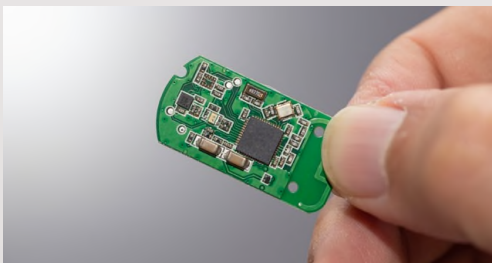


## Don't Let Contamination Impact Your Aerospace PCB Conformal Coatings

- Author: Emily Peck, MicroCare Senior Chemist
- Industry: Electronics
- Published: EPP Europe



*It is essential that the boards are perfectly clean and dry before applying any conformal coatings*



*Fingerprint oils and salts must be removed prior to conformal coating*



PCBs (printed circuit boards) used for aerospace applications must withstand many harsh environmental conditions including high humidity, a range of airborne contaminants and varying temperatures. So, encasing them in a protective conformal coating makes sense. Conformal coatings keep harmful elements from touching the delicate components and degrading the performance of the circuit boards. However, for top PCB longevity and reliability it is essential that the boards are perfectly clean and dry before applying any conformal coatings.

The most common types of PCB contamination are fingerprint oils and salts, flux residue, tape or other adhesive residue, solder balls, marking inks and chip bonder. These contaminants come from many sources including transport, handling, storage and manufacturing the PCBs.

Contaminants or soils on PCBs may interfere with the proper bonding of the conformal coating to the PCB surfaces. If left on the boards, contaminants can cause defects in the conformal coating including uneven coverage, pinholes, craters, blisters and fish eyes.

Some contaminants like flux residue also absorb and hold moisture. If the moisture gets sealed under the conformal coating, the conformal coating will likely crack and peel as the trapped moisture releases during the conformal coating curing process.

If that compromised board then makes it into an aerospace environment, any small voids in the conformal coating can expose the PCB and gradually degrade its components. Water, salts and dust can more easily penetrate the conformal coating, resulting in a variety of damage. This can include board delamination, parasitic leakage, dendrite growth, electrochemical migration and shorting. In some extreme conditions it may also cause a complete PCB failure. So, cleaning the contaminants and drying the PCBs prior to conformal coating is absolutely essential.

### Ensure cleanliness before conformal coating

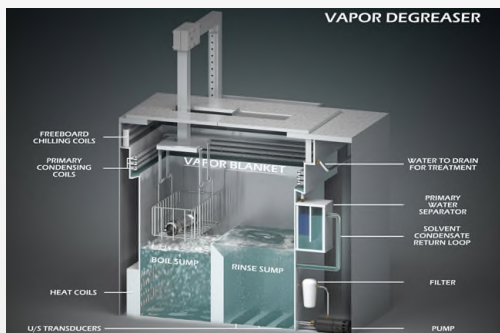
Cleaning and drying PCBs prior to coating improves PCB life-expectancy and reliability. It helps prevent unpredictable board performance and PCB failures due to environmental exposure. It also reduces the chance of malfunctioning PCB returns and costly repairs. Cleaning PCBs ensures good conformal coating that adheres to the PCBs, cures without damage and resists delaminating when exposed to extreme conditions.

Two of the most common methods for cleaning PCBs are automated vapor degreasing and manual cleaning at the benchtop.

### PCB cleaning with a vapor degreaser

As PCBs continue to shrink in size due to the demand for smaller aerospace electronics, manufacturers are squeezing more micro components including low-standoff and bottom-terminated versions onto the boards. As a result, these multi-layered, high-density PCBs are more challenging to clean and dry. Cleaning fluid can get trapped under components leaving the PCBs dirty and unready for conformal coating.

