

## Emulsion information for the screen printer

A technical information article  
by Douglas Grigar

Screen printers have available six types of photoreactive stencil materials. There are three direct emulsion choices, diazo, diazo/photopolymer (dual cure), and SBQ-photopolymer. There are also three photo reactive film choices, indirect film, direct/indirect film, and photoreactive capillary films.

**Diazo emulsions** are the least expensive and the first of the three emulsion types available on the market. Diazo emulsions are mid range in available exposure latitude and can have good edge definition. Drawbacks are that many require hardeners for long runs or water resistance lower solids content is often needed for reasonable viscosity.

**Diazo Photopolymer emulsions** are hybrids of the diazo and photopolymers and are also called dual cure. Dual cure emulsions are the newest available emulsions. Due to the hybrid nature they have the largest available feature and quality range. Dual cure emulsions will have the largest exposure latitude and are available in various levels of water and solvent resistant features. Dual cure emulsions generally have the best resolution, definition, and bridging qualities. Dual cure emulsions are midrange in price, and higher solids content versions are available with reasonable viscosity.

**SBQ- Photopolymer emulsions** are very fast in their exposure speeds but also have the smallest exposure latitude. They are pre mixed and have the longest shelf life. Pure photopolymer emulsions are the most expensive and are best matched with high quality single point exposure systems. Pure photopolymer emulsions have good resolution, definition, and bridging qualities. Pure photopolymer emulsions have the highest solids content available with reasonable and often excellent viscosity.

The solids content in an emulsion does not always reflect in the viscosity An

example would be that pure photopolymer emulsions are available in very high solids content with low viscosity. Emulsion viscosity can also change with temperature. Lower temperatures cause the emulsions to thicken. Solids content less than 30% with low viscosity are often difficult to coat without a mess. In addition, lower solids percentage will require multiple coatings to achieve reasonable mesh coverage.

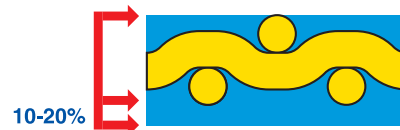


Fig. 1

Emulsion Over Mesh or EOM is a measurement of the emulsion thickness on the face or substrate side of the mesh. EOM is a percentage of the mesh thickness. (Fig. 1) Too low of an EOM ratio will prevent a good gasket seal, prevent good detail resolution, and increase chances of saw tooth edges. Manufacturers recommend an EOM ratio of 10 to 20 percent.

With an emulsion stencil, more is not better. Too much emulsion on the face of the screen can cause difficult ink transfer and details can break down in a run. Emulsion drip from the mesh while drying is a definite indication that the coated emulsion is too thick.

Your emulsion manufacturer can recommend a coating procedure for each mesh count using a rounded or sharp coating edge.

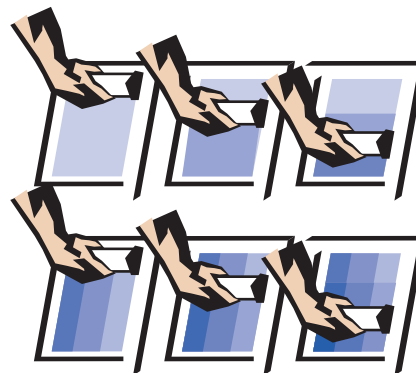


Fig. 2

The step coating procedure (Fig. 2) is used to coat a screen to find your best coating technique for that mesh count. The step coating procedure starts with a stroke on the face of the mesh. Then

coat the squeegee side once over the entire screen. Coat again the squeegee side on only two thirds of the screen, then coat again one third of the squeegee side (all wet on wet).

Dry your screen as normal. When dry, face coat with the sharp edge of the squeegee two thirds of the screen from a crossing direction (perpendicular) then dry face up. When the screen is dry apply the last coat of emulsion on the face side covering only one third of the same direction as the last face coat, then dry. With the face coatings there will be nine examples of coating thicknesses. Pick an exposure time that fits the median coating technique and expose the screen with a test positive that covers all of the coating changes.

