



TECHNICALLY SPEAKING

Screen Printing Chemtronics Temporary Solder Masks

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Chemtronics® Chemask® temporary spot solder masks are usually applied by hand in benchtop masking operations. For large scale production operations two of the masks, the Chemask W water-soluble mask and the Chemask® WF water-filterable mask, can be screen printed over large areas of the circuit board. I want to briefly discuss the screen printing operation and then deal with some of the specifics issues involved in using the two Chemask® masking agents in screen printing.

Let's do a quick review of the screen printing process. A piece of finely woven fabric (at one time made of silk, hence the term silk-screening) normally made of nylon or polyester, is tightly stretched within a wooden or aluminum frame and covered with a template or stencil. The stencil represents a negative image of the pattern to be printed onto the circuit board. The area covered by the stencil is impermeable to the solder mask. The mask will only flow through the screen in the places where the stencil does not appear. The liquid solder mask is poured onto the screen, over the stencil and a rubber squeegee or blade is used to press the mask through the screen. In this way solder mask is "printed" onto the board in sharply define areas, covering those places on the circuit board where the stencil did not cover the holes in the screen.

Stencils are usually made of plastic film, but can he made of other materials, like stainless steel. The stencils are negative images of the pattern for how the mask is to be applied to the circuit board. Stencils can be made in a variety of ways. Usually an image of the mask application pattern is photographed or photocopied and the photocopy is cut out and attached to the printing screen. In the photo-emulsion technique the screen is coated with a photographic emulsion. The masking pattern is drawn or attached to a transparent film and this film is laid over the emulsion-coated screen. The screen is then exposed to bright light. Every where that light passes through the photo-image, it strikes the emulsion causing the emulsion to harden and stick to the screen. The screen is then washed off which removes any photo-emulsion that was not exposed to the light and therefore did not harden. This creates an image of the masking pattern on the printing screen.

The prepared screen is then placed over the circuit board, liquid masking agent is then poured onto the screen and pressed through the screen with a rubber blade. In this way the solder mask is placed on the circuit board in a sharply defined pattern. The printing process is then repeated with other circuit boards. The printing screen can be re-used may times before it needs to be completely cleaned. Once use of the screen has been completed, the screen is cleaned completely to remove all traces mask. The screen can then be stored for later use or the hardened photo-emulsion can be removed and the screen re-stenciled to create a completely different solder mask pattern.



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The mesh size of the screen is important. The larger the mesh size, in relation to the particle size of the mask liquid being screen, the heavier the layer of mask that is applied to the circuit board. For the Chemask[®] Water Soluble the particle size of the “clay” in the product is approximately 0.1 microns, so the size of the square holes in the screen could theoretically be only 0.2 microns on a side to allow the mask to pass through the screen. For the Chemask[®] Water Filterable the largest particle size in on the order of 30 microns, which sets the limit of the screen holes when using this product. In reality larger screen sizes are used, to allow the application of a layer of mask sufficiently thick to completely shield all the parts of the boards when solder is not to be applied.

Screen sizes are quoted as the number of threads that cross within a square inch. As an example a 110 mesh screen has 110 threads crossing per each square inch of screen area. The more threads per each inch the smaller the holes in the screen material. The practical limit for the size of the holes will depend on the thickness or viscosity of the material being printed. The thicker the mask the greater the surface tension it has. More viscous materials are harder to press cleanly through the holes in the screen, so viscosity becomes a limiting factor in screen selection. Considering the viscosities of the Chemask[®] W and Chemask[®] WF, screen sizes between 100 and 300 thread count are usually used, depending on the quality of the print detail required.

Selecting the right mesh size for the screen requires balancing the screen size against the viscosity of the mask, while taking into account the degree of fine detail that needs to be achieved in placing the mask on the board. The best mesh size to use must be determined by a few trial and error runs, starting with a particular mesh size, like 110, and then trying the same print pattern using a larger or smaller mesh size, as required to produce the detail desired. If the mesh size is too small the viscosity of the mask will prevent its movement through the holes in the screen. If the mesh size is too large, too much mask will be applied, which may result in spreading of the mask into areas of the board that should not be masked.

Since a squeegee or rubber blade is used to apply pressure to the mask liquid, to force it through the small holes in the screen and onto the circuit board, the screen printing method **cannot** be used to apply the Chemask[®] peelable latex mask. The squeegee creates shearing forces as the mask is pressed through the screen. Putting shearing force on the Chemask[®] peelable liquid causes the isoprene chains in the natural rubber latex to cross-link. This causes the mask to solidify immediately, which clogs the screen. This effect can be demonstrated by placing a drop of Chemask[®] on a hard surface and smearing it with the fingertip; the mask will immediately solidify when force is applied.



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In summary, screen printing with the Chemtronics[®] temporary solder masking agents will involve testing with a number of screen mesh sizes to determine the best mesh size for the degree of detail required for the specific application, while taking into consideration the viscosity of the mask to be used. Only two of the Chemtronics[®] masking agents are screen printable: Chemask[®] W water soluble mask and Chemask[®] WF water filterable mask. Selection of the optimum screen mesh size will allow printing of these two masks in any degree of detail required. The Chemask[®] natural latex peelable mask is not screen printable as shearing force applied with the squeegee will cause it to coagulate as soon as the force is applied.

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