THE HEAT ON
Dye Sublimation

Why it's a hot trend in the sign and graphics industry and what you need to know about it

BY MICHAEL SYVERSON, COMPILED BY MARILYN DAVENPORT

Dye sublimation is the next big surge in the digital textile printing industry. Quick to take off in Europe, dye sub is becoming the choice technique for end-users because of the efficiencies in fabric shipping and handling, as well as the rich, high-quality results. Fabric is beautiful, but printing on it can be challenging.

With this issue, we are launching a five-part series that will explore the intricacies of dye sublimation with guest expert Michael Syverson, Director of Special Projects at Louisville, Colo.-based Global Imaging Inc.

To get into dye sublimation printing, you basically need a printer, some sort of heat press to sublimate the ink and some finishing equipment.

Michael Syverson has been in the printing industry for almost 20 years, at the forefront of the pivotal time of analog to digital conversion. Syverson worked for EFI-VUTEk for 10 years and was instrumental in the development and rollout of five industrial inkjet printing devices, helping to create and refine many techniques that were critical to successful print through digital methods. Marilyn Davenport is the Public Relations director for Global Imaging Inc.
PrinterEvolution. Syverson has more than 20 years in the printing industry and was an applications specialist on the VUTEk project team when it unveiled the first dye sub printer in 2001. Let’s begin with an overview of the dye sublimation process from inks to equipment, but in subsequent articles we will further examine such topics as substrates, inks, heat setters, finishing, marketplace economics and workflow. Although there are many different approaches and variants to sublimated fabric printing, we will focus primarily on transfer dye sublimation because that is more widely used in the U.S. grand-format arena. We asked Mike the following questions:

Q. What is dye sublimation?
A. Dye sublimation is the process of converting solid dyes into a gas without going through the liquid stage. Heat and pressure are used to infuse colorant into a polymer material (usually polyester). There are two basic methods for printing with dye sublimation inks, direct and transfer. Transfer is the most common method in the U.S. and consists of printing an image on a transfer paper and sublimating the image onto a polyester-based product, usually a textile. The direct process differs from transfer printing in that the image is printed directly on a coated fabric and then sublimated without the use of paper.

Q. What are the advantages and disadvantages of the direct and transfer processes?
A. Both methods require heating the fabric in order to infuse the ink into the fabric, but both have their pros and cons.

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Q. What are the advantages and disadvantages of the direct and transfer processes?
A. Both methods require heating the fabric in order to infuse the ink into the fabric, but both have their pros and cons.
Transfer printing allows the most flexibility in terms of substrate range. You can basically sublimate to any polyester textile (or other polyester coated product for that matter). Transfer printing is very efficient, as you only need to profile and set up the printer for the one transfer paper you are using. Setting changes for the different fabrics are made at the heat press calendar. And printing on paper means you don’t have to worry about the fabric moving, stretching or wicking thereby giving you a clearer, more perfected image with sharper color “pop.”

Direct print has been around for several years and many pieces of equipment have been designed specifically for this application. An advantage of this is you can eliminate the need for transfer paper altogether, which can simplify the process in some ways. Direct printing also increases strike-through, making the image apparent on both sides of the fabric. In some applications this may be desirable.

On the downside, you need to characterize the printer for each fabric (separate ink limits, profiles, etc.). Additionally, you need coated fabrics to provide the best possible output for direct print. This can add cost, sometimes mitigating the cost of transfer paper. Also, there isn’t as wide an array of direct-coated fabrics available as uncoated fabrics. Finally, in many cases the output from direct print is not as sharp as a transfer printed piece. The best print equipment offers both, giving you the ability to produce graphics with either the direct or transfer method depending on the client need.

Q. What are the different dye sublimation inks and coatings?

A. There are three popular variants of dye sub ink: solvent-based ink, oil-based ink and water-based ink. The transfer applications for each of these ink types are roughly the same, using coated transfer paper to release the ink effectively. The main difference with these inks is the medium in which they are carried.

Water-based ink is the most common formulation of ink for dye sublimation.
and by far the most eco-friendly. With green printing growing in popularity, water-based ink offers outstanding attributes. Printers that print with water-based ink range from in-home consumer converted printers to grand-format industrial inkjet printers. Solvent-based and oil-based units are primarily seen in the grand-format space.

Historically, oil-based and solvent-based inks were used because of difficulties with water-based inks, availability of water-based compatible print heads and a compatible transfer paper. As paper gets wider (10 feet or 3 meters) it can become unstable during print, in terms of wrinkles (or cockles), which can cause print artifacts or head strikes. Additionally, when the first grand-format dye sublimation printers were designed, there were not many print head choices that were able to run water-based inks. Responding to demand, paper manufacturers have created papers that run smoothly through a printer, even with high ink loads at industrial level print speeds. Also, there are many more print head choices that are aqueous compatible.

Coatings vary depending on the manufacturer and ink. Different papers all have their own characteristics to hold and release inks. Clay coated paper seems to work best with water-based inks.

Q. Who uses dye sublimation and what are its applications?

A. Customers in the soft signage, trade show, retail, P.O.P., event and entertainment industries are really enjoying the benefits of this type of textile printing and a huge opportunity exists in these areas from small to large sign shops. Typical applications include banners, stretch graphics for exhibitions, flags, T-shirts, retail point of purchase, tents, even hot air balloons. Also, imitable items such as coated ceramics, wood and metals use this method, but it is important to note that dye sub is designed only for polyester based materials. In the case of solid substrates, like a coffee mug for example, the mug must have a polyester coating, usually a liquid that is baked on. If the substrate does not have a polyester coating, then the process will not work. Natural fabrics such as cotton and silk require different processes, such as an acid or reactive ink.

