Complimentary Design Guide

first 5.0

Flexographic Image Reproduction Specifications & Tolerances

FTA

Complimentary Design Guide

An FTA Strategic Planning Initiative Project

The Flexographic Technical Association has made this *FIRST* 5.0 supplement of the design guide available to you, and your design partners, as an enhancement to your creative process. To purchase the book in it's entirety visit: www.flexography.org/first

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Content Notes:

1. This reference guide is designed and formatted to facilitate ease of use. As such, pertinent information (including text, charts, and graphics) are repeated in the Communication and Implementation, Design, Prepress and Print sections.
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The Mission of *FIRST*

FIRST seeks to understand customers' graphic requirements for reproduction and translate those aesthetic requirements into specifications for each phase of the flexographic printing process including: customers, designers, prepress providers, raw material & equipment suppliers, and printers.

The intention of *FIRST* is to provide all participants in the flexographic reproduction process with a common set of guidelines, tutorials, and data that can be used as communication and production tools.

FIRST Objectives

FIRST is a set of specifications, not standards. When followed, these specifications facilitate producing a predictable, consistent result. It is the responsibility of the customer to determine where, when, and how these specifications are implemented. This does not imply that a printer's capabilities cannot exceed *FIRST* specifications, or that the printer is limited to these specifications as a maximum quality level. The process and specifications supported in *FIRST* intend:

- To outline key flexographic procedures and guidelines to be used from the beginning of the process to the end, including the implementation, design, prepress, and print processes.
- To improve quality and consistency through improved communication and measurement procedures.
- To reduce cycle time and minimize rework through improved process control methodology.
- To control production costs through streamlined raw materials and process improvement methodology.
- To enable consumer product companies to obtain optimal flexographic print quality, which equals or exceeds offset lithography and gravure printing.
- To grow the overall flexographic printing industry through increased market share of an expanding market.

Historical Perspective of *FIRST*

Prior to *FIRST*, many consumer product companies were creating individual package reproduction specifications. The generation of too many individualized specifications can become overwhelming to an industry – resulting in manufacturing inefficiencies and confusion. In pursuit of a more universal approach, the FTA membership partnered with leading consumer product companies to create a universal set of flexographic specifications.

The resulting premier edition of *FIRST* (debuting in 1997) and subsequent editions consisted of specifications and tolerances representing the realistic capabilities of 70% of the industry. Data was derived from three years of industry input, three industry-wide surveys, and statistically controlled designed experiments. *FIRST* 5.0 includes technical updates to maintain relevancy with the ever-evolving technology, as well as significant subject expansion designed to more fully encompass the entire flexographic process and various industry segments. With hundreds of industry experts, from around the world, contributing to the technical content over the past decade, *FIRST* has become the technical resource for the flexographic industry.

FIRST 5.0 CONTRIBUTORS

The Flexographic Technical Association would like to recognize the contributions and dedicated efforts of those involved in the development, editing, and evaluation of *FIRST* 5.0. These individuals exhibited tireless enthusiasm in spearheading the continuous advancement of the flexographic printing process.

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2.0 DESIGN INTRODUCTION

2.1 Overview

FIRST was created to facilitate communication among all participants involved in the design, preparation and printing of flexographic materials. The designer is responsible for creating a graphic design that achieves the marketing objectives of the Consumer Product Company (CPC) and that can be successfully reproduced on press. The Design Section is intended to assist the designer in understanding the flexographic print considerations necessary to create reproducible designs. The better the designer understands the flexographic process, the easier it will be to create aesthetically pleasing designs while optimizing production efficiency and reducing the time-to-market. A primary objective of the Design Section is to provide guidance on how to create electronic files that will enhance quality and speed of manufacturing while minimizing cost. This must be accomplished while allowing the designer to maintain creative control of the project. This can be best accomplished when everyone in the supply chain has a clear understanding of the requirements of flexography and when these requirements are addressed during the design phase of development. Because designers and production artists often have overlapping responsibilities, the information in this section applies to both parties.

Depending on the methods and practices of the companies involved and the complexity and frequency of the work among them, *FIRST* recommends establishing ground rules and procedures for designing products before actual production begins. This is a necessary step when providing services to the flexographic industry because of the complexity of the graphics, print issues and converting equipment considerations. A dialogue regarding design and production considerations should be initiated among the production team (designer, consumer product company, prepress provider and printer). *FIRST* provides guidelines to facilitate the project flow through the design and manufacturing processes.

2.2 Responsibility

As packaging graphics continue to increase in complexity and production timelines continue to compress, clear assignment of responsibilities is necessary to ensure a quality printed product in a timely manner. The assignment of responsibilities requires planning and collaboration among all involved parties.

Consumer Product Company (CPC): Ultimately, the customer defines expectations and therefore must drive the collaboration

2.2 Product Development Responsibilities: *In short, the designer creates the image, the prepress provider manipulates the image, and the printer mass produces the image. All members of the supply chain must work together utilizing FIRST to achieve a desirable outcome.*

process. The customer determines the effort expended to reach satisfaction. The CPC must facilitate communication between the supply chain parties: designer, prepress provider and printer.

Designer/Production Design: The designer must work with both the prepress provider and the printer to understand the capability of the printing/converting process being utilized. Based upon the print capability, the designer must provide a design concept that will enable the printer to meet the expectations of the customer (CPC). The earlier in the design development process the prepress provider and printer are involved, the better the team is to determine specific capabilities that will ensure the final product meets the customer's design objectives. Additionally, the designer is responsible for:

- Establishing a color scheme and palette before final files are sent to production
- Checking all copy for spelling and kerning
- Treating common elements and logos consistently in the layout
- Building all copy and vector-based elements in accordance with the specifications of the print provider
- Image positioning

Prepress Provider: The prepress provider must work with the printer to understand the capability of the printing/converting process being utilized. The prepress provider supplies the designer with accurate and timely information regarding print capabilities at the beginning of the design phase to facilitate the creation of a printable design. Based upon the print capability, the prepress provider produces appropriate films/files/plates that will enable the printer to meet the expectations of the customer (CPC). They must document the controls that ensure the consistency and accuracy of the supplied media (films/files/plates). Additionally, the prepress provider produces a contract proof calibrated to accurately predict the printed result. The prepress provider must give the printer the ability to objectively confirm the accuracy of the prepress work and the printing process. This can be accomplished through the use of agreed-upon control targets.

Printer: The printer is responsible for consistently reproducing the graphic design to the satisfaction of the customer (CPC). They utilize and document the process controls necessary to ensure that accuracy and consistency are achieved. They work with the other parties and suppliers to define the capability of the printing process. The printer provides the designer with

accurate and timely information regarding process capabilities at the beginning of the design phase to facilitate the creation of a printable design.

2.3 Assumptions

In order to keep the content focused and pertinent, the following assumptions were made when creating these guidelines:

- The audience consists of professionals who are using current versions of software and hardware (designers who expect their project to efficiently move through the production workflow should be using current versions of software and hardware proven compatible with downstream processes)
- Certain programs and manufacturers are mentioned (*FIRST* recognizes these are not the only solutions)
- The audience is familiar with electronic design terminology and workflow in a digital environment (if you are not familiar with electronic design terminology and/or digital workflows, visit www.flexography.org for more information)
- Technology continues to change rapidly (to help address this issue, additional training and support documentation will be updated and available at www.flexography.org)

3.0 GETTING STARTED

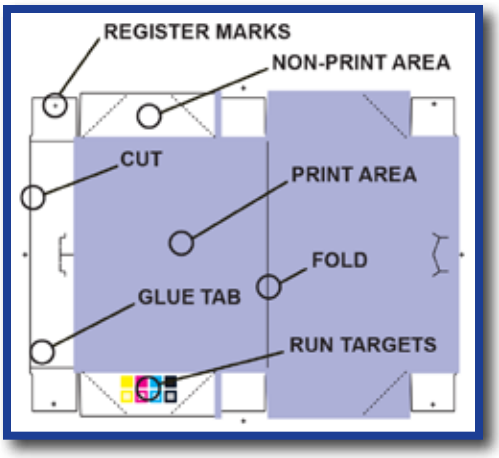
3.1 Recognizing Attributes of the Flexographic Printing Process

The use of spot colors, specialty inks and a wide variety of substrates are just a few choices available with flexography. Designers must be informed about the advantages of the flexographic printing process in order to make use of them during the design process. The designer must communicate with the print provider to understand their capabilities and how they can jointly optimize the quality and effectiveness of the final product.

3.2 Materials and Information Needed to Begin

- Template or Die line: A die template or drawing (supplied by the customer, prepress provider or printer) must include bleeds, glue or heat seal areas, live areas and dimensions. There may also be other pertinent information on the template (ie. die number, size, count number, etc.) that the designer should reference in the digital file.

3.1 Flexographic Market Segments:
The flexographic printing industry offers designers broad choices of packaging types, substrates, inks and in-line converting capabilities.



3.2 Materials & Information Needed to Begin: *Template layouts along with general production information and customer specifications are critical for successful design development.*

- Production information gathered by the design team such as substrate, number of ink colors and whether the specified color is a spot or process color build should be documented in the digital file
- Customer specifications
- Design brief
- Brand style guide and corporate art guidelines
- Legal and government regulations

3.2.1 Template Layout/Die-Cut Specifications

Die line/Electronic File

A final die line or electronic file must be provided with the art, prior to final assembly, for all die-cut jobs. All supplied die lines must indicate cuts, folds and scores as well as non-print areas. The designer, in conjunction with the packaging buyer, should indicate the area in which the print control target may be placed. Refer to Sections 1.3.3, 3.7 and 12.7 for print process measurement and control.

Using the Template Layout

A template layout is also referred to as a keyline, die line or full-scale drawing. It is the responsibility of the printer and the customer (CPC) to provide the design firm with the appropriate electronic template file, including layout dimensions, prior to the conceptual design phase. The template should include non-image area, non-print area, print direction, varnish area, seal area and "inside view" identification. It is the responsibility of the design firm to consider the non-print areas during the design process. The designer forwards the final template to the prepress facility where all job elements are verified and correctly positioned for product assembly. Refer to Section 12.5 for additional information.

Die Origin

Dies are designed using a graphics program or CAD system. Files generated from these systems can be translated into a format recognizable by design and prepress software. Incorporation of dies, bleeds, or pressmarks (internal and external) should be determined on a case-by-case basis. Early communication about who will build a die line and how it will be used is essential.

Printing Form Layout Considerations

The printing form layout communicates how individual die-cut units are arranged on a sheet or web. This may influence control target placement and create additional design considerations. If certain knives are common, or shared, between individual units, the design may be affected at the perimeter of the unit.

This information can only be obtained through contact with the printer. Designers must work with the customer (CPC) and the printer to receive this vital information.

Print-to-print and print-to-cut production tolerances should also be verified with the printer or the customer (CPC). These tolerances may vary depending on several factors including press width and press type (ie. central impression, stack, in-line). Important elements should be placed away from cuts and scores. Die position tolerance is typically smaller for thin board stock and larger for thicker stock. Consult the printer for job specific print-to-print and print-to-cut production tolerances.

Electronic Format
It is important for the designer to work with an accurate physical representation of the unit's form to avoid downstream adjustments to the design. Sometimes the die is modified to match graphic elements (windows, cutouts, or coupons). Most translation programs provide a link from the more common package design programs to CAD formats (ie. DXF, DDES2, IGES, PDF). The structural designer should indicate what formats can be produced.

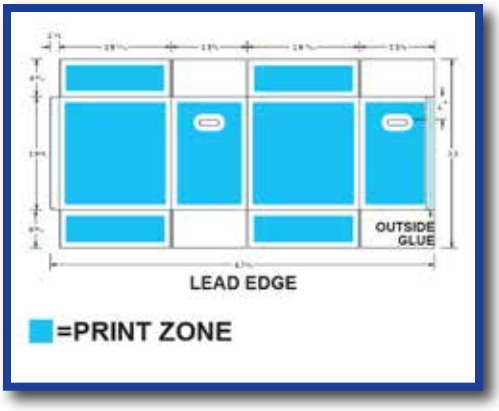
Measurement of Die Drawings
Indicate measurements on the electronic die line file including the dimensions and marks for the live print area.

3.2.2 Print Substrate

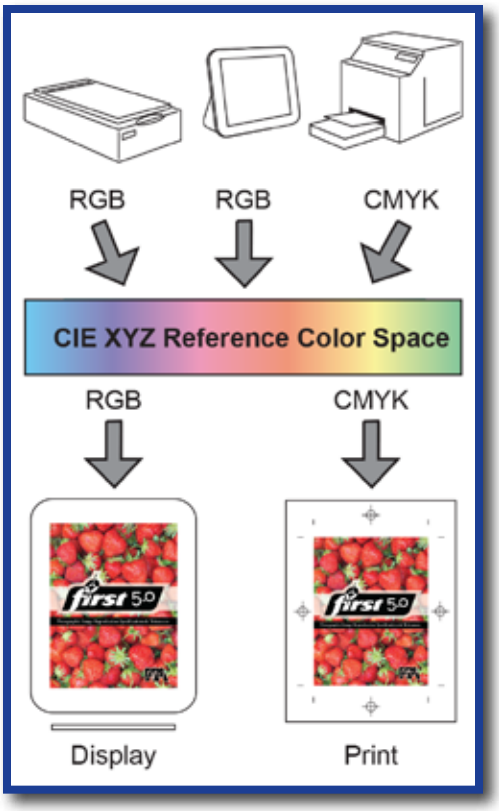
A sample of the substrate should accompany the project as soon as it is available. The whiteness, color and texture of the substrate should be considered. Printing on foil or colored paper, or printing white behind the graphics, will influence the printed color gamut. Often, the colors on the printed product will deviate from the approved contract proof if the proof is not made to reflect the substrate and/or printed white ink. White ink can appear darker (dirtier) and typically less opaque than white paper or film. In addition, various packaging substrates exhibit different color properties when printed. For example, some paper substrates will inconsistently absorb ink producing a 'muddier' image.

3.3 File Naming Conventions

Alternate versions of an electronic file should have separate and distinct names from the original version. File naming conventions for live, high-resolution images should be in accordance with the criteria of the collaborating parties. For example, workflow may dictate file names, SKUs, job numbers, or UPC references.



3.2.1 Template Layout: *It is the responsibility of the design firm to consider the non-print areas during the design process.*



3.4 Color Management: *Color Management Systems (CMS) are a collection of software tools that quantify and reconcile the color differences among monitors, scanners, image setters, proofers, and printing presses to ensure consistent color throughout the reproduction process.*

When naming a file, special characters such as "!", "@", "#", "$", "%", "/", "\" and "*" should never be used. Suffixes identify and distinguish formats and variations of working files. Examples of this are as follows:

asparagus.tif/asparagus.eps/asparagus.psd
or
abcdefgh.raw/abcdefgh.rgb/abcdefgh.cmyk

3.4 Understanding Color Management

The number of colors the average human eye can perceive is much larger than the number of colors that can be reproduced on workstation monitors, proofing devices and printing presses. An important key to understanding color management is to have a familiarity with the concept of color space. Digital cameras and scanners record images in the RGB color space, while proofing devices and film/plate setters output images in other color spaces such as: CMYK, or expanded gamut (ie. CMYKOGV).

Color Management Systems (CMS) are a collection of software tools that quantify and reconcile the color differences among monitors, scanners, imaging devices, proofers and printing presses to ensure consistent color throughout the reproduction process. Typically, the available color gamut diminishes as a job progresses through the production cycle. A CMS will map colors from a larger gamut and indicate what colors are achievable in a device with a smaller gamut, such as a printing press. This process allows for realistic expectations to be set during the proofing process.

Although digital tools can make the process seem as simple as a click of a mouse, converting from one color space to another is the first place where color fidelity and contrast can be significantly compromised. Once information is lost in the conversion process it cannot be restored. Even when sending an RGB image to a digital proofing device, there is an automatic conversion. The proof is actually a CMYK rendering that was run through default color management settings unless a more specific profile has been generated and applied.

Each color output method has limitations based on the type and number of colorants, the imaging engine, colorant delivery technology and the substrates being used. The more a designer understands these limitations, the better the design concept is managed. In the event that a known output source (a specific printing press) is identified prior to the creative stage, the photographer/designer may contact the prepress provider and request a color profile, referred to as an

"ICC (International Color Consortium) profile," for that print condition. An ICC profile of a standardized color space such as GRACoL 2006 can be utilized, allowing the prepress to synchronize press conditions back to this standard. With this profile, the designer can control the conversion process more effectively. Section 14.4 outlines a more comprehensive explanation of color management.

3.5 Viewing Artwork, Proofs & Printed Material

Application: A color-viewing booth is used to view printed images, proofs, or transparencies under a controlled and standard light source. Accurate and consistent visual perception of color requires the image to be viewed in a standard, chromatically neutral, controlled environment. If the designer, printer, prepress provider and customer standardize viewing conditions color discrepancies can be minimized.

Industry Standard: *FIRST* supports the standards set for proper viewing conditions in ANSI 2.30 1989. However, *FIRST* recognizes the light source may not be optimal for all print segments. The designer should consult with the customer to identify the preferred color viewing conditions.

ANSI 2.30 - 1989: Color Viewing Conditions	
Parameter	Specification
Lighting	5000° Kelvin Bulbs
Light Source	Color Rendering Index >/= 90
Viewing Surface	Luminance = 204 +/- 44 Foot Candles
Viewing Area Color	Neutral Gray: Munsell N8 or E
Angles of Illumination	Minimize Glare

Table 3.5

Instrument Agreement: The illumination used in the light booth should be the same as the equipment illuminant setting. For example, if the measurement equipment (spectrophotometer) is using D65 instead of D50, the light booth should use 6500° Kelvin bulbs (D65) instead of 5000° Kelvin bulbs (D50).

Communication: Regardless of the settings used, it is important that the settings are communicated and agreed upon by all parties receiving data measurements.

3.5 Standard Viewing Conditions: *Standardizing viewing conditions between the customer, designer, prepress provider and printer will minimize color discrepancies.*

3.6 Types of Proofs

All parties involved with a project must agree upon the process and terminology used to evaluate and communicate the design, including color. Specifically, every proof created throughout the workflow should be clearly labeled to communicate:

- The purpose of the proof
- The system or device on which it was created
- Whether the output device was profiled and which profile was used
- The proof's suitability for judging color

Types of Proofs

Concept Proof: The concept proof is common in the early creative stages of the project. It is used to capture input from all partners in the supply chain during initial design development and is also referred to as a "collaborative proof". This proof is typically not color profiled, therefore not used for matching color.

Color Target Proof: The color target proof is often the selected "concept proof". It represents the ideal color intent of the designer and client, independent of the print process or the ability of an individual press to achieve that color. Some of the color in this proof may not be achievable in the final print. To avoid rework costs and unachievable expectations downstream, it is helpful when possible, to produce this proof based upon the known or expected capabilities and color gamut of the anticipated printing process(es).

Comprehensive Proof (Comp)/Mock Up: The comp is formed to the shape of the final product and should indicate whether or not it is color accurate.

Profiled Contract Proof: This represents what the customer is expecting to receive off press. The profiled contract proof represents the customer's complete content and color expectations for the final printed product and is the basis for negotiations on project performance. It illustrates how the printed image is expected to look when reproduced on press and is an important quality control tool and communication device. It is profiled using a color management system (CMS) and is prepared using a profile provided by the specific printer or prepress provider and produced according to *FIRST* specifications. The contract proof does not have to be a dot-for-dot reproduction, but it must be an overall visual simulation of the expected print results. Therefore,

it must simulate the tone value increase (dot gain), color attributes, detail and contrast of the printed image. It must also contain a control target that is processed and imaged as part of the proof. The control target is used to verify accuracy and consistency throughout the design, proofing and printing process. It must contain specific screen values, which should be determined with the printer, for all colors printing dots (including vignettes). Although most digital proofing devices may not reproduce a conventional dot pattern, the tonal scales should be measured using a densitometer (or spectrodensitometer) in the dot area function. Each one of the tonal scales must equal the weight (dot area) identified by the press profile. Before a contract proof can be accurately used, the entire reproduction system must be characterized so that the proofing system is calibrated to match the printed result. Afterward, both press and proofing systems must be maintained for consistency and repeatability. Refer to Section 14.0 Process Color Calibration, for additional information on profiling.

A "Proof Compliance Cover Sheet" or label must accompany the contract proof submitted for color match at press once approved by the customer. It should identify the proofing product or system used and the company supplying the proof (contact name, telephone and fax numbers) as well as operator, date, job number and customer. The cover sheet must also contain information needed to verify the proof's compliance to the technical attributes required for that proofing type. Refer to Section 16.5 for more information. It is a best practice approach for all proofs to include a "Certificate of Result". It should include all pertinent measurements: density, dot area, Delta E (@ 100% and 50%), trap, print contrast, bar code scan analysis, etc. Proof densities should be within the printer's on-press density specifications. The Proof Compliance Cover Sheet and Certificate of Result can be combined into one document. Refer to Section 19.4.4 for *FIRST* guidelines on solid ink density by print segment.

Soft Proof: The soft proof consists of viewing a job on a color-calibrated monitor. It is used at any point in the product development process from a concept proof to a contract proof, depending on how well the system is calibrated. Components include a color consistent monitor and a color management system (CMS).

3.6a Profiled Contract Proof: *The contract proof must include a control target as well as template layout markings.*

3.6b Type of Proofs: *Before a contract proof can be accurately used, the entire reproduction system must be characterized so that the proofing system is calibrated to match the printed result.*

3.7 Process Control Test Elements

Application: If consistency and repeatability are important to the customer, then space must be allocated on the sheet, web, or package for appropriate process control test elements. Measuring at set-up and throughout the run enables the printer to produce repeatable, consistent and accurate results on every job. The test elements used to measure the print characteristics outlined in Sections 12.8 line work and 12.9 process color work, can be used for print optimization and fingerprint trials as well as on every "live" jobs to facilitate process control. The test elements included will vary based on the print characteristics that are pertinent to the job being printed and space constraints. Using similar test elements on the fingerprint trial as on live production jobs enables the printer to verify current print conditions and flag any changes since the press was last fingerprinted. Refer to Section 1.3 for a detailed explanation of print optimization, fingerprint, and characterization trials.

