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JIS C 6490 : 1998

**Base materials for printed circuits—  
Polyimide woven glass fabric  
copper-clad laminated sheet  
of defined flammability  
(vertical burning test)**

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ICS 31.180

**Descriptors** : printed-circuit bases, laminates, copper, glass, thermosetting polymers,  
thermoplastic polymers

**Reference number** : JIS C 6490 : 1998 (E)

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## Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of International Trade and Industry through deliberations at Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law. Consequently JIS C 6490 : 1993 is replaced with JIS C 6490 : 1998.

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In the event of any doubts arising as to the contents,  
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Printed in Japan

# Base materials for printed circuits— Polyimide woven glass fabric copper-clad laminated sheet of defined flammability (vertical burning test)

**Introduction** This Japanese Industrial Standard has been prepared based on IEC 60249-2-16 *Base materials for printed circuits—Part 2 : Specifications—Specification No.16 : Polyimide woven glass fabric copper-clad laminated sheet of defined flammability (vertical burning test)* published as the first edition in 1992, Amendment 1 (1993) and Amendment 2 (1994) with some modifications in line with actual conditions in Japan to such items as surface corrosion, corrosion at the edge, etc. Those amendments were edited and compiled into the text.

The portions with dotted underlines show the matters not included in the original International Standard. The IEC standard number is based on the new numbering system of IEC standards put in force on January 1st, 1997, and the standards published before the said date are numbered by adding 60000 to the former number. This is only the change in the numbering system and the contents remain unchanged.

**1 Scope** This Standard specifies requirements on polyimide woven glass fabric copper-clad laminated sheet of defined flammability (vertical burning test), in thickness of 0.5 mm up to 6.4 mm (hereafter referred to as "copper-clad laminates").

Polyimide woven glass fabric laminates are available in two types:

- type 1: modified polyimide resin
- type 2: unmodified polyimide resin

The two types have equal properties except for the glass transition temperature, and this specification therefore differentiates them only in respect of the glass transition temperature.

**Remarks 1** To designate this material, the reference 60249-2-16-FV1-IEC-PI-GC-Cu may be used; if there is no risk of confusion, the type designation may be abbreviated to read IEC-60249-2-16-FV1.

**2** The corresponding International Standard is as follows.

IEC 60249-2-16 : 1992 *Base materials for printed circuits—Part 2 : Specifications—Specification No.16 : Polyimide woven glass fabric copper-clad laminated sheet of defined flammability (vertical burning test)*

**2 Normative references** The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards indicated below shall be applied.

JIS C 6481 *Test methods of copper-clad laminates for printed wiring boards*

JIS C 6515 *Copper foil for printed wiring boards*

**Remarks :** This standard is identical with IEC 61249-5-1 : 1995 *Materials for interconnection structures—Part 5 : Sectional specification set for con-*

*ductive foils and films with and without coatings—Section 1 : Copper foils (for the manufacture of copper-clad base materials).*

IEC 60249-1 : 1982 *Base materials for printed circuits—Part 1 : Test methods.*  
Amendment No. 4 (1993)

IEC 61189-2 : 1997 *Test methods for electrical materials, interconnection structures and assemblies—Part 2 : Test methods for materials for interconnection structures*

**3 Materials and construction** The sheet consists of an insulating base with metal foil bonded to one or both sides.

**3.1 Insulating base** Polyimide resin bonded woven glass fabric laminate. Its flame resistance is defined in terms of the flammability requirements of 7.3.

**3.2 Metal foil** Copper as specified in JIS C 6515.

The preferred foils are type E (electro-deposited copper) of standard ductility.

