

Printing on Garment-Dyed Apparel

A look at three printing processes conducted on reactive- and pigment-dyed T-shirts.

By Marshall Atkinson, Contributing Writer

From across any room, Comfort Colors® T-shirts have a distinct visual charm. It all stems from the care and thought the company puts into building the color palette for its apparel line. If you are not familiar with the brand, Comfort Colors® markets blank T-shirts, hoodies and sweat shirts that are dyed two ways — pigment and direct/reactive.

Pigment-dyed shirts have a vintage, favorite-shirt appeal. During the dyeing process, the pigment doesn't fully penetrate the fabric, resulting in an apparel blank with a weathered or washed-out look. After washing, pigment-dyed shirts fade more quickly than direct/reactive-dyed shirts. It's probably why that vintage look propels it to the "favorite-from-the-closet" status.

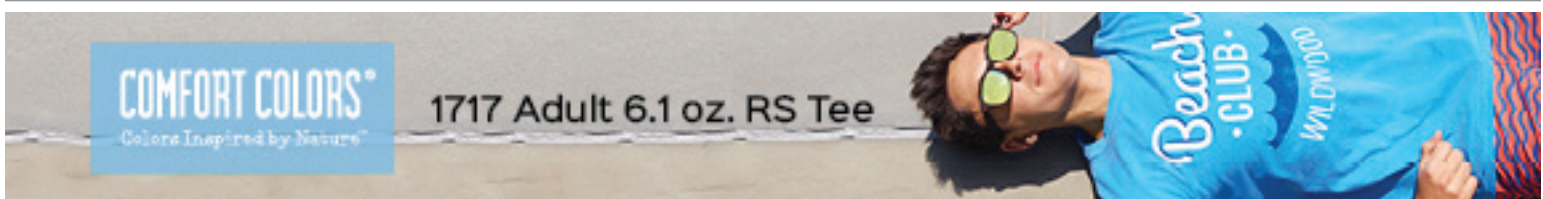
Direct/reactive-dyed shirts produce more of a pop color-wise, but project that same lived-in look that pairs well with a favorite pair of blue jeans or khaki shorts. For these, the dye process fully penetrates the fabric and the colors are fully saturated, not washed out.

Favored by many retail brands, the two different dye processes produce an amazing array of hues that seem to naturally fit into wearers' lifestyle.

In this *Impressions* Tech Tips Newsletter, sponsored by Comfort Colors®, we will explore the possibilities available to decorate both kinds of dyed shirts. To illustrate how printing on these shirts can differ, we tasked the craftsmen at PXP Solutions, Garland, Texas, to print



Get casually cool in one of the 79 garment dyed shades of the Comfort Colors® 1717 Adult 6.1 oz. Tee. This 100% ring spun cotton tee features twill taped neck and shoulders as well as double-needle stitching for added durability. Available in sizes S-4XL



the same design on Comfort Colors® pigment- and direct/reactive-dyed colored shirts using three different processes: traditional screen printing, discharge printing and direct-to-garment (DTG) printing. We've cataloged each step along the way so you can see the differences for yourself.

PXP Solutions provided the artwork, "Cherry Limeade," a simple, three-color design packed with bold, rich color. For our production experiment, it will be interesting to see how this design will differ with traditional screen printing, discharge printing and digital printing on the two different types of shirts. That's six options for our study.

To keep it simple for comparison purposes, we are only showing two different shirt colors. We could have gone in many directions because the Comfort Colors® shirt palette has 42 direct/reactive-dyed and 47 available pigment-dyed color choices. Experiment with your own images on different shirt colors and see if you can also achieve excellent results.

For our testing purposes, the reactive-dyed shirt is the Comfort Colors® Sapphire, which is a blue hue. The pigment-dyed shirt is the Comfort Colors® Citrus, which is a gold hue. Each shirt was printed with the same image for screen, discharge and digital printing to compare the results across the spectrum. We also tried to ensure each process's variables mirrored each other so that the printed results could be equally compared.

Let's dive into what was produced.

TRADITIONAL PLASTISOL SCREEN PRINTING

PXP Solutions used 156-mesh screens, made on static aluminum frames and imaged with a Kiwo I-Jet2 computer-to-screen (CTS) imaging system. The image is 10.8" x 12" in size and is printed with a 12/14 M&R Gauntlet III automatic press and cured with an M&R Sprint 2000 dryer.

