

Avoid a Breakdown

Stencil-making tips and techniques for printing with water-based and discharge inks



Discharge inks offer textile printers a way to produce graphics without the heavy hand of traditional plastisol ink, especially on darker garments. These inks, however, are aggressive on most emulsions and can cause pre-mature stencil breakdown if screen making variables are not carefully controlled.

Chemically speaking

Discharge agents are oxidizers that use an aqueous vehicle which can attack emulsions even when processed correctly. Think about it—stencil removers are also oxidizers that use an aqueous vehicle. And what is their purpose? To reclaim the screen!

The emulsion choice and degree of stencil durability and/or hardening required depends on the brand/type of discharge ink used and the size of the job. Understanding the nature of discharge inks, let's examine options for making screens more resistant to these ink systems. But first let's look at the most important screen making variables that need to be carefully controlled:

Consistency and control

The two most critical aspects of successful stencil making for printing with water-based and discharge inks are emulsion dryness at the time of exposure and the thoroughness of exposure. Control these and you will achieve maximum resistance and durability. Consistency is the key to process control, so incorporate the following simple tools to monitor and control these critical aspects and assure consistency.

Dehumidifiers are used to remove moisture and keep relative humidity below 50 percent. They are not only useful in the screen drying area but for screen storage and art preparation areas as well. Anywhere along the screen-making process, prior to exposure, emulsion reabsorbs moisture like a sponge if it encounters it.

Heaters are used in emulsion drying areas and work most effectively in tandem with dehumidifiers to keep the air dry, ensure quality screens and speed screen production.

Air conditioning is used for storage areas of dry, coated screens waiting for exposure,

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especially if screens will not be used right away. Screen preservation is best achieved in a cool, dry environment. Air conditioning dries the air without subjecting screens to prolonged exposure to heat which, over time, can be harmful.

Hygrometers are instruments used for measuring the water-vapor (humidity) content of the atmosphere. They are essential tools used to monitor relative humidity levels throughout screen department.

Moisture meters are instruments typically used by contractors for measuring moisture content of various substrates like drywall, wood and concrete, but are used in the screen printing profession to measure the relative dryness of screen emulsion prior to exposing. Moisture meters provide a good "go/no-go" indication for screen exposure.

Exposure calculators are exposure films specifically designed to help calibrate optimum exposure times. They consist of a series of test images that underlay a series of neutral density filters ranging from 10 to 90 percent. The filters block respective percentages of UV from reaching the emulsion, thus providing a series of different exposures using only one screen and one exposure. Each step in the series is evaluated to determine which step provides the best emulsion cure and/or resolution. (Read the author's article on screen exposure in the Mid-March issue of *Printwear*, or search www.printwearmag.com using the 'find articles by authors' link.)

Table 1

SCREEN PROCESSING VARIABLE	IDEAL CONDITION
Relative humidity (RH) of emulsion drying area	Very dry (30-45, max 50 percent)
Drying time of emulsion	Complete and thorough (\leq 4 percent moisture)
RH of screen-staging area and exposure room	Very dry (30-45, max 50 percent)
Quality, consistency and intensity of UV light	Use integrated metal halide light source with fresh bulbs
Completeness of exposure	Expose to the long side of expose window
Water resistance of emulsion	Quality emulsion with high degree of water resistance
Age (pot life) of emulsion	For best resistance use freshly sensitized emulsion

