Avery Dennison®
Screen Preparation for Screen Printing

Instructional Bulletin #8.30
Revised: May 2011

Frame Selection

Proper screen tension minimizes off-contact printing and enhances print resolution. Because wooden frames may warp and swell, they often provide inconsistent tension and provide poor print resolution, improper ink deposit, and color to color misregistration. Properly tensioned screen mesh in a re-tensionable frame will greatly extend the life of the screen mesh. Compared to variable screen tension on a stretch and glue frame, a work hardened screen on a re-tensionable frame can extend the life of the screen by up to 5 times, significantly reducing screen mesh expenditures.

Screen Fabrication

1. Set the Proper Screen Tension

Ensure the screen mesh has been properly and evenly stretched, since proper screen tension will prevent stencil wear from excessive off-contact and squeegee pressure settings. Moreover, consistent tension is critical to maintain proper reflectivity and color as well as optimize ink utilization. Be sure to consult the stretching procedures recommended by the mesh manufacturer.

Since screen tension decreases over time and with repeated use, the following screen tension and work hardening process for 157 - 200 plain mesh low elongation fabric screens is recommended when using re-tensionable metal frames:

Stretch Cycle	*Tension (N/cm)*	*Relaxation Time Before Next Cycle*
Initial Tensioning	16	3 - 4 Hours
First Re-tensioning	18	3 - 4 Hours
Second Re-tensioning	20	3 - 4 Hours
Third Re-tensioning	22	12 - 16 Hours

Re-tensioning the screen through the four stages listed above will result in a work hardened screen. Throughout repeated print and reclaiming cycles, a work hardened screen will yield excellent printing results and efficient ink utilization with little loss in screen tension. **A minimum screen tension of 15 N/cm is required prior to printing Avery Dennison Traffic Screen Printing Inks. However, a screen tension of 18 N/cm (or more) is recommended.**

2. Select the Proper Emulsion for the Application

Proper exposure and emulsion processing are mandatory to achieve optimum ink film thickness, reflectivity, and color. A capillary film or a high-solids photopolymer direct emulsion is recommended. Direct emulsions with a conventional coating process will also work. Whatever stencil type is selected, use one that produces a thin film or low film build. A thick film stencil will deposit too much ink, resulting in marginal ink cure as well as poor reflectivity and color. When using an indirect emulsion, it is advisable to abrade the mesh with a mesh abrader to improve emulsion adhesion. Abrading is NOT necessary when using direct emulsions. In fact, it is not recommended because abrading can weaken mesh strength.

Graphics and Reflective Solutions
250 Chester Street
Painesville, OH 44077
1-800-282-8379
www.reflectives.averydennison.com

3. Degrease the Mesh

To enhance stencil adhesion, mesh manufacturers recommend degreasing the fabric thoroughly prior to stencil preparation. Without this step, small pinholes can occur in the blocked portion of the screen due to poor stencil adhesion. During printing, ink will flow through the pinholes, creating undesired print blemishes. To degrease the screen, apply a screen degreaser to the wet mesh. Brush the degreaser into both sides and allow one to two minutes for it to work. Rinse thoroughly. Make it a habit to degrease every screen you make.

4. Apply the Emulsion or Film

Apply solvent-resistant direct emulsion evenly with a scoop coat trough, using the round edge. Apply one or two coats to the print side (substrate side), then inspect the mesh from the squeegee side to ensure that there is a smooth, glossy coating of emulsion on the squeegee side. Additional coats to the squeegee side (wet-on-wet) will increase the stencil build. Apply solvent-resistant capillary film with the wet roll-down method for best results, following the manufacturer's instructions.

5. Dry the Screen Thoroughly

Complete screen drying before exposure is essential to the production of solvent-resistant stencils. High moisture content in the emulsion will prevent the screen from being completely hardened during exposure. Dry direct emulsion screens with the squeegee-side up to enhance printed edge definition. Use a drying cabinet with circulating filtered, warm, dry air, or convert a room to a drying area by installing a dehumidifier. A thermometer/hygrometer should be used to monitor drying conditions. (An inexpensive and useful model can be found in The Fisher Scientific Catalog.) Optimum drying conditions are 40%-50% RH, and 80°-90°F, in a dust-free environment. Dust control in the stencil area will reduce the number of pinholes in stencils. The screen drying area must be under yellow safelight. Drying time varies indirectly with temperature and air flow and directly with humidity, emulsion thickness, and quantity of wet screens present in the drying area. A moisture meter can be used to quantify moisture trapped in a printing screen.

