

DuPont™ Artistri® Brite DTG Inks and Pre-treatment

Direct to Garment – General Process Guidelines

Application

Direct to Garment Printing/Cotton and Cotton Blend Garments

Ink Type

DuPont™ Artistri® Brite P7000/P6000/P5000/P3500 Pigment Ink

Pre-Treatment

DuPont™ Artistri® Brite P5003 for Dark Garments/P5010 for White Garments

Aim

This guide is intended to provide our best know-how for producing high quality digitally printed dark or light garments using DuPont™ Artistri® inks and pre-treatments. Many process variables exist as there are many different print platforms and workflows in the DTG printing process. The DuPont™ Artistri® ink and pre-treatment portfolio has been designed to enable their use in the majority of DTG printer models. Please contact your local DuPont™ Artistri® representative or go to www.dupont/advancedprinting to see which inkset works best for your equipment. Many process variables have been optimized and are outlined in this guide, however, some will need to be tested and setup according to differences in individual setups of varying equipment.

The advantages of using DuPont pre-treatment with DuPont™ Artistri® ink are:

- Outstanding white ink opacity on dark colored cotton garments
- Excellent wash fastness
- Faster white ink set-up enabling faster print speeds
- Heat tunnel drying and curing of pre-treatment and final garments
- Compatibility with cotton and cotton/polyester blend fabrics
- Faster curing times in heat press workflows

DuPont™ Artistri® Brite products were developed for white, light or dark dyed cotton t-shirts and garments, cotton/poly blends as well as some white polyesters.

All recommendations contained in this document assume the use of DuPont™ Artistri® Brite pre-treatments and DuPont™ Artistri® Brite DTG inks. The use of another supplier's product is not covered and will not offer the same outstanding results achieved when using DuPont™ Artistri® Brite products.

Safety

Please refer to the supplied SDS sheet prior to use of any DuPont™ Artistri® Brite product.

General Information

Digitally Printed Garments

Digitally printed garments or Direct to Garment printing (DTG) is a commercially accepted method for creating t-shirts, hats and promotional items with excellent quality featuring bright, photorealistic graphics. DTG printing allows a garment producer to print images that weren't previously available with traditional silk screen systems and allows for the cost to print to be the same whether you are printing one t-shirt or 1000. However, to deliver the best printed results, from bright color to superior wash fastness, it is important to understand the critical aspects of the DTG printing process. This guide has been created to help the garment producer make the best use of DuPont's products for successful completion of their print jobs.

Garment Types and Quality

The quality of the garment that you print on will make a significant impact not only on the look of your final product but can also affect your profitability. In general, a higher cost shirt will allow you to print a high-quality image often with less ink. The type of shirt that you use will be dictated by the application you are targeting.

Standard 100% cotton tees are most common in the industry and offer a good printing base at a reasonable price. Not all 100% cotton are created the same and you should test shirts from multiple manufacturers to find the one that works best for your application. Standard cotton shirts are great for "meat and potatoes" prints—customers who want a good long-lasting shirt with a colorful image or logo. 100% cotton tees come in standard weights (~5.6 oz.) and are economical. For a heavier duty shirt, look for tees in the 6.0 oz. range.

Ring spun combed cotton tees are lighter, softer and hold their shape better than a standard tee shirt. They are also more expensive. The spinning and combing process for a ring spun require more effort but provide a higher quality product. The advantage for digital print providers is that these shirts have a very smooth surface that produces a clean, crisp image and can, at times require less pre-treatment and ink. Ring spun cotton tees

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feature lighter weights (3.9 – 4.2 oz.) and are recommended for fashion and “boutique” printing.

Cotton/poly blend and tri-blend t-shirts are also sometimes used in digital t-shirt printing. These shirts employ a blend of cotton, polyester to make a shirt that is smooth, soft and more durable. However, a digital printer needs to be careful about using these shirts. The amount of polyester in the shirt will dictate the success of the print. The pigment inks in DTG printing do not easily adhere to polyester fibers. By using the appropriate DuPont™ Artistri® inks & pretreatments, your printing on white polyester and on up to 50% polyester/cotton dark blends will be reliable and successful.

100% polyester shirts, while more expensive, are a popular choice for active wear and sportswear. There are multiple methods to print on polyester garments, the most common being dye sublimation. Dye sublimation is a completely different type of ink and requires different equipment. However, digital printing ink and pre-treatment manufacturers are starting to supply solutions for printing 100% polyester tees with existing DTG equipment. A digital printing provider should be careful when considering polyester printing. With the large number of weights and weaves used for polyester garments, a solution that works for one shirt may not work with all polyester shirts.

