Conclusion

The distances between conductors, and the under clearance gaps from the board to the bottom of the components on printed circuit boards, are smaller due to miniaturization. Smaller spacing increases the probability that flux residues or surface contamination will be sufficient to bridge all or most of the under clearance gap between conductors.

High tin solders used in many lead-free solders reflow at temperatures in excess of 230°C, which increased the need for thermal stability, oxidation resistance, and high oxygen barrier properties. The higher soldering temperatures may result in flux thermal decomposition, flux side reactions, and oxidized flux residue. These properties results in a greater cleaning difficulties. The flux residues from these higher molecular weight flux compositions have a greater degree of product to product variation, form hard resinous barriers, and increasingly difficult to clean.

Cleaning flux residues from under component gaps has become extremely challenging due to the nature of the flux residue, under component clearance from the board to the bottom of the component, time required for the cleaning agent to penetrate the gap, the cleaning agents ability to solvate and break the flux dam needed to create a flow channel, and the mechanical energy needed to deliver the cleaning agent to the flux residue. Flux residues that form a hard shell require longer wash times to dissolve in the cleaning agent, thus requiring increased time to clean these residues under the component gaps. The variability of flux residues from different solder paste manufacturer's places increased importance on the cleaning agent design.

Lead-free flux residues require cleaning agents with high dispersive forces. Aqueous engineered cleaning agents provide a viable approach toward meeting the requirements for cleaning lead-free flux residues. The data finds that high solvency with low reactivity provides the best cleaning agent performance for removing lead-free no clean flux residues. The data also illustrates that when a cleaning agent chemical properties do not match up well with the flux residue, mechanical energy is not sufficient in opening the process window for cleaning the residue.

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