

Selecting Flux for Soldering Coilcraft Components



Which flux to use is dependent on many factors

Ideally, solder flux removes all oxidation on the surfaces to be soldered, and allows the solder to flow where it is needed, making solder joints secure. This application note discusses flux selection for soldering Coilcraft components.

Solder flux comes in various chemistry types and activity levels. Flux technologies are described by terms such as high solids, aggressive, low solids, mild, water-soluble, activated, synthetic activated, R (rosin), RA (rosin activated), RMA (rosin mildly activated), and no-clean. While the above terms are used within the electronics industry, IPC J-STD-004 categorizes flux into four composition types: Rosin (RO), Resin (RE), Organic (OR) and Inorganic (IN), and each composition type may have a low, moderate, or high flux/flux residue activity level. The standard also further breaks down the categories by the percentage of halides by weight. Halides measuring <0.05% by weight in flux solids are considered halide-free.

Table 1-1 of the standard shows the many possible combinations: <http://www.ipc.org/toc/ipc-j-std-004b.pdf>

While it is clear that flux helps in the soldering process, it is not obvious which ones should be selected. The selection of an appropriate soldering flux for use with inductors and transformers involves many considerations. These considerations include, but are not limited to:

- The inductor or transformer termination materials
- PCB and part termination contamination/cleanliness
- The PCB pad/hole materials
- The solder alloy and form (string, bar, paste)
- The size of the coil wire
- The package style – e.g. open, partially enclosed, molded, sealed
- Processing options (flux bath, aqueous wash, no-clean, etc.)
- Will the component be potted?
- Is halogen compliance required?

Coilcraft makes wirewound components in a wide range of sizes. During PCB soldering and cleaning processes, flux may wick up into the windings by capillary action, and may become trapped. Washing may drive the flux residue further into the windings. The wire gauge used in our chip inductors and common mode chokes is such that it does not take a large amount of acidic flux residue to damage

the wire or insulation. Most often, the damage is seen as corrosion that is green or brown in appearance. The damage may be discovered just after processing, or it may take time to develop. Components with larger gauge wire may take more time to show the effects of corrosion. Damage to wire insulation may be difficult to detect visually. For these reasons, **complete removal of flux residue is advised.**

While flux removes oxidized surface layers and makes solder joints look great, it may damage the component if it is too aggressive. **The least aggressive flux chemistry that results in a reliable solder connection is the best choice.** If the terminations/land pads/solder vias are copper or have high silver content, they may be tarnished or oxidized from exposure to air or moisture. In this case a mild or more aggressive, higher-activity flux may be considered. However, flux or the flux residue left behind, can damage the fine wire used in the construction of inductors and transformers as describe above. Therefore, **aggressive flux should generally be avoided when soldering fine wire components.**

The activators used in water-soluble flux are typically hygroscopic (absorb water from the air) and if not completely cleaned off may attack the wire, insulation, and connections. These activators increase their activity at higher temperatures. For these reasons, we state our concerns regarding the use of water-soluble flux with fine wire components.

For boards that will be conformal coated, the compatibility of the selected flux should be tested to ensure the coating adheres properly. Some conformal coating companies can provide these testing services.

Environmental tests such as the IPC mirror test for fluxes provide general corrosion results, but these tests are performed after only 24 hours of exposure. Coilcraft recommends verifying the flux, solder, and any cleaning processes, with environmental exposure testing appropriate to the end-use application, to ensure that the part is not affected by the materials or processes.

General statements about fluxes and fine wire components are necessarily ambiguous due to the variety of flux activity levels, the component package style, the range of wire sizes that are used to make the components, and the PCB processing chemicals and variables. Therefore,

it is not instructive to advise a type of flux in general for all applications, and **Coilcraft does not make specific flux recommendations.**

PCB Washing and Coilcraft Parts

Coilcraft products are compatible with a wide range of commercial cleaning systems. Many of our customers use cleaning systems without reporting problems.

However, cleaning systems involve many variables, including pressure, temperature, number of cycles, and cleaning solvents. Cleaning solvents may include neutralizers, surfactants, saponifiers, dispersants and anti-foaming agents. Because of the large number of variables in cleaning operations, it is not practical for Coilcraft to perform tests using cleaning systems. Therefore, **Coilcraft does not test or make recommendations regarding cleaning systems.**

While Coilcraft tests for resistance to solvents per the following specification, this test should not be used as a basis for flux selection:

Resistance to solvents

Specification

There must be no change in appearance or obliteration of marking.

Test method/condition

Inductors must withstand 6 minutes of water or alcohol.

References:

Soldering Coilcraft Components
<http://www.coilcraft.com/soldering.cfm>