Screen Coating Techniques

Direct emulsions offer quality in print, mechanical endurance, solvent & water resistance, and affordability all in one bucket. To use these qualities profitably requires a basic understanding of how to coat a screen prior to exposure. Taking the following steps will ensure success.

Start with a clean screen

Proper reclaiming and degreasing are always first steps in coating a screen with emulsion. Anything left behind on the screen is a contaminate: including degreaser. Contaminates getting between the fabric and the emulsion present a potential for emulsion breakdown when the squeegee and flood bar shear across the screen during printing. It would be well to go back to your screen rooms and look for areas where you may not be optimal in you process.

One of the most common places to find a printer adding contamination is during degreasing. If you use a power washer during degreasing the chances are high that the spray hitting the booth onto the screen when water bounces off the washout booth. If you de-ink, reclaim, and degrease in the same booth all the things you want to remove from the screen have the potential to end up back on the screen in the final step.

To avoid this 'blow-back' use a quality degreaser with foaming action (CleanLine Degreaser). Rinse the screen with a high volume, low pressure water rinse. This would be like water running from a garden hose with no nozzle. Rinse until the screen runs free of bubbles and water sheets from the screen without sagging or showing voids.

If water does not sheet from the fabric, degrease again. If this does not improve the flow you will need a combination of safe but effective haze remover (CleanLine Haze Remover) and screen wash (CleanLine Ink Wash & Haze Remover Activator), prior to degreasing, to remove printing residues still on the screen.

Another area where it is quite common to see residues on the screen which show up in coating are from water and other chemicals which hide in the profile of a retensionable frame. Generally thins problem is at it's worst when the screen is dried in the upright position. Water and contaminates trapped in the profile thread down the screen after degreasing. The contamination dries on the screen and interferes with a good bond between the fabric and the emulsion. For this reason, always give the frame a good wipe, and store the screen parallel to the floor when drying these frames after degreasing.

Don't Abraid

Abraiding fabric is only necessary when you are using capillary film. There are two major reasons not to abraid. The first is that you shorten the fabric life by effectively reducing the tread diameter. The second is that you decrease the ink transfer efficiency.

Because the surface of the thread is effectively larger, the ink clings to the threads for the same reasons that capillary film clings better. This means that less of the ink available in the fabric will transfer to the substrate. For the same fabric you will not be able to print copy as fine as you would otherwise.

There is really only one reason for using capillary film which is still valid today; small screens can be made quickly. All other arguments regarding quality do not hold up when compared with direct emulsion of he same family used properly.

Stencil Parameters

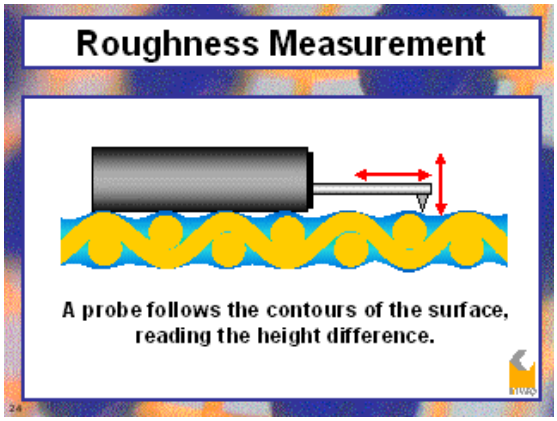
The list of jobs a stencil performs usually includes the following:

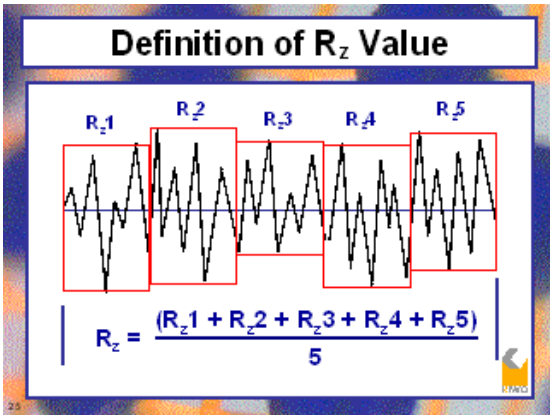
A) Duplicate the film image. This role is further defined by terms like:

- **Edge Definition**
- **Mesh Bridging**
- **Resolution**

These abilities vary dramatically for any given emulsion because of several factors related to coating and exposure as well as the chemical qualities of the emulsion. We will talk about how coating effects them.

B) Create a gasket (Rz). The popularity of capillary films was partially due to getting a good gasket form your emulsion right off the roll. The study of Rz value (measure of surface smoothness) and how to achieve control of these values for different substrates has popularized direct emulsion for high quality print applications.





Roughness Measurement

Basically, the lower number, the smoother the surface, and therefore the better substrate and stencil. Coating technique allows a direct emulsion user to fine-tune their coating Rz for any particular substrate. This is necessary for perfect printing on all substrates and is not an option with capillary films.

