WHITEPAPER **VOL. 2**

The ultimate guide to Industrial Digital Textile Printing.

How digital textile printing can help you set new benchmarks for image quality, uptime, design flexibility and fast deliveries.

spgprints®

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Introduction.

In the past decade, the way we print on textile is subject to change. Next to the conventional screen printing technology we all know, digital textile printing is on the rise. But what is digital printing exactly? What does the digital textile printing process look like? What are the differences between scanning inkjet printers and single-pass inkjet printers? And, most importantly: how can digital printing help your textile printing company set new standards for print quality and production speeds?

The textile market is growing rapidly. Major trends like population growth, increasing purchasing capability and rapidly changing fashion trends (simply take a look at how often fashion brands like H&M, Nike and Zara change their collection) are key drivers for growth in the textile printing market. The production of printed textiles globally is projected to reach 36.8 billion square meters by 2024. It is expected that by 2024 digital textile printing will control 10 to 15% of the textile printing market.

For textile printing companies, this means there is an enormous pressure on the time to market and thus on faster sampling, increasing print speeds, efficiency, flexibility and design. To achieve such goals, the market simply needs to look at other ways to print on fabric. One solution to those challenges is digital textile printing.

Chapter 1
What is digital textile printing and what are the advantages for your company?

What is digital textile printing exactly? Simply put, digital textile printers use digital technologies – just like your printer at home does. The digital textile printing process, when looked at from a bird-view has a lot of similarities with that of conventional textile printing: the fabric will be selected and pretreated, where it will pass through the printer and will subsequently be steamed, washed and dried.

But instead of pressing the different pre-mixed colors of dye on the fabric through rotary screens which each have their own pattern engraved, the digital textile printer uses a printable image (design) of a graphical data file, reads the right color information by using a LAB or RGB system and will then print the desired color onto the fabric with minuscule droplets of ink.

What are the advantages of digital textile printing?

In the introduction of this guide, we have outlined the main drivers for digital textile printing technology. But what exactly are the advantages of digital printing for your textile printing company?

- **Unlimited repeat size** as the repeat size is not limited to the diameter of the rotary screen.
- **High resolution and fine patterns, flexibility and unlimited color combinations** since digital printers are not limited to a maximum amount of rotary screens;
- **Low fixed costs** because of lack of screen engraving and color separation;
- **Low sample costs** as it is not needed to produce and test screens for individual patterns;
- **Fast sampling and short term delivery** as designs can be made digitally and adjusted on the spot;
- **Less or no stock** since brands move to 'produce what you sold' instead of 'sell what you produce';
- **High savings on energy and water** because there is no need to wash rotary screens;
- **Less waste** as droplets of ink are being printed very precisely onto the fabric. No disposal of excess dye and chemicals used in rotary screen printing, harming the environment;

Digital textile printing is able to meet today's demands for short runs and fast turnarounds. By using digital technologies, higher standards of quality on the widest range of fabrics can be achieved, maximizing uptime, and giving customers the flexibility to bring ideas faster to the market.

Chapter 2
Single-pass versus multi-pass digital textile printing.

Throughout the years, textile printing has developed from handcraft to high-speed, automatic processing of fabrics. Innovative techniques have resulted in acceleration and improvement of the printing process creating more and better possibilities for textile printers. These innovations have contributed to the creation of the two main printing techniques that are used nowadays: single-pass and multi-pass digital textile printing. What is the difference between these two printing techniques and how do you decide which technique best fits your and your customer's wants and needs?

Multi-pass textile printing

Multi-pass textile printing shows some resemblance with the inkjet printer that you use at home or at the office to print your documents. Multi-pass textile printing means that the print heads – one or more for each color – move from left to right over the substrate. After moving along the whole substrate, the fabric moves forward and the heads start printing another horizontal lane, but this time they move from right to left. All these horizontal lanes together make up the whole design.

