

3M Corporate General Specification RD1200

Description: Print Quality Management (PQM) Program

Revision: 03/30/2018 See last page for revision details

Supersedes: 08/09/2017

Co-Authors: Michael John – Print Quality Manager email: mjohn@mmm.com

Bill Herzog – Senior Art Production Leader email: weherzog1@mmm.com

Overview

The 3M Co. Print Quality Management (PQM) Program is designed to provide information related to the consistent reproduction of commercially printed packaging and printed product across all 3M Business Groups brands. This collection of requirements is intended to provide direction to any resource that plays a role in achieving print quality.

Purpose

Packaging is the first contact with our consumers where they are influenced to choose our brands. As such, the goal of 3M Design and 3M Business Groups is to consistently maintain high print quality and color accuracy for all commercially printed packaging and printed product from around the world to leverage the value of packaging and product in expressing a brand promise, delivering a positive and consistent experience while differentiating from our competition. The information contained in this document provides information related to standards, equipment, tolerances and sampling expectations that must be used to assess and control 3M Business Groups brands.

Scope

The set of requirements outlined in this document have been established to provide a procedure on how to perform digital color comparisons between a color “Target” and our commercially printed packaging and printed product items. **Note:** In the event that the packaging item or product is **not** printed, adherence to the requirements set forth in this document is **not** required.

Deviations

Any deviations to the requirements set forth in this document **must** be both reviewed and approved (in written format) by 3M Design or the 3M Business Group (or its designee) for acceptance.

Confirmation

See Page #2 for confirmation requirements that you have read, acknowledged and implemented the requirements stated in this document.

3M Corporate General Specification RD1200

Print Quality Management (PQM) Program - Confirmation

I have read, acknowledged and implemented the requirements stated in this document within the applicable functions of my facility. I certify my company can, and will, conform to all the requirements outlined to consistently maintain high print quality and color accuracy for all commercially printed packaging and printed product for 3M.

If my company is a contract supplier to 3M and we hire print services from our print supplier, I acknowledged that my print supplier has read, acknowledged and implemented the requirements stated in this document and that I'm directly responsible for their conformance.

Return to:

3M Design Center
Att: Michael John
3M Center, Bldg #223-1S-01
St. Paul, MN 55144

Email: mjohn@mmm.com

Signature of Supplier Rep.

Date

Supplier Rep. Name (Please Print)

Supplier Rep. Title

Supplier Rep. Phone Number

Supplier Rep. E-Mail Address

If you are a contract supplier to 3M and you hired print services from a printer, list the printers name and location below.

Printers Name

Printers Location

1.1 Color Tolerance Method

The approved color tolerance methods to be used when measuring printed color for 3M Design or the 3M Business Group as it relates to the CIELab (L*a*b*) color space are:

Delta E 2000 (ΔE_{00}) for spot or line colors (e.g. Pantone® 354 Green) and process colors (i.e. cyan, magenta, yellow, and black (CMYK)).

Ink density for “light strength” spot line colors (e.g. greys, pastels, tans). Colors defined during ink draw down process.

Note: Use of any other color measurement system is **not** acceptable.

1.2 Instrumentation

Spectrophotometers and spectrodensitometers are both **approved** devices when measuring printed color for 3M Design or the 3M Business Group (refer to Table 1 for details regarding device utilization by color type and instrumentation settings).

Table 1		
Device Type	Color Type	Instrumentation Settings
Spectrophotometer or Spectrodensitometer	Process or Line Colors	Aperture: 2.0 mm (minimum value) Illuminant: D50 (simulation for daylight illuminate) Observer Angle: 2° Color tolerance method: Delta E 2000 (ΔE_{00}) with l:c ratio of 1:1 (lightness to chroma ratio) Instrument must be set as a M0 measurement device unless substrate contains optical brighteners then set as M1 device

Notes:

- Ensure all instrumentation is set to operate with **no** filters (e.g. “UV Cut”).
- Ensure all instrumentation is utilized in compliance with manufacturer’s instructions related to set-up, operation and calibration requirements.

1.3 Viewing Conditions

All color measurements taken from printed samples, prepress proofs or ink drawdowns **must** be:

- In an environment that offers a “neutral” surrounding (refer to Munsell N7 as specified in ASTM D1729-96 for more details).
- Under a D50 5000K light source (ensure proper maintenance guidelines are followed with respect to light source) per ISO 3664:2009
- In compliance with stated instrumentation settings included in this document.

