Design Guide

first

Flexographic **I**mage **R**eproduction **S**pecifications & **T**olerances

FTA


first

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Content Notes:

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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. This edition of *FIRST* 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 6.0 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* 6.0. These individuals exhibited tireless enthusiasm in spearheading the continuous advancement of the flexographic printing process.

FIRST 6.0 LEADERSHIP COMMITTEE

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Shelley Rubin	Manager of Educational Services	FTA Technical Education Services Team

ADDITIONAL *FIRST* 6.0 SECTION CONTRIBUTORS

David Bell	Correct-Touch Graphic Arts
Richard Black	All Printing Resources
Roy Bohnen	Epson
Kevin Bourquin	Cyber Graphics
Jason Cagle	MacDermid Graphics Solutions
Chad Fulwiler	En Point Marketing
Larry Goldberg	Beta Industries
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Nick Lena	GTI Graphic Technology, Inc.
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Richard Ahlborn	National Envelope Corporation
Larry Ahleman	Western Michigan University
Joe Aker	Hood Packaging, Inc.
Jeff Albaugh	Mastergraphics
Dr. John Anderson	FCA Associates
Frank Anthony	Chattanooga Times/Free Press
Roberto Arosemena	Grupasa
John Babl	Paper Coverting Machine Company
Steve Balschi	Printpack, Inc.
Jason Barrier	Printpack, Inc.
Chuck Bell	Multi Color Corporation
Maynard Benjamin	Envelope Manufacturers Association
Dr. Penny Bennet	California Polytechnic State University
Brian Berhdt	Lauterbach Group
Michelle Beuscher	Independent Consultant
Richard Black	All Printing Resources, Inc.
Denise Bloy	OEC Graphics, Inc.
Dr. Mark Bohan	Printing Industries of America
Roy Bohnen	Epson
Bill Bowers	Flint Group Flexographic Products
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Al Brancaccio	Overnight Labels Inc
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Steve Carter	Phototype
Mark Causey	Beck Compression
Ray Cheydleur	X-Rite, Inc.
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Kevin Chop	Diageo
Brian Chwierut	Sun Chemical
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Randy Crutchfield	Prairie State Group
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Chris Deye	Phototype
Patrick Dillon	CL&D Graphics
Tony Donato	Harper Corporation of America
Dr. Lorraine Donegan	California Polytechnic State University
Dr. Martin Dreher	DFTA - Germany
Rich Emmerling	Flint Group Flexographic Products
Larry Wm. Evans	Clemson University
Jon Fehrman	Scotts Company
Bill Ferguson	Cincinnati Precision Plate
Eric Ferguson	Esko-Graphics, Inc.
Julian Fernandez	Esko
Michael Ferrari	Proctor & Gamble Company
James Ford	Color Resolutions Intl.
Michelle Ford	Monarch Color Corp.
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Larry Haas	Alcan Packaging
Joe Hamilton	Stevenson
Tom Hammer	Flint Group Flexographic Products
Jessica Harrell	A&V
Neil Harrelson	Schawk, Inc
Lesley Hide	EFTA - United Kingdom
Gary Hillard	Hood Packaging, Inc.
Ian Hole	Esko-Graphics, Inc.
Mike Impastato	Flint Group Flexographic Products
Dr. Sam Ingram	Clemson University
Jean Jackson	Praxair, Inc.
Alexander James	Harper Corporation of America
Dr. Malcolm Keif	California Polytechnic State University
Patricia Kent	Pamarco Global Graphics
Rob Kidwell	National Envelope Corporation
Andy Knapp	Flint Group
Bjorn Knutson	FTA Technical Education Services Team
Dick Koslowski	OEC Graphics, Inc.
Tom Kowalski	Eastman Kodak Company
Jim Kulhanek	DuPont Cyrel Packaging Graphics
Allison Lakacha	Techkon, USA
Paul Lancelle	All Printing Resources
David Lanska	Stork Cellramic, Inc.
Colleen Larkin Twomey	California Polytechnic State University
Dr. Brian Lawler	California Polytechnic State University
Paul Lodewyck	LIG Technology
Tim Loehrke	SCHAWK!
Bill Malm	Flexowash
Rory Marsoun	Esko
Dan Martinez	Matthews International Corp.
Darlene Masek	Nestle USA, Inc.
Dr. Mark R. Mazur	DuPont Cyrel Packaging Graphics
Joe McCarthy	Burrows Paper Company
Terri McConnell	Phototype
David McDowell	NPES/CGATS
Michael McGinnis	RR Donnelley
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David Merkley	American Color Graphics
Patrick Mollman	Siegwerk
Jason Nelson	OEC Graphics
Doug Nelson	Water Ink Technologies
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Dr. Dieter Niederstadt	Asahi Photoproducts
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Roberto Nunez	GIPSA - Mexico
David Nunez	International Paper
Robert O'Boyle	Sun Chemical
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Adina Oree	Lohmann
Wayne Peachey	Keating North America
Ted Pech	Group 360

Cherie Pierce	Printpack, Inc.
Bill Pope	FTA/FFTA
F. Cordes Porcher	Packaging Corporation of America
Todd Pressly	Group 360
Lou Prestia	Prestia Consulting Inc.
Dr. Joseph Rach	Chemence, Inc.
Jeffery Randazzo	Controlled Displacement Technologies LLC
Dan Reilly	Plastic Packaging Inc.
John Richardson	All Printing Resources, Inc.
Greg Robinson	Integrity Engineering, Inc.
Lon Robinson III	Tension Envelope Corporation
Steven Rose	National Envelope Corporation
Mark Samworth	Esko
Pete Santkuyl	Kimberly Clark
Kevin Schilling	OEC Graphics, Inc.
Andrew Schipke	W & D Machinery Company, Inc.
Jon Schlosser	OEC Graphics, Inc.
Mike Shanley	National Envelope Corporation
Marek Skrzynski	CSW Graphic Services
Steve Slater	X-Rite, Inc.
Steve Smiley	Smiley Color & Associates
Bob Smith	Great Northern Corporation
Herman Spencer	The News & Observer
Jay Sperry	Clemson University
Seetharaman Srinivasan	Sonoco
David Straten	Advanced Packaging Corporation
John Sweeney	IQ Color
Michelle Talko	Prairie State Group
Brad Taylor	DuPont Cyrel Packaging Graphics
Garrett Taylor	A&V
Tom Thackeray	Weyerhaeuser
Shawn Thiessen	Fastik Label & Supply
Scott Thompson	Southern Graphic Systems
Kevin Trischett	National Envelope Corporation
Katie Tuckwiller	DuPont Cyrel Packaging Graphics
Kelly VandenBosch	ISRA Surface Vision
Rebecca Van Handel	RR Donnelley
Shridhar Varde	Agfa Corporation
Ryan Vest	MacDermid
Joan Wallace	Label Technologies Southeast
Melanie Ward	Wikoff Color Corporation
Bill Warner	Allsion Systems
Brian Watkins	Burrows Paper Company
David Watson	Tesa Tape
Phil Wedding	Sonoco
Torben Wendland	Flint Group
Jarrett Westman	Tetra Pak Inc.
Frank Wheeldon	Schawk, Inc
Catherine Whitaker	Anderson & Vreeland, Inc.
Dr. Nona Woolbright	Clemson University