Placement: In order for the printer to deliver the desired print results, the customer and design team must include key test elements in the product design. Some packaging lends itself to placing test elements under flaps, in a glue zone, or on the waste matrix; other packaging requires the test elements to remain visible on the finished package. Therefore, each print application should determine where to place the individual elements to be monitored throughout the production run. The designer should consult with the printer and CPC on the necessary test elements and properly place them on the package/sheet/web when creating the design.

Format: Sections 12.8 and 12.9 describe the key print characteristics for both line and process work, and the test element used to measure each characteristic. Previous editions of *FIRST* have supplied the *FIRST* control target. Beginning with this edition, all of the test elements discussed in Sections 12.8 and 12.9 will be supplied for construction into a suitable control target, optimization or fingerprint test design for each print application. The test elements are available to all members and nonmembers through the FTA as an electronic file and are included in the *FIRST* Extras Download folder. Sample run targets are also included for review but should not be considered more than working examples of what can be used.

Test Element Construction:
Size: The designer must be careful to allocate enough room for the necessary elements of the process control target. ANSI/CGATS.5 (2003 Graphic Technology – Spectral Measurement

and Colorimetric Computation for Graphic Arts Images) provides the minimum and recommended apertures (and therefore minimum test element size) specified by line screen listed in the following table. While these guidelines are useful, the print application must also be considered. The minimum acceptable aperture may be larger for some print applications. The designer and prepress provider should confirm individual test element size with the printer. For direct-print corrugated, each test patch (solid or tint) should be 2-3 times the flute width to provide a stable measurement target.

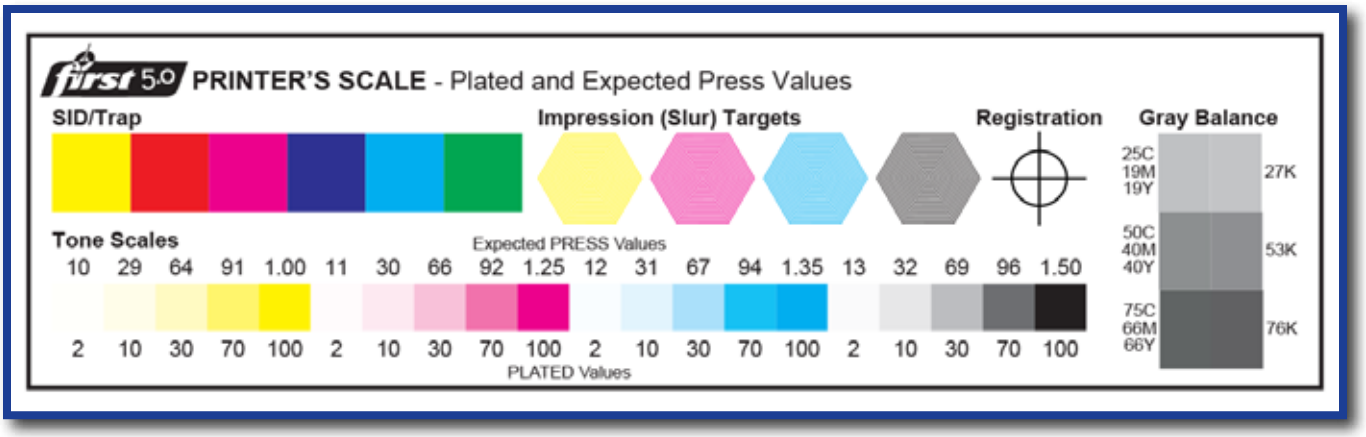
CGATS.5 Densitometer & Spectrophotometer Aperture Size					
Screen Frequency		Round Sampling Aperture (mm)		Non-Round Sampling Aperture (mm)	
Lines per inch	Lines per cm	Minimum	Recommended	Minimum	Recommended
65.0	26.0	3.8	5.7	11.3	25.5
85.0	33.0	3.0	4.5	7.1	15.9
100.0	39.0	2.6	3.9	5.3	11.9
120.0	47.0	2.1	3.2	3.5	7.8
133.0	52.0	1.9	2.9	2.8	6.4
150.0	59.0	1.7	2.6	2.3	5.1
175.0	69.0	1.4	2.1	1.5	3.5
200.0	79.0	1.3	2.0	1.3	3.0

Table 3.7

Imaging: All test elements must be imaged at the same time and with the same care and accuracy as the live job. The test elements must be imaged at the same line screen, angle, dot shape, etc. as the actual image. Surprinting, plate slugs, or plate build up of the test elements is not an accurate representation of the live image area and are, therefore, not acceptable.

Special attention must be given to imaging tone scales. Refer to Section 12.9.2 for a detailed explanation of the type of tone scales required on press trials and production runs.

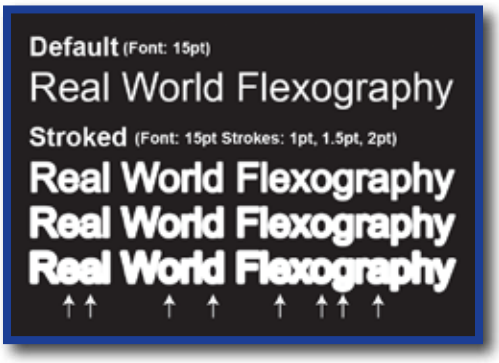
Process Control Test Elements: *FIRST* recognizes certain press configurations (narrow web) and product types (ie. poly bags, envelopes and newsprint) may not have large enough trim areas or glue zones to maintain all recommended process control elements throughout the production run. On these products, the test elements used to verify density and at least one dot



3.7 Process Control Test Elements

area should be placed on the live area of the product to remain consistent throughout the press run. The more test elements included on production jobs, the better equipped the printer is to achieve the desired print result. Ideally, these five test elements should be on all process color jobs:

1. Registration: color-to-color and print-to-cut
2. SID/Trap
3. Tone scales
4. Impression: anilox-to-plate and plate-to-substrate
5. Gray balance



4.1a Typography: *If type is stroked, swelled, or framed to increase its thickness, the "counters" may fill in. Type can be stroked to increase its thickness, but the "counters" (holes in letters such as a, d, o, e and R) may fill in, so care must be used.*

4.0 TYPE AND DESIGN ELEMENTS

4.1 Typography: Know the Print Process Capabilities

Due to the nature of the flexographic process, text that prints positive will tend to fatten while text that is reversed out will tend to fill in (lose fine lines and serifs) and become plugged. Therefore, when selecting fonts, care and attention is critical.

Tables 4.1a and 4.1b provide general guidelines by flexographic print segment. Because the minimum type size and rule width are print system dependent, the designer should confirm rule width and type style and size with the print provider.

When attempting to increase the weight of a serif font, it is not always effective to use the bold, heavy, black, or ultra versions. When fonts are changed to a heavier version, verify the text did not reflow. Type can be stroked to increase its thickness, but the "counters" (holes in letters such as a, d, o, e and R) may fill in, so care must be used. Refer to Section 12.2 for additional information on text elements.

Minimum Type Size: General Guidelines

Minimum type size is print system dependent; determine minimum type size with press fingerprint (ref. 1.3.2)

Segment		Substrate	Positive		Reverse		Printer Specific			
							Positive		Reverse	
			Serif	Sans Serif	Serif	Sans Serif	Serif	Sans Serif	Serif	Sans Serif
Wide Web	Preprint Linerboard	All	8 pt	6 pt	10 pt	8 pt				
	Combined Corrugated	White Top	8 pt	6 pt	10 pt	8 pt				
		Coated Paper	6 pt	4 pt	8 pt	6 pt				
	Folding Carton	All	6 pt	4 pt	8 pt	6 pt				
	Multiwall Bag	Coated Paper	8 pt	6 pt	12 pt	10 pt				
		Uncoated Paper	10 pt	8 pt	18 pt	12 pt				
	Film Products	Polyester	8 pt	6 pt	12 pt	10 pt				
		Polypropylene, Polyethylene & Metallized	8 pt	6 pt	10 pt	8 pt				
	Newsprint	Uncoated Paper	10 pt	7 pt	11 pt	10 pt				
Narrow Web	Paper Products	All	6 pt	4 pt	8 pt	6 pt				
	Film Products	All	6 pt	4 pt	8 pt	6 pt				
	Envelope	All	6 pt	4 pt	8 pt	6 pt				

Table 4.1a

Type Size Considerations

Serif vs. Sans Serif: Sans serif can be printed at a smaller type size than serif print. Sans serif type stays cleaner because it does not have the fancy details on the ends of the letters that tend to fill-in and run together at smaller sizes.

Positive vs. Reverse: Positive type can be printed clearly at a smaller type size than reverse type. Reverse type is more vulnerable to ink volume and impression settings resulting in type filling in and becoming illegible.

Single-Color vs. Multi-Color: Single-color type can be printed clearly at a smaller type size than multi-color type. Multi-color type size is restricted by the press registration tolerances.

Design Variables: Other variables that influence minimum type size includes: ink coverage, substrate absorbency and compression, etc.

4.1b Minimum Type Size: *Using type sizes below the printer's minimum recommended size can result in type filling and is not supported by FIRST.*

Minimum Rule Width: General Guidelines *Minimum rule width is print system dependent; determine minimum rule width with press fingerprint (ref. 1.3.2)*						
Segment		**Substrate**	**Positive Rule**	**Reverse Rule**	**Printer Specific**	
					Positive Rule	**Reverse Rule**
Wide Web	Preprint Linerboard	All	0.010"	0.015"		
			0.254mm	0.38mm		
	Combined Corrugated	White Top	0.013"	0.020"		
			0.33mm	0.51mm		
		Coated Paper	0.007"	0.010"		
			0.18mm	0.254mm		
	Folding Carton	All	0.006"	0.008"		
			0.15mm	0.20mm		
	Multiwall Bag	Coated Paper	0.007"	0.010"		
			0.18mm	0.254mm		
		Uncoated Paper	0.013"	0.020"		
			0.33mm	0.51mm		
	Film Products	All	0.007"	0.013"		
			0.18mm	0.33mm		
	Newsprint	All	0.007"	0.013"		
			0.18mm	0.33mm		
Narrow Web	Paper Products	All	0.005"	0.010"		
			0.13mm	0.245mm		
	Film Products	All	0.004"	0.008"		
			0.10mm	0.20mm		
	Envelope	All	0.007"	0.010"		
			0.18mm	0.254mm		

Table 4.1b

4.1.1 Registration Tolerance

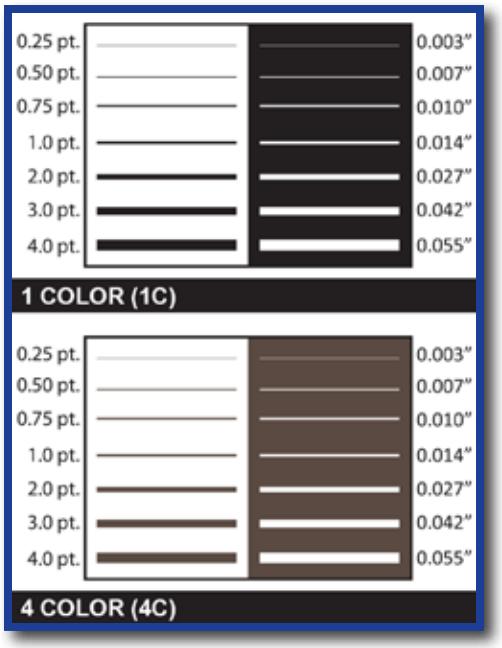
When one word is printed in one color and another word next to it is printed in a second color, register shifts can cause these two words to overlap or misalign. Due to this register shift, different color text should be more than twice the image trap dimension away from each other. Table 4.1.1 Total Trap Tolerance provides general trap guidelines by print segment. Confirm the trap tolerance with the print provider.

4.1.2 Process Color Type

When identifying colors for text copy, the designer should be aware which colors would be built from process and which will use dedicated spot colors. In general, text copy should be printed

Total Trap Tolerance: General Guidelines *Trap tolerance is print system dependent; determine minimum trap with press & print optimization (ref. 1.3.1) and press fingerprint trials (ref 1.3.2).*				
Segment			**Color-to-Color**	**Printer Specific**
Wide Web	Preprint Linerboard	Total Trap	</=0.0156" (1/64")	
			</=0.3969mm	
	Combined Corrugated	Between Station	</=0.0625" (1/16")	
			</=1.5875mm	
		Through the Press	</=0.125" (1/8")	
			</=3.175mm	
	Folding Carton	Total Trap	</=0.0156" (1/64")	
			</=0.3969mm	
	Multiwall Bag	Total Trap	</=0.0313" (1/32")	
			</=0.7938mm	
	Film Products	Total Trap	</=0.0156" (1/64")	
			</=0.3969mm	
	Newsprint	Total Trap	</=0.0156" (1/64")	
			</=0.3969mm	
Narrow Web	Paper Products	Total Trap	</=0.0156" (1/64")	
			</=0.3969mm	
	Film Products	Total Trap	</=0.0156" (1/64")	
			</=0.3969mm	
	Envelope	Total Trap	</=0.008" (1/125")	
			</=0.2032mm	

Table 4.1.1



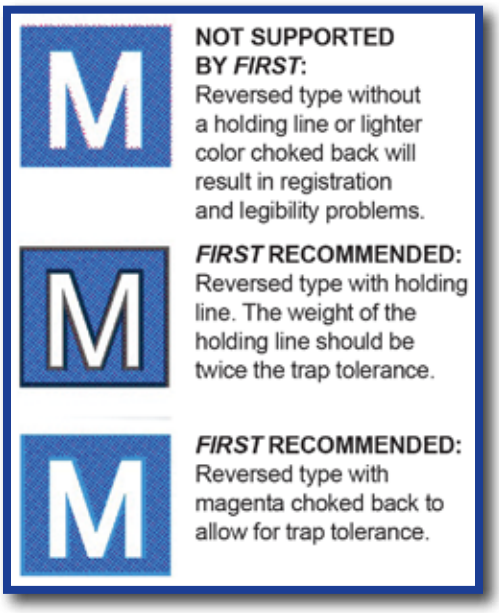
4.1c Line Weight: *The acceptable line thickness will vary depending upon whether the line is positive or reverse printing and whether it is a single color or multicolor line.*

4.1.1a Image Trap: *When trapping two colors, FIRST recommends "spreading" or enlarging the lighter color under the dominant color.*

with a single color or built from two process colors. As text size increases, a third process color may be introduced. Using more than one color to create text should be discussed with both the prepress and print providers to determine capability.

4.1.3 Process Reverse/Knockout

A holding line should be used when type is reversed and comprised of more than one color. The holding line should be a single, dark color to hide any slight misregistration that is likely to occur during the printing process. The weight of the holding line should be twice the registration tolerance for the print segment as identified in Table 4.1.1 Total Trap Tolerance. Because the values



4.1.3 *FIRST* Process Reverse/ Knockout Recommendations

4.1.5 Drop Shadow: *If inappropriate image trap tolerances are applied, objectionable type will result.*

provided are general guidelines, the designer should confirm the trap requirements with the prepress and print providers.

If a holding line is not used, the darkest or predominant color should be made full size and the remaining color must be choked back the width of one row of dots as determined by the screen ruling. If possible, the background color should be limited to one color.

4.1.4 Line Reverse/Knockout

Reverse copy should be limited to one color. If copy is to be reversed from two or more colors, a holdback or choke must be created for register. Refer to Table 4.1.1 Total Image Trap Tolerance and the specific print segment. Because the values are general guidelines and print system dependent, the designer should confirm the trap requirement for reverse text with the prepress and print provider.

4.1.5 Drop Shadow

If a drop shadow is abutting another color, it will need to trap. Be sure to move the drop shadow by more than twice the specified image trap for the appropriate print segment. Refer to Section 4.1.1 for segment specific guidelines on total trap tolerance.

It is best to use drop shadows only for larger type, unless the color selected for the type is darker than the color it is abutting; remember, these abutting colors will be required to overprint each other to form the image trap.

Drop shadows that fade should be limited to a single color to allow special screening to support the light tones of the gradient. Refer to Section 7.5 for additional information on blends/ vignettes/gradations.

4.1.6 Spaces and Tabs

Always use tabs rather than multiple spaces to position text. If a font change is required, the spaces will change size, while tabs will not change.

4.1.7 Text Wrap

Most programs will wrap text around imported images. If an image is replaced in production, text will reflow if automatic text wrapping features were used to define the text wrap area. Use the polygon tool or other shape to define the text wrap or run around instead of letting the text automatically wrap around the image. When the high-resolution image is placed into the file, the program may see its edges differently and rewrap the type.

The prepress provider will have to rebuild the desired wrap to get the text to reflow the same way.

4.1.8 Fonts

It is possible for a font to have the same name but exist in different file formats. For example, two different companies that make the font (sometimes called foundries) may name the font the same. Substituting a different font file format may cause the text to reflow and change the original design.

Fonts may be selected and used from a variety of sources. It is possible for a font to vary in appearance or performance in downstream operations based upon its source. For that reason, it is recommended that, in addition to the original file, a copy of the file be supplied with type converted to outlines.

PostScript/Type 1

A PostScript font is a Type 1 font and is created from two components: a printer font and a screen font. The printer font contains the outlines that allow the output device to accurately render the font in any size. The screen font allows the font to be viewed on a computer screen (monitor). Type 1 fonts require both pieces to work properly. PostScript fonts are the de facto standard for professionals in the creative and print environments.

OpenType Fonts

There are several advantages to the OpenType format. First, as with TrueType, the entire font is housed in a single file. Second, this file is cross platform, the same file can be used on a Mac or Windows platform with consistent results. Third, an OpenType font can contain either PostScript or TrueType outline data. Lastly, OpenType can support Unicode information, which can contain thousands of characters including high quality ligatures, swash glyphs and other advanced typographical features. This is a significant benefit over PostScript Type 1, which is limited to 256 characters.

Manufacturers

Sometimes downstream companies (such as prepress providers and printers) working on a design file may not have easy access to fonts used. If so, the design firm (or whoever is creating the content) should convert these fonts to outlines or paths.

Styles of Fonts

In some applications, there is a style menu with type attributes such as bold, italic, outline, shadow, small caps and all caps. Do not use this feature. Use only the actual font, such as

4.1.8a Font Utility Programs: *There are many font utility programs to help manage fonts effectively.*

4.1.8b Outline Effect: *To create an outline only, use a vector program, and give the type a stroke in the desired color, and a fill of 'none' or 'white'. Be sure the stroke is at least twice the specified image trap for the applicable print segment.*

Times Bold, rather than Times with the bold attribute. When using attributes, results vary depending on the RIP, printer drivers and application being used. Selecting style attributes usually creates a pseudo version of the typeface, which is a degradation from the original font design. Many newer RIPs, printer drivers and applications ignore pseudo commands and simply use the plain printer font. For example, if the italic command from the style menu is selected for Humanist 541 Condensed Bold (which has a corresponding printer font), the font will display as condensed bold italic on screen but will typically not print in italics.

Outline Effect
To create an outline only, use a vector program and give the type a stroke in the desired color and a fill of 'none' or 'white'. To stroke only the outside, use a copy of the type with no stroke and a white fill exactly on top of the stroked copy. Be sure the stroke is at least twice the specified image trap for the applicable print segment. Refer to Table 4.1.1 for print specific total trap tolerance guidelines.

Proprietary Fonts
Fonts designed for a specific client or job are considered proprietary and should be included with the submitted files for the job.

Other Font Architectures
Multiple Master, TrueType GX and other font architecture should be avoided. If their use is unavoidable, confirm the prepress provider can work with the required font architecture.

Poorly Written Fonts
Poorly written fonts may be node heavy (built with too many points), have bad kerning pairs, or incomplete character sets. They should be avoided. If there is a typeface that absolutely must be used, test it first through an imaging device. If using a font that is not available from the output supplier, convert it to outlines. If the font is public domain, send it with the files.

Supplying Type Fonts
To avoid copyright infringements or unauthorized use of type fonts, the licensing responsibility resides with both the creator of the file and the company outputting the file. The creator must check with the supplier of the fonts to confirm that the license held allows the fonts to be used by both the creator and the output supplier.

Converting Type to Outlines
A common practice for handling type is to convert type to outlines in order to prevent font problems and lock content. However, this makes the text no longer editable and may alter its appearance. When converted to outlines, small type may appear heavier and should be reviewed prior to the final conversion.

- When a file with outlined type is supplied, it is advisable to also send a copy of the original file (including fonts) prior to outlining the type
- Electronic files (.ai, .eps, .psd) containing text that are to be placed in another document, should also have all text converted to outlines (fonts in placed images often are not reported as missing until the file is RIPed)
- Converting fonts to outlines helps identify poorly written or corrupt fonts

4.1.8c Converting Type to Outlines: *Type converted to outlines minimizes font problems but cannot be edited.*

4.2 Custom and Special Colors

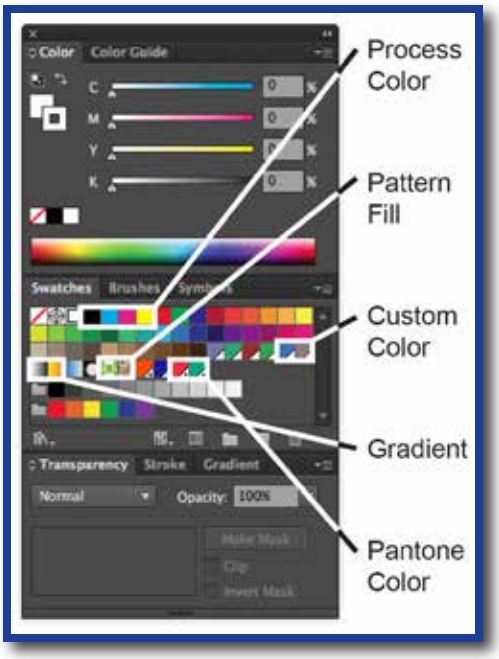
"Custom Colors" as defined in a file should represent only the actual inks, or tints of those inks, that will be printed.

