Sublimation 101

The Complete Guide To Successful Dye Sublimation Printing

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Welcome To The World Of Sublimation

Congratulations on your purchase of a Sawgrass Technologies Sublimation Decorating System. You are about to embark on an exciting, creative, fun and profitable business venture. Without a doubt, dye sublimation is one of the most effective methods for creating a wide range of customized and personalized products on demand. Your new sublimation system will make it easy and cost-effective to provide more products than ever before for your existing clients and while bringing in new customers by reaching new markets.

Using off-the-shelf graphics software, Sawgrass sublimation inks, popular desktop inkjet printers from Espon and Ricoh, and a standard heat press, business owners can quickly produce high-margin, full-color photographic images that will not crack, peel or wash away. It truly is amazing how such a simple the process can yield the level of quality and sophistication that it does.

To help you get your equipment up and running smoothly so you can start making money as quickly as possible, we have put together the Dye Sublimation Handbook. In the pages that follow you will be introduced to the elements of sublimation production including step-by-step instructions for the most common applications. We encourage you to read it from the beginning to the end, rather than skipping around, as each chapter builds on the chapter before it.

After you have finished the book, we suggest you check out some of our other educational resources (listed in Chapter 1) for additional information on topics such as marketing, pricing, and selling. In fact, we have an extensive collection of educational resources designed to help you do one key thing: make money with digital decoration.

Good luck on your journey towards digital decoration success! All of us at Sawgrass Technologies are committed to helping you find the solutions you need to take your business to the next level and are here to support you.

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Chapter 1 –Online Educational Resources

Learn More Earn More!
Before plunging into the mechanics of the sublimation process, it's worth taking a moment to note all of the different educational resources that are available to help you launch your business with the ultimate goal of generating positive revenues. While this book is a great starting point for increasing your knowledge, training and education is a perpetual process that should be treated as a normal aspect of successful business growth and development.

Sawgrass Technologies provides a wide variety of useful online resources in regards to sublimation and digital decoration that can be used in conjunction with and in addition to this book.

Weekly "Live" Webinars
Each week Sawgrass Technologies hosts a live interactive, educational webinar featuring various experts discussing a wide range of topics. Subjects include: Making Money, Pricing, Marketing, Selling, Troubleshooting, CorelDRAW Basics, Photoshop Basics, etc. All you need to participate is a broadband internet connection, a computer with speakers and a comfortable chair.
www.sawgrassink.com/education-events/digital-decoration-webinars

Archived Webcasts
Each online presentation is recorded and stored in our online Webcast Archives. Should you miss a live event or simply wish to review the material, you can view our webcasts 24/7 as needed. You will need to register one time for access, but after that you can freely come and go for knowledge on demand.
www.sawgrassink.com/education-events/digital-decoration-webcasts

How-To Application Videos
The Sawgrass How-To Video Series is designed to provide you with visual instructions for accomplishing a variety of digital decoration applications. Quick and to the point, they make learning new processes simple and painless. You will even find a video for each of the applications discussed in Chapter 9.
www.sawgrassink.com/education-events/digital-decoration-how-to-videos
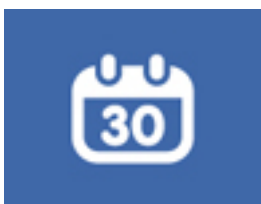
Industry Trade Shows & Events
Tradeshows and Conferences are the ideal way to find out about new technologies and solutions for growing your business. In addition to hands-on opportunities with cutting-edge digital decoration techniques, tradeshows also provide a range of educational opportunities in the form of seminars and workshops.

On the Sawgrass website, you can find a list of upcoming events, free passes to shows (where available) recommended seminars and lists of digital decoration Dealers that are exhibiting at the different shows.

Digital Decoration Knowledgebases
When you need a quick answer to a specific challenge, Sawgrass has the answer. We offer a intuitive knowledgebases for sublimation and for digital garment printing, easily accessible online 24/7.
http://www.sawgrassink.com/education-events/sublimation-knowledgebase
http://www.sawgrassink.com/education-events/digital-garment-printing-knowledgebase

Authorized Sawgrass Dealers
The extensive network of Sawgrass Dealers is composed of a diverse group of Business Professionals with a wide range of expertise and knowledge in many different markets and technical disciplines. Dealers are another great source for education and training resources. You can find a complete list of Sawgrass Dealers using our Dealer Locator.
www.sawgrassink.com/dealerlocator.php

Sawgrass Technical Support
The Sawgrass Technical Support section of the website contains useful manuals, instructional documents and videos that provide information for installing, operating and troubleshooting sublimation systems. Plus you can download the latest software drivers for your system as needed.
www.sawgrassink.com/technical-support

All of these resources and more can be found at www.sawgrassink.com.

We also encourage you to follow us on Twitter and Facebook, so that you can stay up-to-date with the latest information in regards to educational resources, including training, seminars, webinars, events and more.

Chapter 2 - Introduction to Sublimation Printing Technology

Overview

Dye sublimation is a digital printing technology that enables the reproduction of colorful images on common everyday items, including clothing and novelties. Prior to digital printing, reproducing images on these items (T-shirts being a typical example) required fairly involved and labor-intensive analog processes, such as screen-printing. Analog printing technology is not cost-effective when small quantities are involved, due to the immense amount of time preparing the artwork and the equipment for the production process. Therefore, if all you need is one, or even half a dozen items printed, analog printing is going to beexpensive and time-consuming.

On the other hand, digital printing, especially dye-sublimation printing, is quick and inexpensive in boththe setup and production, making it an ideal choice for creating personalized, one-of-a-kind items or for mass producing a variety of custom products. Moreover, dye-sublimation printing yields beautiful and permanent colors that are embedded in the substrate or fabric, rather than printed on the surface. Images on fabric won't fade or crack even after multiple washings. Images on hard substrates will not chip, peel or scratch.

The modern dye sublimation process is quite simple. You create an image on your computer, print it onto special transfer paper using sublimation inks, then apply the paper with the image to the item to be decorated. Using a heat press, the transfer paper is pressed onto the surface at 400 degrees farenheit, which then causes the sublimation inks to "transfer" from the paper to any polymer fibers within the substrate. After about a minute, the heat is removed and the transfer paper is peeled off, leaving behind a permanent, full color image on the substrate.

A Brief History of Sublimation—From Analog to Digital

Dye-sublimation printing was discovered in 1957 by Noël de Plasse, who worked for the French company Lainière de Roubaix. Mr. De Plasse understood that dyes could pass directly from a solid to a gaseous state when subjected to temperatures above 370° F (190° C). This change was termed Sublimation and is the basis of transfer printing, also known as dry printing.

Sublimation technology became popular in the late sixties and early seventies, the early years of modern computers, when dot-matrix printers were the prevailing technology. These printers used special ribbons impregnated with sublimation particles to create monochrome transfers.

The first computer driven sublimation system was developed in the mid 70's by Wes Hoekstra as an application of his image processing work with the Jet Propulsion Lab in Pasadena, California. Mr. Hoekstra has been credited with being the "father" of the computer image sublimation industry and his work led to the development of electrostatic sublimation in the early eighties.

Initially, electrostatic printing dependedon large volume printing in order to be cost effective, due to the expense of the equipment. But as electrostatic printing became widely used, it also became more affordable. As a result, toner cartridges containing sublimation inks became available for laser printers and copying machines and began to appear in the market. However, these types of printers were limited to creating single color or limited color transfers. Subsequent innovations in color copiers and laser printers later enabled the creation of full color transfers using electrostatic technology.

With the introduction of inkjet printers in the 90's, sublimation ink was formulated to work with various models of standard off-the-shelf desktop units, making it possible for anyone to create sublimation transfers without having to invest in costly equipment. Using a relatively inexpensive printer, a computer and a heat press, anyone can now produce full-color transfers cheaply and easily. The end result is a rapid conversion from analog to digital printing techniques and from a world of mass production to mass customization and personalization.

Sublimation, Dyes, PolymersAnd Substrates

To understand dye sublimation and to obtain consistently satisfactory results from the process, it is important to understand the technology. In the simplest terms, dye sublimation is a method of transferring a printed image from paper onto a variety of materials, or substrates. There are many types of substrates that can be used, and they include textiles (T-shirts being the most common), ceramics (mugs), glass, plastics (key chains, identification tags, and decorative auto license plates), rubberized polyester (mouse pads, coasters), and coated metal, to name a few.

To better understand how sublimation works its necessary to first become familiar with the key terms associated with the process:

Sublimation is a change of a solid particle directly into a gaseous state, i.e., without the particle becoming liquid.

A **dye** is a substance used to color materials and fibers. To dye is to impregnate color into a material. Often, this color change is permanent. In comparison, pigment inks, such as those used in screenprinting, are applied to the surface of a substrate.

A **polymer** is a chemical compound made of smaller and identical molecules (called monomers) linked together. Some polymers, such as cellulose, occur naturally, while others, such as nylon, are man-made. Because of their versatility, polymers are widely used in industry, including in the making of plastics, concrete, glass, and rubber.

Substrate is a term used to describe the base material onto which images are printed. Typical substrates include not only paper (coated and uncoated), but also fabrics, plastics, metal, films and foils.

Dye sublimation ink consists of a solid, heat-sensitive dye, which provides the color, dissolved in liquid. Under heat and pressure, the solid dye particles change into gas, bond with any polymers present, and change back into a solid. The high temperature used in sublimation opens the pores of the polymer and allows the gas to enter. When the substrate is removed from the heat source and is allowed to cool, the pores close, and the gas reverts to a solid, becoming a part of the polymer. As such, the dye particles can no longer be removed and will not wash out.

In most cases, dye-sublimation printing is done with inkjet printers, which spray their ink out of tiny nozzles onto transfer paper. Technically, the fluid that is stored in the inkjet cartridge is not ink, but just the carrier of the dye. When heat is applied to the transfer paper, the carrier stays on the paper, while the dye migrates from the paper to the substrate. The dye has very little color until heated, so the final image will look much different from that which you see on the paper.

It is important to note that sublimation inks are not liquid; they are solid particles. They are suspended in a liquid that allows them to flow through an inkjet printer, for example. The dye

particles are designed to bond only with polymers. Therefore, the higher the polyester content in the material, the more dye will bond to it, and the brighter the final image will be. This explains why it's not possible to sublimate 100% cotton fabrics. Similarly, other natural materials used in dye-sublimation, such as ceramic, glass and metal, are first coated with polymers before they can be used in sublimation.

White Is Best

The reason why nearly all sublimation is done on white substrates is thatdyes are actually transparent when sublimated. Therefore, white is the best background for the full color range to be visible and, most importantly, to exhibit their full vibrancy. Any other background may clash with one or more colors, often rendering them invisible, whereas white actually enhances all colors. For this reason, white substrates for sublimation are widely available and include poly-performance apparel, mesh-ball caps with a polyester front, polyester patches, ceramic plates, photo panels, mugs and tiles, mouse pads, jackets, beverage insulators, polyester calendars, clock faces, doll patches, polyester patches, plastic coasters, key chains and license plates, and coated MDF hard board (used in coasters and clipboards). It is possible to sublimate on substrates that are not white in color as long as the sublimation inks are predominantly darker than the substrate color. For example, black lettering on a red shirt. However, this is not recommended for photographs, logos, or detailed multi-color graphics as many of the image colors will be lost in the color of the substrate.

The Product Decorating Industry

Product decoration takes many forms, including embroidery, screen-printing and laser engraving, and is used to embellish a variety of items from soft goods such as textiles and handbags to hard goods such as wood and metal plaques. The focus of this section, however, is in the ways of transferring a printed image to a final product, or printing the image directly onto the product. Besides dye sublimation, these methods include direct-to-surface printing, screenprinting, and pad printing.

Direct-To-SurfacePrinting

Direct-to-surface printing, more commonly known as direct-to-garment (DTG) printing, involves the use of special inks and printers to print an image directly onto fabric surfaces, typically cotton or poly-cotton apparel. Direct printing, like screenprinting, can be used to print on white and light color substrates without any special techniques or preparations.

However, to print on a dark colored fabric, it is necessary to first print a white base underneath the color layer. Otherwise, any parts of the image that are the same color as the substrate will not be visible. In addition, the darker the substrate, the more subdued are the printed colors, thus the white layer also helps to restore some vibrancy to the ink colors. In addition, to print the color white on a non-white surface, white ink is necessary.

In order to be effective, white ink has certain chemical properties which enable it to dry quickly and to accept colored ink on top of it without smearing or distorting. Thus, it's imperative that users of white ink pay close attention to the maintenance requirements set forth by the equipment manufacturer to prevent the ink from drying out and clogging the print heads, which can result in costly repairs.While some DTG printers offer white ink capabilities, many do not and are thus limited to printing on white and light colored fabrics only.

Screen Printing

Screen printing is one of the oldest methods of printing. Also known as silk-screening, this is a printing technique that uses a specialized photo process to impose an image onto a fine mesh screen. Areas of the design that should be visible are left uncovered on the screen, whereas areas that should be blank are coated with an impermeable substance. Thus, ink can be forced through the mesh (only in the non-coated areas) onto the printing surface.

For multi-colored designs, the artwork is broken into individual segments (layers) by color and a screen is created for each individual color of the design. Thus the ink is applied in layers by color to create the final image. The configuration of the equipment determines the number of colors that can be printed. For example, a four station press can print a maximum of four different colors within a design.

One drawback of screen printing is that the method does not normally allow for halftones, or shades of colors, thus a dark green and a light green would be considered a two-color imprint. In addition, when multiple colors are used, color alignment, or registration, is difficult as each color is applied individually. Generally, a 1/16th or 1/8th inch shift can be expected. Because of this registration difficulty, small type text (under 12 point) is difficult to reproduce.

The advantages of the digital processes, such as sublimation over screenprinting are all in the set-up. Screenprinting is fine when you have a long run of identical products, because the set up is expensive and time consuming. With digital, you are working from an image produced or edited in a computer program, an image that can be changed and printed in seconds, and with virtually unlimited shades of color. As such, you can cost-effectively produce one image for one substrate. This is not possible with the high setup costs and time required for screenprinting.