All inks are from the Wilflex Epic plastisol ink system. Wilflex Polywhite is used as the underbase, as this helps with any potential dye migration during the print process with Comfort Colors® blanks. The print order is Polywhite as the underbase, PMS 485 Red, PMS 356 Dark Green, and then PMS 375 Lime Green. The Polywhite and Dark Green screens are double stroked for coverage. Squeegee pressure is 45 psi, and the dryer temperature is set at 380°F, with a chamber time of 30 seconds.



Ink colors are mixed using the formula for each specific Pantone color. This is an easy-to-use system that gives you the amount of base and pigments needed to make any Pantone color. You just add in the specified amount in grams and mix.

Screens are burned with the Kiwo I-Jet2 CTS system. Emulsion used is Kiwo Poly Plus Z, double-coated front and back for a nice EOM. Computer-to-screen systems allow your staff to image the screen and not have to worry about sorting or storing film. The I-Jet2 unit produces imaged screens that are ready for washout and easy registration on press.

The job is registered on press using the M&R Tri-Loc registration system. As each screen has been imaged in relation to the others, it's just a small matter for locking them into the jig and setting up the floodbars and squeegees, and adding ink. Setup time is reduced to less than five minutes per screen.

Next, the shirts are printed. Remember, use only enough pressure to clear the ink through the screen. Too much pressure can distort the image and actually produce registration issues. If you can see a printed image on your press platens, that means you are using too much pressure; dial it back for better results.

Shirts are removed from the press and placed on the dryer belt for curing. Not a lot of press tack was used during this run, but using too much can distort the image — so be careful.

STEP-BY-STEP:

- STEP 1** Ink colors are mixed using the formula for each specific Pantone color.



- STEP 2** Screens are burned using a computer-to-screen (CTS) system.



- STEP 3** The job is registered on press.



- STEP 4** "Cherry Limeade" is a simple, three-color design that is packed with bold, rich color.

- STEP 5** The finished screen-printed design on a direct/reactive-dyed Comfort Colors® T-shirt.



- STEP 6** The finished screen-printed design on a pigment-dyed Comfort Colors® T-shirt.

DISCHARGE PRINTING

Discharge printing, which works well for the Comfort Colors® brand's vintage look, gives a distressed look to designs. For this project, we used the same setup as traditional screen printing with 156-mesh screens and the same screen-printing equipment.

Inks for this shirt are from the Rutland WB water-based ink system, with the Rutland WB Discharge Agent added. Six percent ZFS catalyst is used — based on the ink's weight in the container — as instructed by the manufacturer's directions. An underbase screen was not used. The print order is PMS 485 Red, PMS 356 Dark Green and PMS 375 Lime Green. The red and the dark green screens are double stroked. Squeegee pressure is 35 psi and the dryer temperature is set to 420°F, with a chamber time of one minute.

In preparing for the print, inks are mixed using the Rutland WB ink system with 6% by weight WB discharge agent added. It's important to use a digital scale that goes to .01 grams for accurate measurement. Use a calculator to determine the correct formula, and don't forget to zero out the scale after each component is added to the mixture.

A different set of screens are made for the discharge print, but the same emulsion is used. However, some shops use different emulsions for traditional screen printing vs. normal discharge runs.

