Screenprinting & Graphic Imaging Association International

Garment Discharge Printing

Alan Anderson
Screenprinting and Graphic Imaging Association International

Al Anderson has over 20 years of experience in the screen printing industry in both production and education. He is a graduate of Alfred State College and Rochester Institute of Technology's School of Printing. Al owned his own textile screen printing company and also printed posters, displays, magnetic signs, pressure sensitive labels flat glass, etc. In addition, he also served as a production manger for a high volume private label garment manufacturer. Since 1991 he has worked for the SGIA, first as a Technical Education Associate and now as the Vice President of Divisional Services.

Introduction

Water based ink systems for textile printing have been in use for many years. In fact, they have been available far longer than the now popular plastisol inks. While I must admit that plastisol inks are initially easier to use, I think that water based inks offer some advantages that are only now being realized—with the new discharge systems offering a unique solution to one of the more difficult to overcome problems—opacity on dark fabrics.

Conventional water based inks have had difficulty printing bright multi-color images on dark fabrics with the ease of production offered by the plastisol systems. Their popularity has been further reduced due to the roughness and stiffness of the ink on the fabric. The new discharge ink systems can produce soft, bright colors with printing production speeds up to a level that can meet and exceed those usually reserved for plastisol printing on dark fabric.

The New Process

The problem with printing on dark fabrics has always been one of trying to hide the color of the shirt under the ink. Discharge inks solve this problem a different way by eliminating the original fabric dye. When the dye is gone all that is left is the original neutral color of the fabric. It is then easy to color the fabric with the new dye in the ink.

The steps in the discharge process are quite simple to understand. When the printed ink reaches its cure temperature (it will vary depending on the brand of ink), the discharge agent begins to destroy the original fabric dye. Almost at the same time, the new dye in the ink replaces the old dye to make a new colored image. The ink will then continue to dry as the moisture is removed. The new dye carried by the ink is made to not be affected by the discharge agent during the process.

The discharge printing paste consists of a colored pigment, a discharge agent, a locking agent or binder, thickener, a humectant, and possibly a few added ingredients to help printability and penetration.

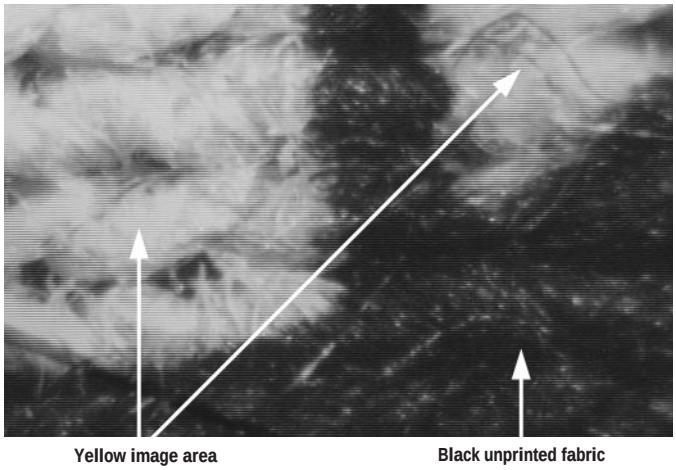
The discharge agent is typically Zinc Formaldehyde Sulfoxylate, (ZFS). This chemical attacks the dye in the garment to break it up and destroy the ability of the dye to act as a coloring agent. The fabric is then a neutral color and is ready to accept the new color of the ink. ZFS works best on 100% cotton fabric and a few other natural fibers that have been dyed using dischargable, fiber reactive type dyes that have been processed under atmospheric conditions. Other reactive and sulfur dyes may work, but check first by testing to be sure.

The binder or locking agent helps the new dye to adhere to the fabric and to help make it permanent. The thickener is needed to add body to the ink (increase the viscosity). Water based inks in their pure form, without thickeners, would be too thin for us to print by the screen process.

A humectant is simply an additive that will enhance the inks ability to hold moisture. The discharge process requires water to work. The humectant keeps the ink from drying too quickly while the discharge process is taking place. Urea is the most common humectant,

Figure 1

Electronic micrograph of a discharge printed image.
Note the absence of a surface image—discharge printing produces nearly imperceptible hand to its images.



but Ethylene Glycol and Glycerin may also be used. Too much humectant will hinder the ability of the new dye to cure well.

Where Do We Begin?

