Choosing the Right Emulsion for Your Application

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Although many of today's stencil systems are capable of performing sufficiently for most applications, you still have to identify your specific requirements on the stencil in order to assure optimum performance.

The type of application may ask for specific stencil quality or maybe the printing press requires a certain feature of the stencil in order to print the job. It could be that the ink you are going to use is especially tough on the stencil, or that you have to use very coarse mesh counts.

This briefing explains the procedures necessary to identify your specific needs and shows how to choose a stencil system that performs trouble free in your environment.

Identifying the Requirements for your Application

Type of application

Each application has its own challenges and requires special attention to certain aspects specific for that application. Printing on garments is quite different from printing on glass or circuit boards. In one case the substrate is absorbent and soft. In the other it is hard and nonabsorbent. In one instance you may have to print 50 micron lines and the other application may ask for printing of bold letters for athletic wear. Where in one case a low cost standard emulsion may be suitable the other application may ask for state of the technology emulsions.

Press type

The type of press may also dictate certain features of a stencil. A belt printer for textiles is a very abrasive press, therefore the stencil needs to have excellent mechanical resistances. On this type of presses the stress on the stencil is enormous and multiplies the demand on chemical resistance as well. A bottle printer needs a very flexible stencil, whereas a flatbed press for graphic prints may be able to handle a harder stencil. Look for the height of off contact and the type substrate. High off contact and thick substrates require a flexible stencil, low off contact and thin substrates can use a harder stencil system.

Length of print run

The longer the print run is, the more resistant the stencil has to be in both aspects, mechanical and chemical resistance. Some stencil systems can be rated for a certain length of print run.

Ink type

There is a distinct trend towards two ink systems: water-based inks and UV-inks. Each requires a certain chemical resistance of the stencil. Other applications such as ceramic printing require high abrasion resistance, again other applications don't required high chemical resistance at all, such as plastisol inks. Determine how "tough" the ink really is and choose an appropriate stencil. Probably the toughest ink systems are water-based inks with solvents in them.

Quality requirements of the application

Each application can be rated in the grade of quality requirements. A banner that flies on a building 30 feet above the ground does not necessarily require extremely sharp edges on the print, whereas a membrane switch has to have perfectly sharp edges. Printing a poster or four color process required a different type of stencil than a printed circuit board.

Screen room equipment

Most important is the type of exposure system you have. A modern single point metal halide lamp can usually handle all types of emulsions and quality requirements. Multi-point light sources such as fluorescent tubes require stencils with long exposure latitude to handle the light undercutting of this type of exposure system. You may even have some special systems like a Computer-To-Screen system, a laser exposure unit, or a projection exposure camera.

Mesh counts

The range of mesh counts you may use may determine a certain viscosity in the emulsion. Coarse mesh counts require higher viscosity, high mesh counts ask for lower viscosity. Some emulsions are not suitable to be coated on fine meshes of coarse mesh counts, whereas others may be suitable to handle everything from 63 tpi to 470 tpi.

Requirements to the stencil

Solvent and water resistance

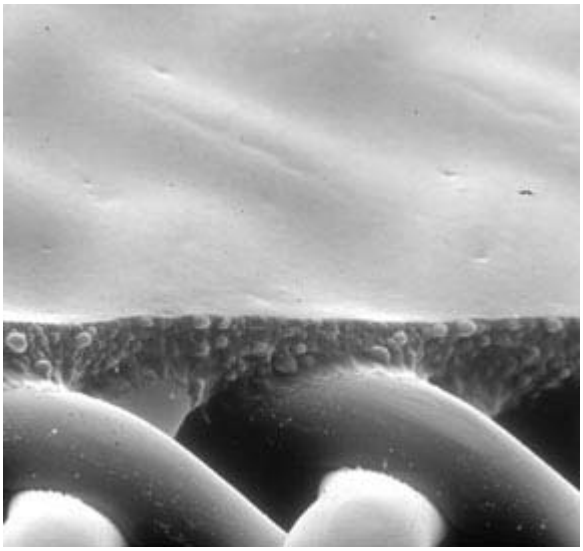
Most stencil systems withstand all solvents used in screen printing. However some low priced solvents used as screen wash can contain water and can soften some stencil systems. Very critical though is the high humidity in some many southern states. High humidity in the print shop requires some water resistance of the stencil system used. If the stencil is affected by humidity, the emulsion becomes soft and tacky and will finally break down.

