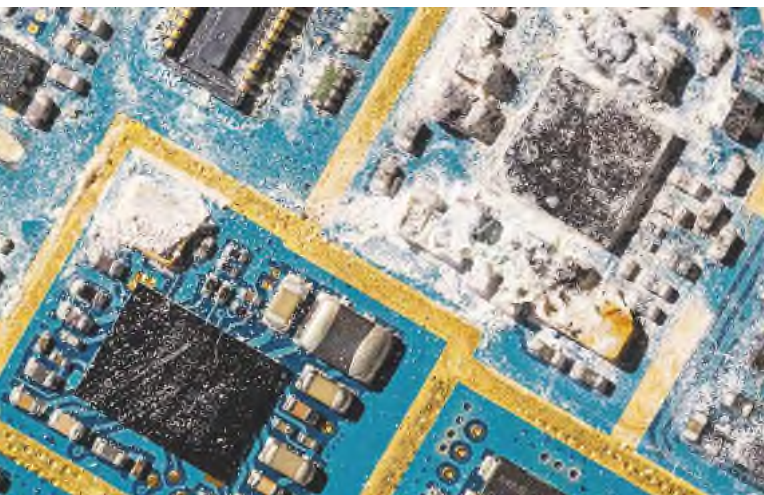


Removing contamination to enhance performance

Cleaning for PCB reliability

Today's PCBA (printed circuit board assembly) customers are requiring maximum performance from miniature-sized printed circuit boards. Their growing demand for smaller electronics assemblies is forcing manufacturers to squeeze even more micro components onto each PCBA. This transition to tinier, denser boards is making circuit board cleaning more difficult and is sometimes leading to reliability issues. If not properly cleaned, contaminated PCBAs can fail in the field, resulting in malfunctioning devices, extensive product recalls and costly warranty replacements.

Emily Peck, Senior Chemist, MicroCare Corporation



Source: MicroCare Corporation

White residue is a common PCB contaminant.

Some complex, modern PCBAs are used in critical applications where failure is not an option. They need to work reliably each and every time without exception. These PCBAs are typically used in products that must endure a long, hard life under harsh circumstances. This includes prolonged exposure to humidity, constant vibration, or extreme temperatures and climates. For instance, GPS satellites, air bag sensors and heart pacemakers all operate under extreme conditions and rely on flawlessly performing PCBAs to help them operate perfectly. If they don't work, then something very expensive, very bad or maybe very deadly could possibly happen.

Time-delayed failures

PCBAs are often used in applications where replacing the PCBAs can be difficult or nearly impossible. For instance, an underground traffic light controller, a space station communication system, or a cochlear implant all require major time, effort or sacrifice to access. Therefore, it is critical that the PCBAs inside these devices work long-term, and continue to work, without interruption, indefinitely. Unfortunately, some failures are intermittent in nature and may not be immediately revealed during initial testing. Even under normal working conditions, some PCBA defects may not appear until a year or more later. In some instances, the products affected, like mobile phones, are replaced often enough (every 2 or 3 years), so it is not

an issue. However, for other more long-lived devices, like a fetal monitor, an electric train motor, or an elevator controller, the possibility of a failure is more of a concern.

Cleaning enhances reliability

Contamination is one of the primary causes of PCBA field malfunctions. Dirty PCBAs are vulnerable to a number of problems including parasitic leakage, electrochemical migration, delamination, dendrite growth and shorting.

Modern PCBAs are small and densely packed with bottom termination components, such as BGAs, CSPs, MLFs, QFNs, and D-Paks. This poses a cleaning challenge since it is difficult to clean under and around these tightly-spaced components. The reduction in pitch between conductors collects and traps contaminants like solder balls under them, making cleaning even more complicated. In some instances, active fluxes or flux residue may stay on the PCBA after reflow in wave machines or after hand-soldering. In addition, other contaminants like ink and fingerprints need to be removed for optimal circuit board reliability.

