



How can I get accurate colors after laminating?



From printing... to finishing!

Thermal Inkjet Printing Technology can be used on a wide variety of printing media, including films, coated papers, photographic papers, canvas and fine art media. By combining this printing media flexibility with a large set of colored pigmented inks, we'll be able to enter into a world of new applications like fine art reproduction and high quality photo printing. Color accuracy and color consistency are key attributes in those markets, as well as fade and scratch resistance.

Lamination is the usual finishing step to achieve this durability. This also helps to gain image quality, stiffness and gloss uniformity. It changes the surface finish of the print, making it glossier or more matte to adapt it to customer's requirements. The appearance of our prints is always modified – colors included – and this needs to be considered when generating a color profile.

The HP DesignJet Z Photo Printer series features a spectrophotometer capable of measuring color in the printer. This makes the color accuracy and consistency tasks easier, including with laminated media.

Basics on lamination

There are two main types of laminates: liquids (also known as coatings) and films (also known as overlaminates).

These can be applied at room temperature (this is the case of the liquid ones and the cold overlaminates) or with heat (heat-assist and thermal overlaminates). A roller-laminator, a press or even a spray gun are some of the devices used to apply these laminates.

Their surface finish ranges from gloss to matte, including luster and semi-gloss, and they can also mimic surfaces like leather and canvas.



My laminate is transparent: does it really affect colors?

The effect of lamination on the colors of a print will depend on parameters like the type and surface finish of the printing media, the type and surface finish of the laminate and its application method.

As seen in **Table 1**, a glossy media with a gloss laminate usually sees its gamut slightly reduced. With a matte laminate, this reduction is much higher. On the other hand, a matte media with a gloss laminate will have a considerable gamut increase. With a matte laminate, the gamut is reduced.

Table 1:

Gamut volume variation relative to the non-laminated print

		PRINTING MEDIA		
		GLOSSY MEDIA HP Everyday Pigment Ink Gloss Photo Paper	MATTE MEDIA HP Professional Matte Canvas	
LAMINATE	GLOSSY (DryTac Interlam EcoGloss)	-2%	20%	LAMINATE
	MATTE (Seal Print Guard Matte)	-42%	-9%	

HP internal testing, based on a 1344 measurements chart done on Xrite Eye one measurement device. Gamut calculations done with an HP internal tool.

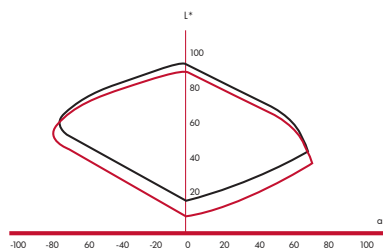
Laminating "darkens" prints.

As transparent as our laminate seems to be, it has a certain opacity and it will capture some of the light that would have been reflected from the print, had it not been laminated.

This effect is illustrated in **Figure 1**, where you can see a slice in the L^*/a^* plane of the gamut of the **HP Professional Matte Canvas** before and after lamination with a glossy laminate, like the Drytac Artshield Satinex.

Figure 1: L^* is globally lowered by laminating

Black: HP Professional Matte Canvas before lamination
Red: HP Professional Matte Canvas after lamination



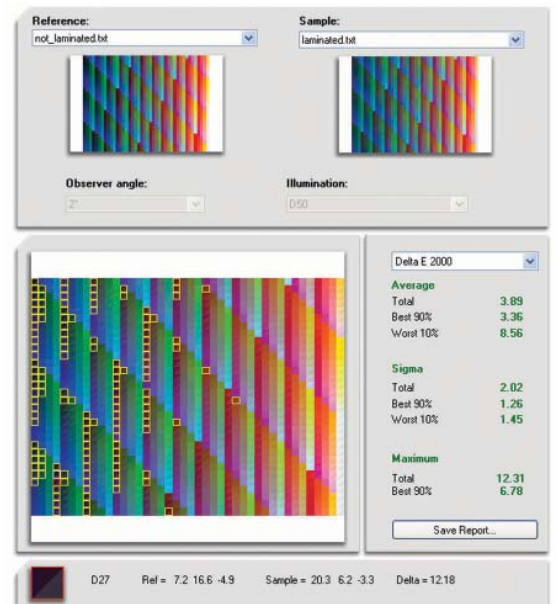
HP internal testing, based on a 1344 measurements chart done on Xrite Eye one measurement device. Gamut calculations done with an HP internal tool.

In the above example, we can see a global shift of the gamut toward lesser lightness (L^*). However, the range of possible colors increases as we gain more in the dark colors (lower L^*) than we lose in the light colors (higher L^*).

Lamination does affect color.