The advantage of multi-pass printing is that you only need a few print heads to print your designs on fabric (minimum one head per color, minimum 4 colors). Since print heads are quite expensive, choosing multi-pass printing can help you minimize the investment you have to make when purchasing a new textile printer. Nonetheless, an important weak spot of digital printing is its high sensibility for errors, like when one of the nozzles gets clogged. No ink is printed on the substrate with that clogged nozzle which will create a white stripe in your design. On top of that, the lanes have to match up precisely to create a high-quality image. If the printer is not properly adjusted, this will also result in white stripes.

A way to solve this problem is to have the print heads create an overlap between the lanes. Instead of printing wide lanes with the same width as the print heads, which then repeatedly follow after each other, you have the printer create an overlap of half of the width of the print heads. This technique is called two-pass printing. Although this technique reduces your printing speed, it also reduces the chance of mistakes being made. This 'trick' can be extended to 4 or even up to 16 passes.

Single-pass textile printing

Single-pass printing is a newer printing technique that enables faster printing at a higher quality. The fast speed and high quality are due to the many print heads that are used for this technique. Instead of having a few print heads moving from left to right over the substrate, single-pass printing uses multiple print heads which are positioned along the whole width of the fabric, and they do not move. This enables faster printing since the fabric can keep running through the printing machine.

Two important benefits of single-pass printing are the high production speed and the extreme sharpness. In multi-pass printing the image is built up in multiple layers, so sharp lines might become a bit fuzzier if the passes do not match up 100%. In a single pass printer, the whole image is printed in one stroke (hence the name single pass) so it guarantees maximum sharpness.

A single-pass printer can print up to 60 linear meters per minute, whereas a multi-pass printer cannot produce more than six linear meters per minute (and this goes down with more passes). This enables printers to accelerate their production speed by at least 10 times. Because there are no multiple strokes, a single-pass printer cannot mask white lines due to lost nozzles. This requires high reliability of the printheads in combination with a very reliable ink.

Another disadvantage of single-pass printing is the high initial investment. Single-pass printing is more expensive than multi-pass textile printing because of the many print heads that are placed in the printing machine. print heads are costly components, so the more print heads there are incorporated in the machine, the more expensive the machine will be. Using single-pass printing, therefore, requires a large investment.

How to choose between single- and multi-pass printing

When choosing a textile printing technique, there are a few questions you have to ask yourself. The first question should be: how much do you want to invest in a new printing technique? Since single-pass printing requires a substantial investment, asking yourself these questions helps you to realize if single-pass printing might be an option for you.

A second important decision factor is the volume you want to print with the new printing technique. If you're printing between 0,5 to 1,5 million meters per year, multi-pass printing best fits your production process. Do you want to print between 4 and 20 million meters per year? Then single-pass printing helps you to reach the desired speed for producing large quantities of textiles.