1.4 Measurement Surface

Utilization of a “backing material” to back up print with a defined white substrate ensures consistent color reading. As such, all color measurements taken from printed samples, prepress proofs or ink drawdowns that are on a clear, translucent, or other non-opaque substrate **must** be taken:

- On a flat surface.
- By using a “white backing” material with a material grade equivalent to GRACol7® Grade 1 premium coated substrate complying to ISO 13655 and ISO 5-4. CIELab (L*a*b*) values are as follows: L* = 95, a* = 1, b* = -4. This backing material is defined in ISO 13655 with no brighteners.

1.5 Color Standards/Ink Color Targets

Standards are the key to consistently reproducing both printed process and line color during every production run. As such, 3M Design or the 3M Business Group has established standards to control both print reproduction for process and spot/line colors. The following information defines the color standards for all package printers/converters.

Process Colors

For 3M Design or the 3M Business Group color targets, reasonable to the print process and substrate, the process colors shall be based on the use of one input standard for consistent CMYK ink color control. This input standard uses CIELab ($L^*a^*b^*$) values.

The **initial** CIELab ($L^*a^*b^*$) values below shall be defined as the values when setting up the press for the initial first run (see Tables 2 and 3 for additional details). These can be used as the initial target values when getting the press “up” to the print industry standard. For litho printing, reference International Standard ISO 12647-2:2013. For flexo printing, reference International Standard ISO 12647-6.

The **final** “Target” CIELab ($L^*a^*b^*$) values are determined by 3M or its assigned designee attending the press check. If 3M or its designee is not present at the press check the **final** “Target” CIELab ($L^*a^*b^*$) values are represented by the CMYK colors on the 3M approved CMYK prepress “hard” proof for that part number and similar line extension items. If the final “Target” color was not determined from a press check or approved “hard” proof then the CIELab ($L^*a^*b^*$) values in Table 2 (offset) and Table 3 (Flexo) are the “Target”.

These CIELab ($L^*a^*b^*$) values will be used against which all printed samples of identical or similar packaging artwork trade dress (ie. background, photos) are measured and evaluated. Contact 3M Design or the 3M Business Group (or its designee) if any question.

Note: The CIELab ($L^*a^*b^*$) values in parentheses found in Table 2 below uses the CGATS method using a white backing. This is the required method for measuring these colors, and will be the method of print evaluation.

Table 2						
Offset & equivalent Digital Printing						
CIELab ($L^*a^*b^*$) Values – (ISO 12467-2:2013) Offset						
Illuminant: D50 / Observer Angle: 2°						
Color tolerance method: Delta E 2000 (ΔE_{00}) with l:c ratio of 1:1 (lightness to chroma ratio). Spectrophotometer must be set as a M0 measurement device unless substrate contains optical brighteners then set as M1 device.						
Paper Type and Surface	PS1 Premium Coated Sheets			PS5 Wood-free Uncoated Sheets		
	Coordinates			Coordinates		
	L^*	a^*	b^*	L^*	a^*	b^*
Black	16	0	0	33	1	1
Cyan	56	-37	-50	60	-25	-44
Magenta	48	75	-4	55	60	-2
Yellow	89	-4	93	89	-3	76

Table 3 – Flexography & equivalent Digital Printing						
CIELab (L*a*b*) Values – (based upon ISO 12467-6) <u>Flexography</u> Illuminant: D50 / Observer Angle: 2° Color tolerance method: Delta E 2000 (ΔE_{00}) with L:c ratio of 1:1 (lightness to chroma ratio). Spectrophotometer must be set as a M0 measurement device unless substrate contains optical brighteners then set as M1 device.						
Packaging Substrates	1,2 Uncoated Paper, Corrugated Board ^a			3 Coated Paper, Film and Foil		
	Coordinates			Coordinates		
	L*	a*	b*	L*	a*	b*
Cyan	58	-25	-43	54	-36	-50
Magenta	54	58	-2	50	71	-2
Yellow	86	-4	75	88	-9	88
Black	31	1	1	26	0	2
a. Coated or uncoated. b. Printing in the sequence yellow-cyan-magenta						

Line Colors

The 3M Design or the 3M Business Group color targets are the **only** targets for printing line color due to the fact that line colors are commonly used to identify 3M Business Group/Div. brands. As such, draw downs will be required as a primary input to provide **confirmation** that the package printer can reproduce 3M Business Group/Div. line colors in compliance with the color measurement values and applicable tolerances (refer to section 1.6 “Delta E Tolerances” for tolerancing details) contained within this document. Ink drawdowns will either: 1) be provided to the package printer by 3M Design or the 3M Business Group (or its designee), or 2) developed through collaboration between 3M Design or the 3M Business Group (or its designee) and the package printer/converter.