A designer should specify or confirm the actual colors that will be used on press. Many products are printed with both spot colors and process colors. Correct identification of "custom colors" versus colors built from process inks, can expedite the production process. A file containing 15 or 20 custom (spot) colors is not printable; therefore, requires the prepress provider to attempt to interpret the intentions of the designer.

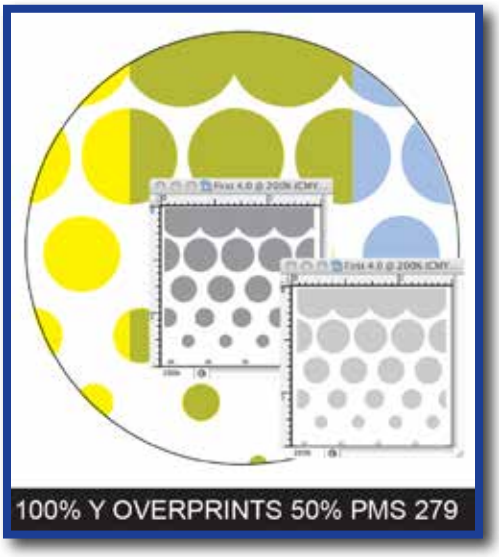
In some programs, the designer can specify whether a custom color is meant to be created using a CMYK (process color) mix, or single custom color ink. The designer must be sure the color specification is clearly indicated. On the annotation layer, it must be specified how each color is created. Using industry standard ink color designations such as Pantone®, TOYO®, etc., will assist with proper color communication and allow standard colorimetric data/values to confirm the final match.

CMYK equivalents of custom colors do not always match. If the custom color is to be built with process colors (CMYK blend), the prepress provider must know if they are expected to use exact percentages or if they are responsible for verifying that the necessary tints are used to match as close as possible to the custom color callouts.

It is not uncommon for special colors to be used in process illustration, either as an enhancement or as a replacement for one of the traditional process colors. In these cases, special separation and proofing techniques are required.



4.2a Custom Colors: *Most products are printed with colors other than CMYK. Correct usage of "custom colors" can expedite the production process.*



4.2b Color Proof vs. Production Files: *If a file includes custom colors that overlap to create a third color, produce two files: One file to produce a color comp proof, and a second file for production plates.*

Differentiating White Ink from Unprinted Areas
If white is to be an ink, a custom color is created and used to specify which areas print white, as opposed to not printed. This color should be named "white ink" in the color palette. To further distinguish areas that are to be left unprinted, create an additional color named "Unprinted" or "Clear." Either the white ink or the unprinted area needs to be filled with a differentiating tint.

Custom Color Proofing: Color Proof Files vs. Production Files
If a file includes spot colors that overlap to intentionally create a third color, it is necessary to set the top color transparency to "multiply". This will display a created third color.

The best way to predict the third color result of overprinting two spot colors is to have the printer (or the ink supplier) create overlapping ink drawdowns of the two inks. If it is necessary to create a proof that accurately represents the overprint, it may be necessary to create a separate proofing file with the color of the overprinting area defined by CIELab data obtained from the overlapped portion of the ink drawdowns.

4.3 Bar Code Design Considerations

Formerly, the Uniform Code Council (UCC) was responsible for managing the bar code system in the USA. The UCC is now the GS1 US organization. GS1 US manages the GS1 system and assigns GS1 company prefixes to companies/organizations in the USA. The most common use of a GS1 assigned company prefix is the creation of UPCs (Universal Product Codes), which contain a 12-digit Global Trade Item Number (GTIN).

The GS1 US publishes the following electronic data interchange guidelines based on the ANSI ASC X12 standard:

- Industrial/Commercial EDI
- Uniform Communication Standard (UCS), used in the grocery industry
- VICS EDI, used in the general merchandise retail industry

The GS1 US is also the code manager for the United Nations Standard Products & Services Code (UNSPSC). The UNSPSC provides an open, global, multi-sector standard for classification of products and services. Identify applicable commodity codes on UNSPSC website (www.unspsc.org).

For more information on prepress and print considerations for bar codes, refer to Sections 12.8.4 and 19.3.4 respectively. The GS1 US & UNSPSC contact information is included in Appendix A.

4.3.1 Bar Code Specifications

Bar code print specifications are produced by combining three types of related specifications:

1. Application Standards are published by accredited standards organizations.

Bar codes are used in many different applications with different scanning conditions. For example, one application involves packaging for retail check out lanes while another application is for coding shipments for conveyor lane routing in distribution centers. The specifications for bar codes used in these two applications are different because the conditions for scanning the bar codes are different. Accredited standards organizations (refer to Appendix A) provide specifications in the form of guidelines and standards to assist in:

- Selecting the bar code type to be used
- Structuring the data inside the bar code
- Defining the printed human-readable information that is inside the bar code
- Selecting bar code size within the acceptable range
- Understanding where the bar code should be placed on the product
- Defining the minimum print quality requirements

2. *FIRST* Print Specifications prescribe a minimal level of capability for all compliant printers.

These specifications fall within the acceptable limits of the appropriate Application Standard for the bar code being printed and will assist in:

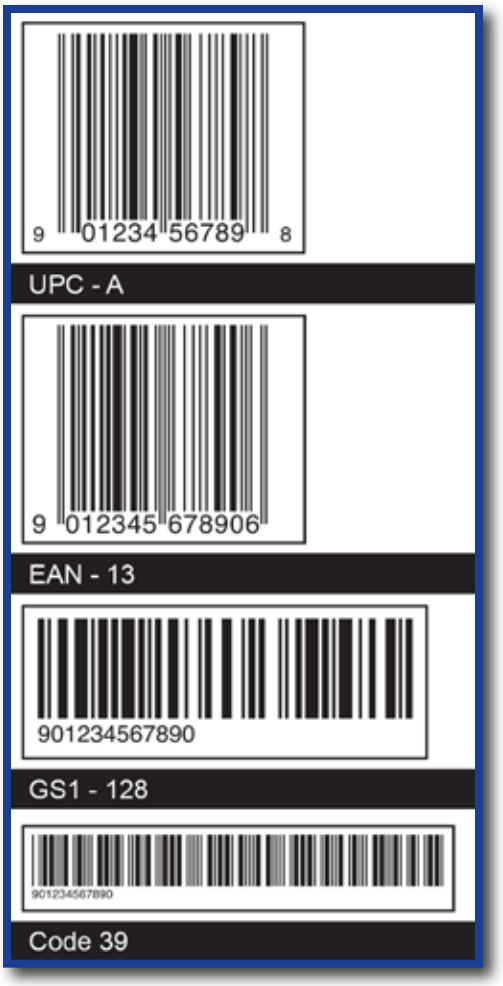
- Determining the minimum size for a bar code depending on the printing press and substrate
- Identifying the preferred bar code orientation given the direction the web or sheet will travel

3. Job Specifications should be published for film or plate output.

These specifications should assist in:

- Identifying optimum film/plate output resolution
- Determining bar width reduction (BWR) required by the specified print conditions.

4.2c The Pantone Matching System: *The Pantone Matching System (PMS) is a common way to specify custom colors.*



4.3.2a Bar Code Type: *The type of bar code depends on many factors including where it will be scanned and how it will be printed.*

4.3.2 Designer Responsibilities

The designer, prepress provider and printer all bear responsibility for producing quality bar code symbols. Designers play a critical role in assuring a bar code conforms to all applicable Application Standards and *FIRST* Print Specifications. When creating an FPO (for position only) symbol, the designer must determine and communicate the symbol type and size, the color(s) used to print it, as well as the location and orientation on the printed product. Refer to Section 12.4 for prepress bar code considerations and Section 19.3.4 for bar code print considerations.

Because designers are often involved in the substrate and color selection process, as well as the bar code placement, orientation, and size determination, they should be aware of the design parameters for bar code performance. The designer should consider if the current design specifications might create scanning problems. Common design revisions requested because of the selected substrate or color include: a larger symbol, a different symbol orientation, an extra layer of background ink, or a dedicated bar code print station

1. Selecting the Appropriate Symbology

The type of bar code selected depends on many factors including the Application Standard, where it will be scanned, and how it will be printed. The designer must defer to the customer to identify which bar code type to use. Some of the common bar code types printed flexographically include:

- UPC--Version A and Version E (including add-on and composite component)
- GS1-128 (formerly known as UCC/EAN-128)
- EAN 8 (including composite component)
- EAN-13 (including add-on and composite component)
- ITF-14 (Interleaved 2-of-5 also referred to as Code 25)
- Code 128 (full ASCII character set supported)
- Code 93 (full ASCII character set supported)
- Code 39 (supported with and without check code)
- MSI (including option to display data)
- JAN 13 (variation of EAN 13 used in Japan)
- JAN 8 (variation of EAN 8 used in Japan)
- Plessey (hexadecimal character set)
- Telepen (including compressed numeric mode)
- 2D Codes
- Codabar (both USS and Traditional format supported)
- USPS 4CB (United States Postal Service Intelligent Mail Barcode)

2. Designing for Printability and Symbol Contrast

Substrate Considerations

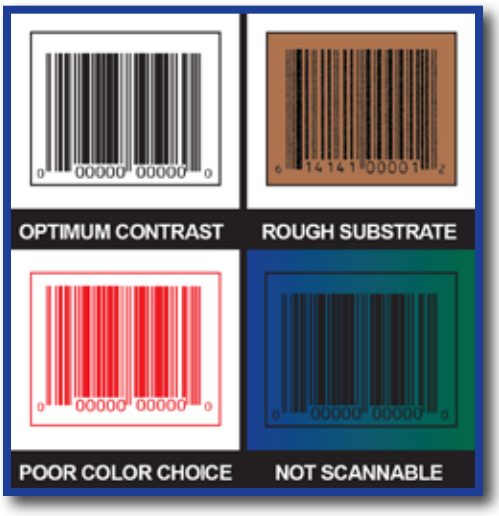
Texture & Porosity: Bars and spaces are most accurately produced on smooth substrates with high ink holdout. The rougher, more textured and more porous a substrate, the greater the potential for printing bars with voids and/or printing specks in the spaces, either of which can reduce scanning rates. Textured and more porous stocks also tend to increase bar edge roughness, bar growth and bleeding. Any of these substrate characteristics can negatively influence scanning rates.

Color & Transparency: Bar codes scan most successfully with an opaque white background that provides white spaces and quiet zones with the maximum reflectance possible. When printing on a transparent or colored substrate, a solid light-colored (white is optimum) background, with maximum opacity, is recommended in the area where the bar code is to be located. Special consideration for the background ink formulation and press setup (anilox, double bumps of background color, mounting material selection, etc.) may be necessary in order to achieve maximum opacity.

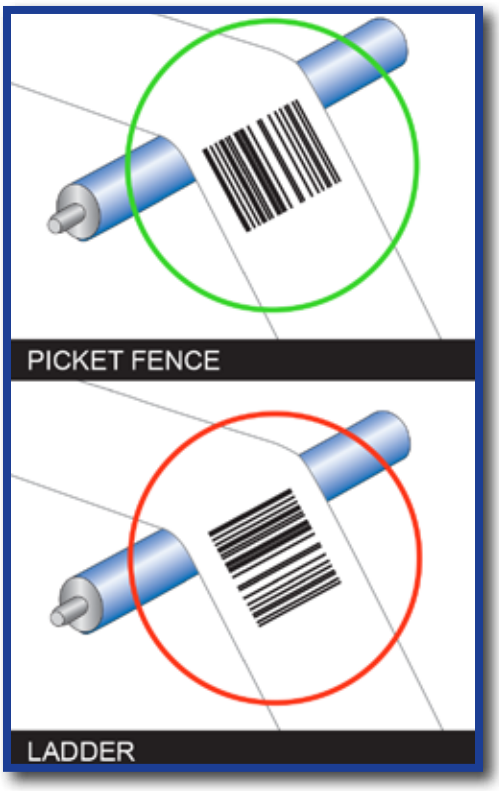
Color Considerations

The optimum bar code color combination is opaque black ink for the bars and opaque white substrate or ink for the background. Bars printed in opaque black, dark blue, or dark green and backgrounds (spaces and quiet zones) printed on an opaque white material or on a white, red, orange, pink, peach, or yellow ink generally scan successfully. It is important to remember that colors with acceptable ANSI/ISO Symbol Contrast on an opaque substrate may not be acceptable on an opaque substrate of another color or on a translucent or transparent substrate. When printing on a transparent substrate or colored substrate, a solid light-colored (white is optimum) background with maximum reflectance is recommended in the area where the bar code is located. It is recommended that the bar code symbol not be placed on a printing plate used to print a large solid ink coverage. Printing plates that print large solid areas typically have requirements for extra impression and higher ink volume, which are not conducive to printing bar codes. Ink color specifications should be evaluated individually for different substrates.

Bar codes require bars with sharp edges in order for the scanner to perform successfully. Because scanning accuracy is reduced when variation in register occurs, the bars comprising a bar code must be printed in one color, using a solid line image on a single print station. Refer to Sections 12.4 and 19.1.3 for more detailed information on bar code color considerations.



4.3.2b Color Considerations: *The optimum bar code color combination is opaque black ink for the bars and opaque white substrate or ink for the background.*



4.3.2c Bar Code Orientation: *Bar code orientation is critical. The left figure illustrates the bars on the UPC symbol traveling in the machine direction. The right figure illustrates the bars running across the press direction.*

3. Determining Optimal Size and Location

Location Considerations

Bar codes are placed in different locations based on the shape of the product and where the product will be scanned. The designer should check with the product manufacturer for placement specifications based on these factors. The designer should also consult with the package engineer to ensure the symbol will not be creased, scored, sealed, or folded. Placement of the codes in these areas may cause the ink to crack, producing voids in the bars or spots in the symbol background. Correct placement of the bar code is crucial to meet regulations and for accurate scanning.

Orientation Considerations

It is strongly recommended that the bars in a bar code be printed parallel to the direction the web is moving through the press to avoid slurring. In certain situations, the bars in a bar code must be placed in the transverse (across the web) direction. In these cases, the printer should be consulted. It may be necessary to use a larger symbol to meet the minimum print quality requirements specified by the appropriate application standard. If print slur occurs with the symbol printing in the machine direction, the bars grow in length only and are still scannable; however, if the symbol is printed in the transverse direction, the bars will grow in width, likely causing the code on the printed product to fail to meet specifications. Printing bar codes in the transverse direction is not supported by *FIRST*. Refer to Section 12.4 for additional information.

Size Considerations

The area reserved for a bar code depends on several interrelated specifications. First, it is important to know what symbol type is specified based on where the product will be scanned. For example, if the product will be scanned at the retail POS (point of sale), an EAN/UPC symbol is typically specified. After the symbol type is known, it is important to know the allowable range of dimensions (height and width) for the symbol, including the human-readable text associated with it. It is important to note that certain symbols have a fixed relationship between their height and width, while others have minimum heights specified.

Bar code truncation is a reduction of a symbol's height below the application standard or symbol specification and is not supported by *FIRST*.

Minimum Bar Code Magnification: General Guidelines *Bar code magnification is print system dependent; determine optimum magnification with press fingerprint (ref 1.3.2)*			
Segment		**Magnification** *(Machine Direction)*	**Printer Specific Magnification** (*Machine Direction*)
Wide Web	Preprint Linerboard	100%	
	Combined Corrugated *(flute dependent)*	UPC: 110% - 200% ITF -14: 100%	
	Folding Carton	100%	
	Multiwall Bag	115%	
	Film Products	100%	
Narrow Web	Paper Products	80%	
	Film Products	100%	

Table 4.3.2

All compliant printers will be able to meet the minimum bar code sizes (outlined in the table 4.3.2). However, the smaller the symbol's size, the tighter the tolerance on bar width growth; therefore, larger symbols are better. Printing a bar code below the minimum size specified by the bar code application standards is not acceptable. Refer to Sections 12.4 and 22.2 for more detailed information on bar code size considerations.

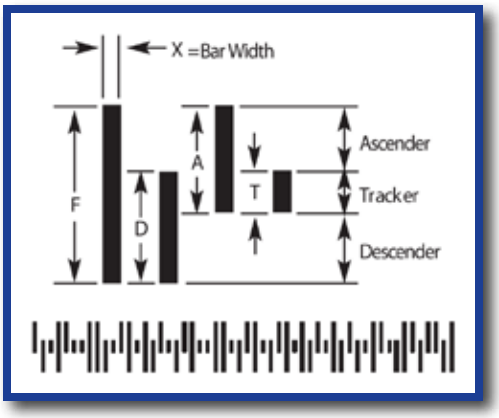
Quiet Zone Considerations

The quiet zone is the area, free of printing, that precedes the left bar and follows the right bar in a bar code symbol. The quiet zones allow scanners to detect when a bar code starts and stops. Quiet zones are based on multiples of the symbol's narrowest element width (X-dimension). Minimum quiet zone specifications depend on the symbol specified. For example, the UPC-A symbol requires a quiet zone of 9 times the "X" dimension on each side, while a ITF -14 symbol requires a quiet zone of 10 times the "X" dimension on each side.

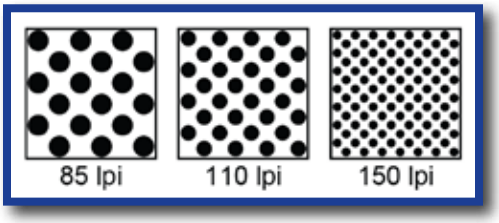
4.3.3 USPS Intelligent Mail Bar Code

The Intelligent Mail Bar Code (CB4), used by the United States Postal Service (USPS), is a 4-state bar code that consists of 65 bars. The information in this section was obtained from the United States Postal Service Intelligent Mail Bar Code specification USPS- B-3200C. For additional information, reference the USPS-B-3200C specification from the US Postal Service. Contact information is included in Appendix A. Refer to Sections 12.4 and 22.3 for additional information.

4.3.2d Quiet Zones: *Quiet zones allow scanners to detect when a bar code starts and stops. Minimum quiet zone specifications depend on the symbol specified and its magnification.*



4.3.3 USPS CB4 Bar Code: *The Intelligent Mail Bar Code (CB4) is a 4-state bar code that consists of 65 bars.*



4.4 Screen Ruling: *The higher the line screen ruling, the more dots per square inch and the smaller the diameter of each dot. Generally, dot gain increases with higher line screens.*

Dimensional Parameters

Horizontal Dimensions: The overall bar code width must be within 20-24 bars per inch

Vertical Dimensions: The overall bar code height must be within 0.134" (3.4mm) and 0.23" (5.84mm)

Quiet Zone:
- Minimum 0.040" (1.02mm) above and below bar code
- Minimum 0.125" (3.18mm) on either side of bar code

Specifications for Human-Readable Information

Horizontal Position: The human readable information, when required, shall be printed so that the left edge of the leftmost digit aligns with the leftmost bar of the Intelligent Mail Bar Code.

Vertical Position: When-human readable information is required, it shall be printed immediately above or below the bar code but outside of the quiet zone. The human-readable information shall be at least 0.04" (1.02mm) above or below the bar code but not more than 0.50" (12.7mm) above or below the bar code. No other printing is allowed between the bar code and the human-readable information.

Content: When human-readable information is required, it shall consist of the 20-digit tracking code and the 5-, 9-, or 11-digit routing code, if present. The tracking code shall include a space between each data field. When the bar code contains a routing code, the 5-digit ZIP code, the 4-digit add-on and the remaining 2 digits shall be separated with a space between data fields.

Font Specification: The human-readable information, when required, shall be printed using a sans serif font and a minimum 10 to 12 point type size.

4.4 Screen Ruling

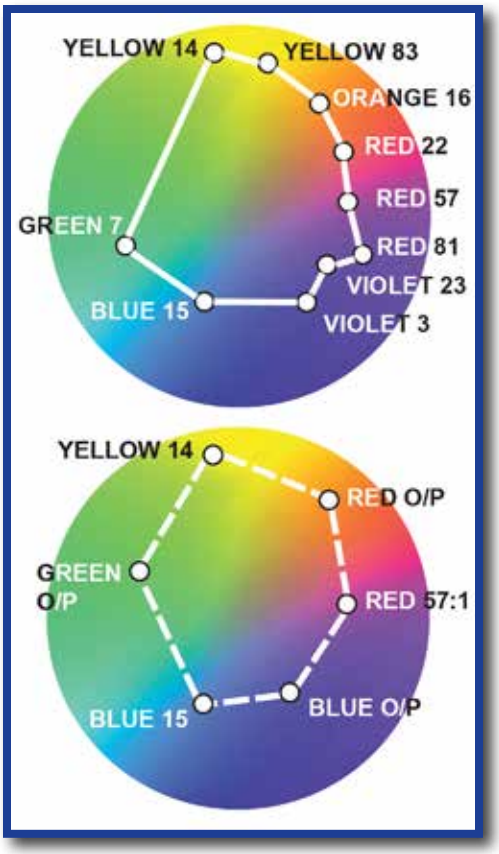
Screen rulings vary based on imaging method, plate material and print conditions (such as press width, anilox configuration and substrate). The range for both conventionally and digitally imaged plates is determined by print and substrate constraints. The graphics and process images to be used should be selected carefully because some print conditions require lower screen rulings. The screen ruling should be specified by the printer and considered by the designer. Table 4.4 provides general line screen guidelines by market segment and substrate category. The designer should consult the prepress and print provider to determine the optimum line screen for a specific design.