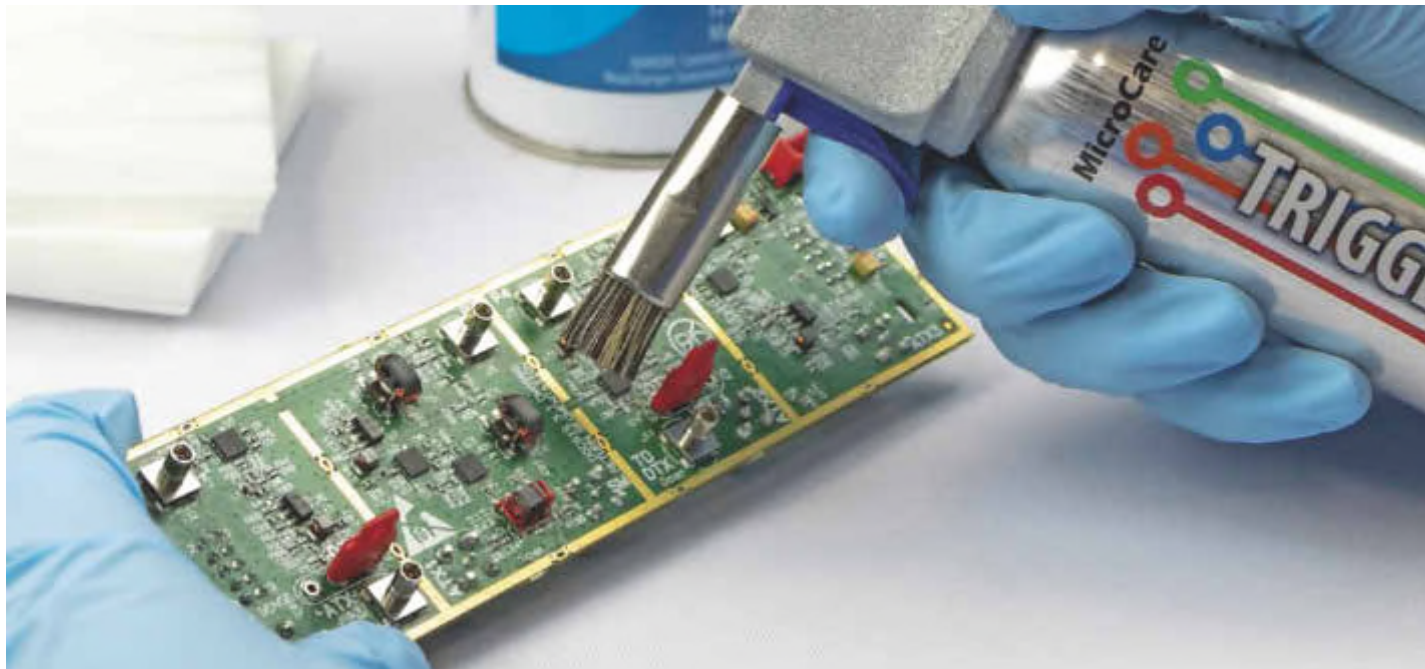
One of the most common types of PCBA contamination directly impacting PCBA performance is flux residue, especially from no clean fluxes. When the salt activators in the fluxes come in contact with heat or other chemicals, they leave behind a white residue that may corrode fragile circuits and enable dendrite growth. This can potentially create noise on the board, interfering with signal transmission, especially on high-voltage systems. Therefore, it is essential to thoroughly clean PCBAs prior to subsequent coating or final packaging.

Three ways to clean

There are three common ways to clean PCBAs. In-line aqueous cleaning, vapor degreasing and benchtop scrubbing. No matter which method used, it is imperative that the PCBAs come out clean and dry to ensure optimum performance, functionality and reliability while increasing the lifespan of the devices they occupy.

In-line aqueous cleaning

Aqueous PCBA cleaning uses deionized water and a detergent in a series of washing and rinsing cycles in large machines. A second operation, using heat or air, dries the PCBAs. Aqueous systems are considered by many to be environmentally friendly however, they do require continuous water monitoring and stringent waste water management.



Source: MicroCare Corporation

A dispensing system helps eliminate waste.

pendent upon two factors: properly trained operators and good tools.

Ideally, the PCBAs are selectively soldered without an overabundance of flux. This improves the chance that all the flux is completely heated and deactivated, leaving as little residue on the board as possible. Less residue makes the boards easier to clean. Typically, well-trained operators choose to clean the entire selectively soldered board, not just the hand soldered area. This ensures the whole board is contaminant-free, including under the components adjacent to the hand soldered area, where the soluble flux might have traveled.

Wet, scrub, rinse, dry

To successfully remove flux residue and other contaminants from PCBAs manually, well-trained operators use the four-step process of wet, scrub, rinse and dry. Wet the board with a pure cleaning fluid. Scrub it using a good quality scrubbing brush. Rinse it off with more clean fluid. Finally, dry the cleaning fluid with a lint-free wipe, a high-quality air duster, or a combination of both. Hand cleaning a PCBA using the four-step process is effective because it allows the operator to adjust the amount of cleaning fluid delivered, how much scrubbing and rinsing takes place, and how well the boards are dried.

Eliminate waste, improve safety

Since many operators clean the entire PCBA after secondary soldering, it is important for them to control the amount of cleaning fluid used. Adding a cleaning fluid dispensing system to their process helps eliminate waste and improves worker safety. Mounting a fluid dispensing system onto an aerosol can of flux remover is fast and simple. It replaces old-style pump bottles and brushes, and keeps the flux remover fluid fresh and pure for each use. The cleaning power of the flux remover is amplified by the mechanical scrubbing action of the brushes. A secondary shot of the flux remover thoroughly rinses and washes away contaminants so they are not left on the board.



Source: MicroCare Corporation

As PCBs get smaller, they are more difficult to clean.

The dispensing system controls the flow and volume of the fluid to deliver the right amount to wet the PCBA completely, but without overspray or waste. The dispensing system allows operators to use 50–60 % less fluid, cutting cleaning costs. Plus, the dispensing system helps limit the operators' exposure to the flux remover by reducing fumes and minimizing the odor.

For benchtop cleaning effectiveness and safety, a cleaning fluid dispensing system is a simple, yet effective way to help protect workers and deliver consistently clean circuit boards for long life and optimum reliability.

Ask for help

As the trend in circuit board miniaturization continues, complexity and high density cause a greater likelihood for cleaning challenges and reliability problems. If the PCBAs are not properly cleaned, the contamination left behind may result in unpredictable performance, costly board failures, and product recalls. Therefore, it is imperative that PCBAs are perfectly clean and dry for the best dependability and performance.

No matter what cleaning method used, it is recommended that PCBA manufacturers work with a critical cleaning partner that specializes in PCBA cleaning fluids. They can help choose the best cleaning process and cleaning fluids to deliver quality cleaning results along with the PCBA performance, reliability, and longevity they expect.

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