Aardenburg

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IMAGING & ARCHIVES

Accelerated Light Fading Test Results

Canon Pro9000, Canon OEM Chromalife 100, Ilford Galerie Classic Gloss Paper

Sample # AaI_20081103_SN002

160 Megalux-hours completed

Conservation Display Rating *	
Lower Exposure Limit (Megalux hours)	Upper Exposure limit (Megalux hours)
29	43

* Please read document **AaI_2009_0118_TA-01.pdf**, "**An Overview of the AaI&A Conservation Display Ratings**", located on the Documents page of the AaI&A website for an explanation of the conservation display ratings.

Document #: AaI_20081103_SN002Lf.pdf Rev: June 4, 2012

Test Print Prepared by: AaI&A member

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About this Report

This report contains light fastness information about a single test print produced by a specific digital printing system. "System" refers to all hardware, software, and materials used to make the finished print. The hardware, software, material components, and printmaker's skills contribute to the final image quality and image permanence. The tested sample is made with current or recently discontinued stocks of commercially available products unless otherwise stated. Each sample has been prepared by Aardenburg Imaging & Archives or one of its members in accordance with customary print making practices unless otherwise noted. The sample may also contain additional finishing materials such as overcoats and laminates which are also noted when used. Finally, the sample has been tested under standardized conditions that are defined on the Sample Description page (see page 2). AaI&A makes every effort to ensure but cannot guarantee that the samples are properly identified and documented and that test results are accurate. For this reason, AaI&A also strives to test independently produced sample replicates in order to increase sampling confidence and to provide information on process variability. Please compare the results in this report to replicate test samples when the data become available.

Understanding the Test Results



AaI_StandardColorSet(v2)forSRGB.tif

The magnitude and visual appearance of fading depends not only on the chosen printing system but the chosen image as well. In other words, different images are comprised of different colors, and the fading relationships between those colors dictate how the image will look as it fades. The sample print in this test report was made by reproducing the digital image shown on the left. It contains 30 standard colors. 24 of the colors are colorimetrically matched to the Macbeth ColorChecker™ chart viewed under D50 illumination. The remaining six colors supplement the ColorChecker™ array with four additional skin tone colors, one patch for paper white, and another for maximum black. The additional colors also round out the distribution of L* lightness values in the test target.

Information about the fading characteristics of the product is provided in three ways:

1) ***You can visually assess the fading.*** The target images reproduced in this report are digitally reconstructed from the spectrally measured color data rather than scanning or otherwise reproducing the physical print by conventional techniques. This method ensures a colorimetrically accurate representation of the print appearance as the print fades. A calibrated monitor is recommended to experience the best possible reproduction of the test sample appearance. The side-by-side presentation of the target images simulates looking at the light-exposed print along side a perfect duplicate of the unexposed original print. The "Before/After" Layer mode takes advantage of Adobe Reader Layer technology. Toggle the "Before/After" layer on and off using the layers feature of Adobe Reader to directly switch between the light exposed print colors and the initial print colors for the image located on the right side of each page. Also, use Adobe Reader's full screen mode to cycle through the pages and "animate" the fading.

2) ***I* Color and tonal accuracy scores are reported.*** This report includes I* metric scores that compare the color and tonal relationships of the light exposed samples to the color and tonal relationships existing in the original print prior to light exposure. Perfect I* scores of 100% can be approached when no significant fading occurs. Average scores above 90% generally indicate excellent retention of original quality, 80% good, 70% fair, etc., but your conclusions may vary depending on your image quality requirements. ***I* color*** rates the retained color accuracy (hue and chroma) while ***I* tone*** rates the retained tonal accuracy (lightness and contrast). The score is on a percentile scale where 100% is a perfect match between the comparison image (e.g., "after" light exposure) and the reference image (e.g., "before" any light exposure). 0% ***I* color*** means no color accuracy is left. 0% ***I* tone*** means essentially no tonality remains and all image information content is lost. Negative I* values have significance as well and contribute to the average I* score when they occur. Negative I* color values mean false color has occurred, for example, when a skin tone turns green or a neutral gray becomes distinctly colorful. Negative I* tone scores mean visual contrast between colors has become inverted (i.e., like the tonal relationships in a photographic film negative). Serious image quality problems must arise before false colors and/or tones appear. For more information on the I* metric, please refer to the AaI&A web site.

3) ***Color changes are also reported using the classic color difference model, ΔE.*** Note that ΔE values lose perceptual scaling significance when they become large (e.g., > 15). Also, the ΔE equation does not unambiguously measure changes in image contrast. This limitation is generally not a problem for paints and textiles, but can be a serious oversight when evaluating photographic images. It was a major reason behind the development of the I* metric.

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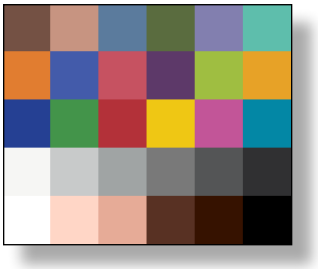
Sample Description

Printer: Canon Pro9000
Ink: Canon OEM Chromalife 100
Paper: Ilford Galerie Classic Gloss Paper

Sample #: AaI_20081103_SN002
Test Print Prepared by: AaI&A member, category: amateur



AaI_StandardColorSet(v2)forSRGB.tif

Test Image: AaI_StandardColorSet(v2)forSRGB.tif
RIP/Driver settings: PS/CS3/Canon OEM, print quality = "fine", color adjustment off
Media Setting: "Photo Paper Pro"

Printed: October 24, 2008
Original print colors measured on: March 12, 2009
Test started on: March 20, 2009

Profile: AaI_Cnpro9000_ILClgloss(1).icm **Rendering Intent:** Perceptual
Profile type: Custom, made by AaI&A staff
Profile Creation Software: Gretag/Macbeth Profilemaker 5.08

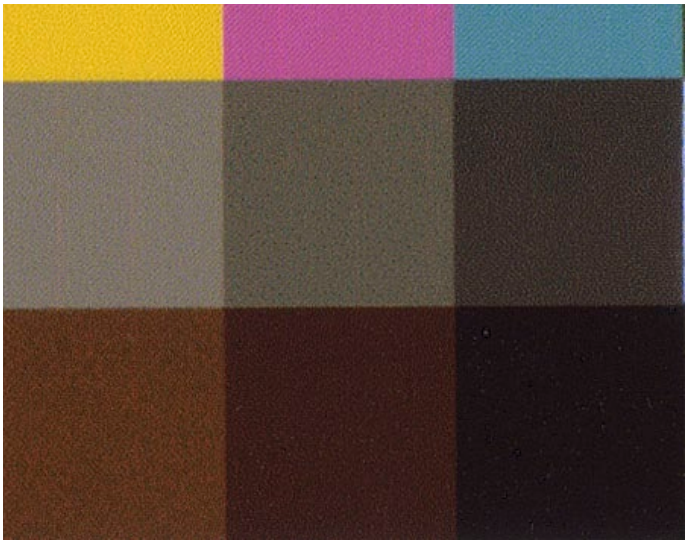
Paper White Color (UV–included versus UV–excluded) and Maximum Printed Black						
Optical Brighteners present? yes	L*		a*		b*	
	UV inc	UV exc	UV inc	UV exc	UV inc	UV exc
Maximum Paper White (no colorants printed)	93.6	93.5	0.3	-0.4	-4.6	-2.0
(1) ΔL*, Δa*, Δb* respectively	0.1		0.7		2.6	
(1) Calculated differences, especially for Δb*, indicate the role and magnitude of fluorescence on original paper color						
Maximum Printed black (UV included)	L* = 7.3		a* = 2.3		b* = 0.6	

Light Source: Phillips Colortone F40T12/C50
Filter/Glazing: Sample framed under Glass*
Light Exposure Cycle: 8 hours on, 4 hours off, twice per 24 hours
Average Illuminance during "on" cycle: 11,946 Lux
Average Temperature: 23.3˚C over full test duration, 24.8˚C during light exposure
Average Relative humidity: 57.1%RH full test period, 57.2%RH during light exposure
CIELAB measurements: D50 2˚ observer, Xrite Gretag/Macbeth Spectrolino/Spectroscan

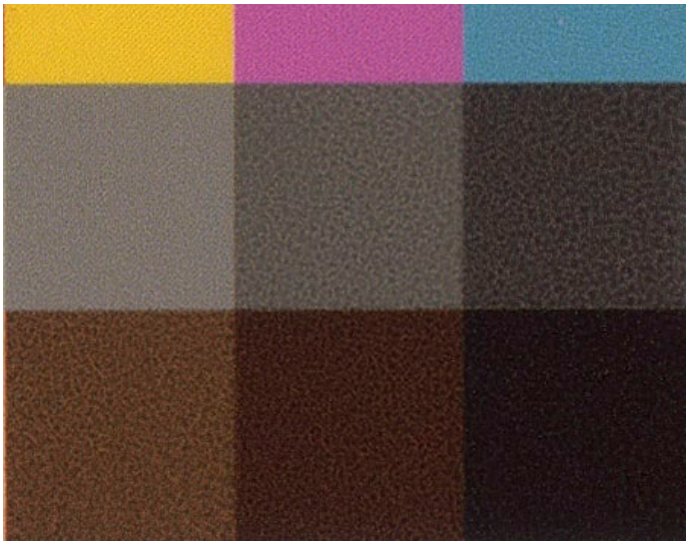
Replicates/Compare to:

No Replicates are available at this time.

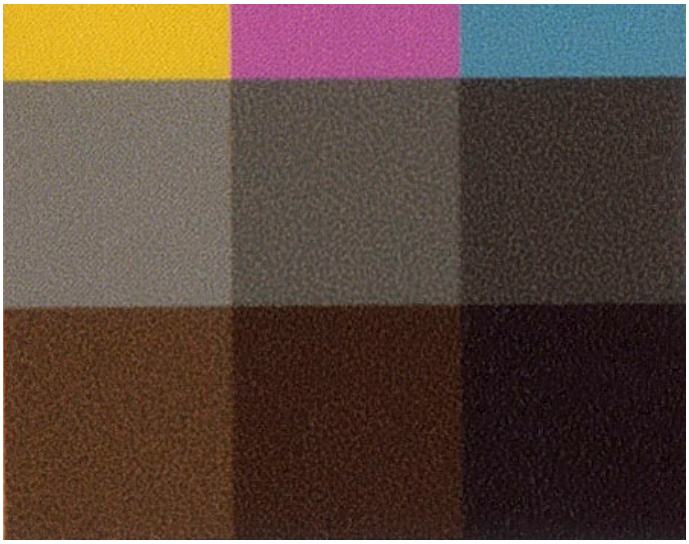
* The Phillips Colortone F40T12/C50 fluorescent light source and ordinary glass picture frame glazing yields UVA content and overall spectral power similar to natural 5000˚K daylight entering a window and then striking a print that has been framed by **standard acrylic glazing** rather than ordinary glass. Other light sources and/or different glazing options may yield greater or lesser fade rates (generally, a 2-5x increase in fade rate for direct sunlight compared to UV–excluded sources at the same Lux level). The spectral quality of the light can also affect individual colors differently.



Sample # AaI_20081103_SN001 – Canon Photo Paper Pro. ***Microporous type ink receptor coating.***



Sample # AaI_20081103_SN002 – Ilford Galerie Classic Gloss Paper. ***Swellable polymer type ink receptor coating.***



Sample # AaI_20081103_SN003 – Ilford Galerie Classic Pearl Paper. ***Swellable polymer type ink receptor coating.***

Sample #s AaI_20081103_SN002 and AaI_20081103_SN003, Ilford Galerie Classic Gloss and Ilford Gallerie Classic Pearl, are examples of inkjet papers with a swellable polymer type ink receptor coating. Traditional photographic gelatin binders used in silver halide photography are a classic example of a swellable polymer. Upon contact with water, photographic gelatin reverts from a hard dry coating to a gel state where the photochemistry can now diffuse easily into the coating. The swellable polymers used for inkjet paper coatings become even more water soluble and essentially dissolve as the ink is applied rather than remain in the gel state. The dyes diffuse fully into the coating and after solvent evaporation, the coating re=dries thus fully encapsulating the dyes. Compared to microporous coatings that soak up the dyes with a capillary action but do not encapsulate them, the encapsulated dyes in swellable polymers are better protected against light and gas fading which is the primary reason they were introduced for inkjet papers. One disadvantage to swellable polymer coatings is that they take longer to become absorbent and a fast inkjet printer can lay down too much ink too quickly. When this happens the print can take on a mottled or grainy appearance in the areas of the image with high ink loading. Ink pooling can be observed in the swellable polymer figures above. Compare the dark areas of the Canon Pro9000 printer images made on swellable papers to the one made on a Canon Photo Paper Pro paper which is a microporous inkjet paper. The illustrations shown above were scanned directly from the print samples. Note that for typical inkjet printers the maximum black areas in the print usually have less ink loading than dark shadow areas because the cyan, magenta, and yellow dyes that form neutral grays are fully replaced by just the black ink.

