



## *TECHNICALLY SPEAKING*

### **Reflow Oven Cleaning: A Necessary Task**

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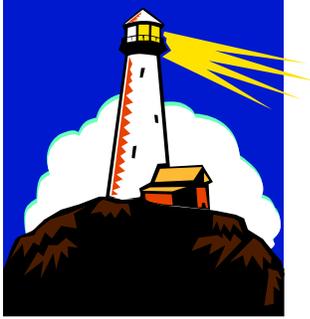
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Cleaning the reflow oven is a thankless task but a necessary one. Ingredients in flux paste and flux solutions will volatilize during heating and these volatile elements will condense out onto cooler surfaces within the oven. Rapid heating of some fluxes can also cause the explosive evolution of volatile solvents, causing the flux to spatter onto interior surfaces. Over time volatilization and spattering causes the buildup of thick layers of flux residue which must be removed to prevent operation problems.

The reflow oven must be periodically cleaned to unclog convection gas jets and nozzles so that temperature profiles can be maintained. Deposits must be removed from conveyor positioning shafts and the fingers that hold the circuit boards to prevent width adjustment and board support problems. Residue deposits can also cause malfunctions by clogging moving parts like conveyors, clamps, chains, pulleys, and drive gears, causing unscheduled shutdowns. Flux deposits within the heater cavity can liquefy and fall back onto boards during the reflow operation. For all these reasons the reflow oven is usually cleaned every two to six weeks as part of a preventative maintenance program, but in facilities that run continuously, the oven may need to be cleaned weekly.

Some conventional reflow ovens are cleaned by running the heater cavity at very high temperatures, so that the flux deposits are burned off. In other setups the oven has a heat exchanger that contains removable collection plates. Purge gas containing the volatilized flux is directed into the heat exchanger and as the gas cools flux vapors condense onto the removable collection plates, which then must be cleaned. Oven performance problems can occur in situations where the heater cavity must be opened for cleaning. Cavity seals can be broken and will then never re-seal properly, which causes increases in nitrogen use. Scrapping the walls of the heater cavity, to remove flux residue, can damage convection gas supply jets and nozzles. With damaged cavity seals and gas jets the oven will never operate as it did when new. Using a solvent cleaner to dissolve the flux residue, so that it can be wiped away, is a gentler operation that has much less chance of damaging sensitive oven components.

Newer "no clean" reflow ovens always operate the heater cavity at temperatures above the condensation point of the flux residue, so that no deposits can form on the walls of the heater cavity. Convection gas within the heater cavity is also kept at a positive pressure to prevent flux particles from solidifying on the walls of the cavity. Re-circulated gas is directed to the preheat zone and the exhaust exit, while flux vapor is condensed onto a removable tray positioned underneath the cooling zone. Such ovens are engineered to minimize the downtime required for cleaning, allowing facilities to operate on a continuous basis



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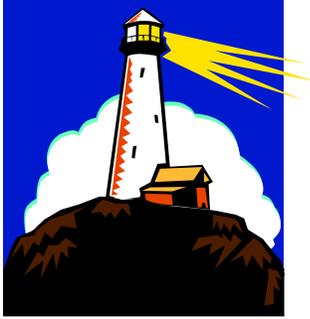
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Traditionally alcohol has been used to remove flux residues from circuit boards and electronic assemblies so it's no surprise that it is also used as the primary reflow oven cleaner, for removing flux residues from interior oven surfaces and collection sites. But alcohol is not the best cleaner for removing the heavy buildup of flux from the inside surfaces of the heater cavity or from the removable collection plates and trays. Alcohol is flammable and since the fastest and best cleaning is achieved when the oven is still warm, this promotes a possible fire hazard. Further, alcohol tends to harden the flux buildup, which makes the residue tougher to dissolve and increases cleaning time.

ITW Chemtronics now offers two cleaners, both of which are used as flux removers for cleaning flux residues from circuit boards and other electronic assemblies, but work well for removing flux residue buildup from the inside of reflow processing ovens. These two products, Flux-Off<sup>®</sup> Aqueous and The Mighty Liquid<sup>™</sup>, can be used singly or together to remove flux buildup from even the dirtiest oven cavities and collection surfaces. Flux-Off<sup>®</sup> Aqueous is offered as a water-dilutable concentrated residue saponifier, while The Mighty Liquid<sup>™</sup> is a solvent-based, non-dilutable product. Flux-Off<sup>®</sup> Aqueous is non-flammable and works best when used on warm oven surfaces, while the solvent-based The Mighty Liquid<sup>™</sup> is flammable and best used on cool oven surfaces.

