INSTITUT IFTEC

FORMATION CONTINUE - FABRICATION EN ELECTRONIQUE
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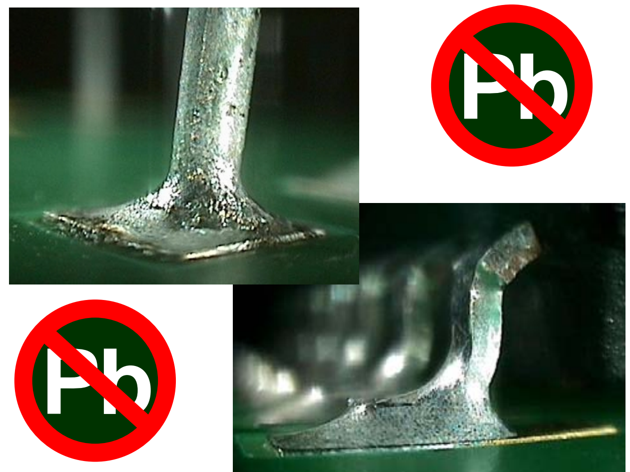
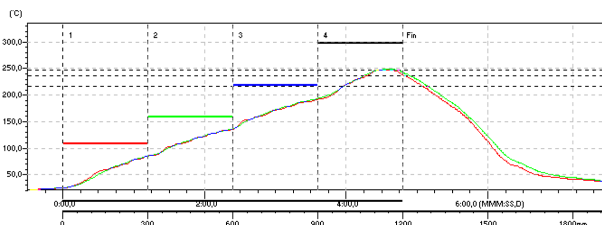
Code TVA : FR 65 324 047 174 – N° Enregistrement Formation Continue : 11 92 00 210 92

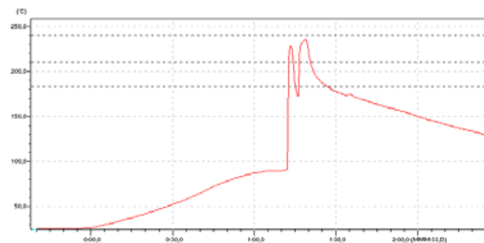
N° 6 LEAD FREE SOLDERING (ROHS)

Training duration : 14 hours / 2 days
Maximum number of trainees = 10
Minimum number of trainees = 3

This training is meant for technical staff concerned by the change to lead free soldering.
The objective is to focus on technical items in order to anticipate the new requirements of lead free soldering processes. What are the characteristics of the new alloys, which fluxes must be used, did PCB substrates have to be changed, will components tolerate the new soldering temperatures, are reflow oven and solder wave compatible with this new process, which soldering equipments have to be change, what about inspection and joint reliability ?







I – PRESENTATION & INFORMATION SOURCES **§I to VI : duration : 1,5 days**

II – THE NEW REGULATIONS
- WEEE & ROHS European directives and their concrete implications.
- World wide status on Lead-Free soldering.

III – STANDARD PROCESSES (FLASH REMINDER)
- Soldering conditions reminder : metals, fluxes, temperature, intermetallic compounds.
- Standard « leaded » alloys, processing temperature.
- The different soldering technologies (soldering wave, reflow and manual soldering).

IV – LEAD FREE ALLOYS
- Lead Free alloys composition (SnAgCu, SnAg, SnCu, SnZn, etc.), comparative costs with SnPb.
- Characteristics: phase diagrams and joint structure, melting temperatures, wetting, Intermetallic Compounds.
- Alloy wetting comparative study (SnPb, SnAgCu et SnCu (wetting force). Consequences on lead free process thermal control, on visual inspection criteria.
- Joint reliability: « leaded » and lead free alloy comparative studies results.

V – IMPACT ON PROCESSES: wave, reflow, manual soldering.

V-1 Impact on PCBs.
- Impact on PCBs: substrates and technical characteristics that must be taken into account for lead free soldering : internal moisture, Tg, thermal expansion, heat resistance, pad lifting, halogen free substrates.
- Consequences on vias and PTH behaviour, boards deformation.

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- The different lead free finishes (HAL, ENIG, OSP, chemical Sn and chemical Ag).

V-2 Impact on components.

Reflow critical parameters.

- Chip damage with temperature.
- « Plastic » components: temperature impact of internal moisture for Reflow process : IPC standards for MSL management : JSTD033B et JSTD020D.
  - Consequences ➔ "pop-corn effect" and Dry Pack management.
  - Consequences ➔ thermal soldering « window »: between minimum soldering temperature and maximum acceptable temperature for components. « leaded » and lead-free soldering « window » compairison. Temperature control..
- Different lead-free finishes ; chemical Tin and Whiskers growth.

V-3 Impact on wave soldering.

- Short reminder of standard thermal conditions with SnPb alloy.
- Lead free alloy configuration ➔ temperature increase: preheating, solder tank and boards.
- Consequences on components: traditional, plastic and ceramic SMD.
- Consequences on solder wave chemical products: wave fluxes (compositions, temperatures)
- Consequences on preheating step, time, boards deformation and transport tools.
- Consequence on soldering step (wave): contact time or solder bath temperature (or both ?).
- Leaching, solder pot and pumps resistance: alloy composition change.
- Dross generation.

V-4 Impact on reflow soldering

- Short reminder of standard thermal conditions with SnPb alloy, difficulties in controlling thermal divergence on a board.
- Lead free soldering thermal « window » change and current temperature control using convection ovens.
  - Consequence ➔ Reflow soldering « window » adaptation, thermal profiles modification: soak, linear, trapezoïdal. Need for a better cooling efficiency.
  - Consequence ➔ capability: is « my oven» capable to withstand the new thermal demand?

Another possibility: reflow by condensation.

V-5 Impact on joints inspection

- Impact on external inspection: shape, aspect, AOI.
- Impact on internal inspection: RX, micrographic cut.

V-6 Impact on manual soldering

- State of art and consequences of the higher melting temperature.
- Iron tips temperature, shape, maintenance.
- Thermal regulation.
- PCB preheating, damage risks, pad lifting, measling.

VI – TRANSITION PHASE

For a given time, « leaded » and « lead free » materials will have to live together, what will be the effect of alloy mix on joint reliability? Several situations are studied including BGA.

- Lead free processes traceability, RoHS compliancy.

VII – PRACTICAL HANDLINGS (1/2 day).

- Lead Free solder paste testing : coalescence. Comparison with SnPb solder paste.
- Reflow: oven setting for a lead free reflow profile, position choice and probe settings.
- Thermal profile study: thermal divergence and conclusion: « is my oven capable ? » to stay with the new processing tolerances..
- Hand soldering: board hand soldering using lead free alloys (recommended prerequisite condition : a good hand soldering practical knowledge to see the new soldering difficulties).

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