For Pantone colors

- 3M “Brand” colors (see listing on Tables 4, 4A and 4B) – use the target CIELab (L*a*b*) color values on **Tables 4, 4A and 4B**.

3M Business Groups

Table 4 – All 3M Business Groups

Table 4A – Consumer

Table 4B – Safety and Graphics

Table 4(TBD) – Electronics and Energy

Table 4(TBD) – Health Care

Table 4(TBD) – Industrial

- Non-3M “Brand” colors - use the target CIELab (L*a*b*) color values provided by 3M Design or the 3M Business Groups/Div. (or its designee) or target CIELab (L*a*b*) color values in the **2010 Pantone Plus Colors digital library**. Note: a CxF file can be provide upon request.

For non-Pantone colors, use the CIELab (L*a*b*) values of the color target provided by 3M Design or the 3M Business Group (or its designee).

Note: Contact 3M Design or the 3M Business Group (or its designee) to verify target CIELab (L*a*b*) values or if any questions.

Table 4 – All 3M Business Groups							
Color Measurement CIELab (L*a*b*) Values 3M and Scotch® Brand Identity Colors							
Illuminant: D50 / Observer Angle: 2° Color tolerance method: Delta E 2000 (ΔE_{00}) with l:c ratio of 1:1 (lightness to chroma ratio). Spectrophotometer must be set as a M0 measurement device unless substrate contains optical brighteners then set as M1 device. <i>Note: Color values in Table 4 are based on instrumentation settings defined under Section 1.2 "Instrumentation"</i>							
		L*a*b* Values (per 2003 Pantone Digital Library)					
3M Brand Color Description	3M Brand Color Number	Pantone Color Reference	L*	a*	b*	C	h
3M Red	3M Red 3M_RD001A	NA	45.74	67.74	46.81	82.33	34.64
3M Red (on uncoated substrate)	3M Red 3M_RD001B	NA	47.37	57.76	39.08	69.74	34.08
Scotch® Yellow	3M_YL001A	PMS 116c	85.24	8.18	91.26	91.63	84.88
Scotch® Yellow (on uncoated substrate)	3M_YL001B	PMS 116c	81.61	6.48	83.81	84.06	85.58

Table 4A – 3M Consumer Business Group

Color Measurement CIE Lab (L*a*b*) Values
3M Consumer Business Group - Brand Identity Colors

Illuminant: D50 / Observer Angle: 2°

**Color tolerance method: Delta E 2000 (ΔE_{00}) with L:c ratio of 1:1 (lightness to chroma ratio).
Spectrophotometer must be set as a M0 measurement device unless substrate contains optical brighteners then set as M1 device.**

