



## Flux Cleaning Myths, Basics

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There are a lot of myths and perhaps just misunderstandings about cleaning solder flux from printed circuit boards.

This article from ACL will hopefully address some of those primary myths and concerns regarding cleaning and PCB preparation for a variety of rework and repair operations.

Firstly, we clean and remove most flux residues in order to prevent metal oxidation and to prevent generally poor electronic circuit connections.

Often, technologists and technicians alike are advised to clean boards post soldering processes with isopropyl alcohol (i.e. IPA). There are proven chemical reasons for not using a hygroscopic solvent like IPA (hygroscopic: it draws moisture from the air to itself as an equilibrium mechanism) for basic board cleaning and further process preparation.

In most instances, IPA is too aggressive for most plastics and can intrude into parts and spaces creating undesirable effects. IPA is known to dissolve polystyrene and other types of plastic capacitors. By dissolving various materials, a potential low-ohm and conductive film is spread over the surface of the PCB while the flux itself (typically a very high solids material) is left untouched in a host of board surface areas, and in particular, at the solder joints. And, left over flux materials can be detrimentally conductive in many instances.

### **Now, briefly looking at flux materials:**

Rosin based flux is generally not conductive unless it is baked on at extremely high temperatures (caramel or black in color). Generally, no-clean flux is just that. It does not always require cleaning and you may leave it on. Many low solids flux materials when applied under a correctly controlled process will completely evaporate with time. Most water soluble fluxes need to be removed simply because they leave behind a soap-scum like residue which is generally conductive. Additionally, there are some very aggressive fluxes like RA that must

be removed as they contain very acidic substances. RMA is the most prevalent rosin flux (RMA rosin mildly activated and RA rosin (less) activated). It is actually not the rosin that performs the flux activity, but another substance in the flux compound which promotes spreading and adhesion. The basic rosin material is simply a carrying vessel for the active flux ingredient. Flux works on two fronts: When activated (and temperature controls this; most fluxes kick in around 100C or 212F), flux is a very reactive element that wants to bind with oxygen molecules. It is so reactive it can strip oxygen molecules that have already bonded with copper. So it converts copper oxide back into basic copper. The second thing flux does is lower the surface tension of the solder. This lets the solder flow over the soldered surface, spread and adhere.

Under a correctly controlled process, the flux is given some time to activate and do its work before solder is applied. Wave solder machines apply warm flux to the board first, then let it soak for a few seconds as the conveyor moves over a warming plate, and finally the flux is fully activated. The board then passes through the solder wave where the flux totally evaporates and essentially leaves behind a clean board. Solder paste works in a similar way. When conducting reflow processes, you have a ramp up to flux activation, a hold phase to let the flux do its work and evaporate, and finally, a ramp up to liquid phase where the solder melts and flows on the remaining flux. In theory, if reflow operations are done correctly, there should be minimal flux residue and board washing is simple or may not be required at all. Boards that have been reworked (e.g. manually touching one individual component) will have residue and require washing with flux removers. The flux in solder wire is a different composition than the flux found in pens or liquid form. The flux in solder wire is dry powder and is more aggressive than paste as it has a shorter time to do its work. And there are specially formulated fluxes like the gel fluxes or tacky fluxes. These are formulated for rework, and the idea is to use a lot of it; so much of it that there is excessive residue and you need to remove it. The same goes for pen fluxes. Those are for rework. Most fluxes for wave soldering come in a 55 gallon drum which is not something most end-users keep on the workbench!

## **In general:**

When performing handwork, you will need to clean the board unless no-clean is used when doing reflow or wave soldering. If aesthetics are key, it's important to clean. And, every kind of flux has its own specific flux remover. Some flux removers are broad spectrum. Most flux removers require flood cleaning; you need to use a substantial amount to effectively clean and wash a board. Simply squirting a tiny bit on does not work. It just leaves goop all over the board like a sticky film. You need to flood it on, let it soak for a few seconds, and in many cases scrub with a brush. Then repeat the spray process to wash the 'spent' material off the board. As a final process, let the board drip out and spray once more. If needed, apply warm air to dry. And, never blow

air using your mouth. As the flux evaporates, it cools down the board which pulls moisture out of the air. Human breath actually contains saliva which is acidic. Always use your reflow hot air gun for any type of final finishing and drying.

As always, contact ACL Staticide with any technical cleaning questions. We are your first source for all rework and repair cleaning products and compliments.

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