

# Stray Voltage on Low Standoff Components

The Doctor diagnoses an acute weak organic acid problem.

This is a short excerpt of a patient visit with the Process Doctor. This is a fictional depiction of an industry problem and customer communication. Any similarities to any actual conversations are purely coincidental.

**Client:** One specific design is showing stray voltage problems on a very sensitive circuit and visually we cannot see anything. We have run FTIR (Fourier transform infrared spectroscopy) and SEM/EDX (scanning electron microscope and energy dispersive x-ray spectrometer), and neither has shown conclusive results. The problem is getting worse. We have tried cleaning the sensitive areas with IPA and a brush; the problems go away for a day or two but return with a greater leakage levels.

**PD:** Are you still using the no-clean flux you qualified?

**Client:** Yes, but we are using a selective pallet process with very densely populated assemblies. Remember, we qualified the mixed-technology assembly process for both solder paste and wave solder liquid flux.

**PD:** Are you seeing leakage issues on the top or the wave-solder side? Do you see these leakage failures during production or are they returns from the field?

**Client:** The sensitive circuit is on the wave-solder side and yes, we see production functional test problems and a larger number of field returns. We are seeing a number of NTF (no trouble found) returns that caused us to investigate the sensitive circuit. We are also using two vendors to supply the component. Problems seem to be related to the switch to a selective pallet with a design change for a connector near, but not subjected, to the wave-solder process.

**PD:** Let's run a couple of tests on some of the leaking returns and on current production samples directly off the assembly line. These are routine tests and will not be destructive. Just see the lab and they will get some total and localized extraction samples. We will see you in two days for a follow-up to discuss your results.

**Client:** Do you think it is serious? I have an ISO audit in a month and I want to do well.

**PD:** Leakage issues like this are becoming more common but need to be corrected, and the process needs to be optimized to eliminate these detrimental

effects on sensitive circuits. Remember, your product is changing. Designers are using better component technology and these issues impact how clean certain circuits need to be. When you qualified the original process to J-STD-001 four years ago, these package styles were not widely used. We will look at the lab results and discuss what may be causing this issue.

Two days later in the Process Doctor's office.

**PD:** How have you been performing? Are the leakage issues still the same or worse?

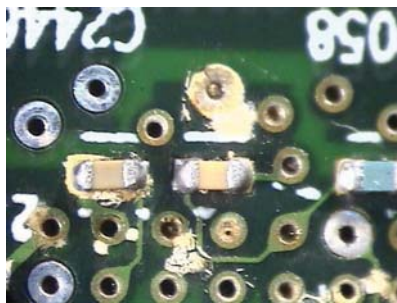
**Client:** It is about the same. Management is worried it will impact our ISO audit and quality program if we do not get it under control. What did the lab tests show?

**PD:** The good news is that the incoming bare boards are still clean and your suppliers are meeting the cleanliness specifications you put in place.

The assemblies overall showed low amounts of ionic and organic residues, with the exception of the area around the selective solder area. As seen in this photo (Figure 1), the white residue is next to the selective solder area. The white residue is a reaction with moisture after exposure to the extraction solution. The WOA (weak organic acid) levels are above 200  $\mu\text{mg}/\text{in}^2$  and are only that high in the surrounding

area of the selective solder location. The area that is contacted with the wave is low in WOA (levels of 39 to 47  $\mu\text{mg}/\text{in}^2$ ) and appears to have no problem with stray voltage based on your schematic details. But the area 1" to 2" from the opening is high in WOA flux residues. This indicates that the flux is wicking up into this critical area of the pallet and then is shielded from the thermal activation energy of the preheats and wave solder itself. This is a very correctable problem. Optimize the flux application, ensure the boards are seated completely and if flux is still present then apply a small amount of secondary heat to the area of the problem. With this additional heat the flux will be completely complexed and then become the benign residue it is everywhere else on the assembly.

Two weeks after implementing the recommended corrective actions, the ESS-biased humidity test samples passed and the process received qualification using SIR and ESS testing on functional hardware. ■



**FIGURE 1:** White residue caused by a reaction with moisture after exposure to extraction solution.

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