Line Screen (lpi & lpcm): General Guidelines *Line screen is print system dependent; determine optimum line screen with press fingerprint (ref 1.3.2)*					
Segment		**Substrate**	**Sheet Photopolymer**	**Liquid Photopolymer**	**Laser Engraved Rubber/ Cured Polymer**
Wide Web	Preprint Linerboard	SBS Board	110 - 133 lpi (43 - 52 lpcm)	85 - 110 lpi (33 - 43 lpcm)	110 - 133 lpi (43 - 52 lpcm)
		Uncoated	100 - 133 lpi (39 - 52 lpcm)	85 - 110 lpi (33 - 43 lpcm)	100 - 120 lpi (39 - 47 lpcm)
	Combined Corrugated	All	55 - 110 lpi (22 - 43 lpcm)	55 - 85 lpi (22-33 lpcm)	55 - 110 lpi (22 - 43 lpcm)
	Folding Carton	SBS Board	120 - 150 lpi (47 - 59 lpcm)	85 - 110 lpi (33 - 43 lpcm)	110 - 133 lpi (43 - 52 lpcm)
		CRB Board	110 - 133 lpi (43 - 52 lpcm)	100 - 120 lpi (39 - 47 lpcm)	110 - 120 lpi (43 - 47 lpcm)
	Multiwall Bag	Coated Paper	75 - 120 lpi (30 - 47 lpcm)	65 - 110 lpi (26 - 43 lpcm)	75 - 110 lpi (30 - 43 lpcm)
		Uncoated Paper	65 - 85 lpi (26 - 33 lpcm)	65 - 100 lpi (26 - 39 lpcm)	65 - 100 lpi (26 - 39 lpcm)
	Newsprint	All	85 - 100 lpi (33 - 39 lpcm)	85 - 110 lpi (33 - 43 lpcm)	N/A
	Film Products	All	110 - 133 lpi (43 - 52 lpcm)	85 - 120 lpi (33 - 47 lpcm)	85 - 133 lpi (33 - 52 lpcm)
Narrow Web	Film Products	All	110 - 133 lpi (43 - 52 lpcm)	N/A	85 - 133 lpi (33 - 52 lpcm)
	Paper Products	Coated Paper	133 - 175 lpi (52 - 69 lpcm)	N/A	110 - 133 lpi (43 - 52 lpcm)
		Uncoated Paper	110 - 133 lpi (43 - 52 lpcm)	110 - 133 lpi (43 - 52 lpcm)	100 - 120 lpi (39 - 47 lpcm)
	Envelope	Coated Paper	133 - 175 lpi (52 - 69 lpcm)	N/A	N/A
		Uncoated Paper	85 - 133 lpi (33 - 52 lpcm)	N/A	N/A

Table 4.4

4.5 Tints

When tints are used, the values are adjusted during output using a print curve to compensate for the dot gain experienced in the printing process. A 2% minimum dot typically prints between 8% to 15%, while a tint value of 75% may print as 100%. Consult the print or prepress supplier for more information about profile specific dot gain considerations. The prepress provider applying the cutback curves can provide guidance on dot gain compensation.



4.6 *FIRST* Ink Pigments: *The top graph illustrates the gamut created using FIRST recommended line pigments. The bottom graph illustrates the color gamut using FIRST process inks.*

4.6 Ink Colors

A designer should collaborate with the printer and consumer product company to determine how many colors are available for a product line. Many products are printed with additional colors other than CMYK. Transparent and/or opaque inks may be used and must be identified and listed in the color palette. The characteristics and print sequence of the inks used may require special considerations during the prepress phase.

In an effort to improve color matching across the product line, twelve ink pigments have been identified by color index (CI) name and number and recommended by *FIRST*. These twelve pigments are combined to create custom line colors (ie. PMS 186 or "Al's Soda" Red). These pigments are recommended because they provide the largest color gamut with reasonable fade resistance required by most packaging applications. Standardizing ink pigments improves the consistency of the color match between press runs and between printers while minimizing metamerism. This results in a more cohesive product appearance on the store shelf. When these twelve pigments are plotted to create a color gamut, colors within the gamut can be reasonably matched. When a designer or consumer product company selects a color that falls outside of the gamut, the printer will not be able to achieve an accurate color match using *FIRST* pigments. In such cases, the printer may opt to include additional pigments that expand the color gamut in order to achieve the desired color. However, due to limitations in the pigments available for a given ink chemistry or application requirement, it is not always possible to match a color precisely. Any combination of ink pigments, proofing/printing methods and substrates result in color matching limitations. The designer must consider the potential color match limitations of the inks, printing method and substrate specified for the project. Refer to Sections 20.2.2 and 20.2.3 for additional information on *FIRST* recommended pigments.

In Image 4.6, the *FIRST* recommended pigments for line inks have been proofed and plotted to create a color gamut (top graph). The bottom graph depicts the printable gamut using *FIRST* recommended process inks. Printers should proof *FIRST* pigments on substrates typically printed and, using a spectrophotometer, plot the color gamut that will best predict their ability to match color on press. All colors are dependent on the substrate to be printed. The designer and consumer product company should see drawdowns of the specified color match on the intended substrate before any job is approved for prepress. Substrate substitution in this approval process is not recommended.

5.0 DIGITAL PHOTOGRAPHY

In this section, workflows and points of measurement are identified to ensure that the aesthetic integrity of the photographer's digitally captured image is maintained. In addition, the responsibilities for handling, processing and repurposing must be clearly identified and communicated, regardless of who works with the digital file.

5.1 Digital vs. Conventional

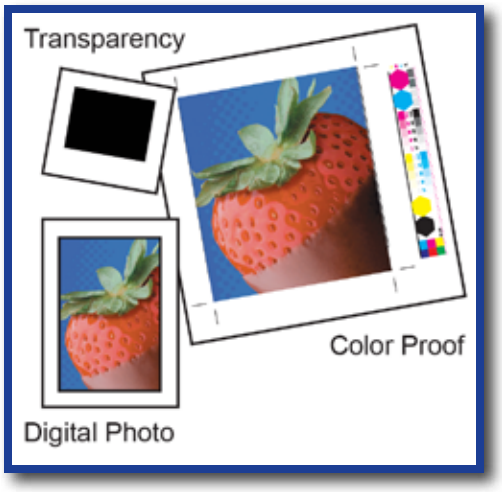
An RGB image must be converted to CMYK in order to provide a color proof. The detail and vibrancy of an RGB captured image is greater than a converted CMYK image due to differences in the respective color gamuts. The photographer will generally review a digitally captured image on a computer display in RGB; however, color proofing is accomplished in CMYK which has a much smaller color gamut. Variability is introduced during the RGB to CMYK conversion and could be significantly different when performed by two different people using two different look-up tables or color profiles.

Refer to Section 5.3 for camera setup recommendations and Section 5.7 for image capture and communication of digital photos provided in RGB or CMYK color space. The camera setup recommendations are intended to capture the full range of the item being shot and do not consider special photographic effects or stylized techniques that may be desirable and intended, but cannot be achieved with strict adherence to the highlight, shadow setting and grayscale aim point. In this instance, special comments should be added to the file stating that a creative license has purposely been taken. Section 3.6 describes the accompanying color proof(s) to be identified according to *FIRST* recommendations.

5.2 Digital Proofs for Digital Photography

The digital proof generated from the digital photograph is often the color target proof. This proof represents the ideal layout and color intent of the designer and client, independent of the print process or the ability of the individual press to achieve it. Some of the color in this proof (and photograph) may not be attainable in the final print. To avoid rework costs downstream, it is helpful, when possible, to produce this proof based upon the known or expected capabilities and color gamut of the anticipated print process. In order to better predict the printed result, the designer or production designer should consider variables such as:

- Line screen
- Substrate
- Ink densities



5.1 Digital vs Conventional: *An RGB image must be converted to CMYK in order to provide a color proof.*

- Ink hue
- Color rotation
- Special color simulation
- Dot structure
- Screen angles

To define the variables listed, the designer should contact the printer and/or prepress provider to obtain these and any other job-specific requirements including the press profile. Refer to Section 3.5 for additional information on proofing requirements.

It is always helpful to include a print control target which has test elements such as: color patches of the minimum dot %, 10%, 30%, 70% and solid ink density for all inks to be printed. A highlight and shadow gray should also be incorporated into the control target to assist in the evaluation of color balance. Refer to Sections 4.9, 19.2, 19.3 and 19.4 for additional information on *FIRST* recommended process control test elements.

5.3 Camera Setup Recommendations

Photographer's Recommended Computer (shooting) Settings

- Photoshop Working Space (RGB): Adobe RGB (1998)
- Photoshop Color Management Policies: preserve embedded profiles
- Recommended (Calibrated) Display Settings: Gamma 2.2, White Point 6500K

Photographer's Recommended Camera Settings

- Recommended Color Space: Adobe RGB (1998); many cameras default space is sRGB
- Recommended Capture Settings: raw or raw + largest TIFF available

Black Settings

In the RGB color space, a highlight setting that can still produce a dot structure should be used. The highlight setting should be between 236 and 240, which typically translates to a maximum dot of approximately 94% on the resulting halftone.

White Settings

In the RGB color space, a shadow setting that will still hold the detail without filling in should be used. The shadow setting should be between 18 and 22.

Grayscale in Photo Shot
It is imperative to use a standard photographer's grayscale for setting up any digital shot. The grayscale should be in all shots and positioned to best capture the scale within the outline of the shot. If there are several dropout shots and the scale cannot be placed in the shot, then start with shooting the scale in test shots to obtain correct grayscale settings.

When creating mood images or images where the light is filtered for an effect, photograph the grayscale with and without the filter on the light. Then supply both shots to the prepress provider noting the difference between the two for color reproduction.

There will be occasions when, for aesthetic reasons, visually pleasing color may be more desirable than technically accurate color. In these instances, it may not always be practical to also provide a completely color neutral reference image. However a second image with accurate color reference for any color critical subjects within the shot, should be provided along with clear direction as to how that reference image should be utilized for color correction.

The X-Rite ColorChecker product series and Kodak Q-14/Q-60 are examples of special color and grayscales that should be used as grayscale targets for digital photography to measure density and color. Place this grayscale in the main light source of the image. If a full grayscale cannot be used, use patches of white, black and a midtone neutral gray for studio photography.

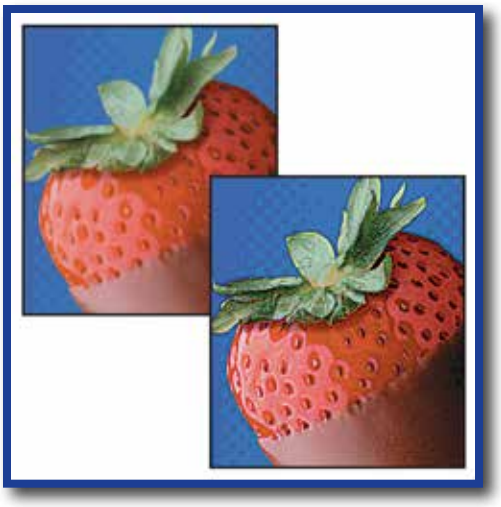
Grayscale Aim Point
The aim point of the shot should be the 40% neutral gray swatch or the number 3 or 4 block on the photographer's scale.

Camera capture color should be neutralized (when neutral color is desired) utilizing either an industry standard Kodak Gray Card (18% reflection) or X-Rite ColorChecker (24 Patch #22, Neutral 5) or comparable product. Gray reference cards should be replaced at least every two years for consistent color fidelity.

5.4 Photographic File Format

All shots sent to the prepress provider should be uncompressed, 8 bit or greater RGB TIFF files. 16 bit color is recommended for optimal color reproduction. CMYK conversions require using the printer profile and should be done from the original (or retouched) RGB file by the prepress provider. Photographers should NOT supply CMYK conversions, but can use soft proofing to emulate CMYK appearances on screen, when

5.3 Grayscale Aim Point: *The aim point of the shot should be the 40% neutral gray swatch or the number 3 or 4 block on the photographer's scale.*



5.5 Unsharp Mask: *Unsharp masking produces the appearance of sharpness and detail within an image.*

necessary. When photographers must supply CMYK conversions, the full gamut RGB files must also be provided in addition to the CMYK files. Providing the RGB files allows for subsequent adjustments and corrections as required by the printing application.

RGB Conversion

Though many off-the-shelf programs are capable of converting from RGB to CMYK color space, there are many factors to consider including: ink pigments, printing substrate, screen ruling, etc. It is critical to identify which party is best equipped and responsible for making color conversions and for documenting the color status of any digital files and accompanying proofs. Traditionally, this is a core responsibility of the prepress provider who has advanced knowledge of the many variables involved.

5.5 Unsharp Masking

Unsharp masking is a technique that produces the appearance of sharpness and detail within an image, by accentuating edges where different densities and contrasting colors meet. The amount of sharpening applied is determined by image content and other factors. The prepress provider usually has the needed information to make the necessary unsharp masking determination. The correct amount of sharpening should be determined by a technician who is knowledgeable about the printing process and the effect of sharpening on images destined for flexographic printing. Too much sharpening can make an image look bad, a result of too much digital noise being added to the image by the sharpening process.

5.6 Resolution

The number of pixels (picture elements) in a given area determines the resolution of an image (typically specified as number of pixels per linear inch). 300 pixels per inch (ppi) is the typical resolution for color images at 100% for 133-150 line screen. The formula for calculating the optimum resolution is two times the output screen ruling. Although this is the "rule of thumb," the amount of captured resolution is related to the final image quality. The enlargement of the image, the screen ruling and the image content (particularly detailed content) must be taken into consideration. For example: Original resolution (1,240ppi) divided by enlargement (350%) equals (354) lines of resolution at the reproduction size (pixels per inch) divided by screen ruling (175lpi) = (2.02). There should be no noticeable loss in detail as long as the answer is approximately 2.0.

Screen Ruling/Resolution		
Screen Ruling (lpi/lpcm)	Resolution (ppi/ppcm)	Key
55 / 22	110 / 43	lpi = Lines per Inch
65 / 26	130 / 51	lpcm = Lines per Centimeter
85 / 33	170 / 67	ppi = Pixels per Inch
100 / 39	200 / 79	ppcm = Pixels per Centimeter
110 / 43	220 / 87	
120 / 47	240 / 94	
133 / 52	266 / 105	
150 / 59	300 / 118	
175 / 69	350 / 138	
200 / 79	400 / 157	

Table 5.6

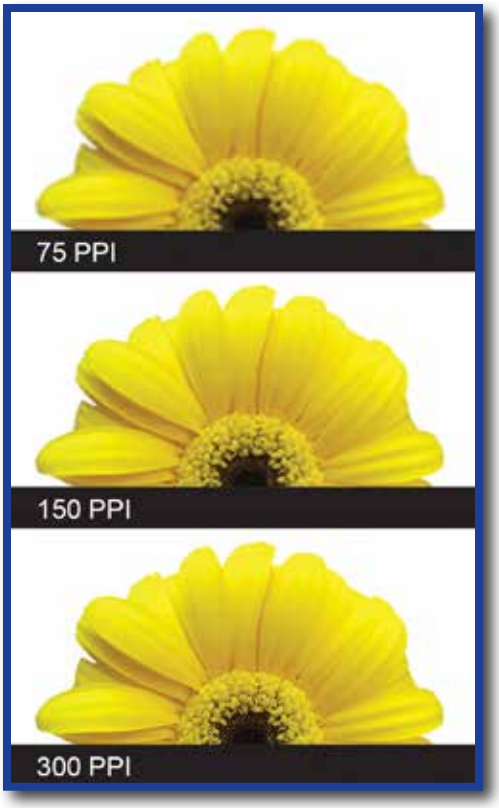
To convert from English measurement (lpi or ppi) to metric measurement (lpcm or ppcm), divide the number of lines/pixels per inch by 2.54.

5.7 File Transfer Recommendations

The receiver of any digital file should be contacted to determine the preferred transfer media. File Transfer Protocol (FTP) is a common method of file transfer, which may be available on the prepress or print providers' web site. Removable media such as a DVD may also be used to transfer files. Note: there are different security levels based on the selected transfer system used.

A hard copy proof must accompany every digital file, even if the hard copy proof is delivered the following day. Regardless of the file transfer method, all jobs processed should be accompanied by:

- A list of file names relevant to the job
- Files organized by directories/folders
- All high-resolution images embedded or linked in the job folder
- All supporting profile files (source and destination)
- A hard copy reflecting all files included
- Screen and printer fonts (when applicable)



5.6 Image Resolution: *Image resolution determines the printed image quality. Generally, the optimum resolution is 2 times the output screen ruling. 300ppi is the typical resolution for images printed at 100% using 133 - 150 line screen.*

6.0 Raster Images: *These files have a fixed resolution when created or scanned and cannot be enlarged without losing detail.*

6.0 PROGRAM APPLICATIONS

Operating System: PC or Mac

The packaging industry commonly uses the Macintosh platform for graphics production, though there are PC/Windows versions of many popular applications available.

Program Applications

Applications used in package design are divided into three categories:

- Drawing Programs: Adobe Illustrator (ie. which create vector files)
- Photo Editing Programs: Adobe Photoshop (ie. which create raster files)
- Page Layout Programs: Adobe InDesign or QuarkXPress

1. Drawing Programs: Drawing programs create files that contain objects and, are referred to as "vector" (mathematical coordinate) files. A line is created by identifying two points and providing the instructions to connect the points with a line of particular weight and color. Shapes have more points and indicate a fill color. There is no resolution to these graphics, thereby allowing an element to be scaled up or down with no loss of detail. Furthermore, they are inherently accurate and are best for graphics with a fixed set of colors (line copy). Most drawing programs also include the ability to create gradients, vignettes and blends.

When composing a job in a drawing program, always include the die drawing or template information on a separate layer or use a unique spot color such as "die line" so it can be isolated at output. *FIRST* recommends die-cut jobs (labels, cartons, corrugated) be produced entirely within a drawing program.

2. Photo Editing Programs: Photographic images or art created in photo editing programs may contain thousands of shades of color and are referred to as "raster" files. The graphics are made of many rows of pixels and each pixel can have its own shade. These files have a fixed resolution when created or scanned and cannot be enlarged without losing detail. When enlarging a previously captured image, check with the prepress provider for input on maximum enlargement without significant loss of image detail.

3. Page Layout Programs: Page layout programs provide an assembly environment where all kinds of elements can be combined. These programs, such as InDesign and QuarkXPress, are generally superior for dealing with multiple scanned images

and volumes of text in multipage documents, but are less adept at accurate placement of elements relative to a template. Therefore, *FIRST* does not recommend using page layout programs for package design.

If documents with placed (nested) images are imported into another document, the final RIP may not find the nested elements. For this reason, *FIRST* does not recommend placing files with nested images in page layout document. If it is necessary to deliver embedded or nested files, always send the original file with the job in case editing is required.

7.0 DOCUMENT STRUCTURE

7.1 Naming Conventions

When the design process is in the early stage, identifying a common naming convention is in the best interest of all parties and is vital in assuring smooth production. Many times the product being developed is part of a larger project or product line. Before the design and production files are created, check with the customer (CPC) to identify if they have already developed a common naming convention to be used by all suppliers.

File Names

File names should be short but descriptive. On some systems, file names may be truncated to the first eight characters when RIPed. Some systems cannot handle characters such as asterisks, spaces, or punctuation, so *FIRST* recommends never using these characters when naming files and/or document elements.

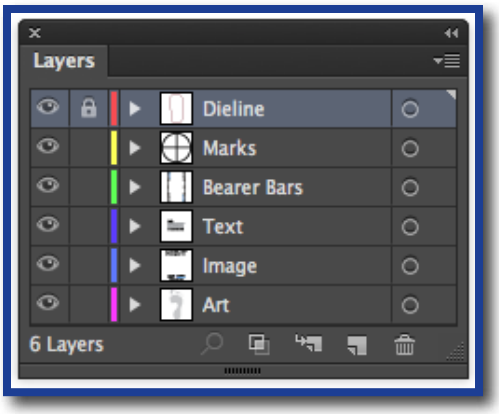
Naming for Image Replacement

In some production environments, low-resolution versions of images (FPOs) are used through various stages of concept, design, and approval. These low-resolution images are smaller in size and faster to process than the actual high-resolution version. With the correct and agreed upon naming convention, the FPO can be linked to the high-resolution file and replaced automatically during the output stage. Determine with the prepress provider if image replacement procedures will be used and what naming procedures are to be followed.

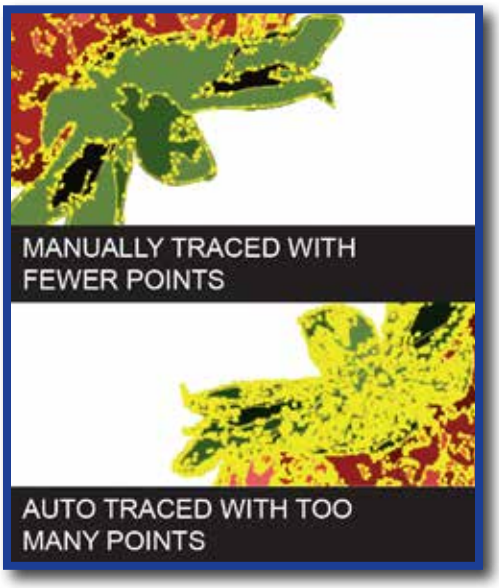
7.2 Document Size

Designs must be built to actual size. If the art is too big to proof in one piece, it will be necessary to tile the proof. All proofs should be made to the final size (100%) of the printed product.

7.1 File Names: *File names should be short but descriptive.*



7.3 Working in Layers: *Use layers for variations in designs, such as special price banners, line extensions, etc. This makes certain that the underlying graphics are identical in content, placement, and prepress execution.*



7.4 Auto-Traced or Revectorized Art: *Auto-tracing features ask a program to make decisions about placing nodes or points. These automatic choices are not the most efficient choices, producing complex files with too many nodes that can slow or stop file processing.*

7.3 Working in Layers

FIRST supports the use of layers to organize a file. Additionally, *FIRST* recommends putting the template on one layer, marks on another and design elements and copy on different layers. Some workflows may require that colors be pre-separated; layers are an ideal way to organize these separations. Separate layers can also be used for variations in designs, such as special price banners or line extensions. This makes certain that the underlying graphics are identical in content, placement and prepress execution. This can also be helpful in jobs with common colors (cylinders or plates shared between two similar designs).