***Note:** Color values in this Table are based on instrumentation settings defined under Section 1.2 "Instrumentation"*

3M Brand Color Description	3M Brand Color Number	Pantone Color Reference	L*a*b* Values (per 2003 Pantone Digital Library)				
			L*	a*	b*	C	h
Post-it® Yellow	3M_YL002A	PMS 109c	86.63	4.02	97.57	97.65	87.64
Post-it® Yellow (on uncoated substrate)	3M_YL002B	PMS 109c	82.26	5.6	87.41	87.59	86.33
Scotch® Yellow, Duct Tough® Duct Tape (Yellow) Futuro™ Yellow	3M_YL001A	PMS 116c	85.24	8.18	91.26	91.63	84.88
Post-it® Orange	3M_OR001A	PMS 1235c	80.85	21.18	79.87	82.63	75.14
Post-it® Orange (on uncoated substrate)	3M_OR001B	PMS 1235c	78.59	18.01	78.72	80.75	77.12
O-Cel-O® Pink	3M_RD003A	PMS 226c	45.79	79.24	-3.40	79.24	359.75
O-Cel-O® Dark Pink	3M_RD004A	PMS 228c	30.34	52.49	-6.68	52.91	352.75
Post-it® Super Sticky Purple	3M_PR002A	PMS 247c	43.11	69.60	-34.0	77.47	333.97
Post-it® Super Sticky Purple (on uncoated substrate)	3M_PR002B	PMS 247c	44.22	59.01	-23.17	63.4	338.56
Scotch® GiftWrap® Purple	3M_PR001A	PMS 2665c	46.76	34.24	-55.28	65.03	301.77
Scotch® GiftWrap® Purple (on uncoated substrate)	3M_PR001B	PMS 2665c	47.92	28.74	-44.25	52.76	303
O-Cel-O® Blue	3M_BL003A	PMS 281c	15.28	9.35	-43.53	44.52	282.12
Scotch-Blue™ Painter's Tape	3M_BL001A	PMS 285c	45.76	0.29	-62.41	62.41	270.27
Scotch-Blue™ Painter's Tape (on uncoated substrate)	3M_BL001B	PMS 285c	45.41	-4.21	-50.01	50.18	265.19
Scotch® Brite Blue (versioning)	3M_BL005A	PMS 3005c	44.53	-19.80	-60.80	63.95	251.96
Scotch® Brite Blue (versioning) (on uncoated substrate)	3M_BL005B	PMS 3005c	44.88	-15.21	-48.3	50.64	252.52
Scotch® Wall-Safe Blue (**)	3M_BL006A	PMS 300c	35.95	-8.53	-63.37	63.94	262.33
Nexcare Teal	3M_BL004A	PMS 3135c	50.99	-47.98	-38.64	61.6	18.85
Post-it® Greener Notes (Green) Scotch-Brite® (Heavy-Duty) Grn	3M_GR003A	PMS 349c	37.25	-38.21	14.22	40.77	159.59
Post-it® Greener Notes (Green) Scotch-Brite® (Heavy-Duty) Grn (on uncoated substrate)	3M_GR003B	PMS 349c	39.86	-35.65	14.68	38.55	157.62
Scotch® Magic Green	3M_GR001A	PMS 354c	59.36	-75.94	37.1	84.52	153.96
Scotch® Magic Green (on Mottled White)	3M_GR001B	PMS 354c	59.78	-60.28	25.66	65.52	156.94
Scotch® Brite Green	3M_GR002A	PMS 361c	62.72	-53.48	47.03	71.21	138.67
Scotch® Expressions Grey (**)	3M_GY001A	PMS 423c	58.13	-0.15	-3.97	3.97	267.84
Ace Red	3M_RD002A	PMS 485c	49.94	66.86	54.31	86.14	39.09
Ace Red (on uncoated substrate)	3M_RD002B	PMS 485c	51	60.1	45.4	75.32	37.07
Nexcare Reflex Blue	3M_BL002A	Reflex Blue	18.64	30.50	-70.57	76.88	293.37

(**) = L*a*b* values per 2010 Pantone Digital Library

Table 4B – Safety and Graphics Business Group

Color Measurement CIELab (L*a*b*) Values 3M Safety and Graphics Business Group - Brand Identity Colors							
Illuminant: D50 / Observer Angle: 2° Color tolerance method: Delta E 2000 (ΔE00) with l:c ratio of 1:1 (lightness to chroma ratio). Spectrophotometer must be set as a M0 measurement device unless substrate contains optical brighteners then set as M1 device. <i>Note: Color values in this Table are based on instrumentation settings defined under Section 1.2 "Instrumentation"</i>							
3M Brand Color Description	3M Brand Color Number	Pantone Color Reference	L*a*b* Values				
			L*	a*	b*	C	h
Scott Safety	3M Red 3M_RD001A	NA	45.74	67.74	46.81	82.33	34.64
Scott Safety		PMS 186C	44.87	67.75	37.46	77.42	28.94
Scott Safety (on uncoated substrate)	3M Red 3M_RD001B	NA	47.37	57.76	39.08	69.74	34.08
PROTECTA®	3M Red 3M_RD001A	NA	45.74	67.74	46.81	82.33	34.64
PROTECTA® (on uncoated substrate)	3M Red 3M_RD001B	NA	47.37	57.76	39.08	69.74	34.08
DBI-SALA® Blue (**)		PMS 2748c	13.93	23.92	-55.46	60.40	293.33

(**) = L*a*b* values per 2010 Pantone Digital Library

Ink Draw Downs

It is the responsibility of the package printer/converter to develop and submit ink drawdowns in compliance with the following requirements:

- Ink drawdowns of line color over the target substrate are **required** from the package printer/converter prior to initial production run.
- Two (2) sets of ink drawdowns **must** be supplied to 3M Design or the 3M Business Groups/Div. (or its designee) for review/approval **prior** to the initial production run. The following assets **must** be supplied with each ink drawdown submission:
 - Printer/converter's name, address and contact information
 - Identification of the ink company (e.g.: Sun Chemical, INX, Kohl & Madden, Color Resolutions International, other)
 - PMS number and color description
 - Substrate definition (e.g.: SBS, CCNB, Clear Film, other)
 - Date (defined as the date the ink drawdown was produced)
 - Coating type/number and description (if/where applicable)
 - Target and actual CIELab values and its Delta E 2000 (ΔE00) variance including a printout verifying targets and Delta E results

REMINDER!

