Expanded Color Gamut Printing 2.0: Integrating Process Control and Sustainability Assessment

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Abstract

Expanded Color Gamut (ECG) printing has evolved from an experimental innovation into a recognized strategic approach that enhances both print quality and sustainability. Previous research conducted at Toronto Metropolitan University and Tampere University of Applied Sciences demonstrated that replacing spot-color workflows with fixed-palette systems (CMYK + OGV) can significantly reduce make-ready time, washing solution use, and ink waste However, most of these findings were based on simulation and production data, not on controlled laboratory verification. The next phase of our investigation aims to bridge this gap by integrating process-control software and Life Cycle Assessment (LCA) to evaluate both colorimetric accuracy and environmental performance under real-world conditions.

The main objective of this study is to evaluate how expanded color gamut printing performs, both technically and sustainably, when compared to a traditional CMYK + 2 PMS workflow - this configuration represents a typical design setup used in commercial print production, although some designs may include as many as 7–8 spot colors, while others rely solely on CMYK. Controlled laboratory tests will be carried out at the Graphic Communications Management (GCM) laboratory at Toronto Metropolitan University. These experiments will focus on the colorimetric behavior of both systems. A calibrated seven-color flexo configuration (CMYK + OGV) will be benchmarked against a reference CMYK + 2 PMS setup to quantify achievable color accuracy and reproducibility across multiple print runs.

Introduction

Expanded Color Gamut (ECG) printing has evolved from a concept of color gamut expansion into a production-oriented methodology with direct implications

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for efficiency, quality, and sustainability in packaging printing. This work introduces Expanded Color Gamut Printing 2.0, defined as the integration of multicolor process printing with systematic process control and sustainability-relevant performance metrics.

The study is based on controlled flexographic press trials and a direct comparison between ECG and conventional spot color workflows. The results demonstrate that ECG workflow can reproduce a large proportion of brand colors within accepted tolerances while reducing makeready time, ink consumption, solvent usage, and substrate waste. By linking color management strategies to operational performance, ECG 2.0 can be seen as a practical production approach rather than a purely color-centric solution.

This study continues a project initiated during the COVID-19 pandemic, in which ECG conversions were performed using GMG OpenColor, Esko Equinox, and an IDEAlliance small ECG test chart. In the present study, Alwan ColorHub and Toolbox were used for ECG conversions together with the IDEAlliance small ECG test chart, enabling direct comparison. A large set of spot colors was selected from the Pantone Solid Coated library V5 (M1) of evenly distributed color tones across the hue angle range from 0° to 360°. All test charts were processed under identical conditions.

The CIEL*a*b* values of the converted Pantone colors were measured and compared with the corresponding Pantone library values. Based on the correlation between predicted and measured ΔE00 values, three spot colors, Pantone 7620 orange, Pantone 7717 green, and Pantone 2091 violet, were selected for further evaluation. A test job was then produced using CMYKOGV water-based flexographic inks, and the printed results were measured and analyzed.

Packaging printing faces increasing pressure to deliver high color fidelity, shorter production runs, and improved environmental performance. In flexographic printing, these demands have traditionally been addressed through extensive use of spot colors. While effective for brand color accuracy, spot color workflows introduce significant production complexity, including frequent ink changes, extended makeready times, and increased material and solvent consumption, thereby negatively affecting productivity and sustainability.

ECG Printing 2.0 investigates the tight coupling between color reproduction and process control to ensure consistent performance while reducing non-productive press time, ink usage, and waste generation. The work focuses on profiling strategies and comparing different test chart models and sizes under real press conditions. Test results show that a larger test target does not necessarily result in a larger color gamut. As expected, optimized color charts produce different color builds for the selected test colors. The results also highlight the importance of ink standardization (CMYKOGV).

Methodology

The research in this study builds on work conducted during the global pandemic in 2020 and 2021. The previous work used software from GMG and Esko to convert each color from the Pantone Coated library into a combination of up to three of the seven process colors, CMYKOGV.

For this study, software from Alwan Color was used. Like in the previous study, a proprietary test chart needs to be printed and measured. The test chart that fit on the 7" wide substrate of the press contained 906 test patches and could be measured with an X-Rite eXact. The measurements from the test chart were then used to create an ICC color profile, which was then used to convert the colors from the Pantone Coated library into a CMYKOGV build. To compare the effectiveness of the proprietary test chart from Alwan Color, the IDEAlliance small ECG test chart with 400 test patches was also printed, measured, and converted into an ICC profile, which in turn was used to convert the 2130 colors from the Pantone Coated library into CMYKOGV builds.

Once the ICC profiles from the test charts were created, a custom test chart containing 27 number of selected Pantone colors was processed with those ICC profiles and printed on press. The L*a*b*- numbers of those selected Pantone colors were measured and then compared to the reference L*a*b*-numbers from the Pantone Coated library to determine the color difference between them. During the project, Alwan Color supplied a new 180 patch test chart. This test chart was also printed, measured, and converted into an ICC profile, and the Pantone Coated library was converted into ECG builds using the ICC profile from this 180-patch test chart. The test chart of selected Pantone colors was also converted into an ECG build using the ICC profile from the Alwan small test chart.

At the end of the project, three Pantone colors from the test chart were chosen and compared color-wise with their spot color versions.

Experimental setup

The press runs for this project were done on a Comco-Cadet narrow-web 7” label press with seven print stations. Here is the list of equipment and materials used for this project:

- Comco Cadet 7-color narrow web label press
- Substrate: Label Supply Extragloss LTR ‘Low Tack Removable’ 40#
- Inks: Siegwerk water-based flexo inks
- Anilox rollers:
    - Yellow: 1.78 BCM, 1000 LPI
    - Magenta: 1.79 BCM, 1000 LPI
    - Cyan: 1.79 BCM, 1000 LPI
    - Orange: 2.93 BCM, 550 LPI
    - Green: 2.97 BCM, 550 LPI
    - Violet: 2.18 BCM, 800 LPI
    - Black: 1.78 BCM, 1000 LPI

The ink sequence for all ECG press runs is shown in Figure 1.

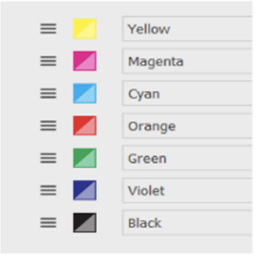


Figure 1: Ink sequence for all ECG press runs, from yellow (unit 1) to black (unit 7)

For the press run with the three dedicated spot colors, some anilox rollers were switched around.

- Anilox rollers:
    - Yellow: 1.78 BCM, 1000 LPI
    - Magenta: 1.79 BCM, 1000 LPI
    - Cyan: 1.79 BCM, 1000 LPI
    - Black: 1.78 BCM, 1000 LPI
    - P7620 Orange: 2.18 BCM/ 800 LPI
    - P7717 Green: 2.93 BCM/ 550 LPI
    - P2091 Violet: 2.97 BCM / 550 LPI

The following equipment and materials were used for preparing the flexographic printing plates.

