



ASSOCIATION CONNECTING
ELECTRONICS INDUSTRIES

IPC-4562A

Amendment 1

Metal Foil for Printed Board Applications

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A standard developed by IPC

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Standards Should:

- Show relationship to Design for Manufacturability (DFM) and Design for the Environment (DFE)
- Minimize time to market
- Contain simple (simplified) language
- Just include spec information
- Focus on end product performance
- Include a feedback system on use and problems for future improvement

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- Inhibit innovation
- Increase time-to-market
- Keep people out
- Increase cycle time
- Tell you how to make something
- Contain anything that cannot be defended with data

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Metal Foil for Printed Board Applications

Replace Section 1.2.4.1 with the following:

1.2.4.1 Foil Grades Foil grades **shall** be distinguished according to the following foil grade designations:

1. Standard electrodeposited (STD-Type E)
2. High ductility electrodeposited (HD-Type E)
3. High temperature elongation electrodeposited (HTE-Type E)
5. As rolled-wrought (AR-Type W)
6. Light cold rolled-wrought (LCR-type W)
7. Annealed-wrought (ANN-Type W)
8. As rolled-wrought low temperature annealable (LTA-Type W)
9. Nickel, standard electrodeposited
10. Electrodeposited low temperature annealable (LTA-Type E)
11. Electrodeposited annealable (A-Type E)

Replace Table A1 and footnotes in Appendix A - Cooper Foil Applications with the following:

Table A1 Application Guide for Copper Foil

T Y P E	G R A D E	C L A S S	Handling	Maximum Strain Range (%) / Minimum Bend Diameter (μm [10^{-3} in]) Accommodated by 1 oz. (CIT) Foil ¹					
				Flex to Install		Continuous Flexing	Flex to Install		Continuous Flexing
				Single Bend	Low Cycle Fatigue ²	High Cycle Fatigue ²	Single Bend	Low Cycle Fatigue ²	High Cycle Fatigue ²
				At Room Temperature			At Elevated Temperature (180°C [356°F]) ³		
E	1	All	Good	Not recommended for applications requiring foil flexing or bending					
E	2	All	Good	30/84 [3.31]	7.1/965 [37.99]	0.19/37,338 [1470]	Not applicable		
E	3	All	Good	20/142 [5.59]	5.3/1320 [51.968]	0.18/39,624 [1560]	15/201 [7.913]	4.2/1600 [62.992]	0.17/40,894 [1610]
W	5 ⁴	All	Good	30/84 [3.31]	7.5/914 [35.98]	0.32/22,098 [870]	15/201 [7.913]	4.2/1600 [62.992]	0.17/40,894 [1610]
W	5 ⁵	All	Good	65/20 [0.787]	13.1/508 [20]	0.32/22,098 [870]	TBD	TBD	TBD
W	6 ⁶	All	–	–	–	–	–	–	–
W	7	All	Caution ⁸	65/20 [0.787]	12.5/533 [20.98]	0.32/22,098 [870]	45/43 [1.69]	9.5/711 [27.99]	0.20/34,798 [1370]
W	8 ⁷	All	Good	25/102 [4.0157]	6.2/1118 [44.0157]	0.15/48,006 [1890]	TBD	TBD	TBD
E	9	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
E	10	All	Good	41/51 [2.0079]	8.9/762 [30]	0.31/22,860 [900]	32/76 [2.99]	6.8/1016 [40]	0.22/33,020 [1300]
E	11	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

1. Larger maximum strain range and smaller minimum bend diameter values indicate superior performance for a given strain mode.
2. Low cycle fatigue <500 cycles-to-failure. High cycle fatigue >10⁴ cycles-to-failure. The values given here have been calculated for 20 and 10⁵ fatigue cycles for low- and high-cycle fatigue, respectively. For the calculations the minimum mechanical properties for 34 μm [0.00134 in] copper foil given in the respective slash sheets have been used. Typical property values can be considerably higher. (See IPC-TR-484.)
3. The values for elevated temperature applications should primarily be used for qualitative purposes, since unproven assumptions were necessary for their calculation.
4. W5 foil is highly anisotropic due to the rolling process; in the rolling direction the performance values can surpass those given for W7 foil.
5. The values given apply in the foil rolling direction *only*. For cross-machine direction values see previous line.
6. Choice of temper allows trade-off in handling/high-cycle fatigue vs. high strain/low-cycle fatigue properties. Grades 5 and 7 are the limiting tempers.
7. Handling characterization is for as-received foil; maximum strain range/minimum bend diameter values apply to W8 foil after low-temperature annealing at 177°C [350.6°F] for 15 minutes.
8. Handling difficulties normally occur only with thinner foils.

Replace the “Specification Sheets for Copper Foil” with the following:

Specification Sheets for Copper Foil

Specification Sheet #	Description	Specification Sheet #	Description
01	Standard Electrodeposited CU-E1	07	Annealed-Wrought CU-W7
02	High Ductility Electrodeposited CU-E2	08	As Rolled-Wrought Low Temperature Annealable CU-W8
03	High Temperature Elongation CU-E3	09	Standard Electrodeposited Ni/E1
04	DELETED	10	Electrodeposited Low Temperature Annealable CU-E10
05	As Rolled Wrought CU-W5	11	Electrodeposited Annealable CU-E11
06	Light Cold Rolled-Wrought CU-W6		

Add the Specification Sheet IPC-4562/6 (CU-W6) with its footnotes between two Specification Sheets: IPC-4562/5 (CU-W5) and IPC-4562/7 (CU-W7):

Metal Foil COPPER
Light Cold Rolled-Wrought IPC-4562/6
CU-W6

Property ¹	Classes 1, 2 & 3	
	Foil Thickness	
	1	2
Properties at 23°C [73.4°F]		
Tensile Strength (MPa) [kpsi]	177-345 [25-50]	177-345 [25-50]
Ductility		
Fatigue Ductility [%]	65-30	65-30
Elongation ² [%]	10-0.5	20-1

TBD = To Be Developed NA = Not Applicable

1. All values in the table are minimums for any single TD measurement in the as-received condition. Foil properties can change with further treatment and time. Minimum properties for foil thicknesses other than listed **shall** be AABUS. The test methods to determine these properties **shall** be those listed in Table 4-1.
2. Elongation measurements **shall** be made with 51 mm [2.01 in] gage length and a cross-head speed of 51 mm/min [2.01 in/min] at 23°C [73.4°F] and 1.30 mm/min [0.05118 in/min] at 180°C [356°F].