When documenting the file, give the layers meaningful names. Put notes, instructions, color mixes and other documentation on a layer, or include them on a separate annotation layer with the art. Creating an annotation layer assures these important instructions will not be lost as the file moves through the production chain.

7.4 Auto-Traced/Revectorized Art

Much of the fine-tuning of designs to achieve printability, die matching and cross matching occurs during the prepress stage of production. To eliminate repeating these changes on each new revision of a base design, it is recommended to send all changes made during the prepress phase back to the designer and/or customer (CPC) to be incorporated into the base design.

Some high-end systems can now convert completed files back to Mac format as Illustrator files. Such files should be used with extreme caution. Auto-tracing features ask a program to make decisions about placing nodes or points. These automatic choices are not the most efficient choices and produce complex files with too many nodes that can slow or stop file processing. In addition, the files are so massive they require large amounts of RAM to open.

Revectorized Files

Files that were created on a Mac, converted to a high-end system, and then converted back to a Mac are called "revectorized." If possible, these files should not be used. If these files are used, they should be simplified as much as possible. When a RIP converted the file to raster, the RIP decided which pixels to turn on, using the PostScript information sent by the application. Now another program has processed it, making more decisions about where to place nodes, making this a third-generation image. Some change is inevitable; in the best case, it may be in the range of 0.001" (0.025mm). For best results, use this image for position and move or adjust the original art to fit.

Recreate the art whenever possible; that is, redraw the elements in the program to create new elements that are native to the program. This solves the file size issue and produces elements that are easily incorporated into future designs and changes.

7.5 Blends/Vignettes/Gradients

The terms blend, vignette, gradient, fade-away, fountain and graduated tint are used interchangeably. *FIRST* uses the term vignette for clarity.

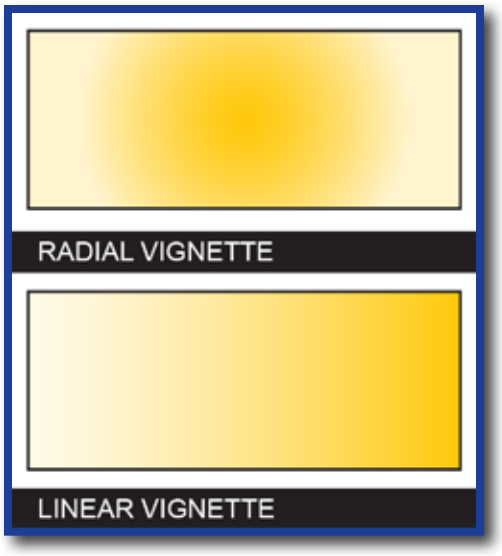
Building a Vignette

There are several approaches to building a smooth vignette as well as multiple problems in creating vignettes. Some of the approaches concern the way they print, others concern the way they are specified in software programs. Vignettes are subject to unpleasant banding (steps where tints do not transition smoothly) or dropping off (leaving a hard edge). Upgrades in software have resulted in higher quality vignettes. Although the algorithms used to create vignettes have improved, they still require skill and careful planning. A thorough understanding of current software applications and the printer's capabilities are required to create a printable vignette. Generally, the prepress provider is best equipped to create the vignette contained in the final production file.

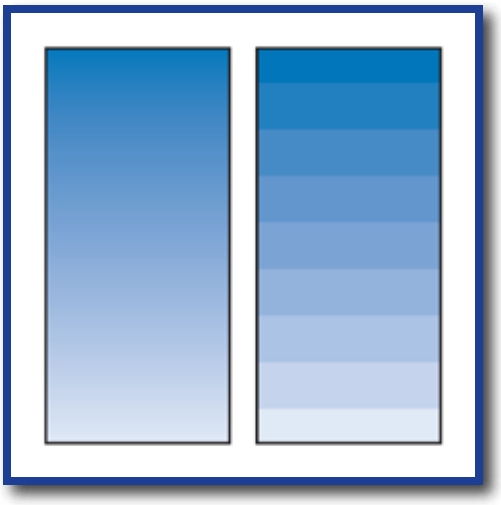
Some of the primary considerations when building a vignette include:

Blending One Spot Color Into Another: When blending one spot color into another spot color, two final files should be produced; a file for creating a comprehensive proof (color comp) and a file for production. The production file must contain two separate vignettes, one for each color. Mark up a proof with instructions for how the vignette is to be created in addition to including instructions on the annotation layer. For example, "100% to 20% yellow overprinting 40% to 80% navy." There is no easy way to create one file that shows this effect and prints the correct tints except with process colors. Another solution is to substitute process colors for custom colors (ie. the magenta channel might print as red, the cyan as reflex blue, the yellow as gold and the black as green, etc.).

Blending A Spot Color Into White: When creating a vignette of a spot color fading to white, specify the minimum dot percentage of the spot color on the lighter end of the vignette. One technique is to use the same spot color for both ends of the vignette. One end should be set to the full tint value while the other end should be set to the printer's minimum dot size in the same color.



7.5a Radial & Linear Vignettes: *A holding line around a vignette protects the smallest highlight dots and helps to prevent hard edges and dirty print.*



7.5b Building a Vignette: *There are several approaches to building a smooth vignette as well as multiple problems in creating vignettes.*

Trapping Vignettes: Vignettes are difficult to trap. The lighter color should trap into the darker color, but that relationship changes in a vignette. When placing type or graphics over a vignette, be aware that when the necessary trapping is applied, undesirable results may occur.

RIPing Vignettes: Designs that use multiple vignettes will take longer to process. To facilitate processing, consider using a raster program for the continuous tone image, the part of the design that looks like a picture. Use vector files for type and other elements that need hard, clear edges or very fine detail. Some processors will RIP vignettes from drawing programs to a continuous tone and add noise to prevent banding. This allows the prepress provider to separate the art, but requires more time to RIP.

Factors Influencing Banding

Many factors that influence banding in a vignette relate to the construction of the vignette. There is a mathematical relationship between the length, range and the number of steps in a vignette. The length refers to the physical length of the vignette and the range refers to the difference in color across or down the vignette. (ie. a vignette of 30% to 50% has a range of 20%).

- The longer the vignette, the more likely it is to show banding
- The shorter the range of the vignette, the more likely it is to show banding
- The fewer steps used, the greater the potential for banding
- Banding is more visible with darker inks
- Lower screen rulings are less likely to show banding

Higher output resolutions may also help reduce banding that may appear on some low-resolution printers and computer monitors. Professional film and direct-to-plate output devices usually run at a resolution of at least 1,200dpi which also helps minimize banding. If objectionable banding is observed when creating the file, make a notation on the annotation layer of the file, transferring the final inspection responsibility to the party outputting the file.

Factors Influencing Hard Edges & Dirty Print

To avoid hard edges and dirty print, it is important to maintain the printer's minimum dot and not fade to zero. The printer specifies the minimum dot used along the edge of any vignette. The lightest area of the vignette should adjoin a holding line or the edge of a graphic window; this will ensure that hard edges or dirty print do not appear across the vignette when the dot fades

to the printer's minimum. When vignettes are made of more than one color, all colors must stop at the same place in order to prevent rainbowing and dirty print throughout the vignette.

7.6 Imported Images – Follow the Links

File names are a critical reference link between the document and the image file. After placing an image, do not rename the file. All images placed in the document must travel with the document for output. Most layout programs treat imported images as electronic "pickups" and refer back (by following the link) to the image file at output. Always make certain that all links are updated properly before sending files. If an imported image is modified, always update it in the final document to make sure that it has not shifted position.

FIRST recommends working with the appropriate packaging application. Problems, such as nested files, can be encountered when working outside of those applications. In many programs, it is an option to embed the placed image data with the EPS file. This is not recommended because some editing may be required downstream. Sending the native application files enables future changes.

7.7 Electronic Whiteout

Do not cover up unwanted elements with a white box. The RIP will still process unwanted elements. Files that are designed in drawing programs can use masking, clipping, or compound paths instead.

7.8 Image Capture Quality – Scanning Considerations

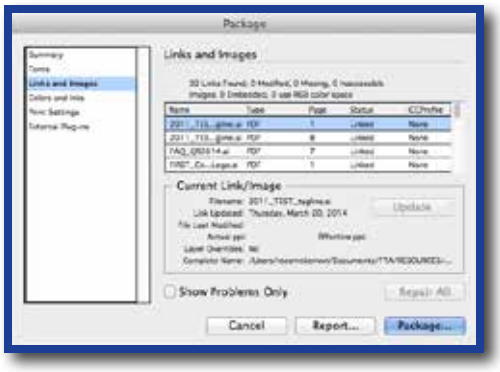
Optimizing scanner variables when capturing the original image is critical to achieving the desired printed result.

Scan Resolution

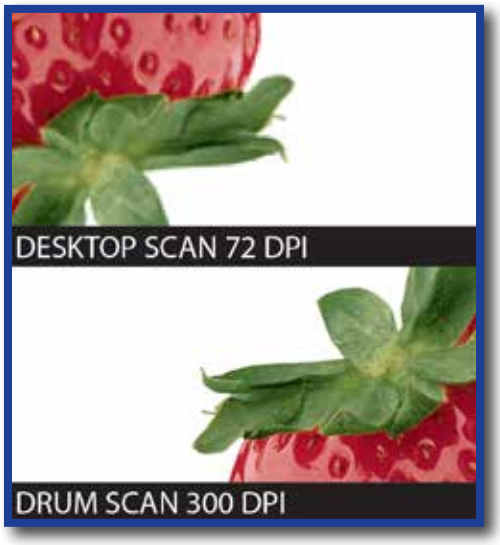
All scanners capture RGB data. Although some scanners can use hardware and/or software to translate the scanned data to CMYK, *FIRST* recommends capturing and supplying the image in the original RGB format to protect against data loss. Entry-level scanners generally are not adequate for production scans. Such devices use interpolation to achieve production resolution or size and real detail cannot be interpolated.

Image Sharpness/Resolution

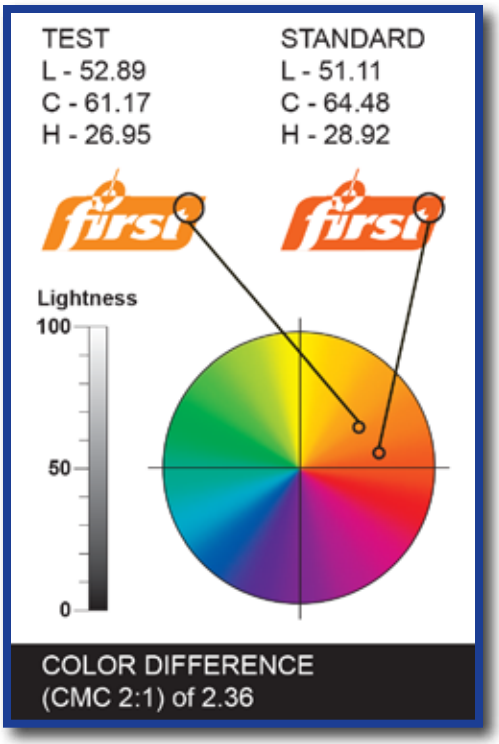
The most important scanning factor is optical resolution. A scan at 100% scale should have a minimum sampling of 1.5-2 times over the final halftone line screen. Fine detail images may be sampled at up to 3 times the output line screen. For example,



7.6 Imported Images: *After placing an image, do not rename the files. File names are a critical reference link between the document and the image file.*



7.8 Scan Resolution: *FIRST recommends images remain in RGB format for delivery to prepress.*



7.10 Color Management System: *Color Management Systems (CMS) translate from one gamut to another, allowing the proof to more accurately mimic the printing process.*

an image that will print with a 200 line screen may need a scan resolution of 300 to 600 pixels per inch, depending on the detail required in the image. If the image is enlarged, it will lower the effective resolution. The objective is to scan images at a high enough resolution to capture enough data to achieve the desired detail at the reproduction size.

Image Enlargement
Enlarging a scanned image will reduce the effective resolution of the image, and can compromise the image appearance. If possible, scan the original at the correct size and resolution; if rescanning is not possible, some enlargement may be acceptable depending on the scanned resolution. Adobe Photoshop is able to enlarge images using interpolation, a mathematical process of creating new pixels. Depending on the image, some interpolation may be tolerable. Whenever possible, it is always preferable to rescan the original image at the desired resolution.

Line Art
Theoretically, line art should be scanned at the same resolution as the output device. However, minimal improvement is visually apparent on most line art subjects scanned above 1,000 pixels per inch. Scaling will degrade quality; the best solution is to redraw line art in an illustration program. This also makes the file size smaller.

7.9 Scaling & Resizing

It is best to place images at the desired reproduction size and resolution, or larger. If upscaling is required, it should be done in Adobe Photoshop and not in the artwork layout. When upscaling an image, be careful to ensure the image resolution does not fall below the calculated resolution value, typically twice the halftone frequency.

7.10 Color Space

Images in a design file (whether captured or created) should remain in their native RGB color space for conversion in prepress to the color space described by the printer profile. Moving the image to any color space other than that of the final printer will result in unnecessary loss of color and detail accuracy. Refer to Section 14.4 for more detailed information on Color Management.

8.0 FILE FORMATS AND USAGE

Before using a new version of software, check with all parties downstream that will have to open and work with the electronic file to ensure compatibility. In newer versions, it is possible to save documents in older formats.

8.1 Specified Formats

The primary specified formats for vector images are: .ai (Illustrator native) and .eps. For continuous tone (raster) images the primary specified formats are: .psd (Photoshop native) or .tif. Refer to Section 8.2 for delivery of images via PDF.

There are numerous types of electronic file formats that can be generated from drawing, photo editing and page layout programs that should not be used. BMP, PICT and JPEG files generally lack detail due to the way their data is compressed. If other file formats must be used, it is imperative that all parties agree which file formats are to be created, exchanged and archived throughout the project. The prepress provider is in the best position to describe the advantages and disadvantages of each format for a specific purpose.

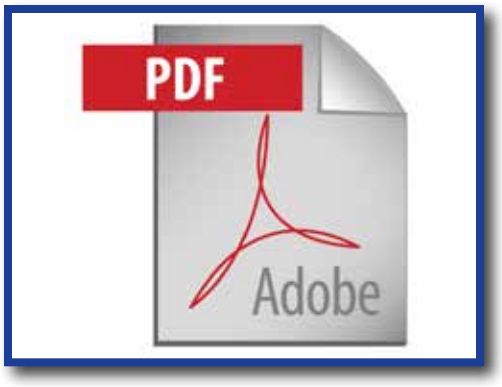
8.2 Portable Document Format (PDF)

PDF is an imaging file format used to transport graphically rich content. It is commonly used in direct-to-plate and digital proofing technologies. The "creator" of the file (designer, ad agency, prepress provider) must produce a file that meets the minimum imaging requirements of the "receiver" (prepress provider, printer). PDF/X is a PDF file with restrictions intended to facilitate the transfer of files from "creator" to "receiver".

A PDF/X is a collection of standards defining a number of conformance levels, all of them targeted at ensuring predictable and consistent printing in a professional print environment:

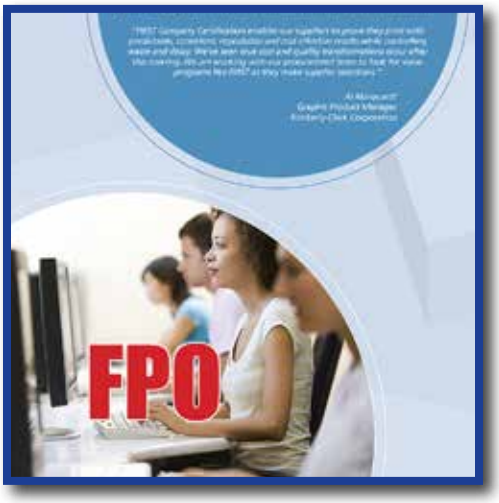
All of these standards are published as parts of ISO 15930, under the general title Graphic Technology — Prepress digital data exchange using PDF:

- **Part 1:** Complete exchange using CMYK data (PDF/X 1 and PDF/X 1a)
- **Part 3:** Complete exchange suitable for colour-managed workflows (PDF/X 3)
- **Part 4:** Complete exchange of CMYK and spot colour printing data using PDF 1.4 (PDF/X 1a)
- **Part 5:** Partial exchange of printing data using PDF 1.4 (PDF/X 2)
- **Part 6:** Complete exchange of printing data suitable for colour-managed workflows using PDF 1.4 (PDF/X 3)
- **Part 7:** Complete exchange of printing data (PDF/X-4) and partial exchange of printing data with external profile reference (PDF/X-4p) using PDF 1.6
- **Part 8:** Partial exchange of printing data using PDF 1.6 (PDF/X 5)



8.2 PDF: *Portable Document Format (PDF) is used to transport graphically rich content. It is typically used in direct-to-plate technologies.*

8.3 Clip Art: *Clip art may come in the form of low-resolution PICTs, better-performing TIFFs, or as well-built EPS images.*



8.4 Creating and Identifying FPO Images: *If an image is not properly identified as a "for position only" image, it may not be replaced.*

As of this writing Part 8 is not supported by all software vendors. *FIRST* looks to the Ghent PDF Workgroup (GWG) as the international group establishing packaging PDF specifications.

While the GWG Packaging Specification is largely PDF/X compliant, there are deviations from this rule for applications that are packaging specific. Section 11.0 summarizes the rules for an ISO 15930-7:2006 compliant PDF file and also identifies the GWG Packaging Specification 2012 exceptions specific for flexography. For additional information, refer to the Ghent PDF Workgroup contact information in Appendix A.

8.3 Clip Art

Clip art may come in the form of low-resolution PICTs, better-performing TIFFs, or as well-built object-oriented EPS images. Be sure to ask about the file format of the clip art being used to confirm the appropriate level of quality. If the image is a scan, identify the scanning resolution. If it was scanned at 72 pixels per inch, the clip art piece will be suitable only for display on a monitor and printing to a low-resolution printer.

The selected image may be one of several on a clip art page. Remember that masking out all the other images does not remove the images; they will all be processed. Save individual images under a new name and import the single image into the document.

8.4 FPO Continuous Tone Images

Whenever possible, a FPO (for position only) continuous tone (CT) image should be created from actual high-resolution data with correct cropping and rotation. Otherwise, the high-resolution image will need to be manually placed. The letters "FPO" must be placed into the live image area because the file will go through many channels before being output and if not properly identified as a "for position only" image, it may not be replaced.

8.5 Special Effects

When editing low-resolution raster files to produce special effects, document the steps used. The effects of most functions change with a change in resolution. It would be difficult to reproduce the same result with the high-resolution image without the documented information. Even with instructions, it is difficult to recreate several complicated special effects. The "action" sets within Adobe's Creative Suite allow the creator of the low-resolution file to record each edit step, in sequence, used to create the file. The "action" set can then be saved and shared with the user that will be creating the high-resolution original.

8.6 Image Substitution – Automatic Image Replacement

Using Low-Resolution Files for Automatic Image Replacement

A low-to-medium resolution file may be provided to the designer for automatic image replacement. These files contain links to full-resolution files on the prepress provider's system. It is important not to rename the file; the file name is the link back to the high-resolution image.

This method allows the designer to move, crop, or resize (within limitations) the APR/OPI image as if it were the live high-resolution image. It places the control of exact positioning in the hands of the designer. Resizing of low-resolution images must be employed with extreme caution. The high-resolution file will be scaled by the same factor. Enlarging the file will reduce its effective resolution significantly and reproduce an image that will not be pleasing due to loss of detail.

Specific recommendations on working with images for automatic placement may vary based on the workflow of the individual designer and prepress provider. The designer and prepress provider should agree on the procedures for using automatic image replacement.

9.0 PREFLIGHT OF FINAL DESIGN PRIOR TO RELEASE

Preflight is required by *FIRST*. The process entails documenting, collecting and testing files prior to release to another vendor in the production process. The preflight requirement was designed to ensure all components of a design have been supplied and received as intended. The designer should keep an electronic back-up of all released files for safety.

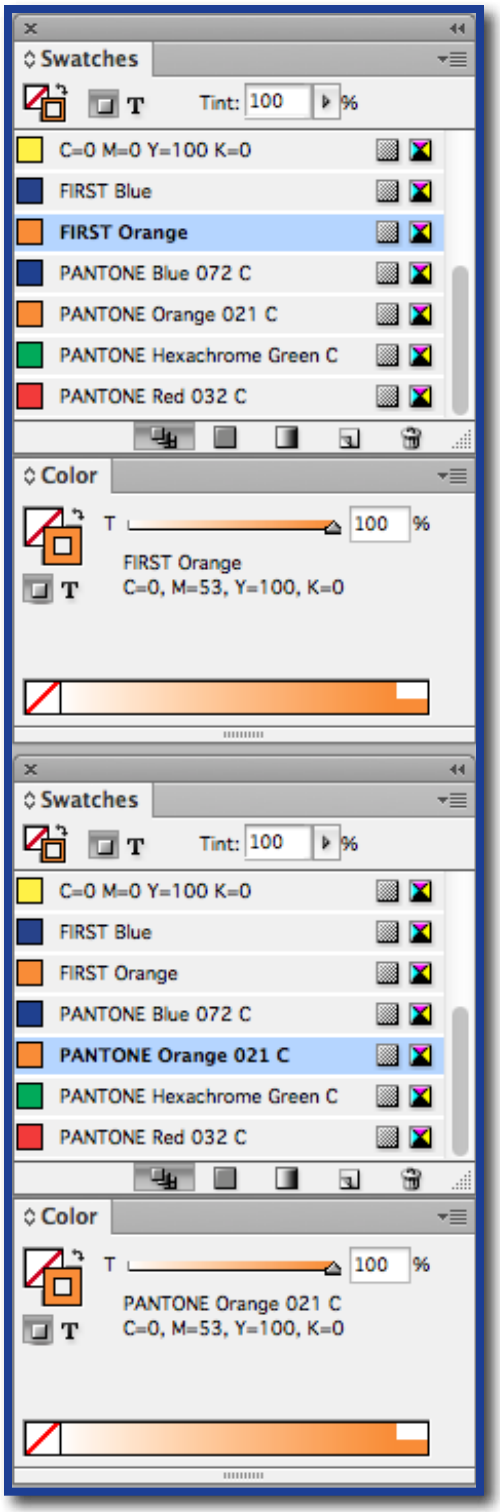
9.1 Documenting the Design

Revised Art

Revised files should be renamed with a revision number or date. Do not rely on the operating system modified date because each time the file is opened the date changes. Keep the old file name the same except for the revision number or date.

