Comparison of Two Processless Offset Printing Plates

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Abstract

This paper will compare two process-less offset plates for their imaging and on-press behavior. Several tests will be performed to evaluate the difference between the two plates. One plate is supposed to replace the other. The newer processless plate promises that the dot can be read directly on the plate after imaging. This will be tested as well.

Imaging and press parameters will remain the same for this project to understand better that the newer processless plate can be exchanged directly without any modifications to the current workflow. The test will be carried out on the same coated paper with the same inks. The older set of plates will be used to establish proper printing conditions and printed solid ink densities. Once this has been done, the plates will be changed. After printing, approximately 500 sheets test sheets will be pulled from delivery and evaluated for the parameters listed below.

A test form will be created to measure the following parameters: printed solid ink density, tone values, tone value increases, print contrast, reproduction capabilities of fine lines regular and reverse, small type reproduction capabilities regular and reverse, and color gamut. It is expected that there will be minimal differences in print quality between the two processless plates.

Introduction

In the School of Graphic Communications Management at Toronto Metropolitan University, we use processless plates for printing on our Heidelberg PrintMaster PM74 press. Seeing the image burned onto the plate was challenging with the plates used before. The newer plates allow the premedia and press operators to see the image on the plate.

Toronto Metropolitan University

Plates requiring a plate processor have the advantage of a clearly visible image area on the plate, making it easy for a press operator to identify the plate color before mounting the plate on the press. A plate processor requires electricity, a developer, a replenisher, water, a finisher, and, quite often, a set of rollers and brushes that must be maintained and replaced regularly. Also, an employee needs to be trained to maintain the plate processor. The environmental impact of printing plates was already described by Zarwan (Zarwan, 2009). In his article, Zarwan mentioned that the chemicals used in plate processor need to be considered towards the environmental footprint of offset printing plates. A schematic of the some of the consumable needed for a plate processor can be seen in the figure below.

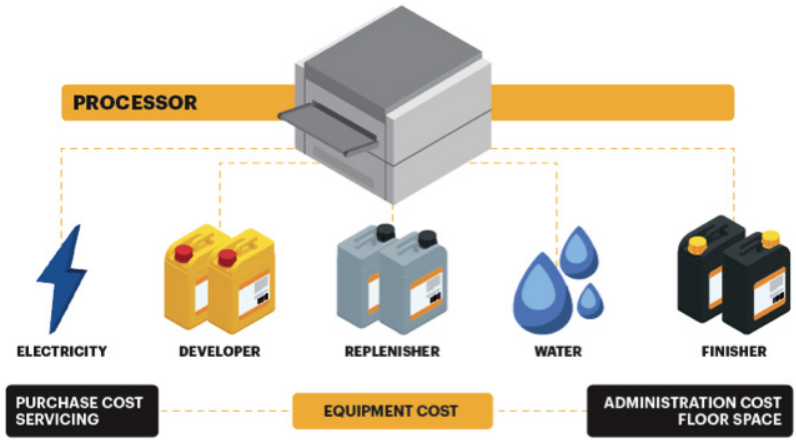

Figure 1. *Typical plate processor with consumables (Kodak, n.d.)*

Processless printing plates don't require a developer and related consumables. The development of the plates happens in the printing unit once the plate has been mounted and the dampening roller is applied to the rotating plate cylinder. The schematics of a process less plate can be seen in the figure below.

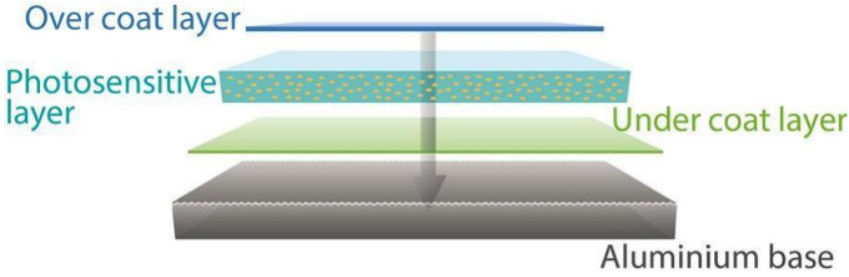

Figure 2. *Schematics of a process less plate (Quian, 2022)*

The development steps of a processless plate are shown in the following figure.