ADDITIONAL CONTENT AND GRAPHICS CONTRIBUTORS

360 Imaging, 3M, AGFA, Asahi Kasei America, Beta Industries, BOBST, BST Pro Mark, CGS Publishing Technologies International, Color Resolutions International, Clemson University, C-P Flexible Packaging, DFTA, Dunwoody College of Technology, DuPont Cyrel Packaging Graphics, Eastman Kodak Company, EFI, E.I du Pont de Nemours & Co., Epson, Esko, Eudes Scarpeta, F. Cordes Porcher, Fischer & Krecke, Flint Group, FTA/FFTA, FUGIFILM Graphics Systems USA, Gallus, Graymills, Harper Corporation of America, Hood Packaging Corporation, IDEAlliance, Integrity Engineering, Inc., Interflex Laser Engravers, INX International, Just Normlicht, MacDermid Printing Solutions, Mark Andy, Inc., Michelle Beuscher, OEC Graphics, Opaltone, Inc., Paper Converting Machine Company, Phototype, Praxair Surface Technologies, Printing Industries of America, Right Angle Concepts, RIT, Smurfit-Stone Container Corporation, Spectrum Label Corporation, Sun Chemical Corporation, Smyth Companies, Sun Chemical Corporation, Techkon, VT Graphics, William Fox Munroe, Windmoeller & Hoelscher Corporation, X-Rite

THE FTA TECHNICAL EDUCATION SERVICES TEAM IS:

Joe Tuccitto, Rose McKernon, Shelley Rubin, Bjorn Knutson, Duane Woolbright, Eileen Cosma and Mark Cisternino

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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

3.0.1 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

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

1. **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.

2. **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.

3. **Customer specifications**

4. **Design brief**

5. **Brand style guide and corporate art guidelines**

6. **Legal and government regulations**

3.2.1 Template Layout/Die-Cut Specifications

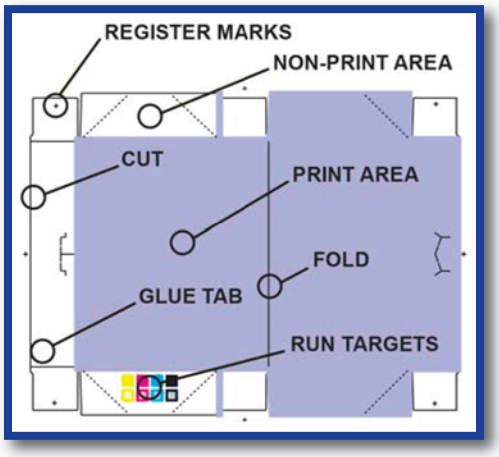
Die line/Electronic File

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.

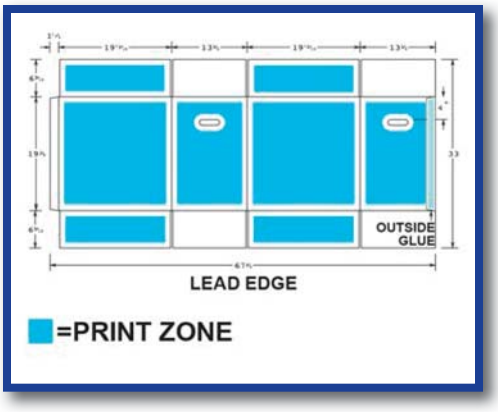
Using the Template Layout

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

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.*



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

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

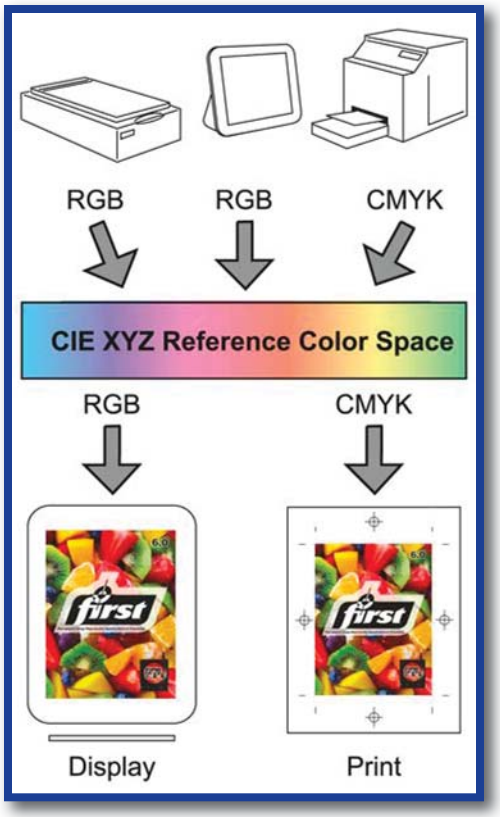
Alternate versions of an electronic file should have separate and distinct names from the original version. File naming conventions for live, high-resolution images should be in accordance with the criteria of the collaborating parties. For example, workflow may dictate file names, SKUs, job numbers,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



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.*

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

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.*

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 profile (International Color Consortium)," for that print condition. An ICC profile of a standardized color space such as GRACoL 2013 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, and transparencies, under a controlled and standard light source. Accurate, consistent, visual perception of color requires the image to be viewed in a standard, chromatically neutral, controlled environment. When the printer, prepress provider and customer standardize viewing conditions, color discrepancies are minimized.

Industry Standard: *FIRST* supports the viewing standards defined in ISO 3664:2009. However, *FIRST* recognizes the D50 light source may not be optimal for all print segments.