Tip: One other factor to be aware of is the use of surface treatments in the original manufacture of a garment. T-shirt manufacturers will sometimes add softeners or other post-treatments to enhance the look or feel of the garment. Unfortunately for digital print providers these treatments can sometimes repel water. Digital printing inks are water-based and a water repellent will not let the ink bind to the shirt. If you suddenly find a shirt that will not print well at all, a simple test is to put a drop of water on the shirt. If the drop beads up and stays on the surface, water based inks will do the same.

The DTG Printing Process

Direct to Garment printing is a fairly standard process but has a lot of variables.

- First, a pre-treatment is applied to shirt and dried. Pre-treatment allows the ink to bind to the surface of the shirt and imparts a lot of the wash fastness properties.
- Next the shirt is printed. The inks used are aqueous pigment that have excellent color and fastness qualities. The printers used can be personal systems that are used for limited runs and print 10 – 20 shirts or they can be full scale industrial printers that can attain speeds of more than 120 shirts per hour.
- Finally, the ink and shirt are cured by a heat fixation step. This final fixation step completes the binding of the ink to the shirt. It can be accomplished with a hand operated heat press or an automated heat tunnel.

Let's look at all of these steps in more detail.

Pre-Treatment Application

Pre-treatments are used to create a bond between the shirt surface and the ink. When pre-treating a white or light-colored shirt, DuPont™ Artistri® Brite P5010 pre-treatment makes the image bright, sharp and clear. For colored or dark shirts, where you want a white base on which to print your color image, DuPont™ Artistri® Brite P5003 pre-treatment gives you the brightest white base available when used with DuPont™ Artistri® Brite DTG inks.

The following instructions are intended to provide best practices for using DuPont™ Artistri® Brite P5003 and P5010 pre-treatment solutions with DuPont™ Artistri® Brite P7000/P6000/P5000/P3500 inks. The pre-treatment and final shirt curing can be accomplished in either a belt conveyer heat tunnel or in a manual heat-press only process. Preferred temperatures are provided for drying and curing; however, it is not uncommon to find temperature variability from one heat press or heat tunnel to another. It is strongly recommended that temperatures be measured and adjusted accordingly if out of calibration. In order to achieve best results on dark or light-colored cotton fabrics, proper application and drying of the pre-treatment solution must be practiced. Proper application of the pre-treatment solution is key to obtaining optimum image quality, white opacity and ink adhesion to the fabric.

As stated above, DuPont™ Artistri® Brite P5003 and P5010 pre-treatment solution can be applied manually using a hand sprayer or mechanically with an automatic pre-treatment unit. Automatic pre-treatment applicators are available from a number of printer and silk screen suppliers. An automatic pre-treatment unit offers a number of advantages, not the least of which is a consistent and repeatable application of pre-treatment to the garment. However, DuPont™ Artistri® Brite pre-treatments can be easily applied through a manual hand sprayer without loss in quality.

Whether an automatic or a manual pretreatment machine is being used, please refer to the vendor's usage instructions for proper safety and use.

P5003 Pre-treatment Application

DuPont™ Artistri® Brite P5003 is DuPont's pre-treatment for printing on colored and dark cotton and cotton/polyester blends (up to 50% polyester) shirts. P5003 allows the user to have excellent white coverage and industry standard wash fastness. It also enables fast drying of the white ink layer for high speed and single pass print systems.

Regardless of whether an automatic unit or a hand sprayer is used, the preferred quantity of P5003 pre-treatment is:

- 0.095 – 0.119 g/in² (0.015 – 0.018 g/cm²) or
- 28 – 35 g sprayed over a 19" x 15.5" (48.3 cm x 39.4 cm) area.

Some automatic pre-treat machines allow the user to specify an application volume—if one of these machines is used, please

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refer to the manufacturer's instructions to dial in the correct amount of pre-treatment. Automatic pre-treat machines are the preferential method of application to control uniformity of application and quantity of application. If a Wagner power sprayer or similar equipment is used, it is recommended to hand squeegee or roll after spraying to improve uniformity.

