Cleaning at the Speed of Sound

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Cleaning at the Speed of Sound The Ultrasonic Advantage

High pressure spray systems have become the dominant technology when it comes to cleaning post-reflow circuit assemblies. Over the past decade, reliance on immersion cleaning methods utilizing CFC-based solvents have virtually disappeared from the electronic manufacturing industry.

As spray-in-air technology gained market share, circuit assemblies became more complex. Component density increased while standoff heights decreased. This forced spray-in-air machines to utilize more spray pressure, fluid flow, and higher temperatures. Additionally, greater board complexities required more sophisticated defluxing chemicals.

Today, spray-in-air technology is ideally suited for modern circuit assemblies. But the same cannot be said for stencil cleaning applications. The same factors that caused spray-in-air cleaning systems to raise their spray pressures for post-reflow applications apply for stencil cleaning applications. To adequately clean a modern fine pitch stencil utilizing spray-in-air technology one must ensure an adequate degree of fluid flow, spray pressure, and fluid temperature. Unlike circuit assemblies, stencils are fragile. A typical SMT stencil is made up of four components.

1. A metallic frame
2. A mesh fabric
3. A metallic stencil
4. An adhesive that bonds the mesh to the frame and the stencil to the mesh

Each of the four stencil components exhibit different degrees of heat-induced expansion. Unlike circuit assemblies that are not heat sensitive and are physically durable, stencils are exceptionally heat sensitive and subject to physical damage.

Most stencil cleaning applications require the use of a chemical to solublize the flux. Although heat is not a required function of solder paste removal per-say, heat is required to activate the chemical de-foamers commonly used in most stencil cleaning chemicals. In short, if a chemical is operated under an agitated state (spray-in-air) it will produce foam unless it is provided heat (140 F). Unfortunately, stencils should never be placed into an environment where they are subject to elevated temperatures (above 100 F) or where they are subjected to moderate to high spray pressures (above 10 PSI). A successful solder paste or adhesive print relies on a stencil s coplanarity. If, either through heat-induced weakening of the adhesive bond or spray-induced warpage of the stencil, a stencil is compromised, so is the forthcoming circuit assembly.

If stencils were more durable, a spray-in-air stencil cleaning system could be configured to remove all solder paste or adhesive. After all, they are commonly used in more

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difficult post reflow applications. But stencils are not durable thus, spray-in-air stencil cleaners by design can not be powerful. Wherein lays the dilemma. In order not to cause stencil damage, spray-in-air systems utilize low pressure spray systems. Modern fine-pitch and ultra-fine pitch stencils by design require high-pressure sprays in order to adequately penetrate the stencil s fine apertures and remove all solder paste or adhesive. Inevitably one must choose between stencil cleanliness and stencil life.

Unlike spray-in-air technology, ultrasonic technology does not utilize a spray pump, spray nozzles, or any other type of mechanical force-producing mechanism. With ultrasonic technology a generator directs energy (high

intensity sound waves) at a specific frequency range through multiple ultrasonic transducers. Ultrasonic cleaning depends upon cavitation, the rapid formation and violent collapse of minute bubbles or cavities in a cleaning solution. Agitation by millions of small and intense imploding bubbles creates a highly effective scrubbing action on the stencil s surface and within its apertures. As the ultrasonic frequency increases, the number of these cavities also increases but the energy released by each cavity decreases making higher frequencies (40 kHz) ideal for small particle removal without stencil damage.

When a stencil is subjected to ultrasonic energy, the solder paste or adhesive simply falls off the stencil. Because the stencil is surrounded by millions of imploding bubbles, it is virtually impossible for any solder paste to remain on the stencil. Although ultrasonic technology is highly effective on all stencils, it is most impressive when used to clean ultra-fine-pitch (micro-BGA) stencils when, after cleaning, even the smallest aperture is solder-ball free.

Because ultrasonic energy does not produce an agitated state, foam is not produced. With the stencil cleaning chemical s foam production capability eliminated, one may operate the solder paste removal process at ambient temperatures without the threat of foam. An ambient or low fluid temperature, the absence of pumps and high pressure nozzles ensure that the stencil will not become damaged. The sound waves created by the transducers and the resulting implosion of millions of bubbles ensure that there will be no solder paste or adhesive on the stencil.

Clean stencils, without damage. Cleaning at the Speed of Sound. That s the Ultrasonic Advantage!