Instrument Agreement: The illuminant 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 to communicate the settings to all parties receiving proofs, printed samples and/or data measurements.

ISO 3664:2009 - Viewing Conditions	
Parameter	Specification
Observer	This practice requires judgments by observers with superior color vision as rated with the FM-100 Hue Test as specified in ASTM E1499, Guide for Selection, Evaluation, and Training of Observers.
Illuminance	The illuminance should be diffuse and non-directional providing illumination at the center of the viewing surface (2 000 ± 250) lx, 1500 to 2250 Lux, also known as P1. When viewing a printed image against a proof the illuminance at the center of the viewing surface should be (500 ± 125) lx for comparing a digital image to a proof, also know as P2.
Daylight Quality	The quality of the illumination shall approximate the CIE standard illuminant D50 at 5000K with a color rendering general index, Ra of 90 or greater with the special indices R1 to R8 in the CRI calculation greater than 80 as specified CIE 13.3-1995 Method of Measuring and Specifying Colour Rendering Properties of Light Sources. The target for chromaticity is U'= 0.2102 and V' =0.4889 both having a tolerance of ± 0.005. The daylight simulation should have a minimum quality grade of B for the visible light and C for the near UV when graded based on ISO 23603:2005/CIE S 012/E:2004. Standard method of assessing the spectral quality of daylight simulators for visual appraisal and measurement of colour. This standard method was previously known as CIE Publication 51 and requires measurements made using a Spectroradiometer with current traceable certification and capable of measuring 300 to 780 nm in a minimum of 5 nm intervals as specified in ISO 23603/CIE S 012.
Viewing Area	The surround should be neutral with diffuse a reflectance of 60% typically Munsell N8/neutral gray. Ambient light should be eliminated from the viewing area which is typically used by using a viewing booth.
Reference standard for more details.	

Table 3.5

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

Concept/Mock Up Proof

A 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 design development and can be referred to as a "Collaborative Proof". This type of proof is typically not color accurate and is to be used for color breaks and content only. These proofs should be labeled to indicate if it is color accurate or not.

Comprehensive Proof/Prototype

This proof is formed to the shape of the final product and should indicate whether or not it is color accurate.

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

Profiled Contract Proof
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 based on profiles provided by the specific printer or prepress provider and is produced according to *FIRST* specifications. The contract proof does not have to be a dot-for-dot reproduction, but it must exhibit a common visual appearance to the press or Characterized Reference Printing Condition (CRPC) dataset. It must also contain a control target that is processed and imaged as part of the proof, which will be used to verify accuracy and consistency throughout the design, proofing and printing process. The CRPC datasets and control target must conform to the ANSI CGATS.21/ISO 12647 (See Appendix B, for all parts).

Soft Proof
This proof is viewed on a color-calibrated monitor. The soft proofing method can be used at any stage from concept proof to contract proof, depending on how well the system is calibrated. To use the soft proofing method, each party must have a calibrated, color consistent monitor. Soft Proofing is defined in ISO 14861:2015 Graphic technology — Requirements for colour proofing systems using electronic displays (See Appendix B).

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" job 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.

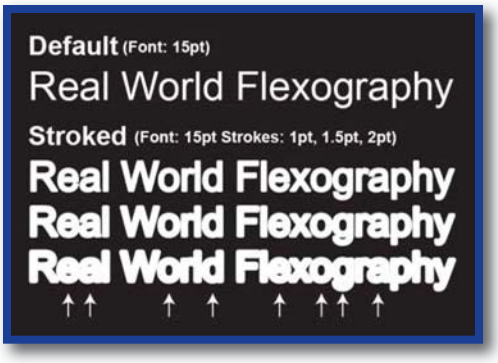
Format: Sections 12.8 and 12.9 describe the key print characteristics for both line and process work, and the test element used to measure each characteristic. Previous editions of *FIRST* have supplied the *FIRST* control target. Beginning with this edition, all of the test elements discussed in Sections 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.5-2009 Graphic technology – Spectral measurement and colorimetric computation for graphic arts images (See Appendix B) 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.

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.



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.*

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

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

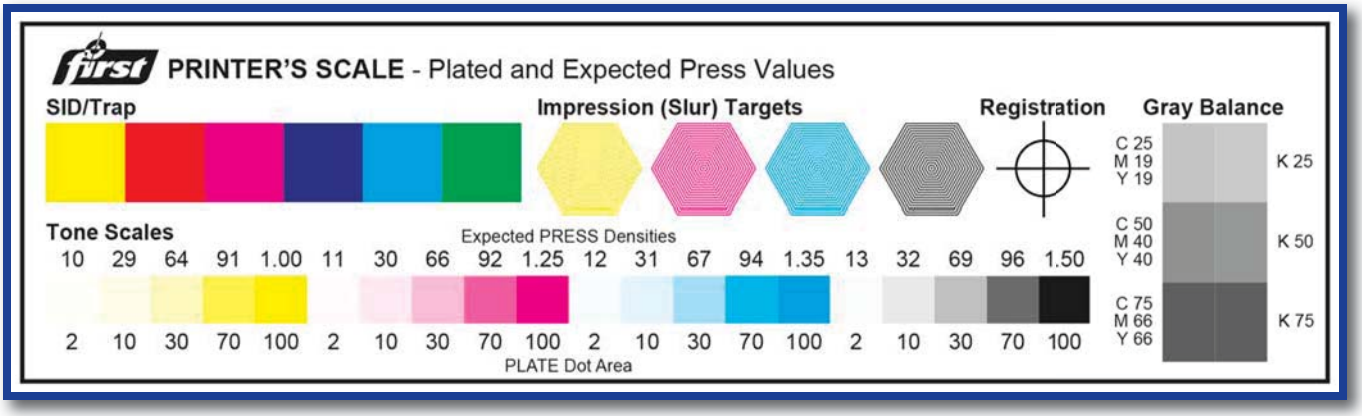
Process Control Test Elements: *FIRST* recognizes certain press configurations (narrow web) and product types (ie: poly bags, envelopes and newsprint) may not have large enough trim areas or glue zones to maintain all recommended process control elements throughout the production run. On these products,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

4.0 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.



3.7 Process Control Test Elements

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.

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.

