

## **DESIGN GUIDE**



**7.0**





*FIRST* 7.0  
Design Guide

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### Content Notes:

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### A Message from the President

Flexographic Technical Association (FTA) was founded in 1958 by a group of industry professionals the common interest of improving the flexographic printing process through unification in order to create unique educational opportunities, forums for the free exchange of information, opportunities to highlight printer capabilities through quality recognition competitions and, generally, by grasping the concept that, in the words of Henry Ford, “Coming together is a beginning; keeping together is progress; working together is success.” Up until then, print quality for packaging produced by this evolving process, which had come to be known as “flexography,” improved slowly and in isolation. Yet, FTA pioneers knew there were better prospects on the horizon through this new association.

With a very similar sense of importance and resolve, a progressive group of FTA members came together almost 40 years after the organization’s inception to begin developing the concepts, structure, goals and objectives of a new doctrine entitled Flexographic Image Reproduction Specifications & Tolerances, prophetically shortened to *FIRST*. These innovators envisioned a day when the “progress through unification” development model would lead to print quality improvements and process workflow enhancements, effectively transitioning flexographic printing from the stigma of its perception at the time to that of a package printing industry leader. Through embracing the mission statement established by the original *FIRST* Committee, “Understand customers’ graphic requirements for reproduction and translate their aesthetic requirements into specifications for each facet of flexographically-printed graphics,” the diverse group of multit talented individuals set in motion the progression that only continued to pick up speed over the past two-plus decades.

The road along the way was not always smooth. During the early years, as *FIRST* principles were woven into FTA FORUM and conference presentations, articles in FLEXO Magazine and other industry trade publications, and most importantly, within the bank of training materials produced by the Association to help printers improve their print quality, industry acceptance and utilization of *FIRST* were slow to come. The build was gradual, yet persistent. To gain the buy-in *FIRST* enthusiasts were so passionately pursuing, it was imperative that the stakeholders effectively communicate the benefits and predictable outcomes that were not only feasible, but most definitely achievable, through the unified confirmation of this important grassroots effort.

With the release of *FIRST* 7.0, on its Silver Anniversary, I respectfully thank and congratulate every flexographic industry professional who has had a hand in creating, supporting, promoting and, yes, even preaching, the “Good Word of *FIRST*” along the way. It would have been easy to bury the whole program back in its infancy when success was not instant. To the contrary, the resistance and skepticism encountered only seemed to drive the enthusiasts all-the-more passionately. “If you really look closely, most overnight successes took a long time.” So said Apple’s Steve Jobs. What better way to describe the life of *FIRST*!

Mark Cisternino

FTA President 2001-2022

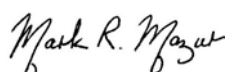
A handwritten signature in black ink, appearing to read 'M. Cisternino', with a long, horizontal, slightly wavy line extending from the end of the signature.



When one reflects on the major changes that have transpired in the flexographic industry your mind jumps to the introduction of anilox rolls, photopolymer plates and digital everything. These technological leaps have enabled flexography to grow and flourish. What is not so conspicuous are the gradual changes. It was not that long ago that the mention of ISO-12647 would illicit eye rolls and a look of bewilderment. You still get the eye rolls, nevertheless, the majority of the industry now aims to print to standards. Slow, methodical changes transform the industry as much as the radical changes. *FIRST* 7.0 reflects both the major and incremental changes that have transpired over the past five years since the release of *FIRST* 6.0.

In 2020 CGATS updated the process control, fingerprinting and characterization guide TR012 which is the foundation of the *FIRST* methodology and this is reflected in the Communication and Implementation section. The Design section has been completely rewritten. However, unless you are intimately familiar with the Design section it may appear as a marginal change. Then you will notice a completely new section; Measurement and Verification. Measurement and verification are important in every step of the process. Incorporating them into each of the individual sections was redundant and less straightforward. Prepress and Print have had significant changes as well. One of the most significant changes has been in Appendix B: Referenced Standards, Specifications and Publications. *FIRST* references over 120 different standards, more than half of these standards have undergone revisions during the past five years.