Wash out and dry as normal. Now you can view the emulsion with a loop or microscope. Inspect the changes in thickness, then print with this screen and inspect the printed results. With the printed results compared to the visual inspection, the best coating technique for that mesh count can be determined. Standardized mesh thread thickness and weave for each mesh count is needed for consistent and reliable results.

The step coating procedure can be used while eliminating some of the steps, or replace the face coatings with all wet on wet coating strokes.

All manufacturers recommend drying coated screens with the face down (squeegee side up) in a horizontal position. A slightly elevated temperature (not over 110 deg. F.), in a filtered drying room or cabinet, will dry screens in record time, often less than half an hour. A dehumidifier will drop emulsion drying time further.



Fig 3

Once the screen is dry, direct emulsion will dry and conform to the profile of the mesh fabric causing small hills and dips in the surface. The smoothness of the dry emulsion can be measured and is represented by the term Rz value. (Fig. 3) The lower the Rz measurement number the smoother the surface.



Fig. 4

Surface smoothness can affect your substrate to stencil gasket. The lower Rz numbers will be produced only by machine coating or film products. Direct/indirect and capillary films will produce the lowest Rz numbers possible for screen stencils. High solids content emulsions and face coating (second or more coats of emulsion over dry first coatings) can also lower your RZ measurements. (Fig. 4) Exact EOM and Rz numbers can only be measured by special testing equipment.

**Indirect film products** are presensitized emulsions on film. They are produced to expose and develop before they are attached to the screen mesh. Indirect film has fallen out of general use as products that are easier to use and have superior reproduction properties are now available.



Fig. 5

**Capillary films** are a photosensitive emulsion layered onto a film backing. (Fig. 5) The name is indicative of the action that causes the adhesion, capillary action. With wet screen fabric the film will draw into the mesh when placed in contact with the face of the screen.

Capillary films suffer from past bad reputation for delamination (Fig. 6) the current products available are capable of long runs and excellent detail. Capillary films produce the lowest Rz numbers possible and can save large amounts of screen room production time.



Fig. 6

Capillary films are best applied with the misting method. Place the film

(emulsion up) on a hard flat surface. (Fig. 7)

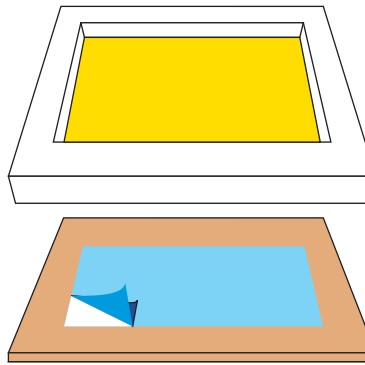


Fig. 7

Place a screen (squeegee side up) onto the film, lightly mist the mesh with a spray gun until the screen starts to draw up the capillary film into the fabric. (Fig. 8)



Fig. 8

**Direct/indirect film products** are two-part film and emulsion combinations. Films assure low Rz numbers and high detail print quality. Direct emulsions produce high stencil durability. Direct/indirect film systems combine the best features of direct emulsion and film products, creating a strong, high definition stencil that will make longer runs possible with direct emulsion.

Direct/indirect film products require a coating of direct emulsion. Then the film can be adhered to the face (substrate side) of the screen. One method is to coat the screen (one stroke on each side of the screen) then place the screen (squeegee side up) on the film (emulsion side up) and stroke the squeegee side of the screen with a low pressure stroke with a soft squeegee.

(Fig. 9) The use of newsprint on your work surface will help with clean up.

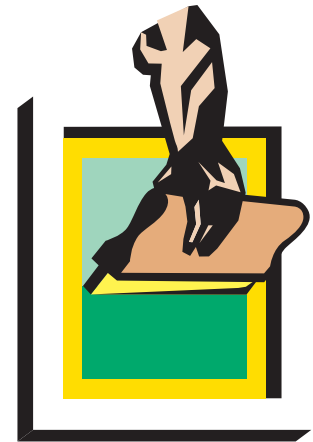


Fig. 9

Stay consistent and you will be able to predict your results with greater accuracy. Your goal should be consistency, predictability, and repeatability.

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