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Lead free hand soldering

The 5 golden rules
By

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Influences of melting temperatures:

Hand soldering applications with lead free solder is more difficult than hand soldering with tin lead alloys. The melting temperatures of lead free solders are approx. 30 - 40 ℃ h igher than of tin lead solders. Therefore it is necessary to increase the temperature of the solder iron too.

Usually the temperature of soldering irons is approx. 100°C higher than the melting temperature of so lders. Often it can be found temperatures which are approx.150°C above th e melting point of the solder due to different factors.

Usually the soldering iron temperature for lead free alloys is selected at approx. 370 - 380℃.
At higher temperatures the wear of soldering iron will increase rapidly and the flux formulation could be out of optimal working temperature.
Consequences: The fluxes can spray and gun, loose activity, charred or leaves black arrears.

Shelf life of soldering irons:

Soldering irons are made of pure copper or copper alloys and afterwards with iron plated to protect the copper core inside. The consumption of soldering irons rises with increasing the temperature, particularly at temperatures above 400℃. Another factor for the consumption of soldering irons is the tin – content in solders. Lead free solders have more tin than lead containing alloys (95 – 99%), which also forward the corrosion of soldering irons. Additions of silver in SnCu alloys decrease the melting temperature of lead free solders, but silver makes the solder more aggressive to the solder iron!

Oxidation of soldering irons:

The transportation of heat and energy from soldering iron to the Pad and components is generated by the molten solder. Therefore a direct contact between soldering iron and solder is the most important thing for transportation of heat and energy to the solder pad and component in very short times.
During long-time soldering with increased temperatures it can be observed that the soldering iron discolours black Fig. 2.1 or scaling Fig. 2.2 and does not accept solder (solder does not stick to the soldering iron).
Therefore the heat and energy transition to the Pad and components is disturbed and each solder joint requires more time.

Fig. 2.1

Fig. 2.2

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Summary:

The corrosion and oxidation of the soldering iron during soldering with lead free alloys will be higher because of the higher tin content, silver content in some alloys, higher temperature of soldering irons and higher activation of fluxes.
Due to the higher soldering temperatures this oxidation is favoured by the wet cleaning of soldering irons!

Therefore the following rules should be kept:

1. Never switch longer than necessary the soldering iron at the soldering temperature
2. Don't select temperatures above 400℃ (370℃ - 380℃)
3. Usage of fluxes which are as mild as possible (class L0 according to J-STD-004)
4. Usage of alloys which have a low copper dissolution.

Handling of problems during hand soldering:

As already addressed, problems can be found when soldering with lead free alloys.
At present there no elements are known, which can replace the lead in alloys regarding melting temperature, flow behaviour, solder ability, viscosity and costs.
It is recommended to consider basic rules in order to load good soldered connections and protect the soldering irons.

Keywords:

- Management of soldering iron temperature
- Management of soldering iron surface
- Selection of fluxes
- Management of PCB finishes and component finishes
- Select soldering stations with optimum thermal characteristics
- Select soldering stations with good control modes.
- Maintenance of soldering irons

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The 5 rules of lead free hand soldering:

1. Select the soldering iron temperature as low as possible; at 400℃ the solder does not better flow.
2. Cover the soldering iron with fresh solder before soldering or put it back in soldering station
3. Switch off the soldering station at breaks which last longer than 5 minutes.
4. Black, oxidized soldering irons does not accept solder anymore and must be cleaned with fine steel wool or fine emery paper (#800 or #1200) and covert with fresh solder after cleaning.
5. Solder residues on the soldering irons should be removed before soldering

Recommended cleaning equipments: Clean-o-point with dry sponges or dry cleaning equipments, for example HAKKO 599

Fig. 3.1: HAKKO 599

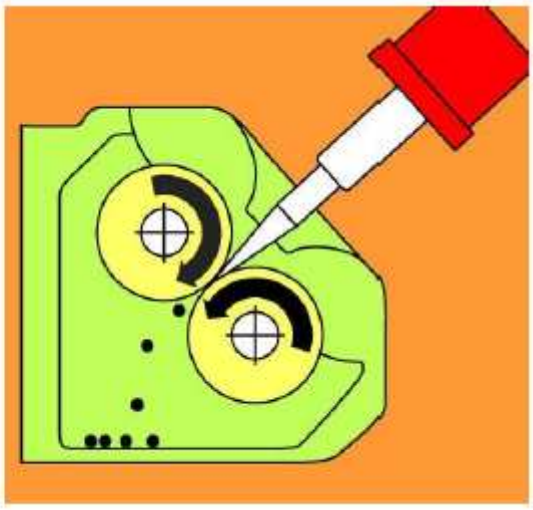

Fig. 3.2: Clean-o-point

BALVER ZINN solder wire for lead free soldering

Flux type	Classification according J-STD 004	Alloys	Standard solid con-tent	Standard diameter
LF 2220 NC	REL0	SN100C; SN96C; SN97C	2.2 %	0.5; 0.8; 1.0; 1.2; 1.5; 2.0; 2.5
395-90	REL0	SN100C; SN96C; SN97C	2.2 %	0.5; 0.8; 1.0; 1.2; 1.5; 2.0; 2.5
395-99	REL1	SN100C; SN96C; SN97C	2.2 %	0.5; 0.8; 1.0; 1.2; 1.5; 2.0; 2.5
LF3135 NC	ROM1	SN100C; SN96C; SN97C	2.2 %	0.5; 0.8; 1.0; 1.2; 1.5; 2.0; 2.5