The *FIRST* Leadership team hopes you find *FIRST* 7.0 a valuable resource in your pursuit of consistently high-quality flexographic print.

  
Mark R. Mazur

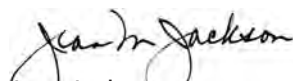
  
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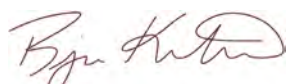
  
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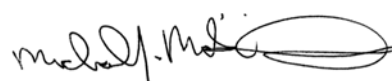
  
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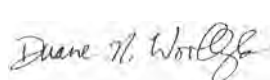
  
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### The Mission of *FIRST*

*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* 7.0 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* 7.0. These individuals exhibited tireless enthusiasm in spearheading the continuous advancement of the flexographic printing process.



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*Some topics in FIRST are referenced in multiple areas,  
please refer to the index for complete information on any topic.*



**DOWNLOAD FIRST7.0 Extras Referenced in this Section at:**  
[http://www.flexography.org/FIRST\\_extras](http://www.flexography.org/FIRST_extras)



2.0 DESIGN INTRODUCTION

2.1 Overview

*FIRST* was created to facilitate communication among participants involved in the design, preparation, and printing of flexographic materials. These participants may include: customers, designers, production artists, prepress providers, raw material and equipment suppliers, and printers. The intention of *FIRST* is to provide all participants with a common set of guidelines, tutorials, and data that can be used as communication and production tools throughout the process.

The Design Section of *FIRST* is a guide for designers and production artists to understand prepress and flexographic print considerations. It offers tips for creating executable and efficient artwork, and additionally describes the requirements of the other members of a print supply chain.

*FIRST* recommends establishing good communication, useful ground rules, and consistent procedures early in the process when creating artwork for use in the flexographic industry. Doing so can help minimize the complexity of art files and the potential for print and converting issues. A dialogue concerning design and production considerations ought to be initiated among all the supply chain partners (designer, production artist, consumer product company, prepress provider and printer). To this end, *FIRST* provides guidelines and support documents to facilitate efficient project flow through the design and manufacturing processes.

2.2 Responsibility

Packaging graphics continue to increase in complexity and production timelines continue to compress. Because of this, it is in the downstream partner's best interest to ensure upstream partners understand how their responsibilities, tasks, and deadlines fit into the larger picture. Clear assignment of responsibilities is necessary to ensure a quality printed product delivered in a timely manner. This assignment of responsibilities requires planning and collaboration among all involved parties.

**Customer:** The customer, often a Consumer Product Company (CPC), defines expectations and is best positioned to drive the collaboration process by leading and facilitating communication between the other members of the supply chain.

**Designer/Production:** The designer and/or production artist collaborates with prepress and print to understand what processes are being utilized downstream, what their capabilities are, and how that will affect creative intent and art file production. Early interaction

with the supply chain also allows other members of the team to prepare for specific requirements of the artist's design. Additionally, the designer and/or production artist can help the process by:

- Establishing a color scheme and palette
- Checking copy for spelling and kerning
- Treating common elements consistently
- Consulting printer specifications
- Utilizing position only images when appropriate

**Prepress Provider:** The prepress provider works with the printer to understand their capabilities and will synchronize them to an appropriate standardized color space when possible. The prepress provider will supply the designer with information regarding print capabilities as early in the process as possible. Based on these print capabilities, the prepress provider produces appropriate image carriers that will help the printer meet the expectations of the customer. They also develop and maintain control targets that ensure the consistency and accuracy of supplied media.

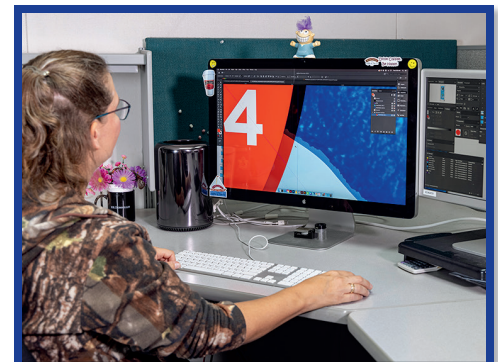
Additionally, the prepress provider produces a contract proof calibrated to accurately represent the agreed-upon color space and press conditions. Using quality control metrics encouraged by *FIRST*, the prepress provider gives the printer, designer, and customer the ability to objectively confirm the fidelity of image carriers and accuracy of print results.

