HOW TO DRY A SCREEN

BY MICK ORR, *Applications Training Specialist for Chromaline Screen Print Products*

Just like baking a cake, drying a screen requires that you follow a specific recipe. In this comprehensive article, Mick covers these procedures and conditions and how to implement them correctly in your operation.

Screen drying involves more than just making sure emulsion is dry to the touch. It requires attention to the coating process, understanding of common drying procedures, and knowledge of the conditions that must be present in order to achieve reliable coated screens on a consistent basis.

Have you ever baked a cake? It's easy! Just rip open a box of cake mix, dump it into a bowl, add some water, an egg, and some oil, then stir it around a bit, pour it into a cake pan, and bake it for 40 min at 325˚F. A piece of cake, so to speak.

As long as you follow directions, the cake is likely to turn out fine--not too dry and not too moist. Say you're in a hurry, though, so you try to speed up the process. Instead of following the directions, you decide to spread the batter out over a cookie sheet and bake it at 650˚F for only 20 min. You don't have to be a pastry chef to know what will happen. In no time, you will have the fire department visiting you, and not for cake and coffee.

THREE SCENARIOS

Drying a screen is not unlike baking a cake. Screen drying is a basic prepress step that seems like a no-brainer on the surface. But because it appears so simple, many printers tend to gloss over the factors that lead to a correctly dried screen. Consider the following scenarios.

SCENARIO 1: THE CRAMPED BATHROOM

A screen printing business operates in a small crowded shop. Screens are made in a bathroom converted for the purpose. Coating occurs with the bathroom's fluorescent lights turned off, because everyone knows that light will expose the emulsion. Still, the screenmaker needs to see what he's doing, so the bathroom door is left slightly ajar to allow a small amount of light into the room. When the room is used for other purposes, coated screens are stored in the bathtub (which also serves as the developing and screen washout/reclaiming area). The shower curtain has been replaced with a piece of black plastic to protect the screens from light exposure when they are in the tub.

For coating, a coating trough with a smooth, nick-free edge is used to apply freshly mixed dual-cure emulsion onto properly stretched screens. After coating, screens are leaned against the side of the tub with a fan blowing on them. The trusty old fan has been used for years, and a thick layer of dust coats the blades. If time is short, a hair dryer is typically used to speed up the drying process. Screens are usually made as they are needed and rarely stored after coating.

SCENARIO 2: THE HOT TEMP SHOP

Another screen shop also operates in cramped quarters, but features a room built specifically for the purpose of screenmaking and includes filtered fluorescent lights (yellow lights) to

Looking for insight on the wonderful world of screen making? Consult the writings of Chromaline's Technical Guru, Mick Orr, Applications Training Specialist.

Mick has been in the screen printing industry since 1970 with printing experience in a wide range of applications from membrane switches, to textiles, specialty graphics to faceplates and more. His hands-on seminars have been appreciated by screen makers around the world.

Maintaining the proper drying environment means paying attention to several factors, including lighting, airflow, and temperature.

reduce the chance of inadvertent exposure. There, properly tensioned screens are coated with a quality coating trough. After coating, the screens are dried in a cabinet that provides further protection against light exposure. The screen maker keeps the cabinet temperature set on "hot" (it features additional settings of "low" and "medium" that have never been used). Since the shop is relatively busy, the screenmaker has an inventory of screens ready to use at all times, and some may sit idle for long periods before use.

SCENARIO 3: THE SOPHISTICATED SHOP

A sophisticated print shop busily churns out screens to meet a demanding production schedule. The company has been careful to lay out and plan each area of its operation to provide the highest levels of efficiency and quality. It has a light-safe coating room where properly stretched, clean screens are coated on an automatic coater. The screens are dried and stored in a separate temperature- and light-controlled room. Inventories of coated screens are always on hand for emergencies and rush jobs.

These examples demonstrate the varying degrees of importance that screen printers assign to proper screenmaking, and more specifically, proper screen drying. What separates these companies isn't the level of automation, the size of the operation, or the volume of work they produce. The real difference is the degree to which they've standardized their procedures to be correct and consistent.

SCREEN DRYING AND ATTENTION TO DETAIL

Attention to the coating process, understanding of common drying procedures, and knowledge of the conditions that must be present in order to achieve reliable coated screens on a consistent basis are required in order to get the results your want when drying a screen. Here are some things to consider.

COATING THICKNESS

Before you can consider drying procedures, you must first understand how the emulsion coating itself impacts the screenmaking process. Virtually all mesh and emulsion manufacturers recommend that the emulsion thickness on the print side of a screen be approximately 10-20% of the mesh thickness to achieve a good stencil. This percentage is called the emulsion-over-mesh ratio, or simply EOM. When a stencil is too thick, it may not dry all the way through and will yield a weak stencil that is prone to premature breakdown. Another problem with emulsion that has been coated too thickly is that it has a tendency to drip, usually onto the coated screens drying below it.