Ensure the utilization of color tolerance method: Delta E 2000 (ΔE00) with l:c ratio of 1:1 with the following instrumentation settings: Illuminant: D50 and Observer Angle: 2° for ALL ink draw-down measurements.

Allowable Delta E Tolerances for ALL ink draw-downs must be less than or equal to 2.0 Delta.

Notes:

- All ink drawdowns should be packaged in such a way that they are protected from all reasonable environment interactions during shipment. In addition, all approved ink drawdowns should be stored in a cool and dark environment.
- Paper-based print substrates (e.g.: paperboard) will be compared to the appropriate GRACoL7 paper grade of 1&2 for gloss and dull coated, grades 3 and 5 for publication.
- Film-based print substrates (e.g.: flexible packaging) will be compared to the CIELab (L*a*b*) D50/2 values of printed whites should be >88L, between -3 and +3 a, and -5 to +5 b.
- **3M Red** litho ink is available premixed from Sun Chemical. When printing on a SBS substrate, the Sun Chemical reference number is **SAP# 91219368**. When printing on a CCNB substrate, the Sun Chemical reference number is **SAP# 91235873**.

1.6 Delta E Tolerances

Ink Drawdowns: All ink measurements captured as part of ink drawdown evaluations to be compared to CIELab (L*a*b*) values as defined/provided by 3M Design or the 3M Business Group (or its designee). Allowable Delta E tolerance for **all** ink drawdowns is less than or equal to 2.0 Delta E 2000 (ΔE_{00}).

Printed Samples: All ink measurements captured to compare a given “Target” against a printed sample **must** be processed in compliance with the following tolerance methods (reference Table 5 below for specific Delta E Tolerances).

Table 5			
Print Process/Substrate	Delta E Tolerances (Process Ink) ¹	Delta E Tolerance (Primary Line Color) ²	Delta E Tolerances (Secondary Line Color)
Offset Lithography	5.0 for K (black) ¹ 3.5 for C,M,Y ¹	2.5	3.0
Flexography (All Other)	5.0 for K (black) ¹ 3.5 for C,M,Y ¹	2.5	3.0
Digital (Indigo) and Ink Jet (equivalent to Offset Litho or Flexo (above))	5.0 for K (black) ¹ 3.5 for C,M,Y ¹	2.5	3.0
Flexography (“Mottled White/Bleached” and “High Holdout” (high definition) Corrugated)	3.0	3.0	3.0
Flexography (“Brown” Corrugated)	4.0	4.0	4.0
Stamp, Pad or Screen Printing	3.0	2.5	3.0
Gravure	5.0 for K (black) ¹ 3.5 for C,M,Y ¹	2.5	3.0
Dry Offset	5.0 for K (black) ¹ 3.5 for C,M,Y ¹	2.5	3.0
1. Delta E Tolerances to the target CIELab (L*a*b*) values outlined in Section 1.5 Table 2 (litho and digital) and 3 (flexo). Tolerances includes the color variability of the substrate. Delta E Tolerance if no approved press sheet or “hard” proof is available. 2. Includes: 3M Brand Identity colors (refer to Section 1.5, “Color Standards/Ink Color Targets” (Table 4)). 3M brandmark, non-3M brandmark (e.g. Post-it®, Scotch™, Meguiar’s®, Tartan, Highland) and private label trade dress colors. Some private label colors may specify a different Delta E tolerance (e.g. 2.0) dependent of the private label customer requirements. The printer will be informed by 3M Design or the 3M Business Group (or its designee) of this unique Delta E tolerance - Significant background (e.g. trade dress) colors			

Note: Visual overrides to these specifications may be granted (refer to Section 2.1, “Visual Overrides” for details).

2.7 Ink Density Tolerances

Use the following allowable ink density tolerances (reference Table 6 below for specific Ink Density Tolerances) within a given production run for “light strength” line colors.