If you are now using plastisol inks for textile printing, you will need to make a few changes to use discharge inks. Water based inks are not harder to use, they are just a bit different. One of your first considerations will be your screens.

Your screens must be imaged with stencils that are not affected by water. Your usual diazo stencils may not be suitable for use with water based inks unless they are of the "dual cure" or water resistant type. Most stencil manufacturers offer emulsions that will work well with water based inks. Ask your supplier for recommendations. Discharge printing inks are very aggressive. Regular "WR" or "dual cure" stencils may not have enough ability to resist this aggressive nature. You may want to try one of the most water resistant stencil systems available.

It is very important to take steps to insure proper stencil exposure when making screens for discharge printing. Stencils are commonly under exposed to help hold fine image detail. Underexposure produces a soft stencil that is easily affected by active agents in the ink or by cleaning solvents. Discharge inks may cause the underexposed stencil to break down early and cause pinholes. It will be hard to see the tiny pinholes on the printed image until it is too late—when the garment has been cured and can not be fixed. You may also notice that when stencils have been underexposed they may become difficult or impossible to reclaim. The stencil may react with the various ink agents to permanently harden it.

I highly recommend that you use an exposure calculator and a light integrator to insure accurate and consistent exposures. If you find that you need to underexpose your screens to hold detail, you are probably using the wrong stencil/screen combination. You may also want to check your positive to be sure that the density is adequate and your exposure system to see if you are getting undercutting. The bottom line is that you need properly exposed stencils for any printing application, and especially for using discharge inks.

Think Differently About Discharge Inks

Discharge systems require different printing techniques than either plastisol or other conventional water based inks. The usual mind-set for printing light ink on dark shirts is to lay the ink on the surface of the fabric. This technique helps to reduce the fabric dye sublimation and migration tendencies which discolor ink, and to maintain the color characteristics of low opacity inks.

Discharge inks are different in that deep penetration into the fabric is desired to allow the discharge agent to fully destroy all of the original fabric dye. Any remaining dye will cause discoloration of the new dye color. You will need to chose the right combination of screen mesh count, ink viscosity, printing speed, and other variables to control the ink penetration and ultimately the quality and brightness of the image. The critical nature of this balance is a big part of what makes discharge printing difficult to master.

At this time there are at least five manufacturers of discharge inks that supply printers in the United States. Each manufacturer's products have similar chemistries but they do vary somewhat to offer different controls to the end user. You must understand what each manufacturer's ink will do for you to control the process. You may find that you will have several manufacturers' inks on hand to suit a wide variety of needs in your shop.

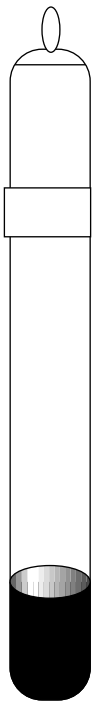
Most inks require that you mix several ingredients to form a press ready ink. These are typically a base, a pigment or colorant, the discharge agent, and possibly a humectant. Some companies have a pre-prepared discharge base while others require that you mix that part separately due to the shelf life of various products. The shelf life of press ready discharge inks is between eighteen and seventy-two hours, depending on the manufacturer. Most manufacturers recommend that you mix only what is needed for your immediate printing needs.

Several of the manufacturers offer a full line of conventional water based textile inks in addition to their discharge system. Some of these products will be interchangeable, meaning that you can use the pigments and colors from their regular water based system with their discharge system. This is often a distinct advantage because you may wish to use some of the more exotic colors such as fluorescents or metallics from their other ink line. It also makes color matching for different shirt colors much easier if you are working from the same basic color palette.

Ink viscosity varies widely from manufacturer to manufacturer. This factor will become a critical variable when you make pre-press decisions. Some inks are designed to be printed as a fairly thick paste while others are extremely thin. It is advisable to get into the habit of using a viscosometer to test your press ready ink.

An effective viscosometer is the Zahn Cup (or equivalent). See figure 2. This is a simple device that permits the timed flow of a known volume of liquid as it passes through a hole in the bottom of the cup. They are inexpensive and easy to use. Simply dip the cup into the ink, raise it up and keep track of the time that it takes for the ink stream to break. Cups are numbered one thru five depending on the size of the hole in the bottom. A #2 or #3 cup, hole size of 2mm - 3mm (.08 or .11 inch) diameter respectively, should do fine for discharge inks. By keeping track of your viscosity you will increase your success in duplicating colors and printing conditions.