- Plates: Toyobo Cosmolight water-washable plate 0.067”
  - Plate thickness: 0.0666”
  - Floor height: 0.0436”
  - Relief: 0.0226”
- Micrometer: Mitutoyo absolute digital micrometer
- Esko CDI Spark 2530
- Anderson & Vreeland Orbital X plate processor with CL-50 Whirl-A-Way AV Polymer Removal System

The plates were processed with Esko’s Flexo - 7.5° set. The details can be seen in Figure 2.

Ink Name	Ruling	Angle
Cyan	150 lpi	7.5°
Magenta	150 lpi	67.5°
Yellow	150 lpi	172.5° (=82.5°)
Black	150 lpi	127.5° (=37.5°)
Green	150 lpi	*67.5°*
Orange	150 lpi	*7.5°*
Violet	150 lpi	*172.5° (=82.5°)*

Figure 2: Line screen ruling and screen angles used

The following list details the software and measurement equipment used.

- Measurement instrument:
  - X-Rite eXact
- Software used:
  - Alwan ColorHub
  - Alwan ToolBox
  - X-Rite DataCatcher
  - Adobe Illustrator
  - MS-Excel
  - ColorThink 3.09 (Mac)

Figure 3 depicts the test charts used initially.

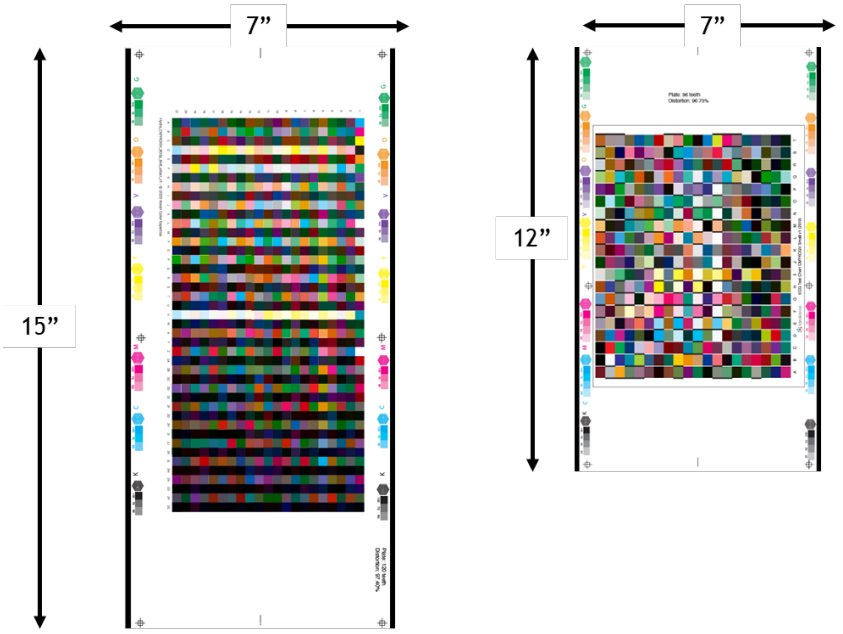


Figure 3: Alwan 906 patches test chart (left) and IDEAlliance ECG small test chart 400 patches (right)

During the 2020/2021 study (Habekost et al. 2021), a special test chart was created to include a selected set of Pantone spot colors. These spot colors show an even distribution of hue angles, as shown in the figure below.



Figure 4: Test chart with 27 selected Pantone colors

In Figure 5, the hue angle distribution of the 27 selected Pantone colors is shown.

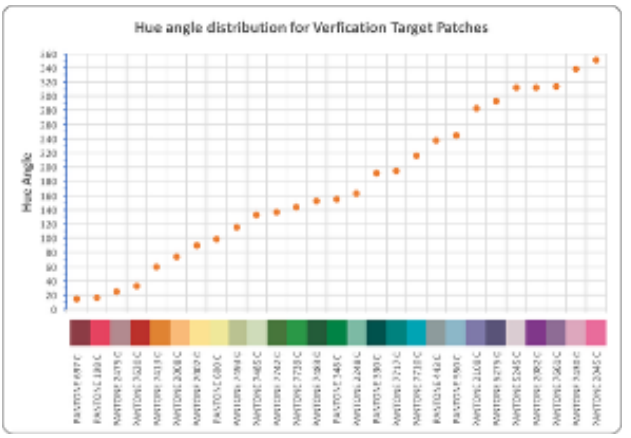


Figure 5: Hue angle distribution of the selected 27 Pantone colors

In Figure 6, you can see the addition of the test chart with the selected Pantone colors. It needs to be noted that the test chart shown in Figure 4 had to be split into two separate charts because Adobe Illustrator can handle only a limited number of spot colors on a single Artboard.

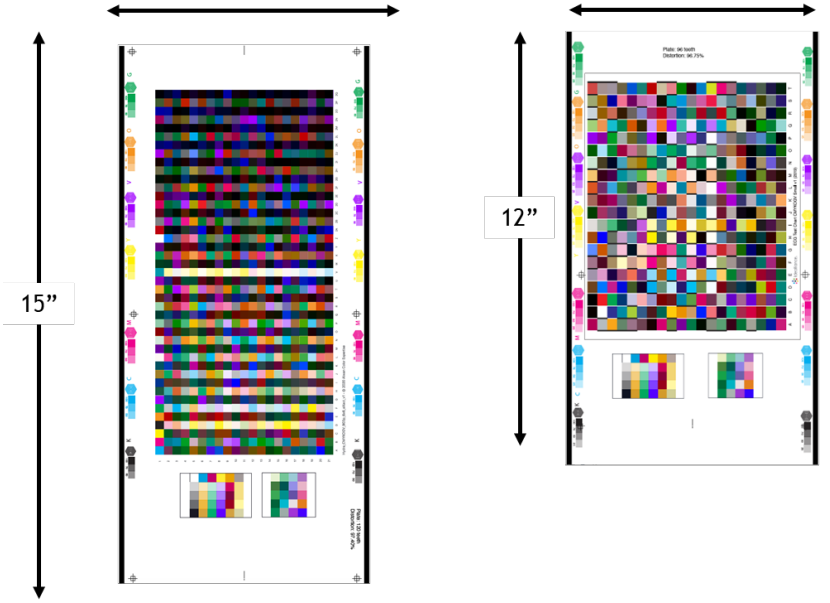


Figure 6: Alwan test chart plus selected Pantone colors (left) and IDEAlliance chart with selected Pantone colors (right)

Based on the results of the first press run, Alwan Color developed a test chart with fewer patches and made it available for this study. This chart is shown in Figure 7.

