Speedline technologies

APPLICATIONS NOTE

Speedline Electrovert
Hwy 5 South
Camdenton, MO 65020
kkirby@speedlinetech.com
February 17, 2004

Lead-Free Soldering
Nozzle Considerations

Ken Kirby
Applications Engineer

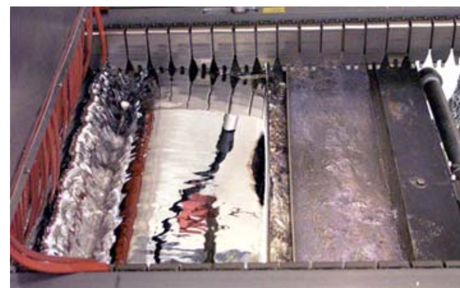
The challenge of wave soldering with lead-free alloys is here and manufacturers around the world are scrambling to qualify equipment and processes that will produce a quality lead-free product. Lead-free alloys behave differently than Sn/Pb alloys. During many evaluations conducted in our applications lab, we have observed these behavioral differences and the process changes needed to counter them. The differences observed and the resulting defects are:

- Lead-free alloys have slower wetting times than the Sn/Pb
- Flow characteristics of lead-free are more viscous
- Bridging is increased
- Insufficient hole fill is a greater problem

Although there are many differences between Sn/Pb and lead-free, we decided to examine the factors that caused the most defects. Process changes that were required to correct the defects include:

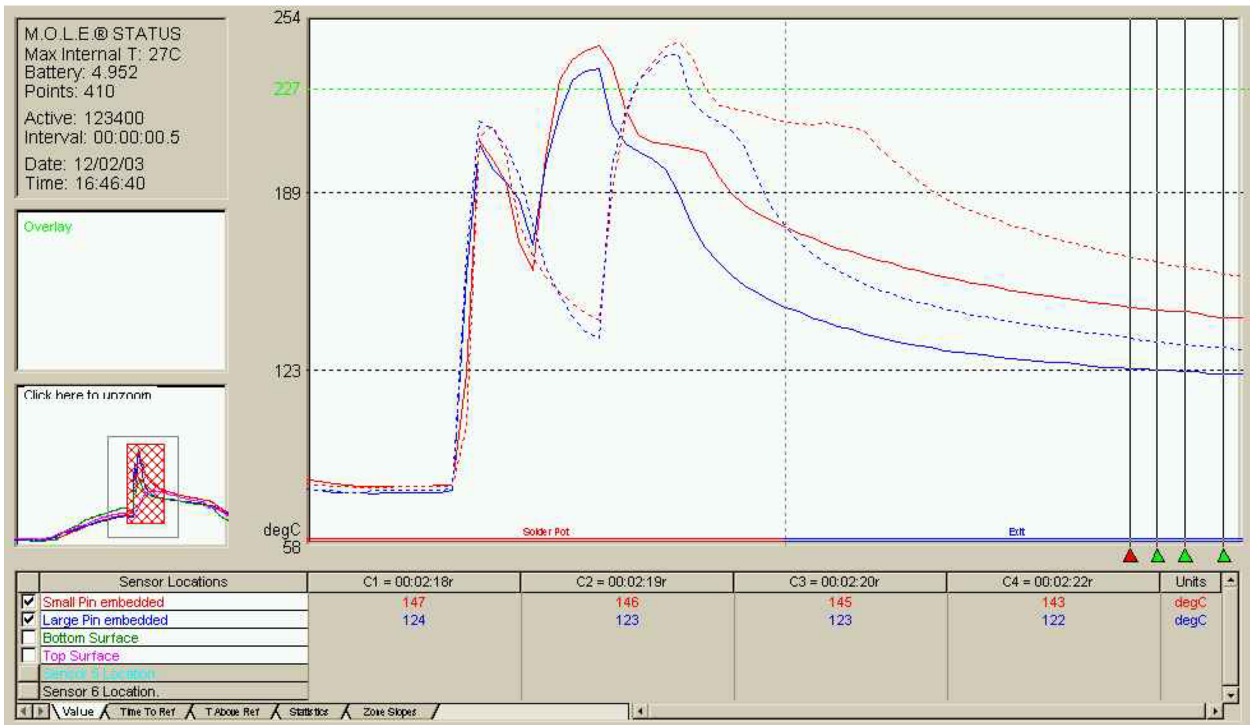
- Increased preheat
- Increased solder temperature
- Higher activity flux
- Increased solder contact time

Many customers do not want to increase solder temperature due to delta T concerns. Also, the flux dictates the temperature profile, so it’s difficult to increase preheat temperatures without changing flux. This leaves increasing the contact time (or the time the solder joint stays above liquidous) with the same contact time to reduce the amount of time that the flux is in contact with solder in the PTH. The solution was to move the nozzles closer together to increase the time above liquidous. The pictures below show the difference between the current nozzle configuration on the left and the new UltraFill nozzle configuration on the right.



Moving the chip and Lambda nozzles closer together reduces the temperature drop between the waves and the solder joint temperature recovers more quickly. The time the flux is exposed to the wave temperature from the entrance to the chip to the exit of the Lambda is also decreased so the survival of the flux increases through the second (or smooth) wave.

The profile below shows the differences between the standard configuration and the new UltraFill nozzle configuration. The solid lines are the UltraFill nozzles.



Hole fill is increased with the UltraFill nozzles without slowing down the conveyor speed for more contact. A reduction in bridging may also be observed due to increased survivability of the flux.

The UltraFill nozzles and lead-free process development is an example of Speedline Technologies/Electrovert's Knowledge in Process.