As dye sublimation costs have come down in recent years, the market for digital dye sublimation has grown exponentially. As a result, the industry has experienced a growth in mass customization, with the ability of small companies to create their own unique corporate identity using hundreds of different substrates.

Pad Printing

Pad printing is especially suited for printing on irregular shaped or contoured objects and on relatively small areas. Pad printing can be compared to printing with a rubber stamp.A pad-printing system consists of three elements: a cliché, the ink and a pad.

The cliché is a plate onto which the image to be printed is etched. The cliché is usually made of a polymer coating on a metal backing or of hardened steel. Once placed on the printer, the cliché is inked either by an open inkwell system or by a closed ink cup sliding across the image.

Pad-printing inks are available in every color imaginable and are specific to the substrate. Different substrates react differently to the inks.

The pads are made of a silicon material, which can vary in hardness. The properties of the silicon allow the inks to temporarily stick to the pad, yet fully release from the pad when it comes into contact with the substrate, or product to be printed. The hardness of the pad dictates how the image molds to the product.

While multiple colors can be used in pad printing, a single color generally produces the best results. Pad-printing applications tend to fall into three main categories:

- **Precision printing**—The application of letters or symbols onto a substrate.
- **Decoration**—A design or effect that is applied to a product to enhance the look of the product. Effects include unusual patterns, simulated wood grain, and the like.
- **Coding** (except bar coding)—The printing of information that must be legible, but not necessarily of high quality. An example is date stamping on containers and other packaging.

Chapter 3 – Create-Print-Press: The Sublimation Process
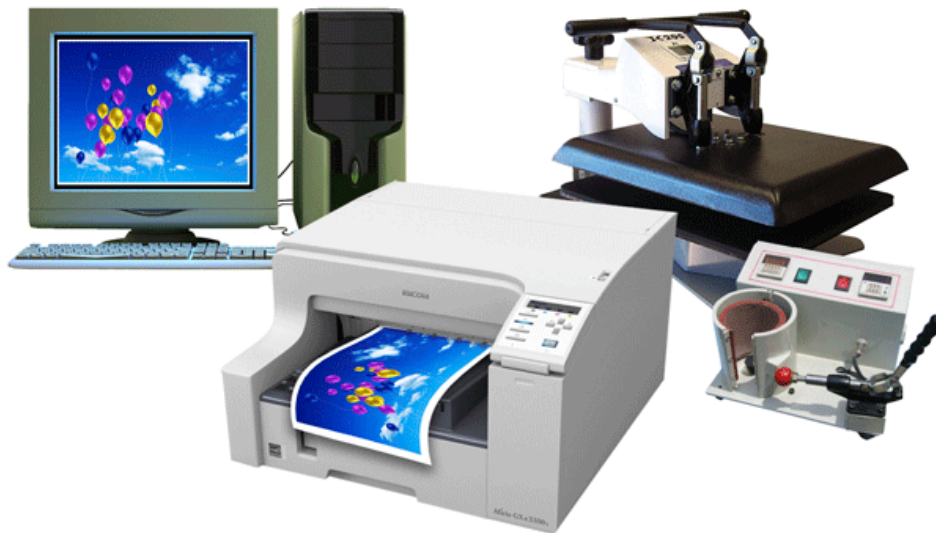
Dye sublimation printing makes it possible to create highly profitable customized products in a quick and easy three-step process:

Create! Create an image or import your artwork into a graphics program, such as CorelDRAW® or Adobe® Photoshop®.
Print! Print your image using SubliJet IQ® or ArTainium® UV+ sublimation inks, a standard Epson® or Ricoh printer and high quality sublimation paper.
Press! Transfer your image onto your desired substrate (T-shirt, mug, mouse pad, or other) by using a standard flatbed or mug heat press.

Image Creation & Preparation

The first step is to create or prepare an image for sublimation. Upcoming chapters will provide specific information and recommendations for things like resolution and color correction, but in general the goal is to create the highest quality image possible.

Sublimation, like any other form of digital decoration, is simply a means to produce an image on a substrate. Though sublimation has the capability of rendering finished images with an extremely high level of detail, clarity and sharpness, the final product will never be better than the initial image.

Think of the computer phrase GARBAGE IN = GARBAGE OUT when creating your artwork. If you initial image is low in quality, then it's logical to assume that the sublimated image will be too.

To get stunning results, you must generate stunning images during the creation stage, as the printing and pressing stages will only duplicate what is developed in the creation stage.

Assuming you have the ability to create, edit and/or modify artwork for sublimation, the beauty of the process is that pretty much any graphics software will do. Unlike embroidery and certain other forms of product decoration, no specialized software is required to create images for sublimation. In theory, all you need is a program that will generate and output standard graphic files that can be read by an inkjet printer setup for sublimation.

The most popular choices of software are Adobe Photoshop and CorelDRAW. Other commonly used programs include Illustrator, Photoshop Elements, and Paintshow. All of these programs are designed specifically to create and edit graphic images, though each has its own unique characteristics.

Sublimation Printers

Printers fall into two main categories: small and large format. Small format describes all printers under 42" in print width, whereas large format references printers that are capable of printing images wider than 42". In general, small format printing is also referred to as desktop printing and wide format printing is referred to as industrial printing.

Piezo Electric Heads

Though small format sublimation printing utilizes desktop inkjet printers, it doesn't mean that just any office style printer will work. Only printers that do not use heat to print are capable of working with sublimation inks.

Piezo-electric print heads, a proprietary technology of the Epson Corporation, use a piezo crystal at the back of the ink reservoir. This is rather like a loudspeaker cone - it flexes when an electric current flows through it. Whenever a dot of ink is required, a current is applied to the piezo element causing the element to flex, which in turn forces a drop of ink out of the nozzle. No heat is generated in the process, thus the sublimation ink is not prematurely turned into a gas, which would happen if using the standard thermal print heads found in most brands of desktop inkjet printers.
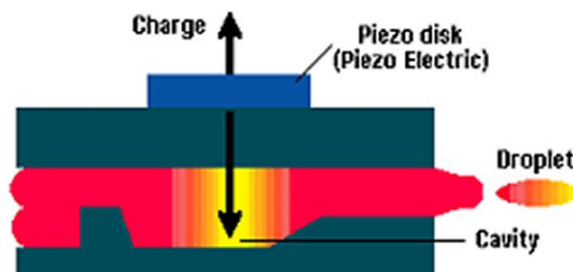
There are several advantages to the piezo method. First, the process allows more control over the shape and size of ink droplet release. The tiny fluctuations in the crystal allow for smaller droplet sizes and hence higher nozzle density. Also, unlike with thermal technology, the ink does not have to be heated and cooled between each cycle. This saves time and the ink itself is tailored more for its absorption properties than its ability to withstand high temperatures. This allows more freedom for developing new chemical properties in inks.

Resolution

Most of today's inkjet printers are capable of well above 720 dpi even as high as 5600 dpi. These super high resolutions are not needed for dye sublimation as you should never print above 1440 dpi and 95% of the time you will only need to use a maximum of 720dpi. Any subtleties you may gain using one of the higher dpi settings will be lost when the ink turns into a gas for the sublimation process.

Transfer Papers

You must use a high quality transfer paper designed to support commercial sublimation. Because the paper is the media that receives the sublimated image and transfers it to the item being

decorated, it's a critical part of the process and can have a detrimental affect when an inferior product is used.

For the most current list of supported printersand papers, visit www.sawgrassink.com

Heat Presses

Sublimation without a heat press is like a broken pencil – pointless. There are many types and sizes to choose from depending upon your products and since sublimation requires precise temperature and pressure, it's imperative that you invest in a good quality unit. Presses come in three basic configurations: flat, mug or cap.

The flat (flat platen) press is available as a clam-shell style or a swing-sway style. The clam-shell version opens and closes like a clam, where the bottom platen is stationery and the top platen moves up and down. The swing-away press opens by lifting up the top platen, but then will move sideways completely out of the way for ease of placement and removal of transferred products.

Examples of clam-shell heat presses
The most commonly used press in sublimation. These units are required for all flat products such as plastics, metals, ceramics, plaques etc. and t-shirts.

Examples of swing-away heat presses
The heated platen swings completely away to allow access to the transferred product.

Non-flat products require special heat presses such as the mug press and the cap press. Since both the mug and the cap have curved surfaces, the mug and cap presses are designed to fit the curvature of those products. There are also combination presses which offer both flat and curve pressing capabilities via the use of specialized attachments.

Examples of mug presses
The mug is placed inside of a rounded heating element which provides equal pressure and temperature all the way around.

Examples of cap presses
Heat and pressure is applied only to the front panel of the crown of the cap.

Examples of combination presses
A combination press with various attachments can be the answer to the problem of creating a variety of different products with one heat press.

Product Applications for Sublimation

There are literally hundreds of different applications for dye sublimation, meaning plenty of profitable business opportunities for digital decoration. The primary limitation is that the surface must be composed of polymer fibers and able to withstand 400° F of temperature without melting. Provided those criteria are met, sublimation will create a premium full-color, photographic-quality image that will not crack, peel or wash away from the substrate.

Apparel - Decorated apparel is a wide-ranging application for sublimation. Everything from t-shirts to cycling jerseys to soccer uniforms is a possibility. The ever-growing popularity of poly-performance apparel is opening up new sublimation opportunities everyday.

Promotional Products - Mugs, mouse pads, clipboards, and message boards (to name a few examples) are ideal promotional products which are easy to sublimate and easy to sell.

Awards and Recognition - Plaques and trophies that were once limited to single color images and/or engraving can now be decorated with high resolution, full color images via sublimation.

Signage - Create on-demand, high impact POP, tradeshow or interior signage, enabling your customers to effectively market time-sensitive products or price changes.

Photo Gifts – From personalized gift items such as magnets, license plates, clocks, dolls and to commercial photo panels, sublimation is the perfect application for delivering high quality photographic images to a wide range of markets.

Sporting Goods - Sell custom designs by allowing your customers to see a finished product (snowboards, skis and more) before committing to more traditional print runs.

Textiles - Customize fabrics to be used in various cut-and-sew applications with dye sublimation inks for virtually indestructible images that are incredibly vibrant and detailed.

Tile Murals Error! Bookmark not defined. - Customized ceramic tiles are transforming home and office décor with unique and fully customized images for kitchens, bathrooms, foyers, museums, restaurants, and offices.

Sublimation works well as a stand-alone business or as an addition to an existing business looking to diversify into new markets with unique applications and products. When assessing the sublimation business opportunities, pay close attention to the substrate size, as it will be necessary to invest in both a printer and a heat press that is large enough to support the required image size.

Frequently Asked Questions

Why can't I sublimate onto a dark material?
This is not ink. This is a dye. Adding a little color to something that is dark doesn't do much of anything. If you have a bucket of black paint and add a cup of green, what do you get? It doesn't make the paint green. It may add a hint of green to the black, but you might not be able to notice.

Why can't I reclaim shirts like in screen-printing?
This is not ink that sits on top of the fabric. It is a dye that penetrates the fiber of the fabric.

There were some spots on my transfer I didn't see before pressing. How do I remove them?
If the shirt is 50 to 100% polyester, the chances are 99.9% that you cannot remove the spots. If you can, you are probably not transferring your images correctly, or there is something else seriously wrong. You can try bleach, but it shouldn't work. If sublimation is done correctly on polyester, the dyes are permanent, as they have become part of the fabric.

Can dye sublimation be used on ceramics, glass and metal?
All of these products need a coating, which is a special layer of polymer for the dyes to bond.

Can I sublimate plastics?
You cannot sublimate onto just any piece of plastic. Many polymers cannot withstand the amount of heat needed to achieve sublimation. Even if they could stand the heat, the added pressure and press time will deform them. Many of them melt and shrink. (Fiberglass Reinforced Plastic (FRP) is the plastic of choice.

Do fabrics have to be 100% polyester?
You can't sublimate onto cotton because the dye particles are designed to bond with polyester and ignore everything else. Fabric enhancers, preparation sheets and sprays are used to add a layer of polyester to non-polyester fabrics so you can sublimate onto these fabrics. This technique works better on 50/50 shirts, since the added polyester can bond better with the polyester that is already part of the shirt, and then the dye also will have more polyester with which to bond. However, if you wish the image to be as bright and vibrant as possible, you must use 100% polyester.

What images do I use?
You can use any image that you can import to or create on your computer with such popular programs as CorelDraw and Adobe Photoshop. More on this in upcoming chapters.

Chapter 4 – Understanding Color & Light

Color Gamuts
A Color Gamut is the range of colors which can be reproduced by any given device (scanner, camera, monitor, printer etc.).Following is a list of representative color systems in order from large to small color gamut.

Photographic Film
This is one of the best systems available for detecting and reproducing color. Movie-goers are familiar with the difference in color quality between the film projections seen in theaters and the home video versions. This is because the color gamut of film far exceeds that of television.

Laser Light Shows
Lasers can produce very nearly monochromatic light, allowing colors far more saturated than those produced by other systems. However, mixing hues to produce less saturated colors is difficult with lasers.

CRT
CRT (cathode ray tube) and similar video displays have a roughly triangular color gamut which covers a significant portion of the visible color space. In CRTs, the limitations are due to the phosphors in the screen which produce red, green, and blue light only, and then have to be combined to create the desired final color.

Liquid Crystal Display
LCD screens filter the light emitted by a backlight. The gamut of an LCD screen is therefore limited to the emitted spectrum of the backlight. Typical LCD screens use fluorescent bulbs for backlights, and have a gamut much smaller than CRT screens. LCD Screens with certain LED backlights yield a more comprehensive gamut than CRTs.

Television
Television uses a CRT display (usually), but does not take full advantage of its color display properties, due to the limitations of broadcasting. HDTV is far better, but still somewhat less than that of similar products using the same display technology, such as computer monitors.

Paint
Paint mixing, both artistic and for commercial applications, achieves a reasonably large color gamut by starting with a larger palette than the red, green, and blue of CRTs or cyan, magenta, and yellow of printing. Paint may reproduce some highly saturated colors that cannot be reproduced well by CRTs (particularly violet), but overall the color gamut is smaller.