Images with Custom Colors

The custom colors used in a placed image must have the same name as the corresponding custom colors in the final design file. This applies to images pasted in as well. Otherwise, the two colors will not output as one color separation. Many programs will now import colors from placed images into their palettes, but the artwork must then be edited in the file to use these same colors.



9.1 Images with Custom Colors: *Custom colors used in a placed image must have the same name as the corresponding custom colors in the final design file.*

TIP: For the placed raster file to output with the line art in the composite file, custom colors must be edited to the corresponding CMYK inks.

Design Report

The final design may seem very simple to the designer, but it can be difficult to decipher when someone in the production process starts to work with it. To make the design flow smoothly through production, details must be provided on how it was developed and the expected end result. Some programs have report features to list details about a file, others use comment layers within the file itself. The following list identifies what information should be included in the design report:

- Final file name(s)
- All placed full resolution and FPO images
- Mechanical name (die drawing used to build the design) including the date and source of the template
- Application/version of files
- Fonts used
- Colors used (CMYK, PMS, Custom)
- Common and/or base layers
- Instructions for vignettes or effects

9.2 Release to Prepress

Files to be released to prepress must be supplied in their entirety including all supporting files (linked/embedded high-resolution images, fonts, etc.). The most reliable way to verify all necessary supporting files have been supplied is to:

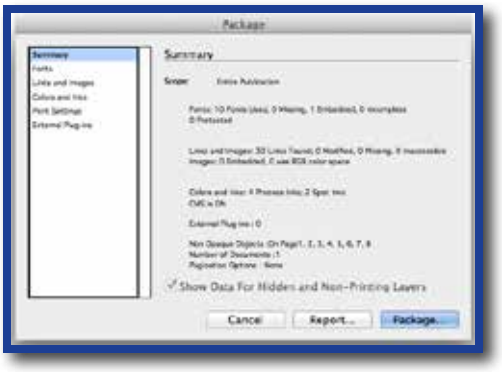
- Copy the files to another computer, or copy files to a different directory or volume on the local machine
- Open document with all supplied fonts loaded, and all supplied images linked
- Output full color, full size proof (tile if necessary)
  Note: Another option is to convert all type to outlines and print a PDF document, which is essentially the same as creating a PDF from a distilled postscript file
- Verify all content against the approved comps

Materials to Be Sent With the Job:

1. Final files, including all supporting high-resolution images, fonts and mechanicals (templates). When sending multiple designs, file-manage each design folder to house the relevant working design file and all applicable supports.
2. Full color, full size, hardcopy proof or a PDF printed out of native application (which is essentially the same as creating a PDF from a distilled postscript file).

3. Documentation described in Section 9.1 Design Report.
4. A printout of the disk directory if supplying files via disk.

Verify the file transfer method with the recipient. Many different options are available for file transfer, refer to Section 5.7 for more information. Additionally, if using data compression (.sea, .zip), check with the prepress vendor to determine compatibility.



9.2 Release to Prepress: *Supply files to prepress in their entirety including all supporting files.*

1-bit TIFF files A file format that contains all image and screening information at final output resolution with values of either zero or one (on or off) typically for writing engines that utilize a laser to image a medium (plate, film, proofing media, etc.). Also see TIFF (tagged image file format).

Abnormal Color Vision One of several kinds of defective color vision, inaccurately referred to as color blindness. See protanopia, protanomalous, deuteranopia, deuteranomaly, tritanopia and monochromatism.

Abrasion Process of wearing away the surface of a material by friction.

Abrasion Resistance A printing ink's or substrate's ability to resist scuffing and scratching with increased handling, an important consideration in the printing of packaging and other materials destined to be subjected to abrasive forces. Also called scuff or rub resistance. Reference ASTM D5264 - 98(2011)

Abrasion Test A test designed to determine the ability to withstand the effects of rubbing and scuffing. Reference ASTM D5264 - 98(2011)

Absolute Humidity A measure of the total amount of water vapor in the atmosphere or material such as paper; also known as moisture content. It is determined by the weight difference of a sample before and after oven drying to "bone dry" or by measuring with various hand-held moisture sensing equipment (hygrometer). Excessive atmospheric relative humidity changes may affect a paper's structural properties resulting in print misregister, wrinkles and other converting problems. See "relative humidity."

Achromatic Color A neutral color (white, gray or black) that has no hue.

Acid Any chemical that undergoes dissociation in water with the formation of hydrogen ions. Acids have a pH less than 7.0; lower numbers indicate greater acidity. Among its properties is a corrosive action on many materials and sour in taste. Will turn litmus paper red.

Additive Color Color produced by the mixing of light falling onto a surface, as compared to subtractive color. The additive primary colors are red, green and blue.

Addressable Output Resolution Maximum number of image positions along a straight line one inch in length that can be addressed by a bar code designer. This resolution would exclude further resolution enhancing techniques performed by the imaging device or software that are beyond the control of the designer.

Aging/Fade Resistance Ability of a paper and/or ink to resist changes in its optical, chemical or structural properties over time. Accelerated aging, yellowing, brightness loss and fading upon exposure to ultraviolet light and humidity can be determined with instruments such as a fadeometer or weatherometer. Also known as permanence, colorfastness and lightfastness.

American National Standards Institute (ANSI) The USA member of the International Standards Organization (ISO) that develops voluntary standards for business and industry. See Appendix for contact information.

Analog Proof A proof typically produced using film(s).

Anilox Roll Engraved ink metering roll used in flexographic presses to provide a controlled film of ink to the printing plates, which print onto the substrate.

ANSI See American National Standards Institute.

Apparent Trap (Preucil)

An estimate of how well an ink overprints a previously printed ink. It is the Ratio of the difference between the density of the overprint and the density of the first down ink to the density of the second down ink; all densities are measured with the complementary color (major) filter of the second down ink. For example, in measuring red created by overprinting yellow over magenta, one would use the blue filter on the densitometer, the complement of yellow.

$$\% \text{ Apparent Trap} = 100 \times \frac{D_{OP} - D_1}{D_2 - D_O}$$

Where: D_O = Density of the substrate.
D_{OP} = Density of the overprint.
D_1 = Density of the first-down ink.
D_2 = Density of the second-down ink."

Archival

Pertaining to the long-term storage of data.

ASCII

American Standard Code for Information Interchange. A 7-bit standard code adopted to facilitate the interchange of data among various types of data processing and data communications equipment.

ASCII File

A digital file encoded in the industry-standard ASCII representation for text. An ASCII file contains only plain text and basic text-formatting characters such as spaces and carriage returns, but no graphics or special character formatting.

Attribute

Distinguishing characteristic of a sensation, perception or mode of appearance.

Baggy Web

A condition where one side of the web, as it runs through a press or converting equipment, has uneven tension from side-to-side. This can result in printing and/or converting problems.

Bar-Width Reduction (BWR)

A prepress decrease in bar-code image width to compensate for normal image growth as predetermined by press fingerprinting and production monitoring.

Base Alignment

In setting type, a mode specifying that the lower reference edge of all letters in a line of mixed sizes or styles should be horizontally even; also called baseline alignment.

Basis Weight

Paper weight in pounds per ream of a given grade, sheet size and number of sheets (usually 500) in North America. Reported in lbs./ream using TAPPI Method T410. Common ream sizes and grades include the following.

Basis Weight of Paper Grades

Paper Grade	Sheet Size/Quality	Square Ft. Area/Ream
Bond, Computer, Copier	17" x 22" / 500	1,300 (Actual 1,298.6)
Book, Offset, Text	25" x 38" / 500	3,300 (Actual 3,298.6)
Bristol, Tag	22.5" x 28.5" / 500	2,700 (Actual 2,226.6)
Cover	20" x 26" / 500	1,806 (Actual 1,805.6)
Index	25.5" x 30.5" / 500	2,700 (Actual 2,700.6)
Linerboard	1,000 Square Ft.	1,000
Bag Paper, Newsprint, Paperboard, Tissue, Wrapping	24" x 36" / 500	3,000
Printing, Writing	17" x 22" / 500	1,300 (Actual 1,298.6)

*International operations report basis weight in Grams per Square Meter.

Conversion formula: $\frac{\text{Basis Weight x 1406.5}}{\text{Basic Size}}$ = Grams per Square Meter

BCM Abbreviation for billion cubic microns; a measurement of the average volume per square inch of engraved ink-carrying cells on an anilox. 1 bcm = 1 microliter.

Binary A coding or counting system with only two symbols or conditions, such as on/off or zero/one; the format for storing data in computers.

Black and White Original art or proof in single color (black image on a white background), as distinguished from multicolor.

Bleed Image or color that extends beyond the trim edge of the finished printed piece.

Blend Vehicle A clear fluid material which is mixed with dispersions to generate a finished ink. Also see vehicle.

Blocking
1. An undesired adhesion between touching layers of materials such as might occur under moderate pressure and/or temperature in storage or use;
2. The extent to which damage to at least one surface is visible upon their separation.

Blushing Milky, foggy, or matte appearance in an ink or coating.

Brightness A measure of reflectance in the blue region of the visible light spectrum, specifically at a wavelength of 457 nm, as specified by TAPPI Method T452 using directional 45°/0° geometry. This method is an industry standard for the determination of the brightness of white, near-white, and naturally colored paper and paperboard. The non-USA standard for paper brightness is measured with diffuse illumination and diffuse reading using spherical geometry. Higher numbers on a 0 –100 scale indicate brighter surfaces that increase the perception of print contrast, brilliance and paper quality, especially when viewed under blue-white illumination common with fluorescent lighting. High brightness papers can improve bar code contrast and scannability.

Bump Curve Highlight compensation applied to avoid imaging dots in the plate that are too small to allow full dot formation on the plate during main exposure and processing. A bump curve can also be referred to as a tonal value increase of any portion of or the entire curve to calibrate the proofing process with the printing process.

BWR See bar width reduction.

C1S Coated, one side.

Caliper Thickness measurement of a single sheet of paper as defined by TAPPI Method T411 and reported in mils or thousandths of an inch (1 mil. = 0.001"). Multiply inches by 25.4 micrometers and round to the nearest whole number to find metric thickness expressed in microns (μ) or micrometers. Also used to identify thickness of other printing materials such as plates, mounting tape, etc. See gauge for flexible film substrate thickness and point for paperboard thickness.

Camera Ready Copy and/or artwork that is ready for the photography step to make a film negative for platemaking in the printing process.

CCNB See clay coated news back.

CEPS See color electronic prepress system.

CGATS See Committees for Graphic Arts Technologies Standards.

Chambered Doctor Blade System An ink chamber made up of two doctor blade assemblies and end seals. Ink is pumped into the assembly, fills the anilox roll cells, and is metered by the doctor blades – popular on wide-web applications.

Character Count

The number of characters included in a block of text. In graphic arts, spaces are counted but other nonprinting characters usually are not. In information processing, both printing and nonprinting characters are usually included.

Character Set

The entire set of characters that can be either shown on a monitor or used to code computer instructions. In a digital printer, the entire set of characters that the printer is capable of printing.

Chatter, or Banding

A print defect where a darker line across the entire printed form is seen on a particular unit where there is slurring of halftone dots and/or solids due to a mechanical vibration. Often attributed to gears and mechanics, it can also be due to other factors including form layout, plate durometer, mounting tape attributes, tension problems, and others.

Chroma

Attribute of color used to indicate the degree of departure from a gray of the same value. Correlates with the dimension of saturation. Chroma is on of three coordinates in the LCH color model. See saturation.

CIE

Commission Internationale de l'Eclairage – see Appendix A for contact information.

CIE Standard Illuminant

A spectrally-based numerical definition of various light sources as defined by the CIE in terms of relative spectral power distribution. Examples include Illuminant A, C, the D-series (D50, D65, etc.). F-series (F2, F7, F11, etc.). Used in conjunction with one of the CIE Standard Observers and the spectral reflectance curve of a measured sample to calculate colorimetric values. The illuminant utilized should always be specified along with the standard observer when communicating color information.

CIE Standard Illuminants

Illuminant	Description
Illuminant A	Incandescent lighting at a color temperature of about 2,856° Kelvin.
Illuminant B	Direct sunlight at about 4,874° Kelvin.
Illuminant C	Tungsten illumination simulating daylight at about 6,774° Kelvin.
Illuminant D50	Graphic arts standard viewing condition at about 5,000° Kelvin.
Illuminant D65	Used by textile, paint and ink industries at about 6,500° Kelvin.
Illuminant F2	Cool white fluorescent lamp at about 4,200° Kelvin.
Illuminant F7	Broadband daylight fluorescent lamp at about 6,500° Kelvin.
Illuminant F11	Narrow band white fluorescent lamp at about 4,000° Kelvin.

CIE Standard Observer

Color matching functions defined by the CIE characterizing the visual response of a typical human observer. Used in conjunction with a standard illuminant and the spectral reflectance curve of a measured sample to calculate colorimetric values. There are two standard observers: the 1931 2° standard observer and the 1964 10° standard observer. The standard observer utilized in calculating colorimetric values should always be specified along with the illuminant when communicating color information.

Clarity/Haze

Material characteristics permitting distinct images to be observed through it; typically a visual comparison to a standard clear transparent material. Poor formation and other related properties could negatively affect clarity and apparent print quality.

Clay Coated News Back (CCNB)

Paperboard made from recycled newsprint base fiber with a clay coated surface to improve printability.

CMYK

Cyan, magenta, yellow, black; the four process color printing inks.

CNK See coated natural kraft.

Co-Extruded (COEX) A multi-layer film or coating in which each distinct layer is formed by a simultaneous extrusion of hot polymers through a single die.

Coated Natural Kraft (CNK) Unbleached paperboard, usually clay coated on the side to be printed for folding cartons.

Coated Recycled Board (CRB) Paperboard made from recycled fiber (newspapers, office waste paper, old corrugated cartons, etc.), clay coated on one or both sides, and printed as folding cartons.

Coefficient of Friction (CoF) Measure of static and/or kinetic slip resistance of one material against another. COF has limited effect on printability, but it is critical in converting and bag filling operations as well as end use applications.

Color A visual sensation produced in the brain when the eye views various wavelengths of light. Light is transmitted, reflected and/or absorbed. For example, if a printed sheet of paper is sufficiently thick, all light will be either absorbed or diffusely reflected; there should be no significant amount of light transmitted. Color viewing is a highly subjective experience that varies from individual to individual. Lighting and viewing standards help ensure the accuracy of color reproduction in the graphic arts industry. The most widely used objective color measurement system is defined by the CIE and known as CIELAB which is a 3-dimensional coordinate system where L* represents lightness, a* represents redness/greenness, and b* represents yellowness/blueness. Color is measured with either a spectrophotometer or a colorimeter.

Color Break Designation of ink colors to be used for specific image areas.

Color Correction Any method (masking, dot-etching, screening, scanning, etc.) used to change reproduction of the color original (photograph, transparency, chrome, 35mm slide, digital photo, painting, etc.).

Color Difference A calculation intended to represent the perceived color difference between two samples. It can be expressed in multiple ways utilizing differences in L*a*b* or L*C*ho, or with an overall color difference calculation known as Delta E, or DE. Refer to section 20.1.1 for more information.

Color Electronic Prepress System (CEPS) A high-quality, proprietary computer-based system that may include equipment for page make-up, scanning color separations and making color corrections. PC-based color scanning and manipulation systems, often referred to as desktop publishing systems, usually lack the capabilities and sophistication of CEPS.

Color Key An overlay proof (analog or digital) made of layers of acetate or polyester attached in register to a backing substrate. Each overlay film carries the colored image from a film negative. Color breaks and traps can be judged, but exact color match to the final printed product cannot be made.

Color Managed Comp A prototype of a contract proof on the finished structure representing the design intent in the context of the target color space. See contract proof and comprehensive layout, comp.

Color Monitor An RGB or composite monitor that uses separate video signals of red, green, and blue, the three primary additive colors. It uses these signals to display almost any number of hues, depending upon the computer software and calibration. This type of monitor usually produces clearer, sharper colors and images than can be reproduced by printing CMYK process inks. Composite monitors use one signal that combines the three primary colors.

Color Resolution The number of different colors or gray-scale values a system can work with or present. The value is usually given in bits; each added bit doubles the number of available colors. For example, 8-bit color displays show 256 colors (or shades of gray).

Color Saturation The component of color that represents the purity of the color and departure from grayness for a particular hue and lightness. Saturation is one of three coordinates in the HSL and HSV color models. See Chroma.

Color Separation The process by which original artwork is separated into individual color components for printing. The final digital file includes color to color trapping, press mandatories (marks), color modification for specific inks and substrates, as well as halftone screening to enable printing a uniform tone scale with proper gray balance from extreme highlights through midtones and shadows to maximum solid color.

Color Target A proof or swatch that represents the customer's expectation for color. Also known as a color reference.

Color Tolerance An acceptable color difference between a standard (reference) and a sample.

Color-Managed Proof See profiled contract proof.

Colorimeter An optical measurement instrument that responds to color in a manner similar to the human eye by filtering reflected light into its dominant regions of red, green and blue. A color's numeric value is then determined by using the CIE XYZ color space or one of its derivatives such as CIE L*a*b* or CIE L*u*v*.

Combination Plate Printing halftones or screen tints and solid line or text copy using the same plate; may require print quality compromises because halftone dots require minimum impression and ink film thickness whereas solids need maximum impression and ink film thickness for optimum printability; often can be avoided with advance planning.

Combination Run A press run that contains multiple designs on the same form/plate. The use of expanded gamut printing and shorter press run volumes has increased the frequency of combination runs.

Committees for Graphic Arts Technologies Standards (CGATS) Formed in 1987, this group reports to ANSI and is charged with the overall coordination of graphic arts standard activities and the development of graphic arts standards where no applicable standards developer is available. The IT8 Committee, developer of digital data exchange standards, was merged under CGATS in 1994. Information about existing and pending CGATS activities is available , see Appendix.

Common Print Stations A common image remains throughout a pressrun; plate or color changes are made for different design elements such as weight marks, UPC codes, ingredients, nutritional labeling, etc.

Comprehensive Layout, Comp A mock-up of a printed piece showing all type and pictures in rough form but in the right size and in the correct position; used for evaluating a design before final type and artwork are produced.

Concept Proof A proof generated early in the creative process used to capture input from all partners in the supply chain during initial design development. It is typically not color-managed and, therefore, not used for matching color.

Cones A photoreceptor cell in the retina of the eye that is responsible for color vision and color sensitivity, functioning best in bright light.

Continuous Tone An image containing a range of color tones from light to dark. Appear as pixels on a color monitor or silver/pigment particles on a photograph. Must be converted to halftone dots in order to be printed. See CT.

Continuous Tone (CT) A picture file format; conveying the concept that halftone screening can be performed on this file upon output, as when screening CTs at a specific size and screen ruling on an image

setter. CT files are created by either scanning a picture into the system or by generating a CT image within an application.

Contract Proof — A proof representing the customer's complete content and color expectations for the final printed product and used as a contract for determining compliance to expectations.

Contrast — The difference between extreme highlight and shadow areas of a continuous tone original or halftone reproduction. Image contrast usually is compressed to bring an originals density range to what can be reproduced on a printing press.

Cross Direction (CD) — The direction across the width of a machine – 90-degrees from machine direction (MD). The direction at right angle to the paper grain or flow of material through a machine (paper machine, extruder, printing press, etc.). See machine direction.

CT Merge — A photo retouching term describing the function of combining two CT files in such a manner that they appear to vignette together smoothly without a noticeable break between images.

Curl — The tendency of a substrate not to lay flat.

Cut-Back Curves — Curves applied in platemaking derived from data that indicates the halftone dot areas needed to compensate for dot gain throughout the entire tone scale during the printing process. This data is specific to particular printing materials and process conditions.

D-Max — The highest measured density on a sample – not to be confused with the maximum density achievable by the material.

D-Min — The lowest measured density on the clear/non-image area of a sample – not to be confused with the minimum density achievable by the material.

DDCP — See direct digital color proof.

DDES — See Digital Data Exchange Standards.

Delta E (ΔE) — An overall color difference calculation used typically to determine pass/fail criteria for printed products. Delta E is a single number that represents the 'distance' between two colors in a specific color space. There are multiple derivations of Delta E formulas currently in use. Therefore, the Delta E method being utilized should always be specified for communicating color difference results.

Densitometer — A photoelectric instrument that measures the optical density of images or colors. A reflection densitometer measures the amount of incident light that is reflected from the surface of a substrate, such as ink on paper or film. A transmission densitometer measures the amount of light that is transmitted through film from a measured light source.

Density, Absolute — Optical density referenced to a perfect reflecting diffuser through calibration procedures; typically referred to as "density with paper/film included."