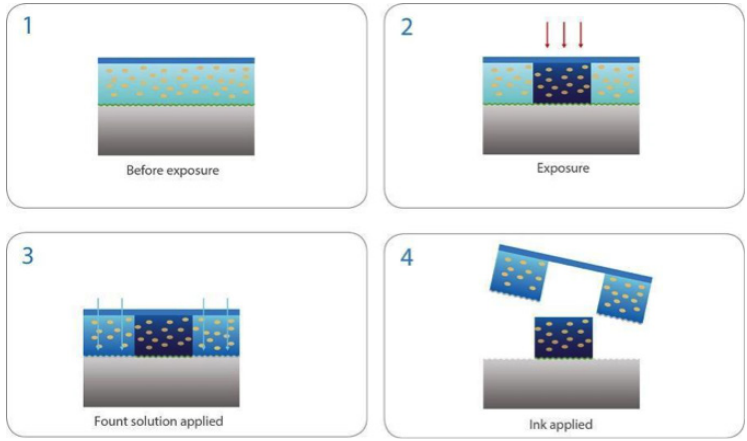

Figure 3. *Development steps of process less offset printing plate (Quian, 2022)*

The benefits of a processless offset printing plate are mostly related to the costs of maintaining the plate process with the various consumables required for the plate processor. These consumables are various rollers and brushes used in the plate processor and the necessary chemicals. The only negative side of using process less plates is their reduced run length.

Equipment and materials

- Kodak Prinergy Workflow with Preps
- Proofer: Epson SureColor P9570
- Old plate: Kodak Sonora Xtra
- New plate: Kodak Sonora XP
- Platesetter: Kodak Trendsetter TSM
- Paper used: Creator coated gloss text, 100lb 19”x25”, grain long, 148 g/m^2
- Inks used:
  - Hubergroup Black, 49RL2501, Inkredible Reflecta COFree Black
  - Hubergroup Cyan 43F10PX, Perfexion-Eco Cyan
  - Hubergroup Magenta 42F10PX, Perfexion-Eco Magenta
  - Hubergroup Yellow 41F11PX, Perfexion-Eco Yellow
- Press: Heidelberg PM74-4P
- X-Rite Intellitrax
- X-Rite eXact (M1), S/N: 28618
- X-Rite i1 ISis 2 XL (M1), S/N: 010811
- Chromix ColorThink Pro 3.0.9
- MS-Excel

Procedure

For the comparison of the two processless plates, a test form was created. The test form contains the updated IT8.7/4 test chart that also contains the P2P target from the G7 method. Another test target is a line target to see if there is a change in the smallest fine line that can be printed. Another test target is a tint ramp that was used to determine tone value increase (TVI). There is also an ink trap test target to see if the ink trap is influenced. There is also a font test target on there to determine the smallest font size that can be reproduced with both plates.

