Spray Cleaning Of PCBs In Industrial 'Dishwashers'

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Spray cleaning processes have become increasingly popular in the European electronics manufacturing industry. These processes, based on dishwasher-type systems, are used especially when limited numbers of boards need to be cleaned, and are an alternative to inline cleaning. In addition to small footprints, spray cleaning processes are also economical and flexible.

The dishwasher process

The cleaning principle of industrial dishwasher equipment (Figure 1) is similar to that of a household dishwasher and hence very accessible to users. Of course, the materials used are adjusted to the requirements of an industrial cleaning application. Furthermore, in an industrial system, the cleaning medium follows a closed loop so that it is used numerous times. Spray cleaning as well as the subsequent rinsing steps are gentle and carried out at a relatively low pressure.

As illustrated in the process flow chart (Figure 2), the cleaning agent is pumped from the holding tank into the cleaning chamber and heated up to the preset operating temperature. As soon as the selected operating temperature is reached, the actual cleaning process starts. After cleaning is completed, the cleaner is pumped back to the holding tank where it is stored for subsequent cleaning cycles. After various rinsing steps with softened or demineralised water, the cleaned parts are dried with hot air. Additional metering channels allow more additives to be supplied, such as inhibitors or defoamers. If required, a range of different baskets allows items with a wide variety of geometries and sizes to be cleaned.

An optimised cleaning process

An optimised approach to this type of cleaning system is the water-based Micro Phase Cleaning (MPC) process. In contrast to traditional surfactant systems, a special feature of the patented MPC technology is that the active cleaning components do not bind to the removed contaminants. The microphases temporarily retain the impurities and then release them to the filter which removes them from the cleaning agent. With this technology, active cleaning agents are not selectively depleted during the cleaning process. In addition, the collected dirt can be easily removed from the system using simple bath treatment processes such as filtration. Consequently a significantly longer bath life as well as lower process costs are achieved in comparison to solvent or surfactant cleaning processes.

Figure 1 - Miele IR 6001 washer

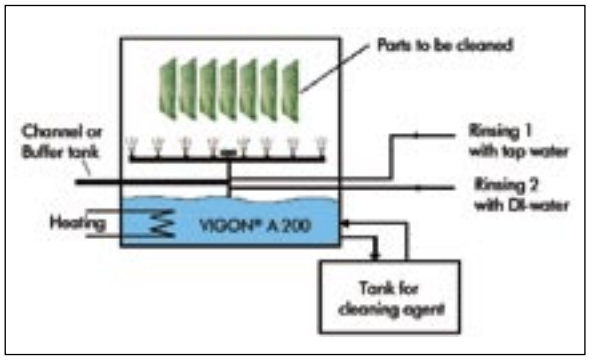

Figure 2 - Process flow chart for spray cleaning in a dishwasher-type equipment

MPC agents were specially developed for the high precision cleaning of electronic assemblies and are suitable for a broad range of flux removal applications. Both polar and non-polar contaminants, organic and inorganic impurities, including salt-like residues, are removed in a single process. Due to the special surfactant-free formulation, electronic assemblies are rinsed and dried residue-free. Lead-free solder pastes have also been subjected to comprehensive tests and can be easily removed.

The process in action

The combination of a dishwasher equipment with an MPC cleaning

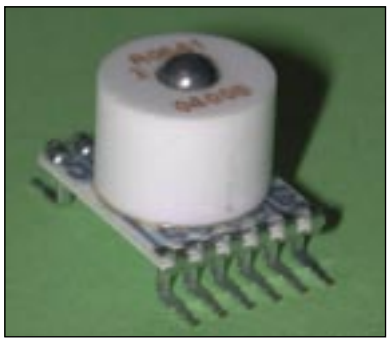

Figure 3 - Inclination sensor by HL Planartechnik

agent allows the use of standard solutions for a wide range of cleaning needs. This is also shown by applications at HL Planartechnik (a division of Measurement Specialties) in Dortmund (Germany) and HE - System-Electronic in Veitsbronn near Nuremberg (Germany). Both manufacturers employ a spray cleaning process with a Miele IR 6001 washer (to be replaced by the Miele IR 6002 in the future) and the water-based MPC cleaner Vigon A 200, but for different applications.

