nelco
Subsidiary of Park Electrochemical Corp.

Nelco Products Pte Ltd
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N4000-6

Processing Guideline

Rev : 05/2000

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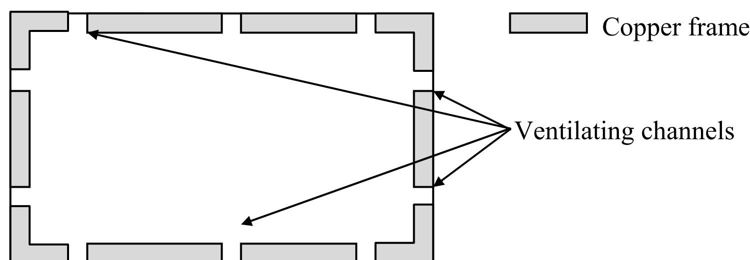
1.0 General Guideline For Inner Layer Circuitry Design

1.1 Inner layer copper frame

The thickness of a multi-layer board work panel tend to be thinner at the edges than the centre portion. This is due to the loss of resin as a result of more resin flow at the edges. Copper frame is commonly added to the edges of the inner layer to prevent excessive flow and therefore reduce the thickness distribution in a work panel.

The following diagram illustrated a typical copper frame design. It is important to include some ventilating channels to the solid copper frame to a allow the flow of volatile gas and any trapped air to escape.



1.2 Artwork compensation factor

Due to stress re-orientation during lamination process, the inner layer board dimension will change. The movement can be compensated at the circuit artwork.

The actual compensation factor of a multi-layer PCB has to be determined prior to volume production, as there are many factors involved. There are some typical factors for dimensional movement :

a) Inner layer board thickness
b) Copper density of circuitry
c) Circuitry trace thickness
d) Type of prepreg used as bonding sheet

1.3 Multi-layer PCB lay-up

Care should be taken in order t optimise the bonding strength of prepreg and laminate. The following suggestions are recommended :

a) Selection of prepreg

Besides meeting the thickness requirement, the bonding sheet (prepreg) thickness should have adequate volume of resin to encapsulate circuitry and fill the spaces.

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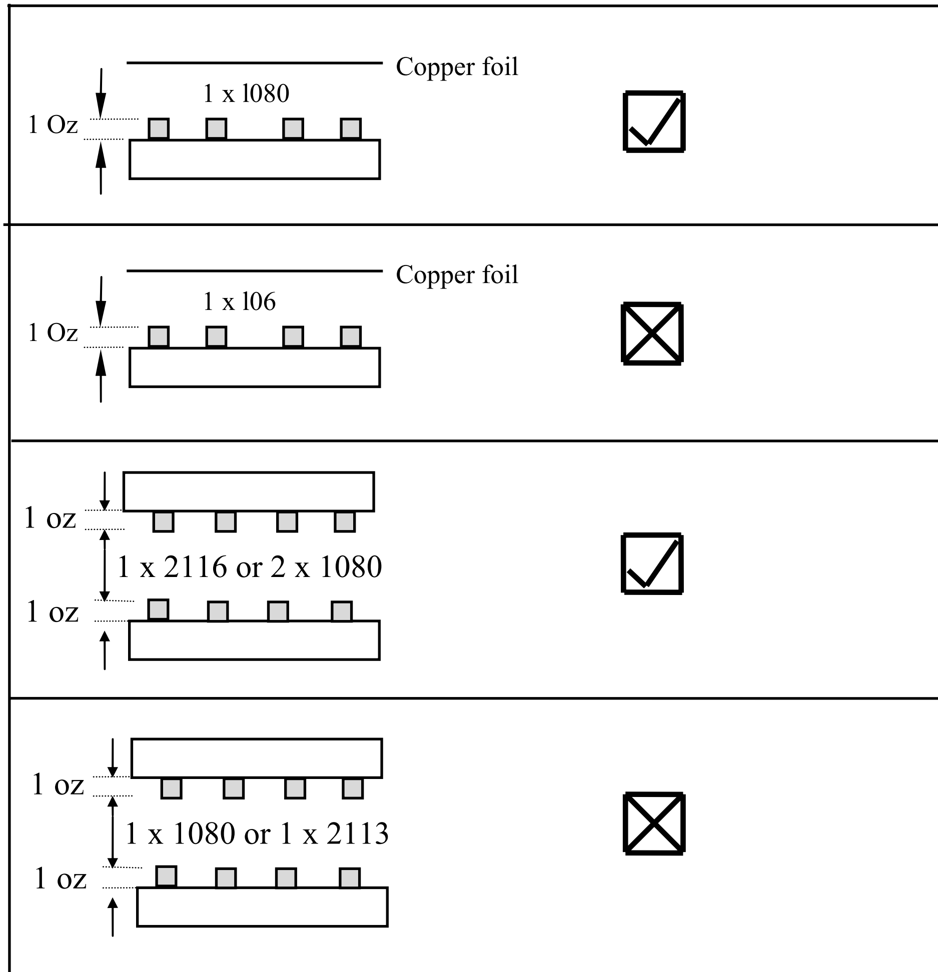
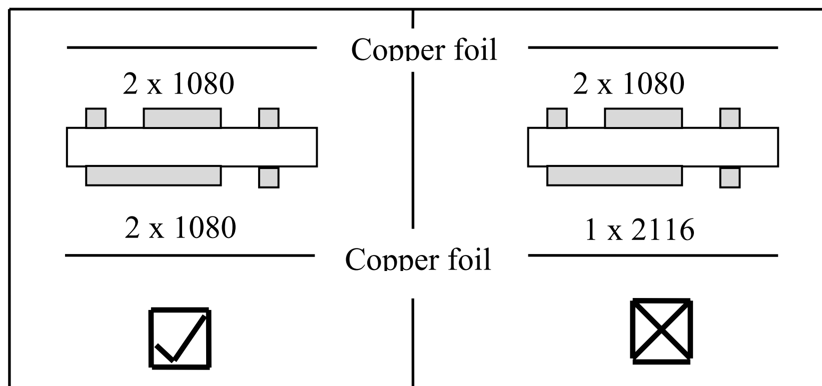


