Professional Paper https://doi.org/10.24867/GRID-2026-p16

Creating Proofs for Indigo

ABSTRACT

Indigo digital printing presses are commonly used today for packaging printing. The packaging industry utilizes a much wider variety of print substrates, which makes standardization in this sector much more challenging than in commercial graphic arts printing. Proofing printers are commonly used in color management systems to visualize the final printed product and for ongoing color monitoring. The main advantage of proofing is obtaining a physical sample of the printed product before the costly and irreversible step of producing a printing plate is done. However, proofs also have their place in digital printing when they simulate the output of a production press. This paper focuses on the preparation of profiles for simulation of output of an HP Indigo 6K Digital Press on 11 different substrates. The proofs were printed on an Epson SureColor P5000 inkjet printer.

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KEY WORDS
Proof, profile creation, color management, printed material

1. Introduction

Historically, a proof served to check the prepared printing plate during the printing process. As the preparation of print materials became increasingly digitized, the significance of the proof and its role in the production process shifted. It is worth noting here the so-called chemical proof, used to check film negatives before exposing the printing plates. Once prepress preparation was fully digitized, the proof began to serve as a means of checking the prepared data and became one of the fundamental components of color management. Today, the primary function of a proof is to simulate the production print output as faithfully as possible. For the customer, the proof represents the "promised quality" of the future print, and for the printer, it is therefore a commitment and a benchmark for the quality of the printed product. For the proof to fulfill these roles, color management must function flawlessly.

The final quality of the printed image depends on many factors; the most fundamental of these are the printing technique used, the method of creating the printing plate, the printing inks used, the substrate, and the press settings. Other factors include environmental conditions (temperature, humidity), the technical condition of the equipment used, operator procedures, and so on. If all these parameters can be kept constant, consistent color in the print can be expected.

In practice, of course, it is not possible to ensure that all possible influences remain constant; therefore, standardization is used—maintaining the production process under predetermined and as consistent as possible conditions. If standard conditions can be maintained, standard print outputs can also be expected.

In a standardized printing process, all individual production steps, the equipment used, its settings, the materials used, external conditions, etc., are defined as precisely as possible. An absolutely precise description of all factors influencing printing is unrealistic in practice; often (e.g., in flexographic printing), there are hundreds of variables (Shejbal, 2026). If everything (or rather, the most important factors) can be kept within predefined tolerances, the resulting print will remain consistent or will fall within acceptable tolerances. Simply put, a color profile describes the standard output of a specific printing press. If even a single parameter changes, the resulting output will change. If, in a standardized printing process, a printing press is used to print on various substrates, the result on each substrate is described by a different color profile (Shaw et al., 2003).

Proofing printers must be able to simulate the color characteristics described by the production printer's color profile as accurately as possible; therefore, the gamut (the total range of reproducible colors) of the proofing printer must be larger than that of the production

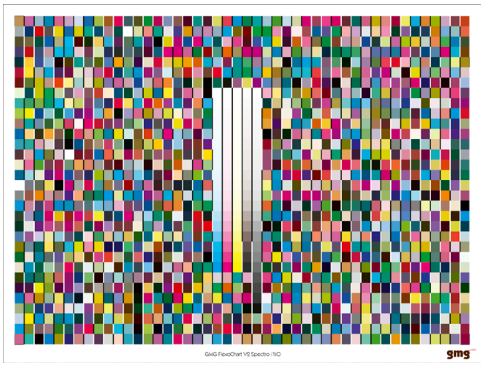
printer (Angerer, 2022). When creating proofs, only one high-quality substrate is typically used, which allows for a wide gamut. To simulate production printing on various substrates, different color profiles are used, each corresponding to the color characteristics (i.e., the limited gamut) of production printing on that specific substrate.