Q. Why use dye sublimation as opposed to other printing methods?

A. Overall, dye sub's advantage over UV-curable, latex or solvent printing is the ability for the fabric to have the same feel, or “hand,” which adds to the high-end perception of the product. Put simply, the end result is by far better in
look and feel because the ink is infused into the fibers of the substrate itself, as opposed to a pigmented ink that builds up on the fabric. This level of saturation produces superior output. Another important benefit of the ink being infused directly into the fabric is that without any additional surface protection, the image is now permanent and cannot be washed away, rubbed off or otherwise removed from the fabric.

UV, however, is the most versatile of these other ink technologies. It adheres well to a wide variety of substrates, including fabric, but it does change the feel of the material. Latex is similar to UV except that it can produce better, brighter color on textile than most UV printers. It can change the hand of the material, but not to the extent that UV does. However, a latex printer must be slowed down and print many more passes to achieve the same color as a dye sublimation print. Solvent inks (pigmented inks not to be confused with solvent-based dye sublimation ink) require the material to be coated with a receptive layer for the solvent ink. This can change the hand of the material as well. In addition, solvent output generally produces a less saturated image than the same print with dye sublimation.

Q. If someone wanted to get started in dye sublimation, what equipment would be required?

A. Basically you need a printer, some sort of heat press to sublimate the ink and some finishing equipment. In the U.S. you will find about six manufacturers offering printers. There are really three types of printers: all-in-one units with a built-in fixation heat press; printers that just print either transfer or direct; or in some cases, both. The all-in-one units are designed for direct print only. Some of the separate printer/press units are transfer only and some separate printer/press units can produce graphics with either the transfer or direct method, depending on application and the type of output required. Then
there are a variety of fixation units, from small clamshell heat presses where pressure is applied manually (think T-shirt shop), to industrial sublimation calendars for roll-to-roll grand-format machines. Lastly, there is the finishing equipment such as sewing machines. We are going to get into this in more depth in the future, but basically those are the three big components.

**Q. Why do you think adoption of this process has been slower in the U.S. than in Europe? What are the barriers to trial?**

**A.** In my opinion there are two reasons: First, the perceived high cost of entry and steep learning curve because of the complexity of the process. Secondly, finishing. On the first point, equipment and materials are expensive but the margins are much higher. Because of the complexity of producing dye-sublimated graphics and the cost of the materials themselves, the selling price of fabric per square foot can range from $7-$10, which is greater than vinyl by a dollar or two. In other words, printing businesses stand to make a lot of money and the dye sub market remains on a healthy upswing. It is less competitive than say banner printing, which has become somewhat commoditized. In the long run, transportation, handling and overall management of fabric is less costly as well, which is attractive to end-users. On the second point, finishing takes people out of their comfort zone. There is a general lack of education in our industry about sewing, appropriate setups for sewing equipment, supplies like needles, threads and the various types of sewing machines. This has left many in our industry apprehensive about taking the first step into the dye sublimation business. However, the market is wide open with great opportunity for print shops to increase their margins, differentiate themselves, and remain competitive. **SDG**
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Continuous advancements in fabrics, inks and printers, have made the wide-format textile printing market one of the fastest growing segments in digital printing today. It is estimated that the volume of graphics printed on fabric will more than double from 2011 to 2014. And most of that printing will be done through dye sublimation.

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at Louisville, Colo.-based PrinterEvolution. Mike has been in the printing industry more than 20 years, and was an applications specialist on the VUTEk project team when it unveiled its first grand-format dye sub printer in 2001. In this article, we will delve into the world of substrates, primarily fabric, from polyester to natural fibers to other materials.

Subsequent articles will address heat presses, finishing, marketplace economics and workflow. We asked Mike the following questions:

Q: Aside from fabric, what are some other substrates that can be used?

A: Most anything can be sublimated, but it has to have a polyester coating. Dyes are formulated to penetrate polyester. When polyester gets heated, the molecules expand, allowing the dye to seep in. Poly-coated mugs, ceramics, wood, glass, specially prepared mouse pads, and many other similar types of products can be printed with dye sublimation technology. There are several websites dedicated to providing these coated “blanks” for companies producing these types of products. By far, fabric is the most widely used, offering the industry many textures and finishes, versatility and flexibility that provide customers with high quality results.

Q: Tell us about the different types of fabrics and their applications.

A: Basically there are two types of fabric, woven and knit. Woven fabric is more stable in terms of its stretch characteristics, but tends to fray making finishing more difficult. Woven fabrics generally do not have much stretch unless they are woven with elastic or spandex type thread. Knit fabrics will have a bit more stretch by nature than a woven fabric and they do not fray which eases the finishing, but knitted fabrics can be more expensive because they are more labor intensive.

A very common material for hanging signs and banners that need weight is poplin. Poplin is usually a knit fabric, although some manufacturers have a
woven version. Poplin drapes nicely and tends to be slightly heavier. Soft knits are typically of a lighter weight and have more stretch to them, making them ideal for overhead signage, tension fabric applications like exhibition graphics, and framed signage for a smoother look and feel. Flag material has an open weave so air passes through it. Flag is typically used for outdoor applications, such as a teardrop display or actual flags. Generally, this material is printed so that ink will pass through to the back side (strike-through) so the graphic is mirrored on the reverse side for double-sided applications. Because of the need for strike-through, it is usually printed directly to the fabric as opposed to transferred. If a customer wants a lightweight double-sided sign or banner, this would be a good choice.