Figure 2



The Balancing Act

Recommended screen mesh counts fall into the 24 lines/cm to 77 lines/cm (60 to 196 lpi) range, with the manufacturers suggestions varying widely. A 43 lines/cm (110 lpi) mesh is a good place to start. It is a good idea to run tests to determine the best mesh count for any particular application.

Your choice of screen mesh count will be affected by the viscosity of the ink. If you are using one of the thinner ink systems, you may need a higher mesh count than for one of the thicker inks. For our purposes, and in the mesh count range specified for the discharge process, the lower the mesh count, the more ink will be deposited. If your mesh count is too high, you may not lay down enough ink to fully penetrate the fabric. This may cause the image to appear dull and "muddy".

The inks are quite easy to thin. You simply add water. But, special thickeners are required to "beef up" your viscosity. In most ink systems, standard thickeners will not work.

You should be ready to make a compromise when it comes to choosing the right screen mesh count and ink viscosity when you consider the possibility of printing finely detailed images. You may need to use a coarse screen fabric, such as an 86 lpi, to get the best penetration and color for your ink system. However, this mesh count may not be able to resolve the fine image detail that you need. This situation will simply require that you make tests of various inks, viscosities, screen mesh counts, printing speeds, etc. But, always remember that it is critical that your screens be made properly as I mentioned before.

You can see the need for good testing with this process. Keep accurate records of all the variables. You will soon find that most of your printing jobs will fit into one of a few categories. You will be able to fall back on one of your "standard" set up procedures which will make production easy, efficient, predictable, and (best of all) profitable. Difficult or odd jobs will also become easier as you learn to adapt your experience to the needs of new work. The key to this process is to do your homework up front. Eliminate and control the variables before they become problems.

Getting The Colors Right

Ink color matching is seldom an easy task for any printing process. Discharge inks can be difficult to match, and often difficult to maintain throughout a print run. But they also have a few nice points in their favor as well. Many discharge ink systems require that you mix pigment into a base to build the color. The amount of pigment needed to achieve a particular "intensity" will be expressed as a percentage, by weight, of the amount of base that you started with. For example, if you started with 100 grams of base and your system requires that you add 7% pigment by weight to match the color palette sample, you would need to add seven grams of pigment. It's that simple. To vary the "intensity" of the color you simply add more or use less pigment as needed. The ink will usually have enough binder to allow you to nearly double the recommended amount of pigment and still let the ink cure properly. More pigment may be added but it may require that you add extra binder. Your manufacturer will have specific recommendations for this situation. They will also have specific mixing recommendations. Some systems work best if they are homogenized slowly, while others simply need to be blended with a mixing blade in a power drill. No matter what, proper mixing is important.

A point that demands special mention when mixing ink is that you should always add the pigment to the base before you add the discharge agent. This is not as critical for some systems but it can be real troublesome for others. The discharge agent can keep the pigment from properly dispersing through the ink. In fact, they may sometimes just form a nasty sludge at the bottom of the container. Whether your system requires it or not, get into the habit of doing things in a systematic way. Learn to mix in the pigment before you add the discharge base on all inks and you should avoid any problems.

Mixing special colors that are not on the manufacturers color palette can be a bit more difficult. This may require that you mix several pigments to obtain the special color. Be careful that you do not add more than the recommended allowable amount by weight without adding extra binder to compensate.

You will find that the only way to accurately determine the final printing color of any discharge ink is to actually try the ink on a sample piece of fabric. Remember to use the exact fabric that you will run in production if color matching is critical. I would strongly recommend that you keep good records of your ink formulations along with a printed sample. It will then be easy to refer back to early formulations to give you a good starting point on new colors.

I can not emphasize enough, the fact that you should test each color on the fabric that you will run in production. This is a very important point. Although a fabric may be made with dischargable dyes, it may not discharge the same for each color or ink system that you use. That's right, several manufacturers red ink may look different on the same exact shirt. Conversely, one manufacturers red ink may look different on several brands of fabric. You may even find it difficult to maintain color during a single print run. This problem is a result of the ability of the discharge agent to react consistently with the fabric dyes. It is essential that you test your inks and fabrics for compatibility and keep good records of the results. Don't get too overwhelmed over this point, but be aware and alert for this problem. If you are already printing garments, you will be quite accustomed to knowing which shirts and inks work well together and which do not. This is just more of the same situation. In the meantime, the ink manufacturers will certainly be trying to help solve this problem.