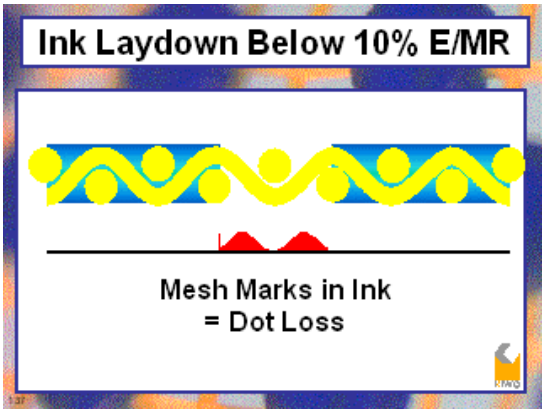
C) Emulsion Over Mesh. **It's a simple fact of out natural world that we cannot get ink to go through a thread. having an amount of emulsion over mesh, or proud of the mesh, is critical for printing fine detail, and in avoiding 'sawtooth'.**

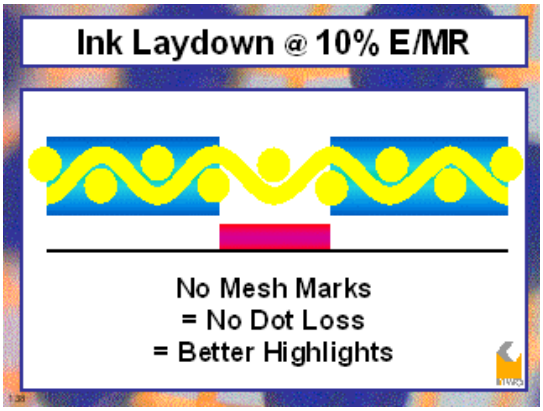
One way fine detail could be defined is: any artwork who's finest details approach two threads and two mesh openings in width on any chosen fabric. You can test this by laying your artwork right on the fabric and looking through a minimum 30 power microscope.

If your smallest dots or lines are not much larger than two threads and two mesh openings, you have fine detail. If you do not have enough emulsion over mesh the threads will create a dam just as the stencil does. In halftone printing, this results in dot loss as the highlight dot is cut into pieces by the threads.

It is necessary even in general printing to maintain correct emulsion over mesh (EOM) for proper print quality. Let's take the example of opaque white ink on black acrylic plastic. The printer selects a 156 T fabric to give the appropriate wet ink thickness. But when the job is printed, the finished print suffers from 'sawtooth', or 'stairstep' edges.

If the EOM was too low, the threads were not held up off the substrate during printing. The thread blocks the flow of ink with a very regular pattern that we recognize as 'sawtooth'.





In this example, it is also quite likely the screen also suffered from an Rz value which was too high. Both high Rz and low EOM results from poor coating techniques. The poor gasket from the Rz allows the ink to leak into the valleys of the stencil. This results in dot gain. The 'sawtooth' from low EOM resulted in dot loss.

The printer never had a chance to produce a print with a sharp edge. These interactions are common. Proper coating techniques allow the screen maker to adjust their stencil parameters for perfect stencils everytime.

Wet-on-wet Coating

Creating the base of emulsion on the screen is typically referred to as wet-on-wet coating. Each successive pass with the coating trough applies emulsion in addition to emulsion which is still wet on the fabric.

The first rule is: ***wet-on-wet coatings accumulates emulsion on the side of the screen opposite the coating trough.***

For most mesh counts you will do all your wet-on-wet coating with a round edge coater. Always start coating from the printing side of the screen. coat as many times from the print side as is necessary to cause the emulsion to visibly gloss on the squeegee side. The purpose is to push out all the air bubbles which may be trapped in the openings of the fabric. This air left in the mesh may cause print quality defects, or pin-holing on press.

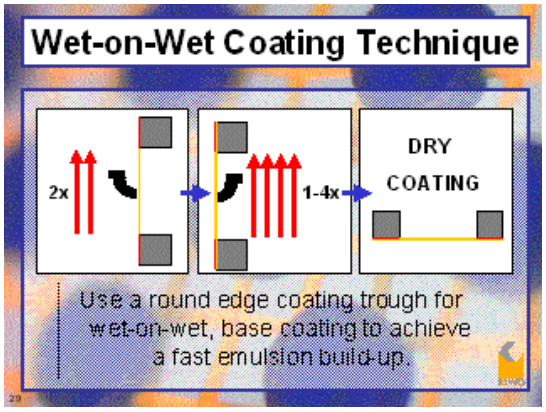
The second rule is: ***Finer mesh counts require more coats than courser mesh counts.***

This visual clue of gloss on the squeegee side of the screen is a good indicator of coating to an absolute minimum EOM. Fabric regulates emulsion flow in the same way that fabric meters, or regulates the amount of ink going to the substrate.

As the percent open area of a fabric decreases it restricts the flow of emulsion. For example, a 390 tpi 33 micron thread fabric may require 3 coats from the print side followed by 2 coats from the squeegee side to build a 5 microns EOM. A 390 tpi 27 micron fabric might be at 9 microns EOM with a 1 coat print and 1 coat squeegee side coating. With the mesh count the same, the 27 micron thread fabric has much more open area and less resistance to flow since the emulsion doesn't have to push against so much thread.