Satin is a closed, tighter weave with a gloss or sheen to it. It drapes beautifully but can be expensive. Satin is most often used for P.O.P. displays and indoor applications. PolySilk is a versatile, lightweight material that is growing in popularity for its translucent, draping applications. It can be bold and bright but it’s not as durable as the heavier materials due to its lightweight weave. Gaming felt is another type of fabric used for specialty applications like pool tables or poker tables with graphics.

This is only a small sampling of the different fabrics that are available. There are several manufacturers that make many different products for virtually any application (see chart, page 38).

Q: What are the trends in new fabrics?
A: The macro-trend in general is a fabric that is becoming the preferred choice over rigid or vinyl substrates for large and grand format applications. Fabrics are versatile, lightweight, have a wide range of applications and provide a high-quality look and feel. They are easier to install and remove and they are more cost effective to ship. Fabric manufacturers and suppliers are continually evolving their products to meet customer demand for environmentally friendly, flame-resistant fabrics that have excellent stretch and recovery characteristics and little to no shrinkage.

Some fabricators are actually designing fabric for clients based on how they want it to look and feel, stretch attributes, shrink level and opacity. This is especially true in the big box retail arena where companies want eco-friendly fibers woven into their fabrics with customized specifications. There’s also a growing trend in specialty upholstery projects and interior design elements. Everyone from architects to hotels to
mom-and-pop interior decorators are using fabric for custom-printed furniture, draperies, shades, wall hangings and other indoor applications.

Q: What are some tips for working with various fabrics?
A: The endless fabric choices make working with them confusing. They all have different characteristics that need to be addressed when printing and sublimating through the calendar. For example, fabrics with a great amount of stretch need special attention on the setup of the printer in order for the material to flow through the machine with consistent surface tension. Flag materials are typically direct printed to maximize the strike-through to the reverse side of the material. When transferring to flag, it is virtually impossible to get over 50-75 percent strike-through. By printing direct, you can easily achieve 90-100 percent. It is important to control the amount of ink printed on the fabric as too little will not penetrate deep enough and too much can cause the ink to bloom (dot-gain).

Many knit fabrics are relatively easy to print, whether transferred or direct. Again, ink load is critical for direct print. When sublimating fabrics, it is important to have your settings dialed in at the calendar (contact time, temperature and blanket pressure). Once these settings are in place, make sure they are maintained as changes in these calibrations can alter how the dyes are sublimated and affect color.

Q: Are there certain media transport systems that work better with different fabric types?
A: There are different philosophies as to media transport, each with their own advantages depending on the application. Many systems use a single nip for the material as it is loaded into the printer. This is a very sound system and can handle a wide array of fabrics and paper, but it lacks the robustness of larger, more industrial systems.
use a dual pinch roller system with tension applied to the material so it can feed very evenly and consistently through the printer. When direct printing to fabric, these systems can have some difficulties.

A third system utilizes a flat sticky belt (similar systems are seen on some flatbed UV printers). This works great for direct-to-fabric solutions, but often times cannot be used with the transfer method of sublimation as the sticky belt can tear the transfer paper.

**Q: What are the most important considerations when selecting fabric?**

**A:** The most important thing in choosing a fabric is to understand how it will be used. What’s the application? Do you need it to be translucent? How will it be lit? Will it be hanging, draped or stretched? You want to avoid fabrics that curl and consider the shrinkage factor. Suppliers should have a good consistent shrinkage rate for their materials and it shouldn’t exceed 1-2 percent. Cost is another factor and sometimes buying the less expensive option could end up costing more because the quality of the fabric may be inferior. There may be more dirt spots, or runs in the fabric. In addition, it may not be pre-shrunk or flame-retardant. Finally, lower cost options could have much more unpredictability from lot to lot.

**Q: How does printing equipment affect fabric selection?**

**A:** Your equipment can also influence the choices in fabrics. If you have a printer that can only print direct to textile, for example, you need to be very aware that some fabrics may not print well, (especially at wider widths) even though they may be available with a direct to textile coating. It is important to speak with your suppliers about your applications and your equipment so they can recommend the best solution for your needs.

**Q: Are there specific inks that work better with fabric than others for both direct and transfer printing?**
A: Dye sublimation is designed to work around polyester materials. When printing to a different material, such as silk, cotton, nylon or linen, other ink technologies need to be considered.

Cottons and linen for example, require reactive dye-based inks. The chemical properties in the dyes and the cotton or linen fibers create a very strong bond for wash fastness and color fastness. After printing, the fabric needs to be steamed and washed for the ink to bond to the fabric.

Silk, nylon and wool require acid dye inks. These are printed in a very similar fashion and also require steaming and washing after printing to affix the colo­rant to the textile. Both of these technologies yield very good results in terms of color brightness and maintaining the hand of the fabric. An alternative to these technologies is printing with a pig­ment-based ink (such as latex, UV curable or solvent-based pigmented ink). Pig­mented inks provide great flexibility as you can print on most any of the fabrics, however, some of them may need to be coated (in the case of solvent, for example). Additionally, pigmented inks will change the hand of the final product, which may be very important, especially in the case of a stretch fabric application.

Q: What should a print shop owner look for in choosing a dye sub trans­fer paper?

