THE DRAWBACKS OF INTERNAL RECYCLING SYSTEMS FOR SOLDER DROSS

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In recent years, there has been a resurgence in the interest of electronic manufacturers toward in-house, or internal recycling systems for solder dross. While the prospect of reducing the volume of solder bar purchases and dross waste sounds financially beneficial, the complexities involved in executing these recycling systems often go underestimated. These complexities can lead manufacturers to reconsider the integration of these systems, or to abandon them after implementation due to unforeseen challenges and inefficiencies.

FIGURE 1. Accumulated dross on the surface of a solder pot.

Solder Wave Integrity and Contamination Risks

In-house recycling systems, such as those used for solder dross, risk reintroducing higher levels of oxides back into the solder wave, as shown in a paper titled, "In House Dross Recovery - Do You Know What You Are Putting Back in Your Solder Bath?" (Holtzer & Fullerton, 2015). This reintroduction occurs due to lack of a comprehensive refining processes typically employed by professional recyclers and can compromise connection quality and product reliability.

This risk is compounded by the possibility of cross-contamination, where foreign materials can mix with the recycled solder. Such contaminants can lead to increased costs associated with rework, warranty claims, and in severe cases, the need to recycle the entire solder pot.

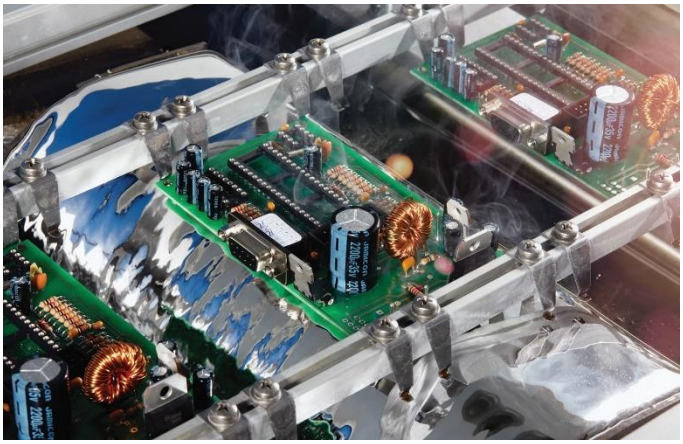

Figure 2. A dynamic solder wave in action.

Environmental and Regulatory Considerations

The environmental impact and regulatory requirements of setting up in-house recycling processes can be substantial and financially burdensome. Electronic manufacturers operate under stringent quality control standards, often

subjected to rigorous audits to ensure consistency and reliability in their products.

Complying with environmental regulations often involves significant initial and ongoing investments. More detailed scrutiny and documentation are required to track the quality of recycled solder, potentially slowing down production and increasing administrative burden.

Moreover, the final waste—comprising primarily oxides from which no further solder can be recovered—still needs to be handled and disposed of properly, typically requiring return to suppliers who are equipped to manage such waste efficiently and safely.

Quality Assurance and Alloy Composition Risks

The in-house recycling process further complicates the standard quality audits due to variations in the alloy composition. This is revealed in the Holtzer & Fullerton paper which found that recycled alloys could shift in their elemental ratios (e.g., tin to silver and tin to lead), leading to unpredictable alloy properties and potential failures in high-reliability applications.

Space Constraints and Operational Efficiency

Space within manufacturing facilities is a critical asset, often directly tied to production capacity and efficiency. The physical footprint required for internal recycling systems can lead to significant opportunity costs. Space allocated for recycling equipment is space that could otherwise be used for additional production lines or other revenue-generating activities. This trade-off must be carefully considered, especially in facilities where space is at a premium.

From an operational standpoint, in-house recycling can divert focus from core manufacturing activities. The training and ongoing management of the recycling process require specialized skills, adding to the operational overhead. There is also the strategic question of whether manufacturers want their engineers focused on recycling or on core production and innovation.

Operator Safety and Health Concerns

The costs associated with providing and maintaining safety equipment and ensuring compliance with health and safety regulations add another layer of complexity and expense to the use of recycling systems.

Handling solder dross and operating recycling equipment involves exposure to potentially harmful substances and undoubtedly the handling of molten metals. Ensuring the safety of personnel requires adequate protective measures, training, and potentially increased insurance and liability coverage.

Economic Considerations and Decreased Reclaim Value

While internal recycling systems can reduce the need for new solder purchases, they also affect the economics of solder use in several ways. For example, the process of skimming and separating metal from dross must be carefully managed to avoid processing more metal than dross, which can misleadingly appear as enhanced performance of the machine.

This economic impact is added to the already-mentioned additional costs such as utilities, labor for operating the recycling equipment, and more complex waste management requirements. Additionally, there is a decrease in reclaim value of the final waste material as it has a much lower percentage of metallic content and higher concentration of contaminants and oxides.

FIGURE 3. Dross reclaim buckets used for collecting solder dross.

A simpler and often more efficient alternative is to allow solder manufacturers to handle the reclaim of dross. By doing this, companies can receive the recovery value for the material without having to manage the complexities, hidden costs and potential liabilities associated with in-house recycling. This approach not only ensures that professional standards for recycling are met but also allows electronic manufacturers to focus on their core production activities without the added burden of managing recycling operations.

Conclusion

While in-house recycling of solder dross may present an attractive opportunity for cost savings and environmental responsibility, the array of challenges and hidden costs it introduces cannot be overlooked. The complexities involved in maintaining alloy integrity, ensuring environmental compliance, managing operational efficiency, and safeguarding worker health present significant barriers. Manufacturers must weigh these factors carefully against the perceived benefits to determine if in-house recycling aligns with their operational goals and quality standards.

References

Holtzer, M., & Fullerton, J. (2015). In House Dross Recovery - Do You Know What You Are Putting Back in Your Solder Bath? Proceedings of SMTA International, September 27 - October 1, 2015, Rosemont, IL.