The Canon Pro9000 is a new generation of printer that is faster than earlier generations. A higher rate of ink flow and hence higher volume of ink reaches the paper quickly. Canon does not offer a swellable type paper for any of its dye-based printers. It is possible that the ink pooling exhibited in this test sample could have been reduced if not eliminated by experimenting with other printer settings than those used to make the samples shown here.

Additional Comments:

January 04, 1010 – Note the b* value progression in the neutral patches as the tests progress. First, there is a shift in the positive b* direction, but after the 20 megalux hour exposure interval (about 4 months in test) the b* values starts to move towards in the negative b* direction. This progression means that at first the neutral values become a little more yellowish gray, but eventually the fading pushes them towards more bluish gray. Both sample #s AaI_20081103_SN002 and AaI_20081103_SN003 use essentially the same swellable polymer coating chemistry, only varying in the finish texture, and hence their fading response is likely to be very similar. Yet there is a significant discrepancy in their Conservation display ratings (CDR). SN003 was given a CDR rating of 22-27 megalux hours whereas SN002 achieved a CDR rating of 29-43 megalux hours. This apparent difference may have occurred not from inherent differences in light fade resistance, rather due to the subtle compounded effects of humidity-induced color drift during the initial stages of the testing (humidity causing the shift towards yellow and light causing the counteracting shift toward blue).

Both samples were printed at the same time on the same Canon Pro9000 printer by a local amateur printmaker here in the Berkshire Mountains of Massachusetts in late October, 2008 when indoor environmental conditions had shifted to moderately low humidity conditions due to seasonal use of indoor heating. The samples remained in AaI&A print files during the winter when environmental conditions become even drier indoors. The reference measurements were taken in early March and tests commenced in March, still during the indoor heating season. Thus, until the start of testing at controlled humidity of 60%, the samples had plenty of time to "dry down" but no significant exposure to moderately high (60% RH) humidity levels until the tests commenced. Dye-based inkjet systems are very susceptible to continuing humidity-influenced dye migration that can cause subtle color changes which have nothing to do with light-induced fading. Hence, their humdity-influenced dye migration effects present a challenge for a rigourous standard like the AaI&A conservation display rating because it's hard to pin down a highly stable state of initial color under which to measure the "reference state" color. Humidity-induced dye migration always slows down in rate as humidity exposure events accrue, whereas light-induced fade may slow down, remain constant for long exposure periods, or even speed up as higher exposure levels accrue.

If we ignore the 30 megalux hour data for sample #AaI_20081103_SN003 and compute its Conservation Display Rating based on the 20, 40, and 50 megalux hour exposure measurements, the CDR becomes 30-42 megalux hours which is in very tight agreement with the 29-43 megalux hour CDR score for sample #AaI_20081103_SN002. However, the original rating for SN003 can't really be dismissed as a measurement error. Both of the original ratings are relevant and speak to the natural variability that exists when testing dye-base systems and to the challenges presented by dye-based inkjet systems in providing highly stable color for professional applications such as graphic arts contract proofs or fine art printing. However, for typical consumer photo finishing applications where higher amounts of color shift are usually acceptable, both samples are still demonstrating "good" average overall I* tone and I* color scores at the 50 megalux hour exposure interval.

Table to Convert Megalux-hours of Light Exposure to estimated "Years on Display"											
Indoor Light Levels for Print Display		Multiply Mlux-hrs by	Megalux-hours in test									
Light Exposure	**Description**		**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
≤ 10 Lux 24 hours per day	Interior rooms, storage areas, or hallways without windows, illuminated sparingly by artificial lighting	**11.42**	114	228	342	457	571	685	799	913	1027	1142
50 Lux 12 hours per day	"Museum Standard" display condition	**4.57**	46	91	137	183	228	274	325	365	411	457
120 Lux 12 hours per day "Kodak Display Years" (1)	Average home illumination level for photos is ~ 60 lux. 90% of all displayed photos do not exceed 120 lux (1).	**1.90**	19	38	57	76	95	114	133	152	171	190
228 Lux 12 hours per day	Relatively bright home or office. Note the simple 1:1 relationship between "years on display" and Mlux-hr values at this condition.	**1.00**	10	20	30	40	50	60	70	80	90	100
450 Lux 12 hours per day "WIR Display Years" (2) Also equals 500 lux for 11.8 hours per day	A bright home or commercial office building illumination level is 200-500 lux. Also, good illumination for color critical viewing and color matching tasks begins at about 500 lux.	**0.51**	5	10	15	20	25	30	35	41	46	51
2000 Lux 12 hours per day	Commercial Gallery. Also, critical color evaluation standards call for 2000 lux and a D50 illumination source.	**0.114**	1.1	2.3	3.4	4.6	5.7	6.8	8.0	9.1	10.3	11.4
5000 Lux 12 hours per day	E.g., Sunlight through a window striking print at an angle.	**0.046**	0.5	0.9	1.4	1.8	2.3	2.7	3.2	3.7	4.1	4.6
10,000 Lux 12 hours per day	South-facing window in U.S.A. , e.g., storefront display with photos directly facing window.	**0.023**	0.2	0.5	0.7	0.9	1.1	1.4	1.6	1.8	2.1	2.3

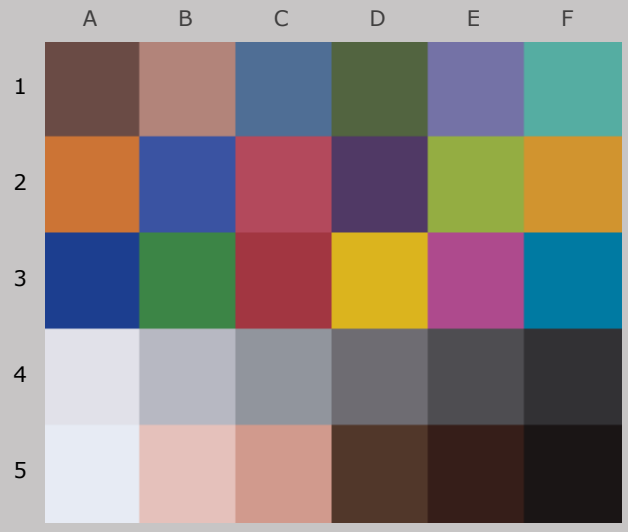
Light levels commonly encountered in the real world fluctuate widely throughout indoor print display environments and produce large variations in how long it takes for artwork to acquire light-induced damage. Use this table as a guide to estimate how many "years on display" (denoted in red text) it takes to accumulate the light exposure test dosage. Review the test results to decide which Megalux-hour dose has caused fading to your level of concern (e.g., just noticeable, easily noticeable, objectionable, etc.). Then choose the print display description that best represents how your print is likely to be displayed. You may want to obtain a lux meter and make some measurements in your own display environment!

Note that as the years of display time increase, light-induced fading can be eclipsed by other serious aging mechanisms such as fading and/or staining caused by heat, humidity, and air pollutants. Mould damage can also occur at high humidity. Even when colorants remain water fast, direct contact with liquids may result in physical deformation and staining of the substrate. Also, temperature and especially humidity cycling can cause physical cracks and/or flaking, etc. Handling damage such as scratching, abrasion, tears and creases, and catastrophic damage by smoke, fire, flood, etc., also degrade print quality over time. Thus, as illumination levels are reduced other forms of degradation take on greater proportion of risk and may appear in shorter time intervals.

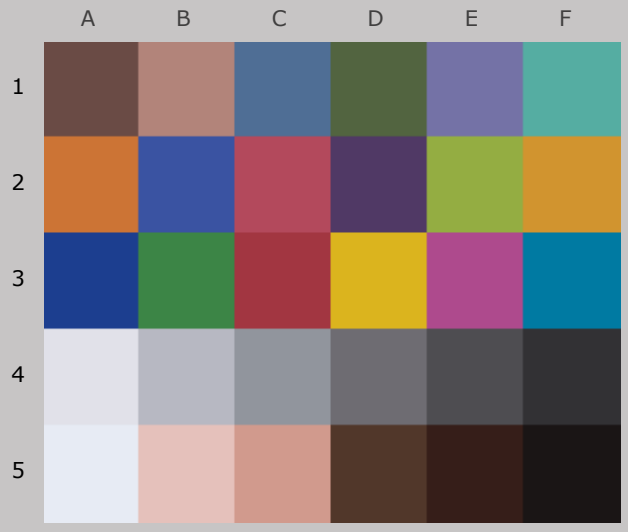
(1) Eastman Kodak has cited this exposure condition and 90% confidence limit as a rationale for estimating print fading times of traditional color photo materials in typical home display environments. For recent light fading claims regarding its line of pigment-based inkjet printers, Kodak has adopted the higher level of 450lux/12 hours per day which is also used by Wilhelm Imaging Research, Inc. (See below).

(2) Wilhelm Imaging Research (WIR) has standardized its light fastness ratings on 450 lux for 12 hours per day in order to estimate the years on display necessary to reach "noticeable" fading. This average light exposure condition, an assumed 75°F/60%RH temperature and humidity level, and WIR's visually weighted densitometric endpoint criteria set V3.0 has become a de facto industry standard for most predictive light fading estimates in the absence of a published International Standards Organization (ISO) test standard.

100color/100tone



Original Print Colors
(measured before light exposure)



Colors at Zero Megalux-hours of Light Exposure
(same as original print colors)

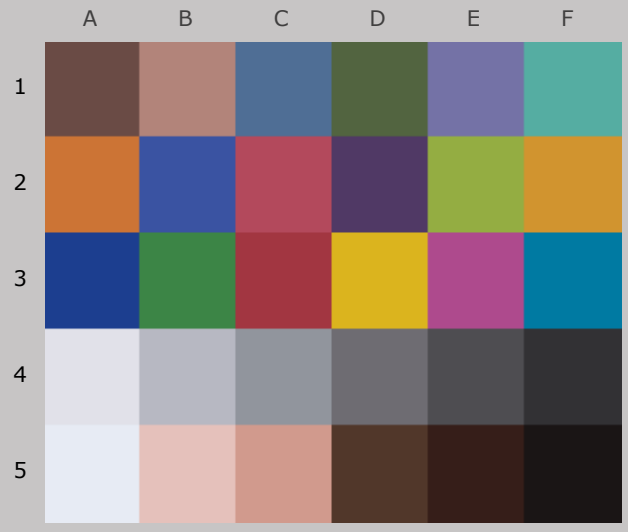
Canon Pro9000, Canon OEM Chromalife 100, Ilford Galerie Classic Gloss Paper