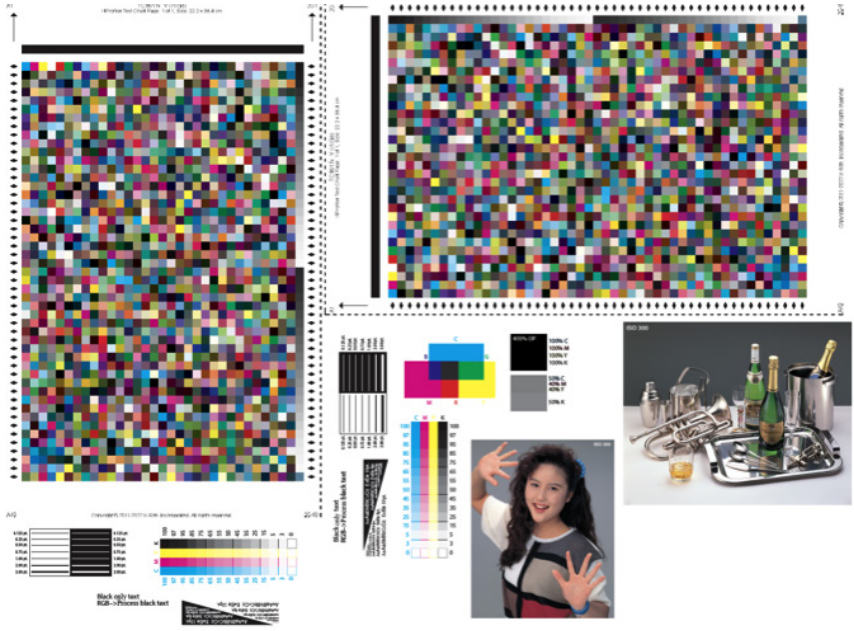

Figure 4. *Test form used in this study*

Results

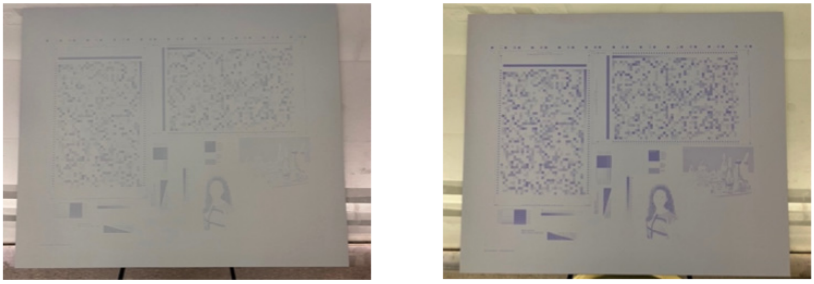

Figure 5. *On the left old plate, on the right new plate*

Tone value increase and solid ink density

The first comparison between the old and the new plates evaluates the average printed ink density and the TVI curves. Below are the results from this evaluation.

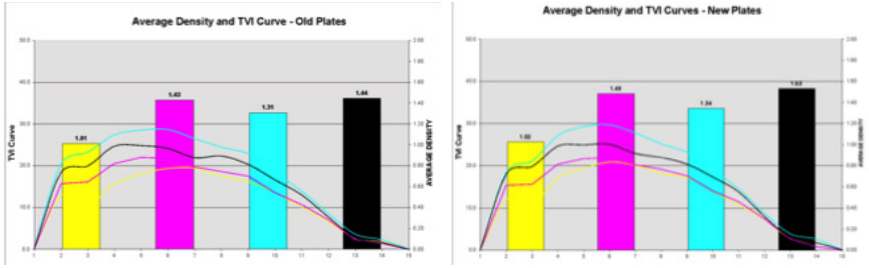

Figure 6. *Average printed ink density and the TVI curves*

It is clearly visible from figure 6 that the solid ink densities and TVI curves are very similar during the press run using the old and the new printing plates. Table 1 shows the numerical values of the solid ink densities.

Color	Solid ink density		Difference
	Old plates	New plates	
Yellow	1.01	1.02	0.01
Magenta	1.43	1.48	0.05
Cyan	1.31	1.34	0.03
Black	1.44	1.53	0.09

Table 1 *Comparison of the printed solid ink density*

The differences in the solid ink density are within acceptable differences. The TVI curves are the same because the same workflow was used to create the color separations and image the plates.

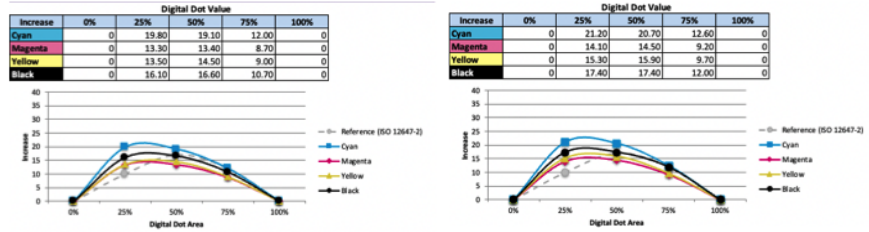

Figure 7. *Tone value increase and solid ink density tests*

The values in the tables above the graphs show that the newer plates show slightly larger TVI values.

Print contrast and ink trapping

The print contrast and ink trapping are the next comparison between the two types of printing plates. Print contrast is measured on the 75% tint patch of the tint ramp.