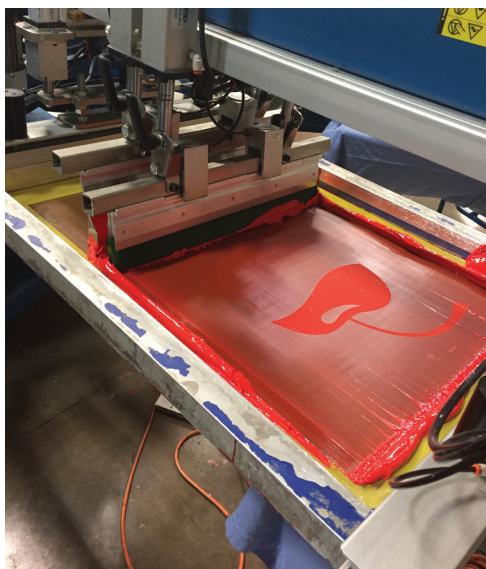
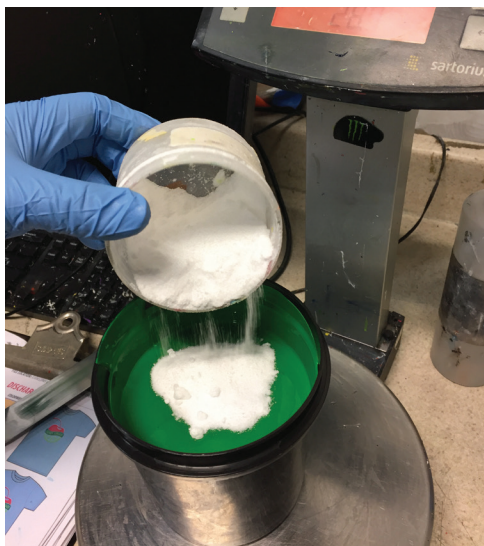
The job already was registered from the traditional screen-printing job, so only new inks were used for this discharge-printing job. Remember to carefully card out the ink between processes. Avoid contamination from the same-colored plastisol and water-based inks by using two different-colored buckets. Most shops use clear for plastisol and blue or black for water-based ink. You also can use colored tape on the handle to quickly spot the correct bucket from a distance if they are grouped.

The discharge agent in the ink removes the shirt's dye via heat from the dryer. This allows you to have a great-looking print without using an underbase. Don't forget that some shirt colors discharge better than others. The shirt fabric doesn't become white when the discharge agent removes the dye. The shirt originally is a natural tan color, and that may be slightly tinted with the original color of the shirt. Always test before running a lot of shirts to see the result from your dryer.

When removing shirts from the press and placing them on the dryer belt, remember not to overload it. Also, when there's a size variation, change the direction in which the shirts are laid. This allows your catcher to easily tell when the sizes in an order have changed.

STEP-BY-STEP

- STEP 1** Six percent ZFS catalyst is used, based on the ink's weight in the container as instructed by the manufacturer's directions.



- STEP 2** Inks for this shirt are from a water-based ink system with a discharge agent added.



- STEP 3** The print order is PMS 485 Red, PMS 356 Dark Green and PMS 375 Lime Green.

STEP-BY-STEP:

- STEP**
4 Be careful when unloading the press of placing too many shirts on the dryer belt.



- STEP**
5 The finished discharge-printed design on a direct/reactive-dyed Comfort Colors® T-shirt.



- STEP**
6 The finished discharge-printed design on a pigment-dyed Comfort Colors® T-shirt.

DTG PRINTING

For the digital-printing scenario, the art remains the same, but there won't be any screens. Instead, the art is converted into a CMYK file and ripped to a uni-directional 1,200 x 600 dpi file. According to the M-Link RIP, the ink cost for the print is 88 cents per garment.

The images are printed on an M&R M-Link DTG printer using standard M-Link CMYK inks and pretreatment. The M&R EZ Prep pretreatment is applied to the shirts in a single pass before printing and cured for 50 seconds using heavy pressure on a Geo Knight DK-20A heat press.

Print time is 2 minutes, 33 seconds. Shirts are then cured using the heat press with a 50-second hover, followed by 59 seconds in the heat press using medium pressure and parchment paper to protect the image.

The following provides more details on the process:

Art is ripped and sent to the digital press. Some DTG manufacturers employ a system to automatically set up the underbase white for the image. For others, you'll need to create this in Adobe Photoshop.

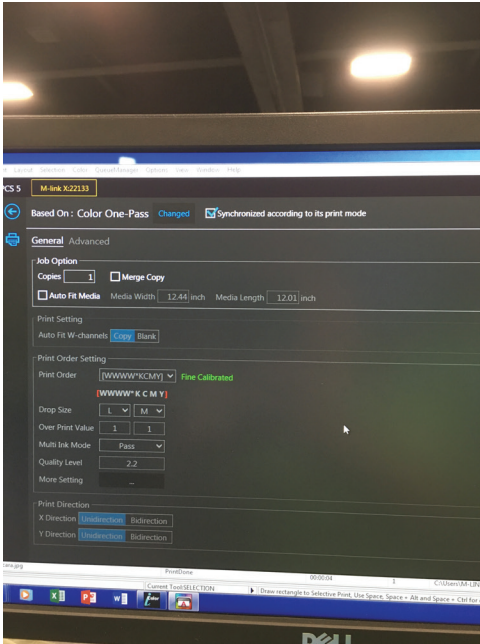
Pretreatment is added to the shirts and dried in a separate step. Some pretreatment chemicals can leave a faded "ring" around the image where only the pretreatment is showing. Simply misting with water around the area after printing often can diminish the unwanted results. Carefully spray around the perimeter and then begin the curing process.

