

Recommendations/comments on “IPC-1602”

(Implementation subject to customer/supplier agreement)

These recommendations supersede and replace the recommendations on IPC-1601 Revision A from June 2016

Objective:

IPC-1602 specifies comprehensive measures regarding the handling and storage of printed boards. In addition to the manufacture, storage and transportation of printed boards, it also covers the requirements for reliable processing at the user’s end. These recommendations are intended to provide a basis for discussing the targeted implementation of IPC-1602 for all process participants.

Method:

Description of the challenging requirements of IPC-1602 and proposals for their feasible implementation. If compliance with IPC-1602 is requested, these recommendations shall serve as a supplement to the agreement between the PCB manufacturer and the customer.

Information provided in the IPC on the new document number (1602)

This document supersedes and replaces IPC-1601 Revision A from June 2016. Originally envisioned as a Revision B to IPC-1601, with the expansion of scope from a guidelines document to a standard with requirements for printed board storage and handling, this document has been released with a new document number of IPC-1602. Changes from IPC-1601 Revision A guideline that are incorporated into this new standard are indicated throughout by gray shading of the relevant subsection(s). Changes to a figure or table are indicated by gray shading of the figure or table header and applicable content.

Recommendations/comments on “IPC 1602”

(Implementation subject to customer/supplier agreement)

These recommendations supersede and replace the recommendations on IPC-1601 Revision A from June 2016

IPC section	Requirement	Comment/remark
3.1.1	<ul style="list-style-type: none">a. Handle PP + resin-coated foils by the edges only and wear gloves at all timesb. Reseal opened PP bagc. Store PP + resin-coated foils at < 23°C and >50% humidityd. Allow PP + resin-coated foils to acclimatise if storage temperature is below room temperaturee. Process control (storage, place of use, transportation) via temperature and humidity indicators.	<ul style="list-style-type: none">a. Make sure that the handling method does not adversely affect product quality and functionality.b. Only if climate of storage room is not controlled.c. Storage conditions must be agreed and/or validated together with the manufacturer of the material.d. Any existing temperature differences should be taken into account during validation.e. Monitor indoor climate via temperature and RH indicators.
3.1.2	Do not mix different resin types	Ensure material storage is organised accordingly.
3.2.3	Minimise time between baking and amination (moisture absorption). Remove any moisture prior to packaging/ assembly.	Any residual moisture that may be present should be evaluated during validation.
3.2.3.2	Determine the degree of moisture of the etched cores according to IPC-TM-650, Test Method 2.6.28. Separate cores on racks and bake at 105°C for 30 minutes. Baking of stacked cores: Max. height: 25.4 mm Temp. in stack middle: 105 °C - 120 °C Bake time: 2 hours	Ensure moisture absorption is kept to a minimum during interim storage.

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IPC section	Requirement	Comment/remark
3.2.3.3	Section 3.2.3.2 also applies to sequentially laminated PCBs. Baking: 180 °C for 2 hours or 150 °C for 8 hours or 120 °C for 24 hours	Ensure moisture absorption is kept to a minimum during interim storage. The drying of the material depends on the laminate material and composite design.
3.3.2	Wear gloves when handling laminated panels/PCBs	Use suitable measures to prevent fingerprint contamination. Some products may also require ESD protection.
3.3.3	Monitor temperature and humidity levels along all process steps. Baking is recommended prior to plating and solder mask application.	The process parameters should be defined so as to prevent any adverse effects.
3.3.6	Moisture content between 0.1 to 0.5% of resin weight.	Baking of PCBs by manufacturer: -> artificial ageing of the soldering surface -> degradation of solderability/reduction of storage life It is recommended that baking takes place just before the soldering process.

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3.4.1.x	Problems caused by baking	<ul style="list-style-type: none"> Baking should be avoided by proper packaging, storage and handling processes! Baking can degrade solderability. Ensure the relative humidity inside the oven is below 5% during the baking process. When baking in nitrogen-inert ovens, the percentage of nitrogen must not exceed 100 ppm. 																												
3.4.4	<p>Recommendations for PCB baking profiles</p> <table border="1" data-bbox="273 715 1182 1262"> <thead> <tr> <th>Final Finish</th> <th>Temperature</th> <th>Time [h]</th> <th>Comments</th> </tr> </thead> <tbody> <tr> <td>Tin</td> <td>105-125 °C</td> <td>4-6</td> <td>Higher temperatures may reduce solderability. See 3.4.1.5</td> </tr> <tr> <td>Silver</td> <td>105-125 °C</td> <td>4-6</td> <td>Silver may tarnish. See 3.4.1.4</td> </tr> <tr> <td>Nickel/Gold</td> <td>105-125 °C</td> <td>4-6</td> <td>See 3.4.1.2</td> </tr> <tr> <td>ENEPIG</td> <td>105-125 °C</td> <td>4-6</td> <td>See 3.4.1.2</td> </tr> <tr> <td>Organic coating</td> <td></td> <td></td> <td>See 3.4.1.1</td> </tr> <tr> <td>HASL/HAL</td> <td>105-125 °C</td> <td>4-6</td> <td>Final surface thicknesses below 0.77 µm (30.0 µin) may turn into pure intermetallics and render the printed board unsolderable.</td> </tr> </tbody> </table> <p>Note: Baking in vacuum or nitrogen atmosphere does not accelerate removal of moisture, but may help preserve solderability.</p>	Final Finish	Temperature	Time [h]	Comments	Tin	105-125 °C	4-6	Higher temperatures may reduce solderability. See 3.4.1.5	Silver	105-125 °C	4-6	Silver may tarnish. See 3.4.1.4	Nickel/Gold	105-125 °C	4-6	See 3.4.1.2	ENEPIG	105-125 °C	4-6	See 3.4.1.2	Organic coating			See 3.4.1.1	HASL/HAL	105-125 °C	4-6	Final surface thicknesses below 0.77 µm (30.0 µin) may turn into pure intermetallics and render the printed board unsolderable.	<p>Individual definition of baking conditions based on type-specific validation by the end user.</p>
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IPC section	Requirement	Comment/remark
4.1.1	Bake polyimide materials prior to packaging. Packaging should include: <ul style="list-style-type: none">- vacuum-sealed moisture barrier bags- humidity indicator cards- desiccants.	Baking of PCBs by the manufacturer results in: -> artificial ageing of the soldering surface -> degradation of solderability/reduction of storage life It is recommended that baking takes place just before assembly.
4.1.2	Include rigid protective backing when packing: <ul style="list-style-type: none">- thin PCBs (< 1.40 mm)- flexible PCBs- PCBs with complex contours	Suitable packaging should be selected to avoid mechanical impact.
4.1.3 :	The storage life of some final finishes is too limited to assure good solderability.	Observing the permitted processing time in terms of solderability is the sole responsibility of the end user.
4.1.5	ESD-compliant packaging material	Packaging material should be agreed between user and supplier. ESD-compliant packaging material for bare PCBs is relevant to pricing.
4.2	Dry packaging requirements <ul style="list-style-type: none">- Moisture content of PCBs upon receipt- Ready for shipment and storage after assembly	The choice of dry packaging material should be agreed between customer and PCB manufacturer.
4.2.1	Water Vapour Transmission Rate for dry packaging: $\leq 0.002 \text{ mg} / 100 \text{ in}^2 / 24 \text{ hrs}$	The choice of packaging material should be agreed between customer and PCB manufacturer.