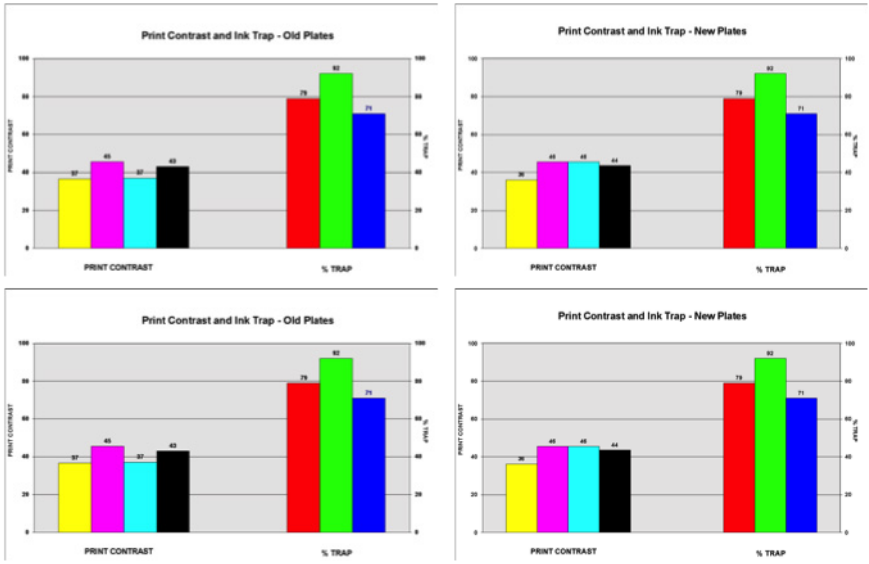

Figure 8. *Print contrast and ink trapping*

From figure 8, the ink trap values are identical for both plate types. The print contrast values are also almost the same. The only exception is cyan on the new plates, which show a higher print contrast.

In the next picture (Figure 9) we can see a comparison of the 50% tint imaged on the old plate (left) and the new plate (right).

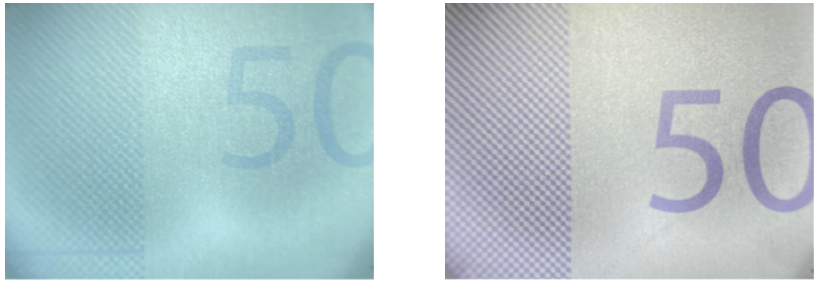

Figure 9. *Comparison of the imaged plates at 50% tint*

The below pictures show a comparison of the imaged plates on the 5% tint. The old plate is on the left, while the new plate is on the right (Figure 10).

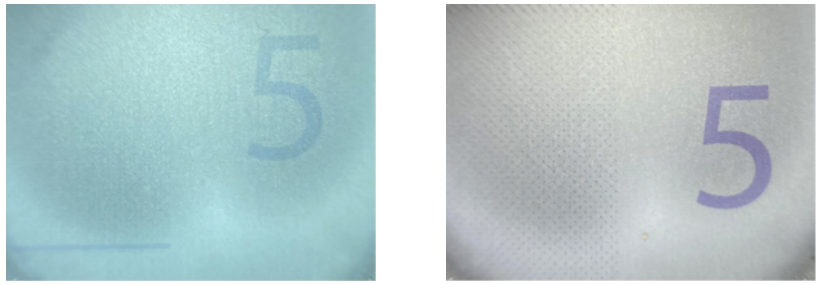

Figure 10. *Comparison of the imaged plates at 5% tint,*

It's clearly visible, especially on the 5% tint that it's almost invisible on the old plates, while is clearly visible on the new ones. That is also one of the benefits of the new plates.

The below pictures show the print quality at the 50% tint (Figure 11). There are no apparent differences in that comparison between old and new plates.

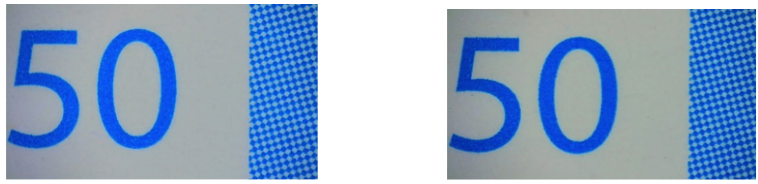

Figure 11. *Comparison of the print quality at the 50% tint*

Line target and text target

The below pictures were tested in comparison of different print qualities, like up to 1 pt. font size or 0.125 pt. lines in black and reverse (Figure 12).