SIX TIPS FOR ENHANCING STENCIL DURABILITY

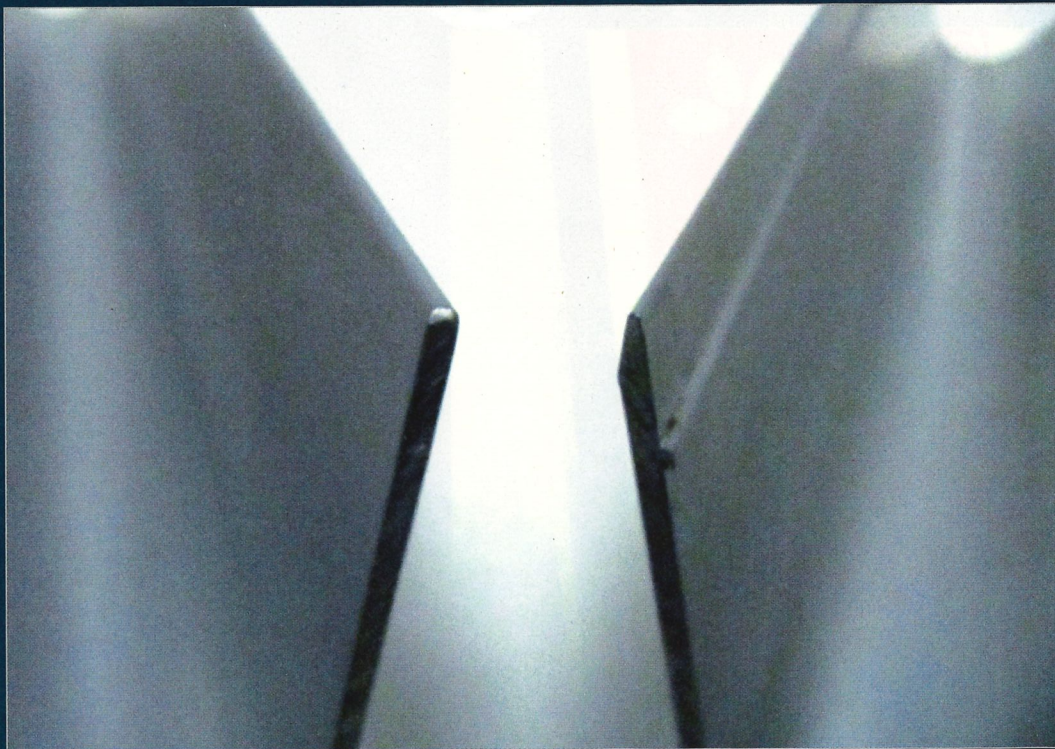
1. Use clean, uncontaminated mesh.

Even the smallest debris trapped in emulsion coating becomes a weak link in the system, making it susceptible to breaking open into pinholes during production. Be sure to use good degreasing, rinsing and drying techniques. A few mesh preparation chemicals not only cleans the mesh but also changes it from hydrophobic to hydrophilic, which helps assure the best possible emulsion coating properties.



2. Use a diazo additive when using SBQ emulsions.

Most emulsion manufacturers provide a diazo additive for use with SBQ emulsions when relevant. SBQ emulsions are pre-sensitized products that require no diazo; however, using a diazo additive in conjunction with SBQ emulsions improves water resistance without severely compromising exposure speed. More chemical bonds form when using diazo, which anchors the emulsion more firmly to the mesh, creating a harder, more durable stencil, especially when humidity is not fully controlled.



3. Use a round edged (~2.5 mm) coating trough to assure adequate stencil buildup.

A thin stencil is more susceptible to pinholes and breakdown. Often, textile printing screens have very small particles of debris that create a weak spot in the stencil, especially if the emulsion coating is thin. Use a two-one or two-two coating technique with a round edged coating trough to provide proper emulsion buildup and reduce risk of breakdown as long as the emulsion is thoroughly dried and is cured properly.

WATER-BASED PRINTING: STENCILS

4. Calibrate exposure time using a damp screen.

It is extremely important not to guess exposure times when using water-based and discharge inks. Use an exposure calculator to conduct a test exposure for each mesh and emulsion combination in use. Or, expose a series of stepped exposures using existing artwork. Follow instructions carefully and examine the test exposure while the screen is still damp, after developing, to determine the proper exposure step. It is easier to see changes between exposure steps when reading an exposure calculator on damp screens. Dry screens will always indicate a shorter exposure versus a damp screen, which will assure optimum water resistance.



5. Use UV post exposure hardening technique.

After processing and fully drying screens, re-expose them from the squeegee side for a minimum of 400 percent longer than initial exposure to completely bond any remaining photo-reactive components. However, do not expect using this technique will compensate for under exposure. Too much emulsion on the squeegee side washes away from non-image areas during developing, permanently weakening the stencil.



6. Use chemical hardening technique.

Select from two forms of chemical hardeners—reclaimable and un-reclaimable (permanent)—depending on your needs and the level of resistance required. Applied generously with a sponge or rag to both sides of a dry or slightly damp, fully-processed stencil, they provide a water resistant or waterproof barrier between the ink and the stencil. (See alternative to stencil-making option three below, which uses a permanent hardener but in a reclaimable way.)



STENCIL MAKING OPTIONS USING WATER-RESISTANT EMULSIONS

OPTION 1—quick, easy and risky:

Process the screen without utilizing any durability enhancement techniques, but only if all screen-processing variables listed in **Table 1** (page 60) are fully controlled. This method should only be used for short runs with the least aggressive ink systems.