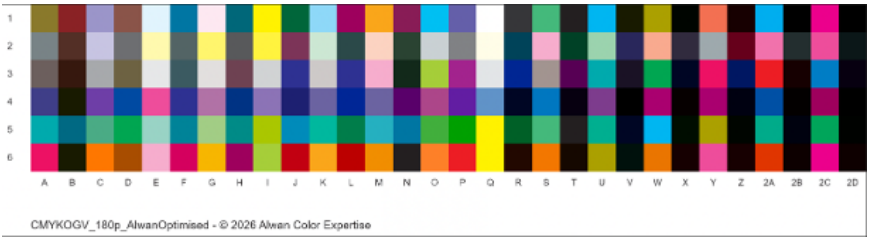


Figure 7: AlwanColor optimized small test chart

The test charts shown in Figure 3 were measured with an X-Rite eXact, and the measurements were converted to ICC profiles. The ICC profiles were then used to convert three selected Pantone colors into their corresponding ECG-build. For this purpose, labels were created using a template provided by Adobe. The template was modified to show the selected spot colors, P2091 violet, P7620 orange, and P7717 green.

For these press runs, the following test charts were used.

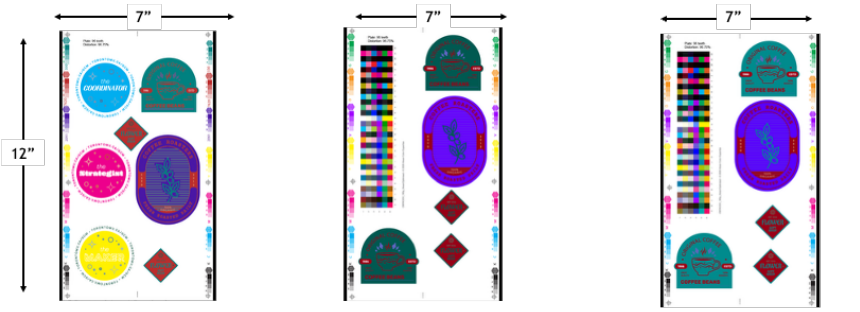


Figure 8: Press runs using different color conversion profiles

Results and discussion

During this project, seven press runs were conducted. Each press run was built on the results of the previous one. The first results of interest were the color gamut of the different ICC color profiles built by Alwan's Toolbox software. The color gamuts were evaluated using Chromix ColorThink software.

Figure 9 shows the color gamut of the ICC profile generated from the measurements of the 906 patches of the Hydra test chart from AlwanColor.



Figure 9: Gamut volume of the ICC profile from Alwan's Hydra 906 patches test chart

Figure 10 shows the color gamut of the ICC profile generated from measurements of the IDEAlliance small 400-patch test chart.

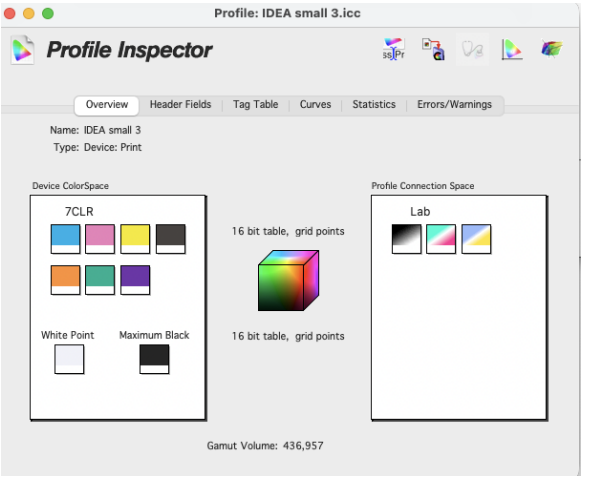


Figure 10: Gamut volume of the ICC profile generated from the small IDEAlliance test chart

Figure 11 shows the color gamut of the ICC profile generated from measurements of the 180 patch small chart provided by AlwanColor.

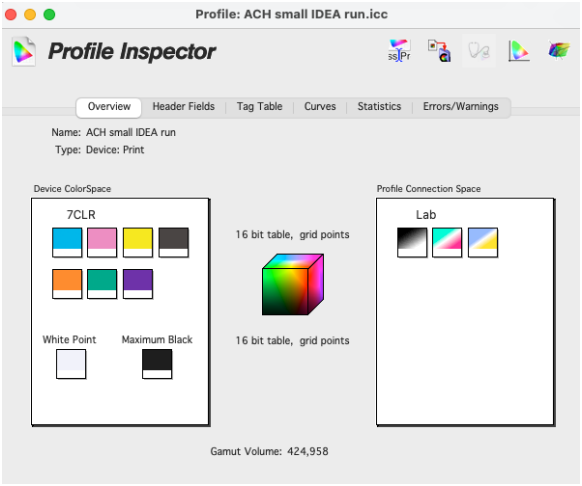


Figure 11: Gamut volume of the ICC profile from Alwan's 180 patch test chart

As shown in Figures 9 - 11, the average gamut volume of the ICC profiles is approximately 432,000.

Chromix ColorThink was also used to visualize the gamut volume of the three ICC profiles and plot the 27 selected Pantone colors shown in Figure 4. This can be seen in Figure 12.

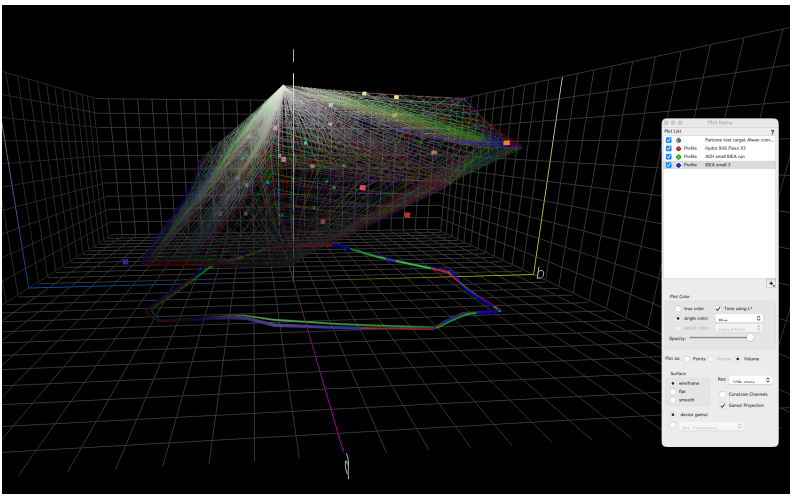


Figure 12: Plot of the three ICC profiles and the selected 27 Pantone colors

From Figure 12, it can be seen that all three ICC profiles have a similar shape. This could mean that the conversion of Pantone spot colors into ECG builds would vary only slightly. It can also be seen that two of the selected spot colors shown in Figures 4 and 5 are outside the gamut of the ICC profiles. In turn, this means these colors will most likely show the largest color difference between the L*a*b* values of the Pantone spot color and the ECG-converted equivalent.

