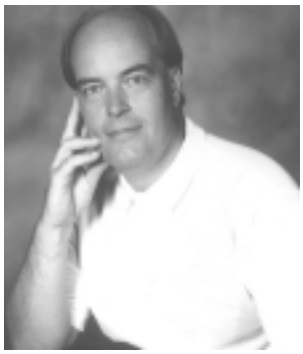
No Clean Technology - Company Introduction with Success not Failure



Bob Willis

The majority of companies in the electronics industry are running a no clean production process for their printed board assembly. The last survey the author conducted with the SMART Group showed that over 85% of companies had eliminated cleaning from their production process. Unfortunately many companies introduce changes in their manufacturing process but often do not think things through completely, hence problems arise which could be easily overcome. The same problems can be encountered as moving from no clean solvent based fluxes and the move to VOC or water based materials.

It is important to have a planned phase in of any new process whether it is the introduction or the elimination of cleaning in the factory. In the introduction of cleaning processes, or the changes to existing cleaning materials, the issues of design, component compatibility and of course reliability each have to be considered and documented. It is fair to say that engineers who have been through the introduction of low residue materials are better placed to phase in VOC free materials. If you are using a no clean but high solids flux and looking to go to a flux with less than 2% solids many process issues can still apply.

The following no clean/low residue material and process issues need to be considered when introducing a new process technology, like a move away from high solids rosin/resin or water soluble fluxes and can be a starting point in a company's implementation plan.

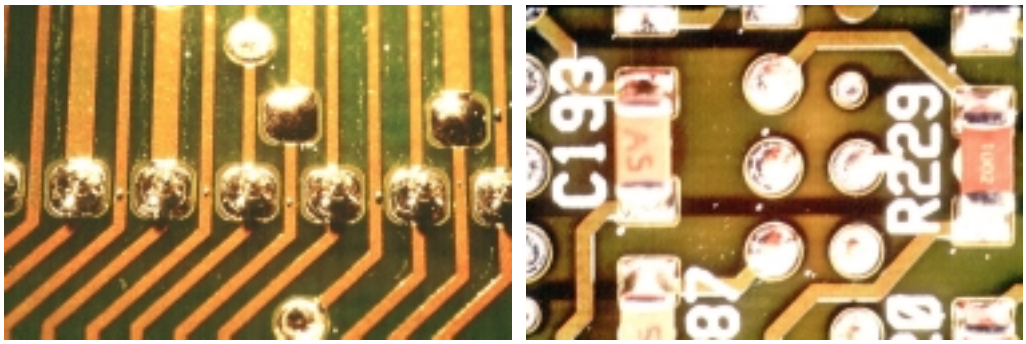
Component termination solderability
Liquid flux for wave and rework
Printed board specification
Solder wire spitting
Wave soldering process set-up
Solder pallet design
Increased drossing
Cleaning solder paste stencils
Cleaning poor prints
Cleaning in circuit test pin and fixtures
Hand soldering iron tips
Visual inspection residues
Rework and repair flux application
Process control cleanliness testing
Reliability testing

Let us consider one of the key issues:

Printed Circuit Boards

The two key issues with printed circuit boards are solder masks and solderable finishes. The type of solder mask used is often disregarded but is the main issue for solder balling and visual cleanliness arguments with suppliers. Define the mask, the supplier, and the application technique; each will have an impact on ball adhesion and can have an impact on visual cleanliness. Actively reducing the number of PCB suppliers is very beneficial as it makes the control of the product much easier to control. Find out how they monitor and test the solder masks they use in production, the temperature/time they use for curing and control of the UV exposure and compare this with the material suppliers' recommendations.

