IEC 61249-2-30

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Materials for printed boards and other interconnecting structures – Part 2-30: Reinforced base materials clad and unclad – Non-halogenated epoxide modified cyanate ester woven glass laminate of defined flammability (vertical burning test), copper-clad

Matériaux pour circuits imprimés et autres structures d'interconnexion – Partie 2-30: Matériaux de base renforcés, plaqués et non plaqués – Feuille stratifiée en tissu de verre époxyde non halogéné modifié et ester de cyanate, d'inflammabilité définie (essai de combustion verticale), plaquée cuivre

IEC 61249-2-30:2012

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

FDIS	Report on voting
91/1051/FDIS	91/1064/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.

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The committee has decided that the contents of this publication will remain unchanged until the stability 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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- replaced by a revised edition, or
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MATERIALS FOR PRINTED BOARDS AND OTHER INTERCONNECTING STRUCTURES –

Part 2-30: Reinforced base materials clad and unclad – Non-halogenated epoxide modified cyanate ester woven glass laminate of defined flammability (vertical burning test), copper-clad

1 Scope

This part of IEC 61249 gives requirements for properties of non-halogenated epoxide modified cyanate ester woven glass laminate of defined flammability (vertical burning test), copper-clad in thicknesses of 0,03 mm up to 1,60 mm. The flammability rating is achieved through the use of non-halogenated inorganic and/or organic compounds acting as fire retardants. These fire retardants are contained as part of polymeric structure or in addition to it. The glass transition temperature is defined to be 160 °C minimum.

Some property requirements may have several classes of performance. The class desired should be specified on the purchase order, otherwise the default class of material may be supplied.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 and other interconnection structures*

IEC 61249-5-1:1995, *Materials for interconnection structures – Part 5: Sectional specification set for conductive foils and films with or without coatings – Section 1: Copper foils (for the manufacture of copper-clad base materials)*

IEC/PAS 61249-6-3:2011, *Specification for finished fabric woven from E-glass for printed boards*

ISO 11014:2009, *Safety data sheet for chemical products – Content and order of sections*

3 Materials and construction

3.1 General

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

3.2 Resin system

Non-halogenated epoxide modified cyanate ester resulting in a laminate with a glass transition temperature of 160 °C minimum. The maximum total halogens contained in the resin plus reinforcement matrix is 1 500 ppm, with a maximum chlorine of 900 ppm and maximum bromine being 900 ppm.

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.

3.3 Reinforcement

Woven E-glass as specified in IEC/PAS 61249-6-3, woven E-glass fabric (for the manufacture of prepreg and copper clad materials).

3.4 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 Internal marking

Not specified.

5 Electrical properties

The requirements for the electrical properties are shown in Table 1.

Table 1 – Electrical properties

Property	Test method IEC 61189-2	Requirements
Resistance of foil	2E12	As specified in IEC 61249-5-1
Surface resistance after damp heat while in the humidity chamber (optional)	2E03	≥10 000 MΩ
Surface resistance after damp heat and recovery	2E03	≥50 000 MΩ
Volume resistivity after damp heat while in the humidity chamber (optional)	2E04	≥10 000 MΩm
Volume resistivity after damp heat and recovery	2E04	≥50 000 MΩm
Relative permittivity after damp heat and recovery at 1 MHz	2E10	≤5,5
Dissipation factor after damp heat and recovery at 1 MHz	2E10	≤0,020
Electric strength(only for material thicknesses <0,5 mm)	2E11	>30 kV/mm
Arc resistance (only for material thicknesses ≥ 0,5 mm thickness)	2E14	≥120 s
Dielectric breakdown (only for material thicknesses ≥ 0,5 mm thickness)	2E15	≥40 kV

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 may have an impact on the material´s fitness for use for the intended purpose.

For the following specific defects the requirements given shall apply when inspection is carried out 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 measure of the quality, see Table 2.

Table 2 – Indentations

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

The total point count for any 300 mm × 300 mm area shall be calculated to determine the indentation 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 indentation class of material shall be specified in the purchase order. Indentation Class A applies unless otherwise specified.

6.1.3 Wrinkles

There shall be no wrinkles in the copper surface.

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 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 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.

6.1.5 Raised areas

Raised areas are usually impressions caused by defects 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 caused by 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 length15 mm

6.1.6 Surface waviness

When examined in accordance to test method 2M12 of IEC 61189-2, the surface waviness in both the machine and crossmachine direction shall not exceed 7 μm.

6.2 Appearance of the unclad face

The unclad face of a single-sided 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 pressure of gases released during the curing are permitted.