One of the challenges with Expanded Gamut Printing is the lack of a color standard for Orange, Green, and Violet. Figure 14 shows the DE00 values of the Orange, Green, and Violet inks used in this project towards the recommended L*a*b* values made by different organizations. (Sharma, 2026)

	DE2000			
	ISO/TC21328	FOGRA55	IDEAlliance 2021	Pantone XGC
Orange	3.39	4.88	3.89	6.36
Green	6.64	1.6	6.64	4.08
Violet	2.62	4.01	2.65	2.12

Figure 13: DE00 value of the Orange, Green, and Violet inks used in this project

Figure 13 clearly illustrates the need to standardize the L*a*b* Values of Orange, Green, and Violet.

The three ICC profiles generated with the Alwan Toolbox were used to convert the Pantone Coated Library Version 5, M1, into ECG builds. This Pantone library contains 2390 spot colors. The maximum allowable DE00 value was set to 4, but it was also important to see how many spot colors fall within a maximum DE00 value of 2. Figure 14 shows the result of these conversions.

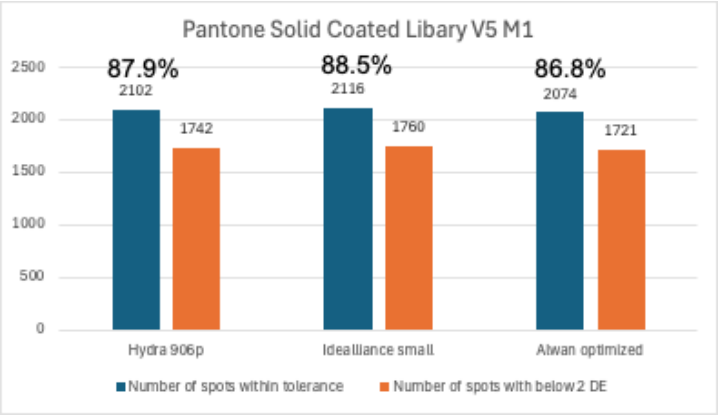


Figure 14: Number of Pantone color conversions with a DE00 of 4 and 2

ICC profile from	Number of colors with a DE00 of 4	Percentage of total colors	Number of colors with a DE00 of 2	Percentage of total colors
Hydra 906 patches chart	2102	87.9%	1742	72.9%
IDEAlliance small ECG chart	2116	88.5%	1760	73.6%
Alwan optimized 180 patches chart	2074	86.8%	1721	72.0%

Table 1: Percentages of color conversion depending on the allowed DE00 value

From Table 1, it can be seen that the conversion numbers are similar. A similar number of Pantone colors could be converted with a maximum DE00 of 4 and and DE00 of 2.

ICC profile from	Average DE00	Maximum DE value	CRF95th DE
Hydra 906 patches chart	1.5	16	5.7
IDEAlliance small ECG chart	1.4	16	5.7
Alwan optimized 180 patches chart	1.5	14.9	6

Table 2: Average DE00 values of the converted Pantone Coated Library

From Table 2, it can be seen that similar average DE00 values and 95% of all colors fall within a DE of about 6. The only difference is that the maximum DE00 value on the Alwan-optimized 180 patches chart is slightly lower than that of the two other profiles.

Another analysis of the three ICC profiles was done using Chromix ColorThink. The Pantone Coated Library V5 was analyzed to determine the DE00 value of all 2390 spot colors. This was compared to the predicted percentage of spot colors shown in Table 1.

In Figure 15, the worksheet in Chromix ColorThink is shown.

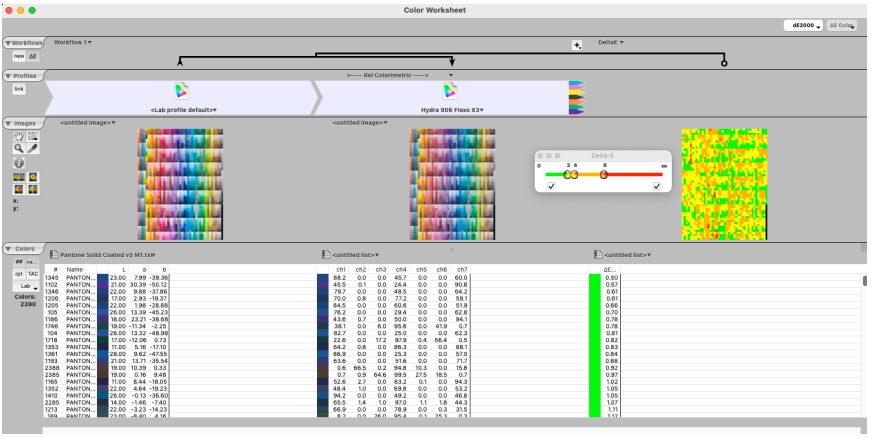


Figure 15: Worksheet from Chromix ColorThink

In Figure 15, on the right-hand side, is a colored chart with green, yellow, and red dots. These dots depend on the DE00 values assigned to the Pantone spot colors.

A DE00 below 2 is green, between 2 and 4 is yellow, between 4 and 8 is orange, and above 8 is red. Based on the results from Chromix ColorThink worksheet, Figure 16 was created.

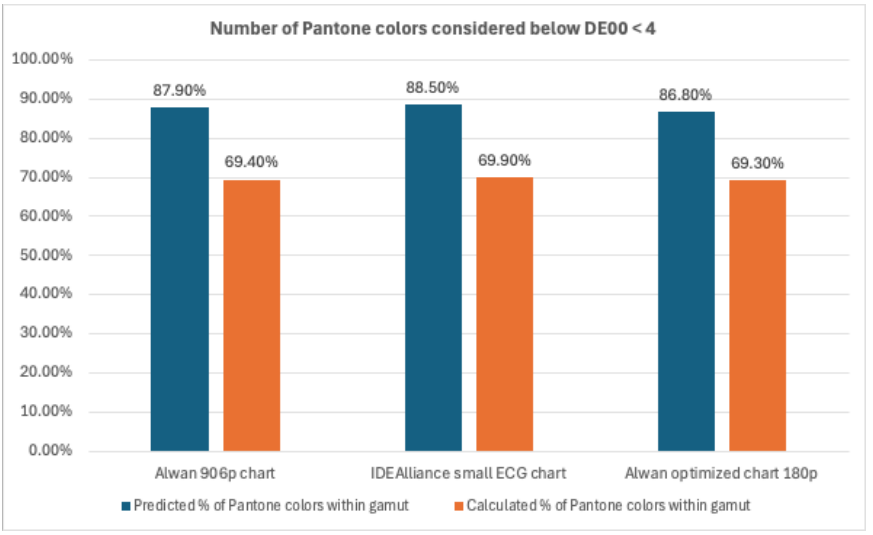


Figure 16: Predicted number of Pantone colors within a DE00 from Alwan Toolbox (blue column) and Chromix ColorThink (orange column)

It is clearly visible that a lower percentage of Pantone spot colors from the Pantone Coated Library actually has a DE00 of lower than 4 than predicted by Alwan Toolbox. The percentages of colors are very similar between all three ICC profiles.

