

## Title: Lead-Free Wave and Selective solder alloys – Impurity Action Levels

It is important to maintain the composition of the solder bath in Lead-Free wave and selective solder processes. Recommendations as listed below have been developed based on the most up to date process knowledge gathered from many users of Lead-Free alloys. The main elements that should be closely monitored are Pb and Cu. It is recommended to have frequent pot analysis in order to take early action in the case of non-compliance or to ensure that the process yield is maintained. The Pot-Rite<sup>®</sup> system offered by Cookson Electronics Assembly Materials offers a valuable and reliable service to meet these needs, please contact your local sales office for details.

### SACX™: Recommended Action Levels

Element	ACTION Levels	Notes
Sn	<b>BAL</b>	No Action level.
Pb	<b>0.10</b>	RoHS Directive 2002/95/EC states a maximum Lead content of 0.1%
As	<b>0.03</b>	Levels greater than 0.03% can cause de-wetting.
Cu	<b>0.50 - 1.00</b>	SACX is tolerant to copper levels up to 1.0%, SACX0300 copper free should be added to maintain copper levels. Levels above 1.0% may cause more bridging.
Bi	<b>0.08 - 0.20</b>	Lead Free alloys are tolerant to Bi up to 1.0%, however if levels above 0.20% are detected this indicates some contamination issues that should be investigated
Zn	<b>0.003</b>	Levels greater than 0.003% may cause higher levels of bridging and icicling and a greater level of surface oxidation in the solder bath.
Fe	<b>0.02</b>	Greater than 0.02% Iron can be an indicator of pot erosion and may cause gritty joint formation and the formation of FeSn <sub>2</sub> IMC needles that can cause bridging.
Ag	<b>0.25 - 0.50</b>	Silver levels of 4% are used in some SAC alloys, however if the levels in SACX rise above 0.5% then some investigations should be held to establish the cause. Solderability should not be affected
Sb	<b>0.20</b>	Lead Free alloys are tolerant to Sb up to 1.0%, however if levels above 0.20% are detected this indicates some contamination issues that should be investigated
Ni	<b>0.05</b>	Levels greater than 0.025% may start to slow the wetting speed and could affect the hole fill performance. If process performance is OK then levels up to 0.05% are OK.
Cd	<b>0.003</b>	RoHS Directive 2002/95/EC states a maximum Cadmium content of 0.01%. Levels of 0.003% may cause higher level of bridging and icicling.
Al	<b>0.002</b>	Levels greater than 0.002% may cause higher levels of bridging and icicling and a greater level of surface oxidation in the solder bath.
Au	<b>0.1</b>	At levels above 0.1% there may be some problems with joint strength.

### SAC305: Recommended Action Levels

Element	ACTION Levels	Notes
Sn	<b>BAL</b>	No Action level.
Pb	<b>0.10</b>	RoHS Directive 2002/95/EC states a maximum Lead content of 0.1%
As	<b>0.03</b>	Levels greater than 0.03% can cause de-wetting.
Cu	<b>0.30 - 1.00</b>	SAC305 can operate at 1.00%, however for finer pitch assemblies bridging may increase at levels above 0.85%. SAC300 copper free should be added to maintain copper levels.
Bi	<b>0.20</b>	Lead Free alloys are tolerant to Bi up to 1.0%, however if levels above 0.20% are detected this indicates some contamination issues that should be investigated
Zn	<b>0.003</b>	Levels greater than 0.003% may cause higher levels of bridging and icicling and a greater level of surface oxidation in the solder bath.
Fe	<b>0.02</b>	Greater than 0.02% Iron can be an indicator of pot erosion and may cause gritty joint formation and the formation of FeSn <sub>2</sub> IMC needles that can cause bridging.
Ag	<b>2.80 - 3.50</b>	Silver levels of 4% are used in some SAC alloys, however if the levels in SAC305 rise above 3.5% then some investigations should be held to establish the cause. Solderability should not be affected
Sb	<b>0.20</b>	Lead Free alloys are tolerant to Sb up to 1.0%, however if levels above 0.20% are detected this indicates some contamination issues that should be investigated
Ni	<b>0.05</b>	Levels greater than 0.025% may start to slow the wetting speed and could affect the hole fill performance. If process performance is OK then levels up to 0.05% are acceptable
Cd	<b>0.003</b>	RoHS Directive 2002/95/EC states a maximum Cadmium content of 0.01%. Levels of 0.003% may cause higher level of bridging and icicling.
Al	<b>0.002</b>	Levels greater than 0.002% may cause higher levels of bridging and icicling and a greater level of surface oxidation in the solder bath.
Au	<b>0.1</b>	At levels above 0.1% there may be some problems with joint strength.