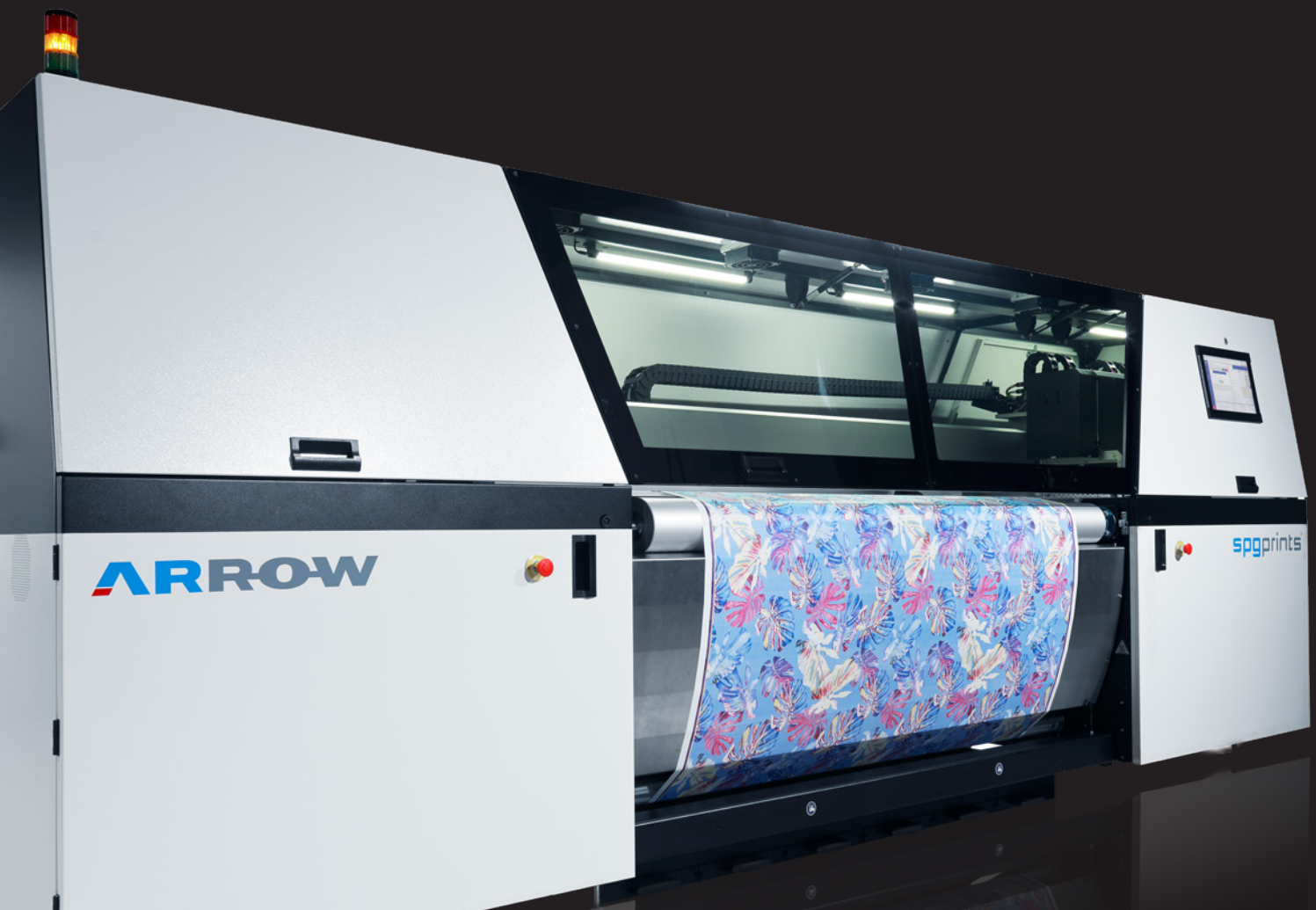
The last deciding factor is flexibility. Do your customers require you to be very flexible when printing textiles? If you need to change the designs often or want to print small runs of a certain design, multi-pass printing can be a suitable technique for you. Single-pass printing, on the other hand, enables you to quickly print large quantities of a certain design but does not offer a lot of flexibility in fabrics. Needless to say that the flexibility in designs remains the same for both digital printing methods.

Reactive or Sublimation Printing

There is another important distinction within printing processes: reactive or sublimation printing. In reactive printing, images are printed on the substrate that is pre-treated for reactive digital printing. For this process, steaming and washing are required. This is not necessary for sublimation.

With Digital Sublimation Printing, you print the design on transfer paper, place the paper onto the fabric and feed it through a calendar. In the calendar, the paper and the fabric are heated and pressed in between two large rolls. The high pressure and the temperature cause the ink to go instantly from a solid state into a gas (sublimate) which will be absorbed by the fabric. As soon as the fabric comes out of the machine, the gas coagulates into the fiber.