The shirts are printed using the DTG system. The white underbase is printed first, then the CMYK inks are applied on top. The quality setting is 2.2, which means the printer is set to overlap a bit to prevent banding issues. This is a quality-control feature.

The shirts are cured using the heat press in two steps. The first is to hover over the T-shirt to gel the ink and get it ready for heat and pressure.

Next, a sheet of parchment paper is placed on top of the shirt, and then the heat press is locked down using medium pressure to cure the ink on the shirt.

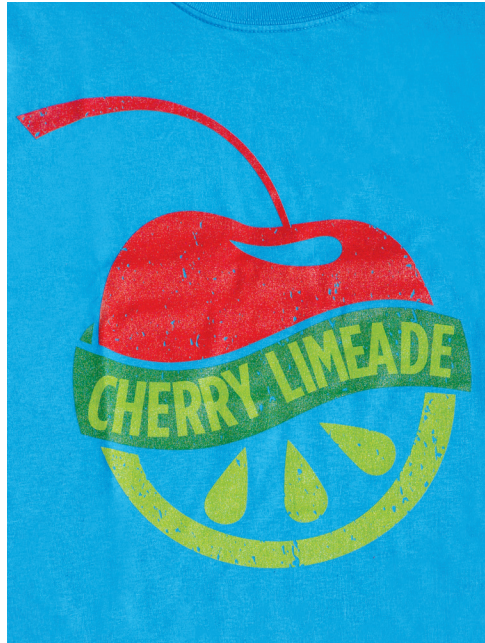
STEP-BY-STEP:



STEP 1 Art is ripped and sent to the DTG printer.

STEP 2 On the DTG system, the white underbase is printed first, then the CMYK inks are applied on top.

STEP 3 The first step in curing is to hover over the T-shirt to gel the ink and get it ready for heat and pressure.



STEP 4 A sheet of parchment paper is placed on top of the shirt, then the heat press is locked down using medium pressure.

STEP 5 The finished digitally printed design on a direct/reactive-dyed Comfort Colors® T-shirt.

STEP 6 The finished digitally printed design on a pigment-dyed Comfort Colors® T-shirt.

FINAL RESULTS

So that is the basic recipe. How do the results compare?

Overall, I'd say the best result for print uniformity is with traditional plastisol screen printing. That makes sense, as the shop will have more control of the results with setting up the image, using an underbase and specific Pantone colors for each. The hand is soft and smooth — not thick at all. Registration was perfect. Coverage was completely opaque, with the results mirroring each other on the two different types of garment-dyed shirts.

The best hand, to no surprise, was with the water-based discharge results. You can't feel the print at all. For both the pigment-dyed Citrus and the direct/reactive-dyed Sapphire shirt colors, the discharge didn't help the inks stay true to their Pantone hues. I think the results still are acceptable for most consumers, but if the client were picky and wanted a PMS match, more effort would be needed to orchestrate it.

The result with the digital print also probably would be acceptable in most circumstances. Like the discharge print, if a Pantone match was required, the shop would need to do a little more with the image. The Citrus shirt had a better-matched result, as it was a lighter color and the stronger CMYK colors prevailed. The Sapphire shirt's hue dominated the thin CMYK digital inks, and the result skewed toward a blue-ish tint for all colors.

One thing is certain: Each of these three production methods produced acceptable results on the two different garment-dyed shirt colors.

Will these methods be satisfactory for your application? Results may vary, but if you engineer the art and dial in your processes in production, you can get amazing results on these two different Comfort Colors® dyed shirt styles.

Editor's Note: Thank you to PXP Solutions, Garland, Texas, for the production help.