In most cases, use the procedure below to determine the correct pre-treatment spray settings. This procedure is not needed every time a shirt is prepared; it is a set up procedure. Once the right amount of pre-treatment is determined, continue to pre-treat consistently and correctly apply pre-treatment whether an automatic unit or hand sprayer is used. In the rare cases where shirts are not printing or washing correctly, refer to the troubleshooting section below.

1. Using a scale that is accurate to at least 1 gram, weigh an un-treated shirt.
2. If the scale has a "Zero" option, zero the scale on the shirt weight. If not, note the shirt weight.
3. Pre-treat the shirt (manual or automatic). An automatic unit should have a setting that is normal – use that as a starting point.
4. Immediately weigh the pre-treated shirt. Weigh the shirt wet, **DO NOT PRESS THE SHIRT OR DRY BEFORE WEIGHING**. If the un-treated shirt was zeroed, the weight should be between 28g and 35g. If the weight of the un-treated shirt was noted, the wet shirt should be 28g – 35g heavier than the un-treated shirt.
5. If the weight was either heavier or lighter than desired, adjust the pre-treatment application and re-run the test.
6. Lighter, higher quality fabrics typically require lower quantities. Heavier, poorer quality fabrics typically require more. Ideally, this pre-treatment quantity should be optimized for different fabric types and colors. This is fabric dependent and tests should be performed to determine the appropriate quantity.
7. Initial optimization can be performed on dark shirts by assessing the opacity of a solid white layer. The L* value of white should be ≥ 92 . If it is not, either there is an insufficient quantity of pre-treatment or insufficient quantity of white ink printed.
8. Further optimization may be necessary to achieve best wash fastness; the prior step will be a good indicator of this.

P5010 Pre-treatment Application

DuPont™ Artistri® Brite P5010 is DuPont's pre-treatment for printing on white and light-colored shirts. P5010 allows the user to bright, sharp, colorful images with industry standard wash fastness. P5010 also enables DTG printing on white polyesters that need no white ink base.

Regardless of whether an automatic unit or a hand sprayer is used, the preferred quantity of pre-treatment is

- 0.068 g/in² (0.0105 g/cm²) or
- 20 g sprayed over a 19" x 15.5" (48.3 cm x 39.4 cm) area.

Some automatic pre-treat machines allow the user to specify an application volume—if one of these machines is used, please refer to the manufacturer's instructions to dial in the correct amount of pre-treatment. Automatic pre-treat machines are the preferential method of application to control uniformity of application and quantity of application. If a Wagner power sprayer or similar equipment is used, it is recommended to hand squeegee or roll after spraying to improve uniformity.

In most cases, you will use a procedure similar to the one outlined above to determine the correct pre-treatment spray settings. Again, this procedure is not needed every time a shirt is prepared; it is a set up procedure. In the rare cases where shirts are not printing or washing correctly, refer to the troubleshooting section below.

1. Using a scale that is accurate to at least 1 gram, weigh an un-treated shirt.
2. If the scale has a "Zero" option, zero the scale on the shirt weight. If not, note the shirt weight.
3. Pre-treat the shirt (manual or automatic). An automatic unit should have a setting that is normal – use that as a starting point.
4. Immediately weigh the pre-treated shirt. Weigh the shirt wet, **DO NOT PRESS THE SHIRT OR DRY BEFORE WEIGHING**. If the un-treated shirt was zeroed, the weight should be around 20 grams. If the weight of the un-treated shirt was noted, the wet shirt should be 20 grams heavier than the un-treated shirt.
5. If the weight was either heavier or lighter than desired, adjust the pre-treatment application and re-run the test.
6. Lighter, higher quality fabrics typically require lower quantities. Heavier, poorer quality fabrics typically require more. Ideally, this pre-treatment quantity should be optimized for different fabric types and colors. This is fabric dependent and tests should be performed to determine the appropriate quantity.
7. Further optimization may be necessary to achieve best wash fastness.

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Drying the Pre-Treatment

General

When drying the pre-treatment, whether it's P5003 or P5010, the objective of drying after pre-treatment application is to remove water and hold down vertical fibers, providing a flat surface which is easily covered by ink. If vertical fibers remain vertical, then these will either be visible (not completely coated by ink) or require more ink to coat them.

CAUTION! Ideal conditions will expose the pre-treatment to the lowest temperatures, shortest times possible and lowest pressure possible to obtain good print quality. Avoid "over-curing" by setting the heat too high or the dwell time too long. This can reduce the effectiveness of the pre-treatment which will lead to poorer wash-fastness.