Table 6 “Light Strength” Line Colors	
“Light Strength” Line Color Reproduction	+/- 0.02 for all “light strength” line colors (e.g. greys, pastels, tans). Note: Colors defined during ink draw down process. Note: Use the “Target” ink density per the approved ink drawdown. These ink densities values will be used against which all printed samples are measured and evaluated.

1.8 Color Bar Requirements

Color Patches for Process or Line Colors: Solid patches of line colors are also required to measure Delta E variance to the target color. These patches must be at minimum large enough to be read by standard hand held Spectrophotometer or Spectrodensitometer, and run in dead area or trim. If the package has a treatment like a varnish, white ink backing, or lamination, this patch must have the same treatment so that this patch is representative of the color on the package. If the live artwork has single color elements that are larger than a .25” square, the live work may be used in lieu of this patch.

If litho printing:

- if process colors, recommend 18 color patches in the control strip (4 CMYK solids, 4CMYK 75% tints, 4CMYK 50% tints, 4CMYK 25% tints, C50M40Y40, and the substrate)
- if spot line colors, recommend 2 color patches in the control strip (100% solid and 50% tint (if screens are present))

If flexo printing:

- if process colors, recommend 7 color patches in the control strip (minimum dot size, and tonal values of 10%, 30%, 50%, 70%, a solid, and the substrate).
- if spot line colors, recommend 2 color patches in the control strip (100% solid and 50% tint (if screens are present))

Web Presses: In situations where print reproduction utilizes web presses, the color bar should be placed in the trim area. **Note:** In situations where a print cylinder repeat does not provide the proper space to incorporate the needed color bar, it is acceptable to split the color bar and place half on the left side and half on the right side of the web in the allocated trim areas. The printer may substitute color patches inside of the bearer bar, waste at the edge of the web, or in waste area between die cuts as long as the patches are, at minimum large enough to be read by standard hand held Spectrophotometer or Spectrodensitometer.

Notes:

- In situations where available “dead space” doesn’t allow for the inclusion of a detailed color bar, please contact 3M Design or the 3M Business Group (or its designee) to discuss alternate color bar requirements as required.
- **White Under Prints:** In situations where print reproduction requires the use of white ink to “back-up” the artwork, the color bar should also be backed up with the same white ink to ensure consistent colorimetric data collection.

1.9 Dot Gain

Dot gains should be managed to achieve neutral grays. It is recommended that the G7® methodology should be utilized for developing TVI (Tonal Value Increase), though it is not required. Quarter Tone, Mid Tone and Lower Quarter Tone are required on print samples submitted as neutral grays will be read as part of the print evaluation (reference Table 8 for applicable reflectance % by tonal type and associated tolerances).

Table 8			
Dot Gain Tolerances (%)			
Print Process	75% (Upper Quarter Tone)	50% (Mid-Tone)	25% (Lower Quarter Tone)
Offset Lithography	Target: 88% Tolerance: +/- 3%	Target: 68% Tolerance: +/- 4%	Target: 40% Tolerance: +/- 3%
Flexography	Target: TBD Tolerance: TBD	Target: TBD Tolerance: TBD	Target: TBD Tolerance: TBD

Notes:

- Exact percentages may vary due to gains required for neutral grays.
- Standard focuses on measuring optical dot gain, **not** a physical dot size.
- If in a situation where the dot gain tolerance cannot be met, please contact your applicable 3M Production Artwork personnel (or its designee) to discuss any deviation to these requirements

2.0 Halftone Resolution

All printed packaging items produced for 3M Design or the 3M Business Group **must** meet the following halftone image quality requirements (reference Table 9 below for specific resolution minimums by print process):

Table 9	
Print Process	Minimum Target Resolution
Offset Lithography	150 LPI (for premium grade coated paper, text, and cover substrates)
Flexography (All Other)	120 LPI
Flexography (Narrow-Web)	120 LPI
Flexography (Mid-Web)	100 LPI
Flexography (Corrugated)	45 LPI
Flexography (Corrugated – Micro-Flute Grades)	100 LPI
Gravure	150 LPI
Dry Offset	100 LPI

2.1 Visual Overrides:

Ink drawdown and print continuity readings will be done by spectral instrument measurement. There may be cases where a visual approval may over ride an instrument reading. In certain situation, visual approvals may be granted by your 3M Design or the 3M Business Group contact (or its designee). Visual over rides will be documented in a similar manner to instrument validation.