Printing
Ink printing typically uses the CMYK color space (cyan, magenta, yellow, and black). A very few printing processes do not include black; however, those processes are poor at representing low saturation, low intensity colors. Efforts have been made to expand the gamut of the printing process by adding inks of non-primary colors; these are typically orange and green or light cyan and light magenta. Spot color inks of a very specific color are also sometimes used.

The examples above show that ink printing offers a very small color gamut that flounders at the bottom of the gene pool.

So what is a color gamut gauge and how does it affect us as Dye Sublimation Printers?

The human eye can distinguish about 300,000 colors which have been defined by empirical analysis based on**Color Mixing**. For the color mixing analysis process, three colors are chosen to act as the standard primary colors. A common choice is: red, green and blue. By mixing these primary colors with varying intensities many different colors can be produced. For a given set of primaries the totality of colors that can be produced is called the color gamut. Unfortunately whatever the choice of primary colors the color gamut associated with the primaries can never match the gamut of visible colors using only positive weightings.

The usual standard used as a reference is that produced by the Commission Internationale de l'Eclairage (CIE) in 1931 which defined three primary colors that can be combined additively with no negative coefficients to produce all visible colors.

The CIE model below is very useful as a standard. However because it is based on three imaginary color primaries it is not practical to use in hardware devices. Thus, various other more practical standard color models have been created for everyday use.
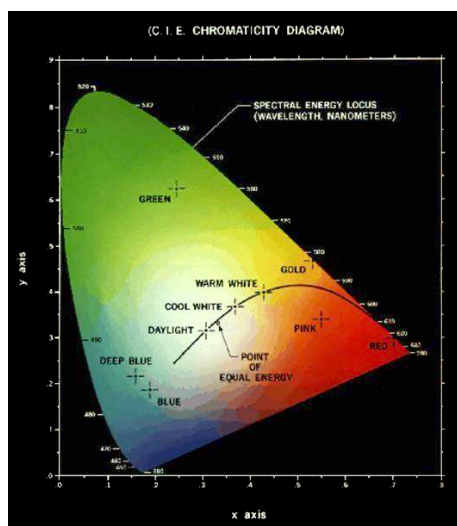

Some of the more common color models are:

RGB - The RGB model is the usual method of describing colors on monitors. The actual red, green and blue primaries used depend upon the phosphors used on the monitor. It is not possible to define the complete set of visible colors as defined by the CIE standard with the RGB primaries.

HSB – The HSB model is based upon Hue, Saturation and Brightness. This model allows a more intuitive method of designing a color.

CMYK – The CMYK model is a subtractive model that is used in printing. It uses the subtractive primaries Cyan, Magenta and Yellow. In addition because it is impossible to produce a pure black from these primaries a Black (K) primary is added thus giving the CMYK model. When the gamut of this model is plotted on the CIE diagram it only covers a subset of the interior and will not usually cover the entire monitor gamut either. Thus the image on a monitor can never be completely accurately captured in print.

Here we see an example of the different color ranges of two devices.The difference has been exaggerated for clarity.
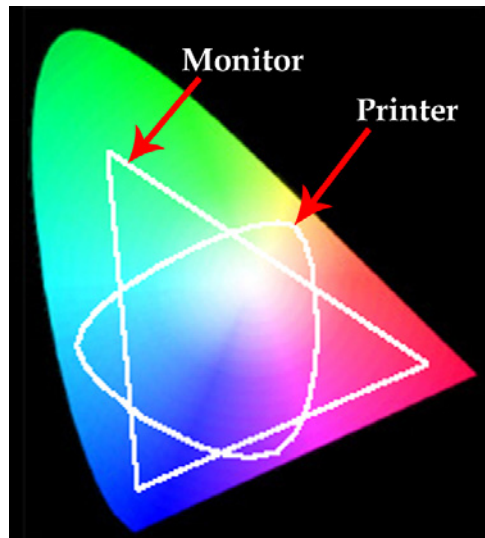
This clearly demonstrates why the colors of an image on the computer screen never look quite the same as the colors in the final printed image. To try and compensate for this anomaly we use a **rendering**designed for handling out-of-gamut colors.

Perceptual Rendering
Perceptual rendering attempts to compress the gamut of the source space into the gamut of the destination space in such a way that the overall relationships between the colors (and hence the overall image appearance) is preserved, even though all the colors may change in the process.

Absolute Colorimetric Rendering
Absolute Colorimetric rendering matches those colors in the source space that are inside the gamut of the target space exactly and forces out-of-gamut colors to the nearest reproducible hue, sacrificing lightness and saturation.

Relative Colorimetric Rendering
Relative Colorimetric rendering first scales the white of the source space to the white of the target space, adjusting all other colors relative to that white. Then it matches the adjusted colors in the source space that are inside the gamut of the target space exactly and forces out-of-gamut colors to the nearest reproducible hue, sacrificing lightness and saturation.

Saturation Rendering
Saturation rendering maps fully saturated colors in the source space to fully saturated colors in the target space, sacrificing hue and lightness.

We recommend Perceptual Rendering as the one to use for all your printing output.When using this method the entire gamut of the image is compressed to fit within the gamut of the destination device.

This means that all of the colors that were actually in-gamut will need to be adjusted to make room for the out-of-gamut colors. Moreover, unlike what happens in the saturation rendering processes, with perceptual rendering all pixels are treated with respect for each other. As a result, out-of-gamut pixels may not be moved to the closest reproducible color.

You may think that this adjustment makes every color wrong. That assumption, in fact, is correct. Therefore, it would seem that perceptual rendering processes would make things even worse.But strangely enough that is not the case because all of the colors have been adjusted proportionally, even those that the destination device could accurately reproduce. With perceptual rendering, the chance that a viewer will notice that all of the colors have been modified is minimized. This is the most common rendering intent that is used when converting from RGB to CMYK color space.

RGB vs CMYK

Computer monitors emit color as RGB (red, green, blue) light. Although all colors of the visible spectrum can be produced by merging red, green and blue light, monitors are capable of displaying only a limited gamut (i.e., range) of the visible spectrum.

Whereas monitors emit light, inked paper absorbs or reflects specific wavelengths. Cyan, magenta and yellow pigments serve as filters, subtracting varying degrees of red, green and blue from white light to produce a selective gamut of spectral colors.

Like monitors, printing inks also produce a color gamut that is only a subset of the visible spectrum, although the range is not the same for both. Consequently, the same artwork displayed on a computer monitor may not match that on a printed publication. Also, because printing processes, such as offset lithography use CMYK (cyan, magenta, yellow, black) inks, digital art must be converted to CMYK color for print.

Many printers now prefer digital art files be supplied in the RGB color space with ICC profiles attached. Images can then be converted to the CMYK color space by the printer using color management methods that rely on color profiles if present; this helps preserve the best possible detail and vibrancy.

RGB – Additive   CMY - Subtractive
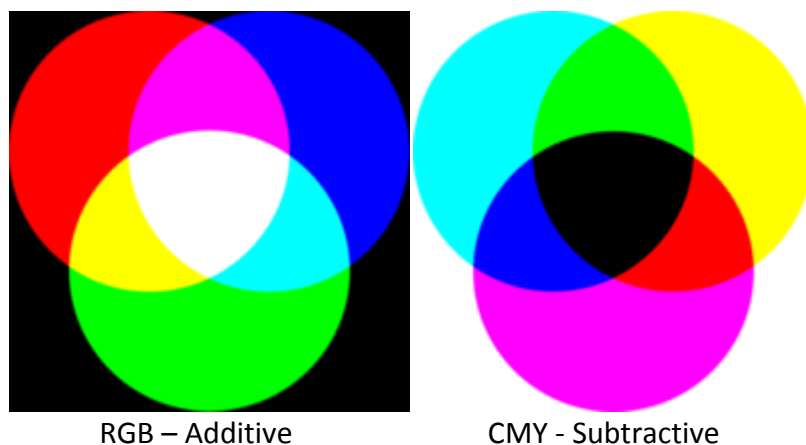
The two diagrams here show just how distinctly different the Color Spaces are. This also helps to explain the difficulty in accurately converting from one space to another.

(Don't let this information overwhelm you. On a day-to-day basis you will most likely be using either the Sawgrass PowerDriver or an ICC profile to manage color. More on this coming up.)

Chapter 5 - Color Management & Correction

Color Matching

Creating color accurately on paper has been one of the major areas of research in color printing. Like monitors, printers closely position different amounts of key primary colors, which from a distance, merge to form any color. This process is known as **dithering**.

Monitors and printers do this slightly differently however because monitors are light sources, whereas the output from printers reflects light. Monitors mix the light from phosphors made of the primary additive colors: red, green and blue (RGB), while printers use inks made of the primary subtractive colors: cyan, magenta and yellow (CMY). White light is absorbed by the colored inks, reflecting the desired color. In each case, the basic primary colors are dithered to form the entire spectrum. Dithering breaks a color pixel into an array of dots so that each dot is made up of one of the basic colors or left blank.

The reproduction of color from the monitor to the printer output is referred to as color matching. Colors vary from monitor to monitor and the colors on the printed page do not always match up with what is displayed on-screen. The color generated on the printed page is dependent on the color system used and the particular printer model, not by the colors shown on the monitor.

Color Management

If color is to be an effective tool, it must be possible to create and control consistent, predictable color in a production chain: scanners, software, monitors, printers etc. The challenge is that different devices can't create the same range of colors. It is in the field of color management that this color matching effort comes into its own.

Recognizing the problems of cross-platform color control, the ICC (International Colour Consortium) was formed in March 1994 to establish a common device profile format. The founding companies included Adobe, Agfa, Apple, Kodak, Microsoft, Silicon Graphics, Sun Microsystems, and Taligent.

The goal of the ICC is to provide true portable color that will work in all hardware and software environments, and it published its first standard - version 3 of the ICC Profile Format - in June 1994.

There are two parts to the ICC profile; the first part contains information about the profile itself, such as what device created the profile and the second is colormetric device characterization, which explains how the device renders color.

Color Correction

With dye sublimation there is another element of the color control process that has to be addressed. When a dye sublimation transfer sheet is pressed onto a substrate, the ink turns into a gas to bond to the polymers of the substrate. During this "gassing" certain colors will 'shift' so the finished product will not look like the original image on the screen or the image that printed out on the transfer paper. **Color correction** is the art of adjusting this color transformation so that you can produce the best quality results on your substrate.

(It should be noted that the colors of the ink printed on the transfer paper are very different from the final image that is created when heat and pressure is applied due to the chemical characteristics of the dye sublimation process. Thus, there is no need to consider the ink colors at this stage when performing any type of color correction.)

When using dye sublimation ink, color correction needs to be addressed for each individual printer and ink combination. In extreme circumstances color correction may be needed for every combination of printer/ink/substrate and transfer paper. However, extensive testing has shown that in most cases good quality transfer paper does not affect the final color, therefore it's recommended that you only deal with high quality papers.

It should be noted, that suitable substrates for sublimation will have white surfaces. However, there are varying degrees of white, which technically could have an affect on the colors of the final image. But in reality, these varying shades have little or no effect on the finished appearance, and thus it's not necessary to perform color correction for every shade of white surface you come in contact with.

Another factor that must be considered when addressing color correction is that each device that deals with an image, whether it's your scanner, digital camera, monitor or printer has a unique way of handling color. The subtle differences among these devices must be overcome and replaced by consistency of color interpretation by known standards.

Different Methods Of Color Correction
There are two basic methods of color correction for dye sublimation: ICC profiles and custom printer drivers. Though both methods are somewhat similar, they have specific differences.

An **ICC (International Color Consortium) profile** is basically a software file that ensures that when a specific color is selected on the computer screen, the designated color is consistently and correctly delivered on the substrate. Think of it as a color matching program, as the screen color rarely produces exactly the same output color. Thus a profile creates a link between specific screen colors and specific output colors. It doesn't change the color, rather it ensures the correct output for a given input.

To use this method you must work with ICC compliant software (e.g. Photoshop, Corel). The profile will be placed in the output stage of printing and the manufacturer's (OEM) printer driver will be set to 'No Color Adjustment'. This method will color correct the image and then send the data to the printer without affecting the colors further.

Color correction profiles for dye sublimation have their own unique problems. Under normal profile creation when a printer has printed out the color swatch for testing, the profiling software knows how to adjust the colors to print out the correct ones. When a dye sublimation transfer is pressed onto a substrate the ink turns into a gas and while in this state the colors change properties.This change can be quite dramatic (e.g. some blues look like green on paper) and it is therefore impossible to judge whether the print is correct or not. Thus, many Sublimators create custom profiles that correlate the screen color to the final sublimated color, rather than just to the ink color.

Custom printer drivers are software programs that have color correction built into the printer control system. The advantage of this method is the ability to use non-ICC compliant software (e.g. Paint Shop Pro, Print Shop) as well as ICC compliant software, as the color correction is performed

at the printer driver stage. In addition, it's easier and less technical to use a custom printer driver than it is to use an ICC profile.

Sawgrass offers the exclusive PowerDriver™ printer driver system for most of its sublimation products. It contains built-in profiles specific to the sublimation process. It should be noted that PowerDriver™ works with most popular graphics programs including Photoshop and CorelDraw.

The PowerDriver™ software inserts a color palette (ColorSure™) into the graphics program so that a user can select colors from the palette while working on images and thereby ensuring that the correct "final" color will be consistently produced during the sublimation production process.