Which Shirts Will Work

As mentioned earlier, the discharge process for our purposes will only work on 100% cotton fabric, and some other natural fibers that have been dyed with special dischargable dyes. Several of the major garment manufacturers have changed over to, or modified their existing finishing line to work well with discharge inks. Many garment manufacturers have used dyes for years that are compatible with the new discharge inks. Our problem as printers is that the vast majority of us do not buy our garments directly from the mill. So, how do we know if our shirts that came from "good ole" ABC Distributing are dischargable?

The first thing you should do is to ask your distributor about their stock. As the popularity of discharge printing increases this will be something that the distributors will have to know and be ready to discuss with you. Obviously, if you buy a major brand that is known and advertised as being dischargable, you should be fairly safe. Any other brand must be tested—in your shop—with your inks—under your conditions to be sure that they will work.

Be careful with different colors within the same brand. Some garment dyes are more difficult to discharge than others. Green is a good example of this. You should also be careful with many of the dark colored shirts. Sometimes a manufacturer will run excess fabric of a color such as yellow, but then they do not need it all. It is not difficult (or uncommon) for them to re-dye the fabric a darker color, such as navy or black. If you happen across this problem you may find that the black will discharge but the yellow underneath will not. So your white print will look yellow and your blue ink will appear green (if it works at all).

If your customer supplies the garments to be printed and they are a brand that you are unfamiliar with, run tests **before** you agree to do the work. Even if the customer says that they will be responsible for any problems, test first. Customers sometimes change their mind about who is at fault when problems occur and it simply isn't good business to have a bad job out on the market if things don't go well on untested garments.

Remember, the key to success with this process is testing. Keep good records of each of the different inks and garments that you test. Also, test any garment and fabric that you can get. You will soon have a good list of what inks and systems work well with each manufacturers shirts and fabric colors. Your tests do not have to be on the entire garment. A one or two inch square print on a four inch piece of fabric is sufficient for testing.

When I Have The Ink In The Screen

When you have run a few tests and have proved to yourself that this system will work; what must you look out for when you start to actually print samples?

If you are accustomed to printing with plastisol only and have no experience with other inks and substrates, you will need to do a few things differently with discharge inks.

When you put the ink into the screen, put it in the back, near the clamp when the screen is in the up position. You do not want the ink to run down through the open image areas of the screen. Discharge inks are so thin that they will quickly drip through to the platen—usually with disastrous results.

For your first prints try a 65 to 70 durometer squeegee with a sharp edge. After you gain some experience you should know what squeegee durometer and profile will work best for your application.

When you are ready to print, flood the screen from the back to the front with a light flood stroke when the screen is in the down position. Then, make

Figure 3

Print differently with discharge inks: make your print by pushing the squeegee forward, leaving the ink in the bottom of the screen when completed.

the print by pushing the squeegee forward. Use a quick print stroke for best results. This technique will leave the ink in the back of the screen when it is raised for removing the printed shirt from the platen. Yes, this is quite different from the techniques used in printing thicker inks but is necessary to keep the screen from dripping. The flood stroke is necessary to "load" the screen with just the right amount of ink to make your printing consistent. It also helps to keep the ink from drying in the image area by briefly wetting any ink that remained after the previous print. Unfortunately, water based inks will dry in the screen if you let them.

If you need to leave the screen set up for a period of time, the ink will dry. To avoid problems, use a damp rag to wipe the image area clean or simply cover the screen with a damp cloth to keep the ink moist. If it is necessary to stop printing for an extended period of time, clean the screen completely.

If you notice that ink has smeared under the screen, you must remove it completely. A quick wipe with a dry cloth is not enough to keep you from having an ugly smear appear on your garment. You must wipe the smear with a damp cloth and then with a dry cloth to remove any trace of ink. The smear will take as many as four or five prints to wear off on its own if you do not remove it properly.

Smears, spots, fingerprints, and other problems may be removed from the shirt using a spotting gun filled with water and a little ammonia. This must be done quickly, before the print is cured.

Once you have made a print, look at it closely before you run it through the dryer. The print will look washed out and dull because the water based discharge inks are transparent and the discharge process has not started. It will be difficult to see defects because the image lacks contrast. Defects will not be easy to see until the print has been cured. You may detect potential defects by keeping an eye on the screen when you print. Look for ink that does not clear the screen or for lint that may block the mesh. Make sure that you check the shirts at the end of the dryer frequently to avoid printing too many defects before it is caught and corrected.