Watching for this gloss to occur on the squeegee side shows you the first moment where the emulsion has filled the mesh. Each pass with the coater after this point causes the EOM to build. This change in thickness is fairly predictable.

To continue building up your EOM you simply turn the screen around and begin coating from the squeegee side. Each pass with the coater will continue to build wet emulsion thickness proud of the mesh. Of course, how much it builds is dependent on several factors; one of them being coater design.



Dry the Base Coat

The base coat is then dried with the print side down and the squeegee side up. This allows gravity to pull emulsion to the print side of the screen where you want it. Not only will you build EOM, but you will lower the Rz values.

Coating Trough Design

The shape of the lip of the coating trough has a great influence on the amount of emulsion which is deposited with each pass of the coater. It is necessary to use a round edge (approx. 1/8 inch diameter) with the wet-on-wet coats to have much influence on building EOM. In fact, a sharp coater will leave little to no EOM with many passes of the coater.

Common build-up with a round edge coater during wet-on-wet.

Coating Build-up

2+1: 4 micron

2+2: 12 micron

2+3: 19 micron

2+4: 24 micron

Common build-up with a sharp edge coater during wet-on-wet.

Coating Build-up

2+1: 3 micron

2+2: 4 micron

2+3: 5 micron

2+4: 6 micron

The third rule is: *Coating trough design partially determines the results.*

Keep SUFFICIENT EMULSION in the coater

The driving force for pushing emulsion through the mesh is the fill level of the coater. If this level varies, so will your results. If you have large screens, fill the coater each time you begin to coat a new screen to keep the coating thickness consistent.

Thin Stencils for Detail

All stencils must have some EOM for proper printing. But, a stencil can be too thick as well. For printing inks the stencil thickness should be a maximum of 20% of the fabric thickness. If the screen is coated with the wet-on-wet technique, this will produce a stencil with a reasonable Rz value as well.

For detail printing, the EOM should not exceed 10% of the fabric thickness. If the stencil becomes thicker, if makes ink transfer difficult. For excellent printing on most substrates, the stencil will also need a low Rz value (approx. 6 microns).

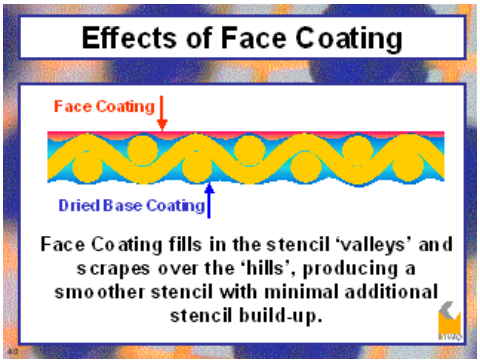
Consider R_z While Coating

Wet-on-wet coating has a second advantage in that it lowers the Rz wile building EOM. Unfortunately, printers who rely solely on wet-on-wet coating may have a stencil which is too thick before they reach an acceptable Rz value.

The forth rule is: *Maintain a thin coating with a low Rz for fine detail.*

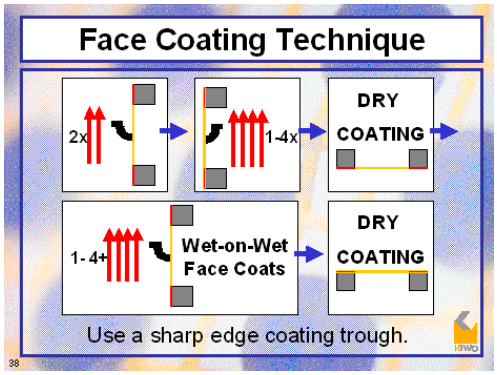
Face Coating

Face coating is applied for the purpose of leveling the screen which reduces the Rz value. When face coating is done with a sharp edged coater, it has the advantage of lowering the Rz with little change in stencil thickness (typically, less that a micron per). This is done from the print side of the screen.



This happens because the coater rides on the high spots (knuckles of the fabric) and leaves emulsion only in the low spots.

With the combination of wet-on-wet bases coats and face coating on the print side of the screen, the printer has the opportunity to adjust the stencil for any substrate and for any type of printing.



The fifth rule is: ***Use a combination of wet-on-wet and face coating techniques for a thin stencil with low Rz.***

Build in CONSISTENCY

Design your coating area so that your staff may make a consistent coating. It is important that the screen be at the same angle each time it is coated. A coating stand works best for this. The coaters must coat at the same speed. As one speeds up, or slows down, there will be more or less emulsion on the screen. Maintain the same angle with the coater. Changes in the angle changes the amount of emulsion which passes through the mesh. Ideally, an automatic coating machine is used to achieve constant coating from screen-to-screen.

The sixth rule is: ***Dry the screen print side down, squeegee side up.***

Conclusion

Wet-on-wet coatings work for most applications. Knowing when and how to use a combination of wet-on-wet and face coating can deliver the 'ultimate' stencil to the press.

Follow these simple steps and you will be rewarded with consistent quality stencils.