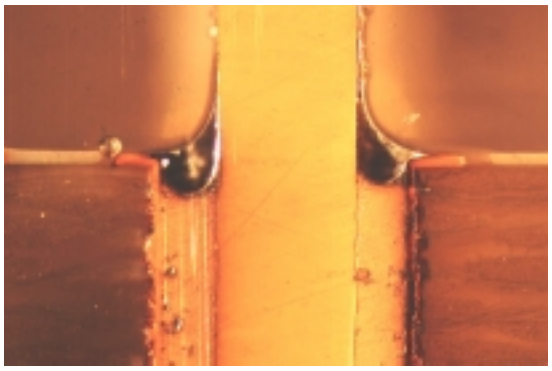
The issues relating to solder balling during wave soldering and the key aspects of the solder mask are part of an National Physical Laboratory (NPL) project. They are trying to establish he critical parameters of solder masks and the reasons why solder balling and other production processes can be affected by mask selection. For further information on the NPL project visit www.npl.co.uk/ie It is also interesting to note that the solder balling issue on wave soldering is having an impact of the Parts per Million (PPM) defect levels in the SMART Group PPM Monitoring Project. Two companies who are involved with collecting and providing data to create the average PPM levels for wave soldering see solder balling as a key issue with some of their products. Further information on the impact on yields can be found at www.ppm-monitoring.com



Two examples of solder balls on solder mask. One is a random ball example and one is design related

The solder finish specified is inter-related to the selection of the no clean materials. Material suppliers have adapted materials to be more compatible with different solder finishes like OSP, silver and tin. This can be seen on many no clean products but particularly on liquid fluxes for the wave soldering process. If you are changing the flux don't change the surface finish at the same time. Introduce both changes separately to better understand the issues. Talk to your supplier regarding the flux activity or solids content, as these are two areas that are often modified to improve soldering on non tin/lead surface coatings.

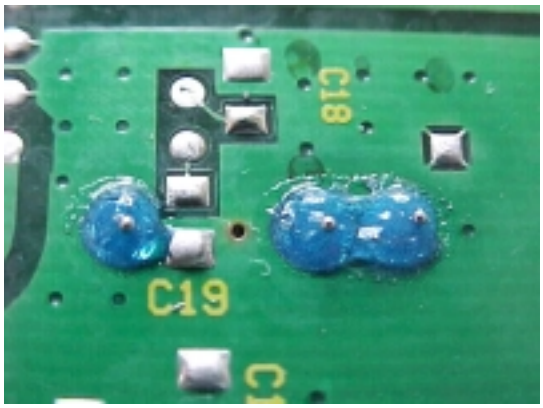
With the advancements of horizontal solder leveling for both tin/lead and lead-free alloys many companies are once again looking at what can be achieved in terms of solderability and surface flatness. Its fair to say that nothing solders as well as solder.



Poor soldering performance shown by this section is due to solderability of the solder finish and the performance of the liquid flux

Temporary Solder Masks

It is common for PCB suppliers to add temporary masks for customers, some can be exposed to high temperatures in reflow prior to wave and still be easily peeled off the surface of the board. Some materials will affect the solderability of the solder finishes that are designed to protect. Temporary solder masks can pick up more solder during contact with the wave as the drainage of solder from them is not as good. This can be based on the flux being used but also the solder pot temperature. Very little work has been done to look at the mask's compatibility with high temperatures for lead-free processes. Initial trials show a slight increase in the solder retention.



Example of solder pickup on a lead-free process with a temporary mask.

All masking should be reduced if possible as there will be stains left by the mask or trapped flux residues. The mask also protects the surface of the solder mask as it passes through the wave, the temperature the solder mask sees is reduced and when the temporary mask is removed there may be a change in colour of the base material. It is not a reliability issue but it does not look good and will lead to a debate.

Over the years Bob Willis has helped many companies with introducing new manufacturing process. He has also run workshops on the used of clean and no clean fluxes dealing with the practical shop floor issues and the long term reliability. Bob Willis may be contacted via his web site www.bobwillis.co.uk or email: bob@bobwillis.co.uk

Please email on to your engineering team!!