Making Sure It Is Cured

Speaking in the most general terms, discharge inks require a cure temperature of between 149° and 177°C (300° and 350° F). for a full two to three minutes and sufficient air flow to remove the moisture as the ink drys. During this time, as the ink reaches 121°C (250°F), the discharge process starts. The discharge process must occur while the ink is still wet. Cure printed garments immediately after printing for best results. If the ink is allowed to dry before heat is applied, the process will not work properly. Once the discharge process is complete, the water must be evaporated fully to allow the water based inks to set.

You must make sure that your dryer has sufficient air flow for this process. Proper air flow will help to remove the water vapor in the dryer which will speed up the cure process. Longer times and/or higher temperatures will help to reduce any residual odor and provide better washability. If it seems to take an excessive amount of time and temperature to get a good cure, your dryer may not have adequate heat and air flow to properly cure the ink in one pass. It could also be an indication that you have added too much humectant to the ink.

The ultimate test for cure is to wash the print. A trait that is particular to water based inks is that they will have an initial cure immediately after exiting the dryer. The image will continue to set for as much as 48 hours or more after the initial cure. If your print will stand up well to a wash test immediately after curing, the cure should only improve with time. If the print seems to have a bad odor within the first 24 hours, it may be due to the ink absorbing moisture from the air. Washing the garment will remove this problem.

One common practice for determining proper cure is to smell the ink at the end of the dryer. If the ink has a bad odor it is not cured. I must caution you that this may not be true in every situation. Discharge inks tend to have an unpleasant odor when they are moist but this does not prove that the ink is set or permanent. In fact, some manufacturers add a deodorant or perfume to their ink which eliminates this aspect almost entirely. Checking for cure by smell is not recommended for this reason.

Gearing Up For Production

Preparing art for discharge printing is not difficult. The key point to remember is that the inks are transparent. This means that trapping is nearly impossible because one ink will not hide the other if they are overprinted. Multi-color designs should be separated and butt registered or separated by using negative space.

The transparency of the ink can be used to your advantage. When transparent colors are overprinted they will combine to produce variations. Therefore, if you print a red over a yellow, you should produce an orange. Careful planning and testing can allow you to make use of this technique for extra profits. One caution should be noted. Large open areas of solid overprinting color may cause the ink in the second screen to become contaminated by the ink on the garment. Care should be taken when designing the art to get this effect right without causing problems.

One of the best aspects of printing with discharge inks is that you may print mulit-color images on dark fabrics with no underlay or spot drying on the press. In fact, most discharge ink manufacturers do not recommend flashing on the press. The advantages of not having to flash on the press are more than significant:

- Reduced press set-up time
- Allows full use of all printing stations for printing colors

- Increased production speed
- Cooler environment for employees working on the press
- Fewer screens to be made
- Less art production time
- Reduced energy cost for production

However, flashing on the press can provide additional flexibility with the process. For instance, you could print a white or neutral flash plate using a white or clear discharge ink on a dark shirt, then print standard water based inks in that area. This would allow you to use special colors that are not available as discharge inks. You could even print plastisols in this manner, and four color process printing would be easy using this method. Make sure that you vent the fumes from your flash system away from your press area and follow the manufacturers recommendations for safe handling during flashing.

Using the "white plate" technique can also help you to print extremely bright colors which may not be obtainable with the standard discharge process. The discharge agent sometimes has a tendency to dull or mute the brightness of the ink color. You therefore can have the option to use the same pigments from your discharge inks without adding the discharge base. This will produce a brighter print using the exact same colors.

If you consider flash curing on the press, you must use some caution. You must take care to not drive off the water with too much heat before the discharge process can complete its job. Remember, the discharge process only works when the ink is wet. A flash temperature of around 291°C (550° F.) set to a height of about 2.5 cm (1") is a good place to start testing. Try an initial dwell time of two seconds. If you are printing on an automatic press, you may have to adjust the height and temperature to allow for a sufficient dwell time as required by your press cycle.

An exhaust hood is essential for using a flash unit on a press. The discharge agent will produce noxious and very irritating fumes which must be removed from the press area. These fumes are usually not much worse than what you may encounter in your everyday life. However, they are irritating to the nose and respiratory system so it is important that the fumes be vented from the press area. A few of the by-products of the discharge process that may be released into the air are carbon monoxide, carbon dioxide, sulfur dioxide and other sulfur and zinc oxides. A simple two stage filter should easily remove most contaminants from the air for safe venting to the outside.