Density, Optical (Reflection Density) — The light absorbing property of a material, expressed as the logarithm of the reciprocal of the reflectance factor (i.e., higher density indicates more light is absorbed or a darker surface). Also called print density.

$$\text{Reflection Density} = \log_{10}\left(\frac{1}{R}\right)$$

Reflectance:
100% = 0.0
10% = 1.0
1% = 2.0
0.1% = 3.0
0.01% = 4.0

Density, Optical (Transmission)

The light absorbing property of a material, expressed as the logarithm of the reciprocal of transmittance (i.e., higher density indicates more light is absorbed).

$$\text{Reflection Density} = \log\left(\frac{1}{T}\right)$$

Where:
T = Transmittance

Density, Relative

The absolute (optical) density of the sample minus the absolute (optical) density of the substrate; typically referred to as density minus paper.

Deuteranomaly

A type of abnormal, defective color vision. Deficient in green response for certain color mixtures. See abnormal color vision.

Deuteranopia

A type of abnormal, defective color vision. Specific to the Red-Green color region, with most of the deficiencies in the green region.

Device Independent Color Space

A color space that can be used to describe all the colors seen by the human eye, independent of the colorants used to reproduce colors for a specific device.

Device Specific Color Space

A color space that is defined based on how a specific device reproduces color. RGB and CMYK are both device specific color spaces.

Digital Bar Code file

A bar code symbol that is designed and stored in a digitized format.

Digital Data Exchange Standards (DDES)

A body of standards developed for the graphic arts industry by the ANSI accredited Image Technology Committee (i.e., ANSI IT8) and the ISO accredited graphics technology committee (i.e., ISO TC130). DDES provides standardized exchange formats for the digital information developed and used in printing design and production.

Digital Proof

A proof produced directly from digital data through a digitally controlled imaging system – without the use of film(s).

Dimensional Stability

Ability of a substrate (paper, board, corrugated, film) to retain its dimensions and its shape despite changes in its moisture or mechanical stressing. Moisture changes are caused by differences in ambient relative humidity from the internal relative humidity of the substrate. Converting, printing and ink drying processes may apply mechanical stresses (roll build, baggy/slack edges, etc. Changes in surface moisture and relative humidity tend to cause curl, wavy edges, frame shrinkage, etc. These can degrade print registration.

Direct Digital Color Proof (DDCP)

Prepress color proof that is imaged directly from digital data without the intermediate steps of film and contact exposure.

Dirt/Gels

Apparent dirt area on a substrate affecting its aesthetic appearance and possibly resulting in print defects/voids. Size, frequency, color and location are typical criteria for measuring dirt/gels visually against a standard agreed upon between the customer and the supplier.

Dirty Print

A print defect. Also identified as dot bridging, feathering and unwanted print. A general description for printed areas showing a build up or excessive ink transfer of unwanted printed dots.

Dispersion

A uniform distribution of solid particles in a vehicle by mixing or milling.

Display Type

In composition, type set larger than the main reading body text. Used to attract attention; for example, a headline.

Distortion

The amount a design/prepress art file is reduced to compensate for cylinder wrap & the stretch of plate material during the mounting process.

Distortion Factor

A multiplier that compensates for normal flexographic image shrinkage with rubber plates and image stretch when any type of flexographic plate is made flat and mounted around a cylinder for printing.

Dot Area (%), apparent (Tone Value in ISO Documentation)

The dot area of a printed halftone element that is computed from reflection densities of the printed element and area of solid, continuous coverage. The computation of apparent dot area makes use of the Murray-Davies equation. It accounts for the physical area covered by the dot pattern plus optical effects that cause the dots to appear larger in size (optical gain). This approximates the visual impression of the printed area. Also identified as Tonal Value Increase (TVI) and Dot Gain.

Dot Area (%), Film Printing (Tone Value in ISO Documentation)

The area that will print as the final dot on the substrate. For making calculations, the following applies:

- The film printing dot area for positive separations is that value measured as the opaque dot on the input film.
- The film printing dot area for negative separations is that value measured as the opaque dot in the input film subtracted from 100."

Dot Bridging

A print defect. A type of dirty print. Appearance of a dirty, grainy effect as a result of two or more process dots linking together. The gaps between dots are bridged by ink.

Dot Gain

A physical and/or optical measurement and theoretical calculation of the apparent increase in dot area from one medium to another. Normally expressed as the difference between a midtone (nominal 50%) dot area on the digital data/film and the printed dot area; for example, a 50% film dot area which prints as a 78% dot has a 28% dot gain. Dot gain (and loss) is normal and must be controlled throughout the prepress and printing process. Also identified as Tonal Value Increase (TVI) and Dot Area.

Dot Gain (Apparent, Equivalent or Total)

The difference in dot area between the digital data/film dot area and the apparent dot area measured on the printed sheet. The computed value includes both physical changes in dot size and optical effects which increase the apparent size of the printed dot (e.g., a 72% apparent printed dot area from a 50% input film dot area is reported as 22% total dot gain). Also identified as Tonal Value Increase (TVI) and Dot Area.

Dot-Gain Curve

Graphic illustration/model of dot gain data throughout the entire highlight (non-image) to extreme shadow (solid image) tone scale.

Double Bump

Application of two layers of ink in the same printed area to achieve greater opacity or more intense color.

DPI

Dots per inch. DPI is used to measure the resolution of an image both on screen and in print. DPI measures how many dots fit into a linear inch. The higher the DPI, the more detail can be shown in an image.

Dyne Level

A measurement of the surface energy, typically associated with film, but can be used to describe the surface energy of other solid surfaces (i.e. anilox, plates).

EAN/UPC Symbols

A family of bar-code symbols using UPC Version A, UPC Version E, EAN-8, and EAN-13.

EB

See electronic beam.

Electron Beam (EB)

EB is a type of radiation ink curing process, avoiding the need for traditional solvent usage in curing inks.

Encapsulated PostScript (EPS)

A file format that carries both a description of an image in the PostScript page-description language and an optional bitmap equivalent for screen display. Commonly used for image interchange on the Macintosh.

Enclosed Inking Chamber

See chambered doctor blade system

EPS

See Encapsulated PostScript.

Expanded Gamut The addition of more colors to the typical four process colors (CYMK) for the purpose of enlarging the available color space.

Extrusion The production of a continuous sheet or film (or other shapes) by forcing hot thermoplastic material through a die or orifice.

Fade See vignette and aging/fade resistance.

Feathering A print defect. A ragged, feathery appearance of type or image edges on the printed material due to ink drying on plates and/or anilox rolls.

FFTA See Foundation of Flexographic Technical Association.

Fill-In (Reverses) A print defect identified as ink bridging across small print and non-printing gaps in design.

Fisheyes A print defect. Tiny round discontinuities in printed image.

Flatness Departure of a substrate from a flat plane to the extent that contributes to misregistration or other printing/converting quality degradation.

FLEXO Color Guide Edition X (10) Color Specification Guide produced by the Glass Packaging Institute (See GPI:Glass Packaging Institute) to help identify brand color standards between similar/same designs that print on glass, along with accompanying Flexo printed items like corrugated containers and other structures. The FLEXO Color Guide was initiated in 1949 by the Glass Container Manufacturers Institute (GCMI), now known as the Glass Packaging Institute (GPI).

Flexographic Technical Association (FTA) Member supported nonprofit organization that promotes, develops and maintains the advancement of flexographic processing and/or printing. For contact information, see Appendix.

Float The material which floats on top of an ink or coating.

Fluorescence The ability of a substrate and/or ink to absorb ultraviolet light waves and reflect them as visible light.

FOGRA The FOGRA Graphic Technology Research Association, located in Munich, Germany, is focused on research and development for printing technology. FOGRA's tasks are research, development, transfer of know-how to industry, development of standards, consultancy and technical reports.

Font A complete set of characters in one design, size, and style. In traditional typography usage, font may be restricted to a particular size and style or may comprise multiple sizes, or multiple sizes and styles, of a typeface design.

Formation Distribution of fibers in paper. Excessive non-uniform distribution or flocking of fibers can contribute to print mottle. Although instruments exist to measure paper formation and print mottle, these characteristics are typically measured visually against a standard agreed upon between the customer and the supplier.

Foundation of Flexographic Technical Association (FFTA) Organization exclusively for educational purposes benefiting members of the Flexographic Technical Association and the flexographic industry.

FPO (For Position Only) The temporary image used for contextual reference in a design that will be replaced in prepress production with a high resolution image.

Frequency Modulation (FM) Screening An alternative to conventional (AM) halftone screening where the frequency of same-size microdots (typically 10 to 35 microns in diameter) are varied, or modulated, to create various tones. Also known as Stochastic Screening. Classifications include First Order and Second Order.

FTA	See Flexographic Technical Association.
G7™	A near-neutral calibration technique developed and offered by IDEAlliance. Refer to the Appendix for contact information.
Gamut	The range of colors that can be produced on various output devices such as printing presses, proofing system, displays, etc. with a given set of colorants.
Gauge	The thickness of flexible packaging film substrates (100 gauge = 0.001"). Also a measurement sometimes used to identify the thickness of printing materials such as substrates, plates, mounting tape, etc.
GCR	See gray component replacement.
Gear Side	The side of the press that contains the gearing or drive mechanisms.
Gels	See dirt/gels.
General Requirements and Applications for Commercial Offset Lithography (GRACoL®)	Guidelines for sheetfed offset litho prepress, press and binding/finishing operations, were introduced in 1996 and as of 2006, is up to GRACoL 7 – available from IDEAlliance; for contact information, see Appendix.
Ghosting	A print defect. Presence of a faint image of a design in areas that are not intended to receive that portion of the image. Usually a repeat pattern in the press machine direction.
Gloss	Specular reflection of light from a surface, measured by a variety of instruments (like a glossometer) and reflection angles, reported as percentage with higher values indicating higher gloss. Film, ceramics & aluminum gloss is often specified at 45°; most paper is manufactured to specifications of 75° (ISO/TAPPI standard for paper); print gloss, metals & plastics are commonly measured at 60°, matte surfaces are measured at 85°; and very high gloss is commonly measured at 20° to correlate with visual perception.
GPI: Glass Packaging Institute	Founded in 1919 as the Glass Container Association of America, GPI is the trade association representing the North American glass container industry. On behalf of glass container manufacturers, GPI promotes glass as the optimal packaging choice, advances environmental and recycling policies, advocates industry standards, and educates packaging professionals. (www.gpi.org) GPI Produces the FLEXO Color Guide Edition X (10)
GRACoL®	See General Requirements and Applications for Offset Lithography.
Grade	Paper classification based primarily upon end use and brightness.
Gradient	See vignette
Gray Balance	The proper combination of cyan, magenta, and yellow ink dot area, hue/density, trap, transparency, and register on a specific substrate under normal printing conditions that reproduce as a neutral gray.
Gray Component Replacement (GCR)	A color separation technique that replaces the least prevalent process color (the "gray component") with black in areas where all three (CMY) are present. An example would be removing magenta from a green and replacing it with black.
Halftone	A pictorial that has been converted from a continuous tone original image, such as a photograph, into dots of appropriate size which, when printed, give the visual illusion closely resembling the original over a gradation range from highlight to shadow.
Halftone Tint	Refers to the pattern of dots of varying sizes applied to an image of varying tones. A Flat Halftone Tint is an area of approximately equal sized halftone dots producing a uniform optical density.

Halo A print defect. An undesirable outline appearing around a printed image or type/copy.

Haze A milky discoloration of a transparent film or liquid solution such as ink or overprint coating in any printing process. Reflection haze is scattering of reflected light in directions near that of specular reflection by a specimen having a glossy surface thereby masking print quality. Transmission haze is scattering of light within or at the surface of a nearly clear specimen causing a cloudy appearance when viewed by transmission typically negatively affecting the quality of reverse printed or laminated items. See clarity/haze.

HDPE See high density polyethylene.

High-Density Polyethylene (HDPE) Film that has excellent moisture barrier and stiffness so it is used in applications such as cereal and cracker packaging. It is frequently co-extruded with heat-seal layers such as Surlyn to make a finished packaging material. Blown HDPE film has better stiffness and moisture barrier than cast HDPE, but is hazier. Extrusion coated HDPE resins are generally used to improve grease resistance. The density of high-density polyethylene can range from 0.93 to 0.97 g/cm3.

Highlight The lightest or whitest parts in an image or photograph represented in a halftone reproduction by the smallest dots or no dots. Also, the range of the tonal reproduction area between 0-15%.

Hooking A term that describes a rapid, undesirable change in hue angle of a process color or overprint color due to an increase in ink film thickness or pigment load in an attempt to maximize the color gamut.

HSL Hue, Saturation, Lightness. Recognizing that the geometry of the RGB model is poorly aligned with the color-making attributes recognized by human vision, computer graphics researchers developed two alternate representations of RGB, HSV and HSL (hue, saturation, value and hue, saturation, lightness)

HSV Hue, Saturation, Value. See HSL.

Hue The attribute of color that distinguishes one shade from another (The name of the color: i.e. red, green, yellow, blue, etc.).

Hybrid Screening A type of screening for flexo platemaking that combines AM and FM screening. Typically, FM screening will be utilized at the extreme highlights, then transition to AM screening. The approach takes advantage of FM screening's capability to render fine highlight tone levels and AM screening's smoothness at higher tone levels. The technique can also be used to smooth the transition from a 95% to 100% that utilizes a solid cell screening technology.

ICC International Color Consortium – formed in 1993 to develop a color management system that would function transparently across all operating systems and software packages.

ICC Profile See profile

Ink Absorbency Ability of an ink to penetrate a substrate surface to a desired level promoting adhesion, high density, high gloss and ink lay uniformity.

Ink Bleed A print defect. Color spreads into subsequently applied coating or adhesive.

Ink Trap Percent A measure of how well one ink prints over another, calculated from print densities measured using the filter for the second ink printed to form the overprint. Higher numbers are desirable indicating the ability of an ink to transfer equally to an unprinted substrate and to a previously printed ink film. "Perfect" 100% trap is rarely achieved due to the inherent measuring geometry and data additive failure. Calculated as follows from print densities taken using the complementary filter for the second ink printed. Formula (next page):

$$\% \text{ Ink Trap} = \frac{\text{Overprint Ink (D3) - First Printed Ink (D1)}}{\text{Second Printed Ink}} \times 100$$

International Organization for Standardization (ISO)
A worldwide group from 100 countries with a mission to promote the development of international standards for intellectual, scientific, technological and economic activity. The ISO Technical Committee for graphic arts is TC 130. See Appendix for address.

ISO
See International Organization for Standardization.

Kerning
Modifying the normal space between letters during typesetting; can be plus or minus letter spacing in computerized typesetting; traditionally involved reducing space between only selected characters, such as the L and Y in ONLY, to be more readable or pleasing to the eye; see letter spacing.

Keyline
An outline on finished art indicating the exact shape, position, and size for elements such as halftones, line art, UPC symbols, etc.

Kick Out
Coagulated ink, with solid lumps or particles in ink

Kiss Impression
The minimum amount of pressure necessary on press to properly transfer ink between anilox and plate and/or plate and substrate/impression. In printing, a very light impression, just enough to produce an image on the paper.

Lamination
A printed or unprinted construction made by adhering two or more substrates together.

LCH
Lightness, Chroma, Hue. LCh is a variant of the CIELab color space. It is sometimes easier to visualize 3D color space in terms of LCh than Lab. In LCh, the further out from the center of the space you go, the more saturation (Chroma) is represented. Also the 'perimeter' of this 3D cylinder becomes a color wheel, which is represented by h (hue angle).

LDPE
See low density polyethylene.

Letter Spacing
Adding space between characters and spaces during typesetting; also known as "tracking" in some typesetting software; see kerning.

Line Color
Color printed as solid areas without halftone screen.

Line Copy, Line Art, Line Drawing, Line Film, Line Work
Any image or design element reproduced with solid ink and without the use a halftone screen.

Linear Low Density Polyethylene (LLDPE)
Film having the same features as LDPE but is stronger with better hot tack strength. Film resins are more expensive than LDPE, and extrusion coating grades are even more expensive. LLDPE has a density of 0.92 g/cm3.

Linear Medium Density Polyethylene (LMDPE)
Film is similar to LLDPE but provides improved stiffness, gloss, and reduced flavor adsorption. LMDPE is defined by a density range of 0.926–0.940 g/cm3

Lines Per Inch (LPI)
The number of dots per linear inch along the angle of imaging in a halftone. Dot size varies from very small highlight dots to large shadow dots. More lines per inch increases resolution detail and dot gain. Lines per centimeter are specified outside the USA. Also used to define the screen line count in anilox rolls.

LIVE
Indicates a scan or illustration in an electronic document that is ready for production of the platemaking film negative.

LLDPE
See linear low density polyethylene.

LMDPE
Linear medium density polyethylene. Film is similar to LLDPE but provides improved stiffness, gloss, and reduced flavor adsorption.

Loose Color Proof Also known as a random proof. Process color proof with no line copy or special ink colors.

Low Density Polyethylene (LDPE) LDPE is defined by a density range of 0.910–0.940 g/cm3. Low-cost resin LDPE film has good moisture barrier, heat sealability, and strength. Extrusion LDPE has an excellent bond to paper and varying bonds to other substrates.

LPI See lines per inch.

Machine Direction (MD) Flow or movement of material through a machine. Cellulose paper fibers are often oriented somewhat parallel to the direction of flow through a papermaking machine. Also see cross direction.

Mask
1. Outline of an image on original art;
2. Opaque material used to protect open or selected areas of a printing plate during exposure.

Masstone The reflected color of a bulk ink. See undertone.

MB See megabyte.

MD See machine direction.

MDPE See medium density polyethylene.

Medium Density Polyethylene (MDPE) A type of polyethylene defined by a density range of 0.926–0.940 g/cm3.This film provides better barrier and chemical resistance than LDPE, but is less dense than HDPE.

Megabyte (MB) A unit of measure equal to 1,048,576 bytes, or 1,024 kilobytes; commonly used to specify the capacity of computer memory.

Metamerism A phenomenon exhibited by a pair of colors that match under one or more set of conditions (real or calculated), but do not match when these conditions are changed.

Metamerism Index (MI) A formula that calculates the difference between two colors under two different light sources. An MI of greater than 2.0 usually indicates that the metameric is visible to the human eye.

Min-Dot or Minimum Dot The smallest tone value, or dot area level that can be consistently resolved, typically when referring to the printed piece.

Moiré An optical interference pattern caused when two screened images are superimposed at inappropriate angles. It is possible for an anilox roll screen pattern, or a substrate with an inherent pattern to be one of the sources of screen interference.

Moisture Content See absolute humidity and relative humidity.

Monochromatism A type of abnormal, defective color vision. No discrimination of hue or saturation. See abnormal color vision.

Mottle Print Defect. Result of uneven ink lay or non-uniform ink absorption across the paper surface, especially visible in mid-tone imagery or areas of uniform color such as solids and continuous-tone screen builds. Also known as orange peel, pigment flocculation, striations, etc.

Murray-Davies (M-D) Equation Used to calculate tonal value increase/dot gain/dot area. This measurement approximates the total of physical dot size plus apparent (optical) dot gain due to insufficient light absorption of the ink and extra light absorption of the substrate, thus the term "apparent dot area." Calculations can be made from densitometric or colorimetric data input.

N-Factor
A coefficient or correction factor that is an empirical calculation specifically for each printing substrate, and is used in the Yule-Nielson equation for factoring out Optical Dot gain. Typically the 50% tint is used. It is a best practice to communicate that an n-factor was used, especially if your data will be compared with others.

Nanometer (nm)
Unit of measure equal to one millionth of a millimeter. Color wavelengths are measured in nanometers.

Near-Neutral Calibration
A technique of calibrating a printing or proofing system to a defined condition in terms of gray balance and tone reproduction. One of the most common approaches is G7(TM) from IDEAlliance, however there are multiple alternate approaches.

OCR
Acronym for Optical Character Reader; a device that allows a computer to read printed or written material.

One Color Moiré
An interference pattern that appears in a one color screened area of a print typically caused by a coarse line screen of the anilox roller.

Opacity
Comparison of the percentage of light reflected by a sheet of paper with a black backing compared to the light reflected with a white backing. Higher values indicate higher opacity (less undesirable show-through of an image printed on the opposite side of a sheet). Can be measured with an opacimeter or a spectrophotometer.

Operator Side
The side of the press where the operator typically interfaces with the press - opposite of the gear side of the press

POP
See oriented polypropylene.

Opponent Color Theory
Opponent Color Theory explains conceptually how the human visual system perceives color. To the human visual system, red and green are opposites and yellow and blue are opposites. This means that if something is red, it has no green in it (but it may also be blue or yellow) and if something is yellow, it has no blue in it (but it may also be red or green). This theory is the basis for most uniform color spaces, such as CIELab and CIELCh.

Optical Scanner
A device that analyzes the light reflected from or transmitted through copy, art, or film and produces an electronic signal proportional to the intensity of the light or color.

Orange Peel
1. A variety of mottle.
2. A finish resembling the dimpled appearance of an orange peel.

Oriented Polypropylene (OPP)
A clear, stiff film with good heat resistance and good moisture barrier. Coated grades also have good oxygen barrier or good heat sealability.

Ortho Response
Specified as Type 2 in ISO 5-3:1995: Photography – Density measurements – Part 3: Spectral conditions. This is generally used for measuring densities when printing to orthochromatic (blue/green sensitive) materials with sensitivities of 350 nm to 520 nm with a peak at approximately 435 nm.

Pantone Matching System® (PMS)
The company/brand name of a system for specifying colors; a standard practice in the printing industry.

Parker Print-Surf
An instrument that uses an air leak principle to estimate substrate surface micro roughness by the average mean pore depth in microns using TAPPI method T555. Higher numbers indicate a rougher surface.

PE, Poly
See polyethylene, HDPE, LDPE, LLDPE, LMDPE, MDPE.

PET Polyester (Polyethylene Terephthalate)
Oriented PET film has excellent stiffness, clarity, heat resistance and dimensional stability good oxygen barrier, and some moisture barrier.

pH A measurement of acidity or alkalinity. pH is often associated with the chemistry of waterbased inks. A value of 7 is neutral in a scale ranging from 0 to 14. Solutions with values below 7 are acid, above 7 are alkaline.