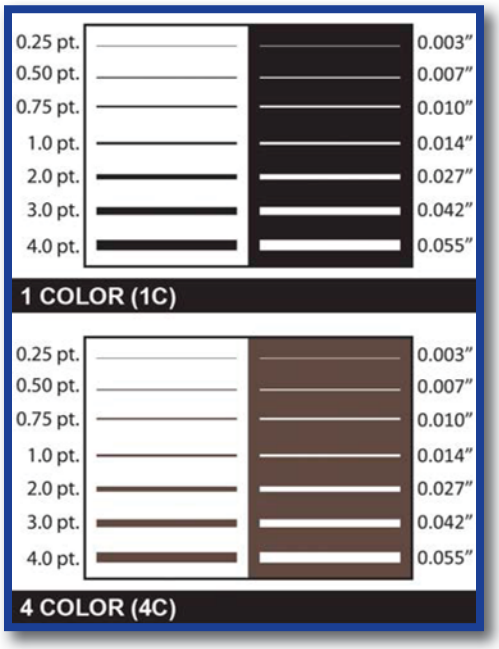
Positive vs. Reverse: Positive type can be printed clearly at a smaller type size than reverse type. Reverse type is more vulnerable to ink volume and impression settings resulting in type filling in and becoming illegible.

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 but is not limited to: ink coverage, substrate absorbency and compression.

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



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.*

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

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

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

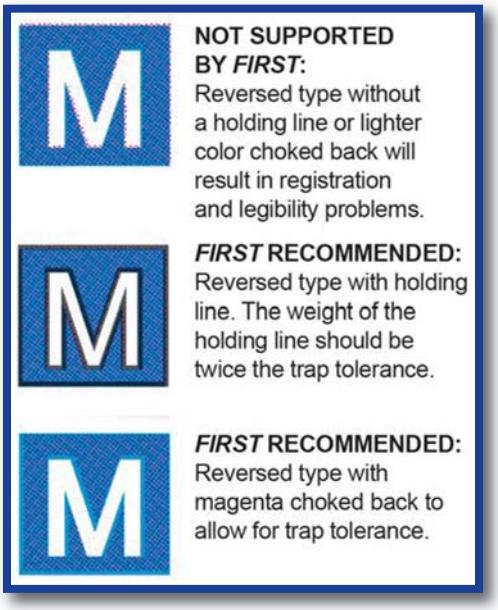
Minimum Rule Width: General Guidelines *Minimum rule width is print system dependent; determine minimum rule width with press fingerprint (ref. 1.3.2)*						
Segment		**Substrate**	**Positive Rule**	**Reverse Rule**	**Printer Specific**	
					Positive Rule	**Reverse Rule**
Wide Web	Preprint Linerboard	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

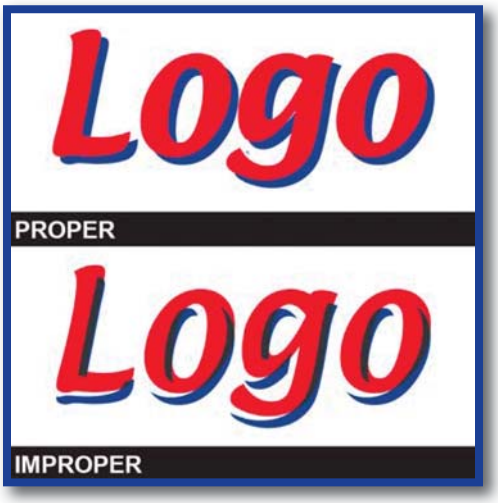
If a holding line is not used, the darkest or predominant color should be made full size and the remaining color must be choked back the width of one row of dots as determined by the screen ruling. If possible, the background color should be limited to one color.

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



4.1.3 *FIRST* Process Reverse/ Knockout Recommendations



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

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

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 and/or include the orignal font(s) used.

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,

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.*

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 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.

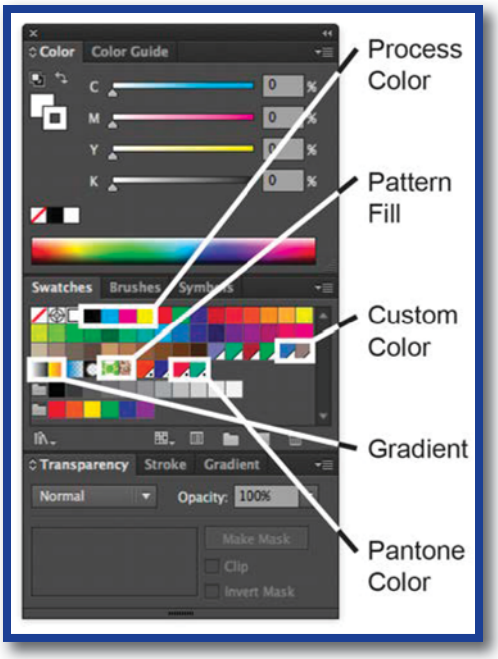
4.1.8c Converting Type to Outlines:
Type converted to outlines minimizes font problems but cannot be edited.

4.2 Custom and Special Colors

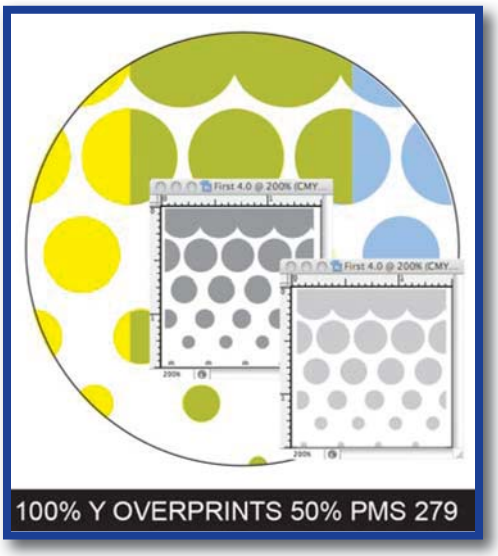
"Custom Colors" as defined in a file should represent only the actual inks, or tints of those inks, that will be printed.

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



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.*

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.

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 and UNSPSC contact information is included in Appendix A.