In the next step of the analysis, the test chart of 27 selected Pantone colors, as shown in Figure 4, was processed in Alwan ColorHub using ICC profiles from the Hydra 906 patches chart and the IDEAlliance small ECG test chart. After the test chart with the 27 Pantone colors was printed on press, the colors were measured and the DE00 values calculated. The results are shown in Figure 18.

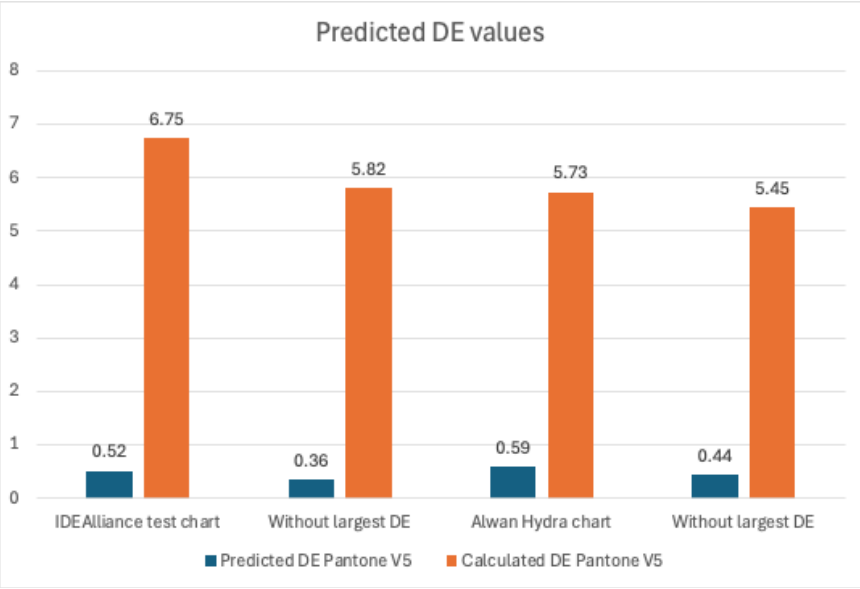


Figure 17: Predicted DE00 values of the selected 27 Pantone colors

As shown in Figure 17, the average DE00 values calculated from the measured prints are much higher than the predicted average values. One can also see that the Hydra chart delivered better results than the IDEAlliance small ECG test chart.

In the following two figures, the predicted DE00 values and the calculated DE00 from actual measurements are shown.

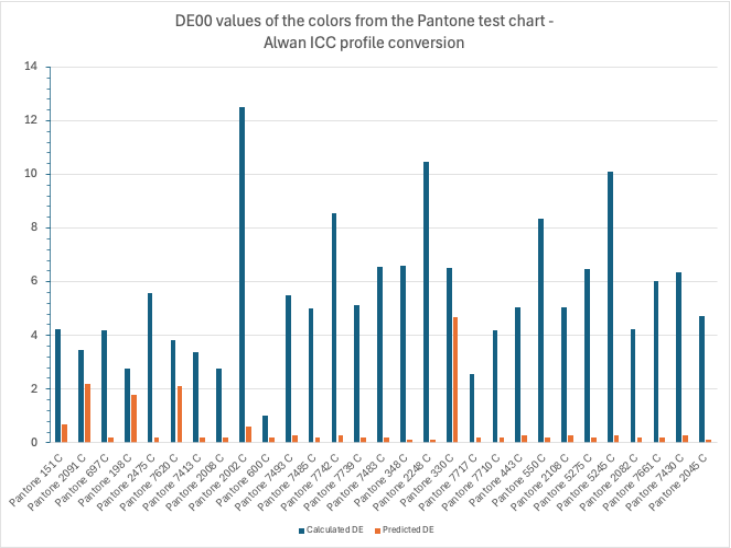


Figure 18: Predicted DE00 values (orange column) vs. the DE00 values from measurements from the printed 27 Pantone color test chart (blue column) for ECG conversions done using the ICC profile from the Alwan 906 patches chart

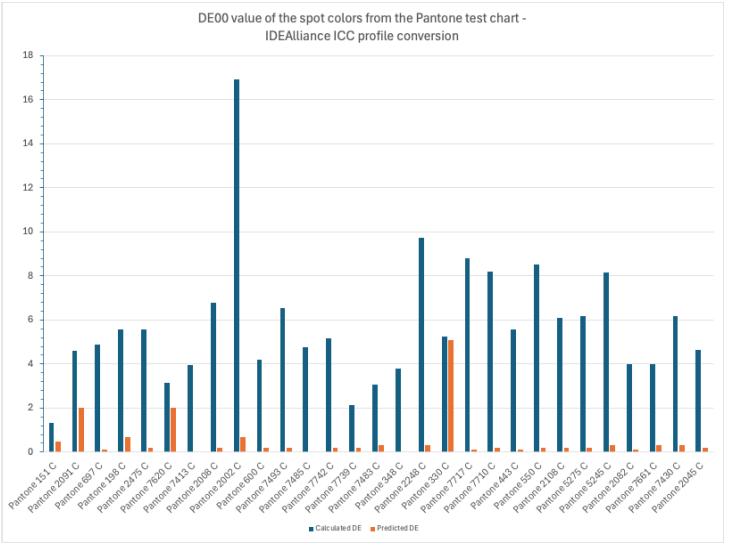


Figure 19: Predicted DE00 values (orange column) vs. the DE00 values from measurements from the printed 27 Pantone color test chart (blue column) for ECG conversions done using the ICC profile from the IDEAlliance small chart

From Figures 18 and 19, one can clearly see that there are sometimes large differences between the predicted and measured values. Most likely, this stems from the observations shown in Figures 15 and 16, that the profiles allow only 69% of all 2390 Pantone Coated spot colors to have a DE00 of 4. The remaining colors will have a larger DE00. Just a few colors stand out where the predicted and measured DE00 is not too far apart. These colors will be looked at next.

The selected colors are Pantone P2091C violet, P7620C orange, and P7717C green. These colors were examined to determine how the different ICC profiles converted the spot color into an ECG build.

In Figure 20, the different builds of P2091C are shown.

