Taking End Application Environment Into Consideration with No-Clean Chemistries

No-clean chemistries became popular with the banning of environmentally-unfriendly CFC based cleaning agents in the 1990's. The idea of not having to clean the residues after soldering became a quick money saver and caught on fast.

No-clean fluxes are formulated to leave behind residues that are non-conductive and non-corrosive when at typical environmental conditions. Interestingly, IPC doesn't discuss or give a standard for "no-clean". However a "no-clean" chemistry is considered a chemistry that passes the IPC corrosion and current leakage testing requirements with the residues in place. These tests are the IPC Copper Mirror, Corrosion and SIR tests.

Previously we mentioned that no-cleans are formulated to be non-conductive and non-corrosive in "typical" environmental conditions. "Typical" conditions means temperatures that are not excessively hot in the actual working environment of the end product and in conditions that are dry (humidity is okay, but actual water moisture/condensation is not okay). In these "typical" conditions, the flux residue will remain non-corrosive and non-conductive. This does not mean that the flux residue will be completely inert and/or non-ionic. Flux is by nature ionic as it is composed of weak organic activators and possibly halogens or halides as well. Equally important, by-products of the fluxing process include metal salts (mostly Tin Adipate for lead-free and Lead Adipate with leaded alloys) and other contaminants including dust, oils, residues from the PCB fabrication etc. All of these residues can become ionic and remain on the board after the soldering process in a no-clean process application. This is not problematic under typical conditions as the residues remain as non-ionic solid, often crystalline, salts. Salts are not ionic until they dissociate when melted or dissolved.

Since it is known that there are significant sources of ionic material after the soldering process, these residues are held immobile so that they cannot become conductive/corrosive by one of two methods. For rosin containing fluxes (such as wire, paste and some liquid fluxes), the rosin is used as a glue to encapsulate and hold all the remaining residuals. The rosins used in flux chemistries (typically water-white gum rosins) are hydrophobic by nature and make very good encapsulants that resist humidity. The rosin does not allow the residuals to become mobile and cause corrosion or become conductive. As for non-rosin based no-clean residues, the residues are designed to remain in a solid form in "typical" environmental conditions and therefore also not be mobile or conductive/corrosive.

Problems only occur when the operating environment is not acceptable (not dry or excessively hot):
If an end product will be used in: 1) an environment that is greater than 90C (above the melting point of the rosin residue), 2) in high power applications, if the temperature at the individual component level sees these high temperatures, or 3) in a condensing type environment (where the solid residues can become dissolved in water moisture and therefore ionize), then we would not suggest the use of a no-clean flux chemistry as the residues could become either melted/liquefied, or dissolved in water condensation. In both cases the residues are now no longer immobile and could potentially become corrosive/conductive. In these types of end use applications, a wash process to fully remove any residue is often necessary.

Please contact Kester Technical Support expert at 1-800-2KESTER (1-800-253-7837) for more information.