Generally, under ideal conditions, the pre-treatment will be first tunnel dried, followed by a fast heat press step. Tunnel drying helps maintain uniformity of the pretreatment.

For heat press drying it is recommended to use disposable parchment paper or disposable lightweight silicon coated sheets. This type of paper gives best uniformity in drying and enables better evaporation of volatiles. These sheets should only be used once per garment and then disposed. This avoids build-up of residue on the sheets which can lead to staining or discoloration.

The pressure applied during this step is dependent on the color and quality of the fabric. Darker fabrics of poorer quality will require both higher pre-treatment loading and higher pressure to hold down vertical fibers. One of the goals of pre-treating is to create a flat, smooth, printing surface and avoid stray fibers sticking up (also known as fibrillation). All t-shirts have some amount of fibrillation and, if not controlled can cause small pinholes or inconsistency in white or light-colored ink areas. Lighter colored shirts such as white require less pressure. General guidance is that lighter pressure will help to avoid discoloration or staining of the fabric and provide softer hand feel but this must be optimized for each type of fabric quality and color.

Wet printing on fabrics without a drying step has been successfully demonstrated, however this document will provide no guidance on this process.

A NOTE ON DRYING EQUIPMENT

Almost all heat presses have some variability. It is highly recommended that you test your specific equipment periodically. In our experience, the variability of these drying devices can be as much as 25°F. You can test platen heat by using a digital temperature gun which will read the heat of your press. Alternatively, you can use stick-on temperature strips. These are attached to a garment before pressing or going into a tunnel. The strip will show you the actual achieved temperature of the heat source. Temperature strips can be

found at most heat press manufacturers. We also highly recommend the use of the newer pneumatic heat presses as the pressure can be digitally set. Older presses use a manual pressure adjustment which can be inaccurate.

Heat tunnels vary widely by manufacturer and dialing in the correct temperature and dwell setting should be accomplished with the help of their field service team. Generally, we have found that heat tunnels with better air flow through the tunnel are more effective. But, the user should test to make sure a specific piece of equipment works for their needs.

All of this equipment uses high heat and there is a danger of serious burns if the equipment is not used correctly. Always read and adhere to the manufacturers safety recommendations and proper use PPE during operation.

P5003 Drying Recommendations

COTTON & COTTON BLENDS: TUNNEL AND HEAT PRESS

- 30 – 40 seconds at 330 – 345°F (166 – 174°C) tunnel dried followed by 10 – 15 seconds heat press. Note: The 15 second heat press takes care of any stray fibers that may affect printing.

Tip: You can achieve the best smooth surface by timing the heat tunnel dry setting so that the shirt is slightly damp when it comes out of the tunnel before pressing.

COTTON & COTTON BLENDS: HEAT PRESS ONLY

- 2 x 20 seconds at 330°F (166°C), turning over paper in-between presses

The pre-treatment can be dried in a single operation by pressing for 30 seconds at 330°F (166°C). This can, on some shirts, leave a pre-treatment mark on the shirt that will look slightly shiny where pre-treatment was applied. We recommend the user to always test the process in their own facility using their own shirts.

P5010 Drying Recommendations

COTTON: TUNNEL AND HEAT PRESS

- 30 seconds at 330 – 345°F (166 – 174°C) tunnel dried followed by 10 – 15 seconds heat press.

COTTON: HEAT PRESS ONLY

- 2 x 15 seconds at 330°F (166°C), turning over paper in-between presses

WHITE POLYESTER: TUNNEL

- 30 – 45 seconds at 330 – 345°F (166 – 174°C)

WHITE POLYESTER: HEAT PRESS

- 20 seconds at 330°F (166°C) at very light pressure

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A NOTE ABOUT STAINING

Previous pre-treatments could interact with the dyes on certain color shirts and produce an unacceptable darkening of the area sprayed with the pre-treatment. DuPont™ Artistri® Brite P5003 has been formulated to resist this type of staining. Most shirts, when P5003 is used, will have no appreciable staining but, in the rare case you see a stain, check your pre-treatment coverage. Often the stain will go away with a lower amount of pre-treatment. Some shirts also react to heat. If you see staining, try pressing the shirt with no pre-treatment. If the stain is still visible it was caused by the heat of the heat press. Wait an hour or so and the stain should go away as the shirt cools.