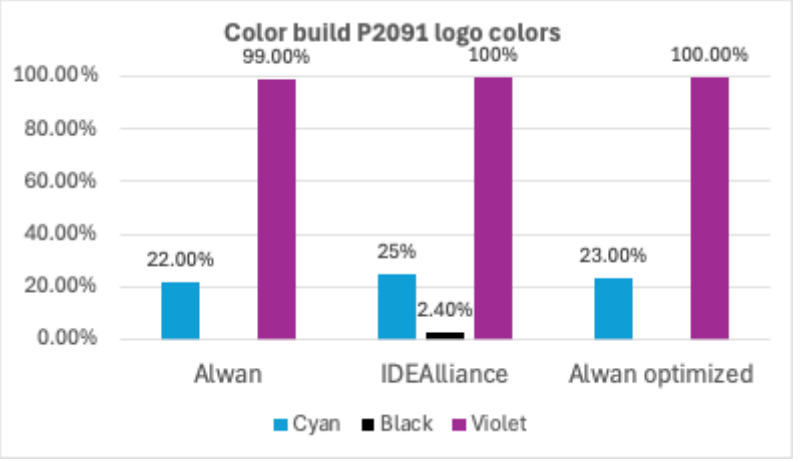


Figure 20: ECG color build of P2091C Violet by the three different ICC profiles

From Figure 20, it is clear that all three ICC color profiles exhibit a similar build. Only the build determined by the ICC profile from the IDEAlliance small ECG chart adds a small percentage of black and a bit more cyan. Otherwise, the color builds are similar.

In Figure 21, the different builds of P7620C are shown.

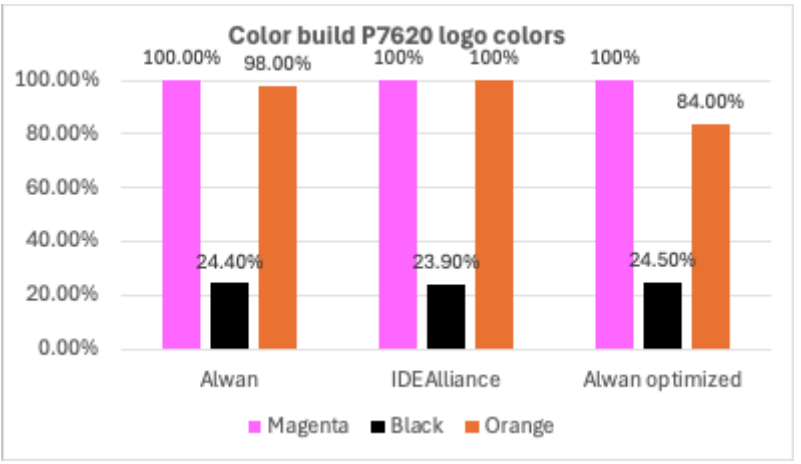


Figure 21: ECG color build of P7620C Orange by the three different ICC profiles

Figure 21 shows that the color builds are quite similar. The only difference is that the color built from the ICC profile of the Alwan optimized 180 patch test chart reduces the amount of orange.

In Figure 22, the different color builds of P7717C green are shown.

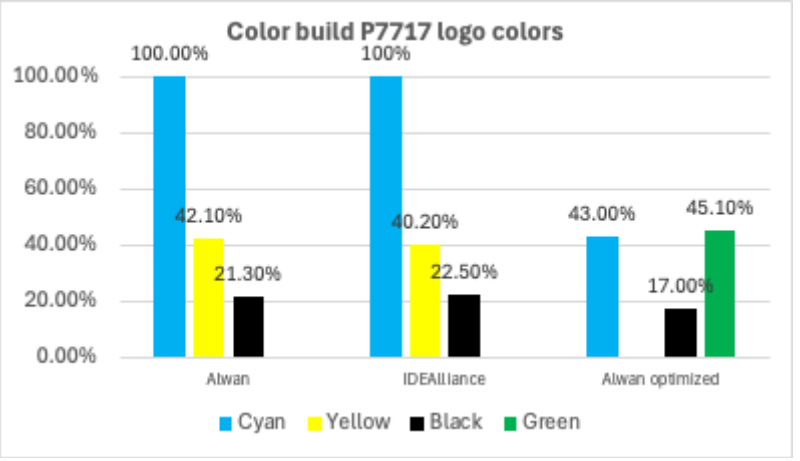


Figure 22: ECG color build of P7717C Green by the three different ICC profiles

The color builds shown in Figure 22 were the only ones that differed. While the color builds from the ICC profiles of the Alwan 906 patch chart and the IDEAlliance small ECG chart showed very similar results, the color build based on the ICC profile of the optimized 180 patch chart used a different approach.

Instead of creating green from cyan and yellow, the green ink, together with cyan and black, is used to create a version of P7717C green.

Since two test charts from AlwanColor were used, it is interesting to compare how the ICC profiles from both test charts convert the spot colors into ECG builds. This can be seen in Figure 23.

	Alwan 906p chart							Alwan optimized 180p chart						
Pantone 151 C			58.5		75.9					73.8		86.3		
Pantone 2091 C	25.7						97.9	21.5						98.5
Pantone 697 C		94.5		50.6	30.5				95.1		45.1	30.5		
Pantone 198 C		100		5.1	32.8				100		4.6	32.4		
Pantone 2475 C		3.7		42.7	9.7				2.1		39	10.3		
Pantone 7620 C		100		23.2	80.5				100		24.3	97.6		
Pantone 7413 C			52.4	13.4	47.6					62.2	10.9	47.6		
Pantone 2008 C		45.7	3.7	11.5						51.2	2.4	12.2		
Pantone 2002 C		53.5		3.5						57.3		3.5		
Pantone 600 C		38.1					0.3			45.1			0.6	
Pantone 7493 C			21.3	14.6		4.6				24.4	12.2		4.8	
Pantone 7485 C			10.3	1.8		5.4				10.3	1.2		5.4	
Pantone 7742 C			62.2	50		28				73.2	45.7		30.5	
Pantone 7739 C			73.1	15.8		37.8				79.3	13.4		40.2	
Pantone 7483 C			52.4	62.2		40.2				57.3	60.4		41.5	
Pantone 348 C			62.2	25.6		53.6				71.9	26.8		56.1	
Pantone 2248 C			11.5	7.9		23.1				12.2	6.1		23.1	
Pantone 330 C	100			13.8			37.3	25.6			63.4		45.1	
Pantone 7717 C	41.5			21.9		41.5		37.2			20.7		42.1	
Pantone 7710 C	56.1		3.6		15.8			51.2			2.4		15.8	
Pantone 443 C	4.8			37.8		3.7		3.9			35.7		3.6	
Pantone 550 C	31.7			9.8				28			9.7			
Pantone 2108 C	17.7			15.5			36.9	15.2			11			39
Pantone 5275 C	10.9			46.3			46.3	8.5			40.2			47.6
Pantone 5245 C		6.8		1.3			5.5	39.7			85.1			100
Pantone 2082 C		31.1		7.3			57.9		28		5.4			58.9
Pantone 7661 C		26.2		12.2			40.2		22.2		9.2			41.5
Pantone 7430 C		34.4		3.1			2.1		31.7		1.2			3.1
Pantone 2045 C		81.1		3.7	2.7				81.7		2.4	2.4		

Figure 23: Comparison of the color builds from the two ICC profiles from the two Alwan test charts

There are some obvious differences. There are changes in the orange and green test colors. For example, P330 green is originally build form 100% cyan, 13.8% black, and 37.3% violet. The new build is 25.6% cyan, 63.4% black, and 45.1% green. A drastic difference is evident in P 600C. The original build was 38.1% magenta and 0.3% violet. The new build is 45.1% yellow and 0.6% green. It still needs to be seen how different these colors appear. At the time this paper was written, this information was not available.