2.2 Print Sample Evaluations

All printers/converters shall be **required** to submit the following,

For **initial production run:**

Submit a minimum of three (3) random print samples to your 3M Design or the 3M Business Group contact (or its designee) as part of a “first article” inspection process. Submit one (1) represented print sample from each of the beginning, middle and end of the production run. Print samples must include associated printed color bar.

Digital Option: Submit actual colorimetric and print performance data using digital communications quality assurance software (e.g. X-Rite ColorCert or equivalent) via near-real time data for this initial press run. Send file to Michael John email address: mjohn@mmm.com

For **BOTH initial and subsequent** (every 3rd or 4th production) runs:

For **line and CMYK colors**, provide colorimetric data report that includes both the “Target” and “Actual” CIELab (L*a*b*) values and it’s Delta E 2000 (ΔE_{00}) variance for each printer color. Print samples must include associated printed color bar.

For **“light strength” line colors (eg: greys, pastels, tans)**, provide colorimetric data report that includes both the “Target” and “Actual” CIELab (L*a*b*) values and it’s Delta E 2000 (ΔE_{00}) variance...and ink density “Target” and “Actual” values and it’s variance.

Digital Option: Submit actual colorimetric and print performance data using digital communications quality assurance software (e.g. X-Rite ColorCert or equivalent) via near real-time data for the initial and subsequent press runs. Send file to Michael John email address: mjohn@mmm.com

This information **must** be provided until otherwise informed by your 3M Design or the 3M Business Group contact (or its designee).

Reminder to verify the printed UPC/EAN bar code symbol is in conformance with GS1 General Specifications and the human readables match the encoded data within the printed bar code symbol per 3M Corp. General Spec. RD-138 - Printing Requirements for Point-of-Sale Bar Code Symbols Using EAN/UPC Symbolology

DEFINITIONS

This section of the document provides definitions associated with various references included in other section of this document.

- **CIELab ($L^*a^*b^*$):** A uniform (opponent color scale) color space in which colors are located within a three dimensional rectangular coordinated system; the three dimensions are lightness (L^*), redness/greenness (a^*) and yellowness/blueness (b^*) expressed in numeric values. When color is expressed in CIELab, L^* defines lightness, a^* denotes the red/green value and b^* denotes the yellow/blue value.
- **CIELab2000 (ΔE_{00}):** The CIE 2000 color difference formula was developed to solve the problem of the differences in the evaluation between color meters and the human eye caused by the difference in the shape and size of the color discrimination threshold of the human eye.

The CIE 2000 color difference formula is not an attempt to build a color space in which the widths of the color discrimination thresholds of the human eye are uniform. Instead, it defines a calculation so that the color difference calculated by color meters becomes close to the color discrimination threshold of the human eye on the solid color space of CIE Lab ($L^*a^*b^*$) color space.
- **CGATS:** The Association for Suppliers of Printing, Publishing and Converting Technologies supports and administers the activities of the ANSI-accredited Committee for Graphic Arts Technologies Standards (CGATS). CGATS was formed in 1987 following a year-long assessment of the need for an umbrella standards committee by the Image Technology Standards Board (ITSB) of the American National Standards Institute (ANSI), and received ANSI accreditation in 1989. The goal of CGATS is to have the entire scope of printing, publishing and converting technologies represented in one national standardization and coordination effort, while respecting the established activities of existing accredited standards committees and industry standards developers.
- **Delta E:** In color tolerancing, the following symbol is used to express delta error. Delta error is a mathematical equation computed to measure color difference between two or more items, typically measuring the color difference between the target color (i.e. ink drawdown, Pantone 2003 CIEL $^*a^*b^*$ digital library values or gray scale patch) to another item (i.e. press sheet). Color data is expressed in CIEL $^*a^*b^*$.
- ***FIRST:** FIRST stands for Flexo Image Reproduction Specifications & Tolerances (FIRST), published by the Flexographic Technical Association Inc. (FTA) focusing on flexography (flexo) commercial printing guidelines (standards) and recommendations.
- **G7®:** A specification providing formal digital colorimetric definitions for neutrality and tonality that together control the visual appearance of the grayscale component of an image located on a proof and printed sheet. “G” denotes the focus on “Grays” while “7” refers to the seven colorimetric ink values of Cyan (C), Magenta (M), Yellow (Y), Black (K), Red (M+Y), Green (C+Y) and Blue (C+M). **Note:** GRACol and SWOP standards are both based on G7 gray balance and tonality specifications. Gray balance is the means to determine if 4 color process reproduction is being produced correctly on the approval proof, prepress proof and printed sheet. This methodology utilizes the existing ISO 12647 Standards as the basis for quality printing. Its goal is to specify a simple calibration process that will help the printers reliably achieve a “visual match” within allowable variability from proof-to-press based on the principles of digital imaging and spectrophotometry.
- **G7® Complaint:** A methodology allowing printers who maintain a G7® compliance to reliably produce high quality commercial printing that matches color from proof-to-press (computer to plate) per G7 specifications.
- ***GRACol®:** GRACol® stands for “General Recommendations for Applications in Offset Lithography” focusing on sheet fed offset (litho) commercial printing guidelines (standards) and recommendations.
- **Gray Balance:** The relationship of C (cyan), M (magenta) and Y (yellow) percentages typically defined as C = 50 (i.e. 50c, 40m, 40y). These tones, called gray scales, are found on the prepress proofs and printed sheet color bars used to measure CIEL $^*a^*b^*$ values to calculate Delta E_{CMC} color variability to make ink adjustments to meet acceptable color tolerances and/or approved prepress proof targets. **Note:** Gray balance is the means to determine if 4 color process reproduction is being produced correctly on the prepress proof or printed sheet.
- **ISO 12467-2:** International Organization of Standards that specifies a number of process parameters and their values to be applied when preparing color separations for four-color offset printing or when producing four-color prints by one of the following methods: heat-set web, sheet-fed or continuous forms process printing, or proofing for one of these processes; or offset proofing for half-tone gravure. The parameters and values are chosen in view of the complete process covering the process stages color separation, film setting, making of the printing form, proof production, production printing and surface finishing. ISO 12647-2 is: directly applicable to proofing and printing processes that use color separation films as input; directly applicable to proofing and printing from printing forms produced by filmless methods as long as direct analogies to film production systems are maintained; applicable to proofing and printing with more than four process colors as long as direct analogies to four-color printing are maintained, such as for data and screening, for print substrates and printing parameters; applicable by analogy to line screens and non-periodic screens.