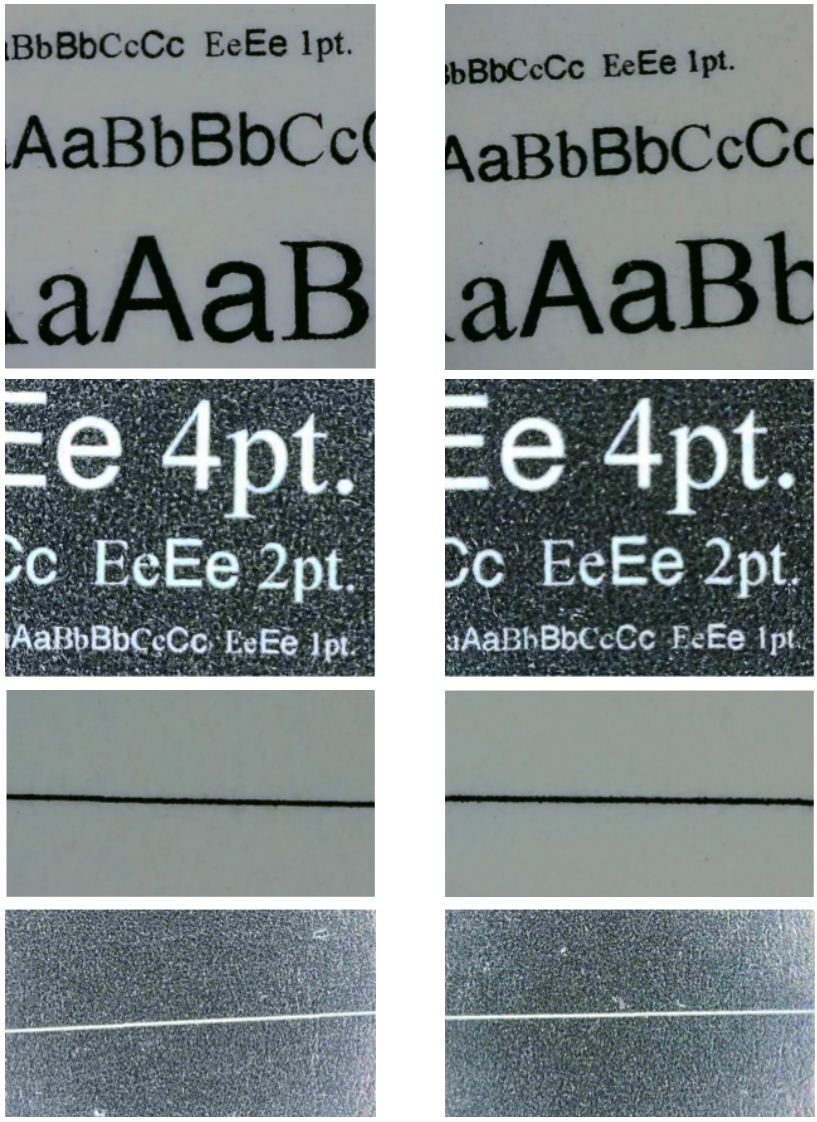

Figure 12. *Comparison of the print quality of fonts and fine lines, old plates on the left and new plates on the right*

Color gamut and color differences between old and new plates

The results for this part of the study, the IT8/7.4 updated test target, was analyzed using Chromix ColorThink 3.0.9. The measurements were done in M1 mode, like the previous measurements in this study. The first comparison is the gamut volume of the ICC profile. The profile was generated with i1Profiler after the test target was measured with i1iSis. From figure 4, it can be seen that the test target was printed

in the machine direction and in the cross-machine direction. The Table below lists the gamut volume numbers obtained from ColorThink.

	Old plates		New plates	
Direction	Machine direction	Cross-machine direction	Machine direction	Cross machine direction
Gamut volume	365,135	384,180	379,044	387,400
Average	374,658		383,222	

Table 2 *Color gamut of the old and new processless plates*

The new plates increased the color gamut by 2.3%. The image below shows a 3D plot of both ICC profiles. The gamut of the old plates is magenta colored and the gamut of the new plates is cyan-colored.