6.3 Laminate thickness

The laminate thickness may be ordered to include or exclude the copper foil contribution as specified in the purchase order. As a general rule, laminates less than 0,8 mm are measured excluding copper, and laminates greater or equal to 0,8 mm are measured including copper. 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

Nominal thickness excluding metal foil (material intended for mutilayer boards) mm	Nominal thickness including metal foil (material intended for single or double sided boards) mm	Tolerance requirement ± mm		
		Coarse	Fine	Extra fine
≥0,03 ≤ 0,10		0,03	0,02	0,01
>0,10 ≤ 0,15		0,04	0,03	0,02
>0,15 ≤ 0,30		0,05	0,04	0,03
>0,30 ≤ 0,50		0,08	0,05	0,04
>0,50 ≤ 0,80		0,09	0,06	0,05
>0,80 ≤ 1,00	≥0,80 ≤ 1,00	0,13	0,09	0,07
>1,00 ≤ 1,30	>1,00 ≤ 1,30	0,17	0,11	0,08
	>1,30 ≤ 1,60	0,20	0,13	0,10

The thicknesses and tolerances do not apply to the outer 25 mm of the trimmed sheet or the outer 13 mm of the cut 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 2M01of IEC 61189-2, the bow and twist shall not exceed the values given in Table 4.

Table 4 – Bow and twist

Property	Test method IEC 61189-2	Nominal thickness mm	Panel dimension longest side mm	Requirements %	
				Copper foil on one side	Copper foil on both sides
Bow and twist	2M01	≥0,8 ≤ 1,3	≤350	≤2,0	≤1,5
			>350 ≤ 500	≤1,8	≤1,3
			>500	≤1,5	≤1,0
		>1,3 ≤ 1,6	≤350	≤1,5	≤1,0
			>350 ≤ 500	≤1,3	≤0,8
			>500	≤1,0	≤0,5
NOTE The requirements for bow and twist apply only to one-sided copper-clad laminates with maximum foil thickness of 105 µm (915 g/m^2) and double-sided copper-clad laminates with maximum foil thickness difference of 70 µm (610 g/m^2). Requirements for laminates with copper foil configurations beyond these limits should be subject to agreement between purchaser and supplier.					

6.5 Properties related to the copper foil bond

Pull-off and peel strength requirements are shown in Table 5. These requirements apply to copper foil with a normal profile depth. In the case of low or very low profile copper foil, the requirements shall be at least 50 % of that shown in Table 5 as a minimum.

Table 5 – Pull-off and peel strength

Property	Test method IEC 61189-2	Requirements			
Pull-off strength	2M05	≥20 N			
		Thickness of the copper foil			
		≤12 µm (101 g/m^2)	18 µm (152 g/m^2)	35 µm (305 g/m^2)	≥70 µm (610 g/m^2)
Peel strength after dry heat 150 °C	2M15	≥0,3 N/mm	≥0,4 N/mm	≥0,5 N/mm	≥0,7 N/mm
		No blistering nor delamination			
Peel strength at high temperature	2M17				
Temperature 125 °C (optional)		≥0,3 N/mm	≥0,4 N/mm	≥0,5 N/mm	≥0,6 N/mm
Temperature 260 °C (optional)		Not specified	Not specified	Not specified	Not specified
In case of difficulty due to breakage of the foil or reading range of the force measuring device, the measurement of peel strength at high temperature may be carried out using conductor widths of more than 3 mm.					

6.6 Punching and machining

Punching is not applicable. The laminate shall, in accordance with the manufacturer's recommendations, be capable of being sheared or drilled. Delamination at the edges due to

the shearing process is permissible, provided that the depth of delamination is not larger than the thickness of the base material. Delamination at the edges of drilled holes due to the drilling process is not permissible. Drilled holes shall be capable of being through-plated with no interference from any exudations into the hole.

6.7 Dimensional stability

When specimens are tested in accordance to IEC 61189-2, Method 2X02, the observed tolerance shall be as specified in Table 6. The nominal dimensional stability value shall be as agreed upon between user and vendor. The tolerance range around the ageed upon nominal value shall be Class B, unless otherwise specified on the purchase order.

The choice of the glass fabrics in the construction of the laminate has a significant impact on dimensional stability. Examples of typical constructions used in printed board applications can be found in Annex B. Annex B is not a construction requirement table but is presented for engineering information only.

Table 6 – Dimensional stability

Property	Test method IEC 61189-2	Class	Tolerances ppm
Dimensional stability	2X02	A	±500
		B	±300
		C	±100
		X	As agreed upon between user and supplier

6.8 Sheet sizes

6.8.1 Typical sheet sizes

Sheet sizes are matters of agreement between purchaser and supplier. However, the recommended sizes are listed below:

– 915 mm × 1 220 mm;
– 1 065 mm × 1 155 mm;
– 1 065 mm × 1 280 mm;
– 1 000 mm × 1 000 mm;
– 1 000 mm × 1 200 mm.

6.8.2 Tolerances for sheet sizes

The size of sheet delivered by the supplier shall not deviate by more than $^{+20}_{-0}$ mm from the ordered size.

6.9 Cut panels

6.9.1 Cut panel sizes

Cut panel sizes shall be, when delivered, in accordance with the purchaser's specification.

6.9.2 Size tolerances for cut panels

For panels cut to size according to the purchaser's specification, the following tolerances for length and width shall apply as shown in Table 7. Tolerances indicated as normal shall be in effect unless otherwise specified in the purchasing specification.