TECHNICALLY SPEAKING

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More Specifics on Soldering Flux

We've discussed soldering flux earlier, with regard to desoldering the new lead-free solder alloys. We talked of how the flux aids in the soldering/desoldering process by removing oxide films which form on the surface of metals being soldered, how it increases the wetting ability of the solder, causing it to flow more uniformly over surfaces without balling-up. In terms of desoldering braid I pointed out that flux is vital for the formation of the solder-to-braid bond, which pulls the solder from the surface of the PCB; without the presence of flux this solder-to-braid bond would not form and the bare copper wire would not remove any solder.

What else can we say about solder flux? The most basic soldering flux, one that has been used for over a thousand years, is the natural rosin derived from pine tar resin. Pine tar **resin** is dissolved in solvent and then distilled to yield the clear, water-white **rosin** used in soldering flux. Rosin is a collection of naturally occurring acids, chiefly abietic acid and its homologs. When used as a soldering flux, the clear rosin is dissolved in a solvent, usually isopropyl alcohol. When used in this manner, without the addition of acid activators, it is referred to as Type R Rosin flux.

Activators are added to soldering flux to increase the ability of the flux to dissolve heavier oxide films, especially those produced at the higher soldering temperatures required for lead-free solder alloys. Activated fluxes can be either mildly activated or Type RMA (rosin –mildly activated) or RA (rosin-activated). Activators commonly used include organic acids, halogenated (containing chlorine or bromine) compounds, amides, and monobasic and dibasic organic salts. All of these activators are corrosive and should be removed from the circuit board to ensure long term reliability.

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Activated and mildly activated rosin fluxes can leave behind chloride ions and other corrosive residues and therefore must be removed from the printed circuit board after soldering or desoldering to prevent long term corrosion related failures. The residues of these fluxes are also sometimes tacky and attract dust which may contain conductive elements that can cause shorts and other electrical failures on the board. As lead-free solder alloys become more prevalent in manufacturing, the use of highly activated fluxes, to overcome oxidation film formation at higher soldering temperatures, will increase. Thorough cleaning after soldering or desoldering, when using a lead-free alloy, will become mandatory.

No Clean fluxes can be either made with natural rosin, or contain synthetic resins. Rosin-based No Clean flux solutions are essentially the same as the rosin (R Type) fluxes, but usually contain natural gum rosin at a much lower concentration than that used in the R Type (R, RMA and RA) flux solutions. True synthetic No Clean fluxes contain synthetic resins that impart the same desirable properties to the flux as does the natural rosin product. No Clean flux solutions can also contain additional activators, and the residues they leave behind can lead to corrosion.

No Clean fluxes were designed to help circuit board manufacturers skip the time and expense of cleaning the board after soldering. No Clean fluxes leave much less residue behind than the conventional R Type flux, and this smaller amount of residue will usually not interfere with the operation of the board or cause long-term corrosion-related failures. The residues left by a No Clean flux may be sticky and attract dust or otherwise detract from the appearance of the circuit board and therefore can require removal (cleaning) to meet appearance or operation standards. If the circuit board is to be conformal coated to protect the circuitry during operation, the board surface must be free of flux residues, even the minimal residues left by No Clean flux, to ensure good adhesion of the conformal coating. The need to use more activated (corrosive) flux when soldering with lead-free alloys may also make removing flux residues a necessity, further reducing the benefits of using No Clean fluxes.

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Water soluble fluxes usually employ water-soluble resins whose residues should be removed using a water rinse. Some water-soluble fluxes are water-based solutions, which eliminates the need for using an alcohol-based flux solution. This is one way in which VOC emissions can be reduced, for those board manufacturers operating under stringent environmental regulations. Acid activators commonly used in water soluble fluxes include organic acids, halogenated (containing chlorine or bromine) compounds, amides, and monobasic and dibasic organic salts. All of these activators are corrosive and should be removed from the circuit board to ensure long term reliability.

The IPC J Standard (Joint Industry Standard) flux classification system has replaced the military's soldering standards under QQ-S-571 and MIL-F-14256.. Fluxes are rated as RO (rosin), OR (organic), IN (inorganic) and RE (resin/synthetic resin). The activity of the flux solution is rated as L (low activity or <0.5% halide), M (medium activity or 0 to 2% halide) and H (high activity or 0 to >2 % halide). Fluxes are classified for halide (Cl^- or Br^-) content as 0 (no halides) or 1 (some halides). The Under this classification scheme an ROL0 flux would be a rosin flux with low activity and zero halides An RMA flux could be classified under this scheme as an ROM1, if it contained 0.5 to 2.0% halide content.

As a side note, the flux used on all Chemtronics desoldering braid, for both Chem-Wik® and Soder-Wick® braid, is lead-free. Likewise the CircuitWorks® rosin-cored Pocket Solder, part number S100, and the two CircuitWorks® flux dispensing pens, part numbers CW8100 and CW8200, contain lead-free flux components.

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