



Vector artwork vs. raster artwork.

Separations for Screen Printing

Vector or raster, light shirt or dark, art for screen printing needs to be separated.

Regardless of the type of artwork — vector or raster — or the color shirt it's printed on, all artwork for screen printing needs to be separated. Separations are the individual color components of an image, which are split apart and printed individually as positives either onto film or directly to the screen. The image is then reproduced by printing each separation onto the garment one color at a time.

The type of artwork dictates how to separate it. Vector artwork is made up of a series of individual shapes, paths and points that can each be selected, manipulated and filled or stroked with spot colors. These colors can be recognized and output individually by a printer.

However, raster artwork, such as photographs, is made up of a series of small dots (pixels) that create a continuous tone from one color to the next. The colors in raster artwork need to be split apart either manually using functions in art software such as Photoshop, or automatically with special separation software. A grayscale image is generated from the various

percentages of a color used throughout the image to create the separation for that color. The separations of each of these grayscale images are printed on top of one another in their respective ink colors, and the colors combine to recreate the continuous tone of the original raster image.

Remember the Underbase

While the separation process may be different between vector and raster artwork, printing on black or colored shirts requires an underbase, also referred to as base white or white base, in either instance. To prevent the inks from being absorbed into the shirt and causing a shift in color or creating a muted image, the underbase, which is usually white or an off-white color, allows the ink colors to retain their vibrancy so the color of the print stays true to the artwork. The underbase is printed first and then flash cured to “gel” it so that the colors do not mix with it when printed on top.

When creating vector artwork

When setting up halftones, there are three factors to consider: line screen or frequency, screen angle and dot shape.



When creating a base white for vector artwork, a choke is important to prevent the white from peeking out from under the overprinted color along the edge.



Full color raster image with individual grayscale separations for each spot color.

separations for colored shirts that will require a base white, it's essential to overprint the colors. This literally means that the color on top will print over the color underneath — such as the base white — instead of knocking it out. To set up a base white so that the colors will overprint it, I duplicate my art layer once it is completed, then turn off the top art layer so that I view only the duplicated layer, which will become my base white.

Then I create a new base white spot color, and select all the colored areas and any areas of the design that I want to be white and change them to the base white color. Since black ink doesn't require a base white, anything black in the image should be changed to the default white color or a background color that's not intended to print. When done, print out the base white, then turn off the base white layer, and view the artwork layer to print all the spot colors for your design.

When creating a base white for vector artwork, a choke is important to prevent the white from peeking out from under the overprinted color along the edge. A choke is the slight inset of an underlying color. It can be created either by stroking the top color and overprinting so that it expands past the base white slightly, or the base white can be stroked with an unused color such as the default white or background color to inset. Half a point is generally a good size for a choke.

Registration Matters

Registration of colors is important in screen printing. This is the accurate alignment of one color on top of another to prevent any unwanted overlapping of color or gaps between colors. For vector artwork in particular, there are three types of registration: trap, butt and gap.

In **trap registration**, one color slightly overlaps another. (The overlap is referred to as the "trap.") This type of registration helps prevent gaps from showing between colors if the registration is off slightly. To create the trap, a thin outline, or stroke, of color is applied to the edge of a shape. In general, an overlap of .5 point works well. While this type of registration can help with gaps, the drawback is that overlapping colors can sometimes mix, creating a fuzzy edge. Flash curing between colors can help prevent this, but will slow production time.

Butt registration occurs when two colors "butt up" next to one another with no overlap. There are no strokes, traps or

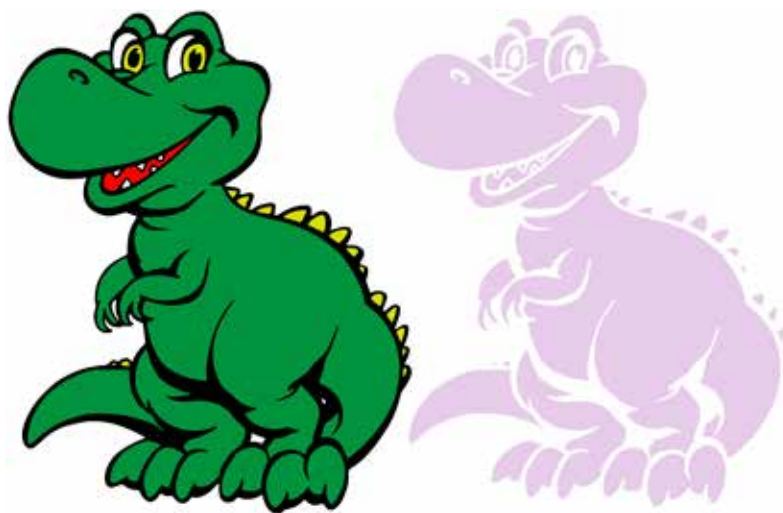
overprinting involved. This is the preferred registration method because it prevents bleeding like you might find with trap registration. However, because there is no trap, gaps can occur if the registration is off. This is why it is very important to keep your equipment well-tuned for accurate registration.