A: There are several things to consider when choosing a transfer paper. First, make sure the coating is compatible with the ink technology being used. Many manufacturers make different papers that are compatible with either oil, solvent or water based inks. The goal of coating is to minimize ink absorption in the paper by holding as
The newer water-based, eco-friendly inks are more widely available for grand format printers. These inks have also improved in depth of color and consistency.

much ink as possible in the coating. The better coatings can hold more ink during printing and release more of that ink into the fabric when sublimated. Generally this yields more color vibrancy, but it is somewhat subjective.

Another thing to look for when choosing a paper is how it runs through the printer. You want a paper that doesn’t cockle and will run through the printer smoothly. If the paper cannot absorb much ink, it will tend to cockle, potentially causing a head strike. Large shifts in humidity can also cause problems with the paper by making it unstable on the printer and more prone to wrinkling on the heat press. It is important to keep humidity levels stable within your facility. Most of the printer and heat press manufacturers have a lot of experience with different papers. When choosing one, they should be able to help by recommending products they have tested on their equipment.

Q: How have printing and ink technologies contributed to the growth of digital textile printing?

A: There’s been an increasing demand for printing equipment particularly in the 10ft. wide textile market. Manufacturers have started providing more options to customers interested in direct and transfer printing with equipment that can offer both and is faster and more efficient. Print heads have improved significantly in the past several years. Print heads with a fixed, binary droplet of 80 picoliters (pL) have been replaced with variable drop heads with droplets as small as 6-10 pL. This has resulted in greater sharpness and detail, finer lines, and overall, better image quality with excellent color gamut.

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Feel the Heat

IN THE DYE SUBLIMATION WORLD, heat is king. In order to fixate the dyes to the fabric, they must first be heated at 400°F for at least 30 seconds. For that you need a good quality heat press or calendar unit. Any variation in consistency of time, temperature and pressure can impact color, ruin the job and in the end, cost you more money. Thus understanding the equipment necessary to achieve effective dye sublimation and rich output is one of the most important steps you can take.

Calendars and heat presses are key to sublimation success

BY MICHAEL SYVERSON, COMPILED BY MARILYN DAVENPORT

Michael Syverson has been in the printing industry for almost 20 years, at the forefront of the pivotal time of analog to digital conversion. Syverson worked for EFI-VUTEk for 10 years and was instrumental in the development and rollout of five industrial inkjet printing devices, helping to create and refine many techniques that were critical to successful print through digital methods. Marilyn Davenport is the Public Relations director for Global Imaging Inc.

Understanding the function and applications of the heat press and/or calendar unit is crucial to achieving beautiful dye-sub output such as this. (Image courtesy of Mimaki)
This is the third in our five-part series that explores the intricacies of dye sublimation with guest expert Michael Syverson, Director of Special Projects at Louisville, Colo.-based PrinterEvolution. Syverson has been in the printing industry more than 20 years, and was an applications specialist on the VUTEk project team when it unveiled its first grand-format dye sub printer in 2001. In this article, we will discuss the heat press and calendar equipment that is used in the signage and graphics industry and other applications. The final articles in the series will explore finishing, marketplace economics and workflow.

Q: What does a heat press/calendar machine do, and why is it important in the dye sublimation process?

A: The primary purpose of a heat press or calendar is to facilitate the sublimation of dyes into fabric. All of these devices have a heated element and some sort of feature to apply pressure to the transfer paper and fabric to convert the ink to gas (sublimate) and have it permeate the fibers of the polyester fabric (or polyester coating). This is a required step in the dye sublimation process as the dyes are not fixated until they have been heated at a certain temperature for a certain amount of time.

Q: The terms “heat press” and “calendar” are frequently interchanged. Can you explain the difference?

A: Although the function of a heat press and a calendar in dye sublimation are basically the same—fixate the colors into fabric—the fundamental difference is that a calendar is designed for...
roll-to-roll sublimating, typically for rolled textiles and more commonly used in the signage and graphics industry. A heat press is designed for one-off images. Heat presses come in many different sizes and designs depending on the specific application. There are flatbed-heat presses that can be used for one-off flat prints such as mouse pads, glass or ceramic tiles, or other specialty small graphics. There are also circular heat presses with a curved heating element for imaging on to a mug, for example.

The most common heat presses are clamshell and swing-away units. A clamshell opens from the rear and the platen opens up at an angle to allow access to your image area. This is good for small imprintable items and garments. The swing-away style raises and lowers the platen vertically and swings to one side and is usually used for rigid surfaces. Some of these presses are automatic in that they will close and open on a timer so you have precise control of your transfers. Many units are fully manual. These are much more popular as they require a lower initial investment. Finally, there are units designed for transferring onto t-shirts. These have a shuttle type system so you can stage a t-shirt on a jig while one is transferring. If you are doing short-run t-shirts, this is a good way to produce this type of product.

There are many choices for calendars as well. They are available in several different widths and can come with many options, such as a staging table for setting up flexible sheeted goods, multiple rolls, different diameter drums, auto shutdown timers, blanket or belt lengths and a variety of other enhancements. There are also beltless calendars specifically for direct dye-sub printing that don’t require transfer paper. You may need protection paper however if you’re working with delicate fabrics. Although these are less expensive machines, the results cannot be compared. The transfer paper produces a higher quality image, with sharper, deeper color output.
Q: What is a flatbed heat press, how does it work, and what applications is it best used for?