- **ISO 12647-6:** International Organization of Standards that specifies a number of process parameters and their values to be applied to four-color process printing by the flexographic printing process for packaging and publication, excluding newsprinting. The parameters and values are chosen in view of the complete process covering the process stages "color separation", "film setting", "making of the printing form", "proof production", "production printing" and "surface finishing". This covers printing on printing substrates which are nearly white or on films to which a white coating has been applied. ISO 12647-6 is directly applicable to: publication flexographic printing including magazines, catalogues and commercial materials, and packaging flexographic printing including labels, boxes and flexible packages; half-tone and continuous tone proofing processes that predict the colorimetric results of flexographic printing.
- **Kelvin Degrees:** The scale of absolute temperature in which the zero is approximately -273°C, abbreviated: K.
- **Spectrodensitometer:** A combination spectrophotometer and densitometer, convenient for measuring the color reproduction quality, typically located on the press sheets and prepress proof color bar. A spectrodensitometer has the capacity to measure both ink density and colorimetry functions.
- **Spectrophotometer:** A piece of computerized equipment that defines the attributes of color precisely in terms of lightness (L*), redness/greenness (a*) and yellowness/blueness (b*) name ab values and in lightness (L*), chroma (C*), and hue angle (h) numeric CIELCh values.
- ***SWOP®:** SWOP® stands for "Specifications for Web Offset Publications" focusing on web offset (litho) commercial publication printing standards.
- **TVI (Tonal Value Increase):** The percent increase in the apparent darkness of an image in the mid-tone range during the production run. Example: With 15% dot gain, a 55% halftone will increase to 70%. This increase is compensated for in reproduction by making the image lighter in the color separations.

* G7®, SWOP® and GRACoL® are registered trademarks of IDEAlliance. Objective is to provide all participants in the print reproduction process – customers, designers, prepress providers, and printers – with a common set of guidelines, targets, and tolerances that can be used as communication and production tools. The goal is to improve quality, reduce cycle times, minimize rework and waste, and facilitate producing a predictable, consistent result, print run after print run.

REVISION DETAILS

Revision: 03/30/2018

Page #1 Add Table 4B – Safety and Graphics Business Group. Added PROTECTA®, Scott Safety and DBI-SALA® target brand colors.

Revision: 08/09/2017

Page #6 Corrected L*a*b*C*h* target values for the uncoated colors 3M_YL001B PMS 116C in Table 4

Page #7 Added and corrected L*a*b*C*h* target values for the uncoated colors in Table 4A