Tip: Pre-treated shirts can be stored for up to 7 days before use. Any shirt that has been stored for more than a couple of hours should be re-pressed for 10 seconds prior to printing.

Printing

General Comments for Dark Shirts

DuPont's new DuPont™ Artistri® Brite pre-treatments were developed to enable fast print speeds by improving the drying rate when used with DuPont™ Artistri® Brite inks during printing. This will be of significant value for customers using larger industrial printers.

If the capability exists, instead of printing in separate layers, (i.e. first printing a white layer, and then printing a CMYK layer) print in a single layer mode where the white ink is printed on the leading edge in front of CMYK inks in a single pass. Many industrial scale DTG printers have this capability. We have also found that the best wash-fastness is achieved when the time between printing CMYK on top of white is minimized.

Some printers have the capability of printing a first layer of white ink, and then in a second layer additional white ink and CMYK. This is commonly referred to as a Highlight pass. This is not recommended. The new pre-treatment was designed to enable fast crashing and drying of the white ink. The white level attained with P5003, makes Highlight passes unnecessary. When printing in Highlight mode, the second pass of white ink will not receive the benefit of the pre-treatment and bleeding between white and CMYK inks may occur, or fine line resolution may be lost.

The printer should be optimized to lay down enough white ink to achieve a L* value of ≥ 92 when printing a solid white graphic.

As always, consult with your specific printer manufacturer on their recommendations for the best way to use their equipment.

Preferred Method for Black Shirts

The preferred printing mode will not use black ink but rely on the fabric to achieve black graphics. Shades of grey may be achieved with a light white under-layer and appropriate black ink. Ink quantities should be optimized for image quality.

Preferred Method for Light-colored Shirts

The preferred printing mode should use some level of white ink underneath CMYK inks. Although initial good quality print images may be obtained by printing without white ink (e.g. black directly on light blue without a white under-layer), best wash-fastness results will be achieved when a white under-layer is used. Ink quantities should be optimized for image quality.

Preferred method for white shirts

There are no special instructions for white shirts, cotton or polyester. Ink quantities should be optimized for image quality.

Final Curing

The last step after pre-treating and printing is to cure the ink on the final garment. Curing binds the ink to the fibers in the shirt. In the case of a shirt that has a white ink underbase, curing also binds the color ink to the white ink. Incorrect curing can lead to poor wash fastness and durability of the print. As we pointed out before, it is important that you test and maintain your heat press or tunnel dryer regularly so that the correct amount of heat is applied during any drying or curing step.

Heat-Press Curing of Printed Garments

General Comments

Care should be taken when transferring the printed garment with wet ink to the heat press so that the image isn't compromised from handling. If there are any signs of overly wet ink, these should be left to hover under a heat press for some short period of time to allow for more complete drying. When using parchment paper or a silicone with a wet printed image, take care to drop the paper onto the image, without any lateral manipulation of the paper after dropping which can cause smearing of the ink. Discard any paper which may have folds, creases or wrinkles, as these may transfer to the printed image.

Parchment paper, non-stick papers, or non-stick polymer sheets may be used. It is known that these can give rise to different levels of gloss or sheen to the printed image. Non-stick polymer sheets enable shorter curing times with better wash-fastness.

Preferred curing conditions which have been optimized for dark or white fabrics are described below. For light-colored shirts, it is recommended to test by trial and error, to identify the highest tolerable temperature which does not lead to staining as a method of optimizing curing conditions. Additional time or temperature are not known to improve wash-fastness, and in fact over-curing can lead to poor wash-fastness or color vividness. These general guidelines are provided to help you achieve optimal results, however, some optimization may need to be performed due to changes in fabric types or inconsistencies/variability in temperature control of heat press or tunnel driers.

Digitally printed garments should always be cured immediately after printing.

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Tunnel-Dry Curing of Printed Garments

General Comments

Significant variability exists between tunnel drier types, manufacturers, and models. In general, the fastest curing times, best color vibrancy, minimal staining, discoloration or scorching, are achieved with high quality gas fired convection ovens. Electric ovens, and those with an IR zone should be profiled and optimized for temperature control. Suggested times and temperatures refer to actual times and temperatures during a run. It is not uncommon in lower quality ovens for a significant fraction of the dwell time to be at lower temperatures than those recommended and curing and dwell times may need to be increased to accommodate this to achieve adequate curing.