Original Print Colors as Measured and at Start of Test

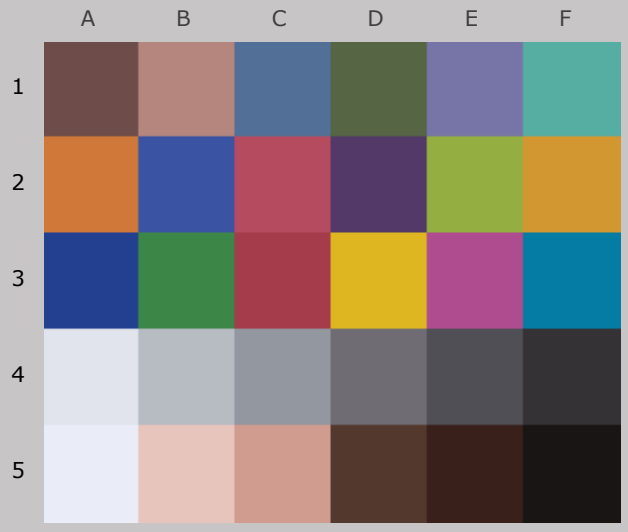
				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	100.0	0.0	35.4		13.3		8.7	
B1	light Skin	100.0	0.0	59.7		17.1		12.5	
C1	blue sky	100.0	0.0	45.5		-3.4		-24.9	
D1	foliage	100.0	0.0	39.9		-11.8		17.8	
E1	blue flower	100.0	0.0	49.6		10.4		-27.7	
F1	bluish green	100.0	0.0	65.0		-30.2		-3.2	
A2	orange	100.0	0.0	58.2		32.4		49.5	
B2	purplish blue	100.0	0.0	36.4		11.2		-46.8	
C2	moderate red	100.0	0.0	46.2		44.7		11.8	
D2	purple	100.0	0.0	28.1		17.8		-21.6	
E2	yellow green	100.0	0.0	66.9		-21.1		50.5	
F2	orange yellow	100.0	0.0	66.5		17.0		59.2	
A3	blue	100.0	0.0	28.0		12.1		-49.0	
B3	green	100.0	0.0	49.9		-34.8		27.2	
C3	red	100.0	0.0	39.8		46.3		18.8	
D3	yellow	100.0	0.0	75.5		5.3		71.9	
E3	magenta	100.0	0.0	46.6		47.0		-17.1	
F3	cyan	100.0	0.0	47.1		-19.1		-29.7	
A4	white	100.0	0.0	89.8		0.7		-4.2	
B4	neutral 8	100.0	0.0	74.9		0.6		-4.6	
C4	neutral 6.5	100.0	0.0	61.4		0.5		-5.2	
D4	neutral 5	100.0	0.0	45.7		1.9		-2.9	
E4	neutral 3.5	100.0	0.0	33.0		0.5		-2.0	
F4	black	100.0	0.0	20.4		1.3		-2.0	
A5	paper white	100.0	0.0	93.0		0.3		-5.0	
B5	skin highlight L*=89	100.0	0.0	81.1		12.7		8.4	
C5	skin highlight L*=75	100.0	0.0	68.6		20.0		14.9	
D5	skin shadow L*=25	100.0	0.0	25.8		11.1		12.9	
E5	skin shadow L*=11	100.0	0.0	14.6		10.8		9.5	
F5	Max Black	100.0	0.0	7.3		2.3		0.6	

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	100	100	0.0
Average Score for the Worst 10% (3 lowest scoring patches)	100	100	0.0

98.3color/97.2tone



Original Print Colors
(measured before light exposure)



Colors after 10 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100, Ilford Galerie Classic Gloss Paper

10 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

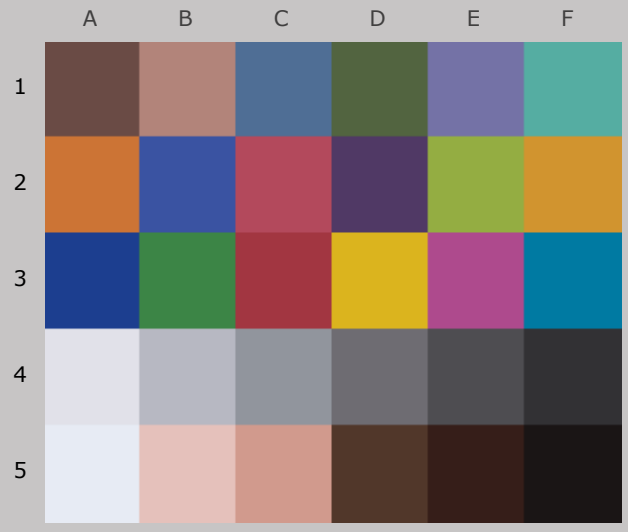
				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	98.1	1.1	35.4	36.1	13.3	13.7	8.7	8.0
B1	light Skin	99.2	1.1	59.7	60.6	17.1	16.7	12.5	13.1
C1	blue sky	100.0	0.7	45.5	46.2	-3.4	-3.4	-24.9	-24.8
D1	foliage	97.5	1.2	39.9	40.6	-11.8	-11.4	17.8	16.8
E1	blue flower	99.9	1.0	49.6	50.5	10.4	10.1	-27.7	-27.3
F1	bluish green	99.9	0.8	65.0	65.6	-30.2	-30.4	-3.2	-2.7
A2	orange	96.7	2.8	58.2	59.5	32.4	30.7	49.5	47.7
B2	purplish blue	100.0	0.7	36.4	37.0	11.2	11.2	-46.8	-46.6
C2	moderate red	100.0	1.0	46.2	47.1	44.7	44.7	11.8	11.7
D2	purple	98.3	1.1	28.1	28.7	17.8	18.5	-21.6	-22.2
E2	yellow green	100.0	0.6	66.9	67.5	-21.1	-21.1	50.5	50.6
F2	orange yellow	100.0	0.8	66.5	67.3	17.0	16.8	59.2	59.1
A3	blue	99.8	0.7	28.0	28.4	12.1	12.6	-49.0	-49.2
B3	green	99.7	0.9	49.9	50.5	-34.8	-34.6	27.2	26.6
C3	red	94.1	3.7	39.8	41.1	46.3	45.4	18.8	15.5
D3	yellow	100.0	0.7	75.5	76.2	5.3	5.1	71.9	72.0
E3	magenta	100.0	1.1	46.6	47.6	47.0	47.0	-17.1	-16.7
F3	cyan	100.0	0.6	47.1	47.8	-19.1	-18.9	-29.7	-29.8
A4	white	99.8	0.9	89.8	90.5	0.7	0.3	-4.2	-3.9
B4	neutral 8	97.1	1.2	74.9	75.7	0.6	0.1	-4.6	-4.1
C4	neutral 6.5	98.8	1.0	61.4	62.2	0.5	0.1	-5.2	-4.7
D4	neutral 5	99.4	0.9	45.7	46.5	1.9	2.1	-2.9	-3.4
E4	neutral 3.5	87.2	1.8	33.0	33.6	0.5	1.4	-2.0	-3.5
F4	black	94.6	1.3	20.4	21.2	1.3	2.2	-2.0	-2.5
A5	paper white	100.0	0.6	93.0	93.6	0.3	0.0	-5.0	-5.0
B5	skin highlight L*=89	97.9	1.3	81.1	82.0	12.7	12.1	8.4	8.9
C5	skin highlight L*=75	99.2	1.2	68.6	69.5	20.0	19.4	14.9	15.3
D5	skin shadow L*=25	97.6	1.2	25.8	26.6	11.1	11.7	12.9	12.2
E5	skin shadow L*=11	96.7	1.3	14.6	15.6	10.8	11.6	9.5	9.9
F5	Max Black	97.3	0.8	7.3	7.1	2.3	1.6	0.6	0.6

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	98.3	97.2	1.1
Average Score for the Worst 10% (3 lowest scoring patches)	92.0	93.2	2.8

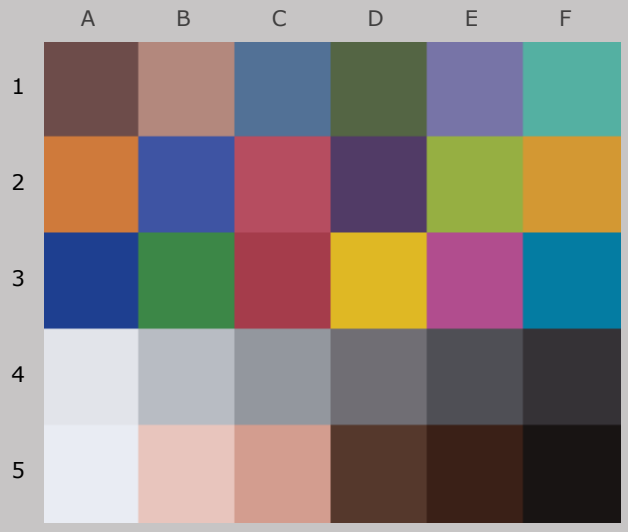


Aardenburg Imaging & Archives

97.0color/96.1tone



Original Print Colors
(measured before light exposure)



Colors after 20 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100, Ilford Galerie Classic Gloss Paper

20 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

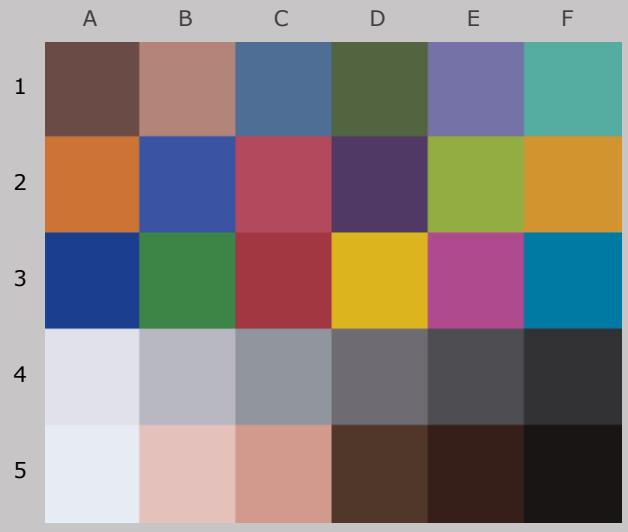
				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	100.0	0.9	35.4	36.2	13.3	13.6	8.7	8.5
B1	light Skin	97.0	1.6	59.7	60.9	17.1	16.2	12.5	13.3
C1	blue sky	99.6	1.1	45.5	46.4	-3.4	-3.7	-24.9	-24.4
D1	foliage	100.0	0.9	39.9	40.7	-11.8	-11.6	17.8	17.4
E1	blue flower	97.6	1.6	49.6	50.7	10.4	9.6	-27.7	-26.8
F1	bluish green	98.9	1.2	65.0	65.7	-30.2	-30.6	-3.2	-2.5
A2	orange	95.6	3.5	58.2	59.9	32.4	29.8	49.5	47.7
B2	purplish blue	99.7	1.0	36.4	37.1	11.2	10.8	-46.8	-46.2
C2	moderate red	100.0	1.2	46.2	47.3	44.7	44.5	11.8	12.0
D2	purple	99.0	1.0	28.1	28.8	17.8	18.4	-21.6	-22.0
E2	yellow green	100.0	0.8	66.9	67.7	-21.1	-21.2	50.5	50.8
F2	orange yellow	99.7	1.2	66.5	67.5	17.0	16.4	59.2	59.4
A3	blue	100.0	0.5	28.0	28.4	12.1	12.2	-49.0	-49.0
B3	green	100.0	0.7	49.9	50.6	-34.8	-34.6	27.2	27.3
C3	red	93.2	4.2	39.8	41.4	46.3	44.9	18.8	15.2
D3	yellow	99.8	1.1	75.5	76.4	5.3	4.8	71.9	72.3
E3	magenta	99.1	1.6	46.6	47.9	47.0	46.5	-17.1	-16.3
F3	cyan	100.0	0.8	47.1	47.9	-19.1	-19.2	-29.7	-29.4
A4	white	93.5	1.3	89.8	90.5	0.7	0.0	-4.2	-3.3
B4	neutral 8	90.9	1.8	74.9	76.0	0.6	-0.4	-4.6	-3.7
C4	neutral 6.5	93.2	1.6	61.4	62.5	0.5	-0.3	-5.2	-4.4
D4	neutral 5	100.0	0.9	45.7	46.7	1.9	1.8	-2.9	-2.9
E4	neutral 3.5	92.8	1.4	33.0	33.7	0.5	1.2	-2.0	-3.0
F4	black	94.5	1.4	20.4	21.4	1.3	2.3	-2.0	-1.7
A5	paper white	97.7	0.9	93.0	93.5	0.3	-0.2	-5.0	-4.5
B5	skin highlight L*=89	93.7	1.9	81.1	82.3	12.7	11.6	8.4	9.3
C5	skin highlight L*=75	96.5	1.9	68.6	69.9	20.0	18.9	14.9	15.7
D5	skin shadow L*=25	98.2	1.2	25.8	26.7	11.1	11.8	12.9	13.3
E5	skin shadow L*=11	86.5	2.7	14.6	15.8	10.8	12.5	9.5	11.2
F5	Max Black	93.8	1.2	7.3	6.9	2.3	1.2	0.6	0.6