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4.2.2	<p>Use packaging material with metallic layers, especially for lead-free PCBs (moisture). Clear plastics/polymers (non-metallic) – plastics that do not incorporate a metallic layer in the construction provide limited moisture barrier performance, and should not be used for dry-packaging of PCBs.</p>	<p>The choice of packaging material should be agreed between customer and PCB manufacturer.</p>
4.2.3 and 4.2.4	<p>Desiccant materials und humidity indicator cards acc. to IPC-J-STD-033.</p> <div data-bbox="327 831 568 1190" style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p style="text-align: center;">HUMIDITY INDICATOR <small>Complies with IPC/JEDEC J-STD-033</small></p> <p>LEVEL 2 PARTS</p> <p>Bake parts if 60% is NOT blue</p> <p style="text-align: center;">60% </p> <hr/> <p>LEVEL 2A-5A PARTS</p> <p>Bake parts if 10% is NOT blue and 5% is pink</p> <p style="text-align: center;">10%  5% </p> <p style="text-align: center;"><small>Do not put this card into a bag if 60% is pink</small></p> </div> <p style="font-size: small;">Figure 4-1 Humidity Indicator Card (HIC) Example</p> <p>Source: IPC</p>	<p>Validation to be agreed between customer and supplier.</p>
4.2.5	<p>Use of Laminate Witness Coupons to determine the moisture level.</p>	<p>Provision of coupons to be agreed between supplier and customer.</p>

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IPC section	Requirement	Comment/remark
4.2.6 and 4.3.1	Use of sulfur-free and pH-neutral packaging material for Immersion Silver PCBs.	Use a packaging material that does not adversely affect the solderability/storage life.
4.2.7	Full air evacuation (vacuum) is not recommended as this may impair the effectiveness of desiccant.	PCB manufacturers must optimise the degree of vacuuming: <ul style="list-style-type: none">- to achieve reliable mechanical stability of packaging material- to ensure good performance of desiccant.
4.2.8	Place desiccant along the edges of the PCBs inside the moisture barrier bag.	The placement of the desiccant must not: <ul style="list-style-type: none">- degrade solderability- impair performance of desiccant- mechanically impair PCBs. Inclusion of desiccants to be agreed between supplier and customer.
4.2.9	For PCBs $\leq 144 \text{ in}^2$ (0.093 m^2) = 25 boards/package For PCBs $> 144 \text{ in}^2$ (0.093 m^2) = 10 boards/package	The number of boards to be grouped per package depends on the PCB size, PCB thickness and circuit design. The supplier should determine a suitable batch size. Details to be agreed between customer and PCB manufacturer.
4.2.9.1	Marking of packaging unit	Marking of the packaging unit to be agreed between customer and PCB manufacturer.

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4.3.2	External packaging	External packaging to be agreed between customer and PCB manufacturer.
4.3.3	Support material	Support material to be agreed between customer and PCB manufacturer.
4.4.1	Marking: Lead-free/RoHS compliance 	Material compliance to be agreed between customer and PCB manufacturer.
4.4.2	Packaging of ESD-sensitive circuit boards should be marked acc. to ANSI, including the ESD protective symbol.  Source: IPC	Package marking to be agreed between customer and PCB manufacturer.
4.4.3	PCBs enclosed in dry packaging should be marked with a suitable warning or moisture sensitivity caution symbol as indicated below.  Source: IPC	Package marking to be agreed between customer and PCB manufacturer.
4.4.4	Other markings Other markings (e.g., date codes, U.L.) must comply with the user specifications	Marking details to be agreed between customer and PCB manufacturer.
5.	Goods receipt, storage and assembly of PCBs	Does not apply to manufacturers of bare PCBs.