Curing Recommendations

HEAT TUNNEL (WITH HEAT PRESS)

These recommendations assume that the user is operating a well maintained and profiled heat tunnel. The stated times are to be used as a starting point only. There is variability between different makes and models of heat tunnels. The user should test to confirm a temperature and dwell time that works best for their business and customers.

For each of these recommendations, the user should briefly heat press the garment at 330°F (166 – 174°C). This is to press down any fibers still sticking up off of the face of the garment. This step is strongly encouraged but not absolutely necessary.

DARK OR BLACK COTTON & COTTON BLENDS (USING P5003 PRE-TREATMENT):

P5000

- Not Applicable

P3500/P6000

- 3.5 – 5 minutes at 356°F (180°C)
- 3:15 minutes at 365°F (185°C)

P7000

- 3.5 – 5 minutes at 356°F (180°C)
- 3:15 minutes at 365°F (185°C)

LIGHT COTTON & COTTON BLENDS WITH A LIGHT WHITE UNDERBASE (USING P5003 PRE-TREATMENT):

P5000

- Not Applicable

P3500/P6000

- 3.5 – 5 minutes at 330 – 345°F (166 – 174°C)

P7000

- 3.5 – 5 minutes at 330 – 345°F (166 – 174°C)

WHITE COTTON (USING P5010 PRE-TREATMENT):

P5000

- 2.5 – 4 minutes at 340 – 345°F (171 – 174°C)
- 1:15 minutes at 365°F (185°C)
 - Be aware that higher temperatures can cause scorching.

P3500/P6000

- 2.5 – 4 minutes at 340 – 345°F (171 – 174°C)
- 1:15 minutes at 365°F (185°C)
 - Be aware that higher temperatures can cause scorching.

P7000

- 2.5 – 4 minutes at 340 – 345°F (171 – 174°C)
- 1:15 minutes at 365°F (185°C)
 - Be aware that higher temperatures can cause scorching.

WHITE POLYESTER (USING P5010 PRE-TREATMENT):

P5000

- 2.5 – 4 minutes at 330°F (166°C)

P3500/P6000

- 2.5 – 4 minutes at 330°F (166°C)

P7000

- 2.5 – 4 minutes at 330°F (166°C)

HEAT PRESS ONLY

DARK OR BLACK COTTON & COTTON BLENDS (USING P5003 PRE-TREATMENT):

P5000

- 60 – 75 seconds at 356°F (180°C)
- 35 seconds at 365°F (185°C) – With Non-Stick Plastic Sheet

P3500/P6000

- 45 – 60 seconds at 356°F (180°C)
- 35 seconds at 365°F (185°C) – With Non-Stick Plastic Sheet

P7000

- 45 – 60 seconds at 356°F (180°C)
- 35 seconds at 365°F (185°C) – With Non-Stick Plastic Sheet
- Light Cotton & Cotton Blends with a Light White Underboss (Using P5003 Pre-treatment):

P5000

- 60 – 90 seconds at 330 – 345°F (166 – 174°C)

P3500/P6000

- 60 – 75 seconds at 330 – 345°F (166 – 174°C)

P7000

- 60 – 75 seconds at 330 – 345°F (166 – 174°C)

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WHITE COTTON (USING P5010 PRE-TREATMENT):

P5000

- 60 seconds at 340 – 345°F (171 – 174°C)
- 35 seconds at 365°F (185°C) – With Non-Stick Plastic Sheet.
 - Be aware that higher temperatures can cause scorching.

P3500/P6000

- 60 seconds at 340 – 345°F (171 – 174°C)
- 35 seconds at 365°F (185°C) – With Non-Stick Plastic Sheet.
 - Be aware that higher temperatures can cause scorching.

P7000

- 60 seconds at 340 – 345°F (171 – 174°C)
- 35 seconds at 365°F (185°C) – With Non-Stick Plastic Sheet.
 - Be aware that higher temperatures can cause scorching.