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	97.0	96.1	1.4
Average Score for the Worst 10% (3 lowest scoring patches)	90.1	91.3	3.5

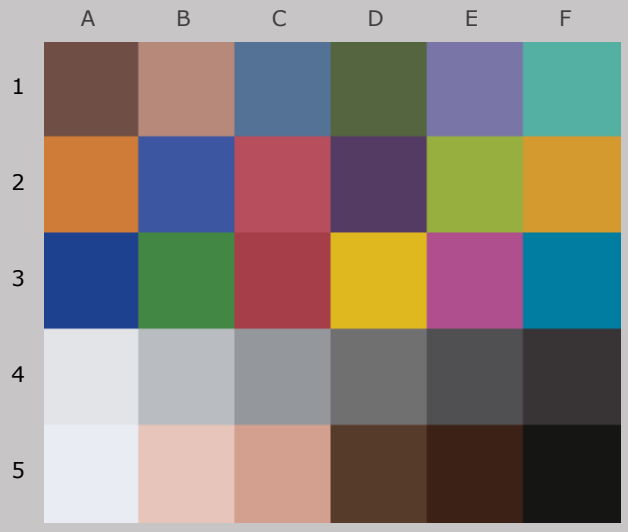


Aardenburg Imaging & Archives

91.7 color / 94.7 tone



Original Print Colors
(measured before light exposure)



Colors after 30 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100, Ilford Galerie Classic Gloss Paper

30 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

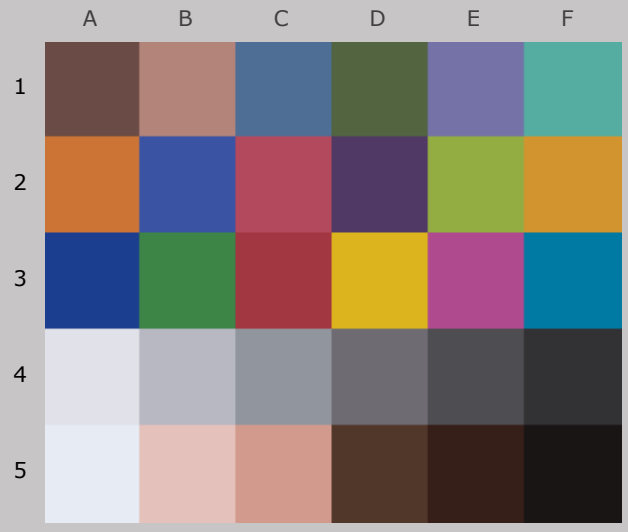
				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	90.9	2.2	35.4	36.5	13.3	13.3	8.7	10.7
B1	light Skin	90.5	3.0	59.7	61.4	17.1	15.6	12.5	14.6
C1	blue sky	94.6	2.3	45.5	46.8	-3.4	-4.3	-24.9	-23.3
D1	foliage	94.7	1.9	39.9	41.0	-11.8	-11.6	17.8	19.4
E1	blue flower	92.8	3.1	49.6	51.2	10.4	8.8	-27.7	-25.6
F1	bluish green	97.0	1.7	65.0	66.0	-30.2	-30.6	-3.2	-1.9
A2	orange	95.8	3.7	58.2	60.3	32.4	29.4	49.5	49.8
B2	purplish blue	96.8	2.3	36.4	37.5	11.2	10.0	-46.8	-45.1
C2	moderate red	96.3	2.7	46.2	47.7	44.7	43.9	11.8	13.9
D2	purple	97.7	1.5	28.1	29.1	17.8	17.8	-21.6	-20.5
E2	yellow green	98.9	1.4	66.9	67.8	-21.1	-20.9	50.5	51.5
F2	orange yellow	97.8	2.3	66.5	67.8	17.0	16.2	59.2	60.9
A3	blue	98.6	1.4	28.0	28.7	12.1	11.4	-49.0	-48.0
B3	green	97.3	1.8	49.9	50.6	-34.8	-34.4	27.2	28.8
C3	red	96.0	3.2	39.8	41.7	46.3	44.4	18.8	17.1
D3	yellow	98.8	1.7	75.5	76.5	5.3	4.8	71.9	73.1
E3	magenta	95.8	3.1	46.6	48.3	47.0	45.7	-17.1	-14.8
F3	cyan	97.5	1.7	47.1	48.1	-19.1	-19.6	-29.7	-28.4
A4	white	83.9	2.1	89.8	90.5	0.7	-0.4	-4.2	-2.5
B4	neutral 8	80.7	2.7	74.9	76.3	0.6	-1.0	-4.6	-2.9
C4	neutral 6.5	81.6	2.7	61.4	62.8	0.5	-0.8	-5.2	-3.4
D4	neutral 5	87.6	2.1	45.7	46.9	1.9	1.4	-2.9	-1.3
E4	neutral 3.5	94.4	1.4	33.0	33.9	0.5	0.7	-2.0	-1.0
F4	black	80.1	2.8	20.4	21.8	1.3	2.3	-2.0	0.2
A5	paper white	89.0	1.6	93.0	93.3	0.3	-0.4	-5.0	-3.6
B5	skin highlight L*=89	86.4	3.0	81.1	82.5	12.7	10.8	8.4	10.1
C5	skin highlight L*=75	90.5	3.4	68.6	70.3	20.0	17.9	14.9	16.9
D5	skin shadow L*=25	89.2	2.8	25.8	27.3	11.1	11.7	12.9	15.2
E5	skin shadow L*=11	75.0	4.4	14.6	16.3	10.8	13.0	9.5	12.9
F5	Max Black	84.1	2.0	7.3	7.0	2.3	0.4	0.6	1.1

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	91.7	94.7	2.4
Average Score for the Worst 10% (3 lowest scoring patches)	78.6	90.2	3.8

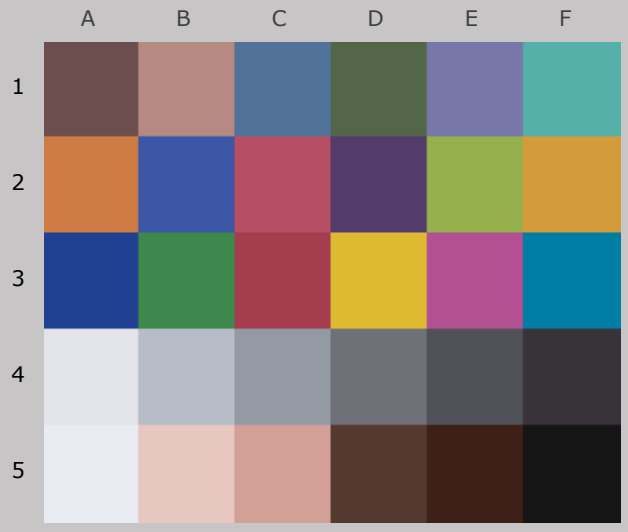


Aardenburg Imaging & Archives

91.8color/94.7tone



Original Print Colors
(measured before light exposure)



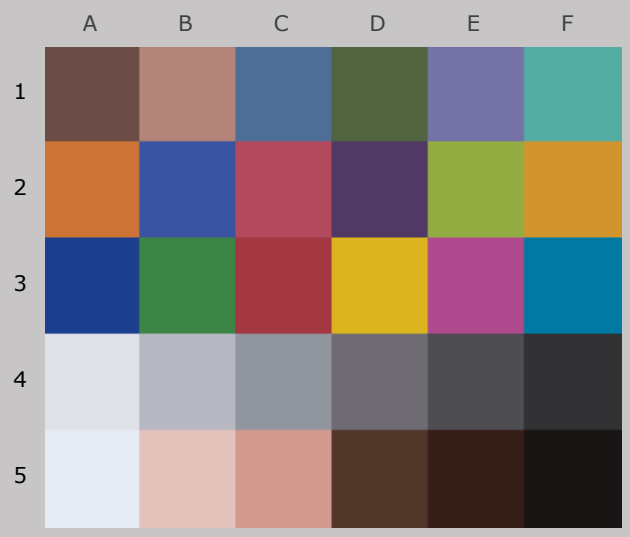
Colors after 40 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100, Ilford Galerie Classic Gloss Paper

40 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

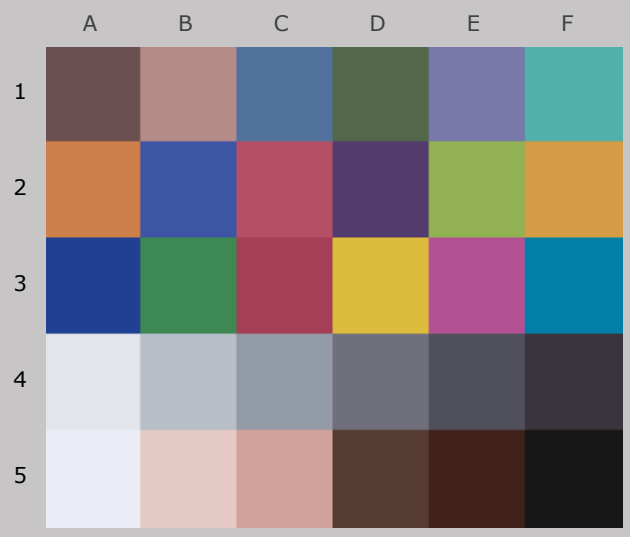
				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	88.0	2.7	35.4	36.6	13.3	13.4	8.7	6.3
B1	light Skin	91.3	3.0	59.7	61.6	17.1	15.6	12.5	10.8
C1	blue sky	99.5	1.6	45.5	47.0	-3.4	-3.7	-24.9	-25.5
D1	foliage	90.1	2.9	39.9	41.1	-11.8	-11.6	17.8	15.2
E1	blue flower	96.9	2.2	49.6	51.4	10.4	9.1	-27.7	-27.3
F1	bluish green	96.8	1.9	65.0	66.2	-30.2	-30.1	-3.2	-4.7
A2	orange	90.2	6.7	58.2	60.5	32.4	28.7	49.5	44.4
B2	purplish blue	99.1	1.6	36.4	37.6	11.2	10.4	-46.8	-46.3
C2	moderate red	96.7	2.6	46.2	47.7	44.7	43.9	11.8	10.0
D2	purple	94.2	2.3	28.1	29.1	17.8	18.6	-21.6	-23.5
E2	yellow green	94.5	3.7	66.9	68.1	-21.1	-21.5	50.5	47.0
F2	orange yellow	94.6	4.1	66.5	68.1	17.0	15.4	59.2	55.8
A3	blue	100.0	1.0	28.0	28.8	12.1	12.2	-49.0	-49.4
B3	green	95.5	2.7	49.9	50.9	-34.8	-34.6	27.2	24.7
C3	red	87.9	6.8	39.8	41.7	46.3	44.3	18.8	12.5
D3	yellow	95.4	4.0	75.5	76.9	5.3	3.9	71.9	68.4
E3	magenta	98.6	2.2	46.6	48.5	47.0	45.8	-17.1	-17.0
F3	cyan	99.5	1.3	47.1	48.3	-19.1	-18.9	-29.7	-30.3
A4	white	89.0	1.8	89.8	90.7	0.7	-0.4	-4.2	-3.1
B4	neutral 8	88.6	2.4	74.9	76.6	0.6	-1.0	-4.6	-4.7
C4	neutral 6.5	91.4	2.2	61.4	63.1	0.5	-0.6	-5.2	-6.0
D4	neutral 5	85.5	2.3	45.7	47.1	1.9	1.8	-2.9	-4.7
E4	neutral 3.5	73.7	3.2	33.0	34.0	0.5	1.2	-2.0	-4.9
F4	black	89.4	2.3	20.4	22.2	1.3	2.7	-2.0	-2.6
A5	paper white	91.4	1.4	93.0	93.5	0.3	-0.4	-5.0	-3.9
B5	skin highlight L*=89	89.4	2.8	81.1	82.9	12.7	10.7	8.4	8.0
C5	skin highlight L*=75	91.2	3.4	68.6	70.7	20.0	17.8	14.9	13.3
D5	skin shadow L*=25	96.6	1.8	25.8	27.2	11.1	11.8	12.9	12.1
E5	skin shadow L*=11	76.9	4.3	14.6	16.5	10.8	13.7	9.5	11.9
F5	Max Black	83.1	2.1	7.3	7.1	2.3	0.2	0.6	0.4