The last type of registration is **gap registration**, and as the name suggests, a gap is placed between two adjacent colors. The gap is created by stroking shapes with an unused color that will not be printed, such as the default white or background/shirt color. This type of registration is used with specialty inks, such as puff ink, that will expand. The gap allows room for the inks to grow and not overlap or mix.

When coloring vector images, it's important to make sure the colors are set up as spot colors. Default colors in a swatch palette, for example, are usually set up as process color. Colors that are set up as process will separate into four colors — cyan, magenta, yellow and black (CMYK). When a color is set up as a spot color, the printer recognizes it as a single color and will therefore only print out one separation for that color. So if, for example, a three-color image has each color set up as a spot color, there will be one separation for each color.

But when it comes to raster images, there are several types of separation processes — and four-color process separation is not the most recommended process. The entire image, regardless of the number of colors, would separate in just four colors — CMYK. However, CMYK process inks are transparent inks and therefore are not usually used for printing on dark shirts. Another drawback to using process color separations for screen printing is that it is very unreliable. It's harder to match specific colors than it is with other separation processes, and when a job may need to be reordered, getting the image to print exactly as it did the first time can be difficult.

Simulated process separations are created when an image is broken down into a series of spot colors as grayscale images. They are reproduced by printing halftones using opaque plastisol inks. Because they are set up as spot colors, specific PMS colors can be selected, making it easier to match colors in the original image. Before automated separation software, simulated process separations were done manually and were very tedious and time consuming. However, with software such as Spot Process Separation Studio



Colored vector image with base white.



Three types of registration.



Raster image opened in Separation Studio.

4, generating raw separations takes just a few seconds and they are ready for final on-screen adjustments.

Setting up Halftones

Since raster separations are created as grayscale images, halftones in varying percentages are necessary to reproduce the image. Even vector images, which may incorporate tints of color or gradients, will need halftones to print the image. Halftones are a series of small dots lined up in rows. A higher percentage means more dots will be applied, creating a darker color. When the percentage is lower, fewer dots are printed and the color is lighter.

When setting up halftones, there are three factors to consider: line screen or frequency, screen angle and dot shape. The line screen is the number of dots per linear inch. The higher the line screen, the more dots per inch. While a higher line screen can reproduce better detail, it also uses a smaller dot, which can be harder to hold on screen. So 45 lines per inch (lpi) is the recommended line screen to make it easy to hold on screen and still maintain good detail in the image.

Screen angle — the angle at which the rows of dots are aligned — is the next factor



Screen printed image with close-up of halftone dots.

in setting up a halftone screen. The angle I recommend is 61 degrees. Separation Studio recommends 22.5 degrees; both will work fine. Angles such as 45 or 90 degrees are not recommended, because they align with the mesh threads in a way that can cause the dots to be clipped and create an unsightly moiré pattern.

The dot shape is the final factor. There are various shapes that can be used, but elliptical is recommended. It provides more area than a round dot, so there's more opportunity for the dot to be printed rather than clipped off by the screen threads.