Although it is interesting to see how the different ICC profiles convert the Pantone Coated Spot Color Library into ECG builds by combining a maximum of three of the seven process colors, it is also interesting to see how the press parameters were throughout the different press runs.

The first press parameter being investigated is the tone value curve for the seven process colors. The tone values were measured with the X-Rite eXact, which was used throughout the whole study. The eXact was set to SCTV mode to measure all seven process colors. The results can be seen in Figures 24 - 26.

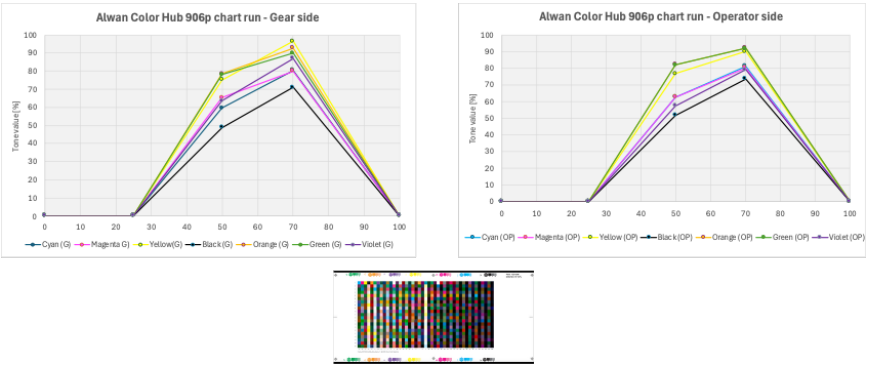


Figure 24: Tone-value curves of the press run with the Alwan 906 patch test chart

Although there are slight differences between the gear and drive sides of the press, the overall trend in tone value is similar. It should be noted that the 25% patch was missing from the test chart; therefore, the tone value at the 25% tint is zero.

The next figure shows the tone-value curve during the press run of the IDEAlliance small ECG test chart.

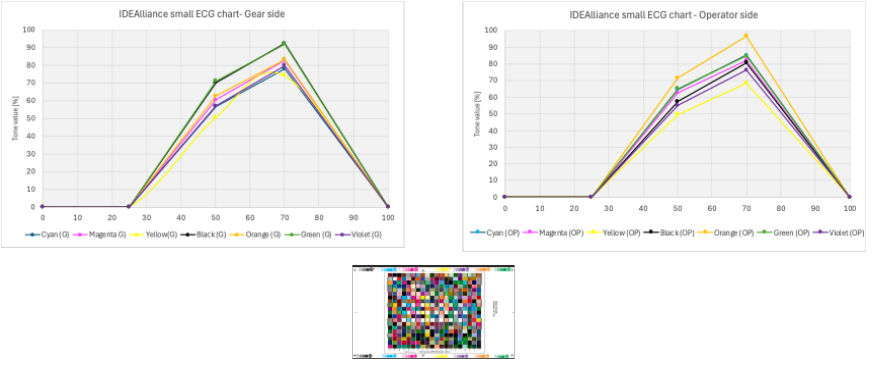


Figure 25: Tone value curves of the press run with the IDEAlliance small ECG test chart

It should be noted that on the gear side of the press, cyan, and green showed the largest tone values, while on the operator side, orange showed the largest tone values. It should be noted that the press used in this project is purely analog, and the printing pressure settings, which influence the tone values, depend on the operator's skill.

The final set of TVI curves is from the press run of the Alwan optimized 180 patch test chart.

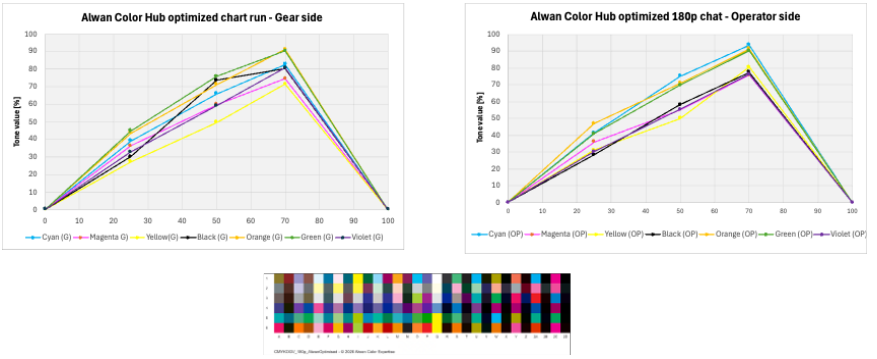


Figure 26: Tone value curves of the press run with the Alwan optimized 180 patch test chart

For this press run, the 25% test patch was added to the press form. Even though there are slight differences between the gear and operator sides of the press, the overall trend of TVI across the three test patches at 25%, 50%, and 75% is quite similar.

Other press parameters evaluated included solid ink densities and print contrast. The target values for solid ink density were adopted from the 2020/2021 ECG study (Habekost, M, El Asaleh, R., Sharma, A., 2021). The solid ink densities of the seven colors from the three test chart press runs are shown in Figure 27.

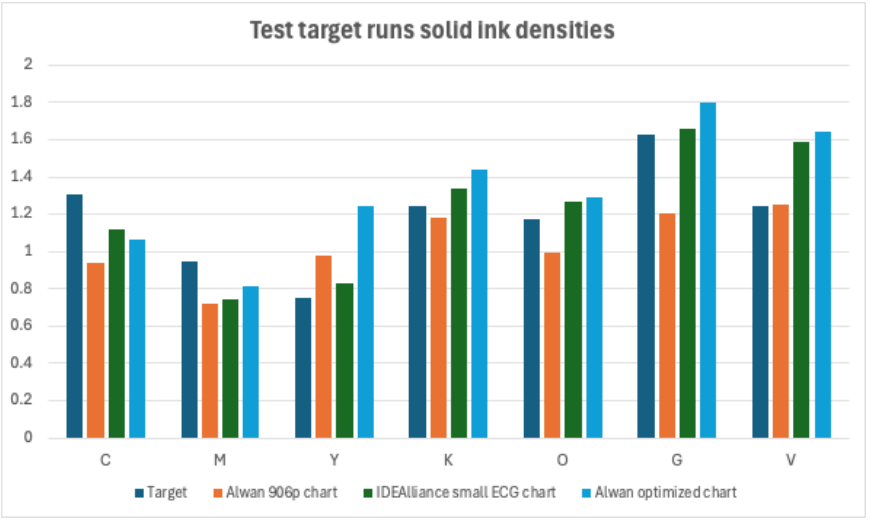


Figure 27: Solid ink densities of the three test chart press runs

From Figure 27, it can be seen that the cyan and magenta ink densities across all three press runs were slightly below target. The printed ink densities for yellow were all above target. For black, the printed ink densities were either around the target or slightly above. For orange, green, and violet, the printed ink densities were mostly above target. For the press run of the Alwan 906 patch test form, the printed ink densities were mostly below the target ink densities. For the press runs of the IDEAlliance small ECG chart and Alwan's optimized 180 patch test form the printed ink densities were above the target. Even though there were these variations, it did not seem to influence the shape or the gamut volume of the ICC profiles.

