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Perfect Stencils Need Hi-Res AOI Inspection

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Why the need for AOI?

As components get smaller and boards get denser, there is more need to ensure that the deposition of solder paste meets the criteria for a given component. Before we can determine the feasibility of such deposition, we must consider the stencil being used and factor in its manufacture, problems that can occur, and the ability to examine its accuracy. Newer, smaller product designs such as GPS systems and cellular phones require smaller components that are often placed closer together. This combination can make placing components tricky and can increase the possibility of problems such as tombstoning, solder balling, solder beading, and solder bridging.



One problem that can arise with laser cut stencils is missing apertures. Laser systems are equipped with nozzles that suction the metal from the openings as the apertures are cut. The nozzles can become blocked with metal from large apertures or a build up of residual metal. The laser optics can become polluted and cause the laser beam to lose focus. If the laser settings are not properly compensated for changes in foil thicknesses or if the laser equipment is not calibrated, errors can occur when cutting the stencil.

There are limitations in chemical etching that cause problems in stencils as well. If an aperture is not within the aspect ratio (smallest aperture is a minimum of 1.5 times the foil thickness), the aperture may not fully etch. Additionally, if the spacing between apertures is too thin,

there could be breakthrough causing the separated apertures to become one. Debris in the phototool or resist can be exposed and developed in the foil creating pinholes or extra apertures.

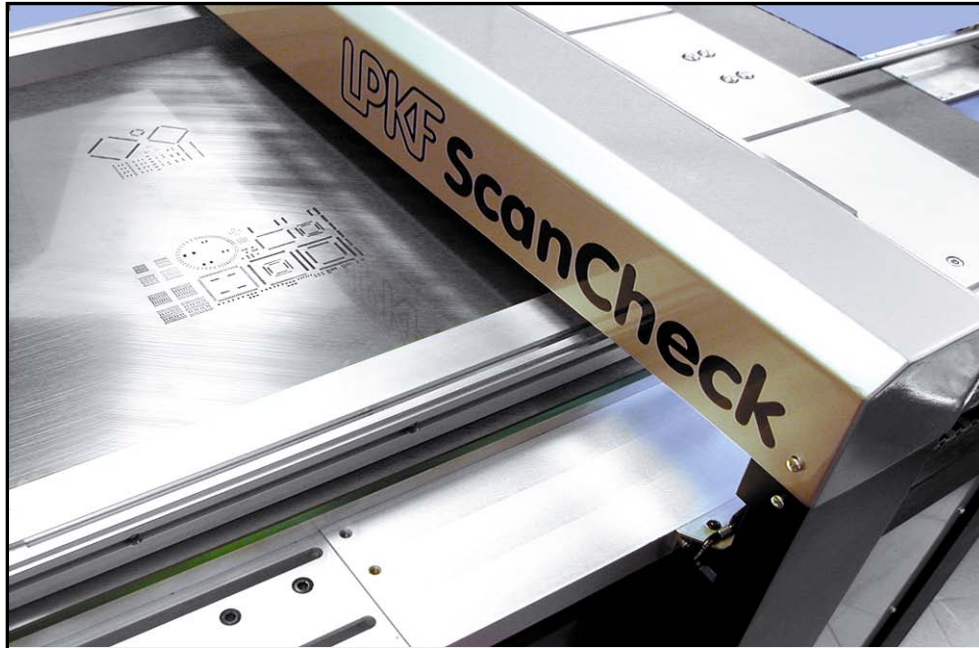
One can quickly realize the need for a proper inspection procedure after considering these and other possible manufacturing problems. In the past, inspection typically consisted of visually looking at the foils with a microscope and measuring some apertures.

Physically counting the apertures to ensure 100% presence isn't realistic.

Today's technology for laser cut, electroformed and chemically etched stencils requires a sophisticated inspection system. One such unit used by MicroScreen in South Bend, IN, is the LPKF

ScanCheck AOI system.

The system is easily operated by placing the stencil on the ScanCheck. High precision guides move the stencil on a granite base over a high-resolution scanner, and the automatic functions of the ScanCheck reduce operator interpretation and allow the scanned data to precisely align to the Gerber data. Alternate AOI systems and scanners used to inspect stencils are slow and have restrictions on the size of the image to be scanned. MicroScreen's AOI scans at 12,000 dpi, while a typical AOI systems scans at 4,000 dpi resolution. Other reasons for selection of this equipment include the ability to scan larger areas – 18.5" x 26" compared to 11.7" x 16.5" characteristic of other equipment.



MicroScreen's LPKF AOI compares the total aperture count from the scanned data to the original Gerber data. The aperture total would also identify extra apertures and pinholes caused by debris in the chemical etching process. Sometimes laser cut apertures are cut through but are not extracted properly and are hung up in the aperture. Similarly, a chemically etched stencil with a deformed aperture caused by resist residue would also be identified.

Another function of the AOI used by MicroScreen is to 100 percent measure every aperture on the stencil. Other AOI systems depend on contrast for aperture definition and require the operator to identify the aperture edge for measurement, which can be an uncertainty much of the time. Incorrectly sized apertures can be caused by the laser beam being out of focus or the laser equipment being on the wrong settings. Underetching or overetching will make the apertures too small or too large throughout the pattern.

In addition to the aperture count, positional accuracy is inspected. If any of the scanned apertures are misaligned with the Gerber data due to an out-of-focus laser beam or non-calibrated laser equipment, the operator is alerted with a % error and the misaligned apertures are highlighted.

Bottom Line: Image analysis of stencils is critical given the growing trend towards boards heavily populated with small and tightly spaced components. Whether you are an EMS or an OEM, you need 100 percent assurance that your stencil has been properly manufactured.

As part of MicroScreen's pro-active commitment to shipping stencils that are 100 percent accurate and reliable, experience shows that an extremely high resolution inspection system is the only way to find even the slightest deviation from size and position.

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