Mechanical resistance

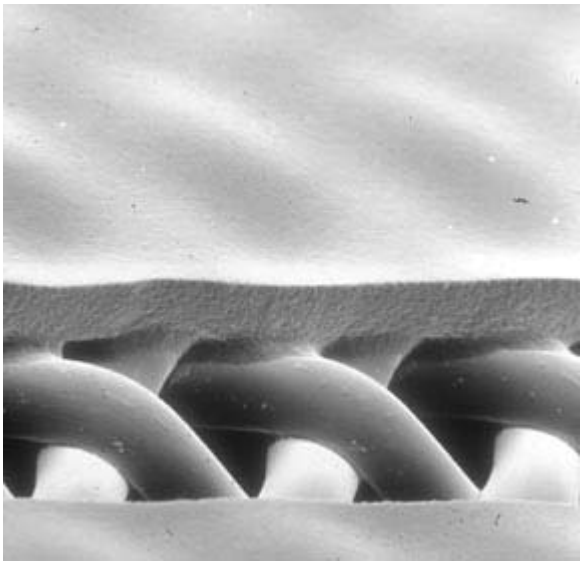
Different stencil systems offer different durability. The choice depends very much on the length of the print run, the type of press and the shop layout. If the environment is very dusty and the screen has to be cleaned during the print run, mechanical resistance of the emulsion is a major factor and an emulsion with lower resolution will "cover up" dust particles.

Edge definition

Especially for fine detail printing, the edge definition of the stencil system should be as good as possible. Edge definition is not only the sharpness of the edge but the smoothness of the vertical plane in the emulsion build up. If the vertical plane of the emulsion is not smooth enough, the ink release is very difficult resulting in loss of detail. The rougher the edge , the easier for the ink to hold to it. A smooth edge aids the ink release and results in better detail reproduction.



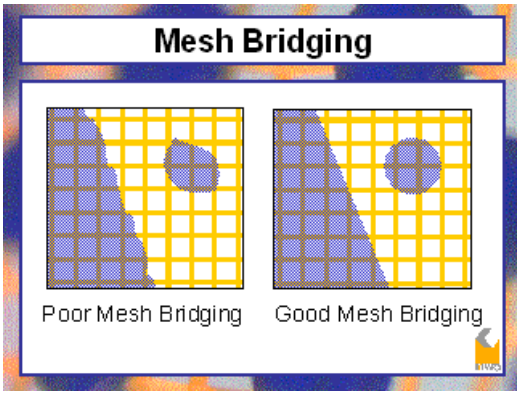
Rough Stencil Wall - Poor Edge Definition



Smooth Stencil Wall - Good Edge Definition

Mesh bridging

Mesh bridging is the ability of the emulsion to cross a mesh opening in a straight line, no matter in what direction and how far away from the threads of knuckles the image edge is located. Some emulsions will not show perfect edge bridging with thin emulsion build up. Bad mesh bridging results in distortion of the image and sawtooth effects.



Resolution

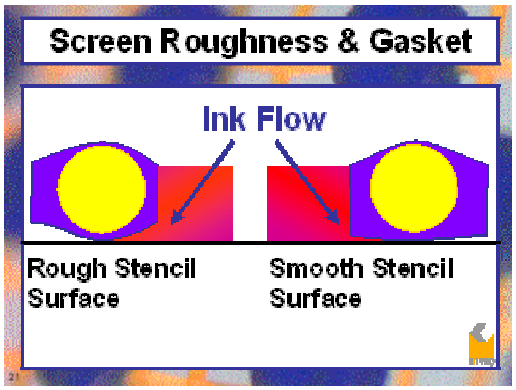
Resolution has to be considered relative to mesh bridging and edge definition. Resolution is defined as the ability of the emulsion to reproduce finest details on the screen. If you imagine that a fine dot of , for example, 50 micron diameter has to be reproduced, and the emulsion does not offer excellent mesh bridging and edge definition, the edge of the dot will not be straight or smooth. This will automatically result in bad resolution, i.e. the dot might be only 40 micron in diameter.

Resolution can be defined as the finest line width resembling exactly the same width as the original. Furthermore, the resolution should be stated for the positive line, which is an open line on the otherwise covered screen. The resolution of the positive line will always be worse than the resolution of the negative lines (emulsion line on uncovered mesh).

Mesh structure compensation

Mesh structure compensation is the ability of the stencil to fill and smooth out the woven three dimensional structure of the mesh. In order to achieve an almost flat surface on the substrate side of the stencil.

Only a very flat and smooth surface of the printing screen will have good contact to the substrate and create a perfect seal between screen and substrate. The contact between screen and substrate will keep the ink from running under the edges of the printing image maintaining a sharp print.