The next print quality metric evaluated was the print contrast of the three ECG test chart press runs. The higher the print contrast number, the better the print quality. The result of this evaluation is shown in Figure 28.

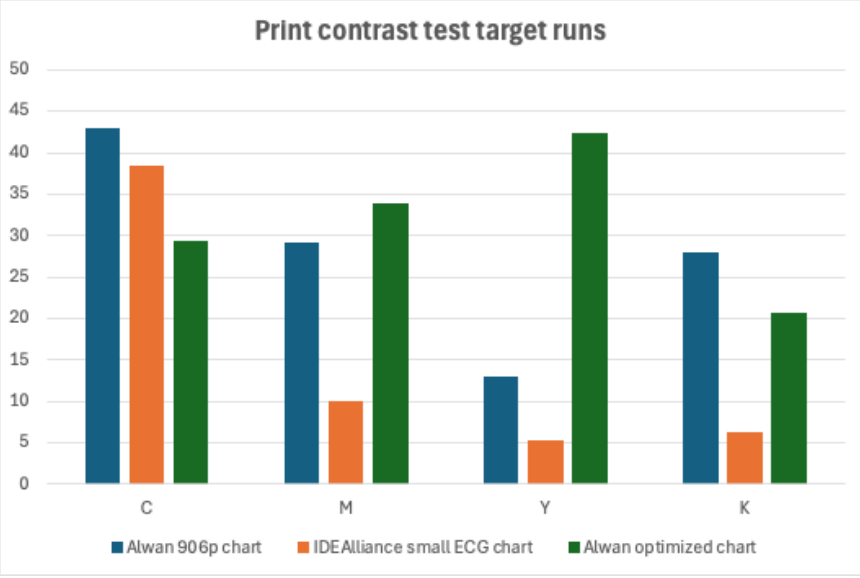


Figure 28: Print contrast results from the three ECG test chart press runs

The print contrast was measured at the 70% tint patch and the solid of the control elements on the press form. The only anomaly that stands out is the low print contrast of magenta, yellow, and black during the press run of the IDEAlliance small test chart.

For the final evaluation of this project, the three selected spot colors were mixed and printed using a flexographic hand proofer. For the P7620 orange, the lowest achievable DE00, after some formula adjustments, was 2.73 with an anilox roller

of 360 LPI and 5.5 BCM. The same procedure was repeated for P2091 violet, and the lowest DE00 achieved was 6.63, using the same anilox roller as for the orange. For P7717 green, the lowest DE00 was 4.65 with an anilox roller of 360LPI and 5.5 BCM. The DE00 values were calculated by using the L*a*b* numbers from the Pantone Solid Coated V5 library.

The DE00 numbers look a bit different when compared with the current Pantone Solid Coated book for mixed-color prints. The results are shown in Table 3.

	7620	2091	7717
ΔL	0.13	1.78	0.72
Δa	0.40	-12.44	-2.60
Δb	1.71	11.58	-0.67
ΔE00	**0.81**	**4.50**	**1.12**

Table 3: DE00 values of the three selected Pantone colors compared to a current Pantone Solid Coated book

One of the main arguments for using expanded gamut printing is the time savings, since the same inks remain in the ink fountain, and only the plates and the substrate are changed. During all press runs conducted in this project, the time required for each stage was recorded. For one of the press runs, the time required for mixing the three selected spot colors was also recorded. The results can be seen in Figure 29.

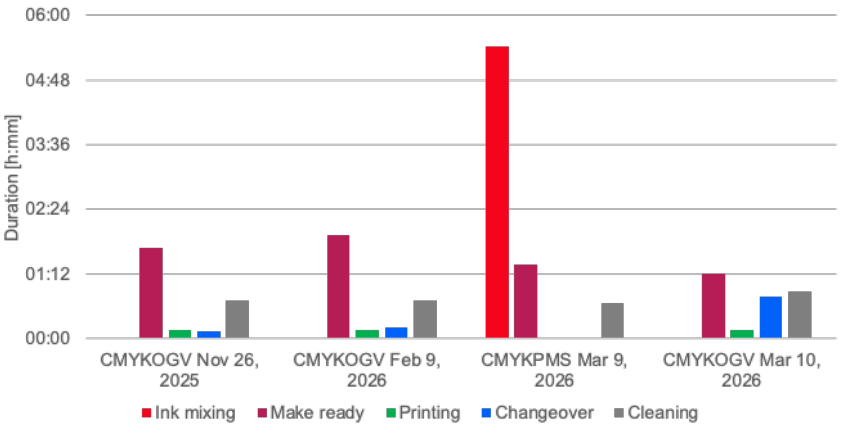


Figure 29: Time needed for the various stages of the press runs conducted throughout the project

In Figure 29, the time required to mix the three spot colors is clearly evident. It took almost six hours to complete mixing the inks. The makeready time includes changing the plate cylinders and achieving color register. The changeover time between two press runs is only a few minutes. Only during the last press run on March 10, 2026, did it take a bit longer to change the plate cylinders between two press runs, because one plate required remounting.

Conclusions

There are a few key findings from this project. One of them is that a larger test target does not mean a larger or more accurate ICC color profile. It was interesting to see that the ICC profile from the 906 patches Alwan color target and the 400 patches IDEAlliance small test target resulted in similar ICC color profiles and similar conversions of the Pantone Solid Coated Library to ECG builds. It was interesting to see that the small 180 patch color target from Alwan produced an ICC profile of a similar size to those derived from the larger test targets. Some color conversions were done differently, as shown above. This needs to be evaluated further to determine whether the selected 27 Pantone colors exhibit larger or smaller color differences.

As shown during this project, there are different recommendations for the L*a*b* values that the expanded process colors orange, green, and violet should have. This needs to be clarified sooner rather than later and incorporated into an ISO standard.

Future Directions

The accuracy of converting Pantone spot colors into ECG needs improvement.

The DE00 values need to be reduced, so brand owners will accept brand colors printed with an expanded-gamut ink set.

Holistic Life Cycle Analysis of an Expanded Color Gamut, vs conventional with using the Pantone Matching System colors should bring more scientific value to this research and give outcomes.

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