6. Expose the Image onto the Screen

After the emulsion is dried, the screen must be exposed using a light exposure unit, which contains a specifically designed light source for emulsion curing. By placing a "right reading, emulsion-up" film positive image over the substrate side of a screen during this step, only the emulsion surrounding the image is exposed to the light. After exposure, the area of the positive image contains uncured emulsion and the screen area surrounding the image contains cured emulsion. Thus, the uncured emulsion on the actual print image can simply be washed away with water. When completed, the finished print screen has open screen mesh pores behind the area of the screen that was covered by the image positive, and all other screen mesh pores are blocked by the cured emulsion.

Since this step defines the print image, proper exposure of the emulsion is critical. If the emulsion is underexposed, the integrity of the screen stencil is weak and can break down prematurely. Underexposure

Graphics and Reflective Solutions
250 Chester Street
Painesville, OH 44077
1-800-282-8379
www.reflectives.averydennison.com

can also cause pinholes, mesh staining, and difficult screen reclaiming. Conversely, overexposure can cause emulsion to fill in the printed areas and make stencil areas difficult to wash out.

7. Use of the Exposure Calculator

Prepare an everyday screen emulsion coated by established procedures. Place the Exposure Calculator on the screen like a film positive and expose it for DOUBLE your usual, or expected, exposure time (e.g. if the current exposure time is 100 integrator units, then double it to 200 units). The actual amount of exposure light received by each column of the Exposure Calculator is simply the test exposure time multiplied by the percentage light transmission of a particular column (e.g. 200 units x 25% = 50 units). After the test exposure is completed, develop the screen with a thorough water washout and examine the stencil in white light.

The correct exposure is determined by examining the color change, called the Color Change Method, at each exposure level. The key to this technique is that emulsion color will change close to its original un-sensitized color after correct exposure. Diazo or dual cure emulsions exhibit the most distinct color change from orange back to red or from brown back to purple. Photopolymer emulsions do not truly change color, since there is no diazo in the system. However, photopolymers at different degrees of exposure swell to different degrees, so an apparent color change may be visible.

Next, notice where the filtered areas of the Exposure Calculator cover the emulsion. Examine the column of emulsion, which represents the shortest exposure (25%). If there is a color difference between where the filter was and the surrounding area, then 25% of the exposure time is UNDEREXPOSED. Move up to the next column (33%) and again look for color differences. Repeat this until you find a column where the area covered by a filter is the same color, as the surrounding stencil not covered by the Exposure Calculator. This represents the minimum exposure time to achieve emulsion cure, thereby generating a fully hardened stencil. Take the percentage marked in that column and multiply it times your total test exposure time in units. The result is the correct exposure time, in integrator units, needed for the application.

If the color change occurs at the high exposure percentages (75% or 100%), double the exposure time and repeat testing for confirmation. It is recommended that exposure tests be conducted daily or weekly, as well as when a new exposure lamp is installed.

If you have followed the instructions above and used the Exposure Calculator to determine the proper exposure time and are experiencing stencil-related problems, please refer to the matrix located in the process guide entitled **Troubleshooting Printing and Processing of Avery Dennison Traffic Sign Reflective Sheeting.** Refer to IB # 8.34 for additional guidance.

NOTE: The reflectivity of a transparent color will decrease as the ink deposit increases. Therefore, it is critical that the above recommendations are followed closely and printing variables are reduced to better control ink film thickness.

Graphics and Reflective Solutions
250 Chester Street
Painesville, OH 44077
1-800-282-8379
www.reflectives.averydennison.com

Avery Dennison®
Screen Preparation for Screen Printing

Instructional Bulletin #8.30
Revised: May 2011

The above Avery Dennison literature provides information to the user for proper application, storage, and other requirements. Please refer to Product Data Bulletins or your local Avery Dennison Representative for warranty information. Find the latest information on the Avery Dennison website, www.reflectives.averydennison.com. We encourage you to check our website periodically for updates.

Graphics and Reflective Solutions
250 Chester Street
Painesville, OH 44077
1-800-282-8379
www.reflectives.averydennison.com