**Printer:** The printer is responsible for consistently reproducing the design to established tolerances and to the satisfaction of the customer. To do this, the printer will work with supply chain partners and vendors to define the capabilities of the printing process. They will utilize process controls to ensure the accuracy and consistency of their deliverable and provide feedback back upstream to fellow supply chain partners through the life cycle of a project.

## 2.3 Assumptions

In order to keep focused and pertinent content in this guide, the following assumptions were made:

- Our audience consists of professionals who use relevant versions of software and hardware compatible with all downstream processes.
- The audience is familiar with design terminology and workflows in a digital environment.
- If you are not familiar with design terminology and/or workflows in a digital environment, visit [www.flexography.org](http://www.flexography.org) for more information)
- Technology changes frequently, so the FTA also offers additional training and support documents at [www.flexography.org](http://www.flexography.org)



**Prepress**



**Plate Making**



**Print**

**2.2 Responsibilities:** *Good planning, communication and an understanding of responsibilities helps assure a project's success.*

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## 3.0 GETTING STARTED

### 3.0.1 General Definition and Outline 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 dos and don'ts of the brand identity), while a Creative Brief provides specific details concerning the execution of a single package design (i.e.: 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 documents such as these makes things easier for everyone in the supply chain. The following describes typical information included in both Creative Briefs and Style Guides respectively.

## Creative Brief

- Project Title
- Client: Main Contact and decision maker
- Key Approvers: Brand Owners, Buyers, Engineering, Legal etc.
- 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, prototype
- Timeline: Concept deadlines, production/delivery schedule

## Style Guide

- Overview: Standards
- Building our Brand: Alternate heading
- Mission/Vision: Meaning/purpose of company
- Logo/Identity/Brandmark
- 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 information
- 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 Attributes of the Flexographic Printing Process

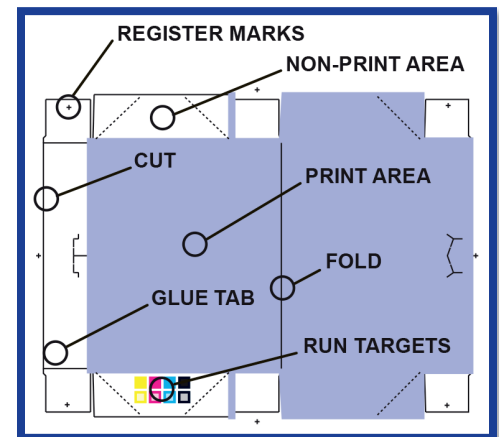
Specialty inks, expanded gamut inks, a wide variety of substrate and lamination options, and length of print run are a few of the advantages of the flexographic print process. It is useful for designers to be aware of the benefits of flexography. Print and prepress partners in the CPC's supply chain will help packaging designers and production artists understand the capabilities of the process and how they can be best utilized.

## 3.2 Materials and Information Needed to Begin

- Template or Die line
- Production information
- Customer specifications
- Design Brief
- Brand Style Guide and corporate art guidelines
- Legal and Government regulations



**3.1 Flexographic Market Segments:**  
*The flexographic printing industry offers designers and their customers 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.*

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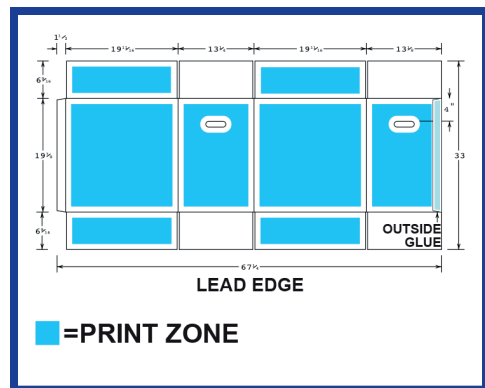
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### 3.2.1 Template Layout: *Non-print areas ought to be considered during the design process.*

### 3.2.1 Template Layout/Die-Cut Specifications

## Die line

A final die line 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. At the direction of the packaging buyer, the designer or production artist ought to indicate the area where print control targets can be placed.