A: Flatbed heat presses are designed for sheeted applications only. The presses can range in size from small 11” x 14” presses to 4’ x 8’ presses with two full size beds. They usually have a bed where the substrates and transfer paper is laid out. Above the bed is a heated platen that is lowered on the substrate. This bed is heated to approximately 400°F and is lowered on to the substrate with an amount of pressure sufficient enough to sublimate the inks into the donor substrates. The pressure and time can be changed based on the substrate. Some of these devices are manually actuated while some of the more sophisticated devices have electronic or pneumatic systems for raising or lowering the platen. Many of the smaller products, such as gifts, promotional items, and specialty graphics are imaged with the smaller units. Some larger shops use the bigger presses for higher volume products. A 4’ x 8’ press can be used to set up 32 12” tiles with one large sheet of transfer paper to create custom tiled mosaics, for example. The units with two 4’ x 8’ beds are designed so you are laying out one print while the other is sublimating, creating a more efficient workflow.

Q: What is a rotary calendar and how does it work? What applications is it best used for?

A: A rotary calendar is designed for output onto flexible substrates, such as rolled fabrics. Its operation is somewhat similar to a laminator. There is a continuous blanket (or belt) that wraps around a heated cylinder. Fabric and transfer paper are put together and set upon this blanket. The blanket carries the fabric and paper and presses it against the heated drum for a given time to sublimate the image to the fabric. The blanket also has pressure applied to it against the drum to help facilitate the process. The advantage of this device is that is can be used for high volume rolled goods (and some select sheet materials).
Because the material is wrapping around a heated cylinder, items such as coated tiles or other rigid materials cannot be sublimated with this process. For rigid materials, you must use a heat press.

Calendars are ideal for the large production textile industry as well as large-format graphics such as exhibition signage, banners, exterior and interior design displays and upholstery.

Q: What is “protection paper” and why is it used? Is it different than transfer paper?

A: Protection paper, or tissue paper, is used on a calendar or heat press to protect either the drum/platen or the blanket from ink sublimating on to it. It absorbs excess gasses that do not sublimate into your polyester fabric or coating. If, for example, you did not use tissue paper on the blanket of your calendar and ink sublimated through the fabric, there is a possibility the ink in the blanket would offset back into your fabric the next time that spot in the blanket wrapped around and came into contact with the fabric.

This is a very important component to use on the calendar in order to extend the life of the blanket and prevent any unwanted offsetting of ink onto your printed graphics.

Q: What should a print shop owner look for when purchasing a calendar and/or heat press?

A: There are many things to consider when choosing a calendar or heat press.

For calendars you need to consider:

- **The width**—The calendar should match up in terms of width with the output device being used. Calendars are available in sizes from 64” up to 10’ wide. Many shops will purchase a calendar that is wider than their current output device in the event they decide down the road to purchase a wider printing device. Companies will purchase the calendar and keep it many more years than a printer so anticipated growth should be taken into account when purchasing.

- **Maximum capacity**—Calendars have a cylindrical drum that is heated. The diameter of this drum determines the speed of the calendar, as fabric needs a certain amount of contact time with the drum to achieve proper fixation. The bigger the diameter, the faster it will produce graphics.

**How the drum is heated**—Most calendar units these days have a drum filled with oil that is heated to approximately 400˚F. You want a calendar that uses oil because it produces a very even heat across the width of the unit and the temperature will stay very stable. Calendars with electrically heated drums can cause hot spots in the fabric and some units cannot keep up with the transfer speed in terms of heat. Hot spots can cause color differences and a variance in temperature from the beginning to the end of a print.

**The length of the printing blanket or belt**—The longer the belt, the steadier it runs through the calendar. The belt will tend to wander and move which has to be corrected and different machines have different ways of handling that. Some machines use a pushing and pulling mechanism that tends to damage the belt over time. Others use an electrical steering arm that moves up and down which doesn’t damage the belt and extends its lifetime.

For heat presses, the following areas need to be considered:

- **Size of press bed**—How large do you need the press to be? It again depends on the application.

- **Heating element**—Most heat presses use an aluminum upper heating element with a heat rod or heating wire attached or cast into it. Make sure the heating element heats evenly and can keep consistent heat. Where many heat presses are one-off type machines, it is...
easier to maintain heat as you can let the press heat back while you are staging your next print.

**Warranties**—You should expect at least a one-year warranty on your purchased piece of equipment in addition to training and installation.

Q: What is the Black Box equipment used in direct printing?

A: This type of device is usually associated with all-in-one units that print and sublimate in one pass. These units have infrared heaters (or similar) that heat the box and start the sublimation process. They have the advantage of not needing a separate device for sublimation, but do have limits. Some of these units cannot sublimate the ink completely and may require the finished graphics to be washed after printing/sublimating to prevent any of the un-sublimated ink running on the finished graphic. Also, due to the nature of these units, transfer printing is usually not possible due to the architecture of the printer/heating element. A calendar or heat press provides the best possible solution for sublimation as it has the ability to apply pressure to the graphics as it goes around the drum (or under a platen). Most of the black box units do not have this ability.

Q: How can a shop owner justify the cost of the calendar versus that of a heat press. What are the particular benefits?

A: The choice between a flatbed heat press versus a calendar unit is fairly simple. It really depends on the applications. If a shop owner is producing soft signage (banners, flags, etc.), then a rotary calendar is the way to go. If a shop is producing nothing but small garments, gift and promotional items, then a flatbed press is more appropriate. Several shops that have rotary calendars may also have a small heat press for proofing small files or testing different applications. The smaller heat presses are relatively inexpensive and cost much less to operate than a 10’ rotary calendar.
Breaking Down Dye Sub, Part 4

Finishing Touch

The finishing department for dye-sub applications can make the difference between a high-end fabric graphics job and one that isn’t

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Most professional fabric graphic printers understand that there’s more to a project than just printing. Once you print it, you have to finish it and oftentimes, finishing techniques can make the difference between a high-end looking product and something that isn’t compelling enough to compete in the marketplace. Finishing procedures can range from seaming and hemming, to adding pockets and grommets. While the options are numerous, the equipment to perform these tasks is also formidable. Fabric steamers, heat presses, industrial-strength sewing machines, sergers, welders and seamers all contribute to the successful finishing of soft signage and textiles.

