



TECHNICAL SERVICE REPORT

Plastisol Ink Film Failure...The Cause? The Cure.

The symptoms are many and varied: Poor wash fastness, dye migration, poor adhesion, ink crocking. What's the cause?..... It's the CURE.

I work in Technical Service, and my job is to answer the phone when you're in trouble. I receive many calls a day soliciting advice, asking for direction and troubleshooting problems. Of the calls I receive on problem prints, I can easily say that 80 percent of them are related to ink cure problems. The relationship between your dryer and your ink is the most important one in your shop. Great art, perfect screens and excellent printing are wasted unless you have good cure in your ink film. So, how do you protect yourself from this problem? Treat these symptoms as if you were going through the stages of a chronic illness.

Denial

Don't ignore the real cause of the problem just because you have an easy mark to blame. The ink is usually the scapegoat when cure issues are evident. I'm not saying that the ink could not be to blame when there is a cure problem, but in my experience, an adjustment of the dryer will alleviate the problem. I'll give you the top three statements I hear when I advise customers of the probable causes of poor cure.

"The ink worked fine on all the jobs except a few of them." This statement tells me that the ink is fine. If it was able to reach cure on jobs previously, then another factor caused it to fail. If the dryer is at a setting that is slightly above the ink cure temperature, a slight change of the situation may affect the temperature. Examples of variables that can affect the situation include humidity, belt speed, a fully loaded belt, and ink deposit and ink type. Cure temperatures in ink can vary due to the following factors: Pigment color, product density and chemistry (as in an athletic vs. general purpose vs. fast fusion ink). Setting your dryer to ensure that the temperature window is above the ink cure recommendation is your best chance for success.



Step 1: Place the Thermoprobe 'donut' with the crosshairs in the ink film.

Step 2: Record the temperature at 5 seconds intervals.



Step 3: Plot time and temperature points on a graph.



Step 4: Connect points to determine temperature curve.

"I've had my dryer on the same settings for years, and this is the first cure problem." Obviously, I always check the ink, but when I hear this comment, I ask the customer to also check the dryer heat to see if there has been any change. Many things can cause a dryer to dip in temperature including malfunctioning parts or clogged filters. And one thing is for sure: With age, a dryer will change. (Don't we all?) This is why it is important to read and map your dryer temperatures. Not only will mapping ensure good cure, but it will also alert you to symptoms related to failing mechanics in your dryer.

"I take readings on my dryer belt, and it reaches the recommended temperature." Taking readings of your belt or of a shirt surface does not ensure that the ink film will reach the recommended temperature. You need to be a skeptic. Don't believe any temperature reading unless it is actually taken at the point where the ink meets the fabric. Any other reading can be misleading. The dryer temperature panel only reports the ambient air temperature inside the can. A temperature strip on the surface of the garment reports the garment temperature. A temperature gun pointed at the surface of the ink reports the surface temperature. (See where I'm going here?)

Education

If you discover that you have an illness, your best route to recovery is take control of the situation and learn as much as you can about your options. When you are trying to find the CURE in screen printing, the best scenario is for you to fully understand how the ink reaches full cure and what you can do to ensure correct monitoring of the ink film.

The ink will pass through different phases as it continues toward a full cure.

Fluid or liquid phase The first phase is the fluid or liquid phase. This is how you receive your inks from the manufacturer. At room temperature, the resin particles are suspended evenly in a plastisizer and the ink can flow easily through the screen.

Pre-gelation phase The second phase is the pre-gelation phase. As the ink film temperature rises, the PVC resins in plastisol begin to absorb the plasticizer. At this stage, the ink is unstable and may have a sticky consistency.

Gel phase The next phase is the gel phase. During this phase the ink will feel dry to the touch, and you are able to print other inks on top of it.



A word of caution. If you use an electric dryer, the thermostat control will turn your heat panels off and on. Record the dryer readings during both stages of on and off, make sure your dryer stays above the recommended temperature even when it is on the low side. The goal of the flash unit is to help the ink reach the gel phase.

Partial fusion phase The next phase is the partial fusion phase. At this stage, if the ink were cooled from this temperature, you would have a film that appears good but it will be weak. This could mislead you if you depend on the "stretch" test at the end of your dryer. The ink could appear totally fused, but it may have weak adhesion to the fabric.

Full fusion The last phase is full fusion. Total fusion of a plastisol is accomplished when the entire thickness of the ink is brought to the manufacturer's recommended curing heat.

Dryer Belt Speed and Ink Film Temperature

The ink needs to hit the temperature recommended by the manufacturer sometimes in the dryer. For instance, if the dryer is reaching a temperature of 335° F, the ink film temperature is actually rising slowly as it passes through the oven, and it usually doesn't hit the high temperature until it is close to the end of the oven.

The reason higher temperature doesn't necessarily compensate for a faster belt speed is because the ink itself needs to rise in temperature and hit the mark. It is safe to say that if the ink doesn't usually hit the high mark until the end of the oven, it may just run out of exposure time if the belt is slightly too fast.



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Treatment

You've accepted that you have a problem, and you've educated yourself about your disease. Now you're ready for the treatment. My recommendation is to buy a Thermoprobe or temperature strips. I would not use a spot gun for the cure test. Print the ink to be tested over the temperature strip or place the Thermoprobe cross hairs IN the wet ink. Run it through the dryer and map or read the results. This is the best way to ensure that the entire ink thickness reaches the cure temperature recommended by the ink manufacturer.

Recovery

Ink is a chemical. In order for ink to complete its chemical metamorphosis, it needs proper heat. Remembering that the ink temperature is the only thing that matters in your dryer is the best defense against undercured designs.

Prevention

Now that you've worked so hard to recover, you will want to know how to avoid cure problems in the future. The best prevention is

to test the ink temperature in your dryer religiously. It is vital that you keep records of mapped dryer temperatures at various times of the day, at different times of the year and during changing weather periods. It is also a good idea to check the cure at the beginning of each print run. It is highly recommended that you check ink film temperature when you are trying new types of inks, and new print parameters like high density or metallic printing. Regular maintenance and service on your dryer is money well spent, an ounce of prevention is worth a pound of cure.

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Printed in U.S.A.

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