2. Methods

In this study, profiles were created to simulate printing from an HP Indigo 6K Digital Press on an Epson SureColor P5000 proofing printer. HP Indigo printers use a special liquid toner called ElectroInk, which ensures high print quality (Dataline, 2024). The specific machine for which the profiles were created used seven colors (CMYKOVW—in the HP IndiChrome Plus 7-color system (HP Indigo, 2026), green was replaced by opaque white; transparent films are often used when printing stickers) and special Rainbow 196 screening (196 lpi by default, but the line count can be adjusted within the range of 160–300 lpi). To prevent moiré patterns, the individual screens are set at angles of 35° (C), 53° (M), 80° (Y), 27° (K), 72° (O), and 8° (V) (Ruibar, 2026). The use of seven colors expands the achievable color gamut and, of course, places greater demands on the proofing equipment. The Epson SureColor P5000 printer achieves the required gamut by using up to ten inks (C, LC, VM, VLM, Y, LK, LLK, O, G, PK/MK), printheads with a resolution of 360 dpi, and a droplet size of 3.5 pl (Epson, 2017).

Profiles were prepared for 11 different self-adhesive materials: 8 types of paper, transparent and white PE film, and metallic silver PP film; see Table 1. The substrate material and adhesive used are not specified here, this information can be find in Vrbová (2026).

The profiles were created using GMG ColorProof software. The GMG FlexoChart V2 Spectro i1iO test pattern was printed on the production press; see Fig. 1. Three selected prints were measured using an xRite i1 spectrophotometer; the values were averaged, imported into GMG ColorProof software, and smoothed using the Smooth Target Values tool (GMG, 2024). The generated profile was then used to create a proof. The proof was measured again with the spectrophotometer, and the average color values of the print and the proof were compared; the average and maximum color difference (ΔE*00) were evaluated. If the measured values met the required tolerance (average ΔE*00 < 0.5 or maximum ΔE*00 < 2.0), the generated profile was saved. If the tolerances were exceeded, the profile was adjusted and used to create a new proof. This procedure was repeated until appropriate color profiles were prepared for all 11 materials. Subsequently, the color of both the final prints and the test prints was measured manually using an xRite eXact spectrophotometer.



» **Figure 1:** *GMG Flexochart V2*

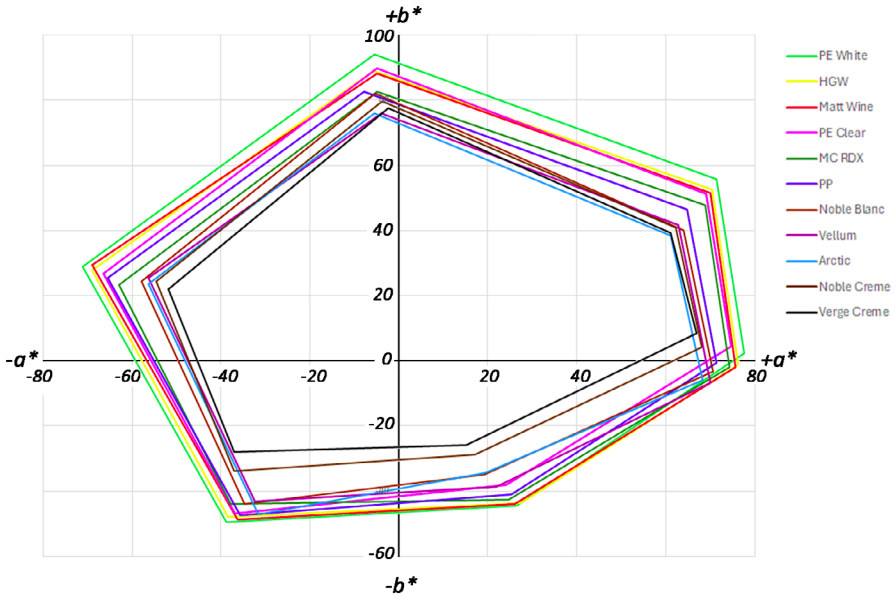
3. Results and discussion

Each of the 11 substrates used has different properties, which affect the resulting color. The graph in Figure 2 shows a simulation of the color gamuts of the individual substrates (CMYRGB colors in the a*b* color space).