OPTION 2—common for short to medium run jobs with less aggressive ink systems:

Use diazo additive and UV post exposure techniques described in tip number 2. Most emulsion manufacturers provide a diazo additive for use with SBQ (non-diazo sensitized) emulsions to enhance stencil resistance. Omit diazo additive if using a diazo-sensitized emulsion already. Post-expose the screen from the squeegee side for at least 400 percent longer than initial exposure time for best results.

OPTION 3—for any size job and/or with moderately aggressive ink systems:

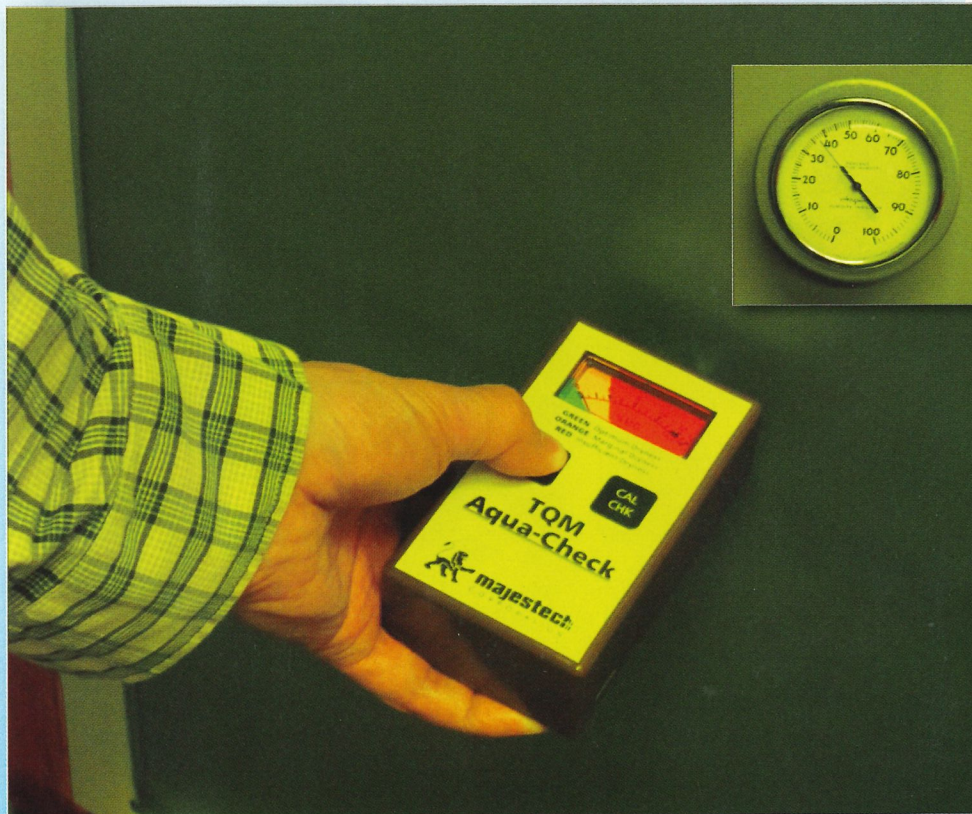
Add the chemical hardening technique to Option 2 using a reclaimable hardener. Apply hardening fluid as described in tip number 6 and, for maximum resistance, be sure to properly cure the hardener according to the instructions.

An alternative to this option that may enhance durability further, though still enabling reclaim, is to use a permanent hardener without fully curing and applying only to the squeegee side of the screen. Stencil hardeners need to air dry for 24 hours or heat cure at 104°F for two to three hours to become fully cured. Screens should be used shortly after the hardener dries for this technique. The premise of this technique is to provide maximum water resistance to the squeegee side of the screen while leaving the substrate side less resistant to stencil removers during reclaiming. This technique may also work for those who don't want to purchase a water-resistant emulsion to print one small job.

A word of caution: This alternative technique carries some risk and should be tested carefully on one screen to confirm adequate resistance and reclaiming ability before treating further screens.

OPTION 4—for long runs with very aggressive inks or when other options have failed:

Add the chemical hardening technique to Option 2 using an unreclaimable (permanent) hardener. Apply hardening fluid as previously described. Allow the hardener to air dry naturally first, before completing the full curing process according to the manufacturer's instructions. Curing hardeners with elevated temperatures speed the process and enhance the durability.



Controlling the dryness of emulsion at the time of exposure and the thoroughness of the exposure will achieve maximum stencil resistance and durability. Use hygrometers and moisture meters to monitor and control these critical aspects and assure consistency. Hygrometers measure the water-vapor (humidity) content of the atmosphere. Moisture meters measure the relative dryness of screen emulsion prior to exposing. (All images courtesy the author)

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