Burnout and Discharge Inks

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Introduction

In the genesis of the textile screen printing industry there was water-based, followed by plastisols. As the technologies of the ink manufacturing industries have progressed, many modifications and alterations have been made to textile screen printing inks as we know them. In this installment, we will look at two types of inks that dictate their own unique production and process techniques. Those are discharge and burnout inks.

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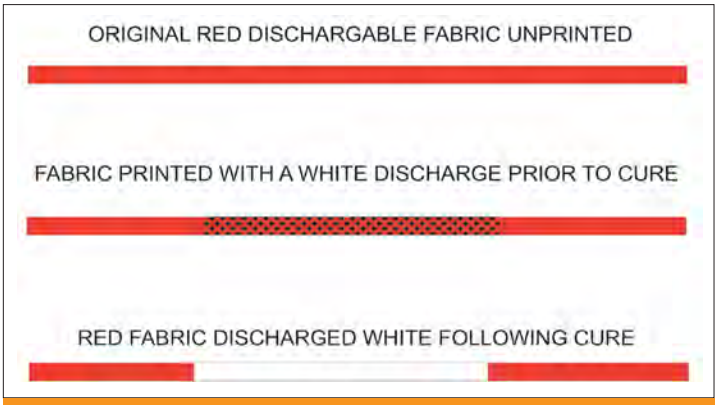
Discharge Inks

Discharge inks are somewhat simple in their general application. The basic concept being to print an ink onto a dischargeable garment which remove the dyes present (via a thermo-chemical reaction) in the fabric and replace them with the pigments / dyes in the ink.



The final color of the print ink will not be evident until the ink film is properly cured.

For years, discharge inks were primarily water-based, with the discharge agent added to the ink prior to printing. The primary discharge agent used in these inks is Zinc Formaldehyde-Sulphoxylate. Once the discharge agent is added to the ink, it must be used at that time, as the agent will drastically shorten the shelf life of the ink. Water-based inks will need to be used within six to eight hours of the addition of the discharge agent.

As technologies advance, there is progress being made on more user- and environmentally friendly products than the current Zinc Formaldehyde-Sulphoxylate (ZFS)-based discharge agents. There are products available today with Formaldehyde-free discharge technologies, as well as high-solids, water-based inks which will achieve the same graphic effects of soft-hand prints on dark, 100 percent cotton without the use of a Zinc Formaldehyde-Sulphoxylate-based activator.

Two different applications can be applied here. The first, and most traditional method uses discharge inks for all colors in the graphic. The discharge agent is added to each individual color, and thus each color independently discharges the dyes from the garment and replaces the garment color with the dye present in

Photo 1: Full (six) color graphic printed on 100 percent cotton with full water-based discharge colors. (Garment courtesy of Real Thread, Orlando FL)

Photo 2: Here the effects of printing a discharge onto a 50/50 cotton / Poly blend are shown. (Garment courtesy of Real Thread, Orlando FL)

each ink. When completed, the result is a full-color graphic with a extremely soft hand.

The second method utilizes the discharge underbase under the entire design. The underbase can be dried using a flash unit, and then overprinted with straight water-based colors or soft -and plastisols. Once the finished print passes through the dryer and the underbase has properly and thoroughly discharged the dyes from the garment, you will have a vibrant and soft print on the darkest of colors (Photo 1).

Aside from traditional water-based, a Formaldehyde discharge additive for plastisols allows you to print in either of the previously mentioned formats and still achieve bright soft-hand prints on dark garments. The same precautions apply to the pot life of a plastisol once the discharge agent is added to the ink. The general pot life for a plastisol is 18 to 24 hours.

Garment Selection

The general discharge process was designed for 100 percent cotton dischargeable garments dyed with reactive dyes that lend themselves to the process. With the exception of a few darker shades, most 100 percent cotton garments will completely discharge with little problem. The aspect to consider is the effect that can be achieved when printing on garments other than the cotton the process was intended for. As the graphic demand for distressed effects and the vintage "look" has increased over the years, so have the printers' drive to achieve this effect in different manners.

Cotton/Polyester Blends

Discharge inks are only effective on 100 percent reactive dyes, though this does not affect dyed polyester because of dye types and that polyester is unchanged in the discharge process. It is here where a different effect can be achieved printing on different degrees of cotton / poly blends. In this printing scenario, the cotton dyes in the blended fabric are discharged and replaced with the pigment in the ink. The polyester percentage of the fabric remains unaffected (Photo 2).

The end result of a discharged vintage effect can vary slightly from garment to garment. Many printers have started to work with water-based inks and discharge applications as a sales tool, to offer the client more options (Photo 3).

