

Color Control in Lithography

Process Control is the first step to any successful color management strategy. The variability of each step of the process must be measured and controlled before attempting color management. The establishment of upper and lower control limits to each step of the process is necessary to verify any deviation that takes place. These steps, scanning, proofing, platemaking and presswork will be examined and controlled through measurement, calibration and standardization.

Do you measure -films, proofs, and plates? On press, do you measure gray balance, dot gain, and print contrast? What do you measure? What are your standards, tolerances, and targets?

Let's begin with a brief discussion of color. It's certainly subjective. Different individuals "see" color differently. Most people are sensitive to 'grays' and some to 'reds' and others to 'blues' and generally, people working around color printing pay close attention to neutral colors, there is good reason for this. When images are in 'gray balance' they are neutral throughout the tonal scale (0%-100%). If any neutral area is 'out of balance' it is classified as "casted" – towards magenta (red), cyan (blue) or yellow. If you look at a Lab CMC color tolerance chart, the elliptical shapes represent the measurable "Delta" difference in lightness, hue and saturation. The smallest elliptical shape, on the entire chart, noting the tightest tolerance for Delta difference, is gray.

When viewing color, individuals should be in an area that simulates 5,000 degrees Kelvin. GATF makes an inexpensive product #7065R Rhem Indicators that help determine the viewing condition. These stickers are placed on color proofs to help define the lighting condition. There are 50 stickers per order.

To begin our Process Control - Best Practices procedure, we need a target. It can be a house standard or some specific ISO specification. It is my opinion that SWOP (Specification for Web Offset Publications) is an excellent place to start. I have all the data associated with SWOP – density, dot gain, gray balance, print contrast and upper and lower control limits. Although SWOP is for Web printing at 133-line screen, it works equally as well for sheetfed work at 175-line screen. Reason #1- because all images converted in Photoshop's default settings are close to this reference. Reason #2-In addition the Pantone solid to tint book is close to this SWOP reference (see the printed page defining density and dot gain targets). Remember, Process control – Best Practices is the prelude to complete, successful color management. Attempting to color manage an uncontrolled printing process is futile.

In scanning our first priority is gray balance, then tone reproduction and color correction. If we scan an image, make a good measurable proof and want to 'correct' a certain color area. We enlarge or reduce, "dots" in the adjusted area then re-proof. Gray balance remains the constant, with local adjustments to color dot sizes. The same applies to photographic captured images, gray balance, and color correction. The last step is tone reproduction, the adjustment of the 'dot gain' or overall weight of the image. Dot gain is a 'bell shaped' curve starting at 1% increasing to the midtone (50%) then declining to 99%. The 50% dot has the most gain and is the most sensitive to change. This is why the scanning person asks what press is this going on? Is it coated or uncoated? Sheetfed or Newsprint? We know the weight (dot gain) and gray balance is according to (SWOP)

recommendations. Photoshop's defaults are nearly the same. You can certainly see the problems if dot gains and gray balance were different for every press or proof condition!

Proofing has its own set of parameters. When film based systems were around we controlled the color of the laminate for each color Y-M-C-K and the dot gain by exposure and proof base material decisions. With a digital proof – all bets are off. If I make a digital proof in Pittsburgh, PA will it match a proof in Alexandria, VA.? It “depends”. Platemaking is another over looked area. Each plate should have a Plate Control Target on it, to measure highlight, shadow and midtone values. Knowing the 50% (midtone) is the most sensitive to change, it's imperative that we know the value on the plate. Many of the CTP devices were installed with the 50% reading 50% or less, this created a lot of problems for printers with film based systems that made plates with 54% in the midtone. They were now too ‘sharp’ on press to match their work from last week! On CTP devices this value can change because of replenishment temperature and/or rate of replenishment. These values have a direct response to the dot gain numbers on press and must be measured.

The presswork Process Control - Best Practices includes the measurement of solid ink density, gray balance, dot gain, print contrast and trap. This means that the information must be available on the color bar for measurement. I hear printers say “we don't sell color bars”! This is true - but the color bar is the only thing that's consistent from job to job. The images and coverage are always different- -so what's our control? A good color bar!

Prior to any color calibration or color management program the press should print a Test Form to confirm the press is printing in a stable print condition. If there were any concerns that the press is suspect, I would encourage a consultant to be present during the test. You can add the ECI or IT.8 or custom target to the test form for the color management information.

Any press test should include the parameters for the test. Here are mine based on SWOP.

Density	Y-1.00	M1.40	C1.30	K 1.70
Dot Gain	Y-18%	M-20%	C-20%	K-22%
At the 50%				

Also, a color bar with a 50-Cyan, 40-Magenta, 40-Yellow representing a midtone (50%) gray is essential. With this patch we can visually inspect neutrality of the patch and can measure it with a densitometer. If we measure all 3-filter readings Y-M-C (Blue-Green-Red) and they are equal in value, it will be near neutral in color.

The press has the most variability, it's standard deviation for dot gain is plus or minus 2%. The ‘secret’ is to keep the Magenta & Cyan gain the same with Yellow 2% less. If you look at the GRACoL chart you will note that this is the case for every paper condition – that's GRAY BALANCE.

As I stated in the beginning, gray balance is very important. In fact, in my opinion, the ‘secret’ to excellent color printing is to print to gray balance and use GCR to control it! The use of GCR allows for a wider deviation at press without ‘changing’ the color! GCR removes the color tone values from the image and places more tone in the black printer. This change requires the black printer to be controlled more than the Y-M-C printers. According to a recent NAPL/PIA/GATF Survey, the number one complaint

from print buyers was “inconsistent color”. With GCR use, the color will stay more consistent.

Any questions or comments please call:

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