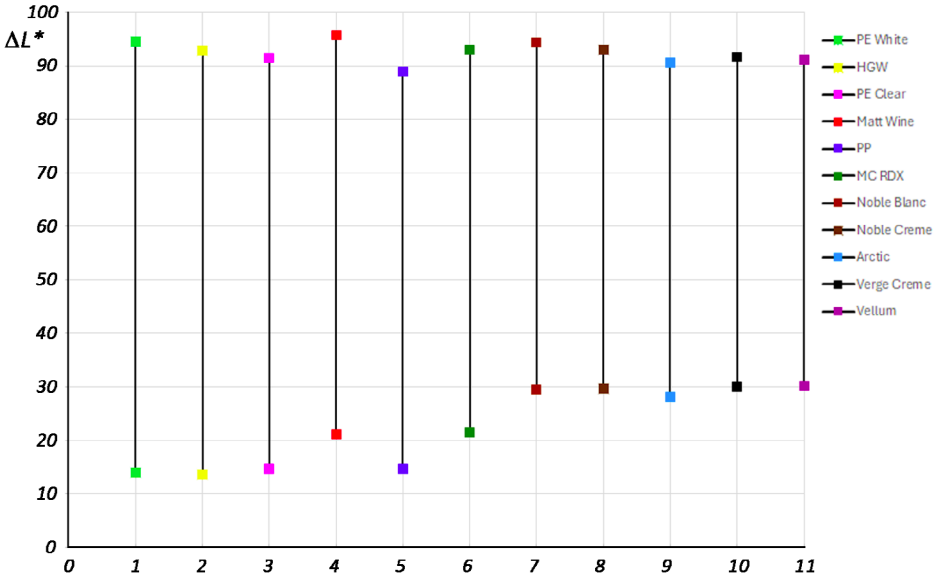
Table 1

Overview of self-adhesive materials for which color profiles have been created

Substrte	Description	L*	a*	b*
Arctic RPlus FSC	matte uncoated paper	90.6	2.4	-9.4
HGW Premium FSC	gloss coated paper	92.8	0.4	-2.7
Matt Wine NG FSC	matte coated paper	95.7	1.8	-3.6
MC RDX FSC	semi-gloss coated paper	93.0	1.5	1.5
Noble Blanc FSC	matte uncoated paper	94.4	0.9	-0.7
Noble Creme RPlus FSC	matte uncoated paper	93.0	0.3	12.2
Vellum Logistics NXT	super-calendered paper	91.2	3.9	-4.6
Verge Creme FSC	matte uncoated paper	91.7	0.8	20.5
PE85 Clear	clear pe film	91.6	0.1	1.1
PE85 White	white pe film	94.6	0.1	1.1
PP light Top Silver	glossy metallized pp film	88.9	-1.1	-2.1



» **Figure 2:** *Comparison of substrates color gamut*



» **Figure 3:** *Comparison of maximum substrates contrast*

It is clear that the largest color gamut is achieved with the white PE film (area in the a*b* color space = 100%) and the smallest with the Verge Crème substrate (59.2%).

The graph in Figure 3 shows a comparison of the contrast (ΔL* = L*paper – L*K100%) for each substrate. Once again, the PE White substrate has the highest contrast, while the Vellum Logistics substrate has the lowest (74.9%).

Table 2 compares the color measurement results for the primary colors C, M, Y, K, R, G, and B on prints from an HP Indigo production press and a proofing press. The results clearly show that the profiles created are of sufficient quality, and that the colors of the proofs match those of the production press prints.

At the end, the color stability of the proofing printer was verified. After 14 months, the GMG Flexochart V2 test pattern was reprinted using these profiles and measurements of color differences was performed. The results confirmed that the colors had not changed significantly; the color differences were within the required tolerance.

Table 2 (part 1)
Comparison of color reproduction between prints and proofs on the tested substrates