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

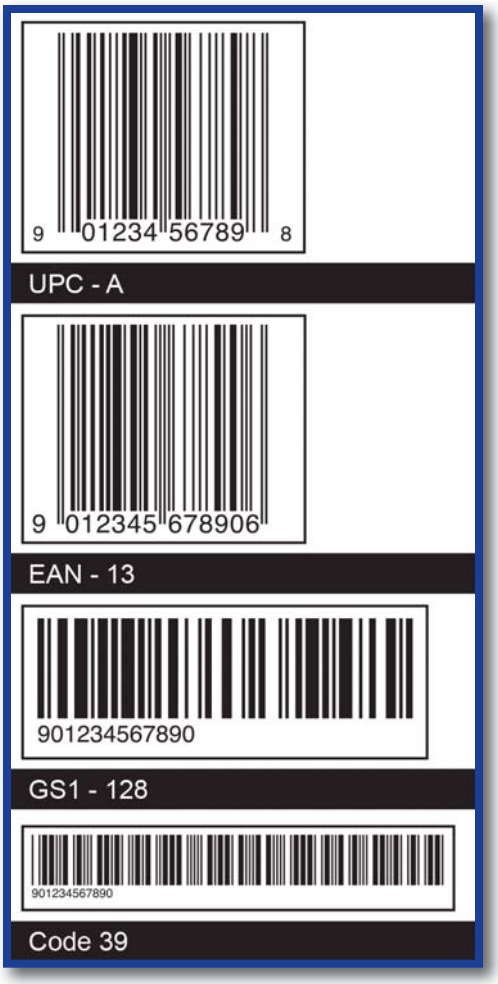
4.3.1 Bar Code Specifications

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; for example, one bar code application involves bar coding products for retail checkout lanes while another application is for bar 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 very different. Accredited standards organizations 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 printed 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:



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.*

- 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, file or plate output. This type of specification should assist in:

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

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:

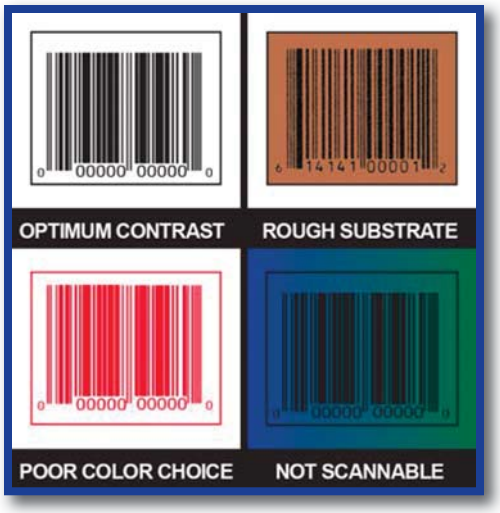
- UPC-Version A and Version E (including add-on and composite component)
- GS1-128 (formerly known as UCC/EAN-128)
- EAN-8 (including composite component)
- EAN-13 (including add-on and composite component)
- ITF-14 (interleaved 2-of-5 also referred to as Code 25)
- Code 128 (full ASCII character set 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)

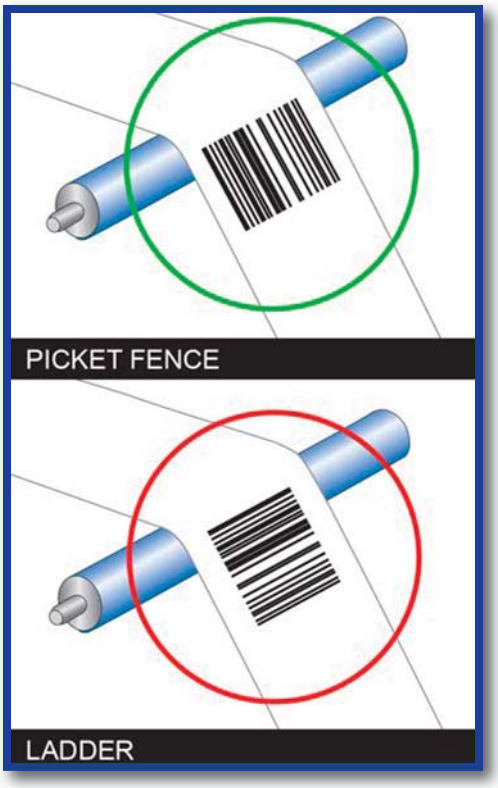
2. Designing for Printability and Symbol Contrast
Substrate Considerations
Texture & Porosity: Bars and spaces are most accurately produced on smooth substrates with high ink holdout. The rougher, more textured and more porous a substrate, the greater the potential for printing bars with voids and/or 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 background (white is optimum), 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 background (white is optimum) with maximum reflectance is recommended in the area where the bar



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.*

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.

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

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

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.

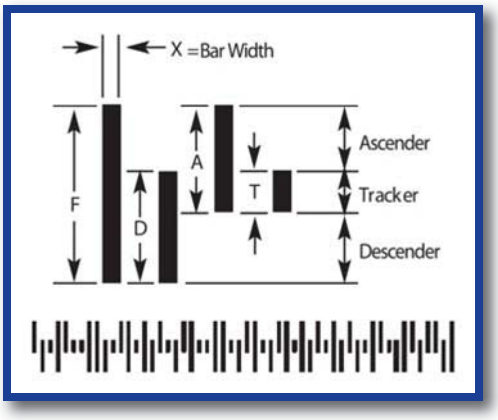
Bar code truncation is a reduction of a symbol's height below the application standard or symbol specification and is not supported by *FIRST*.

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.

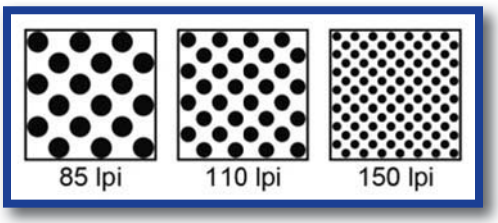
Quiet Zone Considerations

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.

4.3.2d 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.*

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.

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.

