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Stencil Sawtooth Prevention

Screen makers often struggle against ongoing direct emulsion **saw-toothing** or **serration**, but there are several things we can do about it by managing some critical control areas. Our goal is to produce a thin, flat, smooth stencil which offers resistance to the ink and substrate, required resolution, sufficient durability for the print run, and easy reclaiming when the job is finished.

Saw-toothing in the stencil and print can also be caused by low-resolution digital images, but that problem must be addressed with the digital image or film positive provider. Film problems aside, let us address the areas under the control of the screen technician:

Mesh Count General Guidelines

Application	Typical Mesh Count Range
Textile Inks	34 to 77 threads per cm
Conventional Solvent Inks	77 to 140
UV Curable Inks	140 to 180
Speciality Applications	Consult ink manufacturer

Emulsion Solids Content and Mesh Bridging

The solids content of an emulsion is an indicator of what proportion of the emulsion remains after all the water has evaporated. Low solids content in some older emulsions contributed to poor mesh bridging and saw-toothing. Modern emulsions have higher solids content to allow faster emulsion build-up with fewer coating passes, which bridges the mesh more effectively, resulting in sharper, cleaner stencils with improved print definition. Ensure that you are using the proper emulsion for your application.

Coating Method & Stencil EOM and Rz

A smooth stencil of optimum thickness will form a gasket between the substrate and the knuckles of the mesh, allowing a sharp, crisp, and smooth transfer of ink through the stencil. Your coating methods will affect both stencil thickness and smoothness. Both characteristics can be measured, so consult your emulsion supplier for assistance.

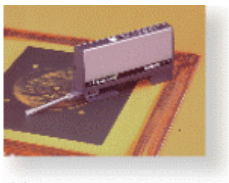
As the water evaporates during emulsion drying, the coated emulsion layer can shrink down into the mesh knuckles, which affects both stencil thickness and smoothness. In some cases, the shrinkage can be enough to leave a rough or jagged stencil surface, which can cause saw-toothing in the printed image and can contribute to excessive dot gain in four-colour process printing.

1. Select a clean, dry, degreased screen at proper screen tension.

2. Evenly apply one or two coats to the substrate side of the screen, and immediately inspect the mesh from the squeegee side to ensure that there is a smooth and glossy coating of emulsion, free of mesh marks. If the squeegee side is not glossy, apply more coats from the substrate side! Repeat until the squeegee side is glossy from emulsion. This ensures that the mesh openings are filled with emulsion instead of air, and eliminates pinholes caused by air bubble entrapment.

3. Follow the substrate-side coats with one or two coats of emulsion on the squeegee side. Additional coats to the squeegee side (wet-on-wet) will increase the stencil build, or thickness of emulsion over mesh. Dry the freshly coated screens with the substrate side down and the squeegee side up.

4. Test and measure to determine how many coats from the squeegee side are needed for your application.



The smoothness (Rz) of the stencil can be enhanced by applying a face coat (or fill coat) to the substrate side of the screen after the initial emulsion coats dry. Apply one or two face coats with the sharp side of the coater. Face coats do not substantially increase the stencil thickness; they simply fill in the stencil surface "valleys" left between the mesh knuckles when the water evaporates during screen drying. This improves the gasket effect of the stencil and enhances print definition. Rz can be measured with an instrument called a Surface Profilometer.

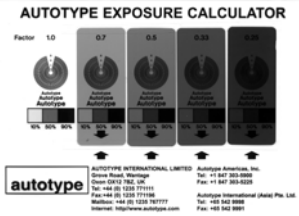
Stencil Thickness General Guidelines

Application	Typical EOM Range
Textile	10 to 20 microns
Conventional Solvent Inks	5 to 10 microns
UV Curable Inks	3 to 6 microns
Speciality Applications	Consult ink manufacturer
Direct Projection screens	Avg 2 microns EOM

Optimum stencil thickness will vary with different applications. Coarser mesh counts have thicker mesh knuckles, and tend to require more emulsion over mesh to achieve the desired gasket effect. Direct projection screens are in another group altogether, as they may show only 1-2 microns EOM.

An Electronic Thickness Gauge is an instrument for ensuring consistent, precise stencil coating by measuring the thickness of the stencil. EOM or Emulsion Over Mesh is especially important in four colour process printing and for printing with UV curable inks. Emulsion over mesh (EOM) is the thickness in microns of emulsion that is greater than the thickness of the mesh. EOM is sometimes expressed as a ratio or percentage of the total thickness of mesh plus stencil, but the actual measurement in microns is a more common expression.

Exposure



Underexposure is a major cause of serration, along with too thin of a stencil, but it is the easiest to control. Overexposed screens tend to show a loss of fine lines and details, caused by light undercutting. The printed result will be choked or smaller than the image on the film positive. Proper use of the Exposure Calculator will simplify your exposure chart. The Colour Change Method is the most reliable for emulsions containing diazo sensitizers, including dual-cure or diazo-photopolymer emulsions.

How can I tell if my screens are underexposed?
Symptoms visible *before going to press* include visible film positive edges and tape marks, slimy stencil during developing, and foaming in sink or on screen during washout.

Symptoms *on press* include pinholes, scumming, breakdown during print run, and even bits of stencil flaking off the screen.

Symptoms *after press* include difficult reclaiming, and yellowish-brown mesh staining where the emulsion used to be.

Any of these symptoms, or any changes in emulsion, mesh, exposure equipment, or procedures, indicate that the conscientious screen technician conduct a series of exposure calculator tests.

Conclusion: As Simple as 1-2-3

1. **Select a good quality high-solids emulsion.**
2. **Follow good coating procedures.**
3. **Expose the stencil properly.**

Your emulsion supplier should be able to assist you with any of these stencil control areas. These simple steps will enable your screen technician to achieve consistent and predictable screens, and **Stencil Sawtoothing** will be a thing of the past.

Toll Free **Customer Service** within Australia: **1300 650 504**
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