b) Keep the Warp and Fill of laminate and prepreg in the same direction to give the best flatness performance.

c) Whenever possible, maintain a "mirror image"(symmetrical lay-up) for the PCB construction.



d) Keep the circuitry from the panel edges, with a clearance of about 20 mm to accommodate Frosted Edges and Frosted Corner.

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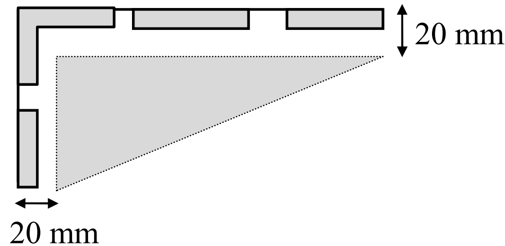

2.0 Inner layer surface treatment

2.1 Recommended process flow for laminate claded with standard Electro-plated Copper Foil or Rolled(and Annealed) Copper Foil.

Mild Acid Treat → Rinsing → Micro-etch →
Rinsing → Drying → Pre-heat →
Dry Film Lamination

2.2 Recommended process flow for laminate claded with Reverse Treated Foil (RTFoil) or Double Treated Foil (DTFoil).

Mild Acid Treat → Rinsing → Drying →
Pre-heat → Dry Film Lamination

Remarks : In both 2.1 and 2.2, no pre-baking of laminate is needed as the laminate is fully cured. However, a pre-bake is recommended for laminate that has been kept for a substantial period of time. The recommended drying condition varies upon the humidity level and length of exposure. Generally a 2 hrs @ 120 C baking in an hot air oven is sufficient to dry the laminate.

3.0 Inner layer oxide process

3.1 Double Treated Copper Foil provides optimum bonding strength between prepreg and traces. When standard copper foil is used, following oxide condition is recommended (based on Shipley Chemistry).

Oxide treatment temperature = 80 C
Dwell time = 3 min.

Remarks : Typical weight gain is 0.35 mg/cm^2. Care must be taken to avoid over-treatment, which may lead to over build-up crystal that may weaken the bonding strength.