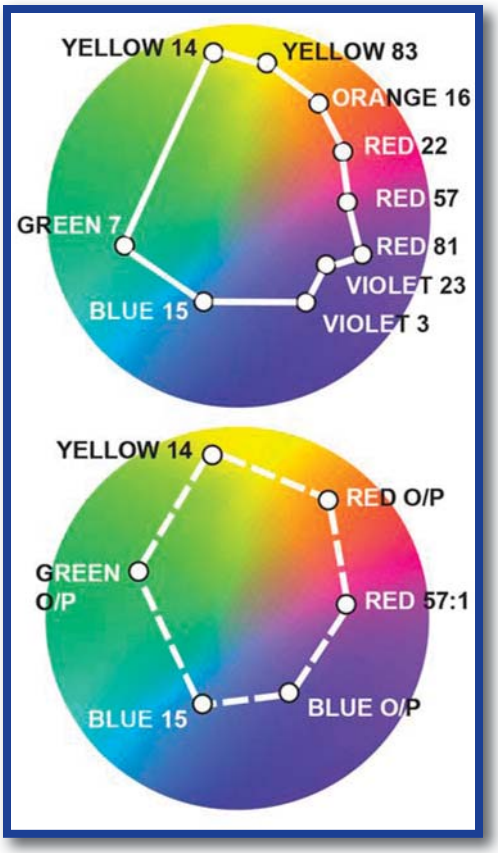
4.4 Screen Ruling

Screen rulings vary based on imaging method, plate material and print conditions (such as press width, anilox configuration

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 - 150 lpi (22 - 59 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

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.



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.*

4.5 Tints

When tints are used, the values are adjusted during output using a print curve to compensate for the dot gain/TVI 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/TVI considerations. The prepress provider applying the compensation curves can provide guidance on dot gain/TVI compensation.

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 (C.I.) 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.

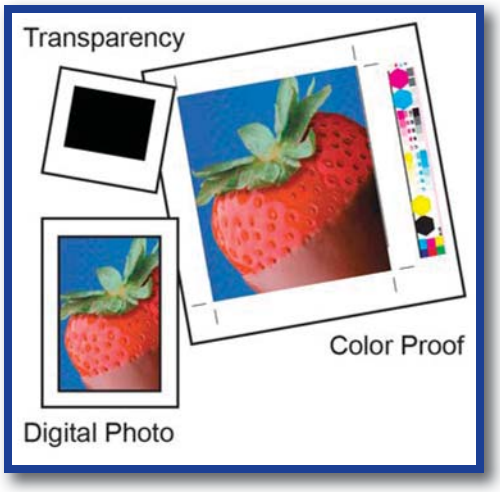
5.1 Digital vs. Conventional

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



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

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
- 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.

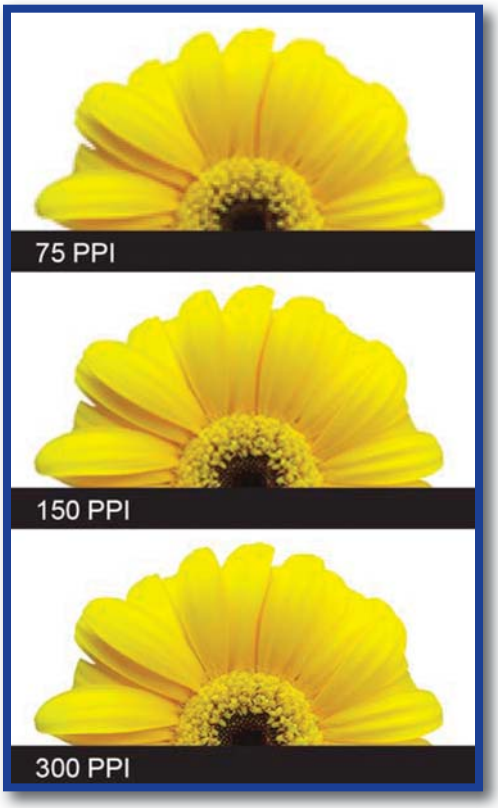
Camera capture color should be neutralized (when neutral color is desired) utilizing either an industry standard Kodak Gray Card (18% reflection) or X-Rite ColorChecker (24 Patch #22, Neutral 5) or comparable product. Gray reference cards should be replaced at least every two years for consistent color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

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.*



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.*

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 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)

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) to 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/linked) 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 a 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

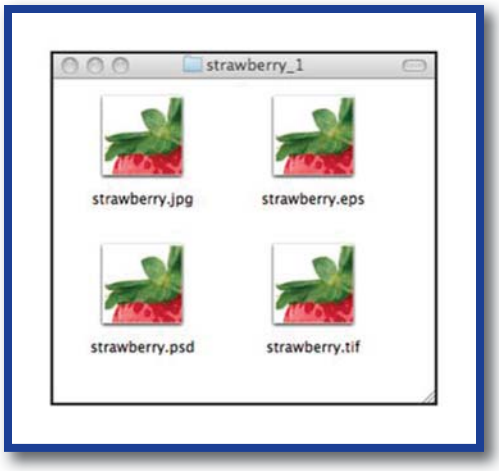
File names should be short but descriptive. On some systems, file names may be truncated to the first eight characters when RIPed. Some systems cannot handle characters such as asterisks, spaces, or punctuation, so *FIRST* recommends never using these characters when naming files and/or document elements.

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.

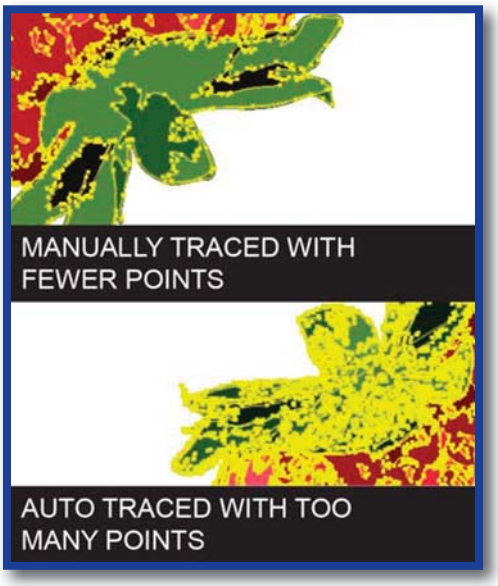
7.2 Document Size

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

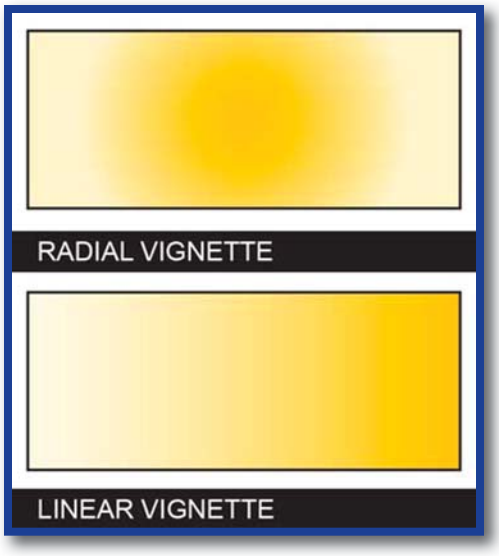
The terms blend, vignette, gradient, fade-away, fountain and graduated tint are used interchangeably. *FIRST* uses the term vignette for clarity.