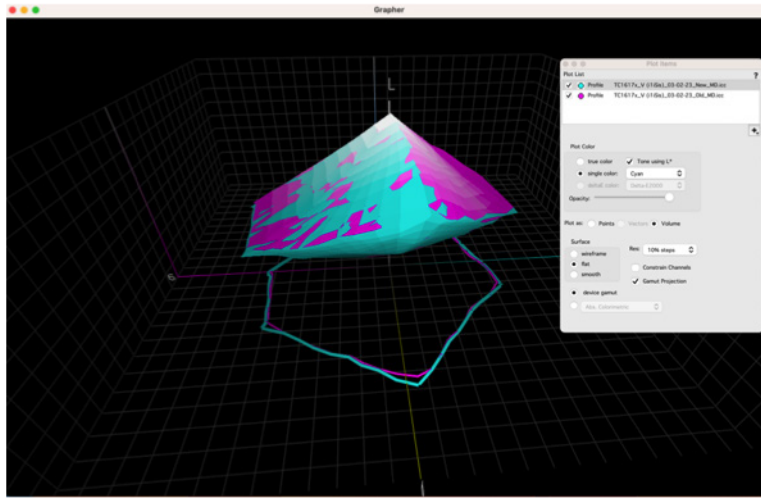

Figure 13. *Color gamut of the old and new plates in machine direction*

Figure 13 shows that the gamut of the new plates is mostly larger than the gamut of the old plates. A look underneath the gamut volume in the region of the darker colors shows that the new plates have a bit of a wider gamut there. This is shown in the figure below.

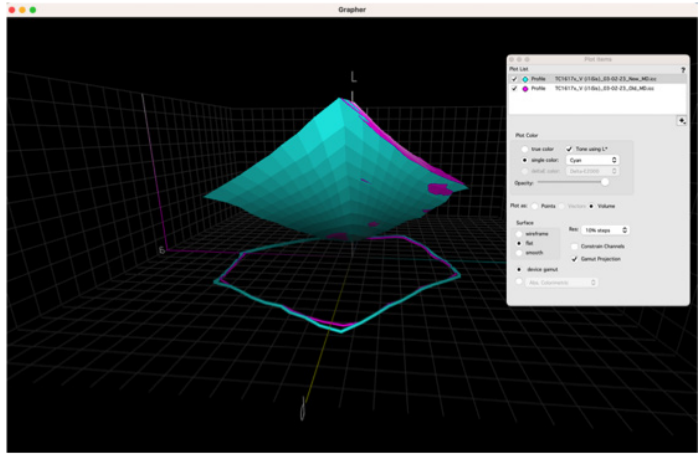

Figure 14. *Color gamut space of the old and new plates in cross machine direction*

In the next tables, the color differences of the process colors to ISO Lab reference as calculated by ColorThink are shown.

Ink	ISO Lab reference	Old plate machine direction	dE00 difference
Black	16.0, 0.0, 0.0	20.4, 0.8, 1.3	3.65
Cyan	55.0, -37.0, -50.0	58.0, -35.3, -47.4	2.89
Magenta	48.0, 74.0, -3.0	48.0, 73.8, -1.5	0.61
Yellow	91.0, -5.0, 93.0	88.2, -5.4, 84.1	2.57
			Average: 2.43

Table 3 *Color differences in dE00 for the process colors to the ISO reference, machine direction test target, old plates*

Ink	ISO Lab reference	Old plate cross-machine direction	dE00 difference
Black	16.0, 0.0, 0.0	20.6, 0.8, 1.6	3.63
Cyan	55.0, -37.0, -50.0	58.0, -35.8, -47.5	2.86
Magenta	48.0, 74.0, -3.0	48.6, 73.2, -3.5	0.67
Yellow	91.0, -5.0, 93.0	87.7, -4.9, 89.4	2.20
			Average: 2.34

Table 4 *Color differences in dE00 for the process colors to the ISO reference, cross-machine direction test target, old plates*

Ink	ISO Lab reference	New plate machine direction	dE00 difference
Black	16.0, 0.0, 0.0	18.8, 0.9, 1.2	2.52
Cyan	55.0, -37.0, -50.0	56.2, -35.4, -49.3	1.29
Magenta	48.0, 74.0, -3.0	46.5, 75.3, 1.9	2.45
Yellow	91.0, -5.0, 93.0	87.9, -5.1, 88.8	2.13
			Average: 2.10