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	91.8	94.7	2.8
Average Score for the Worst 10% (3 lowest scoring patches)	77.9	90.2	5.9



Original Print Colors
(measured before light exposure)

85.4color/94.2tone



Colors after 50 Megalux-hours
light exposure

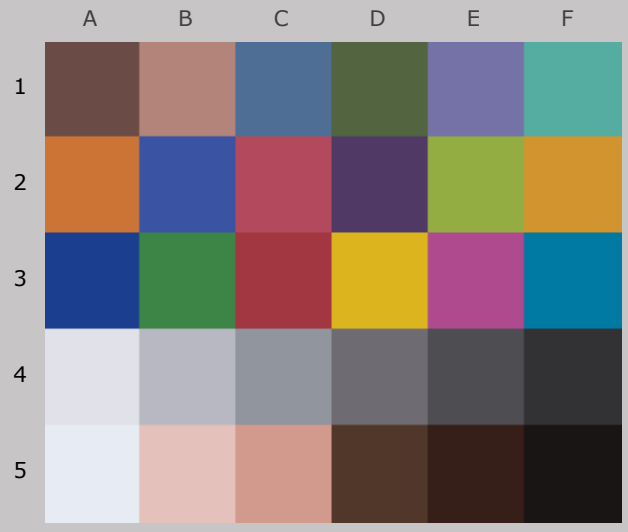
Canon Pro9000, Canon OEM Chromalife 100, Ilford Galerie Classic Gloss Paper

50 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

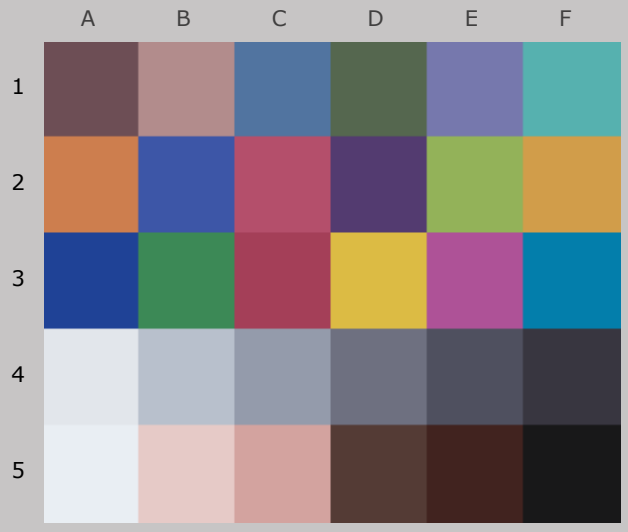
				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	74.9	4.7	35.4	36.9	13.3	13.4	8.7	4.2
B1	light Skin	81.8	4.9	59.7	61.9	17.1	15.5	12.5	8.5
C1	blue sky	94.8	2.5	45.5	47.3	-3.4	-3.3	-24.9	-26.7
D1	foliage	80.2	4.9	39.9	41.3	-11.8	-11.6	17.8	13.1
E1	blue flower	97.1	2.5	49.6	51.7	10.4	9.1	-27.7	-28.2
F1	bluish green	90.3	3.8	65.0	66.5	-30.2	-29.5	-3.2	-6.6
A2	orange	85.8	9.3	58.2	60.8	32.4	28.2	49.5	41.6
B2	purplish blue	99.7	1.6	36.4	37.8	11.2	10.5	-46.8	-46.8
C2	moderate red	92.0	4.5	46.2	47.9	44.7	43.8	11.8	7.7
D2	purple	87.8	4.1	28.1	29.4	17.8	19.1	-21.6	-25.2
E2	yellow green	89.0	6.7	66.9	68.4	-21.1	-21.6	50.5	44.0
F2	orange yellow	89.5	7.3	66.5	68.5	17.0	14.9	59.2	52.6
A3	blue	98.6	1.6	28.0	29.0	12.1	12.5	-49.0	-50.1
B3	green	89.7	5.2	49.9	51.2	-34.8	-34.4	27.2	22.2
C3	red	83.1	9.2	39.8	41.9	46.3	44.2	18.8	10.1
D3	yellow	91.0	7.2	75.5	77.3	5.3	3.5	71.9	65.2
E3	magenta	97.4	2.7	46.6	48.6	47.0	45.6	-17.1	-18.2
F3	cyan	95.9	2.4	47.1	48.6	-19.1	-18.3	-29.7	-31.5
A4	white	89.3	1.9	89.8	91.0	0.7	-0.5	-4.2	-3.2
B4	neutral 8	84.1	3.0	74.9	77.0	0.6	-1.0	-4.6	-5.8
C4	neutral 6.5	77.2	3.4	61.4	63.5	0.5	-0.5	-5.2	-7.7
D4	neutral 5	63.4	4.3	45.7	47.5	1.9	2.0	-2.9	-6.8
E4	neutral 3.5	50.6	5.4	33.0	34.4	0.5	1.6	-2.0	-7.1
F4	black	76.0	3.6	20.4	22.7	1.3	3.1	-2.0	-4.1
A5	paper white	89.9	1.6	93.0	93.7	0.3	-0.5	-5.0	-3.7
B5	skin highlight L*=89	83.6	3.8	81.1	83.4	12.7	10.5	8.4	6.4
C5	skin highlight L*=75	83.5	5.3	68.6	71.1	20.0	17.7	14.9	10.9
D5	skin shadow L*=25	84.9	3.5	25.8	27.4	11.1	11.8	12.9	9.9
E5	skin shadow L*=11	80.6	4.2	14.6	17.3	10.8	13.8	9.5	10.7
F5	Max Black	81.6	2.3	7.3	8.0	2.3	0.3	0.6	-0.5

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	85.4	94.2	4.2
Average Score for the Worst 10% (3 lowest scoring patches)	63.0	88.9	8.6

78.1 color / 93.9 tone



Original Print Colors
(measured before light exposure)



Colors after 60 Megalux-hours
light exposure

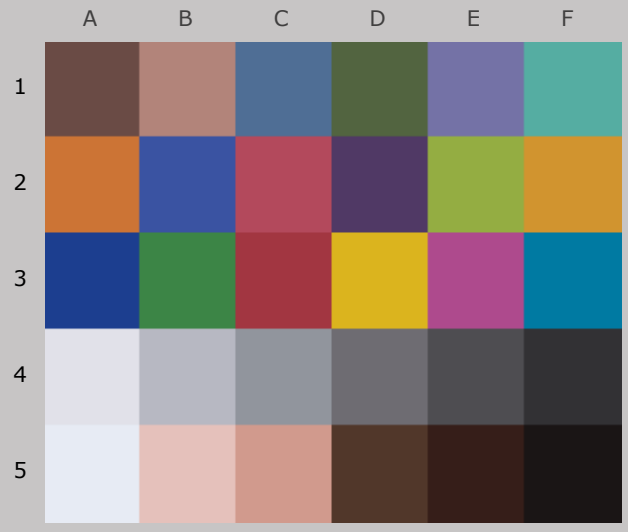
Canon Pro9000, Canon OEM Chromalife 100, Ilford Galerie Classic Gloss Paper

60 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

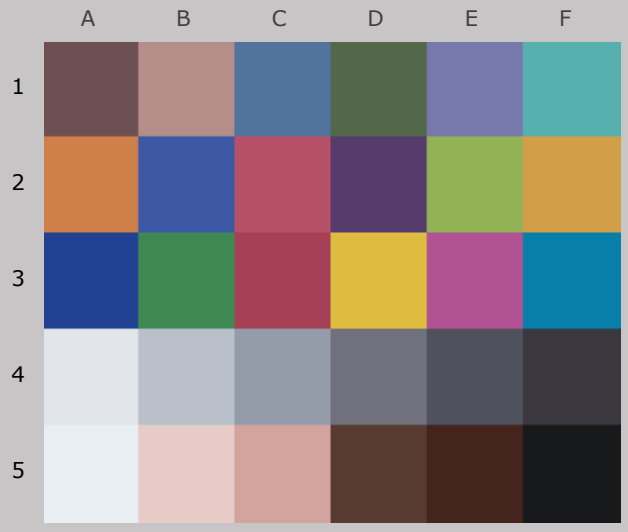
				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	59.3	7.2	35.4	37.0	13.3	13.5	8.7	1.7
B1	light Skin	71.2	7.0	59.7	62.1	17.1	15.5	12.5	6.1
C1	blue sky	89.6	3.6	45.5	47.4	-3.4	-2.9	-24.9	-28.0
D1	foliage	69.9	7.1	39.9	41.5	-11.8	-11.4	17.8	10.9
E1	blue flower	95.5	2.8	49.6	51.8	10.4	9.2	-27.7	-29.1
F1	bluish green	83.9	5.6	65.0	66.5	-30.2	-28.9	-3.2	-8.4
A2	orange	81.4	11.8	58.2	60.8	32.4	27.8	49.5	38.9
B2	purplish blue	99.5	1.8	36.4	38.0	11.2	10.6	-46.8	-47.2
C2	moderate red	87.1	6.7	46.2	47.8	44.7	43.6	11.8	5.5
D2	purple	81.9	5.7	28.1	29.5	17.8	19.5	-21.6	-26.9
E2	yellow green	83.7	9.5	66.9	68.6	-21.1	-21.6	50.5	41.1
F2	orange yellow	84.7	10.2	66.5	68.6	17.0	14.5	59.2	49.6
A3	blue	97.5	2.2	28.0	29.2	12.1	12.7	-49.0	-50.6
B3	green	84.0	7.7	49.9	51.3	-34.8	-34.1	27.2	19.7
C3	red	78.1	11.6	39.8	41.8	46.3	44.0	18.8	7.6
D3	yellow	87.0	10.1	75.5	77.4	5.3	3.1	71.9	62.2
E3	magenta	95.1	3.6	46.6	48.7	47.0	45.3	-17.1	-19.6
F3	cyan	92.4	3.5	47.1	48.7	-19.1	-17.8	-29.7	-32.6
A4	white	89.5	1.9	89.8	91.0	0.7	-0.5	-4.2	-3.3
B4	neutral 8	75.7	3.7	74.9	77.2	0.6	-1.0	-4.6	-6.9
C4	neutral 6.5	61.0	4.8	61.4	63.7	0.5	-0.3	-5.2	-9.4
D4	neutral 5	40.0	6.5	45.7	47.6	1.9	2.4	-2.9	-9.1
E4	neutral 3.5	25.9	7.7	33.0	34.5	0.5	2.0	-2.0	-9.4
F4	black	59.6	5.1	20.4	23.1	1.3	3.5	-2.0	-5.7
A5	paper white	87.2	1.8	93.0	93.7	0.3	-0.5	-5.0	-3.5
B5	skin highlight L*=89	76.5	4.8	81.1	83.6	12.7	10.3	8.4	5.1
C5	skin highlight L*=75	75.3	7.2	68.6	71.3	20.0	17.5	14.9	8.7
D5	skin shadow L*=25	73.8	5.3	25.8	27.6	11.1	11.8	12.9	8.0
E5	skin shadow L*=11	79.0	4.7	14.6	17.8	10.8	14.2	9.5	10.1
F5	Max Black	76.6	2.8	7.3	8.1	2.3	0.2	0.6	-1.1

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	78.1	93.9	5.8
Average Score for the Worst 10% (3 lowest scoring patches)	41.7	87.8	11.2

83.8color/92.9tone



Original Print Colors
(measured before light exposure)



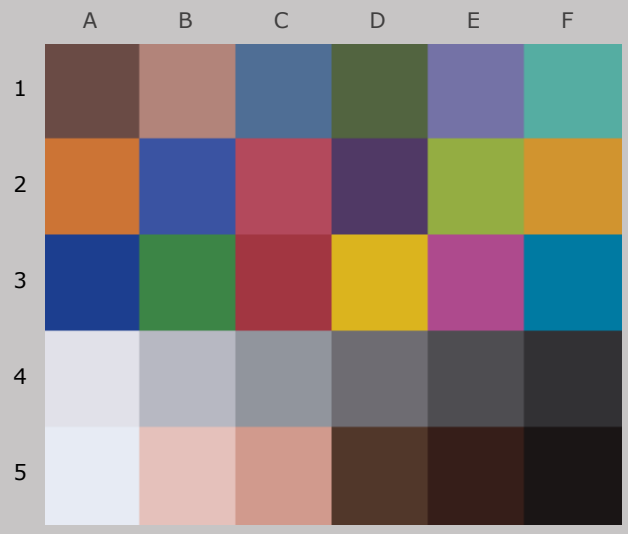
Colors after 70 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100, Ilford Galerie Classic Gloss Paper