Building a Vignette

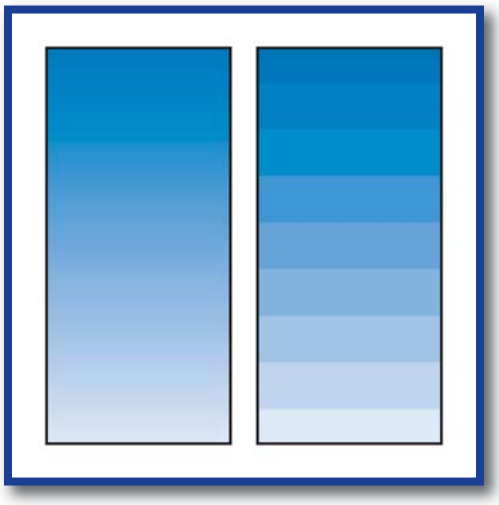
There are several approaches to building a smooth vignette as well as multiple problems in creating vignettes. Some of the approaches concern the way they print, others concern the way they are specified in software programs. Vignettes are subject to unpleasant banding (steps where tints do not transition 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:

1. **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).

2. **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.*

3. **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.

4. **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

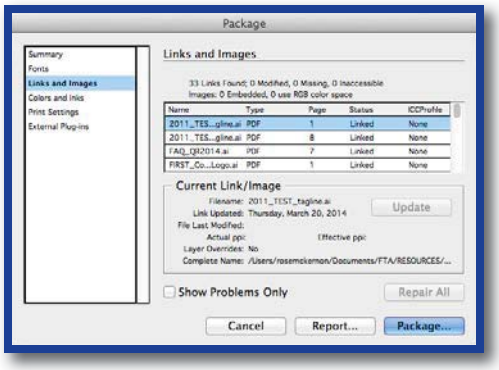
To avoid hard edges and dirty print, it is important to maintain the printer's minimum dot and not fade to zero. The printer specifies the minimum dot used along the edge of any vignette. The lightest area of the vignette should adjoin a holding line or the edge of a graphic window; this will ensure 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 (in a packaged folder) enables future changes.



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.*

7.7 File Integrity

It is not uncommon to start from a previously built file when beginning a new project. It is also not uncommon for a finished layout to carry stray elements from the design phase in the margins of the art board.

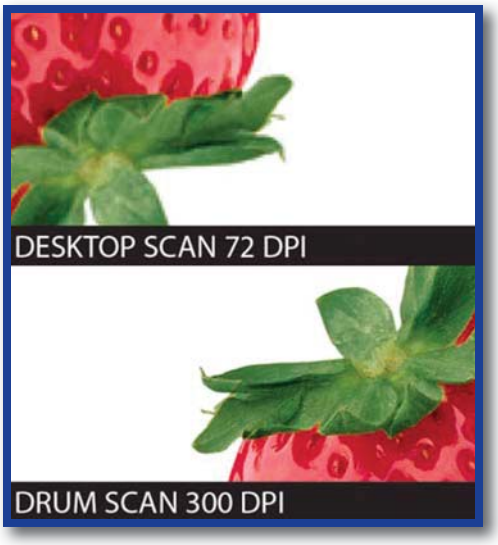
Extraneous elements from pick-up files and left over design elements may carry instruction tags, like opacity or transparency settings for example. These elements can influence how objects on layers below them render producing unintended results during calibrated Proofing and Ripping. Covering elements with a white box does not eliminate this issue.
For these reasons it is always good to include a "stray element inspection" as part of your final file review and delete unnecessary elements before releasing the file to Prepress.

7.8 Image Capture Quality – Scanning Considerations

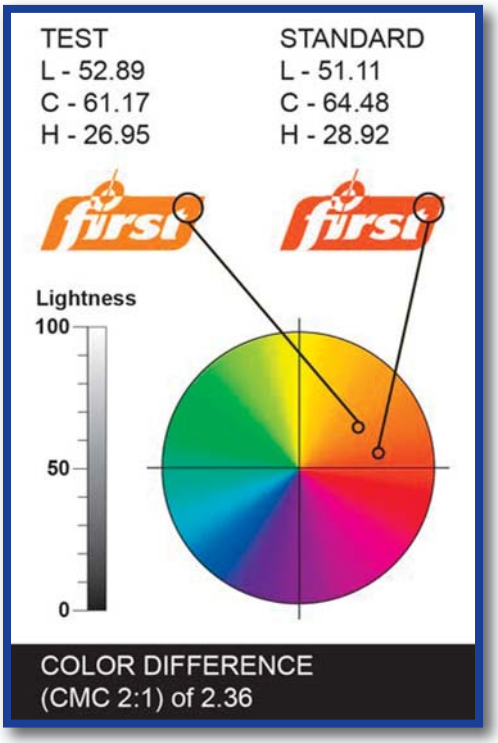
Optimizing scanner variables when capturing the original image is critical to achieving the desired printed result.

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



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.*

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, 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.

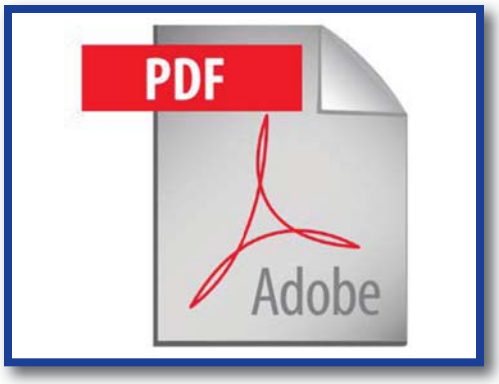
There are numerous types of electronic file formats that can be generated from drawing, photo editing and page layout programs that should not be used. BMP, PICT and JPEG files generally lack detail due to the way their data is compressed. If other file formats must be used, it is imperative that all 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)

