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Edition 1.0 2018-01

INTERNATIONAL STANDARD

Materials for printed boards and other interconnecting structures – Part 2-47: Reinforced base materials clad and unclad – Non-halogenated epoxide non-woven/woven E-glass reinforced laminate sheets of thermal conductivity 2,0 W/(m•K) and defined flammability (vertical burning test), copper-clad for lead-free assembly

IEC 61249-2-47:2018-01(en)

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International Standard IEC 61249-2-45 has been prepared by IEC technical committee 91: Electronics assembly technology.

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

CDV	Report on voting
91/1449/FDIS	91/1485/RVC

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

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

A list of all parts of the IEC 61249 series, under the general title *Materials for printed boards and other interconnecting structures*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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- withdrawn,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

A bilingual version of this publication may be issued at a later date.

MATERIALS FOR PRINTED BOARDS AND OTHER INTERCONNECTING STRUCTURES –

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1 Scope

This part of IEC 61249 gives requirements for properties of non-halogenated epoxide non-woven reinforced core/woven E-glass reinforced surface laminate sheets of thermal conductivity and defined flammability (vertical burning test), copper-clad for lead-free assembly in thicknesses of 0,60 mm up to 1,70 mm. The flammability rating is achieved through the use of non-halogenated fire retardants reacted as part of the epoxide polymeric structure. The glass transition temperature is defined to be 105 °C minimum. Thermal conductivity is defined to be (2,0 ± 0,30) W/(m•K).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 61189-2:2006, *Test methods for electrical materials, printed boards and other interconnection structures and assemblies – Part 2: Test methods for materials for interconnection structures*

IEC 61249-5-1, *Materials for interconnection structures – Part 5: Sectional specification set for conductive foils and films with and without coatings – Section 1: Copper foils (for the manufacture of copper-clad base materials)*

IEC/PAS 61249-6-3, *Specification for finished fabric woven from "E" glass for printed boards*

ISO 11014, *Safety data sheet for chemical products – Content and order of sections*

3 Terms and definitions

No terms and definitions are listed in this document.

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

4 Materials and construction

4.1 General

The sheet consists of an insulating base with metal foil bonded to one side or both.

4.2 Resin system

Non-halogenated epoxide, filled, resulting in a laminate with a glass transition temperature of 105 °C minimum.

Contrast agents may be added to enhance processing such as automated optical inspection (AOI).

Its flame resistance is defined in terms of the flammability requirements of 7.3.

4.3 Metal foil

Copper as specified in IEC 61249-5-1, copper foil (for the manufacture of copper-clad materials). The preferred foils are electrodeposited of defined ductility.

4.4 Reinforcement

Woven E-glass as specified in IEC/PAS 61249-6-3, woven E-glass fabric (for the manufacture of prepreg and copper-clad material) as the surface sheet on each side of a core reinforcement comprised of non-woven E-glass mat.

5 Electrical properties

The electrical property requirements are shown in Table 1.

Table 1 – Electrical properties

Property	Test method IEC 61189-2	Requirements
Surface resistance after damp heat while in the humidity chamber	2E04	≥5 000 MΩ
Surface resistance after damp heat and recovery (optional)	2E04	≥40 000 MΩ
Volume resistivity after damp heat while in the humidity chamber	2E04	≥5 000 MΩm
Volume resistivity after damp heat and recovery (optional)	2E04	≥10 000 MΩm
Relative permittivity after damp heat and recovery (1 MHz)	2E10	≤6,6
Dissipation factor after damp heat and recovery (1 MHz)	2E10	≤0,040
Arc resistance	2E14	≥60 s
Dielectric breakdown	2E15	≥40 kV
Surface resistance at 125 °C	2E04	≥1 000 MΩ
Volume resistivity at 125 °C	2E04	≥1 00 MΩm

6 Non-electrical properties of the copper-clad laminate

6.1 Appearance of the copper-clad sheet

6.1.1 General

The copper-clad face shall be substantially free from defects that can have an impact on the material's fitness for use for the intended purpose.

For the defects given in 6.1.2 to 6.1.5, the requirements given shall apply when inspection is made in accordance with IEC 61189-2, method 2M18.

6.1.2 Indentations (pits and dents)

The size of an indentation, usually the length, shall be determined and given a point value to be used as a measure of the quality as indicated in Table 2.

Table 2 – Size of indentations

Size mm	Point value for each indentation
0,13 to 0,25	1
0,26 to 0,50	2
0,51 to 0,75	4
0,76 to 1,00	7
Over 1,00	30

The total point count for any 300 mm × 300 mm area shall be calculated to determine the class of the material.

- Class A 29 maximum
- Class B 17 maximum
- Class C 5 maximum
- Class D 0
- Class X To be agreed upon by user and supplier

The required class of material shall be specified in the purchase order. Class A applies unless otherwise specified.

6.1.3 Wrinkles

There shall be no wrinkles in the copper surface.

The inspection area shall exclude a 13 mm border from the edge of the panel or sheet.

6.1.4 Scratches

Scratches deeper than 10 µm or 20 % of the nominal thickness of the foil thickness, whichever is lower, are not permitted.

Scratches with a depth of less than 5 % of the nominal thickness of the foil shall not be counted unless this depth is 10 µm or more.

Scratches with a depth of between 5 % and 20 % of the nominal thickness of the foil are permitted to a total length of 100 mm for a 300 mm × 300 mm area.

The inspection area shall exclude a 13 mm border from the edge of the panel or sheet.

6.1.5 Raised areas

Raised areas are usually impressions in the press plates used during manufacture but may also be caused by blisters or inclusions of foreign particles under the foil.

Raised areas caused by blisters or inclusions are not permitted.

Raised areas being impressions of defects in press plates are permitted to the following extent:

– Class A and X material maximum height 15 µm and maximum length 15 mm;
– Class B and C material maximum height 8 µm and maximum length 15 mm;
– Class D material maximum height 5 µm and maximum length 15 mm.

6.2 Appearance of the unclad face

The unclad face of single side clad sheet shall have the natural appearance resulting from the curing process. Small irregularities in colour are permitted. The gloss of the unclad face shall be that given by the press plate, release film, or release foil used. Variations of gloss due to the impact of the pressure of gases released during the curing are permitted.

6.3 Laminate thickness

If the copper-clad laminate is tested in accordance with test method 2D01 of IEC 61189-2, the thickness shall not depart from the nominal thickness by more than the appropriate value shown in Table 3. The fine tolerances shall apply unless the other tolerances are ordered.

Table 3 – Nominal thickness and tolerance of metal-clad laminate

Property	Test method IEC 61189-2	Nominal thickness including metal foil mm	Tolerance requirement ± mm		
			Coarse	Fine	Extra fine
Thickness	2D01	≥0,60 <0,80	0,08	0,06	0,05
		≥0,80 <1,00	0,17	0,10	0,08
		≥1,00 ≤1,70	0,19	0,13	0,08

The thickness and tolerances do not apply to the outer 25 mm of the trimmed master sheet or the outer 13 mm of the cut-to-size panel as manufactured and delivered by the supplier. At no point shall the thickness vary from the nominal by a value greater than 125 % of the specified tolerance.

6.4 Bow and twist

When the copper-clad laminate is tested in accordance with test method 2M01 of IEC 61189-2, the bow and twist shall not exceed the values given in Table 4.