It is suggested that the user print out and sublimate the entire palette to a pure white substrate, and then retain this color "chart" as a visual reference for working with the ColorSure™ palette. The printed chart demonstrates the exact color that is created via sublimation (plus the RGB settings), so the graphic designer has an accurate reference when choosing the proper colors for the image being created.
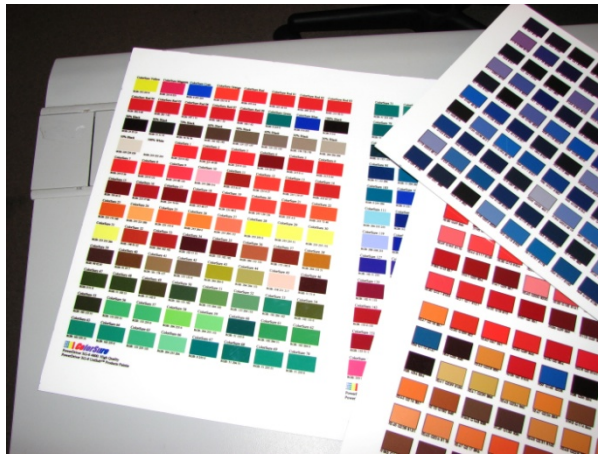
Chapter 6 – Working With Graphic Image Files

Image Formats And Graphics Software

There are two basic types of image formats: vector and raster. The type of format will determine how and what you can edit within the image.

A **raster** graphic or bitmap is a data structure composed of a rectangular grid of pixels or points of color that represent an image. Most pictures taken with a digital camera or found on the web are examples of raster graphics. A raster image is technically categorized by the width and height of the image in pixels and by the number of bits per pixel (color depth) which determines the number of colors it can represent.

The larger a raster image is, the more disk space the image file will take up. For example, a 640 x 480 image requires information to be stored for 307,200 pixels, while a 3072 x 2048 image (from a 6.3 Megapixel digital camera) needs to store information 6,291,456 pixels.

Since raster graphics need to store so much information, large bitmaps require large file sizes. Fortunately, there are several image compression algorithms that have been developed to help reduce these file sizes. JPEG, BMP, TIFF, GIF and PNG are the most common compressed image formats on the Web, but several other types of image compression are available.

Raster graphics can typically be scaled down with no loss of quality, but enlarging a bitmap image causes it to look jagged and "pixelated." A raster file is also difficult to modify without loss of information, although there are software tools that can convert a raster file into a vector file for refinement and changes.

Vector graphics, unlike raster images, are not made up of a grid of pixels. Instead, vector graphics are comprised of paths, which are defined by a start and end point, along with other points, curves, and angles along the way. A path can be a line, a square, a triangle, or a curvy shape. These paths can be used to create simple drawings or complex diagrams.

Because vector-based images are not made up of a specific number of dots, they can be scaled to a larger size and not lose any image quality. If you enlarge a bitmap file, it will have rough edges and fuzzydetail. In contrast, enlarging a vector graphic, yields an object with smooth edges and fine detail. This makes vector graphics ideal for logos, which can be small enough to appear on a business card, but can also be scaled to fill a billboard. Common types of vector graphic files include AI, SVG, DRW, CDR and EPS.

Here are the most popular graphic software packages and the image formats they are based on:
Adobe Photoshop (Raster)
CorelDRAW (Vector)

Adobe Illustrator (Vector)
Corel Photo-paint (Raster)
Corel (ex JASC) Paint Shop Pro X (Combination of Vector and Raster)

As with any printing production, to produce high quality results you must start with a high quality image. Whether you are creating your own designs or working with existing designs you must be critical of the original. Unless you are satisfied with what you see on-screen you are not likely to be satisfied with the end result.

Graphic Image File Types

There are many universally recognized file types for storing images. Here is a list of the most commonly used formats as well as specific details about the characteristics of the file type:

bmp

A .bmp (commonly referred to as bitmap*) file is a raster-based or pixel-based format that only supports the RGB color space and bit depths of 1, 4, 8, or 24 bits per channel. These attributes make bitmap images unsuitable for use in a high-end print production workflow.

Bitmap files have some confusion associated with them as most people refer to any pixel-based image as a bitmap file. However, a true bitmap image file refers to the standard Windows image format. This type of file is mostly used on DOS- and Windows-based machines.

eps

An encapsulated post script file is a graphics format that describes an image in the PostScript language. An extension of the PostScript graphics file format developed by Adobe Systems, eps lets PostScript graphics files be incorporated into other documents. The eps file format supports both vector graphics and raster images as it can contain two versions of an image: a bitmap used to display the image on the screen, and a PostScript^{TM} description used to print the image.

psd

Adobe Photoshop (.psd) files are generally written and read by Photoshop exclusively, however, there are several other applications that will read this format. Most page layout applications (except Adobe InDesign), do not allow native Photoshop images to be placed. A Photoshop file will retain all of the original files attributes. Saved file characteristics include the following: resolution, color info (CMYK, RGB, grayscale), spot color channels and image bit depth.

jpeg (jpg)

The jpeg (Joint Photographic Experts Group) file is one of the most commonly used graphic formats. Initially, this raster file format was intended for use in Web applications, but has found a home in the high-end print production markets, as well. The jpeg file format can be your best friend if used properly, or your worst enemy if implemented incorrectly.

A jpeg file is encoded by using an adjustable loss compression approach. This means that to achieve smaller file sizes, image data is actually thrown away. In small doses, the jpeg compression approach can be very effective and efficient. However, in larger amounts, the resulting file will contain distortion and blurriness in the image. Thus caution must be used when preparing jpeg files for use in a print production workflow. The jpeg format will support the RGB, CMYK, and grayscale color settings.

tiff (tif)

The tiff is, in principle, a very flexible format that retains all of the image data when edited or resized as the details of the image storage algorithm are included as part of the file. In practice, tiff is used almost exclusively as a lossless image storage format that uses no compression at all Consequently, file sizes are quite large. (Sometimes a lossless compression algorithm called LZW is used, but it is not universally supported.)*Of the file formats discussed, the tiff is probably one of the best for dealing with high quality images.*

JPEG Compression versus TIFF Quality

As you apply greater amounts of JPEG compression, an image gets smaller in size and at the same time it undergoes a certain degree of degradation of image quality by virtue of the process. Take a look at the images below. One has been highly compressed as a jpeg the other is an uncompressed tiff.

| Uncompressed tiff | Compressed jpeg |
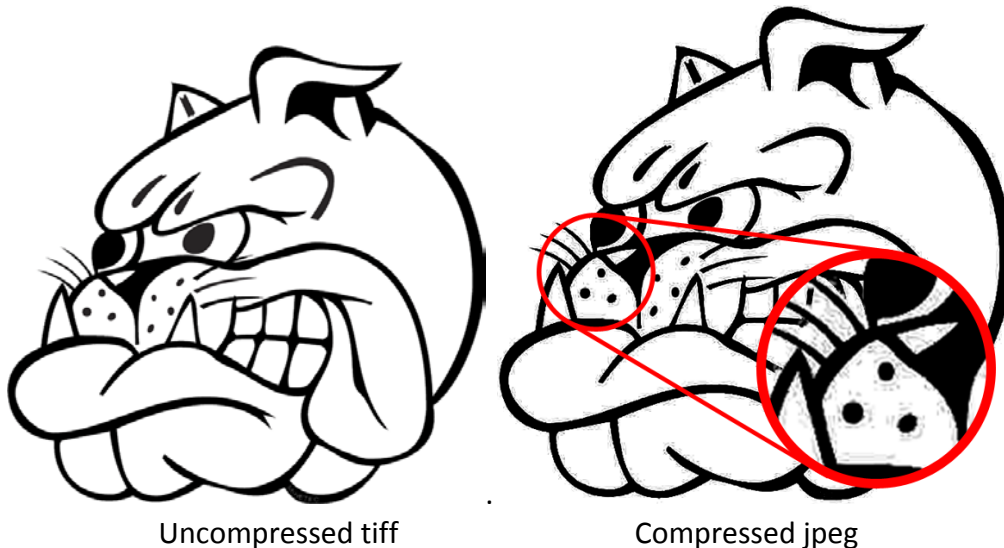
On the tiff, notice how this image has crisp and clean edges. This image will reproduce well. The jpeg on the other hand has much softer edges that appear fuzzy, plus there is some "noise" (unwanted pixels) in the red circle which gives the image a "dirty" look. In most cases, the noise is not readily visible on the computer, but shows up during printing.

There is no going back!
Since the jpeg compression process removes image data, once an image has been compressed (or over compressed), the damage done is permanent. Even if you try to convert the compressed jpeg image to a tiff image, you cannot fix the issues. Unfortunately there is no repair for an over compressed JPEG image.

Chapter 7 – PreparingRaster Images For Sublimation

One of the most frustrating aspects of producing decorated products from digital images is the quality of some of those original images. Unless you start with a good source image there is very little chance of producing a high quality product. Think of the computer phrase "garbage in = garbage out".   No matter how good your sublimation printer is, it can never output an image that is higher in quality than the graphic image file that was delivered to it. A good measurement of quality, especially with raster images is resolution.

Resolution

Resolution is a measurement of image quality. In general, an increased amount of resolution means that an image is sharper and displays more detail. Every raster digital image whether a scanned image, a printed image or an image displayed on your monitor is composed of tiny dots. The more dots in a given space, the greater the resolution will be.

When dealing with graphics files there are three properties that go into determining the resolution of an image file: pixels, dpi and inches.

Pixelsrefers to the total number of 'dots' both horizontally and vertically that make up the file. This is the actual resolution of the file. Once a raster image is created, the total number of pixels is fixed.

dpirefers to the number of 'dots' or pixels per each inch of a printed or scanned document. The more dots, the higher the quality of the image.

Inchesis a linear measurement thatrefers to the actual physical size (either printed or scanned) of an image.

The following formulas illustrate the relationships between the different parameters that define resolution:

<p align="center">pixels = inches X dpi
dpi = pixels/inches
inches = pixels/dpi</p>

Example: An image is created in Photoshop at 300pixels x 300pixels with a dpi of 100. What is the actual size in inches?

Width: 300pixels/100 dpi = 3 inches
Height: 300pixels/100 dpi = 3 inches

Image size will be 3" x 3"

If you look at the Image Size Menu in Photoshop you can see a little easier how these parameters relate.Notice the Resample Image check box. This determines whether you want to actually resize the image. With this box unchecked, when you enter a new DPI Photoshop will automatically change the DPI to compensate and vice-versa.
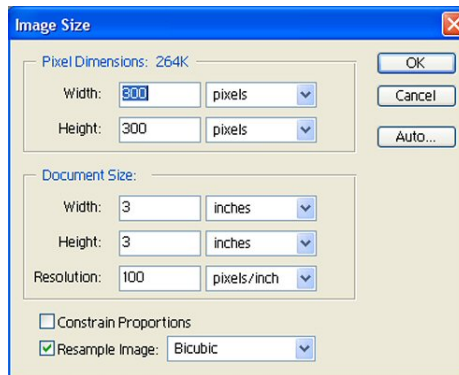
Resolution And Resizing

A digital raster image has no absolute size or resolution. All it has are a certain number of pixels in each dimension. Obviously the resolution changes as the image size changes because the number of pixels that make up the image are being spread over a greater or lesser area. Therefore the resolution changes accordingly.

Suppose you had an image provided to you by a customer that was 4" x 4" with a dpi of 350. Using the formula **pixels = inches X dpi** you would see that the image has 1400 pixels x 1400 pixels.

pixels = inches X dpi
1400pixels = 4.0inches X 350dpi

But what if you wanted to make it larger, say 9" x 9"? Because the number of pixels are fixed for a raster image (after its created) you would be spreading out the same number of pixels over a wider space, which effectively lowers the dpi rating and the result is a lower resolution image.

dpi = pixels/inches
155.55dpi = 1400pixels/9.0inches

Conversely, reducing the size of the image will actually increase the resolution or at least the dpi setting as the pixels are compacted into a smaller space. In the case of a new image size of 3" x 3", the resolution will increase.

dpi = pixels/inches
466.67dpi = 1400pixels/3.0inches

A good rule of thumb is that you can always decrease the size of a raster image without degrading the resolution, but increasing it could cause quality issues.

Resolution And Equipment

The resolution of an image is impacted by the device that creates or displays it as each one (scanner, digital scanner, monitor) has a maximum number of dots that it can process and display, no matter how many dots are in the image.

Example:A 300 dpiinkjet printer can print up to 300 dots of image information in an inch. If you print an image that was scanned at 600dpi, the extra pixels are "discarded" by the printer since it's not capable of processing them. When an image has more dots than the processing device can support, those pixels are wasted. They increase the file size but don't improve the quality of the printed image. Bottom-line, the resolution is too high for the device.

NOTE: A photograph scanned at both 300 dpi and at 600 dpi will look the same printed on a 300 dpiinkjet printer.

Example: Pictures on the Web are usually 96dpi or 72 dpi because that is the resolution of most computer monitors. If you print a 72dpi picture on a 600dpi printer, it won't usually look as good as it does on the computer monitor, as the printer doesn't have enough dots of information to create a clear, sharp image. It may be necessary to reduce the physical image size in order to increase the dpi value to take advantage of the printer resolution.

Obviously, when creating the initial image you should focus on higher resolutions and larger image sizes so that you have plenty of range to work within. This refers to the INPUT or CAPTURE resolution. Through the processing of the image, the resolution can be adjusted to more closely match the specifications of the printing device, which is referred to as the OUTPUT or PRINTING resolution.

It should be noted that the in general, the normal resolution at which the human eye can discern details, is 200dpi or less.

ResolutionAnd Dye Sublimation Printing

A final output resolution of 300 DPI at the actual output print size will almost always give you great results when printing raster images for dye sublimation.