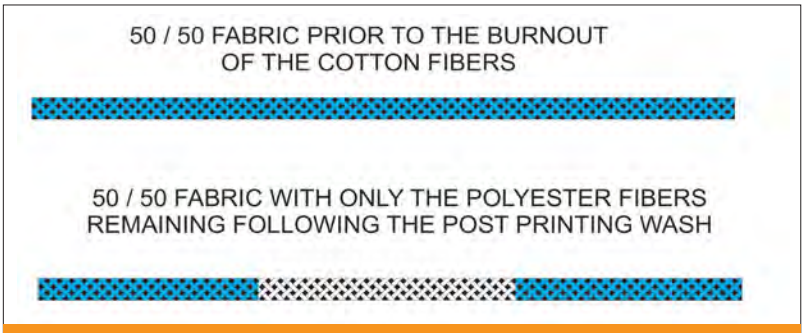
When working with standard ZFS discharge inks, it is important to follow all of the safety precautions recommended by the manufacturer, as well as employing the proper emulsions and printing precautions needed when printing with water-based ink. It is also important to remember that the performance of water-based inks of this type is determined by ensuring the proper curing of the ink film. Although infrared dryers will work for such applications, gas-fired, forced-air dryers will work best to ensure that the water is completely driven from the ink, properly activating the discharge agent.

Burnout Inks

Burnout printing of fabrics started in the 1920s, and was primarily used on velvet to etch patterns or graphics into the surface of the fabric. Today, the process is utilized in the apparel industry to produce abstract patterns into an overall garment, and to burn a graphic into the fabric (Photo 4).

Burnout printing is executed on 50/50 cotton/polyester garments. The active compound in the ink will eat away the natural cotton (cellulose) fibers, and leave only the polyester threads. The printing process is executed in two steps. First the garment is printed with the use of a water-based ink and an acidic additive

— sodium hydrogen sulphate (i.e., Sodium Metasulfite). In this case, the compound will dissolve the cotton fibers and leave only the polyester threads, which are immune to the effects of the compound. The Sodium Metasulfite is mixed into the ink and saturated into the fabric during the printing process. Once the ink is dried, it must be washed. During the wash process, the areas of the garment that were saturated will wash away, leaving only the polyester threads. The final result is a see-through mesh effect left in the pattern or graphic printed onto the fabric (Photo 5).



The end result is a see-through mesh effect with only the polyester fibers remaining.

Printing Considerations

As with discharge printing, you will want to observe all safety warnings and precautions offered by the manufacturer of the ink. In both cases, you should always pretest the inks on the fabrics you intend to embellish. Due to the nature of the inks and the different fabrics, you will want to confirm product performance prior to starting production. Follow the ink manufacturer's recommendations on mesh selection and printing parameters.

Due to the aggressive nature of the compounds utilized in both processes, you will need to employ a water-resistant emulsion and potentially a hardener. This will hold especially true for larger, automated production runs. Again, refer to the manufacturer's recommendations for specifics on stencil preparation. There are also specific post-printing washing instructions that must be followed, and may vary. Please refer to these instructions and follow them to achieve optimum results.

The Future

Although the standard for discharge and burnout printing has been the utilization of Zinc Formaldehyde Sulphoxylate and Sodium Metasulfite respectively, research is ongoing to identify alternatives. There are already relatively new formaldehyde-free discharge inks available on the market today.

The research into burnout chemistry has companies looking into less caustic (organic) compounds that will achieve the same results without the need of such acidic compounds.

As long as garment manufacturers continue to create garments in ever-changing fabric configurations, the ink manufacturing companies will be making specialty products to embellish those fabrics. It is up to the textile screen printer to stay on top of this technology through trial and research.

Rick Davis has been in the textile manufacturing and screen printing industries for over 30 years. His background includes manufacturing, plant management and operations, consulting, plastisol printing and troubleshooting. Currently, he is Southeastern regional sales manager for the Triangle Ink Company. He has published more than 200 papers on all aspects of the industry and printing processes, and is a regular contributor to current trade publications. Davis is also a member of the Academy of Screen & Digital Printing Technologies.

Photo 3: Photo shows a print on a 60 / 40 Cotton Poly Blend.
(Garment courtesy of Real Thread, Orlando FL)

Photo 4: The burnout process shown here is used to create an abstract pattern into the overall garment.

Photo 5: Here you see the screen image where the cotton fibers have been washed away following the printing and curing process.
(Garment courtesy of Real Thread, Orlando Fl.)