Table 5 *Color differences in dE00 for the process colors to the ISO reference, machine direction, new plates*

Ink	ISO Lab reference	New plate cross-machine direction	dE00 difference
Black	16.0, 0.0, 0.0	18.6, 0.8, 1.4	2.50
Cyan	55.0, -37.0, -50.0	57.1, -35.6, -48.5	2.04
Magenta	48.0, 74.0, -3.0	48.6, 73.5, -3.0	0.63
Yellow	91.0, -5.0, 93.0	87.6, -5.1, 88.7	2.33
			Average: 1.88

Table 6 *Color differences in dE00 for the process colors to the ISO reference, cross-machine direction, new plates*

From the tables 3 – 6 it can be seen that the newer plates have a slightly better conformance to the ISO Lab reference values for the process colors. It can be said that a dE00 of close to a value of two is a quite good result.

General color differences between old and new plates

For this section a worksheet was opened in ColorThink and the spectral M1 measurements were used to have the software calculate the color difference for the 1617 colors. A visual presentation can be seen in the image below.

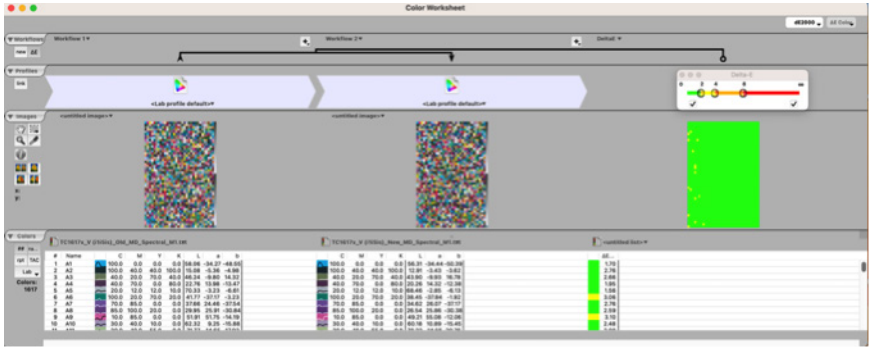

Figure 15. *The color difference between the old and new plates for the test target in the machine direction*

	Overall (1617 colors)	Best 90% (1454 colors)	Worst 10% (163 colors)
Average DE	1.31	1.17	2.55
Max DE	4.59	2.11	4.59
Min DE	0.10	0.10	2.12
Std dev	0.59	0.42	0.37

Table 7 *Color difference values for all the test patches in the machine direction*

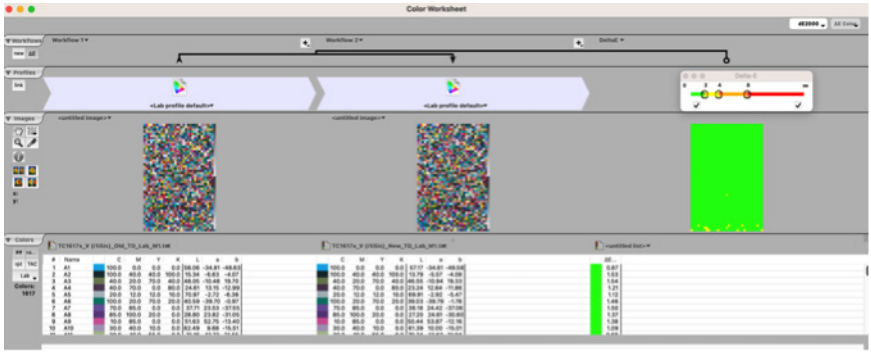

Figure 16. *The color difference between the old and new plates for the test target cross-machine direction*

	Overall (1617 colors)	Best 90% (1454 colors)	Worst 10% (163 colors)
Average DE	1.11	0.97	2.31
Max DE	4.06	1.78	4.06
Min DE	0.06	0.06	1.78
Std dev	0.56	0.38	0.46

Table 8 *Color difference values for all test patches in cross-machine direction*

Tables 7 and 8 show that the color differences between the old and new plates are minimal, with a dE00 difference in machine and cross-machine direction being very close to a dE00 value of 1.

Conclusions

Benefits of the new plate:

- Plates are “developed” in three press cylinder rotations.
- No new plate curves are needed.
- Very similar TVI and print contrast results.
- Slight colour gamut improvements.
- Minimal color difference in the printed result between old and new plates

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