Take a look at these two images that are going to be used for pressing onto a mug and an 8" x 10" tile.
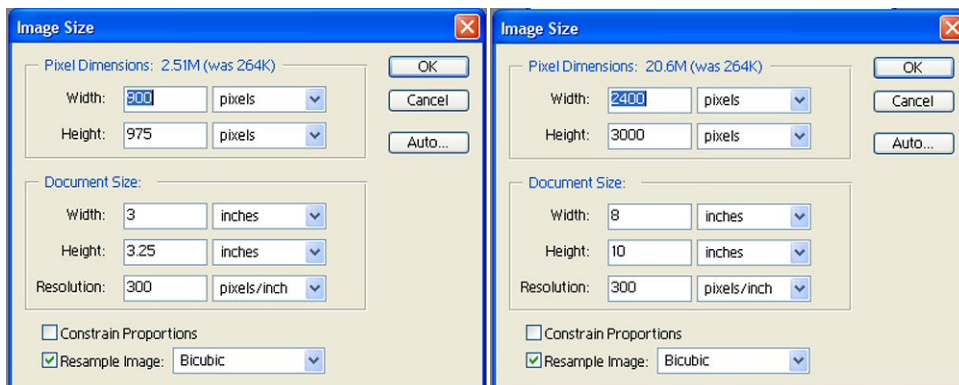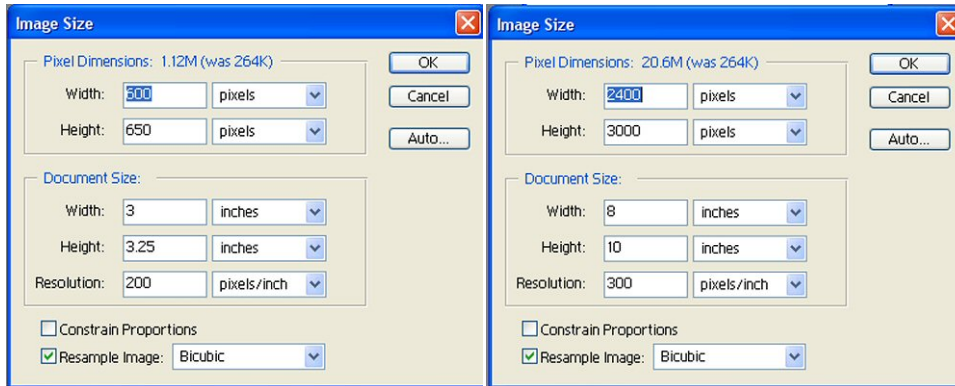

Mug Image	Tile Image

Note the respective file sizes (pixel dimensions) of each image. The image for the tile is over 8 times larger than the image for the mug.

While it is good practice to scan your images at a high resolution there are certain limitations in dye sublimation transfer that negates the need for a very high dpi setting. Due to the nature of the process, which involves the ink turning into a gas to bond to the polymers of the substrate, resolutions higher than 300 dpi are usually unnecessary.

On Fabrics (T-Shirts, Mouse Pads etc) it is quite often possible to use printing resolutions as low as 150 dpi, whereas for hard substrates (Ceramics, Metals etc) 200 dpi is the recommended printing resolution.Let's look at what this does to the sample images from above:

Mug Image   **Tile Image**

Note that the new file sizes are now less than half that of the original. If these images were going to be used on fabrics at 150 dpi then the file sizes would be even lower, 643K and 5.15M respectively.

This serves a number of purposes as smaller file sizes require less processing time. Image editing in Photoshop and CorelDRAW will be quicker and more efficient. Sending image information to the printer (spooling) will be faster. If importing multiple images into a design the finished file size of the overall design will be much smaller. And of course, each file will take up much less space on your hard drive

Example: Let's say you are using a template in Corel to create multiple raster images for a single pressing of six coasters at one time. (See Below)

If the single raster image imported six times has been created at 300 dpithen the final file is about 10meg. If you want to print 30 images (6 pages) then the print spooling is going to be 60meg. This amount of number crunching will take Corel quite some time to figure out (how much time depends entirely on your computer system).

In comparison, if the raster image had been created at 200 DPI then the page size would now be 5meg so the spooling would be 30meg. This is a much more manageable page size and would be comparable in finished quality to the images created with a higher resolution.

There is a way round this issue in Corel as long as each raster image is identical (as above). Instead of importing the image six times you import it once then either 'Duplicate' or 'Clone' the image five more times. (Refer to Corel manual for difference between 'Duplicate' and 'Clone'.) This method dramatically reduces the page size. Unfortunately this does not work if you have six unique images.

Color Masking

Sometimes a raster image may produce a 'dirty' or Off White background on the finished item. This should only occur during the printing of bitmap images in Corel Draw. To cure, click on 'Bitmap' and check the 'Bitmap Color Mask'. You should then see a control panel appear as shown below.
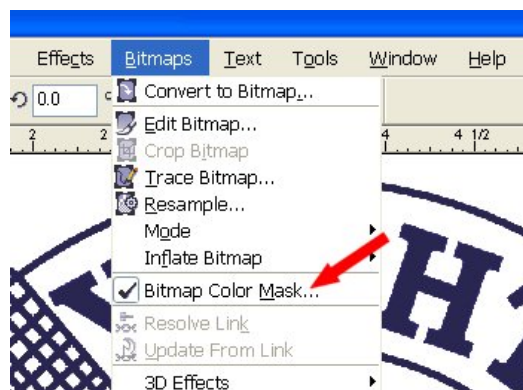
1. Make sure that the radio button for 'Hide Colors' is checked
2. Check one of the slots available for choosing a color.
3. Choose the Color Picker tool.
4. Click somewhere on the white background that you wish to clean up.
5. Then click 'Apply' - the small box at the side of the tick mark (number 2) should now have changed to white.
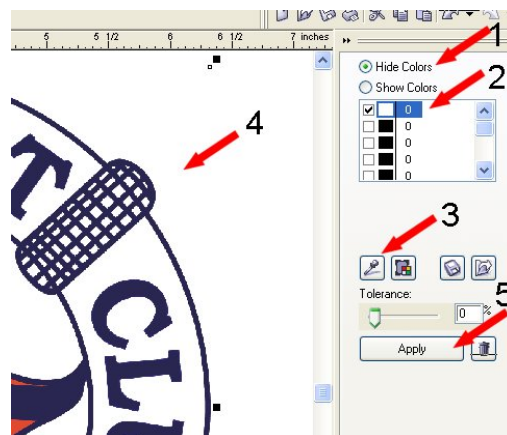
When you print this image the white areas should now be clean.

Tonal Range

Many raster images produced by scanners and/or digital cameras tend to have a "flat" or "bland" look to them. Before using for dye sublimation, you may wish to tweak your pictures to add a little

'life' or 'pop' to the image. Obviously this very much depends on the actual image but usually 1-2 minutes of adjustment in Photoshop (or Corel Photo Paint) can make the difference between a good image and a great image.
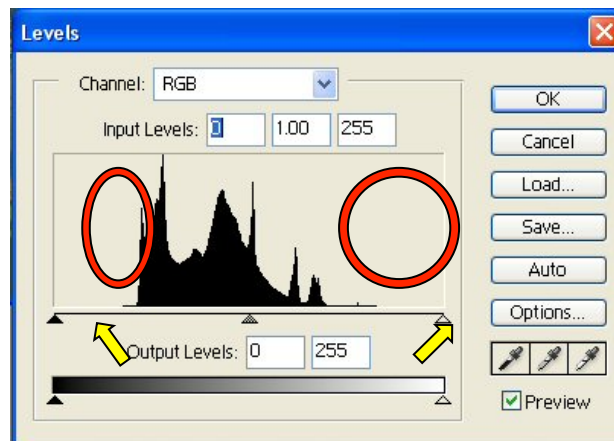
Here is an image, which is definitely 'flat' and 'bland'. It looks like it was taken through a haze.

The first thing to adjust is the levels.In Photoshop go to 'Layer' – 'New Adjustment Layer' – 'Levels'
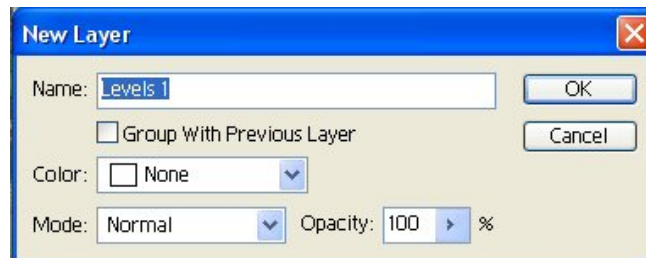
Click on OK

The histogram (the black series of spikes) represents the tonal range of the image. Clearly, there are two areas where the data is missing, as indicated by the red circles. If the histogram was concentrated to the left it would mean there was plenty of information in the shadows, concentration to the right would mean there was plenty of information in the highlights. A good imagehas the information spread across the entire histogram.

To make changes, first drag the two triangles towards the edges of the histogram using the mouse pointer.
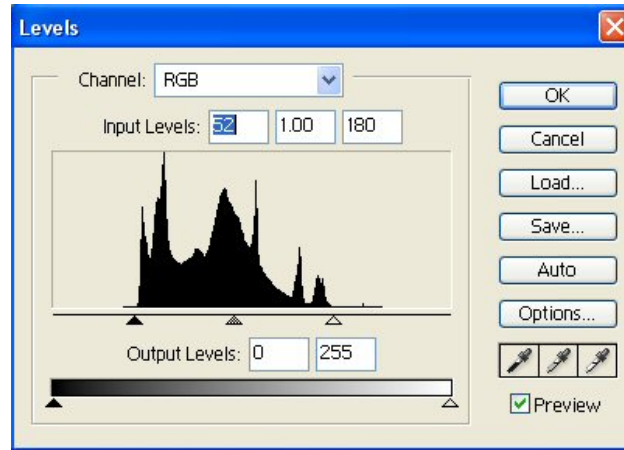
Click on OK

Now we see a transformation in the image. This is infinitely more desirable than the original image.

Similar enhancements are usually available in any of the recommended software packages (In Corel Photo Paint for e.g. you would use 'Contrast Enhancement' in the 'Image'-'Adjust' menu.

Color Balance

Sometimes a raster image may seem ok in the brightness and contrast area but has a strange color-cast to it. This is not something that "color correction/color matching" can cure. Fundamentally, if it doesn't look good on screen there is a distinct chance it will not look good when printed.

There are many ways to cure color issues within a raster image, some more complex than others (particularly when using a professional package like Photoshop). Here is one fairly simple way using the same process as the previous 'Tonal Range' correction.

The image below has a distinct "yellow cast" to it making the sky very look "muddy" and "dull".

To get started with this adjustment in Photoshop go to 'Layer' – 'New adjustment layer' – 'Levels'
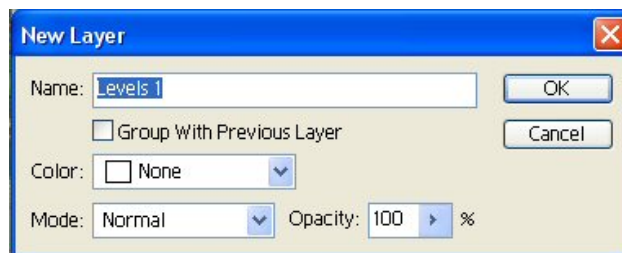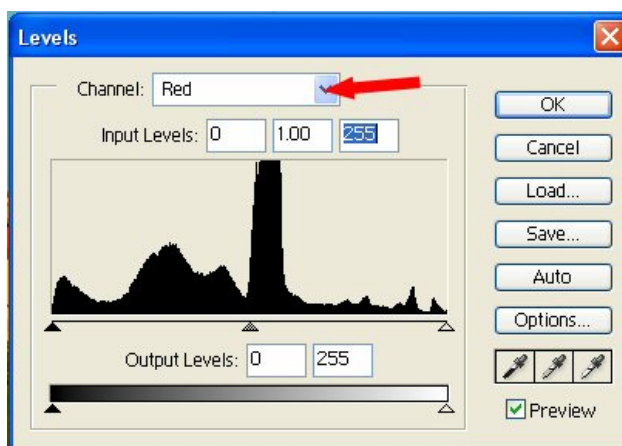

Click on OK

Here we see the tonal range spreads across the whole Histogram (albeit a little weak in the highlights).
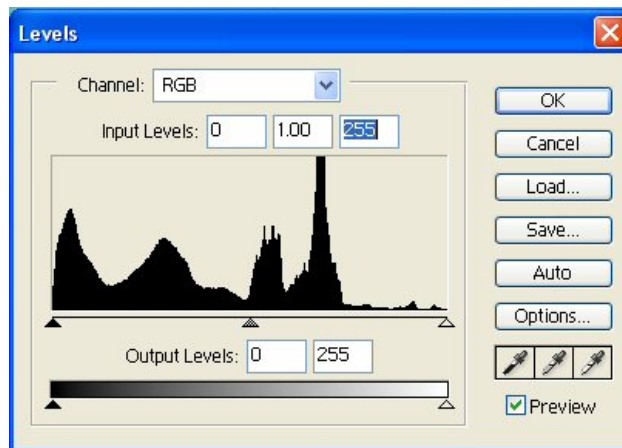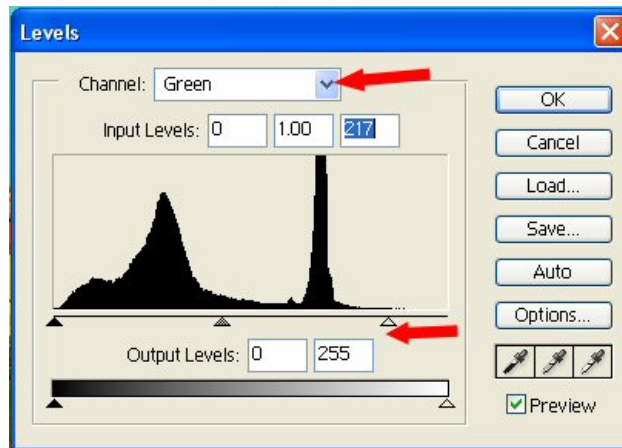

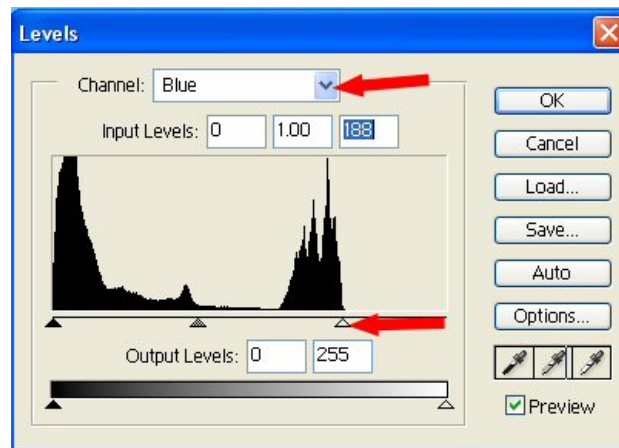Click on the drop-down arrow for Channel and select Red.

