIST prEN IEC 60893-2:2022

01-december-2022

Izolacijski materiali - Industrijske toge laminirane plošče iz smol s toplotnim utrjevanjem za električne namene - 2. del: Preskusne metode

Insulating materials - Industrial rigid laminated sheets based on thermosetting resins for electrical purposes - Part 2: Methods of test

Stratifiés industriels rigides en planches à base de résines thermodurcissables à usages électriques - Partie 2: Méthodes d'essai

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Ta slovenski standard je istoveten z: **prEN IEC 60893-2:2022**

ICS:

29.035.20	Plastični in gumeni izolacijski materiali	Plastics and rubber insulating materials

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COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER:	
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DATE OF CIRCULATION:	CLOSING DATE FOR VOTING:
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IEC TC 15 : SOLID ELECTRICAL INSULATING MATERIALS	
SECRETARIAT: United States of America	SECRETARY: Mr John Gauthier
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY	
☒ SUBMITTED FOR CENELEC PARALLEL VOTING **Attention IEC-CENELEC parallel voting** The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.	☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

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Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE:

Insulating materials - Industrial rigid laminated sheets based on thermosetting resins for electrical purposes - Part 2: Methods of test

PROPOSED STABILITY DATE: 2026

NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INSULATING MATERIALS – INDUSTRIAL RIGID LAMINATED SHEETS BASED ON THERMOSETTING RESINS FOR ELECTRICAL PURPOSES –

Part 2: Methods of test

FOREWORD

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International Standard IEC 60893-2 has been prepared by subcommittee 15C: Specifications, of IEC technical committee 15: Insulating materials.

This third edition cancels and replaces the second edition, published in 2003, and constitutes an editorial revision.

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

a) removal of reference to withdrawn specification IEC 60167:1964;

b) inclusion of reference to IEC 62631-3-3:2015, which supersedes IEC 60167:1964. Details in Section 6.3 have been updated accordingly. The actual performance of the test has not changed;

c) normative references have been updated;

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

FDIS	Report on voting
15/xxx/FDIS	15/xxx/RVD

92

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

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

96 The committee has decided that the contents of this publication will remain unchanged until 2005.
97 At this date, the publication will be

98 • reconfirmed;
99 • withdrawn;
100 • replaced by a revised edition, or
101 • amended.

102

INTRODUCTION

This part of IEC 60893 is one of a series which deals with industrial rigid laminated sheets based on thermosetting resins for electrical purposes.

This series consists of four parts:

– Part 1: Definitions, designations and general requirements (IEC 60893-1)
– Part 2: Methods of test (IEC 60893-2)
– Part 3: Specifications for individual materials (IEC 60893-3)
– Part 4: Typical values (IEC 60893-4)

INSULATING MATERIALS – INDUSTRIAL RIGID LAMINATED SHEETS BASED ON THERMOSETTING RESINS FOR ELECTRICAL PURPOSES –

Part 2: Methods of test

1. Scope

This part of IEC 60893 describes methods of test for the materials defined in IEC 60893-1 (referred to also as Part 1).

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 60112, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60212:2010, *Standard conditions for use prior to and during the testing of solid electrical insulating materials*

IEC 60216-1:2013, *Electrical insulating materials – Thermal endurance properties – Part 1: Ageing procedures and evaluation of test results*

IEC 60243-1:2013*, Electric strength of insulating materials – Test methods – Part 1: Tests at power frequencies*

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

IEC 60296:2012, *Fluids for electrotechnical applications - Unused mineral insulating oils for transformers and switchgear*

IEC 60587:2007, Electrical insulating materials used under severe ambient conditions – Test methods for evaluating resistance to tracking and erosion

IEC 60695-11-10:2013, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*

IEC 60893-1, *Insulating materials - Industrial rigid laminated sheets based on thermosetting resins for electrical purposes – Part 1: Definitions, designations and general requirements*

IEC 60893-3 (all parts 3), *Insulating materials - Industrial rigid laminated sheets based on thermosetting resins for electrical purposes – Part 3: Specifications for individual materials*

IEC 60893-4, *Insulating materials - Industrial rigid laminated sheets based on thermosetting resins for electrical purposes – Part 4: Typical values*

IEC 62631-3-3:2015, *Dielectric and resistive properties of solid insulating materials – Part 3-3: Determination of resistive properties (DC methods) – Insulation resistance*

ISO 62:2008, *Plastics – Determination of water absorption*

ISO 178:2010, *Plastics - Determination of flexural properties*

ISO 179-1:2000, *Plastics – Determination of Charpy impact properties – Part 1: Non-instrumented impact test*

ISO 179-2:1997, *Plastics – Determination of Charpy impact properties – Part 2: Instrumented impact test*

ISO 180:2000, *Plastics – Determination of Izod impact strength*

ISO 527-1: 2012, *Plastics – Determination of tensile properties – Part 1: General principles*

ISO 527-4:1997, *Plastics – Determination of tensile properties – Part 4: Test conditions for isotropic and orthotropic fibre-reinforced plastic composites*

ISO 604:2002, *Plastics – Determination of compressive properties*

ISO 1183-1:2012, *Plastics – Methods for determining the density of non-cellular plastics – Part 1: Immersion method, liquid pyknometer method and titration method*

ISO 3611:2010, *Micrometers for external measurements – Design and metrological characteristics*

3. Conditioning of test specimens

Unless otherwise specified, test specimens shall be conditioned for at least 24 h in standard atmosphere B according to IEC 60212 (temperature 23 °C ± 2 K relative humidity (50 ± 5) %).

Unless otherwise specified, each specimen shall be tested in the conditioning atmosphere and at the conditioning temperature, or the tests shall commence within 3 min of removal of each test specimen from the conditioning atmosphere.