3.2 Bake the oxide panel for 45 min@110 °C in a hot air oven before lay-up to eliminate the effect of moisture.

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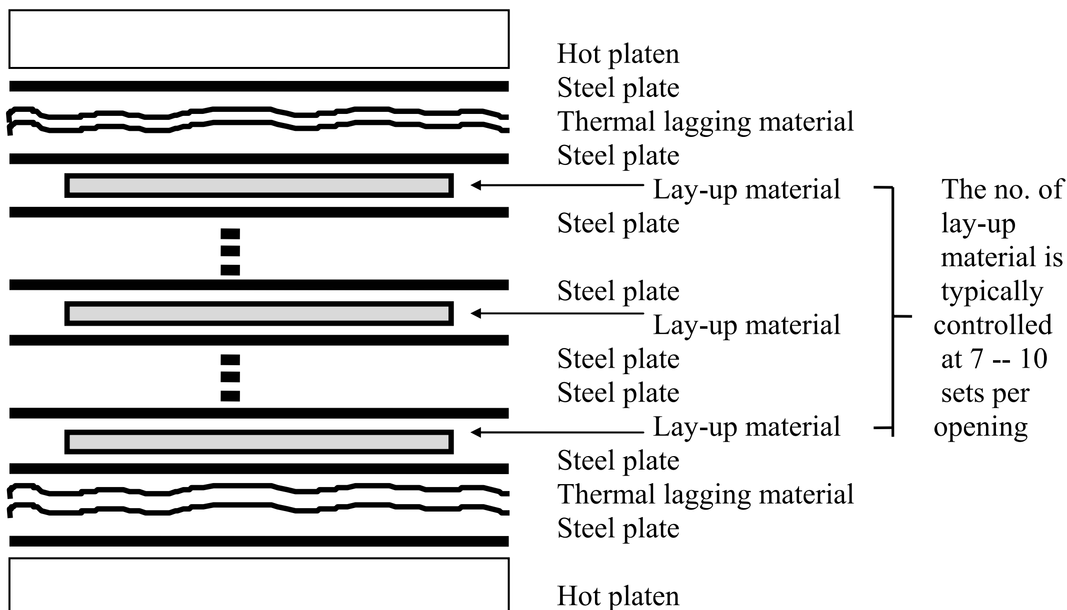
4.0 Lamination process

4.1 Lay-up

a) This process should be performed in a dust controlled room to keep foreign particle away from the prepreg and inner layer.

b) Thermal lagging material such as Kraft Paper or Top Board should beused in the following manner (see diagram below) in each opening to prevent thermal shock and even up the distribution of pressure over the work area.

c) Stack the material in the following manner in each opening.



4.2 Lamination process

Type of machine	= Vacuum Hydraulic Press
Platen temperature	= 190 +/- 5 C
Heat rise	= 4 - 7 °C/min (material temp. measured between 70 °C to 130 °C)
Curing time	= 90 min. @ 183 °C and above (material temp.)
Pressure	= 300 psi
Vacuum level	= -28" Hg or higher

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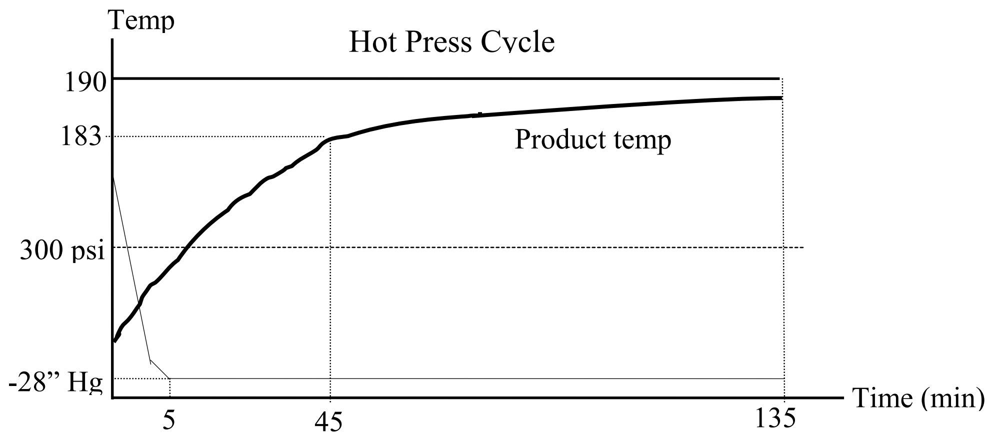

5.0 Drilling condition

The followings are the typical drilling parameters :
Max hit count : 1000 – 1500
Surface feet/ min (SFM) : 350 – 500

$$SFM = \frac{\text{dia of drill bit (in) x } \pi \text{ x splinder speed (rpm)}}{12} \quad \text{Chip load} = \frac{\text{Feed (IPM)}}{\text{Speed (Krpm)}}$$

Drill Size (mil)	RPM (x 1000)	Chip load (mil)	Retract Speed (in/min)
13.8	100	1	680
15.7	100	1.1	1000
23.6	80.9	1.5	1000
25.6	74.6	1.8	1000
39.4	48.5	3	1000
55.7	34.7	3	1000
61.0	31.3	3	1000
63.0	30.3	3	1000
80.7	23.7	3	1000
98.4	20.0	3	1000
124.0	20.0	3.5	1000
126.0	20.0	3.5	1000
196.9	20.0	2.5	1000

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6.0 Desmearing condition

N4000-6 can be successfully desmeared with a Permanganate chemistry. The following condition is recommended.

Option	Type	Temp (°C)	Time (min)
1	Butyl /OH	78 ± 5	4 - 6
2	Cyclic Amine 50% v/v	76 ± 5	3 – 5
3	Cyclic Amine 100%	54 ± 5	3 – 5
Oxidizer			
	Alkaline Permanganate	77 ± 5	8 - 14