This Channel is fine and we do not need to move any of the triangles.

Next select the GREEN channel from the channel list.

Here we can see a lack of data to the right so we move the right triangle towards the start of the data.

Next select the BLUE channel from the channel list.

Here there is a larger area of data missing so we move the triangle towards the start of the data. You can see that the "yellow" cast has been removed and the sky is now very clear.

You can tweak the design color even further by using the same approach to adjust the Brightness and Contrast. Just open another 'New Adjustment Layer' with the 'Brightness and Contrast' controller and tweak the image further to get an even more impressive image as shown below.

There are many very useful tools in Photoshop to improve an image further (Curves being the most useful but not quite as intuitive to use). The image opposite has been tweaked further with masking off areas and enhancing them individually.

It cannot be overstated how important it is to make sure your image is as good as it possibly can be before you even consider sending it to the printer. If a little care is taken in the production of your images a great deal of improvement will be noticed at the finished product stage. There is nothing more satisfying than presenting a product to a customer which you feel proud to have created.

Software programs such as Photoshop and CorelDRAWmay seem a little daunting when you first start to work with them but persistence and practice will be greatly rewarded in the long run.

The internet is a fantastic source of Photoshop and CorelDRAWtutorials for the user who wish to develop their skills further.

Chapter 8 – PreparingVector Images For Sublimation

The previous section deals with raster images (bmp, jpeg, tiff etc.), here we will look at the uniqueattributes of working with vectors. It should be noted that image resolution does not apply when dealing with vectors.

While color correction usually works very well with raster images it is sometimes lacking in absolute accuracy for spot colors. Vector designs are very often created using a single color for each section (this is only not true when filling a section with a gradient or a pattern) and in some circumstances (e.g. company logos) the accuracy can be critical.

Working With Colors

If a design is being created on screen then the accuracy of the monitor itself becomes critical. Setting up a monitor to show accurate colors is difficult enough but it is also possible to choose a color on screen that is outside the color gamut range of a printer.

For these reasons we always recommend creating a design using a color swatch that you have created yourself (using the kind of substrate that will be used for your customer's products).The printing industry has always worked with these swatches (e.g. Pantone Charts) but these are primarily CMYK charts. As we recommend you always work with RGB data for composite printers (it is advisable to create your own RGB chart.

Print these swatches using the correct setup for your printer/software package and press them onto the type of substrate you plan to use for the finished item. It is possible to use a good quality white 100% polyester fabric to create these swatches as for most cases these will produce colors that are within the tolerance for accuracy.
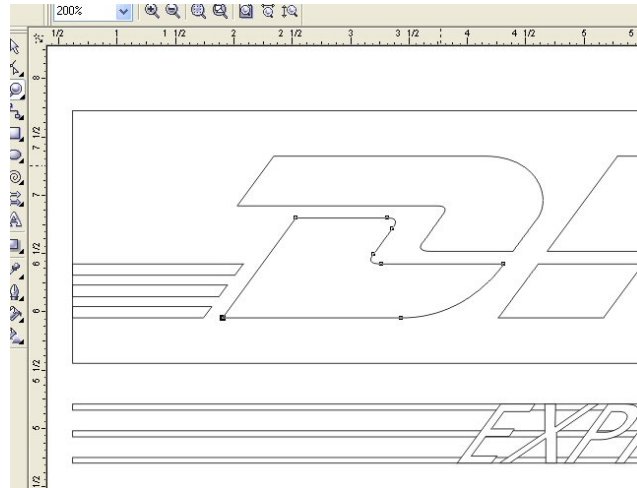
Once you have created the color swatches they can be used for future jobs.

Applying Colors To A Vector Image

In the following example, CorelDRAW will be used to create some products that will be sublimated with the logo of the shipping company DHL.

The first step was to create the vector (wireframe) logo for DHL.

An RGB red of 167,44,41 was then selected for this printer/ink/substrate combination by comparing the color chart to the artwork provided by the customer. On the screen the red actually looks slightly browner than the artwork, but this can be attributed to the fact that the monitor color is not an exact match to the actual color.

The next step is to fill each of the 'red' areas of the design with the chosen color. The quickest way to accomplish this is to choose all of the affected elements at the same time. It may also be necessary to remove the outline color.
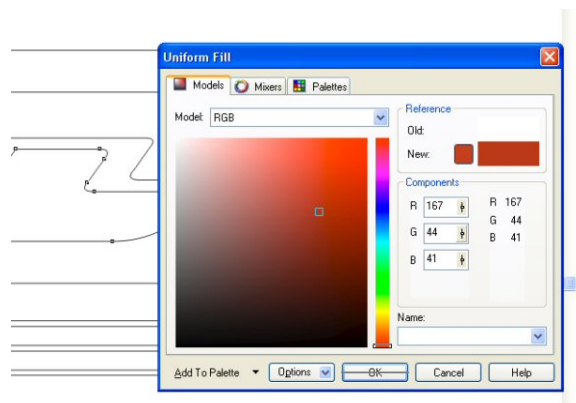
Now choose any other colors required for the design and fill those accordingly. Again, reference the color chart, preferably under a bright daylight.
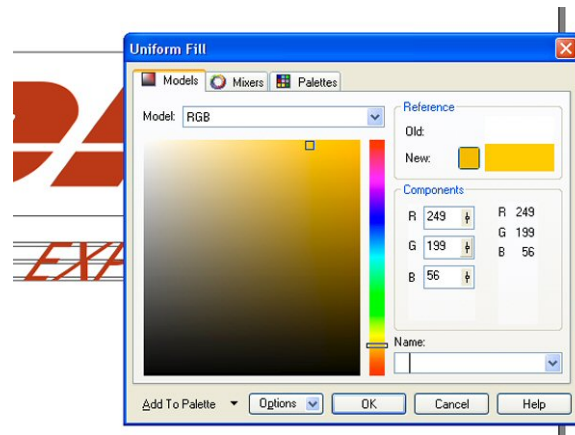
Now you have a finished design which, when printed and pressed will give you the colors you chose from the swatch irrespective of how they look on screen. The accuracy of the design is reliant on choosing the correct color from the swatch. This is also something that can be done with the client before starting the job so that the colors to be used can be approved for production, which will eliminate any questions about the concerning the look of the finished product.

To ensure the highest degree of color accuracy, you can print and press the chosen logo colors onto the actual material that will be used for the final product, as different substrates may affect the colors slightly, particularly if the white background is not pure white

If accuracy is critical and there doesn't appear to be a color on your standard RGB swatch that matches closely enough, then a different swatch may need to be used. You can create your own custom swatches from the RGB palettes that ship with CorelDRAW. Go to: 'Window' – 'Color Palettes' – 'Open Palette' – and browse the RGB folder.

One huge benefit of working with vector graphics is the sizing capabilities of the design. Once the design is complete it can be used on any size product the customer requires without any loss in quality. Whereas with a raster file, enlarging the design will reduce its clarity and resolution.

RGB vs CMYK In CorelDRAW

When working with vector based programs (CorelDRAW etc.) the default palette is often set to CMYK values. This would be fine if you were sending the print information to a color separations printer, you are however sending this information to a composite printer. In practice you will create more accurate results (using the RGB profile provided) if you create your designs with RGB values.

One of the most common complaints with dye sublimators is the inability to create a good solid black. There can be many reasons for this but the first area for inspection is the image itself. If, for example a design was being created in Corel without checking the palette values there is a distinct possibility that the design is using CMYK values. This example shows some text being created and 'Black' being chosen as the text fill color.

If we double click on the black rectangle in the bottom right corner of the screen we will open up the 'uniform fill' box.
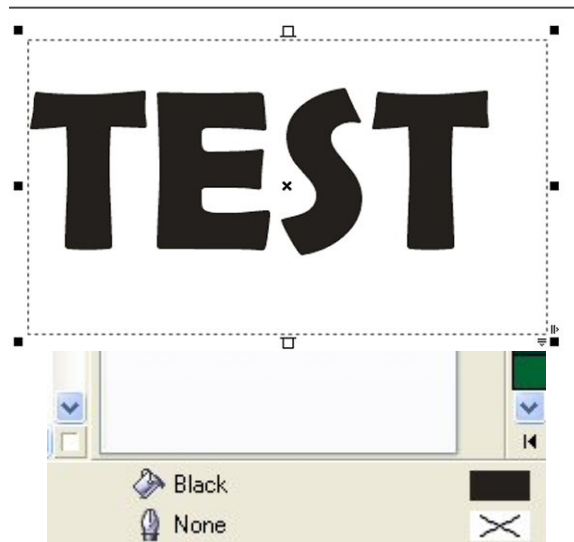
If the Corel default palette is still being used this is the result you will see. The 'Model' is set to CMYK and the small square showing where the color is in the color space is a long way from the bottom left corner (which would be actual black). We can also see the RGB values showing as 36,32,29. This would in fact tell the printer that you wished to print Grey (and not even a neutral one as the three values are not identical)
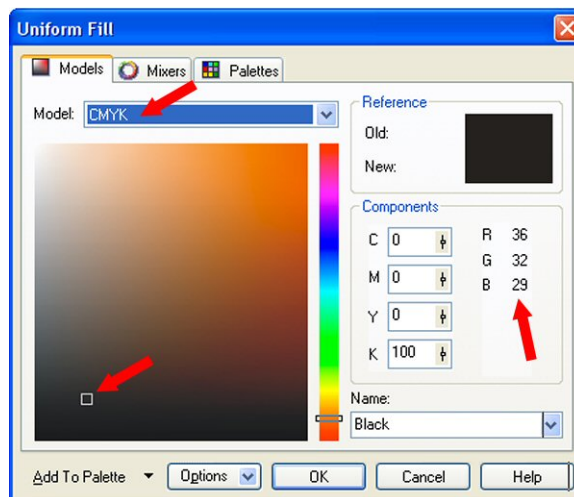
To tell a composite printer that you want Black you need to first change the 'Model' to RGB. Then you can change the RGB values to 0,0,0. The small square showing the colors position in the color space is now at the extreme bottom left corner and the printer will print a good solid black.
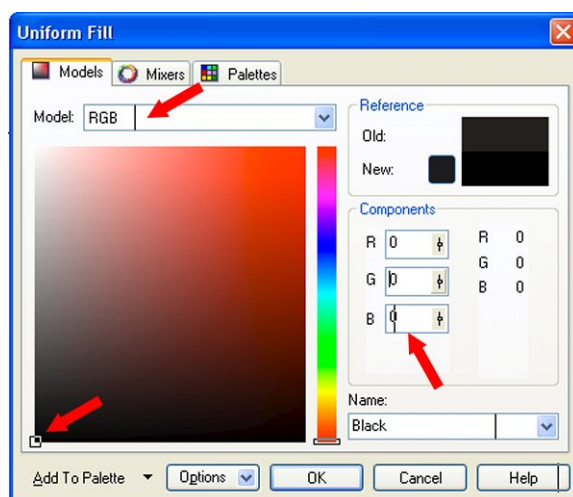
This is a good example why it is imperative that you use RGB values in your designs when printing to a composite printer It's a good idea to change your default palette to an RGB one. In Corel this would be under 'window' – 'color palettes' – then check the Default RGB palette. Here you can also uncheck the default CMYK palette to avoid confusion.
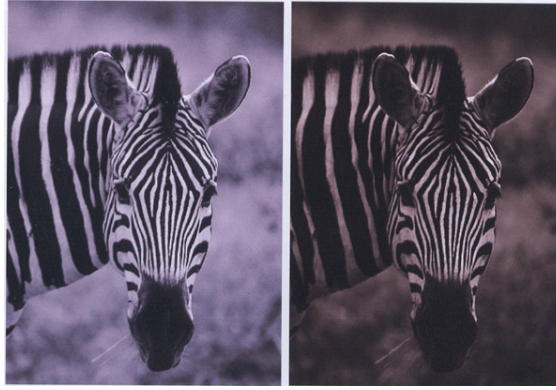
Grayscale Images

Using grayscale images for black & white printing in Corel is not advisable for dye sublimation. Grayscale images are treated uniquely in Corel and are not sent to the printer with the color correction profile (the assumption being 'there are no colors so why do I need a color profile). This effectively acts as if you have turned off the profile in Corel and used 'No Color Adjustment' in the printer driver. The result is a dark image with a very heavy magenta cast.
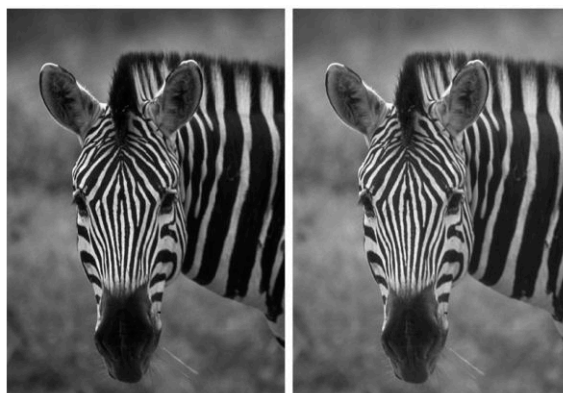
Grayscale   RGB

Corel is also capable of working with Grayscale and RGB images on the same page. Here we see the grayscale image on the left is only slightly darker than the RGB image on the right.

Grayscale   RGB

When this file is sent to the printer the RGB image (Now on the left due to mirror imaging) has been processed with the profile but the Grayscale image has not. As you can see these are going to produce wildly different results.

The purple cast on the RGB print is normal and should result in a black & white image when pressed onto your substrate. It is however, very difficult to produce perfectly neutral black & white images using dye sublimation.

There are a few reasons for this, firstly black and white images are printed using all the printer's colors (depending on your printer this can be four colors or up to eight colors), so if one or more of the colors are slightly dominant in the profile they will be very obvious in the finished print. For example, If Cyan is showing slightly more than the rest of the colors then you will get a 'cool' looking image. If Magenta is the slightly dominant color then a 'warm', almost sepia, image will result.

Everyone views colors slightly differently, so a full color photograph to one person may look different to someone else but not enough to make either of them wrong. With black & white images however those same two people can see if there is color where there should not be and agree that neither image is a true neutral series of grays.