This has a couple of advantages (f.e. no steamer or washing machine is needed and the ink usage per square meter is 20-30% lower), which can be found in this blog. Digital Sublimation Printing is possible for both single-pass and multi-pass textile printing and is seen as one of the most future-proof printing processes. However, whether Sublimation Printing is suitable for your printing process depends on the material on which you are going to print. We will look at different materials in more detail in Chapter 3.



Chapter 3

Digital textile printing fabrics: what materials are suitable for printing?

Digital textile printing ensures high-quality designs and enables a fast production rate. However, due to the print heads being close to the fabric, some materials cannot be used for digital printing. Fabrics that, for example, have quite some loose threads can come in contact with the print heads and therefore cause damage.

The digital textile printing technique can be used for both woven and knitted fabrics. In this chapter, we specify which materials are suitable for digital printing and which are not.

Cotton

Cotton is a natural fiber that, especially within the fashion industry, is widely used for clothing because of its high moisture control, comfort, and durability. With a digital textile printing machine, you can print on cotton. To obtain the highest quality possible, most digital printers use reactive inks since this type of ink provides the highest wash fastness for prints on cotton.

Viscose

Another natural fiber that is widely used in the fashion industry is viscose. Printing on viscose with a digital printer is possible. As is the case with printing on cotton, you will get the best results when printing on viscose with reactive ink.

Wool

Printing on wool with a digital textile printer is possible. Wool can be printed with reactive ink (when high-fastness is priority) or with acid inks (if color gamut is priority). As wool is by nature quite “hairy” - meaning it has a lot of loose threads sticking out - the print heads have to be positioned as far away from the substrate as possible. Woolen yarn is five times as thick as the diameter of the nozzle in the print head and can therefore severely damage the print head.

For this reason, it is important to choose a digital printer that enables you to position your print heads at a considerable distance from the substrate. SPGPrints’ Archer technology supports a print head distance of four millimeters, compared with the typical 1.5 mm nozzle-fabric distance offered by other print heads, which enables you to digitally print on any type of wool.

Silk

Another natural fiber that is suitable for digital textile printing is silk. Silk can be printed with reactive ink (when high-fastness is priority) or with acid inks (if color gamut is priority).

Polyamide Lycra

Polyamide Lycra is a type of fabric that is mainly used for swimwear. Printing on polyamide Lycra with a digital printer is possible and can best be done with acid inks. By using acid inks, you obtain the highest colour brilliance, wash fastness and resistance for saltwater and chlorine.

Polyester

Over the last couple of years, polyester has become an increasingly popular fabric within the fashion industry. Direct disperse is the most commonly used for printing on polyester, but there is another solution for digital textile printers. Printers have switched to sublimation printing on paper and even to direct printing on polyester fabric with sublimation inks as the result of an easier process. Compared to paper sublimation the direct sublimation requires a more complex printer since a belt system to hold the fabric is needed, but it saves paper costs.

Overall, general sublimation printing on polyester results in somewhat lower fastnesses than printing with direct disperse inks. In the fashion industry, that is nowadays an acceptable compromise for sustainability.

Mixed fabrics

Mixed fabrics - fabrics consisting of two different types of materials - can challenge digital printing machines. In digital textile printing, only one type of ink can be used. Since each material requires a different type of ink, as a printer you have to use the ink that is suitable for the material that makes up most of the fabric. This means that the ink won't fixate on the other material that is used in the fabric, which could result in pale colors.

In general, digital textile printers can handle mixed fabrics with a maximum division of 70-30%. For example, a mixed fabric consisting of 70% cotton and 30% polyester can be printed with a digital textile printing machine with reactive inks. However, digitally printing fabrics with a 60-40% division will limit the color depth as only 60% of the fibers will be colored by inks.

Chapter 4

Digital textile printing inks: what types of ink are there and how can they improve the quality of your designs?