Substrate	Color	print HP Indigo			proof Epson			ΔE^*_{76}
		L*	a*	b*	L*	a*	b*	
Arctic RPLUS FSC	C	58.2	-31,5	-47,1	58,5	-32,0	-45,1	2,1
	M	52.8	68,3	-5,9	52,4	68,8	-5,1	1,0
	Y	86.7	-5,5	76,1	85,9	-5,8	75,9	0,9
	K	28.1	0,4	1,1	27,2	1,0	0,1	1,5
	R	52.3	61,1	38,6	52,2	61,3	37,6	1,0
	G	52.9	-56,4	23,5	53,2	-55,9	24,1	0,8
	B	29.7	19,4	-34,5	29,6	20,2	-35,4	1,2
	CMY	30.3	1,6	2,2	30,4	2,3	1,8	0,8
	substrate	90.6	2,4	-9,4	90,9	1,9	-7,5	1,9
HGW Premium FSC	C	55.5	-38,5	-48,0	55,5	-39,8	-47,5	1,4
	M	49.6	76,3	-1,1	49,7	77,1	0,1	1,4
	Y	88.1	-5,8	89,1	88,7	-6,0	90,6	1,6
	K	13.7	-0,3	2,9	13,3	-0,2	2,3	0,8
	R	49.2	70,5	52,7	49,6	70,8	52,9	0,6
	G	49.4	-69,1	27,7	50,0	-70,2	29,3	2,0
	B	19.0	27,4	-43,6	19,6	28,3	-44,3	1,3
	CMY	19.0	3,9	2,0	18,8	4,4	2,2	0,6
	substrate	92.8	0,4	-2,7	93,6	-0,1	-1,5	1,5
Matt Wine NG FSC	C	57.4	-36,4	-48,8	57,9	-37,5	-47,3	2,0
	M	52.8	75,6	-1,9	52,9	75,7	-1,1	0,8
	Y	90.9	-5,0	88,1	90,2	-5,7	89,0	1,4
	K	21.1	-0,1	2,0	21,5	0,3	1,7	0,6
	R	51.6	70.0	51.5	51.8	70.3	51.9	0.6
	G	51.0	-69.1	29.4	51.7	-68.9	31.7	2.4
	B	21.4	26.0	-44.0	21.9	26.9	-45.0	1.4
	CMY	20.8	4.7	2.6	21.1	5.3	2.8	0.6
	substrate	95.7	1.8	-3.6	95.2	0.8	-2.1	1.9
MC RDX FSC	C	57.6	-37.8	-43.9	58.2	-38.5	-42.4	1.7
	M	52.7	74.4	-1.8	52.6	73.8	-2.1	0.7
	Y	89.6	-4.9	82.6	89.4	-5.7	82.7	0.8
	K	21.5	0.0	3.0	21.5	0.2	2.8	0.4
	R	51.9	68.8	47.7	52.0	69.0	47.7	0.2
	G	53.6	-62.9	23.4	54.5	-62.7	25.0	1.8
	B	23.8	24.6	-42.8	24.9	25.2	-43.0	1.3
	CMY	23.4	4.9	-0.4	24.2	5.2	-0.1	0.9
	substrate	93.0	1.5	1.5	93.2	0.9	3.1	1.8
Noble Blanc FSC	C	60.1	-34.8	-44.0	59.8	-35.6	-43.7	0.9
	M	55.0	70.7	-3.3	55.7	70.3	-3.0	0.9
	Y	89.7	-5.4	82.2	89.7	-5.6	81.0	1.2
	K	29.6	0.6	1.2	29.3	0.5	1.4	0.4
	R	54.8	63.9	40.0	55.2	63.6	40.1	0.6
	G	54.4	-57.9	24.3	54.5	-58.0	24.5	0.3
	B	32.1	19.2	-34.9	32.3	19.0	-34.7	0.4
	CMY	30.9	1.3	1.3	30.9	1.0	2.0	0.7
	substrate	94.4	0.9	-0.7	95.0	0.6	-0.8	0.7

Table 2 (part 2)
Comparison of color reproduction between prints and proofs on the tested substrates