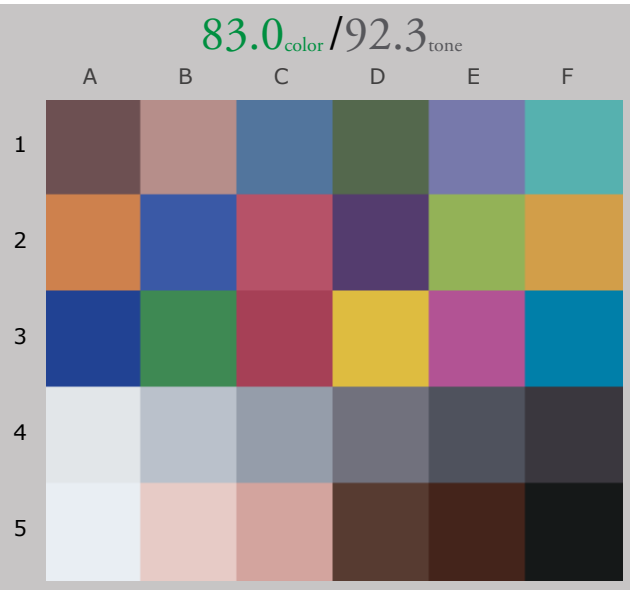
70 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	76.1	4.7	35.4	37.2	13.3	13.1	8.7	4.4
B1	light Skin	78.7	5.7	59.7	62.3	17.1	15.0	12.5	8.0
C1	blue sky	95.9	2.6	45.5	47.5	-3.4	-3.6	-24.9	-26.5
D1	foliage	81.9	4.7	39.9	41.6	-11.8	-11.8	17.8	13.4
E1	blue flower	95.4	3.1	49.6	52.1	10.4	8.5	-27.7	-27.6
F1	bluish green	88.1	4.4	65.0	66.6	-30.2	-29.3	-3.2	-7.2
A2	orange	85.3	9.6	58.2	61.1	32.4	27.5	49.5	41.7
B2	purplish blue	97.4	2.6	36.4	38.3	11.2	9.7	-46.8	-45.9
C2	moderate red	92.7	4.4	46.2	48.3	44.7	43.1	11.8	8.3
D2	purple	91.1	3.4	28.1	29.8	17.8	18.5	-21.6	-24.5
E2	yellow green	87.5	7.6	66.9	68.7	-21.1	-21.7	50.5	43.2
F2	orange yellow	88.3	8.1	66.5	68.8	17.0	14.3	59.2	52.0
A3	blue	100.0	1.5	28.0	29.4	12.1	11.9	-49.0	-49.1
B3	green	90.0	5.1	49.9	51.4	-34.8	-34.4	27.2	22.3
C3	red	83.5	9.1	39.8	42.2	46.3	43.6	18.8	10.5
D3	yellow	89.7	8.2	75.5	77.5	5.3	3.0	71.9	64.3
E3	magenta	96.4	3.4	46.6	49.1	47.0	44.7	-17.1	-17.5
F3	cyan	97.1	2.3	47.1	48.9	-19.1	-18.5	-29.7	-31.1
A4	white	84.0	2.3	89.8	91.0	0.7	-0.7	-4.2	-2.8
B4	neutral 8	80.2	3.5	74.9	77.4	0.6	-1.3	-4.6	-6.0
C4	neutral 6.5	72.6	4.0	61.4	63.9	0.5	-0.7	-5.2	-8.1
D4	neutral 5	62.8	4.6	45.7	47.8	1.9	1.8	-2.9	-6.9
E4	neutral 3.5	49.9	5.5	33.0	34.7	0.5	1.5	-2.0	-7.2
F4	black	77.6	4.1	20.4	23.5	1.3	3.1	-2.0	-3.8
A5	paper white	82.8	2.2	93.0	93.6	0.3	-0.6	-5.0	-3.1
B5	skin highlight L*=89	79.1	4.6	81.1	83.8	12.7	10.0	8.4	5.9
C5	skin highlight L*=75	79.7	6.3	68.6	71.6	20.0	17.2	14.9	10.1
D5	skin shadow L*=25	85.5	3.7	25.8	28.0	11.1	11.8	12.9	10.0
E5	skin shadow L*=11	72.7	5.8	14.6	18.4	10.8	14.6	9.5	11.6
F5	Max Black	73.0	3.3	7.3	8.5	2.3	-0.4	0.6	-0.8

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	83.8	92.9	4.7
Average Score for the Worst 10% (3 lowest scoring patches)	61.8	86.1	9.0



Original Print Colors
(measured before light exposure)



Colors after 80 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100, Ilford Galerie Classic Gloss Paper

80 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	75.1	4.9	35.4	37.3	13.3	13.1	8.7	4.3
B1	light Skin	77.6	6.0	59.7	62.6	17.1	14.9	12.5	7.8
C1	blue sky	96.4	2.7	45.5	47.8	-3.4	-3.9	-24.9	-26.3
D1	foliage	80.6	5.0	39.9	41.8	-11.8	-11.8	17.8	13.1
E1	blue flower	94.4	3.4	49.6	52.3	10.4	8.3	-27.7	-27.5
F1	bluish green	87.0	4.8	65.0	66.8	-30.2	-29.2	-3.2	-7.5
A2	orange	84.2	10.3	58.2	61.4	32.4	27.4	49.5	41.0
B2	purplish blue	96.6	3.0	36.4	38.4	11.2	9.4	-46.8	-45.6
C2	moderate red	91.7	5.0	46.2	48.5	44.7	43.1	11.8	7.8
D2	purple	89.5	3.9	28.1	29.9	17.8	18.7	-21.6	-24.9
E2	yellow green	86.1	8.3	66.9	68.8	-21.1	-21.6	50.5	42.4
F2	orange yellow	87.1	8.8	66.5	69.1	17.0	14.1	59.2	51.3
A3	blue	100.0	1.6	28.0	29.5	12.1	11.7	-49.0	-49.1
B3	green	89.0	5.6	49.9	51.5	-34.8	-34.3	27.2	21.9
C3	red	82.7	9.5	39.8	42.4	46.3	43.6	18.8	10.0
D3	yellow	88.6	9.0	75.5	77.7	5.3	2.8	71.9	63.5
E3	magenta	96.0	3.7	46.6	49.3	47.0	44.5	-17.1	-17.2
F3	cyan	97.9	2.3	47.1	49.0	-19.1	-18.8	-29.7	-30.9
A4	white	81.3	2.6	89.8	91.0	0.7	-0.8	-4.2	-2.5
B4	neutral 8	78.8	3.7	74.9	77.6	0.6	-1.5	-4.6	-6.0
C4	neutral 6.5	72.5	4.1	61.4	64.2	0.5	-0.9	-5.2	-8.0
D4	neutral 5	65.3	4.4	45.7	48.0	1.9	1.6	-2.9	-6.7
E4	neutral 3.5	51.5	5.4	33.0	34.8	0.5	1.4	-2.0	-7.0
F4	black	79.3	4.1	20.4	23.7	1.3	3.2	-2.0	-3.6
A5	paper white	78.6	2.6	93.0	93.5	0.3	-0.7	-5.0	-2.7
B5	skin highlight L*=89	78.0	4.8	81.1	84.0	12.7	9.8	8.4	5.9
C5	skin highlight L*=75	79.6	6.5	68.6	71.8	20.0	17.0	14.9	10.2
D5	skin shadow L*=25	88.9	3.3	25.8	28.0	11.1	11.9	12.9	10.7
E5	skin shadow L*=11	66.1	6.6	14.6	18.5	10.8	15.2	9.5	12.6
F5	Max Black	70.0	3.4	7.3	8.0	2.3	-0.8	0.6	-0.7

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	83.0	92.3	5.0
Average Score for the Worst 10% (3 lowest scoring patches)	61.0	84.9	9.6



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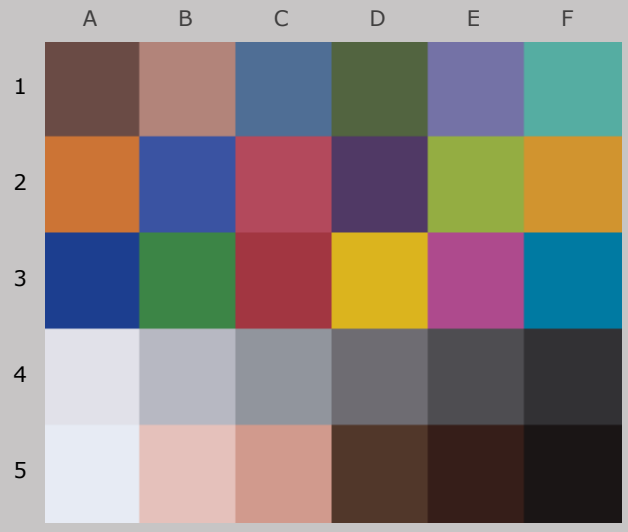
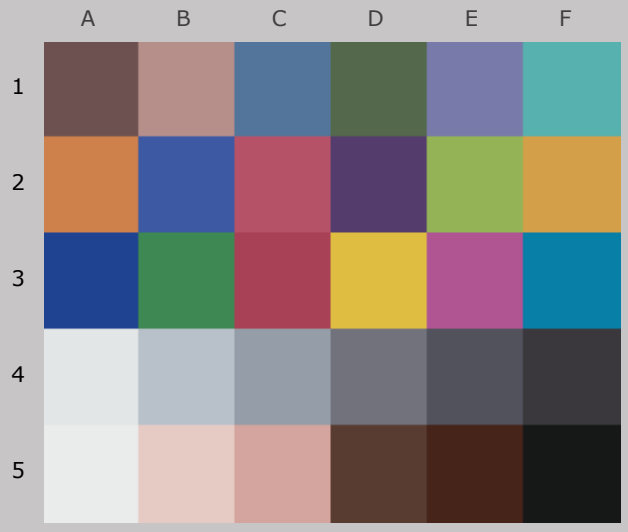
83.0$_{color}$/91.4$_{tone}$



Original Print Colors
(measured before light exposure)



Colors after 90 Megalux-hours
light exposure

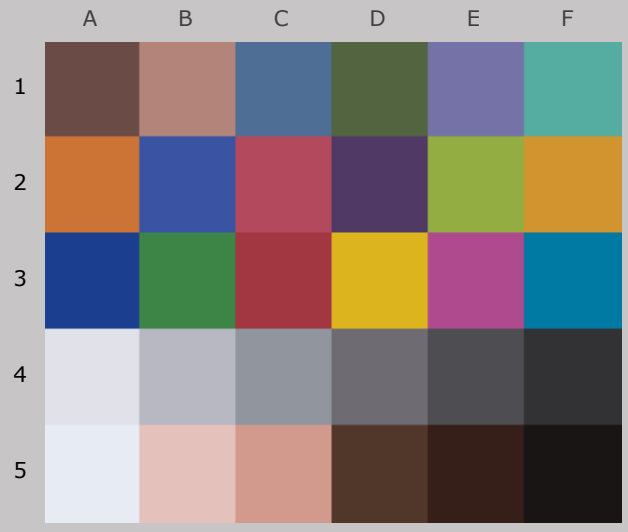
Canon Pro9000, Canon OEM Chromalife 100, Ilford Galerie Classic Gloss Paper

