Process-Color Pad Printing

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As with most methods of reproducing process-color images, the creation of near-photographic quality separates the novices from the experts. Process-color pad printing has been practiced for many years and came of age when photographic images first saw use in CD printing, before the introduction of today's high-speed multipolar screen-printing presses.

At that time the output requirements were much less, with 500 discs/hr being acceptable. A pad-printed line ruling of 175 lines per inch allowed a tonal range of 5- 95%, which was printed on a gloss white background, and the printed results were superb. Admittedly some of the designs were pretty wild, their designers having resorted to something stronger than Earl Grey tea before their creative sessions. But this was the pinnacle of multipolar pad printing and arguably the best quality direct CD printing ever achieved.

Why were these pad-printed CDs so good? Pad printing has characteristics that are ideally suited to high-precision process printing: thin ink films, very accurate registration, excellent dot reproduction, the ability to print fine line rulings, and no mesh-induced moiré. Although the current high-speed CD screen-printing machines exceed 4,000 images/hour, they are limited to coarser line rulings and experience inherent moiré problems associated with screen-printing.

Now that print buyers are so accustomed to photographic images and the design freedoms that accompany them, the demand for finer line counts and higher quality printing is greater than ever. it’s a perfect time to think about process-color pad printing. And once again, the key to success is found reducing and control-ling the variables.

Registration is one of the most important variables to control. It is affected primarily by the indexing accuracy of press’s feed mechanism. Mechanical indexers should have positional accuracy of ±0.01 mm (±0.0005 in.). The jig must be stable and must hold the object firmly. (1f you try to use a manually loaded single jig to print colors in succession you will find the process both time consuming and impractical.) The ink pick-up and print stroke of the pad requires similar accuracy. With these factors under control the foundation for good pad printing is in place.

The next decision involves the plate material. We recommend either a high-quality steel plate with a fine crystalline structure or a photopolymer plate. Personally we prefer the photopolymer plate because it generally enables you to use a finer line. But be aware that controlling the etch depth on photopolymer plates can be more of a challenge.

Regardless of the plate material the target etch depth is 20 microns. A steel plate will resolve a tonal range of 10-90% at 150 lines/inch while a photopolymer plate will resolve a tonal range of 5-95% at 175 lines/in. Dot shape is normally elliptical in pad-printed images, and halftone screens typically have the following angles: cyan, 67.50; magenta, 22.50; yellow, 90; black, 45. Stochastic screening also works very well on photopolymer plates.

The quality of etched steel plates would be better if many of their producers were better at controlling their production processes. Etch depth is often uncontrolled and definition is lost. For the vast majority of pad-printed images, the current offering of etched steel plates is more than adequate. But when your job calls for very small dots and line halftone work some suppliers are still struggling to produce an acceptable plate. Prepress is critical but you do not have the luxury of test strips and grayscales that other printing processes have. And there’s the rub. Your inability to measure the image with a densitometer means that decisions about the quality of the image have to be made against a personal standard which amounts to a veer subjective assessment.

You have to be sure of the etch depth and ink condition. Dot reproduction with pad printing is very accurate and although there is some change in dot size, it is not as significant as in screen-printing. The change in dot size will be exaggerated if you over-pressure the pad. Consistent pad pressure on all the colors is critical. Pad condition also has to be monitored, as degradation of the pad surface will cause a color shift.

Ink condition is probably the most critical area of concern. It starts with the color as received from your supplier. You need to be assured that each ink and color has the characteristics you expect as specified by the manufacturer such as optical density. If you need to adjust the density, it's a1- ways better to start with ink

that has known density characteristics then simply reduce the ink with an appropriate amount of transparent base.

Your only method of increasing the density of a printed color is to increase your etch depth, and this is *not* a good idea! You are making decisions on color correctness without the aid of a densitometer, so adding yet another variable into the equation is an invitation for trouble. The solution is to purchase ink of a higher density than you require and reduce the density to the required level by adding base. This gives you a tool to modify color by altering only one parameter.

To obtain (and maintain) the desired transfer characteristics for the ink as you adjust its density, you will also need to measure the correct solvent mix into the ink. The density you decide to use for each individual color will be based on the values you establish when making separations. You have to replicate these densities in your print to get predictable results.

Successful process-color pad printing requires strict process control and a thorough understanding of printing technique. You shouldn't consider process-color pad printing unless all of the following characteristics apply to your shop:

> Your printing equipment is capable of holding tight registration.
> You are currently able to control ink conditions on non-process color work.
> You have written procedures for achieving accurate colors and consistently follow them.

If you wish to take on the challenge of process-color pad printing, congratulations! But before you proceed make sure you are aware of your customers' expectations. Agree upon standards with the customer that you can main- tain from the start of the contract until the job is finished. This will allow you to minimize the risk of creating a pile of rejects!

Digital Misprints

A customer once returned 20 000 printed plastic bottles to a manufacturer we known and all exhibited the same fault: The ink was not adhering properly in one specific part of every bottle. The bottle was a medicine container, printed in one color with very fine text. For obvious reasons, it was crucial that all of the instructional and dosage information remained on the container! The printer was also the bottle manufacturer and he was at his wits end trying to find out how to resolve the problem.

Upon visiting the facility it became clear that this company knew what it was doing. It had a well-organized production floor with top-end, properly maintained equipment. We looked first at the bottle presentment system, designed to improve ink adhesion to the material. The company used a flame-treatment unit with a controlled flame mounted inline on the press. It was in perfect working order and was ruled out as the culprit.

The ink was also not the source of the problem. The vast majority of the printed image passed the specified crosshatch tape test. The problem area was an oval shape, about 1 x ¾ inch large. It was time for some detective work.

We began exploring the process at the end of the printing line and worked backwards to the bottle-molding floor. Everything checked out, and everyone appeared to be wearing the correct personal protective equipment.

The bottles were blow molded, then exited from the machine down a ramp where an operator picked up the bottle and removed a small plastic burr with a sharp knife. He wore a glove on his left hand and held the knife in his right hand. The hot bottle was held in his gloved left hand while he cut off the burr. He then transferred the bottle to the right hand -between his thumb and the knife- to place it in the transport packaging.

The problem was his thumbprint. He was hot and perspiring, and the oils from his hand were contaminating the surface, prohibiting the flame treatment from improving the material's surface tension. The only way to remove this thumbprint was to use a solvent wipe. The solution was quite simple; he put a glove on each hand. This covered up the offending digit and the problem disappeared.

Regardless of the printing process you are using, handling the printing surface can wreak havoc on the print. Ink will only adhere if the surface energy of the substrate is higher than the surface tension of the ink -the ink has to wet the surface to be printed. With polypropylene and polyethylene, flaming, corona discharge, or plasma treatments are all suitable methods of making the surface *wettable.* They all increase the surface energy of the material to be printed -provided there is no skin oil or other contaminant on the surface.

Contamination by whatever means is a major problem for any surface. One of the most insidious contaminants is silicone spray, which is sometimes used for lubrication. The application of such a spray anywhere near

surfaces that have to be printed or coated can disable a facility. So keep your operation printing profitably - keep it clean!

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