Flux-Off<sup>®</sup> Aqueous, part number ES132, is supplied in one-gallon plastic containers as a concentrate. Depending on the degree of flux residue buildup within the reflow oven, Flux-Off<sup>®</sup> Aqueous can be used full strength or diluted with deionized or distilled water. For quicker cleaning Flux-Off<sup>®</sup> Aqueous should be applied to the flux residue while the interior oven surfaces are still warm (90 °F to 125 °F). For ease of application Flux-Off<sup>®</sup> Aqueous should be placed in a polyethylene or polypropylene bottle equipped with a plastic trigger sprayer. We further recommend that the trigger sprayer to be used contain a polyethylene or polypropylene piston, to prevent swelling or deterioration of the sprayer internal mechanism under prolonged exposure to this product.

Since Flux-Off<sup>®</sup> Aqueous is a concentrated cleaner it can be diluted up to 10X with deionized or distilled water for increased cost savings and still dissolve even moderately thick deposits of flux residue. Of course thicker deposits may need a "stronger" diluted cleaner, such as a 1 to 5 dilution with water or a 1 to 2 dilution, and some may even require the use of the Flux-Off<sup>®</sup> Aqueous at full strength to achieve complete removal within an acceptable time. Spray the Flux-Off<sup>®</sup> Aqueous onto the interior surface of the warm oven, coating any visible flux residue buildup. Let the cleaner stand on the residue for five to ten minutes then wipe off the saponified residue with a suitable wipe. Depending on the thickness of the residue within the oven, the Flux-Off<sup>®</sup> Aqueous solution may need to be applied two or three times to completely remove all layers of flux residue down to the bare metal. Since Flux-Off<sup>®</sup> Aqueous can be corrosive to some metals, remove any over-sprays from



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uncontaminated surfaces by wiping with a damp wipe. There is no need to rinse a newly cleaned surface after all the flux residue has been flushed away, as residual traces of Flux-Off® Aqueous will have been removed by saponification with the flux residues.

To prevent compounding the cleaning operation by leaving behind lint and cloth fibers we recommend using a polyester-cellulose blend wipe, such as the quilted Econowipe™, part number 6713, for wiping down the interior surfaces to remove dissolving flux after Flux-Off® Aqueous has been applied. The quilted Econowipe™ provides a durable and economical cleaning wipe that will not tear or fray and leave behind lint or fibers that will stick to the dissolving flux residue or the interior surfaces of the oven. The 6713 Econowipe™ provides a large 12" by 13" cleaning surface, and its high absorbency will soak up a large volume of dissolved flux. Wiping away dissolved and saponified flux residue is much gentler than scraping the residue away using an appropriate tool and will therefore be much less likely to damage sensitive gasket seals and gas jets and nozzles.

For very heavy residue and especially where baked flux has become encrusted on oven surfaces, initial cleaning should be performed using The Mighty Liquid™ solvent-based cleaner. The Mighty Liquid™ is supplied in a one-gallon plastic container, so for ease of application fill a polyethylene or polypropylene trigger sprayer-equipped bottle with The Mighty Liquid™. Allow the interior of the oven to cool to room temperature then spray The Mighty Liquid™ onto all encrusted and hardened flux residue. Let the cleaner stand for approximate five to ten minutes then wipe the area down with an Econowipe™ wiper. Additional applications of The Mighty Liquid™ may be required to completely remove exceptionally heavy flux residue buildup. Once all the encrusted flux has been removed future maintenance cleaning should be performed at least a weekly using Flux-Off® Aqueous.

Unlike the Flux-Off® Aqueous, The Mighty Liquid™ is a solvent-based cleaner and cannot be diluted with water. As the solvents used in The Mighty Liquid™ are somewhat aggressive, care should be taken not to spray The Mighty Liquid™ onto plastic surfaces that might be damaged by this strong cleaner. Also The Mighty Liquid™ is flammable so it should only be used on oven surfaces that have cooled to room temperature.

The Econowipe™ wipe along with The Mighty Liquid™ for initial cleaning and/or Flux-Off® Aqueous for periodic maintenance cleaning, provide a unique cleaning system for maintaining the reflow soldering oven at maximum cleanliness for optimum performance.

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