In Part 4 of our 5-part dye sublimation series, we provide you with information on the various finishing procedures, the equipment available to achieve the best results and ways to determine if a finishing department can contribute to your business success.

Q: What are the advantages of investing in a dye sub fabric finishing department?

A: These days, finishing is seen as a necessary part of the dye sub process and a business should consider it seriously if it’s going to get into the game. Adding an internal finishing production area can help retain customers and build loyalty. It alleviates the cost of outsourcing for these services and in the long run, can make a shop owner more money. It also is added value to be able to offer high-quality finishing as part of the entire project, saving time as well as the risk of error as multiple people handle the project if it’s not under one roof.

Q: What should digital graphics and sign shops know if they are just starting to explore offering finishing services?

A: Sign shop owners need to understand the equipment requirements for the various finishing techniques, look at
Finishing Touch

the pros and cons of each piece of equipment, research the pricing, labor and training involved and determine what types of applications they want to pursue, whether it's large or small scale production. Also a shop needs to have enough space to stage graphics for large applications. The application determines if it is sewn or welded. With dye sublimation, sewing is the most common finishing technique. However, both welding and sewing have their benefits.

Q: What type of equipment is used in finishing procedures?
A: Depending on the type of fabric being used, there are required pieces of equipment needed in order to properly finish the printed graphics. Fabrics made of natural fibers, such as silk, wool or cotton, need to be steamed after they are printed. The steaming fuses the dyes to the fabrics. Once that is completed, the finished fabrics need to be washed before final finishing. With dye sublimation printing, polyester fabrics need to be heat set or transferred on a calendar or heat press after printing. Once this is completed, then the final finishing can take place.

Most print shops finish fabric graphics by sewing them. There are a variety of industrial level sewing machines on the market today designed for many different applications. The final application and
install location will determine the level of finishing needed for the graphic. For example, if a graphic is going to be mounted in a stretch frame with a silicon bead, then the fabric is usually cut with a hot knife and the silicon bead is sewn into the fabric. This application does not allow the fabric to be hemmed as the hem would make the edge too thick to fit in a stretch frame.

If a graphic is going to be used in a double-sided application (such as a hanging aisle marker for a trade-show), then the graphic is usually printed twice, sublimated and has a black fabric (or other blockout layer) sewn in between the two facing graphics so no light passes through the finished product. These require some skill during sewing as you are sewing three layers together. Heavier duty applications such as this may require a double stitch. There are sewing machines that have this capability automatically built-in.

A serger sewing machine is also a valuable tool to have for sewing graphics with a heavy duty stitch that can have some stretch. A serger creates a stitch with two, three or even four threads and can also cut the edge of the fabric automatically to create a finished edge. They are also very helpful for adding strength to a seam. Keep in mind that while a serger can do a wide variety of applications, it will not replace a standard sewing machine for basic seams, such as zippers or top-stitching.

Fabrics can also be welded, similar to how welded vinyl graphics are created. Although this isn’t as popular as sewing, it can leave a very clean edge for those applications where a sewn edge or seam is not desired. It can also create a very strong bond that can be more durable than the fabric itself.

Another aspect of finishing is the cutting of the fabric graphics. Most graphics are trimmed manually with scissors. For high production needs, an X/Y cutter can be very beneficial. Some manufacturers carry special blades that will cut fabric very easily, such as Zünd's Driven Rotary Tool (DRT). An important thing to note when cutting fabric is that the system is designed to take fabric stretch into account as it registers the cutting geometry with the actual printed graphic. These flatbed cutting tables are very versatile, not only for fabric graphics, but for cutting of all graphics produced in a shop.

Finally, all shops should have a hot knife for cutting graphics that cannot or may not need to be hemmed. A hot knife basically has a blade that is heated above the melting point of the polyester fabric and sears the edges as it cuts the fabric. This can be particularly useful for woven graphics that tend to fray after being cut with a scissor.

Q: What should you look for when buying sewing equipment for dye sub finishing?

A: It really depends on the needs of the company. A shop that only does a few sewn products a day should consider...
a low volume solution for their sewing needs. A standard sewing machine and serger in this category can be obtained for under $800. If a PSP is a very high-volume shop, then they should consider an industrial solution for their needs. Equipment in this category can cost from $6,000 on up. There are benefits for these industrial machines as they will last a lot longer in a high production environment and can often have features not available in the lower volume segment.

Both automated and hand-action grommet machines are available. Which is the best choice?

Both pieces of equipment are valuable and again, the choice really comes down to the volume of work in the shop. A high-production facility will more than likely have an automated grommet machine that will automatically punch and grommet the fabric, but a smaller shop with less volume can function just as well with a hand-action, manual grommet machine.

**Q: How can this equipment increase productivity and profit?**

**A:** Higher-end sewing machines are faster and can increase productivity, but you still need talented sewers to provide damage control and produce the high-end finished product that customers expect. Additionally, by bringing the finishing in-house, a print provider can further control costs, scheduling and manage the entire project to ensure a high level of quality and increase efficiencies.

