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**Copper foil for
printed wiring boards**

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Foreword

This translation has been made based on the original Japanese Industrial Standard established 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 Consequently **JIS C 6511 : 1992**, **JIS C 6512 : 1992** and **JIS C 6513 : 1996** are withdrawn and replaced with **JIS C 6515 : 1998**.

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Copper foil for printed wiring boards

Introduction

This Japanese Industrial Standard has been prepared, based on the 1995 Edition of **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), without changing the technical contents.

Those underlined passages by dotted line in this Standard are not stated in the original **IEC** Standard. And **IEC** Standards referred herein are assigned numbers in accordance with the new **IEC** Number Code effective since January 1st, 1997. As for previously issued **IEC** Standards, their numbers have been changed to 60000 plussed numbers, but this does not mean any change made in their contents.

1 Scope

This specification gives requirements for properties of copper foil intended for use in the manufacture of copper-clad laminated sheets and of copper-clad flexible materials, used in the manufacture of printed boards.

It applies to copper foil supplied in rolls, sheets or cut panels.

2 Normative reference

The following Standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of these normative standards shall be applied.

IEC 60249-1 Base materials for printed circuits—Part 1: Test methods

IEC 61249-5 Materials for interconnection structures—Part 5: Sectional specification set for conductive foils and films with and without coatings

ISO 4287-1 Surface roughness—Terminology—Part 1: Surface and its parameters

3 Designation

3.1 Types of copper foil

Copper foil for the uses considered in this specification includes the following two types:

E = electrodeposited copper foil;

R = rolled copper foil,

with the grades given in table 1.

Table 1 – Types and grades of copper foil

Type designation	Type
E1	Standard electrodeposited
E2	High ductility electrodeposited
E3	High temperature elongation electrodeposited
R1	As rolled wrought
R2	Light cold rolled wrought
R3	Annealed wrought

3.2 Types of surface profile

In consideration of the processes used in the manufacturing of both electrodeposited and rolled copper, three designations for rough side profile are given in table 2.

Table 2 – Types of profile

Type designation	Grade	Ten point average maximum height of profile (R_z) μm
S	Standard	14*
L	Low profile	10
V	Very low profile	5
* For copper foil thicknesses up to 105 μm only.		

The ten points average height of irregularities corresponds to the term R_z of **ISO 4287-1** and is measured by the test method described in Annex A.2.5.

In future, **IEC 61189-2** (Test methods for electrical materials, interconnection structures and assemblies—Part 2: Test methods for materials for interconnection structures)⁽¹⁾ shall be applied, as from the date of its enactment.

3.3 Bond enhancing treatment and passivation

A chemical or electrochemical surface treatment shall be applied to the copper foil to increase the bonding strength to the substrate. Such treatment may be applied to one or both sides, designating 1 for one side treatment and 2 for both side treatment.

In case of one side treatment on electrodeposited copper foil it shall be applied to the rough side of the foil.

A chemical passivation shall be applied to both sides of the foil to increase its shelf life.

3.4 Complete designation

For the designation of copper foils according to this specification the following code shall be used:

Note (1) See Annex B.

Example:

	CU-JIS C 6515- 35 - E2 - S 1
Thickness of foil in μm	
Foil type	
Profile type	
Treatment on one side (2 = on both sides)	

If there is no risk of confusion, the designation may be abbreviated to read:

CU-JIS-35-E2-S1.

4 Mass per unit area and thickness

The primary measure of quantity of copper foil shall be the mass per unit area, together with applicable tolerances.

Thicknesses of copper foil corresponding to specified values of mass per unit area shall be regarded as given for information only.

Table 3 – Mass per unit area and thickness

Requirements		For information only
Nominal mass per unit area	Tolerance of nominal mass per unit area	Nominal thickness
g/m^2	%	μm
45	10*	5
76	10*	9
107	10*	12
152	10*	18
230	10	25
305	10	35
445	10	50
610	10	70
915	10	105
1220	10	140
1525	10	175
1830	10	210
* These specification shall not be applied to type R copper foil.		

Mass per unit area shall be determined by the test method given in Annex A.2.1. Direct thickness measurements on microsections result in incorrect values due to the irregularities caused by the treatment roughness.

5 Copper purity

Copper foils without treatment shall have the following minimum purity (with silver content regarded as copper):

Type E : 99.8 mass % copper;

Type R : 99.9 mass % copper.

The copper content shall be determined after removal of the surface treatment or contamination by the test method given in Annex A.2.2.

6 Electrical properties

The minimum conductivity of copper foils is a percentage of that of the International Annealed Copper Standard (IACS) at 20 °C as given in table 4 and 5; 100 % corresponds to $0.5800 \times 10^8 \Omega^{-1} \text{ m}^{-1}$ minimum electrical conductivity or $1,7241 \times 10^{-8} \Omega \text{ m}$ maximum resistivity.

Maximum specimen resistance of copper foils shall be measured by using the test method specified in IEC 60249-1. In future, the test method No.2 E12 specified in IEC 61189-2⁽²⁾ shall be applied, as from the date of its enactment.

The electrical properties of type E copper foils and type R copper foils of different nominal mass per unit area, shall have the values given in table 4 and table 5.

Table 4 – Electrical conductivity and specimen resistance of type E copper foils

Nominal thickness μm	Nominal Mass per unit area g/m^2	Minimum IACS conductivity %	Maximum specimen resistance $\text{m}\Omega$
5	45	88.5	25.0
9	76	90.5	15.0
12	107	92.14	10.4
18	152	94.12	7.1
25	230	95.05	4.7
35	305	96.60	3.5
50	445	96.60	2.4
70	610	96.60	1.7
105	915	96.60	1.2
140	1 220	96.60	0.87
175	1 525	96.60	0.70
210	1 830	96.60	0.58

Note (2) See Annex B.