Figure 2 demonstrates how much an individual color can be affected by lamination. In this example, we chose the **HP Everyday Pigment Ink Gloss Photo Paper** and laminated it with Seal Print Guard Matte laminate. A large number of color patches were printed and measured before and after lamination showing differences of over $12 \Delta E_{2000}^*$.

Figure 2: Effect of lamination on color



HP internal testing, based on a 1344 measurements chart done on Xrite Eye one measurement device. Gamut calculations done with an HP internal tool.

How to optimize color accuracy for finishing?

Considering the possible impact of lamination, color critical prints will want to take into account this effect either by manual adjustments to the image or by taking into account the lamination in the ICC profiling.

As seen previously, a consistent effect of lamination is a slight darkening of the plot. An overall compensation for this effect can be done with image editing tools. However, this is a complicated task due to the non-homogeneous effect of lamination on lightness. In **Figure 1**, we note the darker colors are affected more than the lighter colors, hence a global lightness shift in an image editing tool will not perfectly balance the effect of lamination.

Including the effect of lamination on color can also be done with the help of a spectrophotometer and an ICC generation program. For that, we need to measure the ICC target after it has been laminated.

The resulting ICC will thus optimize the rendering of the colors for the laminated prints.

The importance of considering the effect of lamination on your final print is illustrated in **Figure 3**, where we can highlight the following improvements:

- Compensation of the loss of luminosity when laminating (left is slightly more luminous).
- A more vivid red shirt on the left, underlining a better use of the improved gamut of the laminated media.

Figure 3. Left: ICC on laminated target - Right: ICC on non-laminated target



Simulations done on Adobe Photoshop CS3, soft proofing the Relative colorimetric rendering intent. The ICCs used for the simulation were generated using HP Color Center tool and using the printer's internal spectrophotometer.

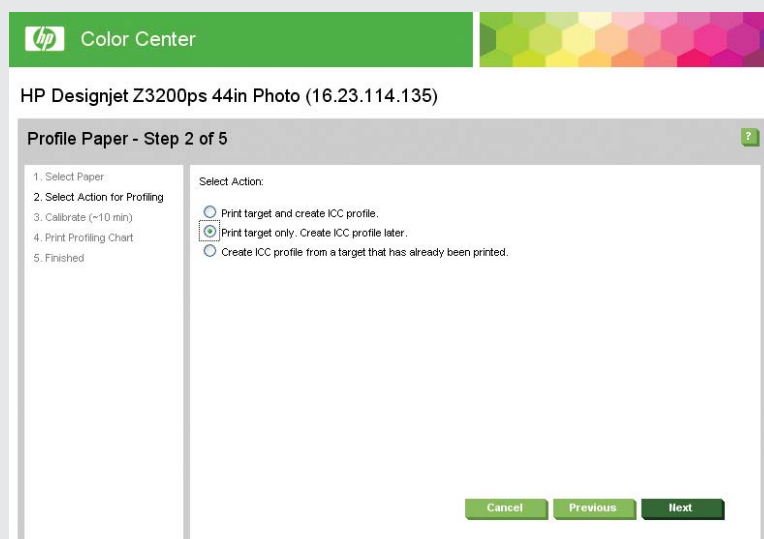
Creating an ICC for laminated media is an easy task with the HP Designjet Z Photo Printer series and its embedded spectrophotometer. This straightforward process is executed semi-automatically (**Figure 4**):

1. "HP Printer Utility" prints your calibration target (**Figure 5**).
2. Laminate your target.
3. Load back your calibration target into the printer and let the "HP Printer Utility" automatically generate an ICC optimized for your laminated media.

Figure 4: Generation of an ICC profile on laminated media with the HP Designjet Z Photo Printer series



Figure 5: HP Printer Utility "split" ICC process





Conclusions

Lamination is the act of applying a layer of transparent material over your prints. By doing so, the colors could be significantly affected.

Compensating for this effect can be done easily by using an ICC profile measured over a laminated target. This task can be easily achieved using the HP Designjet Z Photo Printer series with its embedded spectrophotometer.

Roman Barba
is an HP Large Format
Printing Media Research &
Development Engineer

roman.barba@hp.com



Jean-Frederic Plante
is an HP Large Format
Printing Media Research &
Development Engineer

jf.plante@hp.com



To learn more, visit www.hp.com

© 2008 Hewlett-Packard Development Company, L.P. The information contained herein is subject to change without notice. The only warranties for HP products and services are set forth in the express warranty statements accompanying such products and services. Nothing herein should be construed as constituting an additional warranty. HP shall not be liable for technical or editorial errors or omissions contained herein.

This is an HP Indigo digital print.

4AA2-0898ENW, September 2008