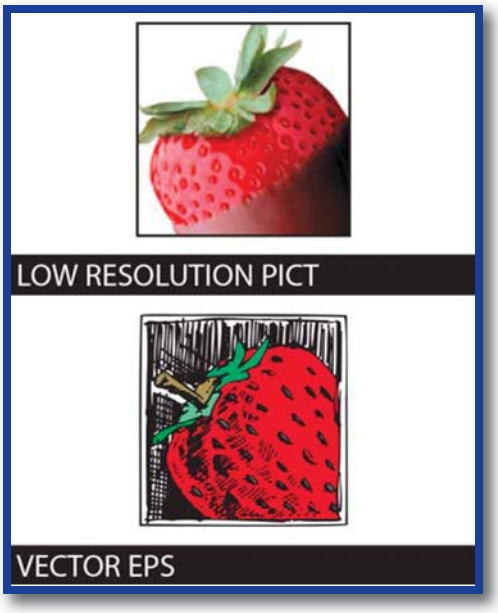
PDF is an imaging file format used to transport graphically rich content. It is commonly used in direct-to-plate and digital proofing technologies. The "creator" of the file (designer, ad agency, prepress provider) must produce a file that meets the minimum imaging requirements of the "receiver" (prepress 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 — Use of PDF (See Appendix B):

1. **Part 1:** Complete exchange using CMYK data (PDF/X-1 and PDF/X-1a)
2. **Part 3:** Complete exchange suitable for colour-managed workflows (PDF/X-3)
3. **Part 4:** Complete exchange of CMYK and spot colour printing data using PDF 1.4 (PDF/X-1a)



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.*

4. **Part 5:** Partial exchange of printing data using PDF 1.4 (PDF/X-2)
5. **Part 6:** Complete exchange of printing data suitable for colour-managed workflows using PDF 1.4 (PDF/X-3)
6. **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
7. **Part 8:** Partial exchange of printing data using PDF 1.6 (PDF/X-5)

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 15930-7:2010 (See Appendix B) compliant PDF file and also identifies the GWG Packaging Specification 2015 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

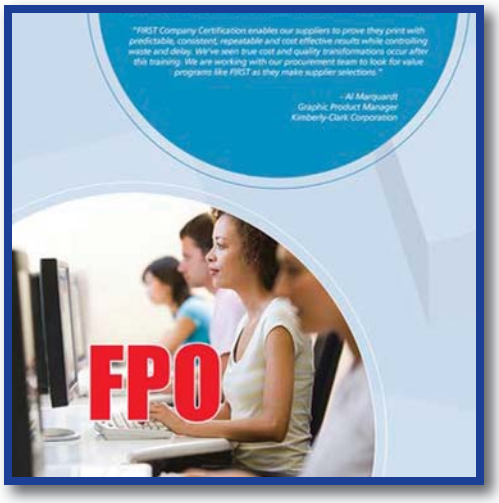
A low-to-medium resolution file may be provided to the designer for automatic image replacement. These files contain links to full-resolution files on the prepress provider's system. It is important not to rename the file; the file name is the link back to the high-resolution image.

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.

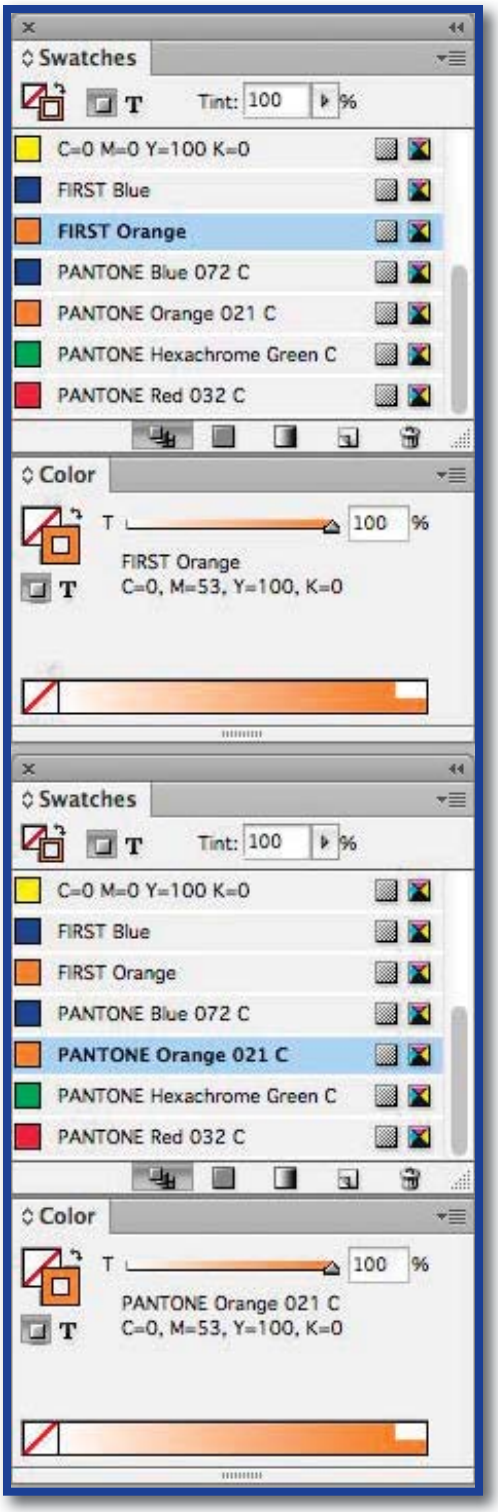
Specific recommendations on working with images for automatic placement may vary based on the workflow of the individual designer and prepress provider. The designer and prepress provider should agree on the procedures for using automatic image replacement.

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.



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.*



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.*

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.

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:

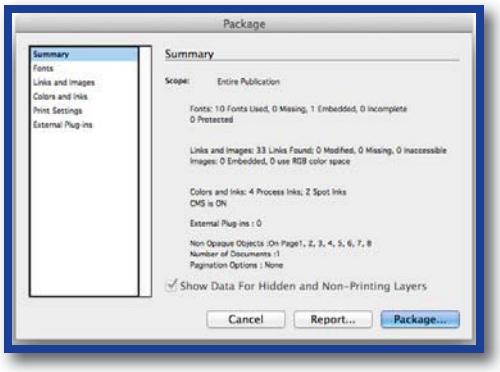
1. Final files, including all supporting high-resolution images, fonts and mechanicals (templates). When sending multiple designs, file-manage each design folder to house the relevant working design file and all applicable supports.

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 or .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.*