

## AT&S General Storage and Processing Conditions for Printed Circuit Boards ("General Storage and Processing Conditions")

Any warranties, guarantees, representations or similar assurances provided by AT&S are based on the prerequisite that AT&S's products are stored and processed appropriately. These General Storage and Processing Conditions provide an overview about those prerequisites. In case the General Storage and Processing Conditions are not adhered to AT&S disclaims any liability and warranty claims, including but not limited to liability or warranty claims concerning "solderability" or "resistance of delamination".

The IPC-Standard J-STD 020 must generally be complied with by the contracting party, unless otherwise specified in the General Storage and Processing Conditions or otherwise agreed in writing between AT&S and the contracting party.

### General Conditions for storage:

Materials used for the production of printed circuit boards (PCBs) are „hygroscopic“, which means that they absorb humidity from the air during storage. The absorbed humidity evaporates in an extremely short time during the „Reflow Process“, which under certain circumstances could lead to delamination. For Flex and Rigid-Flex (FPC, RFPC) this phenomenon is even more distinct.

To avoid absorption of humidity following storage conditions are mandatory for packaged PCBs:

**Temperature:**        **20 ± 5°C**  
**Relative humidity:**    **max. 60 %**

Under the above storage and processing conditions PCBs can be soldered **3x Reflow** (profile: IPC J-STD 020 / clause 5.6). The time between two reflow cycles shall in no case be more than **24 (twenty-four) hours maximum**. This is a different requirement compared to IPC J-STD 020, but is a mandatory precondition to minimize the absorption of humidity and oxidation on the surface. AT&S recommends the time between two reflow cycle not to exceed 12 (twelve) hours, otherwise AT&S shall be consulted – see **\*1)** below.

AT&S does only warrant for the solderability and resistance of delamination during assembling of Printed Circuit Boards if the contracting party proves, upon notification of a defect, that the affected PCBs were stored and treated in accordance with the conditions contained in this document.

### Drying:

For the above reasons drying of the PCBs before the thermal impact of assembly is recommended as stated below. If appropriate, this drying of the PCBs might be repeated.

- For Flex and Rigid-Flex (FPC, RFPC) a Drying step is mandatory before assembly.
- In case of storage of packed PCBs between 6 (six) and 12 (twelve) months between manufacturing date of the PCB and soldering by the contracting party, PCBs must be dried promptly before soldering – see **\*2)** below.

**General Conditions for processing:**

| Surface Technology            | Technical Requirements [Thickness $\mu\text{m}$ ]                               | Shelf life, packed [mth] | Process Time in unpacked condition *1) |             |          | Comments Drying *2)  | Refreshing  |
|-------------------------------|---|--------------------------|--|-------------|----------|--|---|
|                               |   |                          | SS/DS                                  | ML/EC P-PCB | FPC RFPC |  |   |
| OSP                           | 0,2-0,4 $\mu\text{m}$   | 6                        | <48h                                   | <24h        | <6h      | Not possible, only refreshing at AT&S  | Possible to increase shelf life by 6 months, max. shelf life 12 months from date code |
| Immersion Silver *3)          | 0,15-0,4 $\mu\text{m}$  | 6                        | <6h                                    | <6h         | <6h      | Possible but tarnishing of Ag will decrease solderability performance  | Not possible  |
| Chemical tin                  | >1,0 $\mu\text{m}$<br>AT&S recommends >1,2 $\mu\text{m}$ for multiple soldering | 9                        | <48h                                   | <24h        | <6h      | After thermal stress (e.g. drying) a reduction of the solderability can occur. Observed sampling production is recommended. Refreshing of the tin surface is possible. | Possible to increase shelf life by 3 months, max. shelf life 12 months from date code |
| HAL / HASL                    | >0,76 $\mu\text{m}$   | 12                       | <48h                                   | <24h        | <6h      |  | Not possible  |
| galv. Ni/Au                   | Ni: 2,5-10 $\mu\text{m}$<br>Au: 0,76-2 $\mu\text{m}$                            | 12                       | <48h                                   | <24h        | <6h      |  | Not possible  |
| ENIG HP (high Phosphor) *4)   | Ni: 3-6 $\mu\text{m}$<br>Au: 0,025-0,08 $\mu\text{m}$                           | 12                       | <48h                                   | <24h        | <6h      |  | Not possible  |
| ENIG MP (medium Phosphor) *4) | Ni: 3-6 $\mu\text{m}$<br>Au: 0,05-0,09 $\mu\text{m}$                            | 12                       | <48h                                   | <24h        | <6h      |  | Not possible  |
| ENEPIG                        | Ni: 4-8 $\mu\text{m}$<br>Pd: 0,1-0,5 $\mu\text{m}$<br>Au: >0,02 $\mu\text{m}$   | 12                       | <48h                                   | <24h        | <6h      |  | Not possible  |

- 1) Process time in unpacked condition is only applicable in case relative humidity in process area is max. 60 %.
- 2) General limits for the drying:

| PCB Type                           | Single-Sided / Double-Sided (SS/DS) | Multilayer (ML) < 8 Layers | Multilayer (ML) and ECP-PCB ≥ 8 Layers | Flex / Rigid-flex PCBs (FPC/RFPC) *5) |
|------------------------------------|-------------------------------------|----------------------------|--|---------------------------------------|
| <b>Drying</b>                      | 110 – 120°C<br>2 hours              | 130 +/- 5°C<br>3 hours     | 130 +/- 5°C<br>5 hours                 | 130 +/- 5°C<br>3 hours                |
| Time between drying and processing | 46 hours                            | 8 hours                    | 8 hours                                | < 6 hours                             |

- 3) This assurance only applies if the PCBs are stored as per IPC 4553 section 3.8. Tarnishing of the immersion silver due to excess heating to remove moisture after expected shelf life recommendations or improper packaging will result in a decrease in solderability performance – as indicated in \*3).
- 4) If there are designs on the PCB with **BGA grid size < 600µm AT&S does not recommend ENIG**. AT&S suggests OSP or immersion tin because there is a high probability of solder cracking in the BGA area.
- 5) Solder mask in holes is seen as critical by AT&S. Therefore AT&S reminds the contracting party that AT&S recommends not to use such process but to clear the hole from solder mask and coat it with the selected surface treatment (e.g. ENIG or TIN, or as otherwise applicable) – as indicated in \*4). During solder mask coating in holes undefined cavities can appear which might contain chemical residues, which may result in bonding problems or discoloration on the surface. Defects caused by such a design of a PCB/FPC/RFPC are outside of AT&S’s responsibility and AT&S cannot assume any related claim or liability.
- 6) AT&S indicates that Rigid-Flex (RFPC), in particular unbalanced and/or thin constructions, tend to increased twist and warping. Depending on the respective construction the twist and warping may be up to 2 % (relating to the longest side).
- 7) AT&S does not warrant for the non-occurrence of delamination for FPC/RFPC even when the above stated max. time between drying and processing is observed, because the actual time frame until a delamination may occur is varying depending on the specific PCB design, which is the contracting party’s responsibility. The optimal parameters for drying may differ as they are determined by the product structure and the technology applied for drying (e.g. vacuum drying, use of drying oven), and thus have to be determined in the course of product qualification at the contracting party’s site – see \*5) above.