Just to make matters a little more complex, the substrate can also create its own slight cast on the finished product. This cast could be so small as to be invisible on a full color image but because there shouldn't be ANY colors on a black & white it will be noticeable.

Photoshop treats grayscale images differently (it also does not allow a Grayscale image and an RGB image on the same page) and will print either of them perfectly using the profile.

Chapter 9 – Dye Sublimation Production & Applications

Sublimation transfer is not an exact science. Because you can sublimate onto a variety of surfaces, you will need to take all of the variables into account when selecting time, temperature and pressuresetting including:

Thickness of the substrate
Surface texture
Surface size
Surface color (shade of white)
Substrate conductivity
Heat press variations such as accuracy of temperature.

Tips & Tricks

Here are some useful tips for producing high quality sublimation:

- Print your images approximately 1/4" larger than the size of the substrate you are transferring to. This allows a margin of error when aligning everything under the heat press.
- Software templates are a good idea for substrates that you will be creating over and over again such as tiles and mouse pads.
- Use the recommended paper and substrates for sublimation transfers.
- Moisture and humidity will cause undesirable results (color shifts, bleeding and uneven transfers) with the sublimation process. To avoid these problems, keep your paper or fabric in a dry place. If you suspect moisture, try these techniques:
    1. Place paper on the raised pedestal bottom of the press and let it dry under the heat platen. Don't close the heat platen!
    2. Pre press fabric for 10 seconds before transferring.
    3. Use a fresh, non-textured paper towel behind the transfer sheet.
- It is important to protect the rubber pad that is attached to the lowersection of the heat press. The same is true for the rubber pad found in a mug press. Covering the pad with a protective sheet of paper, a paper towel or a Teflon sheet will prevent sublimation ink from being absorbed into it.
    1. If you use paper: Choose an inexpensive white bond paper or a roll of white paper (cut as needed)… discard after each pressing. Unprinted newsprint paper is also a good choice.
    2. If you use a paper towel: Choose an inexpensive, white, non-textured brand (the texture will leave a pattern on the substrate)… discard after each pressing.
    3. If you use a brown Teflon sheet, it should be cleaned with alcohol after each pressing.
- After transferring the image to the substrate, promptly remove the transfer paper. Do not stack the transferred items with anything else until they have completely cooled. Any paper residue left on the substrate after transferring can be removed with isopropyl alcohol.
- Recommended time, temperature and pressure settings are useful starting points. You may need to experiment with slight variations of each setting to fine tune the process. However, large variations of any setting could lead to poor quality imaging.

Sublimation 101

The Complete Guide To Successful Dye Sublimation Printing

Written By

Peter Swain

With Contributions By

Jimmy Lamb

7. When the pressing time is up remove the transfer sheet as smoothly and quickly as possible (this is to avoid creating a 'shadow' image)

9. Remove the shirt from the press.
10. Allow to cool on a clean surface.

Additional notes:
- *Please take note of the variation of printable areas from shirt size to shirt size. You may need to adjust your transfer size for each shirt size or design a size that will suit all sizes.*
- *You may choose to "pre-press" your garment for 5 seconds to remove and moisture that may be present.*
- *A lint brusher or roller will remove any clinging debris that may compromise your imaging.*
- *To sublimate to a Soft L'Ink Sweatshirt, use the same instructions as the Tee's, but increase press time by 10 seconds.*

SAWGRASS
CONSUMER

How-To Application - SublimatingPoly-Performance Apparel – Method #2


Temperature: 400°F (195-200°C)
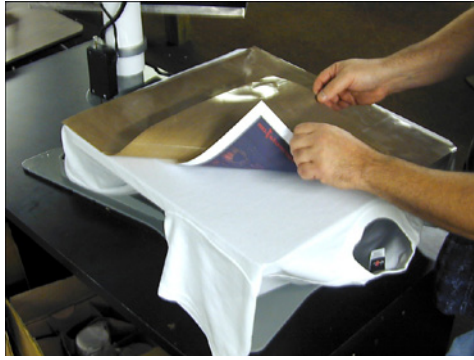**Time: 50-60 Seconds**
Pressure: Light to Medium

With some polyester shirts, the combination of heat and pressure will result in "press lines" where the edges of the transfer paper came in contact with the garment surface. The use of a layer of high temperature foam during pressing may solve this problem.

Instructions

1. Obtain a sheet of high temperature foam (contact your equipment dealer) and place it in your heat press along with a blank shirt. Adjust the platen pressure so that the foam is compressed to no more than half of its original height. (Experiment as needed to find the best pressure setting for your press.) Once the pressure is set, remove the shirt and foam.
2. Prepare your artwork and transfer with consideration to the size of the t-shirt.
3. If trimming the transfer paper, leave a 1" to 2" margin on all sides.
4. Cut the foam so that the edges are smaller than the transfer paper's outer edges, but approximately the size of the printed image.
5. Trim the top edges of the foam to a 45°degree angle to create beveled edges all the way around.
6. Spread a Teflon sheet (or white paper) on the bottom of the press.
7. Place the prepared foam on top of the Teflon sheet.
8. Place the shirt, face-up, on the press over the top of the foam. Smooth out folds and wrinkles.
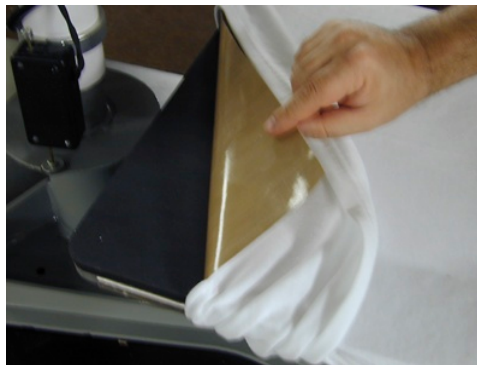
9. Place the transfer, facedown, in position on the shirt. Carefully position the foam, such that it is centered under the transfer, with the edges of the transfer extending over the edges of the foam.
10. Cover the shirt and transfer with a Teflon sheet while ensuring that the transfer and shirt remain in position.

11. Press with medium pressure 50-60 seconds.
12. When the pressing time is up remove the transfer sheet as smoothly and quickly as possible (this is to avoid creating a 'shadow' image)

9. Remove the shirt from the press.
10. Allow to cool on a clean surface.

CAUTION – Only use foam that is designed for high temperatures (400^oF minimum), otherwise some melting may occur which could damage the shirt.

How-To Application –Sublimating Mugs

Temperature: 400°F (195-200°C)
Time: 4 - 4 1/2 Minutes
Pressure: Heavy

For production purposes, mugs are usually sublimated using a mug press. An alternative is to use a mug wrap in a conventional oven. The instructions here apply to the use of a mug press.

1. Print the transfer and trim to a slightly smaller size than the mug.

2. Attach the transfer in position on the mug with heat resistant tape. Make sure that the transfer is tightly pressed against the mug to prevent the ink on the paper from "gassing out". Here is an example of the ink 'gassing out' because the paper had wrinkles in it.

3. Wrap the mug with a Teflon sheet or plain white paper.

4. Place the mug in the press and press for 4 - 4½ minutes.
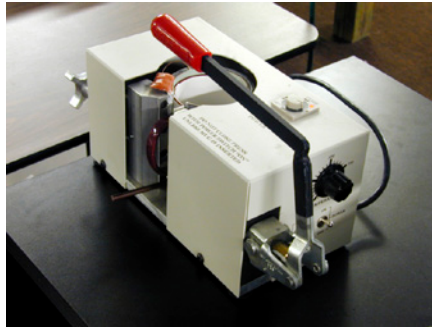
5. When you take out the mug remove the transfer as quickly and smoothly as possible. Because ceramics retain heat for a long period of time, the ink may continue to "gas" for several minutes. This may manifest itself in a blurring at the edges of the image or ink rising/creeping upwards away from parts of the image (a similar look when the paper is not on the mug tight enough). Some Manufacturers suggest placing the hot mug into a bowl of room temperature water to quickly cool it and stop the gassing. Others recommend allowing it to gradually "air cool." Refer to the mug Manufacturer's instructions as to the best method for cooling.

Additional Notes:
- *Ceramic mugs tend to taper from top to bottom. This inconsistency can make it difficult to apply full wrap transfers to a mug and can compromise the imaging. Moistening the transfer or using additional tape to fasten the transfer securely can help eliminate problems.*
- *It is important to recognize what your specific mugs' 'safe area' is. It is suggested that you make a test mug to define an area that you can depend on for quality results. For example, an average mug may take an image up to 1/4 inch off the top and bottom and no closer than 1 inch off the handles horizontally.*
- *This guide is mainly for use with a mug press that heats 'from cold'. Times will vary from press to press and you should experiment to find the optimum time for your mug and press combination. As a rule with dye sublimation – if the image is dull or faint then the time was too short – if the image is bright and vibrant but looks out of focus or blurred then the time was probably too long.*

How-To Application – Sublimating Hard Poly Fiber Substrates


Temperature: 400°F (195-200°C)
Time: 55-75 Seconds
**Pressure: Medium**

Examples of hard poly fiber substrates also known as FRP (fiberglass reinforced plastic) are: awards, plaques, coasters, signage, name badges, license plates, etc. These items may be composed of material such as wood, which is ok as long as the surface is composed of a polymer based plastic that is designed specifically for sublimation.

1. Prepare your artwork and printed transfer with consideration to the size and shape of the specific product.
2. It is good practice to print the artwork slightly larger than the finished product (⅛" or 3mm works well).
3. Don't forget to remove the protective plastic covering.
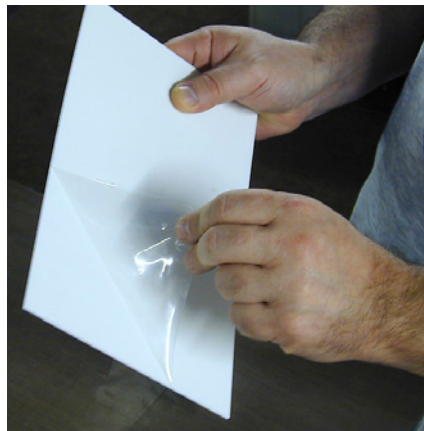
4. Place thesubstrate onto the transfer paper prior to taping into place as it is much easier to align the product to the image. If the image is not full bleed (i.e. a motif in the centre on a white background) then it is advisable to draw a boundary slightly larger than the finished product with the motif in the correct position within the boundary.
5. Using heat resistant tape, fasten the substrate in position facing the printed side of the transfer. (Notice how the image is slightly larger than the substrate)
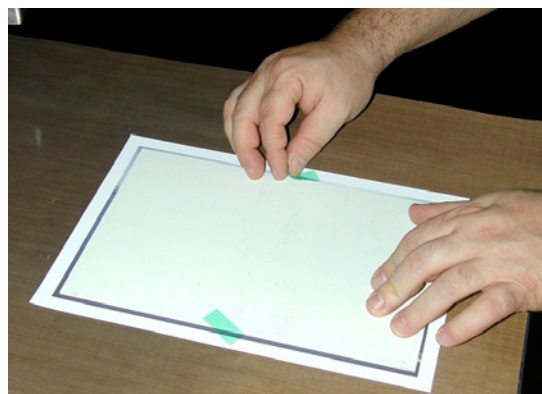
6. Spread a Teflon sheet (or white paper) on the bottom of the press.
7. Turn the objects over so the transfer paper is on top (facedown) and place on the heat press.
8. Cover substrate and transfer paper with Teflon sheet (or white paper). This avoids any ink gassing onto the top platen of the press (which will then transfer onto any following items).
9. Press the items for the correct time. This will depend on the product but small items are usually just under one minute and larger pieces (like the one shown here) could be 65-70 seconds. When the pressing time is up remove the transfer sheet as smoothly and quickly as possible (this is to avoid creating a 'shadow' image)

Additional Notes:
- *If you are using double sided items, be sure to allow the plastic to cool to room temperature before pressing to the second side.*
- *There are templates available to facilitate sublimation to the Unisub FRP plastic products. They are available to aid with the setting-up of the artwork in addition to placement of the multiple items on the press.*

How-To Application - SublimatingCoated Metal Products


Temperature: 400°F (195-200°C)
**Time: 45-60 Seconds**
Pressure: Medium

Coated Metal is similar to FRP as it can be shaped to create many items for customizing. Name badges, magnets, license plates, license plate frames, picture frames, bag tags, key chains, dog tags to name a few. You can also purchase whole or cut sheet stock.

There are different colored coated metals (aluminum and brass being the popular) and although these can be used for plaques, nameplates etc. full color or photographic images will require the metal to be white for the best results.

1. Prepare your artwork and transfer print with consideration to the size and shape of your sheet or cut sheet metal.
2. It is good practice to print the artwork slightly larger than the finished product (⅛" or 3mm works well). When placing the metal onto the transfer paper prior to pressing it is much easier to align the product to the image. If the image is not full bleed (i.e. a motif in the centre on a white background) then it is advisable to draw a boundary slightly larger than the finished product with the motif in the correct position within the boundary.
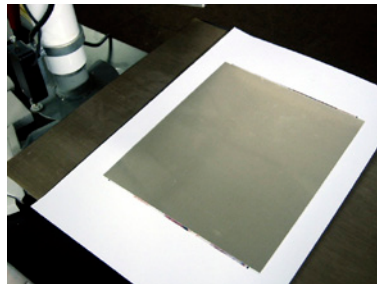
3. You can use the same method of attaching the print to the metal as the plastic production with the heat resistant tape but as metal is a great conductor of heat I always place the print face up on the heat press and position the metal face-down on the print (this only works if the bottom platen is horizontal). Positioning is easy due to the image being slightly larger than the metal.
4. Spread a Teflon sheet (or white paper) on the bottom of the press.
5. Lay the metal facedown (transfer, face-up) on the heat press.
6. Cover with Teflon sheet (or white paper).). This avoids any ink gassing onto the top platen of the press (which will then transfer onto any following items).
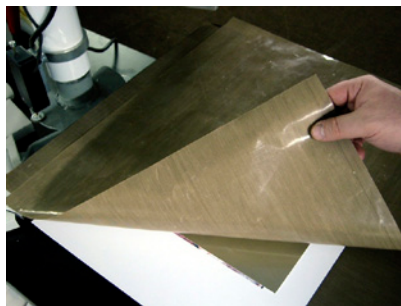
7. Press the items for the correct time. This will depend on the product but small items are usually 45 seconds and larger pieces (like the one shown here) could be 60 seconds.
8. When the pressing time is up, carefully, (very hot) lift the metal from the transfer (without sliding it) as smoothly and quickly as possible (this is to avoid creating a 'shadow' image).
9. Allow to cool on a clean surface.