## Tech Article



Vapor degreasing uses cleaning fluid immersion, combined with vapor rinsing and drying to remove contamination



The four steps to successfully cleaning PCBs are wet, scrub, rinse and dry

A good solution for effectively cleaning small, complex PCBs is to use a vapor degreaser and a modern, sustainable cleaning fluid. Vapor degreasing uses cleaning fluid immersion, combined with vapor rinsing and vapor drying, to remove all types of contaminants including fluxes, pastes, particulates and residue. The fluid easily gets into and under all components, but more importantly, it gets out of the tiny channels between stacked components without leaving any contaminant behind.

The vapor degreaser boils a cleaning fluid at a low temperature, usually between 40°C/105°F and 65°C/165°F, to produce a pure, clear and dense vapor blanket. PCBs lower into the boiling cleaning fluid in the boil sump to heat, loosen and remove the majority of the contamination. They then move to the rinse sump where any remaining contamination rinses away. Finally, the PCBs raise up and hold inside the vapor blanket.

The cleaning fluid has a low surface tension to flood the entire board, including under and in-between tightly-spaced components to wash away fingerprint oils, fluxes and residue. Using a low temperature fluid minimizes the risk of damage to the PCB components and since the cleaning fluid is ultra-pure, it leaves no residue behind.

The vapors dry the PCBs quickly by flowing under the low-mounted components. The PCBs come out of the vapor degreaser completely dry, and cool enough for immediate conformal coating.

### Benchtop cleaning and drying

Wet, scrub, rinse and dry are the four steps used for manual benchtop cleaning. First, wet the board with a pure cleaning fluid. Second, scrub it using a good quality scrubbing brush. Third, rinse away any by-products with more clean fluid. The final step is to dry the PCB completely, using a lint-free wipe or air duster to keep moisture from getting trapped under the conformal coating.

### Conformal coating removal for rework and repair

If necessary, conformal coatings are removed for PCB rework and repair. But removing conformal coatings is challenging since the coatings are made to be very durable and difficult to take off. The best way to dissolve a conformal coating is to use a cleaning fluid with a similar chemical composition to the coating. For example, for silicone conformal coatings choose a remover that is silicone-based. It is chemically similar to the silicone conformal coating and makes it easier to dissolve.

Other conformal coatings like acrylic, epoxy and urethane are more difficult to remove. They typically need stronger, more aggressive cleaners and may require soaking to soften the coating. Parylene coatings, typically used as a moisture or chemical barrier in military and aerospace applications are rock-hard and simply cannot be removed chemically. They often require physical abrasion like scraping, cutting or sandblasting to remove.

### Clean for conformal coating success

To ensure the functionality and long-term reliability of PCBs used in harsh aerospace environments, it is crucial that the PCBs are both clean and dry



prior to conformal coating. By properly preparing the PCBs before coating, PCB fabricators can mitigate potential problems including shorts, noise on the boards, or a complete circuit board failure. Simple cleaning and drying, using either automated vapor degreasing or manual benchtop cleaning methods, will help ensure the PCBs are successfully encapsulated without any conformal coating defects and therefore protected from dirt, heat and moisture.

For fabricators looking for help in preparing their aerospace PCBs prior to coating, it is essential to work with a critical cleaning vendor that offers expertise in PCB cleaning and drying. MicroCare can recommend the best cleaning fluids and drying methods that will work best to ensure their conformal coating success.

---

#### **About the Author:**

*Emily Peck is a Senior Chemist at MicroCare which offers benchtop and vapor degreasing critical cleaning solutions. She has been in the industry more than 6 years and holds a MS in Chemistry from Tufts University. Peck researches, develops and tests cleaning-related products that are used on a daily basis in electronics, medical, fiber optic and precision cleaning applications. For more information, visit [www.microcare.com](http://www.microcare.com).*



ISO 9001:2015 Registered

© 2021 MicroCare. All Rights Reserved. "MicroCare", the MicroCare logo and "Discover Perfectly Clean" are trademarks or registered trademarks of MicroCare, LLC. Rev. 21263

