Roman Shakespeare and Cleaning

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The leading manufacturer of cleaning and cleanliness testing products.

The first Roman baths were built around 312 B.C. Bathing became very popular, and a normal part of society. By the end of the 2nd Century A.D., Greek physician Galen began recommending the use of soap for cleansing and medicinal purposes. Rome fell in 467 A.D., as did personal bathing habits. The fall of Rome, and the resulting decline in cleanliness standards, contributed heavily to the great plagues of the Middle Ages - especially the Black Death of the 14th century.

Fortunately, those days are behind us. Cleanliness, in fact, has entrenched itself into all areas of society, including our vernacular. Referees instruct the fighters to have a "clean fight;" sports teams hope for a "clean sweep;" and patients hope for a "clean bill of health." Society spends billions annually on cleaning-related products.

I entered the cleaning industry in 1985. Soon thereafter, the industry was paralyzed by legislation proposing the ban of certain CFC-based cleaning solvents. Experts predicted the end of Western technological dominance as cleaning would no longer be effective, and environmentally sound equipment and chemicals would be in short supply. Some even predicted a modern-day "Black Death" of the electronics industry.

It was in this context that no-clean fluxes emerged. Some no-clean fluxes and solder pastes were referred to as no-residue. Currently, they are referred to as low-residue. But does residue equal failure? Not necessarily. Many applications function normally with residue, due to the forgiveness of the application, minimization of the residue, and/or design optimization.

Most consumer products are made in exceptionally large quantities, such as DVD players and MP3 players that are produced by the millions. Board designs and assembly procedures are optimized for acceptable performance under low-residue conditions. Considerable engineering effort has been afforded to ensure adequate product life and reliability while eliminating the flux-residue-removal process.

Board residues have the potential to cause various types of board failures, including electrical leakage, metal migration, and electrolytic corrosion. It should be noted that residues leading to the aforementioned failures may be caused by uncleaned flux residues and also may be caused by contamination on the bare board.

We face a new challenge. Lead-free technology is sweeping the world. Does one specific alloy affect the cleaning process? Absolutely. Heat has long been the enemy of cleaning. Burn a pot on the stove and you know first-hand the increased cleaning required to remove burned-on debris. Lead-free solder pastes generally require more heat to reflow. This increased heat increases visible residues - even with low-residue fluxes. Fortunately, advances in cleaning technologies (equipment and chemistry) allow for residue removal, even in higher-temperature reflow applications. Is residue acceptable? That answer depends on a number of factors. The degree of cleanliness (or lack

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thereof) largely is a matter of reliability, liability, environment, and perceived value.

Reliability

While a residue-caused failure in an MP3 player during a transatlantic flight will not result in a major news event, a similar failure in an in-flight engine control system could reap more tragic results. Applications that are considered high-reliability normally are cleaned to remove board-level residue. This involves most space, flight, military, and medical products.

Liability

William Shakespeare said, “The first thing we do, let’s kill all the lawyers.” The threat of liability, particularly in the U.S., has had a great effect on product designs, warning labels, and the overall cost of goods. In today’s liability-centered society, one must be prepared to prove that methods were implemented to make products safer and more reliable. There is no shortage of published technical data linking flux and other residues to product failures. Proper cleaning eliminates residue-caused failures, thereby eliminating associated liability.

Environment

When determining if a low-residue or no-residue result is applicable, consider the environment in which the product will exist. While some products will function reliably with flux and other residue left intact, others will fail. Heat, humidity, and other environmental factors impact a product’s reliability. Moisture will exacerbate some types of residues, leading to corrosion and metal migration and causing undesired electrical failures.

Perceived Value

While flux residues may cause catastrophic board failures, often these residues only cause undesirable cosmetic appearances. From dull solder joints to white residue, the results of some low-residue applications look bad. In most applications, boards are expected to look clean. White residue, visible flux, and dull solder joints lure the eye of a quality control inspector or, worse yet, a customer.

Conclusion

A product’s value is increased when steps have been initiated to increase reliability, longevity, and appearance. Given the unlikelihood of Shakespeare’s admonishment, cleaning may be the next best alternative.

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