WHITE POLYESTER (USING P5010 PRE-TREATMENT):

P5000

- 2.5 – 4 minutes at 330°F (166°C)

P3500/P6000

- 2.5 – 4 minutes at 330°F (166°C)

P7000

- 2.5 – 4 minutes at 330°F (166°C)

Curing Quick Reference Chart

Pre-Treatment	Curing Method	Shirt Color	Fabric Type	Temperature	Ink		
					P5000	P3500/P6000	P7000
					Curing Time		
P5003	Heat Press	Black or Dark Shirts	Cotton	356°F (180°C)	60 – 75	45 – 60	45* – 60
				365°F (185°C)	35 (Non-Stick Plastic Sheet)		
		330 – 345°F (166 – 174°C)		60 – 90	60 – 75	60 – 75	
	Tunnel*	Black or Dark Shirts	Cotton	356°F (180°C)	N/A	3.5 – 5 min.	3.5 – 5 min.
				365°F (185°C)		3:15 min.	3:15 min.
		Light Shirts		330 – 345°F (166 – 174°C)		3.5 – 5 min.	3.5 – 5 min.
P5010	Heat Press	White	Cotton	340 – 345°F (171 – 174°C)	60 sec.	60 sec.	60 sec.
				365°F (185°C)	35 (Non-Stick Plastic Sheet)		
			Polyester	330°F (166°C)	60 sec.	60 sec.	60 sec.
	Tunnel*	White	Cotton	340 – 345°F (171 – 174°C)	2.5 – 4 min.	2.5 – 4 min.	2.5 – 4 min.
				365°F (185°C)	1:15 min.	1:15 min.	1:15 min.
			Polyester	330°F (166°C)	2.5 – 4 min.	2.5 – 4 min.	2.5 – 4 min.

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Troubleshooting

The following instances outline a few common problems. If you have further questions, please contact DuPont Service and Support

Correct/incorrect Pre-treatment

The image below represents a shirt that has been properly pretreated, printed, heat-pressed and subsequently washed through three (3) industrial washes. Note the white underbase and color retention.

This is a properly treated, printed and post-treated shirt.

Insufficient Pre-treatment

If too little pre-treatment solution is applied, the white ink will soak into the shirt and have a mottled appearance after printing. This is due to an insufficient amount of pre-treatment to keep the white ink layer on the surface.

An example of white ink with insufficient pre-treatment.

Poor Wash Fastness

DuPont™ Artistri® Brite P5003 and P5010 pre-treatment solutions have been shown to meet industry accepted standards for wash fastness. If acceptable wash fastness is not attained, we suggest these troubleshooting steps:

- Check the actual heating/curing temperature on local equipment using an IR heat gun or an adhesive temperature test. Below temperature curing can adversely affect wash fastness.
- Check to that you aren't over-curing the pre-treatment. Drying the pre-treatment for too long or making the temperature too hot can affect the binding agent in the pre-treatment.
- Check to see whether the garment being printing on has a surface application such as a softener or silicone treatment that is repelling the ink.
- Check the cotton/polyester content. While DuPont™ Artistri® Brite P5003 and Artistri® Brite inks will work well with many cotton/poly blends up to a 50/50 ratio, it is possible that some blends may not work if the polyester content is too high.

Color ink is bleeding into the white layer.

This can happen when the white layer doesn't have enough time to dry or the volume of white ink too high. Suggested troubleshooting step:

- Check the white volume that is being used. Printer resolutions and pass counts at the upper end of the printer's capability can lay down more ink than is necessary. Check your user manual to cut back the amount of white ink being used. This is true for two-pass and single-pass DTG printers.

My white shirts look slightly brown after curing.

This is called scorching. It occurs when the garment has too much heat applied. The cotton fibers become singed and can take on brownish appearance. Suggested troubleshooting step:

- Check the actual heating/curing temperature on local equipment using an IR heat gun or an adhesive temperature test too insure that the dryer or press isn't working too hot.
- Set the temperature down. If you do this, you should raise the dwell time to insure proper curing. It should be noted that some garments by their nature are more susceptible to scorching at lower temperatures. These are usually thinner, high end shirts.

I see staining on the pre-treated areas of the shirt.

While DuPont™ Artistri® Brite pre-treatments have been designed to minimize staining, it is still possible that certain will react chemically to a pre-treatment. Suggested troubleshooting step:

- Press a completely unprinted shirt to check the shirt is staining due to heat application.
- Lower the amount of pre-treatment used on the shirt.
- Lower the curing temperature and increase the dwell time.

I see pinholes or cracking on the white printed areas of the shirt.

The cotton fibers on the shirt haven't been properly pressed to resist fibrillation. Suggested troubleshooting step:

- If tunnel dried, check to make sure the garment was pressed after drying.
- If the garment was stored for more than a couple of hours should be pressed for 10 seconds prior to printing.
- Check the platen pressure on the heat press being used.



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