Playing It Safe

It is important for me to explain a few of the other health and safety details about discharge inks. There has been some heated debate regarding the safety of using discharge inks. At this time, several companies have conducted air quality tests under "normal" conditions. All reports with which I am familiar have shown that the products are perfectly safe if they are handled per the manufacturers instructions and as directed in the Material Safety Data Sheets (MSDS).

The MSDS for ZFS indicates that it is a stable compound which is not unusually hazardous. It is not listed as a carcinogen by any reporting agency and has a health, flammability, and reactivity rating of only one. It is reasonable to conclude that it may be used safely if proper care is taken as outlined by the instructions and the MSDS.

The final print could contain potentially hazardous remnants from the printing process, which may include formaldehyde. This of course, is true of any printing process. Manufacturers have tested printed fabric and have found that formaldehyde levels fall well below the garment industry accepted standard of 500 ppm. You should note that formaldehyde is a common material that is used in fabric manufacturing and is not specific to the discharge process. It is for this reason that you should recommend that your customers wash all printed (or unprinted for that matter) garments prior to wearing to remove any possible residual materials left over from the manufacturing or printing process.

Finishing The Job

Clean-up with water based inks is easy but care should be taken not to allow your waste inks to go down the drain. The pigments, binders, dispersants, and other materials used in water based inks are considered to be hazardous waste, just the same as plastisol and other conventional inks. Use a water filtering system to remove the ink residue from your screens and dispose of this residue properly.

You can expect to have less waste that must be disposed of with water based inks than with inks such as plastisol. After the water is removed from water based inks, less "sludge" will remain for disposal.

Get Started

Water based inks are gaining back some of their "lost popularity" within the textile printing industry. This is partly because of tighter governmental regulations concerning Volatile Organic Compounds (VOCs') and new developments in water based ink technologies. Discharge printing inks offer a valuable alternative to the other types of textile inks used to print on dark fabric.

If you would like to learn more about discharge inks and how to use other water based inks for textile printing, contact SPAI Technical Services Department.

I would like to offer my most sincere appreciation to Charles Leach, CHT North America; Mark Buchanan, Printwear Magazine and Alan Singer for their assistance in providing information for this article.

You may learn more about the discharge printing process by reading the following articles:

"Where Does It Go? The Discharge-Printing Process for Garments" by Paul DeWynGaert, *Screen Printing* magazine, March 1991, pp. 75–77

"Garment Discharging — New Ground for an Old Process" by James Elliott, *Screen Printing* magazine, January 1985, pp. 94–103

"Discharge Systems — The Wave of the Future?" by Barbara D. Engel, *Impressions* magazine, September 1991, pp. 83–90

"Discharge Printing, Part 1" by Mark Buchanan, *Printwear* magazine, August 1991, pp. 13–74

"Discharge Printing, Part 2" by Mark Buchanan, *Printwear* magazine, October 1991, pp. 20–117.

Discharge Printing Troubleshooting Chart

Problem	Cause	Remedy
Color is muted or not bright enough	• Dye not fully discharged	• Increase dryer time/temperature
	• Too much discharge agent	• Reformulate ink to proper level of discharge agent
	• Ink colorant is not compatible with discharge agent	• Use recommended ink colorant
	• Shirt dye not dischargable	• Check that fabric is dyed for discharging
	• Fabric is scorched	• Increase urea content in ink • Decrease dryer time/temperature
	• Inadequate ink deposit or penetration into the fabric	• Decrease ink viscosity with water • Increase print stroke speed • Flood just prior to printing • Decrease screen mesh count
	• Water in ink evaporated too quickly	• Decrease dryer time/temperature • Increase urea content
Color is different than what it should be, ie., blue looks green or red ink looks orange	• Overdyed garment fabric	• Replace shirts (check with manufacturer)
Print has dark inner area	• Water has not evaporated	• Increase drying time and/or temperature
Color fades after first washing	• Ink is not fully cured	• Increase dryer time/temperature
	• Not enough colorant in ink	• Reformulate ink - increase colorant
Pickup on bottom of screen during multi color printing	• Poor penetration into the fabric	• Decrease ink viscosity with water • Increase squeegee printing speed • Increase squeegee durometer
Premature stencil breakdown causing pinholes, leaks, deteriorating image	• Improper emulsion	• Use only water resistant emulsion
	• Poor resistance to active agents in the ink	• Make permanent or epoxy type stencils