## 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 to provide the design firm with the appropriate template file, including layout dimensions. The template should include non-image area, non-print area, print direction, varnish area, seal area, and “inside view” identification. It is the responsibility of the design firm to consider the non-print areas during the design process. The designer forwards the final template to the prepress facility where all job elements are verified and correctly positioned for product assembly.

## Die Origin

Dies are designed using a graphics program or CAD (Computer Aided Design) software. 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 be obtained from prepress or the printer.

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

## Die Files

Dies should contain information describing the live print area and artwork should be built to the die intended for use in production.

However, downstream adjustments to art files may be needed to fit art to the final die, and this can be done by either production art or prepress. On occasion, an existing die may be modified to match graphic elements, such as windows, cutouts, or coupons.

Most modern package design software can convert or import CAD file formats (e.g.: DXF, DDES2, IGES, PDF). The structural designer will know which file formats can be exported from their brand of CAD software.

### 3.2.2 Print Substrate

An understanding of the whiteness, color, and texture of the substrate can be useful information for the design process. A sample of the substrate ought to be sent upstream to the designer as soon as it is available. Printing on foil or colored paper, or printing white behind graphics, will influence color results. The white point of the substrate will be accounted for by prepress in the contract proof, and prepress can provide the design team with either a substrate-adjusted proofing profile or a Characterized Reference Printing Condition (CRPC) in the form of an .icc profile with a white point similar to production substrate.

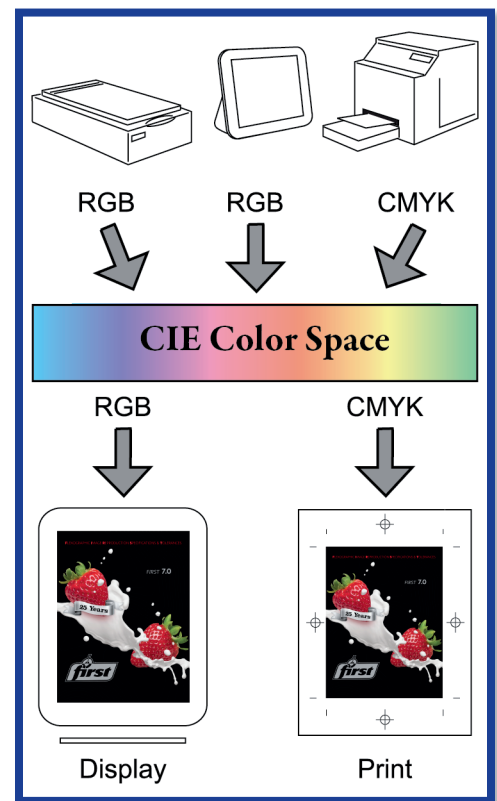
### 3.3 File Naming Conventions

All files and images for a given project ought to use a relational naming schema that allows for the distinction between originals and versions and should not use special characters. Suffixes can help identify and distinguish file formats and variations of working files. Examples of this by file type are: zombiesquirrel.tif, zombiesquirrel.eps, zombiesquirrel.psd or by color space as aww\_puppy\_raw, aww\_puppy\_rgb, aww\_puppy\_cmyk.

In general, a shareable spreadsheet or database is useful for large projects.

### 3.4 Understanding Color Management

The number of colors the human eye perceives is larger than the number of colors that can be reproduced on monitors, proofing devices, and printing presses. A “color space” is a useful conceptual tool for understanding the color capabilities of a particular device or digital file. Digital cameras and scanners capture images in an additive color space-- some form of Red, Green, and Blue (RGB), while proofing devices and presses output or print images in a subtractive color space, utilizing Cyan, Magenta, Yellow, and Black (CMYK). Both proofers and presses often utilize additional colors beyond CMYK to increase the gamut, or size, of the potential color space.