90 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

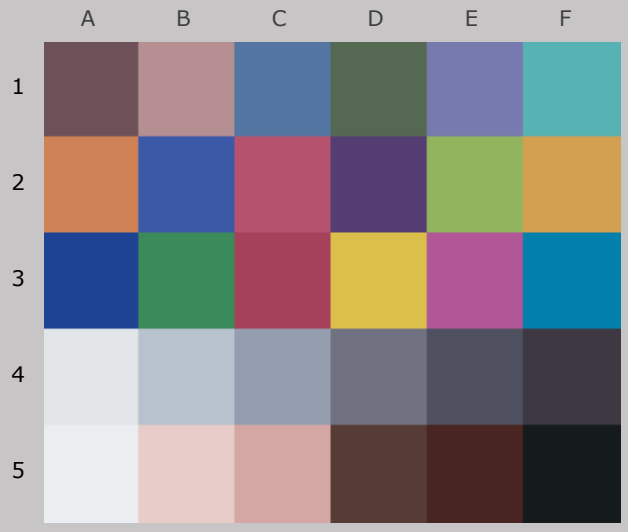
				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	78.9	4.4	35.4	37.4	13.3	13.1	8.7	4.9
B1	light Skin	79.5	5.8	59.7	62.8	17.1	14.8	12.5	8.3
C1	blue sky	98.2	2.6	45.5	47.9	-3.4	-4.2	-24.9	-25.4
D1	foliage	83.6	4.4	39.9	41.9	-11.8	-11.8	17.8	13.8
E1	blue flower	91.6	4.1	49.6	52.5	10.4	7.8	-27.7	-26.3
F1	bluish green	88.2	4.5	65.0	66.9	-30.2	-29.2	-3.2	-7.2
A2	orange	85.0	10.0	58.2	61.6	32.4	27.3	49.5	41.6
B2	purplish blue	94.0	4.0	36.4	38.5	11.2	8.6	-46.8	-44.5
C2	moderate red	93.4	4.4	46.2	48.7	44.7	42.9	11.8	8.7
D2	purple	92.5	3.1	28.1	29.9	17.8	18.4	-21.6	-24.1
E2	yellow green	86.5	8.2	66.9	68.9	-21.1	-21.6	50.5	42.6
F2	orange yellow	87.8	8.5	66.5	69.3	17.0	14.0	59.2	51.8
A3	blue	98.4	2.0	28.0	29.5	12.1	11.0	-49.0	-48.2
B3	green	90.3	5.1	49.9	51.5	-34.8	-34.3	27.2	22.4
C3	red	84.5	8.7	39.8	42.6	46.3	43.6	18.8	11.0
D3	yellow	89.2	8.6	75.5	77.9	5.3	2.8	71.9	64.0
E3	magenta	94.7	4.3	46.6	49.6	47.0	44.0	-17.1	-16.0
F3	cyan	100.0	1.9	47.1	49.0	-19.1	-19.2	-29.7	-30.0
A4	white	62.2	4.2	89.8	90.9	0.7	-1.2	-4.2	-0.6
B4	neutral 8	80.0	3.7	74.9	77.7	0.6	-1.8	-4.6	-4.9
C4	neutral 6.5	77.5	3.9	61.4	64.3	0.5	-1.1	-5.2	-7.3
D4	neutral 5	73.3	3.9	45.7	48.1	1.9	1.3	-2.9	-5.9
E4	neutral 3.5	61.9	4.5	33.0	34.8	0.5	1.2	-2.0	-6.1
F4	black	85.3	3.9	20.4	23.8	1.3	3.1	-2.0	-2.5
A5	paper white	55.7	4.7	93.0	93.3	0.3	-1.1	-5.0	-0.5
B5	skin highlight L*=89	79.5	4.7	81.1	84.0	12.7	9.5	8.4	6.8
C5	skin highlight L*=75	81.0	6.3	68.6	72.0	20.0	16.7	14.9	10.8
D5	skin shadow L*=25	95.2	2.6	25.8	28.1	11.1	12.0	12.9	11.9
E5	skin shadow L*=11	55.2	8.1	14.6	18.8	10.8	15.9	9.5	14.2
F5	Max Black	65.7	3.8	7.3	7.9	2.3	-1.3	0.6	-0.3

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	83.0	91.4	5.0
Average Score for the Worst 10% (3 lowest scoring patches)	57.6	83.4	9.1

74.9 color / 91.1 tone



Original Print Colors
(measured before light exposure)



Colors after 100 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100, Ilford Galerie Classic Gloss Paper

100 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	54.3	8.1	35.4	37.7	13.3	13.4	8.7	0.9
B1	light Skin	63.7	8.9	59.7	63.1	17.1	15.0	12.5	4.6
C1	blue sky	90.7	3.9	45.5	48.2	-3.4	-3.4	-24.9	-27.8
D1	foliage	65.2	8.2	39.9	42.1	-11.8	-11.5	17.8	9.9
E1	blue flower	94.2	3.8	49.6	52.7	10.4	8.3	-27.7	-28.3
F1	bluish green	78.1	7.5	65.0	67.2	-30.2	-28.3	-3.2	-10.1
A2	orange	78.4	13.8	58.2	61.8	32.4	27.0	49.5	37.3
B2	purplish blue	96.4	3.2	36.4	38.7	11.2	9.2	-46.8	-45.8
C2	moderate red	86.2	7.3	46.2	48.8	44.7	42.9	11.8	5.2
D2	purple	82.1	5.8	28.1	30.1	17.8	19.3	-21.6	-26.9
E2	yellow green	79.1	12.2	66.9	69.3	-21.1	-21.6	50.5	38.6
F2	orange yellow	81.3	12.4	66.5	69.6	17.0	13.6	59.2	47.7
A3	blue	99.7	1.9	28.0	29.7	12.1	11.7	-49.0	-49.5
B3	green	82.4	8.5	49.9	51.8	-34.8	-34.0	27.2	19.0
C3	red	77.9	11.9	39.8	42.6	46.3	43.6	18.8	7.6
D3	yellow	83.7	12.6	75.5	78.2	5.3	2.3	71.9	60.0
E3	magenta	95.0	4.3	46.6	49.7	47.0	44.2	-17.1	-18.0
F3	cyan	94.8	3.2	47.1	49.3	-19.1	-18.3	-29.7	-31.9
A4	white	77.0	3.0	89.8	91.2	0.7	-1.0	-4.2	-2.1
B4	neutral 8	71.2	4.5	74.9	78.0	0.6	-1.5	-4.6	-7.0
C4	neutral 6.5	55.9	5.7	61.4	64.6	0.5	-0.8	-5.2	-9.8
D4	neutral 5	45.2	6.3	45.7	48.4	1.9	1.8	-2.9	-8.6
E4	neutral 3.5	31.3	7.3	33.0	35.1	0.5	1.6	-2.0	-8.9
F4	black	67.2	5.3	20.4	24.2	1.3	3.5	-2.0	-4.8
A5	paper white	70.3	3.4	93.0	93.6	0.3	-0.9	-5.0	-1.9
B5	skin highlight L*=89	70.1	6.1	81.1	84.4	12.7	9.6	8.4	4.5
C5	skin highlight L*=75	71.1	8.6	68.6	72.4	20.0	16.7	14.9	7.9
D5	skin shadow L*=25	80.9	4.6	25.8	28.4	11.1	12.0	12.9	9.3
E5	skin shadow L*=11	63.6	7.5	14.6	19.6	10.8	15.7	9.5	12.4
F5	Max Black	59.6	4.5	7.3	8.6	2.3	-1.5	0.6	-1.4

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	74.9	91.1	6.8
Average Score for the Worst 10% (3 lowest scoring patches)	43.6	81.8	12.9



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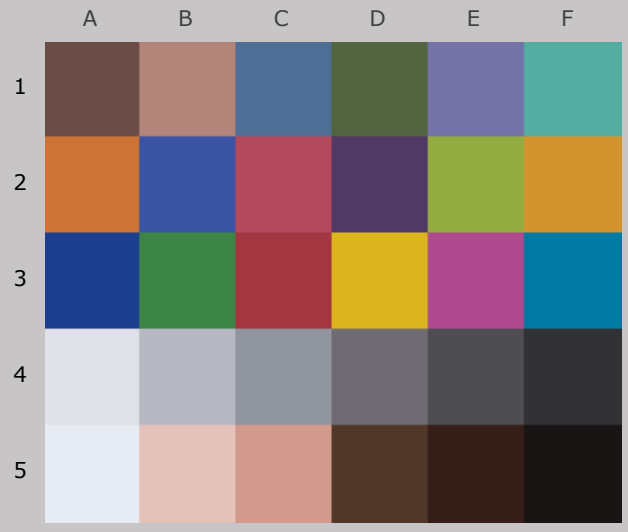
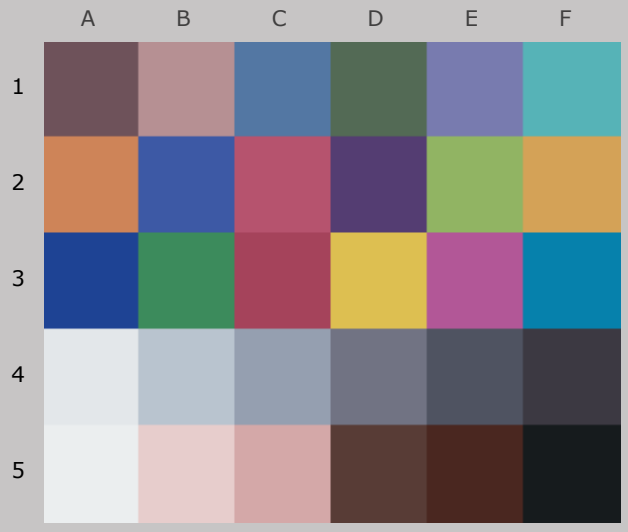
72.0color/90.2tone



Original Print Colors
(measured before light exposure)



Colors after 120 Megalux-hours
light exposure

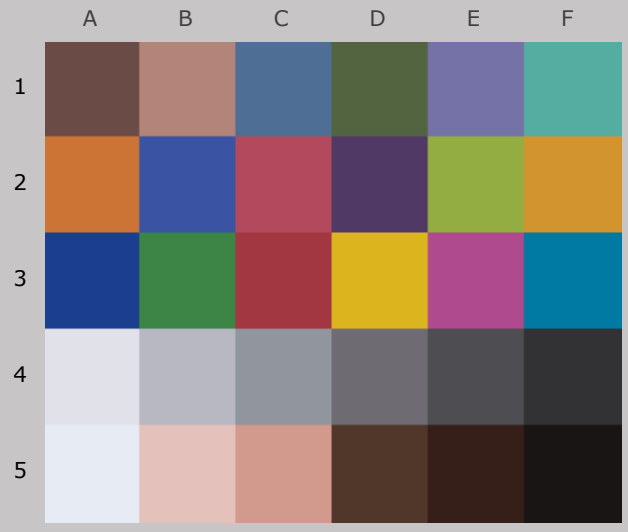
Canon Pro9000, Canon OEM Chromalife 100, Ilford Galerie Classic Gloss Paper

120 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	49.9	8.9	35.4	38.0	13.3	13.2	8.7	0.2
B1	light Skin	58.5	10.0	59.7	63.5	17.1	14.7	12.5	3.5
C1	blue sky	89.5	4.3	45.5	48.5	-3.4	-3.5	-24.9	-28.1
D1	foliage	61.4	9.1	39.9	42.4	-11.8	-11.6	17.8	9.1
E1	blue flower	93.1	4.2	49.6	53.0	10.4	7.9	-27.7	-28.3
F1	bluish green	73.6	8.9	65.0	67.4	-30.2	-27.9	-3.2	-11.4
A2	orange	76.2	15.1	58.2	62.2	32.4	26.5	49.5	36.2
B2	purplish blue	95.2	3.9	36.4	39.0	11.2	8.7	-46.8	-45.5
C2	moderate red	85.4	7.8	46.2	49.0	44.7	42.5	11.8	4.9
D2	purple	82.1	5.9	28.1	30.3	17.8	19.0	-21.6	-27.0
E2	yellow green	75.6	14.1	66.9	69.6	-21.1	-21.9	50.5	36.7
F2	orange yellow	78.6	14.1	66.5	70.0	17.0	13.0	59.2	46.1
A3	blue	99.3	2.2	28.0	30.0	12.1	11.2	-49.0	-49.3
B3	green	80.3	9.4	49.9	52.1	-34.8	-34.1	27.2	18.0
C3	red	77.0	12.4	39.8	42.9	46.3	43.2	18.8	7.2
D3	yellow	81.1	14.5	75.5	78.6	5.3	1.7	71.9	58.2
E3	magenta	94.0	4.9	46.6	50.0	47.0	43.6	-17.1	-17.9
F3	cyan	94.7	3.4	47.1	49.6	-19.1	-18.4	-29.7	-32.0
A4	white	73.9	3.3	89.8	91.3	0.7	-1.2	-4.2	-1.9
B4	neutral 8	66.4	5.1	74.9	78.3	0.6	-1.7	-4.6	-7.5
C4	neutral 6.5	48.2	6.5	61.4	65.0	0.5	-0.9	-5.2	-10.5
D4	neutral 5	41.2	6.8	45.7	48.7	1.9	1.5	-2.9	-8.9
E4	neutral 3.5	28.4	7.7	33.0	35.4	0.5	1.3	-2.0	-9.2
F4	black	66.8	5.7	20.4	24.7	1.3	3.3	-2.0	-5.0
A5	paper white	63.1	4.0	93.0	93.6	0.3	-1.1	-5.0	-1.2
B5	skin highlight L*=89	65.9	6.8	81.1	84.8	12.7	9.3	8.4	3.9
C5	skin highlight L*=75	66.9	9.7	68.6	72.8	20.0	16.4	14.9	6.9
D5	skin shadow L*=25	77.7	5.1	25.8	28.6	11.1	11.6	12.9	8.7
E5	skin shadow L*=11	63.5	8.1	14.6	20.3	10.8	15.9	9.5	12.0
F5	Max Black	51.2	5.5	7.3	9.3	2.3	-2.1	0.6	-2.1