	• Poor screen making procedures	• Try a dual-cure emulsion
		• Review screen making techniques:
		  • Proper degreasing
		  • Proper coating/application
		  • Fully dry emulsion before exposure
		  • Avoid under exposure
		  • Use proper mesh/stencil combination

Uneven or mottled color	• Clogged or partially blocked screen	• Clean screen
	• Inadequate ink mixing	• Flood before printing • Mix ink thoroughly, use a drill and a mixing blade or homogenizer
Ink separates and forms a sludge	• Inadequate mixing technique	• Blend with a mixing blade or homogenizer • Add colorant to the base before adding the discharge agent

Discharge Sample/Production Specifications

Sample/Job Name _____

Operator _____

Customer _____

Press # _____ Date _____

Printing Sequence	Screen		Ink			Squeegee			Notes
	#	Mesh	Type	Color	Batch	Speed	Angle	Duro	
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									

Climate/Season _____ Dryer Temperature _____ F.

Temperature ☐ 18°C (Below 65°F) ☐ 8–29°C (65–85°F) ☐ 29°C (Above 85°F) Dwell Time _____ Min./sec.

Humidity ☐ Below 40% ☐ 40–60% ☐ Above 60% Airflow ☐ On ☐ Off

Garment Manufacturer/Brand _____

Fabric Color _____

Fabric Weight _____ Content _____

Comments _____

_____

_____

_____

Note: Keep on file with a sample garment and with the appropriate ink sample forms and swatches.

Ink Ticket

Batch #______________ Test #______________

Color ______________________________

Mfg ______________________________

Sample/job ______________________________

Viscosity ______________________________

	Weight	Total
Base	__________	__________%
Colorant	__________	__________%
Discharge	__________	__________%
Humectant	__________	__________%
	__________	__________%
	__________	__________%
Total	__________	100%

Notes ______________________________

____

____

____

____

Keep a copy with the sample swatch.
Attach a copy to the ink container.

Ink Ticket

Batch #______________ Test #______________

Color ______________________________

Mfg ______________________________

Sample/job ______________________________

Viscosity ______________________________

	Weight	Total
Base	__________	__________%
Colorant	__________	__________%
Discharge	__________	__________%
Humectant	__________	__________%
	__________	__________%
	__________	__________%
Total	__________	100%

Notes ______________________________

____

____

____

____

Keep a copy with the sample swatch.
Attach a copy to the ink container.

Ink Ticket

Batch #______________ Test #______________

Color ______________________________

Mfg ______________________________

Sample/job ______________________________

Viscosity ______________________________

	Weight	Total
Base	__________	__________%
Colorant	__________	__________%
Discharge	__________	__________%
Humectant	__________	__________%
	__________	__________%
	__________	__________%
Total	__________	100%

Notes ______________________________

____

____

____

____

Keep a copy with the sample swatch.
Attach a copy to the ink container.

Ink Ticket

Batch #______________ Test #______________

Color ______________________________

Mfg ______________________________

Sample/job ______________________________

Viscosity ______________________________

	Weight	Total
Base	__________	__________%
Colorant	__________	__________%
Discharge	__________	__________%
Humectant	__________	__________%
	__________	__________%
	__________	__________%
Total	__________	100%

Notes ______________________________

____

____

____

____

Keep a copy with the sample swatch.
Attach a copy to the ink container.

Ink Ticket

Batch #______________ Test #______________

Color ______________________________

Mfg ______________________________

Sample/job ______________________________

Viscosity ______________________________

	Weight	Total
Base	__________	__________%
Colorant	__________	__________%
Discharge	__________	__________%
Humectant	__________	__________%
	__________	__________%
	__________	__________%
Total	__________	100%

Notes ______________________________

____

____

____

____

Keep a copy with the sample swatch.
Attach a copy to the ink container.

Ink Ticket

Batch #______________ Test #______________

Color ______________________________

Mfg ______________________________

Sample/job ______________________________

Viscosity ______________________________

	Weight	Total
Base	__________	__________%
Colorant	__________	__________%
Discharge	__________	__________%
Humectant	__________	__________%
	__________	__________%
	__________	__________%
Total	__________	100%

Notes ______________________________

____

____

____

____

Keep a copy with the sample swatch.
Attach a copy to the ink container.