Substrate	Color	print HP Indigo			proof Epson			ΔE^*_{76}
		L*	a*	b*	L*	a*	b*	
Noble Creme RPLUS FSC	C	59.7	-37.1	-33.8	59.5	-38.6	-33.9	1.5
	M	55.1	68.0	4.1	55.0	68.1	2.9	1.2
	Y	90.1	-3.8	79.7	89.4	-4.4	79.2	1.0
	K	29.7	0.3	3.2	29.6	-0.3	2.5	0.9
	R	55.0	62.4	41.0	54.9	62.0	40.2	0.9
	G	55.7	-54.6	24.5	55.0	-55.6	24.4	1.2
	B	31.7	17.0	-28.7	31.9	16.8	-30.4	1.7
	CMY	31.8	2.7	2.3	31.8	2.1	1.5	1.0
	substrate	93.0	0.3	12.2	92.6	0.0	12.1	0.6
PE85 Clear	C	54.1	-36.9	-47.0	55.3	-37.4	-45.9	1.6
	M	48.6	74.7	4.5	49.1	75.0	4.5	0.6
	Y	87.3	-5.0	89.9	88.2	-6.1	89.6	1.5
	K	14.6	-0.7	1.3	15.1	-0.5	0.7	0.8
	R	48.4	69.0	51.2	48.9	69.0	51.1	0.5
	G	48.2	-66.5	26.7	49.7	-66.9	28.1	2.1
	B	18.0	24.2	-38.2	19.5	25.0	-39.7	2.4
	CMY	20.3	4.4	3.3	21.3	4.7	3.9	1.2
	substrate	91.6	0.1	1.1	92.8	-0.6	1.7	1.5
PE85 White	C	55.9	-38.8	-49.6	55.9	-39.0	-47.2	2.4
	M	51.3	77.6	2.3	50.6	76.6	2.5	1.2
	Y	90.8	-5.6	94.0	89.6	-6.1	91.7	2.7
	K	13.9	-0.5	3.3	14.8	-0.5	1.6	1.9
	R	51.0	71.5	55.8	49.9	70.1	53.2	3.2
	G	50.1	-71.1	28.9	50.2	-69.2	29.4	2.0
	B	19.1	26.4	-44.6	20.5	25.6	-42.7	2.5
	CMY	19.6	2.0	2.2	20.9	3.3	3.3	2.2
	substrate	94.6	0.1	1.1	95.2	-0.3	1.4	0.8
PP Light Top Silver	C	53.4	-35.7	-47.4	54.4	-36.2	-46.7	1.3
	M	47.2	71.4	-0.7	48.1	71.9	-1.2	1.2
	Y	84.5	-7.8	82.6	84.9	-7.7	81.7	1.0
	K	14.6	-0.9	1.5	15.5	-0.6	0.6	1.3
	R	47.3	64.7	46.5	47.7	64.9	45.5	1.1
	G	48.5	-65.6	25.4	49.8	-64.9	26.9	2.1
	B	19.3	25.3	-41.1	21.1	26.0	-42.4	2.4
	CMY	20.6	3.5	1.1	22.0	3.4	2.0	1.6
	substrate	88.9	-1.1	-2.1	89.2	-0.9	-2.2	0.3
Vellum Logistics NXT	C	59.8	-32.4	-43.1	60.1	-33.5	-41.3	2.1
	M	54.5	70.1	-6.7	54.6	69.6	-6.1	0.8
	Y	88.0	-3.9	75.9	88.0	-4.3	77.0	1.2
	K	30.1	0.6	2.0	30.7	0.5	1.7	0.6
	R	53.4	62.9	41.6	53.9	63.0	41.2	0.6
	G	55.5	-56.4	25.4	56.0	-56.2	27.5	2.2
	B	29.5	22.0	-38.6	30.3	22.2	-38.1	1.0
	CMY	28.8	4.2	1.9	29.0	5.0	1.9	0.8
	substrate	91.2	3.9	-4.6	90.9	2.8	-2.6	2.3

Table 2 (part 3)
Comparison of color reproduction between prints and proofs on the tested substrates

Substrate	Color	print HP Indigo			proof Epson			ΔE^*_{76}
		L*	a*	b*	L*	a*	b*	
Verge Creme FS	C	57.7	-37.0	-28.0	57.8	-37.0	-28.2	0.2
	M	55.2	67.0	8.4	54.7	67.6	6.6	1.9
	Y	89.8	-2.4	77.5	89.0	-2.2	77.1	0.9
	K	30.1	0.5	3.6	29.8	0.6	3.0	0.7
	R	55.5	61.2	39.4	55.3	61.7	38.0	1.5
	G	54.6	-51.9	22.0	54.7	-52.1	23.0	1.0
	B	31.5	15.2	-25.8	31.9	15.4	-26.4	0.8
	CMY	31.9	2.2	1.1	31.7	2.5	0.9	0.4
	substrate	91.7	0.8	20.5	91.5	0.7	20.1	0.4

4. Conclusions

Eleven color profiles were created for the Epson P5000 proofing printer to simulate the output of the HP Indigo 6K Digital Press on the most commonly used label materials. These color profiles have been used in the printer since their creation for all jobs on these materials; they are fully functional, with a small color deviation that falls within the tolerance range for proofing.

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