Textile printing companies are always looking for ways to improve the quality. An important element of print quality is the combination of fabric and ink that is used for printing. In recent years, there has been a high demand for high-quality inks that are easy to print with and are also less damaging to the environment. How do you find the type of ink that best fits your fabric and production process when there are so many different types of ink? In this chapter, we explain the different types of ink to you and discuss the advantages and disadvantages of each type to make your choice an easier one.

Reactive inks

Reactive inks are one of the most commonly used inks in the textile industry nowadays. Especially among digital textile printers, reactive inks are very popular. The ideal application of reactive inks is printing on cotton. However, reactive inks can also be used when printing on silk and wool.

Two great advantages of using reactive inks for textile printing are the high quality of the colors and the high wash fastnesses. The best color quality is reached when using reactive inks to print on cotton or viscose. When printing on silk or wool the colors can become less bright and intense. Especially for the fashion industry, the high wash fastness is an important advantage of reactive inks. A high wash fastness means textiles can be washed often without losing their color.

Acid inks

Acid inks are known for their vibrant colors, even when printing on materials that colordo not retain colors very easily. For that reason, acid inks are often used for printing wool and silk. With acid inks, you get a high level of color brilliance when printing on these types of materials. Besides wool and silk, acid inks are regularly used for printing swim clothing, which contains a stretch fiber, mostly polyamides like Lycra. Because of its high color brilliance, and also because acid inks have a high tolerance for chlorine and saltwater.

Disperse inks

Disperse inks are mainly used for printing on polyester. With disperse printing, the ink is printed directly on the textile after which it is then being steamed and washed as the next process steps. The steaming process opens up the fibers allowing the ink to fully penetrate the textile. After the steaming process, the fiber closes again and the colors are locked into the material. This results in a very high color brilliance and a high wash fastness.

In the last couple of years, polyester has become more and more popular within the fashion industry, which means there is a high demand for fast printing with disperse inks on this fabric. Please note that disperse inks, like within conventional printing, cause slightly more soiling of the printer and dryer. With proper maintenance, however, this won't be a problem. Disperse inks are nonetheless an excellent solution for digital printing on polyester. Another point to consider is that disperse inks need a long drying time.

Sublimation inks

Sublimation inks are used solely for polyester. Sublimation printing means that you print the sublimation ink onto a piece of special transfer paper after which you put this paper on the textile and together they go into a calender. This calender applies a pressure combined with high temperature which changes the ink from the liquid form directly into a gas (hence the name sublimation). This gas easily penetrates the polyester fibers. After removing the pressure and lowering the temperature, the colors are locked into the fabric.

An advantage of using sublimation inks is that you do not need to steam and wash the textile after printing. For this reason, this technique is more environmentally friendly, easier and cheaper than other printing methods for polyester.

Textile printers often use a technique called Direct Sublimation Printing. With this technique, you print with sublimation inks directly onto the textile for more ink penetration. No transfer paper is needed and you do not need to steam or wash the textile after printing it.

Pigment ink

Pigment ink is a type of ink with a very high color fastness that you can use for any type of fabric. Pigment inks are very sustainable as washing and steaming are not necessary, which is why it is seen as the ink of the future. However, the printing process makes the fabric less soft; the “touchness” changes. Consider this carefully if you want to use pigment inks for your digital textile printing process.

Whitepaper

From conventional to digital: the three core investment reasons of direct sublimation textile printing.

Do you feel that, after reading this Digital Textile Printing Guide, digital textile printing could be a good solution for your company? But are you doubting if digital textile printing is worth the investment?

In an independent study, Gherzi identified the three main investment reasons for digital textile printing. Three core advantages of digital textile printing have helped other textile printers to address new business units and assure their businesses of a future.

Find out what they are and if they could be of value to your company by downloading the Gherzi white paper:

Whitepaper

From conventional to digital: the three core investment reasons of direct sublimation textile printing.

An independent Gherzi study on the costs and earnings of digital textile printing

Download the whitepaper