

Materials for printed boards and other interconnecting structures —

Part 3-1: Copper-clad laminates for flexible boards (adhesive and non-adhesive types)

ICS 31.180

National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

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**Materials for printed boards and other
interconnecting structures –**

**Part 3-1:
Copper-clad laminates for flexible boards
(adhesive and non-adhesive types)**



JPCA

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MATERIALS FOR PRINTED BOARDS AND OTHER INTERCONNECTING STRUCTURES –

Part 3-1: Copper-clad laminates for flexible boards (Adhesive and non-adhesive types)

1 Scope

This PAS specifies the properties of copper-clad laminates used for flexible boards for both adhesive and non-adhesive types.

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.

JPCA-TD01, *Terms and definition for printed circuits*

JIS C 5603, *Terms and definition for printed circuits*

JIS C 6471, *Test methods of copper-clad laminates for flexible printed wiring boards*

JIS C 6472, *Copper-clad laminates for flexible printed wiring boards (Polymer film, Polyimide film)*

JIS C 6515, *Copper foil for printed wiring boards*

IEC 60194, *Printed board design, manufacture and assembly – Terms and definitions*

IPC-4204, *Flexible Metal-Clad Dielectrics for Use in Fabrication of Flexible Printed Circuitry*

ASTM D149, *Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies*

ASTM D150, *Standard Test Methods for AC Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulation*

ASTM D882, *Standard Test Method for Tensile Properties of Thin Plastic Sheeting*

3 Terms and definitions

For the purposes of this document, the following terms and definitions, as well as those mentioned in IEC 60194, JIS C 5603 and JPCA-TD01, apply.

3.1

machine direction (MD)

longitudinal direction in production of film, copper foil, and copper-clad laminate

3.2

transverse direction (TD)

transverse direction in production of film, copper foil, and copper-clad laminate

4 Designation of copper-clad laminates

The designation of types of laminates shall be made in the following way. Constituent designations are connected by hyphens.

Symbol for identifying copper-clad laminate	Symbol for base material and its thickness	Symbol for adhesive and its thickness	Symbol for type and grade of copper-foil and thickness	Symbol for profile and treatment	Symbol for flammability
(3.1)	(3.2) (3.3)	(3.4) (3.5)	(3.6) (3.7) (3.8)	(3.9) (3.10)	(3.11)
Example: ADF	- E6	- TA	- E1/12/12	- V1	- F

4.1 Copper-clad laminate

The symbol to show the types of flexible printed wiring boards (hereinafter called CCL) shall be as given in Table 1.

Table 1 – Copper-clad laminates

Symbol	Copper-clad laminate
ADF	Adhesive type (3-layer) CCL
ALF	Non-adhesive type (2-layer) CCL

4.2 Base materials

The symbol to designate the base material shall be as given in Table 2.

Table 2 – Base materials

Symbol	Base material
E	Polyimide
B	Polyethylene terephthalate (PET)
A	Polyvinyl fluoride (PVF)
C	Ethylene fluoride-propylene copolymer (FEP)
D	Polytetra fluoroethylene (PTFE)
F	Aramid
G	Polyamide-imide
H	Epoxy
J	Polyether imide
K	Polysulfone
L	Polyethylene naphthalate (PEN)
M	Liquid crystal polymer (LCP)
X	Others

4.3 Thickness of the base material

The symbol to designate the thickness of base material shall be as given in Table 3.

Table 3 – Thickness of base material

Symbol	Thickness of base material μm
0	No base material
1	25
2	50
3	75
4	100
5	125
6	12,5
7	38
8	17,5
9	10
10	7,5
11	20
12	40
X	Other thickness
NOTE A thickness of 15 μm is an example of another thickness.	

4.4 Types of adhesives

The symbol to designate the adhesive shall be as given in Table 4.

Table 4 – Adhesives

Symbol	Adhesive
L	Epoxy resin
M	Acrylate
N	Polyester
O	No adhesive
P	Butyl phenol
R	Ethylene fluoride–propylene copolymer (FEP)
S	Nitrile phenol
T	Polyimide
U	Polyether
W	Perfluoroalkoxy (PFA)
Y	Cyanate ester
X	Other thickness

4.5 Thickness of base materials and adhesives

The symbol to designate the thickness of base material and adhesives shall be as given in Table 5.

Table 5 – Thickness of adhesives

Symbol	Thickness of adhesive µm
O	No adhesive
A	2,5
B	5
C	7,5
D	10
E	13
F	15
H	18
J	20
K	23
L	40
M	25
X	Other thickness

4.6 Type of copper foil

The symbol to designate the type of copper foil shall be as follows.

- Type E: Electrodeposited copper foil
- Type R: Rolled copper foil
- Type O: Other type

4.7 Grade of copper foil

The symbol to designate the grade of copper foil shall be as given in Table 6. A slash shall be used between the symbols of grade and the thickness of the copper foil.

Table 6 – Grade of copper foil

Symbol	Type of copper foil
E1	Standard electrodeposited copper foil
E2	High-ductility electrodeposited copper foil
E3	High temperature elongation electrodeposited copper foil
R1	As-rolled wrought copper foil
R2	Light cold-rolled wrought copper foil
R3	Annealed wrought copper foil
O	Copper foil made by means other than rolling or electrolysis

4.8 Copper-foil thickness

The symbol to designate the thickness of copper foil shall be as given in Table 7. The thicknesses of the copper foils on both surfaces of a base (double-sided laminate) are expressed by two numbers separated by a slash. The thickness of copper foil of single-sided laminate is expressed with "0" after the slash. In the case of double-sided CCL with different copper foil thickness on both sides of the laminate, the thicker copper foil thickness shall be stated first in front of the slash. The designation for type O is to be agreed upon between the supplier and the user.

Table 7 – Thickness of copper foil (Types E and R)

Symbol	Nominal thickness μm	Mass designation g/m^2
Less than 5	Less than 5	To be agreed upon between the supplier and the user
9	9	76
12	12	107
18	18	152
25	25	230
35	35	305
50	50	445
70	70	610

4.9 Types of profiles

The symbol to designate the profile of copper foil to increase the adhesivity of the copper surface shall be as given in Table 8.

Table 8 – Types of profiles

Designation	Type	Ten-point height of roughness profile (Rz) μm
S	Standard	Less than 14*
L	Flatter than S (low profile)	Less than 10
V	Flatter than L (very low profile)	Less than 5
Z	Flatter than Z (ultra low profile)	Less than 2,5
* Applicable range: Thickness of less than 70 μm		
NOTE The measurement of the surface roughness is made by a stylus instrument. Use of an optical laser surface measurement is based on agreement between the user and the supplier.		

4.10 Surface treatment to increase copper adhesivity and anti-rust

The surface treatment for the purpose of increasing copper adhesivity and for anti-rusting may be applied on either both sides or a single side of the CCL. The symbol for the surface treatment shall be as follows.

0. No surface treatment for adhesivity increase, but both surfaces treated for anti-rusting.
1. Surface treatment for adhesivity increase on one surface, and treated for anti-rusting on both sides.
2. Surface treatment for adhesivity increase on both surfaces, and also treated for anti-rusting on both sides.

4.11 Symbol for flammability

An English capital letter “F” shall be designated when CCL complies the requirement of flammability stated in 6.3 (properties of CCL).

5 Observation

5.1 Base film

There shall be no break, hole, or wrinkle by folding in base film. There shall not be any defect that is harmful for the performance of CCL such as scratch, dent, surface damage, or any contamination.