Case study—

Solder pallet cleaning: 50% cost reduction

By changing to a modern maintenance cleaning agent, Lenze Corporation, a specialist in drive and automation technology, was able to realize enormous cost savings and to increase process reliability. How? The following case study shows the way.

Lenze is a global corporation with over 60 years of experience and about 40 sales companies, development locations and production facilities in Europe, Asia and America. The corporation, headquartered in Hameln, Germany, develops, manufactures and sells innovative products, extensive solutions and complete systems for machine and plant construction. Drive and automation technologies from Lenze set things in motion—conveyors, robotics and handling systems, as well as packaging technologies in the sectors of intralogistics, automotive and foodstuffs, for example.

The electronic assemblies used in these systems are produced by Lenze itself at the company’s location in Aerzen, Germany. In order to ensure a reliable wave-soldering process for the assemblies, the used solder pallets must be cleaned automatically and on a regular basis. Otherwise the flux residues on the pallets could cause the assemblies to tilt. This can lead to bad soldering results, or even production defects that need to be selectively reworked.

Therefore, as a preventive measure, the corporation installed an automated cleaning process some time ago (Figure 1). It was intended to remove all contaminants from the solder pallets in a low-cost, user-friendly process.

Weaknesses of the original cleaning process

The solder pallets are cleaned in a one-chamber spray-in-air system (Figure 2). The cleaning medium used at first, however, showed a few disadvantages in the ongoing process.

In particular, the high operating costs that the process caused were the main problem. The old cleaning agent had a short bath life, which meant that the bath had to be changed after just 100 cleaning cycles. Because the cleaning medium had to be run at a concentration of 20% or more in order to achieve acceptable cleaning results, changing the bath was expensive. In addition, the cleaning results were not satisfactory, especially as the system did not reliably remove all flux residues from the solder pallets.

Besides the cost for the fresh cleaning agent, additional costs occurred for a defoaming additive that was unavoidably needed due to the severe foaming of the cleaner.

There were also a number of technical application problems in the process, such as a recurring bad odor from the machine that often disturbed the operators of the cleaning machine. The odor was caused by the rapid buildup of microbes in the rinse water.

Additionally, it was also very difficult to monitor the quality of the cleaning bath because it could only be controlled superficially by measuring the pH-value of the cleaner. It was impossible to determine other important parameters, such as the current cleaner concentration in the cleaning bath.

Requirements for the new process

Due primarily to the high operating costs and the low level of user-friendliness, Lenze decided to replace the old cleaning process. In addition to cost reduction and improved technical application factors, Lenze hoped to improve the cleaning results as well. Thus, the new cleaning agent had to completely remove the baked-on flux residues from the solder pallets. But since the existing cleaning equipment had to remain in use, the material compatibility of the new cleaning agent with the machine’s construction materials also had to be ensured.

Additional requirements for the new cleaning process, determined from experience and by examining previous process problems, were as follows:

- Increase the bath life of the cleaning agent and the number
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Ideally, be able to use a lower application concentration
Increase the ability to monitor the cleaning bath in order to achieve a stable process
Prevent foaming without the use of additional defoaming additives
Increase user friendliness by reducing odor issues
Completely remove flux residues from the solder pallets

With this list of requirements in hand, Lenze contacted Zestron to evaluate a suitable cleaning agent. Before changing the cleaning bath, the compatibility of different maintenance cleaning agents was tested in jointly conducted material compatibility tests. The cleaning agent Atron SP 200 was ultimately determined to be 100% compatible with the materials in the interior of the cleaning machine, particularly with the plastic materials predominantly used. Therefore, it was possible to change the cleaning agent while continuing to use the existing cleaning machine.

**Improved user-friendliness and cost reduction**

In the cleaning trials, the new cleaning agent provided excellent results even at a concentration of only 10% (Figure 3). The complete removal of all flux residues from the solder pallets was achieved. This ensures that the assemblies can be properly secured for the downstream wave-soldering process.

Despite the low concentration, the number of cleaning cycles could be increased from 100 to over 170 cycles with the new cleaning medium. This is due to the FAST® Technology, which the new cleaning agent is based on. Compared to conventional surfactant sys
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By cutting the concentration in half, from 20% to 10%, and at the same time nearly doubling the bath life, more than 50% of the operating costs could be saved.

In contrast to the previous cleaner, the new cleaning medium did not cause any problems with foaming in the cleaning machine. An additional defoaming additive thus became unnecessary, which in turn lowered the operating costs.

The use of the new cleaner also provided the desired technical advantages, as the rinse water no longer showed any microbe buildup. Thus, the offensive odor was reduced for the operator of the cleaning process, and the previously daily change of the rinse water was no longer necessary. Altogether, water consumption was reduced from 375 liters per week to half of that amount.

Last but not least, the change of the cleaning agent had a positive effect on process stability. In addition to automatically measuring the pH-value of the rinse water, the cleaning agent concentration can now be determined directly at the site using quick and easy to handle chemical tests from Zestron.

### Summary

Working together with Zestron, Lenze was able to evaluate a new cleaning agent that fully met all requirements. Simply by replacing the cleaning agent in the existing cleaning machine, the weaknesses of the old process were fixed.

The new cleaning process provided significant overall cost savings due to a longer bath life and a lower application concentration, while simultaneously increasing process stability with improved bath monitoring.

Since November 2008, the new cleaning process has been running at Lenze onsite in Gross Berkel, Germany, to the complete satisfaction of the electronics manufacturing team.

<table>
<thead>
<tr>
<th>Previous cleaning process</th>
<th>Current cleaning process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bath life</td>
<td>Change bath after 100 cycles</td>
</tr>
<tr>
<td>Cleaning agent concentration</td>
<td>≥20 %</td>
</tr>
<tr>
<td>Rinse water change</td>
<td>Daily, 5 times per week</td>
</tr>
<tr>
<td>Water consumption</td>
<td>375 liters per week</td>
</tr>
<tr>
<td>Solder pallet cleaning results</td>
<td>Some flux residue remaining</td>
</tr>
<tr>
<td>Defoamer</td>
<td>Yes</td>
</tr>
<tr>
<td>Odor</td>
<td>Strong odor</td>
</tr>
<tr>
<td>Bath monitoring</td>
<td>Only pH measurement</td>
</tr>
</tbody>
</table>

Table 1. The comparison shows significant improvements due to the new cleaning process.

“I need my assemblies to be clean and dry for my aerospace application. I want to go directly from the defluxing system to conformal coating.”

Trident removes all flux residues, tests for cleanliness, thoroughly dries, and provides complete SPC data records. With Trident, I know my boards are clean and dry.

“Our assemblies are cleaned in Trident”

Trident automatic defluxing and cleanliness testing systems are used by aerospace manufacturers and other high-reliability electronic assemblers.

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