

LEAD-FREE AND HOT AIR, HOT GAS, AND NITROGEN

Much the same arguments obtain for hot gas soldering and desoldering, viz., temperatures must be increased sufficiently to allow the solder to reflow, and dwell times must be longer so that the components will attach or detach properly. The use of under-board 'pre-heaters' is encouraged.

Hot gas soldering with lead-free alloys could cause damage to components' plastic packages, induce board warping, and lead to problems with the solderable finish. Thus the melting point of a lead-free alloy is important, as many components and materials cannot withstand the very high peak temperatures (> 260°C) of some tin-silver and tin-copper alloys.

As the proposed lead-free solders all require higher process temperatures they may not work well in an oxygen-rich atmosphere. The increased amount of tin in these solders not only makes them somewhat more expensive but also increases the tendency to oxidize, form dross, and react with other metals. Although the higher tin content might lead one to believe that wetting would be improved, this is not so (v. supra). Only under nitrogen do we generally achieve Wetting similar to that for the eutectic tin/lead composition can be achieved in an inert atmosphere (e. g., nitrogen).

This becomes even more critical when other solders are considered: indium, zinc, bismuth and antimony are being used for special applications and most such solders show miserable wetting properties in air; some of them are even marginal under nitrogen.

Using nitrogen under mild pressure to drive off oxygen during soldering with conventional alloys has become a generally accepted practice in electronic assembly. The user easily acquires the impression that nitrogen 'improves' the process, and in a way it does because there is less risk of oxidation. The benefits of nitrogen are difficult to evaluate since they often are process-specific and reliability based.

As for lead-free soldering, test data and reports have been published concluding that lead-free soldering with nitrogen is highly recommended. The need for a controlled atmosphere in lead-free soldering is even greater than with traditional Sn/Pb alloys. Controlling the oxygen level in the atmosphere improves wettability, solder joint appearance, and reduces the amount of board residues. Better wetting could even allow lead-free process temperatures to be close to current peak reflow temperatures as long as the thermal demand of the product is not a significant issue. This could eliminate component thermal shock issues altogether...although this is a desideratum and not an established fact.