**4 Internal marking** Not specified.

## 5 Electrical properties

**Table 1 Electrical properties**

| Property                                                                 | Test method<br>(sub-clause of IEC 60249-1) | Requirement                                                              |
|--------------------------------------------------------------------------|--------------------------------------------|--------------------------------------------------------------------------|
| Resistance of foil                                                       | 2.1                                        | As specified in JIS C 6515.                                              |
| Surface resistance after damp heat in the humidity chamber (optional)    | 2.2                                        | 10 000 MΩ min.                                                           |
| Surface resistance after damp heat and recovery                          | 2.2                                        | 50 000 MΩ min.                                                           |
| Volume resistivity after damp heat in the humidity chamber (optional)    | 2.3<br>IEC 61189-2 : 2E04                  | 10 000 MΩ · m min.                                                       |
| Volume resistivity after damp heat recovery                              | 2.3<br>IEC 61189-2 : 2E04                  | 50 000 MΩ · m min.                                                       |
| Surface corrosion <sup>(1)</sup>                                         | 2.4                                        | No visible corrosion products in the gap.                                |
| Corrosion at the edge <sup>(1)</sup>                                     | 2.5                                        | Positive pole: not worse than A/B.<br>Negative pole: not worse than 1.4. |
| Relative permittivity after damp heat and recovery                       | 2.7                                        | The average value shall not exceed 5.4.                                  |
| Dielectric dissipation factor after damp heat and recovery               | 2.7                                        | The average value shall not exceed 0.025.                                |
| Electric strength (optional), material thickness not greater than 0.8 mm | 2.8                                        | 30 kV/mm min.                                                            |
| Surface resistance at 200 °C <sup>(1)</sup>                              | 2.9.1                                      | 50 000 MΩ min.                                                           |
| Volume resistivity at 200 °C <sup>(1)</sup>                              | 2.9.1                                      | 50 000 MΩ · m min.                                                       |

Table 1 (concluded)

| Property                             |               | Test method<br>(sub-clause of IEC 60249-1) | Requirement     |
|--------------------------------------|---------------|--------------------------------------------|-----------------|
| Insulation resistance <sup>(2)</sup> | Normal state  | JIS C 6481 : 5.11                          | 500 000 MΩ min. |
|                                      | After boiling |                                            | 1 000 MΩ min.   |

Notes (1) This test may be omitted subject to agreement between the parties concerned with acceptance.

(2) This test method has been achieved and experienced a lot in Japan and is under proposal to the IEC. The test method of JIS C 6481 for insulation resistance is applicable until adoption by the IEC.

## 6 Non-electrical properties of the copper-clad sheet

### 6.1 Appearance of the copper-clad face

**6.1.1 Normal surface finish** The copper-clad face shall be substantially free from blisters, wrinkles, pin-holes, deep scratches, pits and resin. Any discoloration and contamination shall be readily removable with a hydrochloric acid solution of density 1.02 g/cm<sup>3</sup> (4 wt%) or with a suitable organic solvent.

**6.1.2 High-quality surface finish (optional)** If a surface of high quality is essential for precious metal plating or fine line etching and is ordered by the purchaser, the following requirements shall apply in addition to those of 6.1.1 when inspected in accordance with 3.9 of IEC 60249-1.

- The surface finish of the copper-clad face shall be such as not to conceal imperfections.
- The surface of the copper foil shall be free from scratches of depth greater than 0.010 mm, or  $\frac{1}{5}$  of the nominal thickness of the copper foil, whichever is the lower.
- The total length of scratches of depth greater than 0.005 mm but not more than 0.010 mm shall not exceed 1 m per square meter of the total area of the sheet.
- This requirement applies to the surface of 35 μm (305 g/m<sup>2</sup>) and 70 μm (610 g/m<sup>2</sup>) foils. Permitted scratches on surface of 18 μm (152 g/m<sup>2</sup>) foil are still under consideration.
- The total area of all pin-holes in an area of 0.5 m<sup>2</sup> shall not exceed 0.012 mm<sup>2</sup>.
- No sheet shall have more imperfections of the types listed than those permitted by Table 2.

### 6.1.3 Surface roughness (optional)

Under consideration.