Phthalocyanine Official name for phthalic acid commonly referred to as "Phthalo Blue" or "Phthalo Green". A bright greenish blue crystalline compound C32H18N8; metal derivatives that are brilliant fast blue to green dyes or pigments.

Pica Unit of measurement principally used in typesetting. One pica equals 12 points or approximately 1⁄6 of an inch.

Pick Resistance A balance of substrate surface cohesive strength being higher than the force necessary to split a wet ink film.

Picking Print Defect. Rupture of the surface being printed that occurs when the force necessary to split (transfer) an ink film is greater than the surface strength of the substrate being printed. Occurs when pulling force (tack) of ink is greater than surface strength of paper. Transfers from the substrate web to the image carriers & rollers.

Pinholing Print Defect. Failure of a printed ink to form a completely continuous film. This condition appears in the form of small holes or voids in the printed area.

Pixel In electronic imaging, a basic unit of digital imaging. A picture element, or the smallest unit (cell, dot, square) on a color monitor display screen grid that can be displayed, stored, or addressed. A picture is typically composed of a rectangular array of pixels.

Plate Break Non-print area where the two ends of a flexographic plate butt together after being wrapped around the plate cylinder on the printing press.

PMS See Pantone Matching System®.

Point 1. A typesetting measurement indicating type size. One point equals 0.01383";
2. Paperboard thickness measurement (20 pts. = 0.020").

Poly See polyethylene.

Polyethylene (PE, Poly) A polymerized ethylene resin used for packaging films or molded for a wide variety of structures. see HDPE, LDPE, LLDPE, LMDPE, MDPE.

Polypropylene (PP, Polyprop) Film has the highest melting point of the economical polyolefin family. It has excellent optics, high stiffness, and good moisture barrier. Copolymer polypropylenes give improved low temperature impact resistance and sealability. PP can be oriented (OPP) to make films with improved stiffness, barrier and optics.

Polyvinylidene Chloride (PVDC) Film with excellent water, oxygen and flavor barriers. In emulsion form, it can be used as a barrier coating.

Porosity The resistance of substrate to the passage of air, oil or water; it can affect ink absorbency, drying and adhesion. Porosity is measured quantitatively as either the length of time it takes for a quantity of air to pass through a paper sample, or the rate of the passage of air through a sample, using either a Gurley densometer (in the first case) or a Sheffield porosimeter (in the second case).

PostScript Adobe® Systems' trademarked page description language.

PP See polypropylene.

Print Contrast An indicator of a printing system's capability to hold image detail in the shadow region. Most desirable (highest) print contrast occurs with the simultaneous highest solid ink density and

the lowest dot gain. Calculated using the ratio of the difference between the printed solid area density and a printed shadow tint area (traditionally 75% for offset lithography and 70% for flexography) to the density of the solid, expressed as a percentage.

$$\text{Print Contrast} = \frac{D_S - D_T}{D_S}$$

Where:
D_S = the Density of Solid Ink/Printed Solid
D_T = the Density of the Halftone Tint.

Note: Solid and tint must be the same color.
% Print Contrast = Print Contrast x 100

Printing Industries of America — A member-supported, nonprofit, scientific, technical, and educational organization serving the international graphic communications industries; for contact information, see Appendix.

Process Colors (CYAN, MAGENTA, YELLOW & BLACK) — Cyan, magenta, yellow, and black; inks used in four-color process printing; hue may be modified to meet specific needs. Incorporated into past and current editions of FIRST, process colors have been colorimetrically specified and are mono-pigmented. All process inks must be a transparent. This will allow for the blending of varying amounts of each of the process colors to achieve the visual appearance of the many thousands of shades capable of being printed by flexography.

Profile — A file that serves to describe how a particular output device (press, proofer, etc.) renders and reproduces color. It is used to allow conversions from RGB to CMYK and CMYK to CMYK for transferring of images from one output device to another with the most accurate color matching.

Profiled Contract Proof — Also known as a color-managed proof, this type of proof is created using a color management system and is typically meant to represent a specific printing condition. Proofing systems often have larger color gamuts than most printing systems, so their gamuts need to be constrained, or limited, so as to not produce colors that cannot be achieved on press. It is often used as a contract proof, or agreement between a supplier and a customer.

Proof — A physical sample of a print or ink. A proof is typically intended to be a representation of the finished printed product and is used to judge the acceptability of an intermediate step in the process.

Proofer — The hardware device used to generate a proof. (Graphic target or drawdown.)

Protanomalous — A type of abnormal, defective color vision. Deficient in red response for certain color mixtures. See abnormal color vision.

Protanopia — A type of abnormal, defective color vision. Specific to the Red-Green color region, with most of the deficiencies in the red region. See abnormal color vision.

PVDC or PVdC — See polyvinylidene chloride.

Quiet Zones — Areas free of printing that precede the leftmost bar and follow the rightmost bar in a barcode symbol.

Radiation Curing — Radiation curing can be UV (ultra-violet) or EB (electron beam). These systems generate energy which will transform a liquid ink or coating into a solid.

Raster Graphics — Sometimes also referred to as "bitmapped graphics". Graphics that are made up of pixels and have a specific resolution. Subject to changes in resolution when scaled which can lead to quality concerns for sharpness and clarity of the image (both edge quality and internal quality)

Raster Image File Format (RIFF) — A file format for paint-style graphics, developed by Letraset® USA. RIFF is an expanded version of the TIFF format used by many scanner makers.

Raster Image Processor (RIP) A computer device or program that translates digital information in a page description language to the pattern of dots to be delivered by the output unit of the system.

Raster Scan The generation of an image on a display screen made by refreshing the display area line by line.

Reference In evaluating color difference, the reference is the color against which all measurements are compared. Also referred to as Standard.

Reflection Densitometry The measurement technology that determines the amount of light absorption of materials by measuring reflectance and calculating and reporting optical density.

Register (Registration) Proper alignment or positioning of two or more elements with each other. This includes print-to-print and print-to-cut applications.

Relative Humidity A percentage of the amount of water vapor the air or a material such as paper can hold at a given atmospheric temperature and pressure. Most paper is made to be dimensionally stable in equilibrium with the atmosphere at 35% to 50% relative humidity. Excessive variation from this general range can result in non-flat paper, print misregister and other converting complications.

Rendering Intents Methods established by the ICC to define the objective for a color conversion. The ICC specification includes four different rendering intents: absolute colorimetric, relative colorimetric, perceptual, and saturation.

Repeat The printing length of a plate cylinder determined by one revolution of the plate cylinder gear.

Representative Contract Proof A contract proof representing a group of similar designs. For example, a customer may ask for one proof to be made to represent two or more pieces of art, typically as a cost saving effort. See contract proof.

Resin A sticky flammable organic substance, insoluble in water, exuded by some trees and other plants

Resolution A measure of image sharpness, usually expressed in lines or dots per inch or millimeter. On a prepress visual display terminal, the number of pixels per unit of linear measure, e.g.,12 pixels per millimeter is a RES 12. Normally, the resolution (RES) of a file is the same vertically and horizontally, thus a square millimeter contains 12 x 12 = 144 pixels for a RES 12 file. The higher the RES, the better the image detail; but the file will be larger and will require longer processing time.

Reverse To change the tonal orientation of an image, making the darker elements lighter and the lighter darker. Note that to physically reverse the spatial orientation of an image is known as "flopping" the image.

Reverse (Knock-Out) The process of dropping a surprinted image out of the background color so type, for example, will appear white with a color surround.

Reverse Angle Doctor Blade Doctor blade used with light pressure and a reverse angle on the anilox roll.

Reverse Print 1. Printing wrong-reading on the underside of transparent film which, when laminated to another substrate the image becomes right-reading when viewed through the sheet it was printed upon. See surface print;
2. Design in which the "copy" is "dropped out" and the background is printed.

RGB Red, green, and blue, the primary additive colors which are the backbone of computer color visual display monitors and prepress color separation. They also are the complementary or

	secondary subtractive ink colors which produce red by overprinting magenta and yellow, green by trapping cyan and yellow, and blue by overprinting cyan and magenta.
Rheology	The science of the flow of matter for liquids and soft solids. The ability of the liquid or soft solid to flow or be deformed.
RIFF	See raster image file format.
RIP	See raster image processor (processing).
Rods	A photoreceptor cell in the outer edges of the retina in the eye that is responsible for peripheral vision and night vision
Rollout	Fluid ink print on a substrate using a Meyer rod applicator.
Rounding Errors (Bar Codes)	The process of allocating imaging device dots to bar or space modules in an uneven manner.
Rub Resistance	See Abrasion Resistance
Sample	In evaluating color difference, the sample is the color to be measured and compared to the target reference/standard.
Sans Serif	Text characters without serifs, which are the fine lines that curve out from the main strokes of a letter. An example is the font Times New Roman.
SBS	See solid bleached sulfate.
Screen Ruling	See lines per inch
Screen Tint	See halftone tint.
Screening	Small voids in print in image areas, often has very regular shape consistent with anilox pattern.
Scuff	A mark made by scraping or grazing a surface or object. Also see Abrasion Resistance
Set-Off	Ink transfers from image side to back side of substrate when unrolled in subsequent operations. Set-off is a less severe case of blocking.
Sharpen	To decrease in color strength, as when halftone dots become smaller; opposite of dot spread, dot gain/area or Tonal value increase.
Sheffield Smoothness	Macro smoothness of a substrate surface (typically uncoated paper, corrugated, etc.) measuring the rate of surface air flow as specified by TAPPI T538 using a Sheffield instrument. Reported as Sheffield units, values are inversely related to smoothness; the higher the value, the rougher the surface.
Shell Cup	A device for measuring viscosity.
Simultaneous Contrast	The phenomenon that occurs when the surrounding color influences how a color is perceived.
SKU	See stock-keeping unit.
Slur	Print Defect. A condition caused by slippage at the moment of impression between any two of the following: substrate, plate, blanket.
Smoothness	Extremely important substrate surface uniformity requirement for high quality flexographic printability that affects ink lay and ink transfer. Measured mostly by a variety of air-leak instruments and profilometers. See Parker Print-surf, Sheffield.

Snowflaking Print Defect. Condition of a printed area characterized by very small dots of unprinted areas showing throughout a deposited ink.

Solid Bleached Sulfate (SBS) Paperboard made from bleached wood pulp, usually clay coated on one or both sides to improve printability.

Solvent A substance that is liquid at standard conditions and is used to dissolve or dilute another substance; this term includes, but is not limited to, organic materials used as dissolvers, viscosity reducers, degreasers or cleaning agents. Water is considered the universal solvent.

Solvent Release In ink, the ability of a binder to influence the rate of evaporation of a solvent.

SPC Acronym for statistical process control.

Specific Gravity The ratio of the weight of a body to the weight of an equal volume of water at the same specified temperature.

Specifications for Web Offset Publications (SWOP) A set of production specifications developed for those involved in heatset web offset litho magazine publication printing. First published in 1975, the eleventh edition was released in 2007, and is available from IDEAlliance; see Appendix for contact information.

Spectral Reflectance Curve The spectral reflectance curve graphically depicts the color composition of an object. The x-axis shows the wavelengths, starting with 380nm and ending with 700nm, and the y-axis shows the relative reflectance (the amount of light reflected from the object in %).

Spectral Response (Densitometer Response) Spectral response is the product of the spectral power distribution of the lamp, attenuation of the optics and filters, and the spectral response of the detector used. The aim responses for spectrophotometers/densitometers are contained in ISO 5-3:1995, Photography – Density measurements – Part 3: Spectral conditions. The status responses of interest for densitometer response to the graphic arts are Status E, Status I, and Status T.

Spectrodensitometer A color measurement device that is truly a spectrophotometer, but includes all of the densitometric functions along with the colorimetric functions in one device.

Spectrophotometer A device that measures the spectral reflectance of a sample and generates a data set that is utilized in combination with a CIE Standard Illuminant and a CIE Standard Observer to generate colorimetric values to describe color quantitatively. Instrument classifications include; inline, hand-held and desktop.

Spot Color A non-process color, typically made up of a combination of two or more pigments. Associated with Brand Colors, metallics, whites, fluorescent pastels and can be used as a line color or with a halftone tint.

Spots (Bar Codes) Undesirable presence of ink or dirt within the space of a bar code symbol.

Stain Level In carbon-mask-based platemaking systems, this describes the amount of carbon left on the plate after CtP imaging/ablation. It is measured with a transmission densitometer and is an important quality consideration, similar to Dmin for film, in its impact on the effectiveness of the main exposure.

Standard In evaluating color difference, the standard is the color against which all measurements are compared. Also referred to as Reference.

Standard Illuminant See CIE Standard Illuminant

Standard Observer See CIE Standard Observer

Standard Reference Material A physical sample with characteristics traceable to an accepted primary standard or set of standards. An example would be a T-Ref from IDEAlliance which is used to verify conformance to the Status-T densitometric response.

Standard Viewing Conditions Conditions defined in ISO 3664 that provide specifications for viewing proofs and printed products so that a fair and consistent visual evaluation can be made.

Stochastic Screening See frequency modulation, FM screening

Stock-Keeping Unit (SKU) An assortment or variety of wholesale items shipped in one physical case.

Streaking Not wiping clean, leaving stripes or lines of color on web, rollers or printed product (Print Defect)

Strength Usually refers to intensity of a color of ink.

Striation A print defect seen as weak ink or no ink in print direction of image. A fine streaky pattern of parallel lines, usually in the direction of the web.

Stroke of Oscillation The distance the doctor blade oscillates.

Substrate The material that is printed upon, i.e., film, paper, paperboard.

Subtractive Primaries Yellow, magenta and cyan, the hues used for process color printing inks.

Surface Print Conventional flexographic printing resulting with a right-reading image on the top surface of the web. See also – reverse print.

Surface Strength See pick resistance.

Surface Tension Measurement of surface energy that affects ink transfer and adhesion to a substrate. (The tendency of a liquid surface to contract rather than flow out.) Commonly measured with a dyne indicator solution applied to a film substrate surface. Substrates typically should be 8 to 10 dynes/cm higher then the ink.

SWOP See Specifications for Web Offset Publications.

Tack In printing inks, the property of cohesion between particles; the separation force of ink needed for proper transfer and trapping on multicolor presses. A tacky ink has high separation forces and can cause surface picking or splitting of weak papers.

TC 130 See International Organization for Standardization.

Telescoping Transverse slipping of successive winds of a roll of material so that the edge is conical rather than flat.

Tensile Strength The maximum load in tension that a material can withstand without failure.

TIFF (Tagged Image File Format) A file format for exchanging bitmapped images between applications developed by Aldus, Adobe, and Apple that is particularly suited for representing scanned images and other large bitmaps. The original TIFF saved only black and- white images in uncompressed forms.

Tinctorial Strength The relative ability of a pigment or dye to impart color value to a printing ink.

Tint See halftone tint.

TIR See total indicated runout.

Tolerances The specification of acceptable variations in print attributes like color, register, density, dot size, plate or paper thickness, concentration of chemicals and other printing parameters. Suppliers and customers should communicate acceptability limits or process capabilities to each other.

Total Area Coverage (TAC) Also known as Total Ink Limit – a description of the total percentage of coverage, typically in four-color process printing. This is typically quantified when profiling, or characterizing, a printing system to determine at which point additional coverage yields no additional darkness, or density. A target is printed with a matrix of CMYK at different amounts to assist in this assessment.

Total Indicated Runout (TIR) A measure of the out-of-roundness of a printing press roller or cylinder. The difference in the lengths of a roller's radius as measured from the center to the outside surface. A perfectly round roller would have zero TIR.

Tracking A print defect associated to an ink that appears in area where there is no print.

Transmission Densitometry The measurement technology that characterizes the light absorption of materials by measuring transmittance, and calculating and reporting optical density.

Transparent Ink A printing ink that does not conceal the color under it. Process & EG inks are examples of transparent inks allowing inks to blend to form other colors.

Trapping (Image) To compensate for registration variation, two adjacent colors butting each other must be altered to allow for normal registration variances to exist without degrading the design. This is accomplished by spreading or overlapping the lighter of the two adjacent colors into the dominant, or darker, color.

Trapping (Ink) The overprinting and adhering of one ink over another to produce desired secondary or tertiary colors. This typically refers to the overprinting of CMY to produce various shades of RGB, but is not limited to this. There can also be trapping of and with spot colors.

Tristimulus The magnitudes of three standard stimuli needed to match a given sample of light. A method for communicating or generating a color using three stimuli (colorants such as RGB or CMY) or three attributes (such as lightness, Chroma and hue).

Tritanopia A type of abnormal, defective color vision. Specific to the Blue-Yellow color region, with most of the deficiencies in the blue region. Confusion of blue with green and Yellow with violet. See abnormal color vision.

Truncated Shortened. Decreasing the height of the bars in an UPC bar code symbol below the normal specification decreases the symbol's ability to be read omni directionally and should be avoided.

Two Roll Metering A method of metering ink in which a rubber roller is used to meter the ink off of an anilox.

Ultraviolet (UV) Radiant energy below just below the visible spectrum

Undercolor Addition (UCA) A color separation technique that adds more cyan, magenta, and yellow to the neutral shadow areas of a process color image.

Undercolor Removal (UCR) A color separation technique that reduces the amount of cyan, magenta, and yellow in neutral areas of a process color image and replaces them with an appropriate amount of black.

Undertone Color of an ink printed in a thin film. See masstone

Uniform Code Council (UCC) An organization responsible for overseeing and administering the Universal Product Code.

Universal Product Code (UPC) A 12- or 8-digit code number that identifies a wide range of products; printed on packages as the UPC bar code symbol which can be read electronically by a scanner at retail store checkout counters.

UV (Ultraviolet) Response Refers to that response specified as Type 1 in ISO 5/3. This is generally used for measuring densities when printing to UV/blue sensitive materials. Type 1 (UV) printing density was standardized to provide printing density values for use when exposing diazo and vesicular films normally sensitive in a narrow band of the blue and ultraviolet region of the spectrum, between 380 nm and 420 nm with a peak at 400 nm.

UV Coating Liquid laminate bonded and cured with ultraviolet light.

UV Ink Solventless inks that are cured by UV radiation.

Varnish A thin, protective coating applied to a printed sheet for protection or appearance. Also, in ink making, it is the binder/resin component of an ink.

Vector Graphics Graphics that are defined in mathematical terms in illustration programs. As a result, the quality of the graphic is independent of any scaling that may occur – edge quality stays razor sharp regardless of any amount of enlargement. A key difference in comparison to raster graphics.

Vehicle In printing inks, the fluid/liquid component which acts as a carrier for pigment.

Vignette A halftone graphic (design element) that changes smoothly in tonal values from light to dark or vice-versa. It may or may not go all the way to a specular highlight (zero tone value). Also referred to as a gradient or blend.

Viscometer Instrument used to measure the viscosity of ink, varnish, or other solution.

Viscosity A measure of a fluid's (ink, coating) resistance to flow, which influences the amount of ink (color) printed.

Visual Spectrum Portion of the electromagnetic spectrum between 380 nm and 700 nm that can be seen by the human eye.

Voids (Bar Codes) The undesirable absence of ink or presence of dirt within a bar of a bar code symbol.

Wash Boarding Print defect of combined board in which the linerboard is depressed between flutes, giving the appearance of a washboard; typically measured visually against a standard agreed upon between the customer and the supplier.

Wetting Agent A substance that reduces the surface tension of a liquid, thereby causing it to spread more readily on a solid surface.

White Opaque Polyethylene Film frequently used to package frozen foods. (WhOPE, WOPE)

WhOPE, WOPE See white opaque polyethylene.

X-Dimension The specified width of the narrow element in a bar code symbol.

Zahn Cup: A device for measuring viscosity. Five cup specifications exist and are identified as Zahn cup #n (n=1, 2, 3, 4 or 5)

Appendix F: General Outline/Definition of a Creative Brief and Style Guide

Creative Briefs and Style Guides play an important role in the development and ongoing continuity of packaging designs. In the simplest terms, a Style Guide is a set of standards for a brand (the do's and don'ts of the brand identity), while a Creative Brief provides specific details concerning the execution of a single package design (ie. a set of objectives for a package).

Not all projects will be accompanied by either of these documents, but it is common for larger brands, or the agencies that represent them, to have both. Regardless of the size of the brand or project, access to the information contained in documents such as these makes things easier for everyone in the supply chain. The following describes typical categories of information that make up the contents of both Creative Briefs and Style Guides respectively.

CREATIVE BRIEF

Project Title
Client: (Main contact/decision maker)
Key approvers: (Legal)
Project Manager: (Coordinator/account manager)
Objective: (Purpose of materials and desired outcome of project)
Messaging: (Supplied copy, priorities/hierarchy, translations/languages)
Supporting Info: (Target audience, market/trend research, competition, brand/product info)
Budget: (Estimated costs with approval)
Project Scope: (Services, quantities, exclusions)
Deliverables: (PDFs, comps/mockups, presentation boards, prototypes)
Timeline: (Concept deadlines, production/delivery schedule)

STYLE GUIDE

Content
Overview: (Standards)
Building our Brand: (Alternate heading)
Mission/Vision: (Meaning/purpose)
Logo/Identity/Brandmark: (Consistency)
Tagline: (With and without)
Lockup: (Spacing/positioning)
Primary Branding: (Logo/lockup)
Secondary Branding: (Icons/alternate colors)
Full Color Logo: (Versions)
One Color Logo: (Versions)
Logo Variations: (Special usage)
Proper Usage: (Size, clearance)
Improper Usage: (Modified logo)
Color Palettes: (Pantone/CMYK)
Secondary Colors: (Pantone/CMYK)
Specifications: (Print vs. web)
Font Usage: (Specified)
Brandmark Placement: (Newsletter, blog, website)
Stationery: (Collateral)
Signage/Collateral: (Logo/color palette/icons)
Apparel: (Alternate style)
Proposals/Presentations: (Format/medium)
Case Studies: (Format/results)
Acquiring/Sending Assets: (Login/download)