The Template

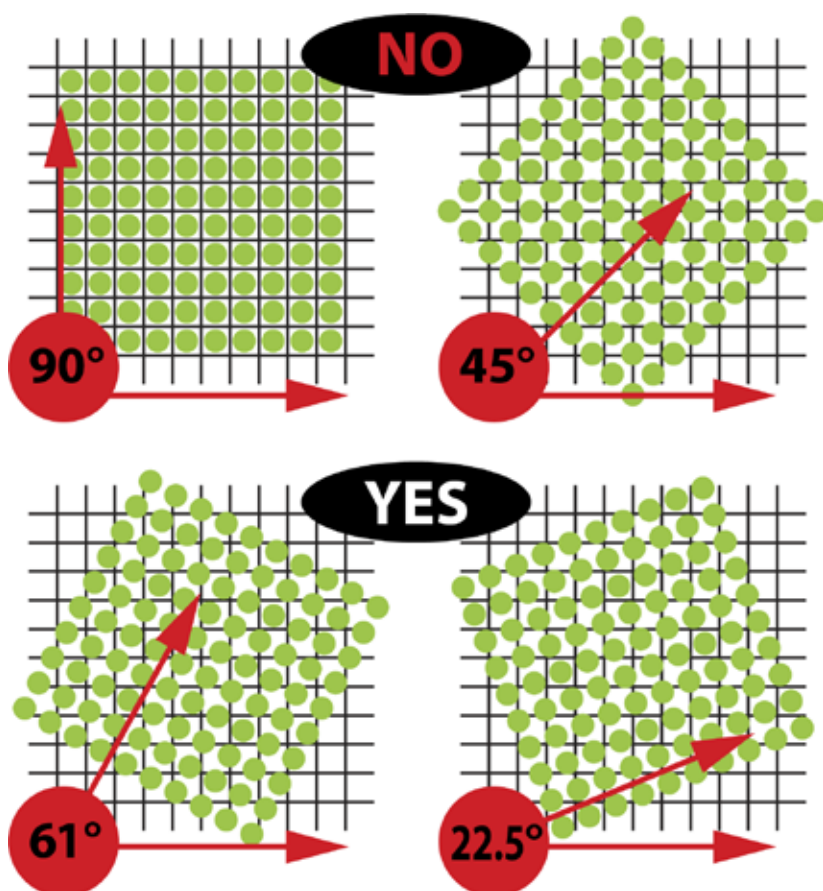
Printing out the separations, setting the screens up on press and getting them registered can be time consuming. To make the setup process run quicker and more smoothly, create a master template that can be used anytime you need to set up separations. Having all the components needed with guides, so that the image will always be set up in the same position, will make it easier to register the image on press. The main components that should be included on the template are registration marks, grayscale bar and ink

colors. Additional information such as mesh counts, image location, job name and customer name can also be included for easier identification.

Registration marks are the most important of the elements needed on the template. Without them, there is no way to align or register all the colors. They should be positioned at the center top, center bottom and top right. The two at the top will always remain in the same position, but the bottom registration mark and print information can be moved up or down as needed depending on the size of the image. When creating a registration mark, include a circle, two cross hairs and a small square. Each line will be a different thickness such as .25, .5 and 1 point to use as a gauge to make sure that all the thicknesses are being held on screen. If any of the lines are not visible, information may be lost in the image, which could affect the print. So this is a good indicator that the screen may need to be redone. When creating the registration mark, make sure to color it using the "registration color." Anything in this color will automatically appear on all the separations when printed.

A grayscale bar is a good tool to include

While a higher line screen can reproduce better detail, it also uses a smaller dot, which can be harder to hold on screen.



Halftone screen angles.



Image placed in template.

Most of today's printers, particularly inkjet printers, require raster image processor (RIP) software in order to print out halftones.

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on a template, because it is a good gauge to show if you are holding all the varying halftone percentages. If any information is missing or filling in, it's a good indicator that the same percentages in the image will be experiencing the same issue, and the screen should probably be redone to get a better print. When creating the grayscale bar, create a series of small squares, each filled in 10% increments of the registration color, from 5% to 100%.

Ink colors should be listed on the template as well, but instead of coloring it with registration color, each ink name should be colored with that specific spot color. That way when the separations are printed out, each separation will have its own specific ink name showing so you'll know what ink color to print for that specific separation.

Once the separations are done and set up in the template, it's time to print them out. Most of today's printers, particularly inkjet printers, require raster image processor (RIP) software in order to print out halftones. Printers can print a halftone screen, but because screen printing requires larger halftone dots, the RIP is needed to interpret the information from the computer and send it to the printer so it can produce the appropriate larger-sized dot.

With the separations printed out, you're ready to go to press. Knowing the necessities to properly create and set up your separations will make your screen preparation and setup smoother and quicker, helping to eliminate production headaches.

Dane Clement is President of Great Dane Graphics, a GroupeStahl company specializing in the creation of production-ready stock art for the apparel decorating industry. He is also Vice President of Art and Creative Process for GroupeSTAHL. Clement has been speaking and writing for the decorated apparel industry since 1987 and is considered an expert on computer graphics and color separations for textile screen printing, dye sublimation, digital direct-to-garment and heat-applied graphics. He is also the author of T-Shirt Artwork Simplified, a how-to book on creating artwork for decorating apparel. Visit greatdanegraphics.com or email him at info@greatdanegraphics.com.