SCREEN ORIENTATION DURING DRYING

I have seen many screen shops over the years that do a good job at coating, only to fail miserably at drying the screen. All emulsion manufacturers recommend that the coated screen be dried horizontally, squeegee side up, so that the emulsion will level out on the print side of the screen and be thicker than on the squeegee side. This is a result of gravity pulling the emulsion to the print side of the screen. Since the emulsion will be in front of the mesh during exposure, you will have less mesh interference and less chance of mesh marks, sawtoothing, and other defects in your prints.

A few screen printing shops use screens so large that they are impossible to dry in a flat or horizontal orientation. Instead, they must be dried vertically. Since gravity can't help produce a thicker stencil on the print side of the screen, that side usually must be recoated

one or more times. This will produce the desired EOM.

For drying, such large-format screens are typically leaned against a wall in a light-safe room, and a fan is used to move dry air toward the screen and accelerate the drying process. Some shops take this a step further and build separate rooms that are heated and climate controlled to dry the screens even more quickly.

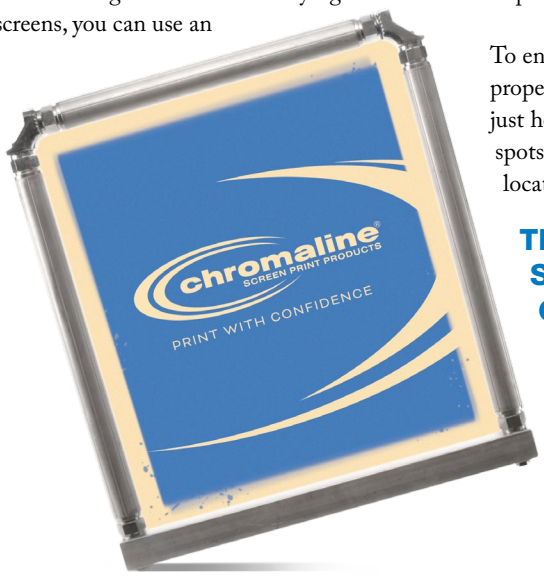
DRYING COATED SCREENS

Check out our chart on the next page for the Proper Conditions for Drying a Screen.

When is a coated screen dry? Is it dry after 10 min, 1 hr, 1 day, a week? The answer is simple: A screen is dry when the emulsion has turned completely from a liquid into a solid. The rate at which this transformation takes place depends on environmental conditions (temperature and humidity), as well as the coating thickness.

The key to drying is that all the water contained in the emulsion must be completely evacuated from the coating. This is generally accomplished by using heat, a dehumidifier, or both. A typical coated screen generally will be dry to the touch after one hour at 70˚F (21˚C) and relative humidity of 50%. When the drying environment is 100˚F with 20% humidity, however, a coated screen can be completely dry in as little as 15-20 min.

To take the guesswork out of drying screens, you can use an instrument, such as Saati's TQM-Aqua-Check, to measure the moisture content of the emulsion coating.



But what an instrument like this can"t tell is what sort of stencil quality you can expect from the coating. The quality of the final stencil is largely determined by both the drying environment and the methods you employ in screen drying.

CHECKING FOR HOT SPOTS

For those thinking about adding a factory-made screen-drying cabinet or making their own, heating is a consideration that deserves some attention. While most heated factory models have been tested to ensure that they will provide uniform temperatures throughout, homemade cabinets often incorporate a small space heater to facilitate the drying process. If the heater is poorly directed inside the cabinet, you will experience hot spots and wide temperature swings throughout the cabinet.

Screens directly in the path of a heater's output may get exposed to higher temperatures on one side than the other and end up with nonuniform drying across the coating. Also, if the circulation within the unit is poor, the screens on the lower levels are likely to be subjected to a lower temperature, while the screens placed higher up get damaged from excessive heat that rises to the top. Make sure that the cabinet you use has both adequate airflow and heat displacement to prevent these conditions.

To ensure your heated drying cabinet works properly, get a thermometer and measure just how hot the cabinet gets. Check for hot spots by taking multiple readings in several locations throughout the cabinet.

THE BENEFITS OF A STORAGE DRYING CABINET

In most screenmaking rooms, including those with automated drying cabinets, one important piece of equipment that will greatly improve the longevity of coated screens is usually missing. That piece of equipment is a second cabinet for holding the dry screens. This cabinet protects the screens from premature exposure and guards them from excessive heat while freeing the drying cabinet for processing additional screens.

