Stencil Making Tips & Techniques
For Printing with Water-based & Discharge Inks

Discharge inks offer textile printers a way to produce graphics without the heavy feel/hand created with 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. Discharge agents are oxidizers that use an aqueous vehicle, which can attack emulsions even when processed correctly. Think about it – *Stencil removers* are 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:

SCREEN PROCESSING VARIABLE	IDEAL CONDITION
Relative humidity (RH) of emulsion drying area	Very dry (30-45, max 50%)
Drying time of emulsion	Complete and thorough (≤ 4% moisture)
RH of screen staging area and exposure room	Very dry (30-45, max 50%)
Quality, consistency & 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

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 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:

Dehumidifier(s) – Are used to remove moisture and keep relative humidity below 50%. Dehumidifiers are not only useful in the screen drying area but for the 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.

Heater(s) – Are used in emulsion drying areas and work most effectively in tandem with dehumidifiers to keep the air dry, insure quality screens, and speed screen production.

Air conditioning – Is used for storage areas of dry, coated screens waiting for exposure, 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.

Hygrometer – Is an instrument 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 meter – Is an instrument typically used by contractors for measuring moisture content of various substrates like drywall, wood and concrete, but are used by screen printers to measure the relative dryness of their screen emulsion prior to exposing them. Moisture meters provide a good "go/no-go" indication for screen exposure.

Exposure calculator – Is an exposure film(s) specifically designed to help calibrate optimum exposure times. It consists of a series of test images that underlay a series of neutral density filters ranging from 10-90%. The filters block respective percentages of UV from reaching the emulsion, thus provide 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.

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Tips for Enhancing Stencil Durability:

Use clean, uncontaminated mesh – even the smallest debris trapped in the emulsion coating becomes a weak link in the system 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.

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.

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 coating is thin. Using a two-one or two-two coating technique with a round edged coating trough with provide proper emulsion buildup and reduce risk of breakdown as long as the emulsion is thoroughly dried and cured properly.

Calibrate exposure time using a damp screen – It is extremely important not to guess exposure times when using water-based and discharge inks. Conduct a test exposure for each mesh and emulsion combination in use using an exposure calculator, or exposing 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, and it always indicates a longer exposure versus a dry screen, which will assure optimum water resistance.

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

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 3 below, which uses an un-reclaimable hardener but in a reclaimable way.

Stencil Making Options Using Water Resistant Emulsions:

Best in class KIWO water and discharge resistant emulsions –

CATEGORY:	PRODUCT:
Diazo emulsion	➢ KIWOCOL® 300 WR
SBQ emulsion	➢ POLYCOL® Discharge (with Diazo D additive*) or ➢ POLYCOL® One-Coat (with Diazo D additive*)
Diazo-photopolymer emulsion	➢ KIWOCOL® POLY-PLUS HWR

* Diazo D is supplied **upon request** at no charge. Diazo D additive is only recommended when printing water based and discharge inks.

Best in class KIWO stencil hardening agents –

CATEGORY:	PRODUCT:
Reclaimable	➢ HARDENER WR
Un-Reclaimable	➢ HARDENER K

OPTION 1 – Quickest and easiest but most risky
Process screen without utilizing any durability enhancement techniques, but only if all screen processing variables listed above are fully controlled. This method should only be used for short runs with the least aggressive ink systems.

OPTION 2 – Most common method for short to medium run jobs with less aggressive ink systems
Use diazo additive and UV post exposure tips mentioned above. Request and use Diazo D additive if using POLYCOL® Discharge or POLYCOL® One-Coat emulsion, otherwise use diazo supplied with KIWOCOL® 300WR or KIWOCOL® POLY-PLUS HWR and post expose screen from the squeegee side 400% longer than initial exposure time for best results.

OPTION 3 – Method used for any size job and/or with moderately aggressive ink systems
Add the chemical hardening technique to Option 2 using a reclaimable hardener (KIWO Hardener WR). Apply hardening fluid as described above and for maximum resistance be sure to properly cure the hardener according to the instructions listed on the Technical Information sheet.

An alternative to this option that may enhance durability further, while still being able to reclaim the screen, is to use a permanent hardener (KIWO Hardener K) without fully curing and applied only to the squeegee side of the screen. Typically stencil hardeners need to air dry for 24 hours or heat cure at 104°Ferenheit for 2-3 hours to become fully cured. In this case, however, screens should be used shortly after the hardener dries. The premise is to provide maximum water resistance to the squeegee side of the screen while leaving the substrate side more receptive to stencil removers for easier reclaiming. This technique may also work for those who don't want to purchase a water resistant emulsion to print one small job.

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 – Method used for long runs with very aggressive inks, or when the other options have failed
Add the chemical hardening technique to Option 2 using an un-reclaimable hardener (KIWO Hardener K). Apply hardening fluid generously with a sponge or rag to both sides of a dry, or slightly damp, fully processed stencil. Allow hardener to air dry naturally first, and then complete the full curing process according to the instructions listed on the Technical Information sheet. Curing hardeners with elevated temperatures speed the process and enhance the durability.

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