Where testing at an elevated temperature is required in one of the specification sheets of IEC 60893-3, test specimens shall be conditioned for 1 h at that elevated temperature immediately before testing.

4. Dimensions

4.1 Thickness

4.1.1 General

Any method which enables the thickness of the laminated sheet to be measured at an appropriate number of points may be used, provided that the equipment used and the method of measurement are capable of a precision of 0,01 mm or better.

The following reference method has been shown to be suitable and shall be used in cases of dispute.

4.1.2 Test apparatus for reference method

In case of dispute, an external screw type micrometer according ISO 3611 having faces with diameters between 6 mm and 8 mm shall be used.

4.1.3 Procedure for reference method

Measure the thickness of the rigid laminated sheet as delivered to the nearest 0,01 mm at eight points, two along each edge but not less than 20 mm from the edge.

4.1.4 Results

Report the maximum and minimum measured values and the arithmetic mean of all measured values in mm.

4.2 Flatness

4.2.1 General

This test is applicable to all sheets having a thickness of 3 mm or greater.

4.2.2 Test specimens

The test specimen shall be the whole sheet or panel under test in the ‘as received’ condition.

4.2.3 Test method

When any sheet of nominal thickness 3,0 mm or more is placed without restraint, concave side up, on a flat surface, the departure at any point of the upper surface of the sheet from a light, straight edge 1 000 mm or 500 mm in length, laid in any direction upon it, shall not exceed the value given in the relevant sheet of IEC 60893-3 appropriate to the material, its thickness and length of straight edge. The mass of the 1 000 mm straight edge shall not exceed 800 g, and the mass of the 500 mm straight edge shall not exceed 400 g.

4.2.4 Results

Report the maximum measured deviation from flatness in mm.

NOTE In cases where the sheet deviates from flatness in two directions, is saddle-shaped, measure both deviations and report the highest.

5. Mechanical tests

5.1 Flexural strength

5.1.1 General

The flexural strength is defined as the flexural stress at rupture. It shall be determined by the method specified in ISO 178. Method A shall be used.

5.1.2 Test specimens

Cut the test specimens from the sheet to be tested with their major axes parallel to the sides of the sheet. Test five test specimens in each direction, except for types with fibres aligned mainly in the same direction. In such cases, cut five specimens only, with their long axis parallel to the direction of the fibres.

If the nominal thickness of the sheet to be tested is more than 10 mm (20 mm in the case of types PF WV), reduce the thickness of the test specimens to 10 mm (20 mm in the case of PF WV).

When it is necessary to reduce the thickness of a test specimen, machine it, leaving one face of the sheet intact. In such cases, test specimens shall be tested with the original surface of the sheet in contact with the two supports.

5.1.3 Test method

The test shall be carried out with the load applied perpendicular to the plane of the laminations. The test speed shall be 5 mm/min with a tolerance of ±20 %.

5.1.4 Results

Report the arithmetic mean of the results for each direction in MPa. Take the lower of the two mean values as the minimum flexural strength of the sheet under test, except in cases where the reinforcing fibres run mainly in one direction. In such cases, take the mean value obtained in this direction.

5.2 Modulus of elasticity in flexure

5.2.1 General

The following test method shall be used in order to determine the modulus of elasticity in flexure.

5.2.2 Test specimens

The specimens shall be in the same form as described for the flexural strength test described in 5.1.2 above.

5.2.3 Test method

Modulus of elasticity shall be determined by the method specified in ISO 178.

5.2.4 Results

Results shall be expressed in MPa.

5.3 Compressive strength

5.3.1 General

The following test method shall be used in order to determine the compressive strength.

5.3.2 Test specimens

Specimens shall be cut from the sheet under test as described in ISO 604.

5.3.3 Test method

Compressive strength shall be determined by the method specified in ISO 604 with the load applied perpendicular to the plane of the laminations.

5.3.4 Results

Results shall be expressed in MPa.

5.4 Impact strength

5.4.1 General

This test is only applicable to sheets of nominal thickness equal to or greater than 5 mm.

5.4.2 Charpy Impact strength

5.4.2.1 Test specimens

Test specimens shall be cut from the sheet under test in accordance with Figure 1a. Five specimens, with a thickness between 5 mm and 10 mm, shall be tested in each direction, except for types with fibres aligned mainly in the same direction. In such cases, cut five specimens only, with their longitudinal axis parallel to the direction of the fibres.

If the nominal thickness of the sheet to be tested is greater than 10 mm, reduce the thickness of the test specimen to 10 mm by machining equal amounts from both faces of the sheet.

5.4.2.2 Test method

The Charpy impact strength shall be determined in the edgewise direction as described by the method given in ISO 179-1 and ISO 179-2 except that the specimens shall be as described above, and the span shall be 70 mm. The material shall be tested with the major axes in each direction parallel to the sides of the sheet, except in the case of materials whose fibres lie mainly in the same direction. For these materials only specimens with their longitudinal axis parallel to the direction of the fibres shall be tested.

5.4.2.3 Results

Report the arithmetic mean of the results for each direction in kJ/m^2. Take the lower of the two mean values as the minimum Charpy impact strength of the sheet under test, except in cases where the reinforcing fibres run mainly in one direction. In such cases, take the mean value obtained in this direction.

5.4.3 Izod impact strength

5.4.3.1 Test specimens

The dimensions of the specimens shall be as described in Figure 1b. Five specimens, with a thickness between 5 mm and 10 mm, shall be tested in each direction, except for types with fibres aligned mainly in the same direction. In such cases, cut five specimens only, with their longitudinal axis parallel to the direction of the fibres.

If the nominal thickness of the sheet to be tested is greater than 10 mm, reduce the thickness of the test specimen to 10 mm by machining equal amounts from both faces of the sheet.