**Q: What are the various finishing options and their applications?**

**A:** Finishing techniques really depend on the final application and need. Here are some common ones:

- **Pole pocket**—mostly used for hanging banners. The poles are inserted in the top and the bottom. Equipment: sewing machine or welder.

- **Grommets**—not often done in fabric, mostly used for vinyl. Equipment: grommeting machine.

- **Hems**—for finished edges, seams
and multiple panels. Equipment: sewing machine, welder.

**Stretch Frames**—sewing of silicon beads that mount to a channel and snap into a frame. Aluvision makes the frames and sells the beads. With stretch fabric you want to avoid ripple or waves. A lot of the same techniques are used on fabric and vinyl in this application. Equipment: sewing machine and the frame.

**Q: What are some of the challenges in running a finishing department?**

**A:** One big challenge is finding skilled labor that can sew. Another challenge is having the space to stage large graphics. When bringing in fabric printing (along with large banners in general), it is important to properly plan the space so there is enough room to stage graphics for finishing. In addition, if the final graphics are being used on a stretch frame, it is advisable to stage the frame and attach the graphics to the frame for proper fitment.

Many applications are 3-D in nature so time needs to be spent in creating the graphics and the seams the final image lays properly on the 3-D frame. The stretch of the fabric needs to be taken into account, along with the location of the seams and how it will attach to the frame (Velcro, zippers, silicon beads, etc.)

**Q: What are some of the trends in the finishing arena?**

**A:** As far as trends go, it seems that many PSPs are continuing to look for ways to minimize the steps in the production process with equipment that is faster and used for various applications. Shop owners want consistency, reliability and more and more are bringing finishing in-house to cut down on outside sourcing and fulfillment. Many PSPs are looking at ways to finish graphics more efficiently to improve their turnaround time and reduce labor costs. Equipment such as faster sewing machines, automated x/y cutters with fabric attachments and welding units designed for textile are some of the products shops are looking to invest in for future.
Dye Sub Marketplace and Economics

When does it make sense to include dye sublimation as a part of your business? Recognizing the growth in the digital textile industry and the increasing demand for the rich, high-quality appeal of fabric and its efficiencies in shipping and handling, it may be now.

This is the final installment in our comprehensive series on dye sublimation, its benefits, intricacies and the technologies associated with it. In this final article we present an overview of the marketplace and its economic impact to help you formulate your future plans and make an informed, intelligent decision about the growth strategy of your business.

Taking advantage of the $165 billion printed textile market

BY MICHAEL SYVERSON, COMPILED BY MARILYN DAVENPORT

Michael Syverson has been in the printing industry for almost 20 years, at the forefront of the pivotal time of analog to digital conversion. Syverson worked for EFI-VUTEk for 10 years and was instrumental in the development and rollout of five industrial inkjet printing devices, helping to create and refine many techniques that were critical to successful print through digital methods. Marilyn Davenport is the Public Relations director for Global Imaging Inc.

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Q: What are the opportunities in the grand-format textile printing market?

A: According to a recent study by InfoTrends, printed textiles represents a $165 billion market, and demand is increasing for custom and personalized fabric design for home and office, retail soft signage, trade show and exhibition graphics. While the potential is great, less than 1 percent of printed textiles are digitally printed today, according InfoTrends. These are all areas of opportunity.

Another very important point is that the digital textile market is not yet commoditized. Printed fabric still commands high margins, and the market is not saturated. Competing profitably in this industry is typically achieved in several ways:

• decreasing operating costs on equipment and supplies;
• increasing efficiency with automation, or faster equipment; and
• finding areas to grow that aren’t yet saturated.

Of the approximately 30,000 U.S. sign shops, we estimate that less than 100 are doing industrial grand-format textile printing (we define industrial as 126” or wider on commercial speed inkjet textile printers). According to a recent 2012 SGIA Market Trends report, graphics and sign companies expect a median growth rate of 11.2 percent this year. Of these companies, 60 percent said they will add imaging equipment or technology to their business and 50 percent said they will add post-print or finishing equipment. That trend shows an increasingly crowded market.

Q: What are the primary markets for dye sublimation?

A: The soft signage, retail, exhibition graphics, event/entertainment industries and customized fabric are the greatest textile printing opportunities. Typical applications include banners and flags, stretch graphics, trade show graphics, retail point of purchase, and the small niche markets like gaming tables and ceramics. Garments and interior and exterior design are also growing markets.
Q: What are the practical challenges of entering each market?
A: Many of the challenges for entering these markets are similar. As textile printing is still very much a craft, certain aspects need to be considered before jumping headfirst into this market space. For example, when fabric is sublimated to, there will be some amount of fabric shrinkage due to the high temperatures in the sublimation process. It is important to recognize this before printing graphics so sizing can be appropriately adjusted in the RIP software. It is also important to note that the different characteristics of the many fabric options on the market need to be considered. For example, the many variations of knits and weaves may have different stretch attributes to them, as well as shrinkage rates. Part of the craft is mastering your materials and equipment so that you can go into true production.

Specific markets have their own challenges that providers need to be aware of as well. If for example, if a company is planning to get into the tension or stretch fabrics segment of textile printing, it is important to realize that there are many other things to contend with beyond the print. Many of the structures and graphics in this market space are three dimensional by nature. A provider may need to source fabrication for the graphic frames (if they are not already doing fabrication in-house). Additionally, graphics need to be designed and printed with the three dimensional aspect in mind. This may require having someone with CAD experience on hand to ensure graphics are set up properly for this sort of application.