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	72.0	90.2	7.6
Average Score for the Worst 10% (3 lowest scoring patches)	39.3	79.5	14.6

65.9color/89.0tone



Original Print Colors
(measured before light exposure)



Colors after 140 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100, Ilford Galerie Classic Gloss Paper

140 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	43.8	9.9	35.4	38.3	13.3	13.2	8.7	-0.8
B1	light Skin	52.3	11.5	59.7	64.0	17.1	14.6	12.5	2.2
C1	blue sky	87.4	5.0	45.5	48.9	-3.4	-3.5	-24.9	-28.6
D1	foliage	55.1	10.4	39.9	42.7	-11.8	-11.6	17.8	7.7
E1	blue flower	92.2	4.8	49.6	53.5	10.4	7.7	-27.7	-28.6
F1	bluish green	68.0	10.6	65.0	67.8	-30.2	-27.4	-3.2	-13.0
A2	orange	72.7	17.2	58.2	62.6	32.4	26.1	49.5	34.1
B2	purplish blue	94.7	4.3	36.4	39.4	11.2	8.4	-46.8	-45.4
C2	moderate red	82.9	9.0	46.2	49.5	44.7	42.6	11.8	3.7
D2	purple	78.4	7.0	28.1	30.6	17.8	19.5	-21.6	-27.9
E2	yellow green	70.5	16.9	66.9	69.9	-21.1	-21.8	50.5	33.8
F2	orange yellow	73.7	17.1	66.5	70.5	17.0	12.7	59.2	43.1
A3	blue	99.3	2.4	28.0	30.2	12.1	11.3	-49.0	-49.5
B3	green	75.1	11.8	49.9	52.3	-34.8	-33.6	27.2	15.7
C3	red	73.5	14.2	39.8	43.2	46.3	43.3	18.8	5.4
D3	yellow	76.1	18.1	75.5	78.9	5.3	1.3	71.9	54.6
E3	magenta	93.3	5.4	46.6	50.4	47.0	43.3	-17.1	-18.3
F3	cyan	91.9	4.3	47.1	49.8	-19.1	-18.0	-29.7	-32.9
A4	white	81.0	2.8	89.8	91.3	0.7	-1.1	-4.2	-2.7
B4	neutral 8	55.6	6.1	74.9	78.7	0.6	-1.6	-4.6	-8.8
C4	neutral 6.5	31.4	8.0	61.4	65.3	0.5	-0.7	-5.2	-12.2
D4	neutral 5	22.4	8.5	45.7	49.0	1.9	1.9	-2.9	-10.7
E4	neutral 3.5	6.3	9.8	33.0	35.6	0.5	2.0	-2.0	-11.3
F4	black	46.4	7.4	20.4	25.2	1.3	3.8	-2.0	-6.9
A5	paper white	73.5	3.1	93.0	93.5	0.3	-0.9	-5.0	-2.2
B5	skin highlight L*=89	56.3	8.2	81.1	85.1	12.7	9.2	8.4	2.2
C5	skin highlight L*=75	58.4	11.8	68.6	73.2	20.0	16.4	14.9	4.6
D5	skin shadow L*=25	65.1	7.2	25.8	28.9	11.1	12.0	12.9	6.5
E5	skin shadow L*=11	60.1	8.8	14.6	20.9	10.8	16.7	9.5	11.5
F5	Max Black	39.3	6.5	7.3	8.9	2.3	-2.9	0.6	-3.0

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	65.9	89.0	8.9
Average Score for the Worst 10% (3 lowest scoring patches)	20.1	77.0	17.5



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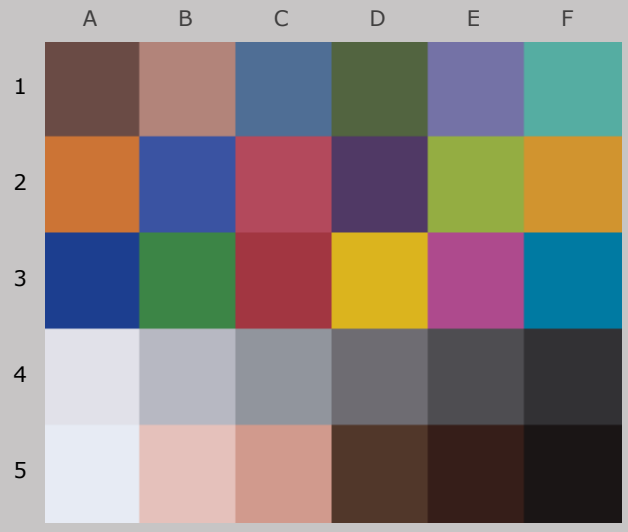
53.4color/88.3tone



Original Print Colors
(measured before light exposure)



Colors after 160 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100, Ilford Galerie Classic Gloss Paper

160 Mlux-hrs Light Exposure (i.e., after) Compared to Original Print Colors (i.e., before)

				L*		a*		b*	
Column/row	Color Patch	I*Color	ΔE	Before	After	Before	After	Before	After
A1	dark Skin	17.2	14.1	35.4	38.8	13.3	13.8	8.7	-5.0
B1	light Skin	36.1	14.8	59.7	64.5	17.1	15.1	12.5	-1.4
C1	blue sky	79.4	6.8	45.5	49.3	-3.4	-2.7	-24.9	-30.6
D1	foliage	32.9	15.2	39.9	43.3	-11.8	-10.7	17.8	3.0
E1	blue flower	90.8	5.4	49.6	53.9	10.4	8.1	-27.7	-30.0
F1	bluish green	59.0	13.3	65.0	68.2	-30.2	-26.4	-3.2	-15.6
A2	orange	64.4	22.1	58.2	63.1	32.4	26.1	49.5	28.9
B2	purplish blue	95.4	4.4	36.4	39.8	11.2	8.6	-46.8	-45.9
C2	moderate red	75.1	12.5	46.2	49.8	44.7	42.6	11.8	0.0
D2	purple	68.1	9.9	28.1	31.1	17.8	20.3	-21.6	-30.7
E2	yellow green	60.2	22.6	66.9	70.6	-21.1	-21.6	50.5	28.2
F2	orange yellow	64.8	22.7	66.5	71.1	17.0	12.5	59.2	37.5
A3	blue	98.0	3.1	28.0	30.7	12.1	11.8	-49.0	-50.4
B3	green	63.7	16.8	49.9	52.9	-34.8	-32.9	27.2	10.8
C3	red	65.3	18.2	39.8	43.6	46.3	43.6	18.8	1.2
D3	yellow	68.1	23.8	75.5	79.6	5.3	1.1	71.9	48.8
E3	magenta	91.6	6.3	46.6	50.9	47.0	43.3	-17.1	-20.1
F3	cyan	86.6	6.1	47.1	50.4	-19.1	-17.1	-29.7	-34.5
A4	white	83.2	2.9	89.8	91.8	0.7	-1.1	-4.2	-3.1
B4	neutral 8	43.9	7.3	74.9	79.2	0.6	-1.4	-4.6	-10.1
C4	neutral 6.5	7.5	10.4	61.4	66.0	0.5	-0.2	-5.2	-14.5
D4	neutral 5	-14.2	12.0	45.7	49.6	1.9	2.7	-2.9	-14.2
E4	neutral 3.5	-36.6	13.9	33.0	36.2	0.5	3.1	-2.0	-15.2
F4	black	8.8	10.7	20.4	25.9	1.3	4.7	-2.0	-10.5
A5	paper white	74.6	3.1	93.0	93.9	0.3	-0.9	-5.0	-2.3
B5	skin highlight L*=89	46.6	9.8	81.1	85.7	12.7	9.2	8.4	0.5
C5	skin highlight L*=75	46.8	14.8	68.6	73.9	20.0	16.6	14.9	1.6
D5	skin shadow L*=25	38.1	11.7	25.8	29.5	11.1	12.4	12.9	1.9
E5	skin shadow L*=11	60.2	9.4	14.6	21.7	10.8	16.9	9.5	8.2
F5	Max Black	26.0	7.9	7.3	9.6	2.3	-2.8	0.6	-5.0

Summary Results	I*Color	I*tone	ΔE
Average Score for all patches	53.4	88.3	11.7
Average Score for the Worst 10% (3 lowest scoring patches)	-14.4	75.5	23.0



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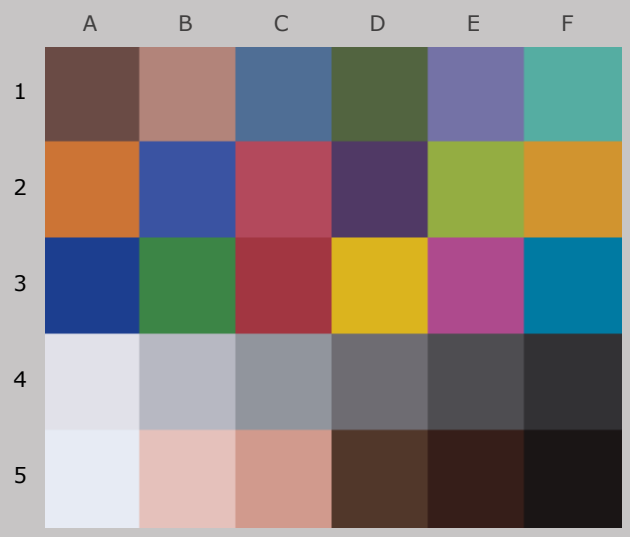
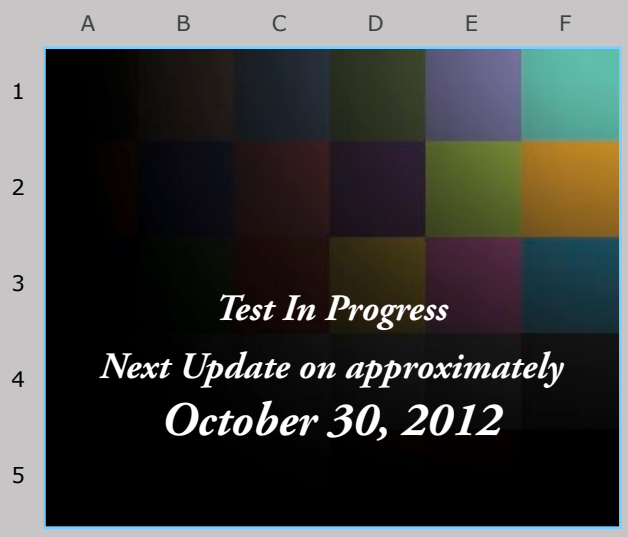


Original Print Colors
(measured before light exposure)



Next update is for 180 Megalux-hours
light exposure

Canon Pro9000, Canon OEM Chromalife 100,
Ilford Galerie Classic Gloss Paper

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