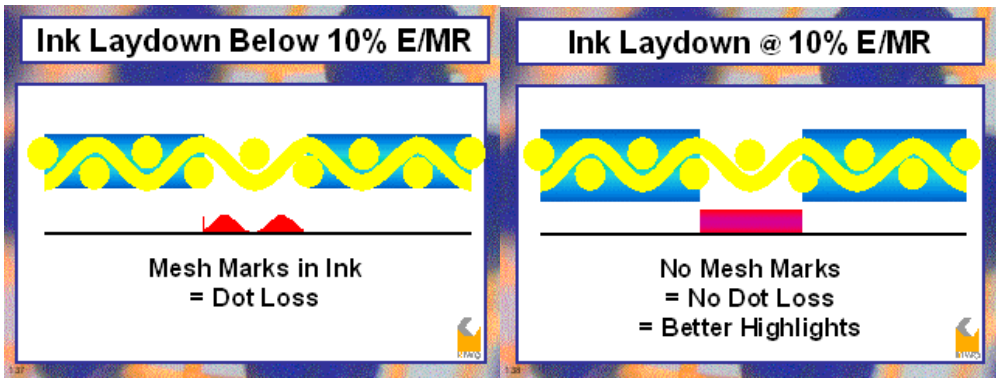
Especially for fine detail printing perfect mesh structure equalization is essential, as unsharp prints or smearing enlarges the area covered by ink and results in severe image distortion or dot gain.

The roughness of the screen depends on the coating technique and to a large extent on viscosity and solids content of the emulsion. A medium viscosity and solids content is usually the best choice for most applications.

Emulsion over mesh ratio

The emulsion build up over mesh should be a minimum of 4 – 5 micron and a maximum of 25% of the mesh thickness.

The minimum emulsion build up is needed to enable the ink to flow underneath the threads in the mesh opening. If the emulsion build up is too low the ink will not cover the entire image area. This is especially important if thixotropic ink systems are used.



When maximizing the emulsion build up it is necessary to keep the total thickness of the mesh / stencil structure low enough to assure easy ink release and low ink deposit.

In the ideal case, the smallest image on our screen should be 100% larger in diameter or width than the mesh / stencil structure is in height.

Choosing the stencil system

Diazo emulsions

Diazo-sensitized emulsions can offer very good overall quality with acceptable exposure times. In moderate climates these emulsions are suitable for fine detail printing. They are available as either solvent or water resistant emulsions but unfortunately cannot offer perfect solvent resistance with good water resistance in one. Diazo stencils offer acceptable copying qualities.

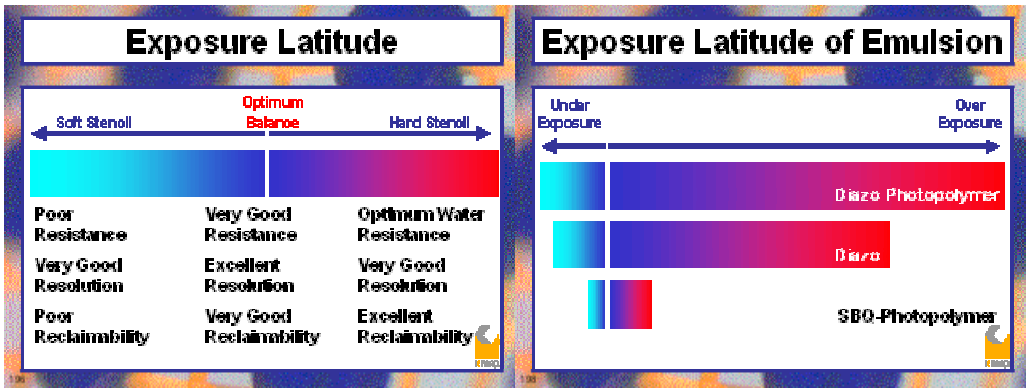
SBQ-Photopolymer emulsions

SBQ-Photopolymer emulsions are one component pre-sensitized systems with extremely fast exposure times. Due to the exposure speed, the exposure latitude is very short and

the risk of either over or under exposure is fairly high. Mesh bridging, resolution and edge definition can vary but is in most cases fully comparable with high quality diazo emulsions. This system offers very good resistance to humidity and is available in water and solvent resistant versions. The resistances, however, can not match the resistances of Diazo-photopolymer systems.

Diazo-photopolymer emulsions

The last and most suitable alternative are Diazo-Photopolymer emulsions. Diazo-Photopolymer emulsions are combinations of pre-sensitized ingredients in the emulsion plus a diazo sensitizer. This system offers superior quality in all respects. Mesh bridging, edge definition, resolution, resistance, mesh structure equalization and exposure latitudes are excellent for all applications. These emulsions are not affected by humidity. The wide exposure latitude of almost 200%, in some cases, offers very high production security and eliminates possible down times due to false exposure. Even if the screen has been highly overexposed only minimum changes in image sizes are noticeable.



Summary

Before you go out and buy any type of stencil system, you should walk through your shop and examine the environment. Determine the quality you can achieve with your screen room equipment and possibly select a stencil system that counters some of the shortcomings in the equipment. Your inks and presses give you further clues to what to ask for and finally determine the amount of screens you have to make each day.

With this information you are able to easily eliminate many of the offered stencil systems and finally pick one or two that may be best suitable for your specific needs. Choosing the right stencil system for your application can be fairly easy, once you know your requirements and your budget. Without knowing your requirements, you may end up with a stencil system that gives you nothing but trouble and costs you a fortune.