

A SPECIAL SUPPLEMENT TO
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GUIDELINES & SPECIFICATIONS



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GRACoL® 7 Specification for Commercial Printing on a #1 Coated Sheet

In an ideal world, each commercial sheetfed offset printing job should exceed the customer's expectations. The printer should be able to match the vision of the creative in the finished product on press. But in the real world, a multitude of creative, premedia, prepress and printing variables often prevent printers from meeting the customer's expectations.

The good news is that with this latest version of GRACoL, we have come a long way toward fulfilling the vision. GRACoL 2007 signals a revolution in printing because for the first time a specification has been designed to provide printers with the ability to visually match output from proof to press and even from press to press. GRACoL leverages new technologies such as spectrophotometry and CTP, as well as taking a lesson from photographers about how color is perceived by the human eye to develop metrics and process controls that assure better visual likeness on press regardless of mechanical variables like dot shape or screen ruling.

Previously GRACoL and other printing specifications have been based on measuring and controlling TVI/dot gain for each printed color. But GRACoL 2007 has broken from this tradition by setting printing aims based on colorimetric data for gray balance and a standardized "Neutral Print Density Curve" (NPDC), rather than on traditional TVI aims for each ink. This new philosophy allows a careful user to achieve a closer visual match from device to device, while maintaining the same overall "appearance" of traditional printing.

G7, the new process control method that was developed by the GRACoL Committee with the assistance of the Print Properties Working Group is documented in the following section of this publication. Here we represent the new GRACoL 2007 Specifications embodied in the new GRACoL Characterization Data Set in the form of the GRACoL 2007 Print Characterization Chart.

GRACoL® Print Characterization Charts

Profile	GRACoL2006 Coated1.txt	SWOP2006 Coated3.txt	SWOP2006 Coated5.txt				
Paper / Substrate	Grades #1 & #2 gloss/dull coated	Premium text & cover	Grade #3 publication	Grade #5 publication	SuperCal SCA+	SuperCal SCA	SuperCal SCB
LPI (for reference only)	175	150-175	150	133-150	133-150	120-133	120-133
TAC	340%	260%	310%	300%	280%	260%	240%

Paper L*a*b*	L*	a*	b*	L*	a*	b*	L*	a*	b*
	L*	95	-	93	90	-	-	-	-
	a*	0	-	0	0	-	-	-	-
	b*	-2	-	0	4	-	-	-	-

L*a*b* aims D50 over white backing	K	L*	a*	b*	L*	a*	b*	L*	a*	b*
	L*	15	-	18.50	18.97	-	-	-	-	-
	a*	0	-	0.01	1.10	-	-	-	-	-
	b*	0	-	-0.12	1.18	-	-	-	-	-
	C	L*	55	-	57.06	56.63	-	-	-	-
	a*	-37	-	-36.97	-37.92	-	-	-	-	-
	b*	-50	-	-45.05	-40.92	-	-	-	-	-
	M	L*	48	-	47.99	47.76	-	-	-	-
	a*	74	-	71.92	69.73	-	-	-	-	-
	b*	-3	-	-3.10	-3.57	-	-	-	-	-
DEab of 5 or less for all colors	Y	L*	89	-	88.08	85.46	-	-	-	-
	a*	-5	-	-5.09	-5.85	-	-	-	-	-
	b*	93	-	87.90	84.52	-	-	-	-	-

Neutral Density Aims minus Paper Density								
25C/19M/19Y	25% CMY/K	.25 / .22	.25 / .22	.25 / .22	.25 / .22	.25 / .22	.25 / .22	.25 / .22
50C/40M/40Y	50% CMY/K	.54 / .50	.53 / .49	.54 / .49	.54 / .49	.54 / .49	.52 / .50	.52 / .51
75C/66M/66Y	75% CMY/K	.90 / .90	.86 / .83	.89 / .87	.89 / .86	.86 / .87	.83 / .85	.83 / .85

Pre-2007 Press Control Guidelines (Historical Reference only)								
Paper / Substrate		1 & 2	3	5	SCA+	SCA	SCB	
Solid Ink Densities	K	1.75	1.30	1.65	1.60	1.50	1.40	1.35
	C	1.40	1.15	1.35	1.30	1.25	1.15	1.10
	M	1.50	1.15	1.45	1.40	1.35	1.20	1.15
	Y	1.00	0.90	1.02	1.00	1.00	0.95	1.00
TVI	K	22	26	22	22	28	28	28
	C	20	22	21	20	26	26	26
	M	20	22	22	20	26	26	26
	Y	18	20	18	18	24	24	24
Print Contrast	K	40+	35+	45	35+	23	23	23
	C	35+	35+	40	30+	21	21	21
	M	35+	30+	41	30+	21	21	21
	Y	30+	25+	35	25+	20	20	20