Coated metal panels are available in several different types of metal base, which affects the appearance of the final image.

Brass Metal Panels

Brass adds a yellow cast to the image. This material can be very effective but its limitations have to be considered if photographic images are used. However, by the same token, the brass can provide an interesting special effect that can be quite appealing in the right situation.

Polished Aluminum Panels

Polished Aluminum has an even greater effect on color than brass because of its highly reflective characteristics. The controlling factor is how much light is bounced back by the material. (Look closely and you can see a reflection of the hands holding the camera used to take the picture.) Just like with brass, this can be beneficial when trying to achieve special effects.

White Metal Coated

Beautiful photograph images can be reproduced on this material and it still maintains its high gloss reflective properties.

How-To Application – Sublimating Soft Poly Fiber Substrates

Temperature: 400°F (195-200°C)
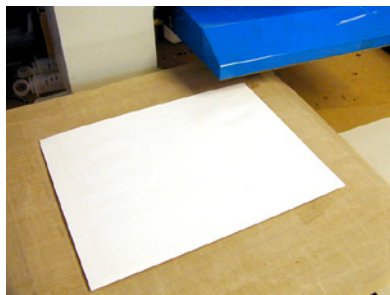**Time: 60-70 Seconds**
Pressure: Medium

Dye sublimation mousepads have a top layer composed of white polyester which works great for a photographic image. Though they come in varying shapes, sizes and thicknesses, the production process is very similar for all versions

1. Prepare your artwork and transfer with consideration to the size of the mouse pad.
2. Using heat resistant tape, fasten the mouse pad in position facing the printed side of the transfer.

3. It is good practice to print the artwork slightly larger than the finished product (⅛" or 3mm works well). When placing the mousepad onto the transfer paper prior pressing it is much easier to align the product to the image. If the image is not full bleed (i.e. a motif in the centre on a white background) then it is advisable to draw a boundary slightly larger than the finished product with the motif in the correct position within the boundary.
4. Spread a Teflon sheet (or white paper) on the bottom of the press.

5. Place the mouse pad and transfer on the platform with the transfer facing down.
6. Cover transfer with Teflon sheet (or white paper)
7. Press with medium pressure for 60-70 seconds.
8. Remove the mouse pad and transfer from the press.
9. Peel the tape and transfer from the mouse pad smoothly and quickly.
10. Place in a clean, dry place to cool.

How-To Application - SublimatingCeramic Tiles

Temperature: 400°F (195-200°C)
Time: 460 - 600 Seconds
Pressure: LightMedium

There are two very distinctive methods of pressing a tile. One is face up so the heat is transferred through the paper. The other (and highly recommended) method is facedown. This method requires the use of a heat resistant felt pad with a recommended thickness of ½" (12mm) and has several key advantages over the face up method.

First, there is no need for taping the transfer paper to the tile as the weight of the tile will hold it in position easily. Second, it allows the tile to sink into the soft felt and force the paper transfer to wrap around the edges which nicely finishes off the beveled edges of the tile.

Finally, there is no texturing of the coated surface of the tile thereby leaving a high gloss, ultra smooth finish. The only trade-off to this method is the transfer time is double the face up method, as the heat has to travel through the thickness of the tile.

1. Print the artwork slightly larger than the finished product (3/16" or 4.5mm works well). When placing the tile onto the transfer paper it is much easier to align the product to the image plus there is enough image to wrap around the edge of the tile. If the image is not full bleed (i.e. a motif in the centre on a white background) then it is advisable to draw a boundary slightly larger than the finished product with the motif in the correct position within the boundary (make sure that this boundary is well outside the edge of the tile after it wraps).
2. Place the transfer face up on the felt pad

3. Place the tile face down on the transfer.
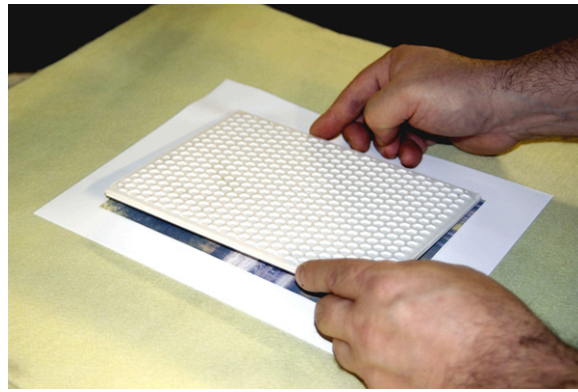
4. Cover the tile and transfer with Teflon sheet (or white paper).
5. Press the tile for 460-480 seconds (tiles of this size will require around 8 minutes pressing, larger tiles or thicker tiles may require up to 10 minutes)
6. Remove the tile carefully using protection (tiles stay very hot for a long time) and place on a heat resistant surface to cool. Note how the tile has embedded into the paper to wrap it round the edges.
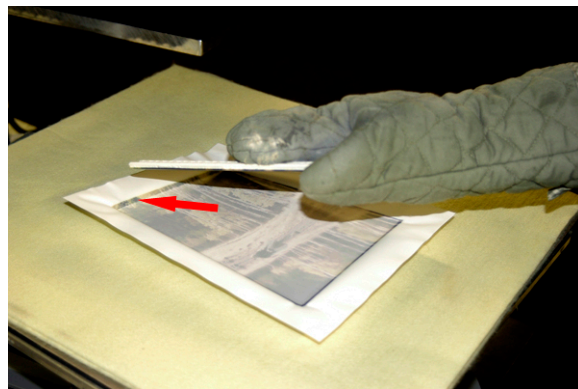

There are many ways a single tile can be displayed and the results are often quite striking. A photographic image where one is not expected always raises favorable comment.

There are also many different shapes and sizes of tile and they can be enhanced further by fitting them into wooden frames or inlaying them into box lids.

How-To Application – Sublimating A Ceramic Tile Mural – Method #1
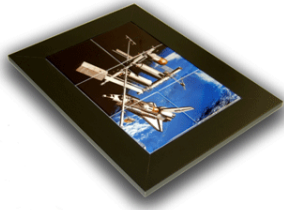
Temperature: 400°F (195-200°C)
**Time: 460 - 600 Seconds**
Pressure: LightMedium

This method requires your printer and heat press to be capable of creating the mural in one pressing. The example shown here is for a mural of six 6"x6" tiles configured in 2 rows of 3, giving an overall mural size (excluding frame) of 12" x 18". Prepare your artwork and transfer print with consideration to the finish size of the of the whole tile mural. It is good policy to lay out the tiles as the finished mural and measure it accurately as 6" tiles may well not be exactly 6 inches.

Print the artwork slightly larger than the finished product (3/16" or 4.5mm works well). When placing the tiles onto the transfer paper prior pressing it is much easier to align the product to the image and there is enough image to wrap around the edge. If the image is not full bleed (i.e. a motif in the centre on a white background) then it is advisable to draw a boundary slightly larger than the finished product with the motif in the correct position within the boundary (make sure that this boundary is well outside the edge of the tile after it wraps).

1. Place the full size transfer print face up on the felt pad.

2. Place the tiles one by one face down on the transfer.
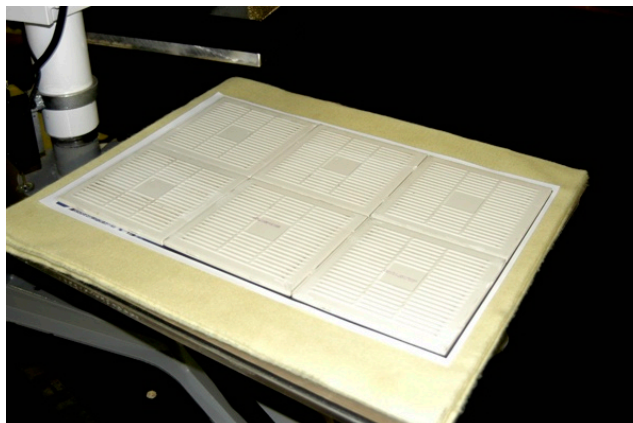
3. Cover the tiles with a Teflon sheet (or sheet of white paper)

4. Press for about 540 seconds (9mins). The time is not specific as different tiles have different needs. You may need to experiment with the pressing time to get the best results possible.
5. Remove the tiles quickly and smoothly and place on a cool clean surface.
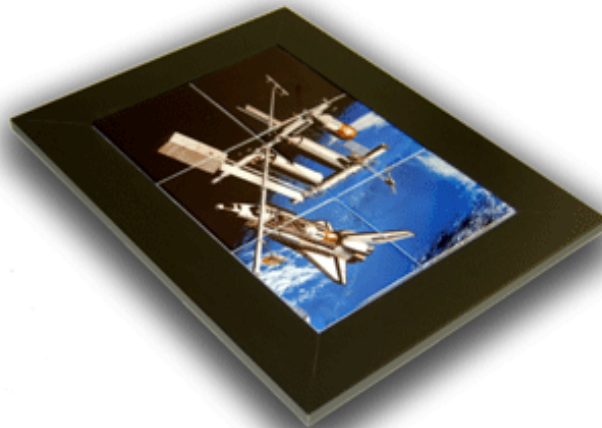
Care needs to be taken when using this method if the edges of the tiles have large radius bevels. Sufficient time needs to be allowed to make sure the ink gasses into the gaps between the tiles. You may need to experiment with pressure to achieve the maximum amount without breaking the tiles, as the paper must crease into the gaps as much as possible. If in doubt or your efforts have failed then you will need to use Method 2.

How-To Application – Sublimating A Ceramic Tile Mural – Method #2

Temperature: 400°F (195-200°C)
Time: 460 - 600 Seconds
Pressure: LightMedium

The second (and more usual) method is to press the tiles individually. The advantages of this method are mainly twofold. Firstly, theoretically a mural of any size can be created (the limitation of this is down to the resolution of the original image); secondly, it is much more likely that the edges of each tile are finished correctly.

Creating the individual images however, is a little more demanding. If the overall mural size is not too large a piece of software called Mural 8 can be used. The limitation of this software package is its ability to handle very large image files as it can become unstable when handling image files larger than 100meg. As an example, if you are trying to create a mural 36" x 24" at 200 DPI you will be very close to this limit. To create individual transfers for murals larger than this you would need to use something like Photoshop.

To take this a step further, even when using a program such as Photoshop, a very large mural (such as a 15' x 12') would probably be overwhelming if working at a resolution such as 200dpi which is ideal for ceramics. But considering that such a mural will probably be viewed at distance it will probably be acceptable to create the image at a much lower resolution, even down to 72 DPI. This keeps the overall image size down to a manageable level as 15' x 12' mural would only be an image size of 384meg.

Once you have your artwork calculated and laid out, it's simply a matter of producing a large number of individual ceramic tiles. Care needs to be taken numbering the tiles for identification within the mural (the bigger the mural the more chance a tiles will look very similar to each other). Depending on the size of your heat press you may be able to press multiple tiles. If pressing multiples always allow at least an inch gap between the tiles to ensure a good (and consistent) wrap around the tile edges.

7' x 5' Mural

DYE SUBLIMATION QUICK REFERENCE GUIDE

The following chart should serve only as a starting place. Getting quality end products is a result of practice, smart color management, following manufacturer guidelines, and more practice!

SURFACE	PRESS TIME	TEMP	PRESSURE	TIPS / COMMENTS
SOFT L'INK T-SHIRTS	35-40 seconds	400° F	40 psi (medium)	Pre-press shirt for 3-5 seconds to eliminate moisture. Tack spray transfer and use blow-out sheet to avoid ghosting.
VAPOR APPAREL	50-55 seconds	390° F	40 psi (medium)	See www.vaporapparel.com for tips on reducing press lines.
POLYESTER / MOUSE PADS	45 seconds	400° F	40 psi (medium)	Look for a tight knit and high white point for more brilliant color.
METAL (Unisub)	60 seconds	400° F	40 psi (medium)	Use blow-out paper. Remove plastic coating before pressing.
METAL (Other) - White, Silver, Bronze	60 seconds	375° - 400° F	40 psi (medium)	Time varies with metal manufacturer (always consult manufacturer for correct time and temp). Place absorbent sheet on bottom of heat press. Then, place product transfer side DOWN on top of the absorbent sheet.
UNISUB PRODUCTS	60 seconds	400° F	40 psi (medium)	Remove plastic coating. Tear transfer paper away immediately after pressing.
FR PLASTICS	60 - 75 seconds	400° F	40 psi (medium)	Remove plastic coating. Tear transfer paper away immediately after pressing.
CERAMICS / MUGS	150 - 210 seconds	350° - 400° F	40 psi (medium)	Time varies with press. Press into silicon pad. Mugs should be cooled down after transfer paper is removed in either a bucket of warm water or using a cooling plate.
CERAMIC & GLASS TILES	300 - 720 seconds	400° F	40 psi (medium)	Time varies depending on tile type and size. Always consult manufacturer. Press tiles from back (transfer side down). Press into silicon pad.
SUBLIMATABLE FILM	30-60 seconds	350° - 400° F	40 psi (medium)	Time varies depending on film type. Transfer should be slightly larger than film and placed face down on the substrate (adhesive side down). Clear materials may be either adhesive front or adhesive back. Watch out to not mirror your image on clear film.

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Sawgrass provides whole product solutions designed to support any size business --- from desktop systems to wide format commercial and industrial systems for production environments. As a total solution provider, Sawgrass combines patented digital ink formulations with advanced color management software and technical support to meet the needs of business customers looking for profitable, short-run production. Sawgrass is committed to delivering quality products that customers can trust.

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