At HL Planar-technik, inclination sensors (Figure 3) are cleaned after soldering. Since the inclination sensors are supplied to the automobile industry, the high cleaning standards typical of this sector must be maintained. Colophony residues from the soldering process with a high lead-containing solder wire must be removed completely (Figure 4).

Additionally, after cleaning a bar code is applied to the sensors by an inkjet printer, which requires a printable, flux-free ink-adhesive surface. The throughput can reach up to 3,000 units per day and the rate is increasing. By introducing an optimised cleaning process (Table 1), the desired reproducible results are achieved.

At HE - System-Electronic, 10cm x 10cm ceramic hybrids (Figure 5) and FR4 assemblies are cleaned after reflow and comb soldering processes. These products are also manufactured mainly for the automotive industry.

The cleanliness requirements are geared toward the J-Std 001D and

	HL Planartechnik	HE - System-Electronic
Cleaning		
Medium	Vigon A 200 (30%)	Vigon A 200 (20%) + 1% Vigon CI 20
Temp.	50°C	50°C
Time	10 min	10 min
Rinse 1+2		
Medium	Softened water	Softened water (+ Defoamer 30)
Temp.	RT	RT
Time	3 min in each case	1 min in each case
Rinse 3+4		
Medium	Demineralised water	Demineralised water
Temp.	40°C + 50 °C	50°C
Time	3 min + 2min	2 min in each case
Drying		
Medium	Circulating air	
Temp.	100°C	115°C
Time	30 min	35 min
Overall process time	50 min	50 min

Table 1 - Process parameters compared

the subsequent wire bonding process. Approximately 4-5 loads are cleaned per day. The water-based MPC spray cleaning process implemented after converting to the lead-free soldering process gave better results than the previously used solvent cleaning method. With the process parameters shown in Table 1, the required thresholds for the ionic contamination were easily met and bondable surfaces ensured.

Other applications

A Miele IR 6001 / Vigon A 200 cleaning process has a wide spectrum of cleaning applications and requests little customisation. In addition to the applications described above, the cleaning of misprinted PCBs is also feasible. By using an appropriate cleaning medium, stencils or solder frames and condensation traps can also be cleaned.

This completely automated process meets the most diverse production requirements and can be used for a broad range of cleaning applications in the SMT industry. Its high degree of flexibility also provides potential cost savings to companies with a range of different cleaning requirements.

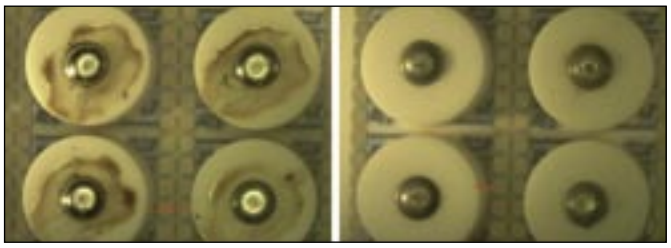

Figure 4 - Inclination sensors before cleaning (left) and after cleaning (right)

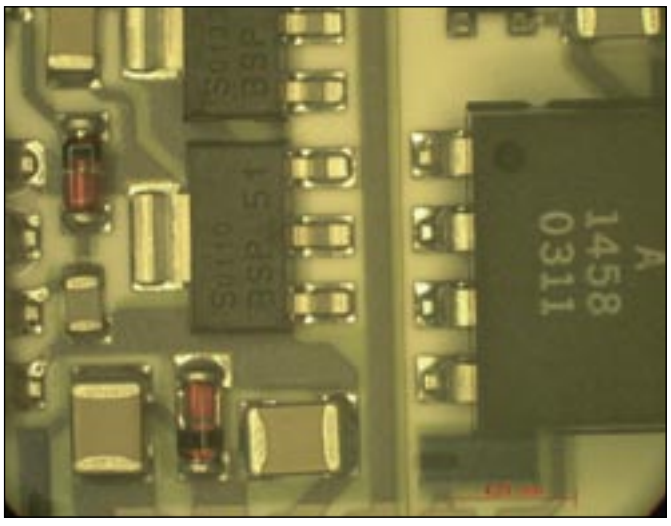

Figure 5 - Ceramic hybrid circuit by HE - System-Electronic