> Attention to the coating process, understanding of common drying procedures, and knowledge of the conditions are all important to achieve the desired results.

Another function served by such a storage cabinet is that it allows screens to adjust to the shop's climate prior to exposure. Screen frames often expand and contract in response to temperature changes, and humidity can affect the stencil by causing it to swell. If screens aren't allowed to acclimate prior to exposure, distortion of the stencil image and registration problems become much more likely. Giving screens time to adjust in a protective cabinet is an easy way to avoid these problems.

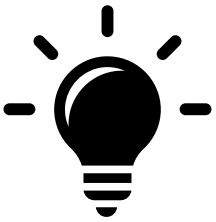
SWEET REWARDS

In order to make a high-quality stencil, it is important to maintain proper drying conditions in your shop. Be sure to dry your coated screens in an environment that is dust-free, protect them from UV light, and dry at low temperatures to prevent premature crosslinking of the emulsion. Also make sure your drying area or cabinet has adequate airflow and that you control temperature and humidity throughout your operation. Finally, use dried screens as soon as possible or store them in a light-safe storage area or holding cabinet. By following these suggestions, you can eat your cake and dry a screen, too. ■

PROPER CONDITIONS FOR DRYING A SCREEN

Maintaining the proper drying environment means paying attention to several factors, including lighting, airflow, and temperature.

LIGHTING

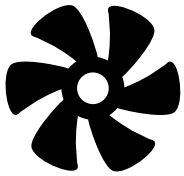


When drying a coated screen, the drying area or cabinet must be complete-ly dark, because any light--specifically UV wavelengths–that strikes the coated screens can cause the emulsion to begin crosslinking and pre-expose the stencil. If this happens, you'll be left with an unusable screen. Even filtered fluorescent bulbs will lead to premature crosslinking if the coated screen is exposed to the light for too long. It usually takes hours before yellow lights create any serious pre-exposure. Still, it's not uncommon for coated screens to remain in drying areas with such lighting conditions for a day or more, which can lead to some significant problems.

Not only do yellow lights give off UV light, but over time, the yellow filtering material begins to fade. You'll notice the problem as a whitening of the bulb toward the ends, which is a sign that the bulbs should be changed. Testing devices are also available to check the light-quality of bulbs and determine whether they are emitting too much UV light.

Some screen printers ask if red safe lights are okay to use. Sure they are. But have you ever been in a darkroom with a red light on? It's almost impossible to see anything! These lights are designed for working with camera film, which is very sensitive to white light. For screenmaking, use yellow lights, which are easier on the eyes and allow you to see what you're doing. Just keep your screens away from them when you're drying emulsion.

AIRFLOW



A few years back I talked to a screenmaker who was having a great deal of trouble because his screens were taking more than three days to dry. After coating, he stacked the screens, squeegee side up, in a "drying box." This protective box was absolutely light safe and free of dust. The problem was that it was also airtight. Very little dry air could get in and very little wet air could escape, which caused the drying process to drag on for days.

Many types of drying cabinets can be used, from heated, thermostatically-controlled factory units to simple homemade ones. If you use such a device, just make sure that it provides good airflow, with an intake to draw in dry air and an exhaust for the wet air. When a drying cabinet is constructed correctly, it accelerates the drying process while saving space and preventing damage and contamination of coated screens.

Speaking of contamination, this is an especially important airflow issue for shops that dry screens in an open environment, such as companies that use large-format screens. As mentioned earlier, large-format printers frequently employ climate-controlled rooms in which they dry their large screens. They frequently accelerate the drying process by moving air around the room with fans. The big problem with fans is that they not only push air around, but they push dirt, dust, and other debris along with it. A big wet screen is a giant target just waiting to be covered by this debris as it flies around the drying room. Therefore, if the drying room itself can't be made completely dust free, it's not a bad idea to at least put an air filter on the intake side of the fan(s). The filter will help capture these particles before they land on screens and become pinholes and other stencil defects during exposure or on press.

TEMPERATURE

Emulsion manufacturers typically recommend drying coated screens at a temperature around 110°F (40°C) because higher temperatures can have an adverse effect on stencil performance. All diazo-based emulsions are sensitive to heat. In fact, any temperature above freezing will start the decay of the diazo sensitizer in the emulsion (this sensitizer allows the coating to cure properly during exposure). The higher the temperature, the faster the diazo sensitizer decays and the greater the likelihood of exposure problems later.

When using either direct or indirect stencil systems, it's best to work in cool or ambient conditions to minimize this decay. It's also important to keep the temperature consistent, since abrupt temperature changes can alter the dimensions of the coating and lead to such problems as edge lifting and reduced adhesion in the final stencil. The safest strategy is to always dry screens as quickly as possible after coating and avoid high temperatures.

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