How to Use the Chart

In the printing process, the relationship between the substrate (paper), LPI (lines per inch), SID (solid ink density), TAC (total area coverage), gray balance and NPCD (neutral print density curves) combine to affect the quality of the printed output. The GRACoL 2007 Print Characterization Chart specifies values and tolerances for input variables and output goals for commercial printing for a #1 or #2 sheet. The chart includes variables for both a premium coated paper and premium text and cover substrate.

The goal of the chart is to facilitate communication and expectations between the print buyer, creative, premedia/prepress service provider and the printer. Using this chart you can select a set of input variables and have a clear expectation of the output parameters that meet GRACoL quality.

This new chart differs significantly from the chart published with previous GRACoL editions. These differences reflect the important new G7 variables that help to maintain a constant visual appearance from proof to press and from press to press. For example gray balance is defined at 50% C, while neutral print density is defined for 25%, 50% and 75% CMY gray patches, and K 25, K50 and K 75%. Maintaining gray balance and gray density at the midtones are key G7 metrics. Gray Balance is specified in CIE a^*b^* at 50,40,40 CMY with target a^* equal to paper $a^*/2$ and target b^* equal to paper $b^*/2$, with a tolerance of $\pm 0.5 a^*$ for proofs and $\pm 1.0 a^*$ on press, and $\pm 1.0 b^*$ for proofs and $\pm 2.0 b^*$ on press. The chart also provides Paper CIE Lab Values, and CIE Lab values for the primary Ink solids.

Tolerances & Variation

Variation is part of the printing process and the GRACoL Committee recognizes this reality. That is why the GRACoL 2007 Print Characterization Chart specifies tolerances. Even using the G7 Proof-to-Print Process, variances should be expected.

Some printers may suggest that their printing parameters differ from those listed here. For example a printer may suggest using a 200-line screen or vary their ink densities. While this may enhance print properties such as resolution, there can be a penalty if the same allowances are not made in proofing and other areas such as file preparation. Print buyers need to understand that printers offering to print “better” than a specification such as GRACoL 2007 or SWOP 2007 may well be able to do so, but files and proofs generated by that printer may not be interchangeable with another printer, and vice-versa, without careful color management.

Important Definitions

Several definitions will help you understand and use the GRACoL 2007 Characterization Chart. These are:

- **CIE $L^*a^*b^*$ (CIELAB):** A 3-D color space mathematically derived from CIE xyz chromaticity coordinates resulting in greater perceptual uniformity. L^* = neutral light-dark axis, a^* = red/green axis and b^* = blue/yellow axis.
- **CMYK:** Four-color process printing uses CMYK—that is Cyan (also called process blue), Magenta (process red), Yellow (process yellow) and black inks to create all colors.
- **lpi:** Lines per inch or Line Screen (LS) is the number of lines of dots per linear inch in a halftone screen. The lower the line screen number (fewer dots in an inch), the larger and more widely spaced the dots which produces less dot gain. Higher line screen rulings (more dots) can contain more image information and produce finer detail if they are used on a paper stock of high enough quality. Higher line screens produce more dot gain.
- **NPDC:** Neutral Print Density Curve is the relationship between the measured neutral density and original halftone percentages on a gray scale.
- **Solid Ink Lab Values:** Color information that is used to specifically map a color gamut. These measurements are extremely useful for ink manufacturers and color management experts.
- **SID:** Solid Ink Density is a numerical measure of how much complementary (major filter) light is absorbed by a solid patch in a color control bar as measured and reported by a reflection densitometer measured dry with instrument calibrated to Status T.
- **TAC:** Total area coverage defines in percentage terms the total amounts of cyan, magenta, yellow, and black in the darkest area of the printed image. Theoretically, the blackest area would benefit from being produced with maximum ink amounts totaling 400%. However, in four-color process printing, that would cause problems in production press operation. Total area coverage should be checked in the heaviest (darkest) area of the film or electronic file and read in the same spot on each color. Look for the appropriate TAC for each print condition in the color preferences setup for the color separation software.