In all cases, it is important for the print service provider (PSP) to understand all of the aspects of the process—from prepress to production to finishing—to ensure a solid product.

Q: What are the driving forces for digital textile growth?
A: Profitability and demand for a better end product are key drivers as digital imagery and printer output quality continue to improve. Fabric has a high perceived value which is opening many doors into a higher-end clientele and enabling printing businesses to increase their margins and market share. Transportation, handling, drayage and overall fabric management are less costly as well. In many conventional signage markets, the cost of shipping and drayage can far exceed the cost of the original graphics.

Textile printing has seen growth in Europe for many years. We are only starting to feel the upswing in demand and know-how here in the U.S. As mentioned before, this is not yet a commodity, so margins remain high. The wide-format industry in particular is on the leading edge of textile printing—with faster machines, improved ink technologies, printhead development, high productivity and quality output.

Q: When does it make sense to move from outsourcing to in-house dye-sub production?
A: This is really an individual business decision based on market demand, internal talent, growth goals and competition. However, the more expertise PSPs can develop in the applications and services they offer, the more successful they will be. This is a way to differentiate their business and remain competitive.

If a PSP is currently outsourcing as a start point for their sales and marketing efforts, it is a good rule of thumb to say that when your monthly equipment lease rate is close to or more than what you’re outsourcing, it is time to bring it in-house. This model may help explain how to approach the decision.

Printed textiles represents a $165 billion market, and demand is increasing for custom and personalized fabric design.
Q: What are some industry trends? Is direct print sublimation gaining on transfer?

A: Whether it’s direct print or transfer, dye sublimation is the preferred imaging method for soft and retail signage and exhibition graphics because of the rich color saturation and consistent high quality results that are possible. Although direct print seems to be increasing in use and popularity, however in my opinion transfer printing is still the optimal way to achieve the sharpest, most superior end product. The best choice is to find the piece of equipment that will allow you to do direct and transfer processes equally well.

Textile customization, especially for shorter runs, is a rising trend, and here digital printing can save time and money. With new specialty inks and improved equipment technologies, the workflow can be streamlined and production increased.

An increasing number of printer manufacturers are introducing new flatbed and inkjet systems designed for textile printing which contributes to market growth and innovation. As ink and substrate technologies continue to advance, the experimentation of different applications in digital printing will expand market demand and increase competition for unique, creative products. According to SGIA’s Marketplace study, the industry is on an upturn, and 88 percent of the study respondents are optimistic about the future. Digital imaging is the technology of choice and will eventually replace analogue systems and textiles are poised to replace vinyl and other rigid substrates. SDG
Analyzing Dye-Sub ROI

This break-even point graphic (provided by Global Imaging) is a tool that is used to evaluate return on investment (ROI) of dye-sub systems by examining many variables including monthly equipment payment, employee cost, monthly rent and other administrative expenses as fixed costs per month with sales and marketing as variable costs.

These are for the first year of operation in a five-year lease. The printer considered in this example is a PrinterEvolution Evo33 dye sublimation printer (the “complete” cost listed includes a Caldera RIP, Klieverik calendar press and training).

The assumed average sell price per square foot is $6.13. Nationally it seems to vary from $3 to $20 per square foot depending on location, competition etc.

Printer capacity is about 112,839 sellable square feet per month, operating seven hours per day, 22 days per month at 916 average square feet per hour.

This analysis shows that break-even is achieved as production reaches approximately 2 percent of machine capacity. Gross margins in the 50 percent range are achieved at approximately 4 percent of machine capacity, and are maintained well above that level at all higher production levels. Total system payoff is achieved in 23.6 months, if maintaining a 100% run rate through that period. Break-even production is achieved in 0.3 days. These are realistically developed estimates, however as with all estimates, your return may vary.

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**Average Sell Price per sq. ft.**

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<th>Production Levels</th>
<th>Sellable sq. ft. Per month</th>
<th>Revenue</th>
<th>Cost</th>
<th>Profit</th>
<th>Profit margin</th>
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<td>$0</td>
<td>$0</td>
<td>$0</td>
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<td>Breakeven</td>
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<td>20% profit margin</td>
<td>2,550 x 1,035 sq. ft.</td>
<td>$8,569</td>
<td>$2,063</td>
<td>$6,506</td>
<td>20%</td>
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<tr>
<td>40% profit margin</td>
<td>4,720 x 2,084 sq. ft.</td>
<td>$16,184</td>
<td>$5,321</td>
<td>$10,863</td>
<td>84%</td>
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<tr>
<td>60% profit margin</td>
<td>8,690 x 3,928 sq. ft.</td>
<td>$25,235</td>
<td>$13,314</td>
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<td>84%</td>
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**BREAKEVEN ANALYSIS**

Tailored expressly for XYZ Graphic Producer

| Fixed/Variable Cost Breakdown | Break-even Point
<table>
<thead>
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<tr>
<td><strong>Fixed Costs</strong></td>
<td><strong>Variable Costs</strong></td>
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<td><strong>Total</strong></td>
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Printer capacity is about 1,996 sellable sq. ft. per month, operating 7 hrs/day, 22 days/month at 916 avg. sq./hr.

This analysis shows that breakeven is achieved as production reaches approximately 20% of machine capacity. Gross margins in the 20% range are achieved at the range of approximately 6% of machine capacity, and are maintained well above that level at all higher production levels. Total system payoff is achieved in 10.9 months, if maintaining a 100% run rate through that period. Break-even production is achieved in 0.3 days. These are realistically developed estimates, however as with all estimates, your return may vary.

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