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

Color Management Systems (CMS) are software tools that quantify, convert, and reconcile color differences among monitors, scanners, imaging devices, proofers, and printing presses to ensure consistent color throughout the reproduction process. Various types of ICC (International Color Consortium) profiles are used to communicate or link different devices to a common color space.

Typically, available color gamut diminishes as a job progresses through the production cycle. A CMS will map colors from a larger to a smaller color space using defined rules and indicate which colors can be output on a device with a smaller gamut and which cannot. This process allows proofing devices to realistically reflect press expectations.

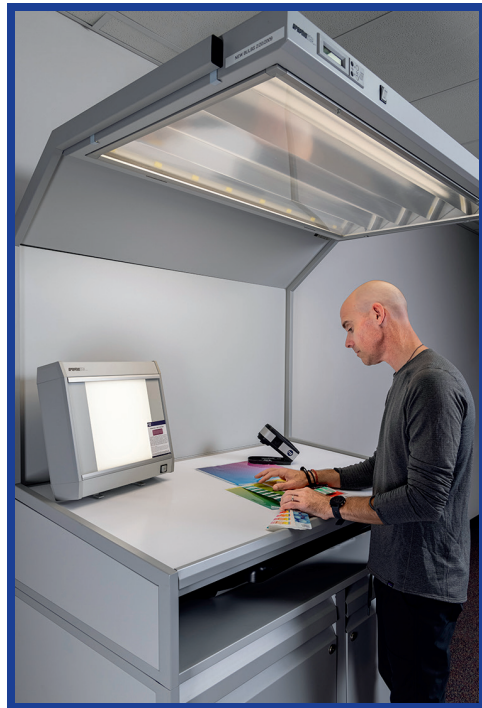
Color management software makes the process of converting from one color space to another predictable. Color space conversion is often the first place where compromises in color will occur. Some loss of information (gamut or gray scale steps) is expected when converting from a larger to a smaller color space and it requires special training and access to higher end software, normally through the prepress provider, to minimize color data loss.

Each color output method has limitations based on type and number of colorants, the imaging engine, colorant delivery technology and substrate options. If a known output source (a specific printing press) is identified prior to the creative stage, the designer may contact the prepress provider and request a proofing profile for that print condition. If the printer uses inks aligned to industry standards for printed color, prepress may synchronize press conditions to a standardized color space like CRPC6, for example. When properly used, this method of color development establishes expectations early and maintains a good relationship between the flexo printed components of a shelf set and those printed with other methods.

### 3.5 Viewing Artwork, Proofs & Printed Material

**Application:** Discrepancies in critical color appearance can be minimized when all partners utilize standardized viewing conditions. Accurate and consistent visual perception of color requires the image to be viewed in a standard, chromatically neutral, and controlled environment. A color-viewing booth can provide such a setting and should be used to view printed images, proofs, and transparencies under a controlled and standard light source.

**Standardization:** *FIRST* supports the viewing standards defined in ISO 3664:2009. *FIRST* also recognizes that CIE D50, the reference illuminant for graphic arts, may not be optimal for all circumstances and encourages early communication to establish whether this light condition or another will be used for color evaluation.



#### 3.5 Standard Viewing Conditions:

*Accurate and consistent visual perception of color requires the image to be viewed in a standard, chromatically neutral, and controlled environment.*

| 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 ( $2\,000 \pm 250$ ) 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 ( $500 \pm 125$ ) lx for comparing a digital image to a proof, also known 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 $\pm 0.005$ . 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:** ISO 3664:2009 – Viewing Conditions

**Instrument Agreement:** Color measurement equipment and color viewing equipment ought to use common light condition settings. For example, if color measurement equipment (spectrophotometers) for a given project use CIE D50, then viewing booths ought to use light conditions with a correlated color temperature of 5000 Kelvin.

### 3.6 Types of Proofs

It is beneficial to the success of a project if all parties adopt a common terminology to evaluate color and content, and to communicate changes. Each proof created during the life cycle of a project ought to be clearly labeled to communicate:

- The purpose of the proof
- The Raster Image Processor (RIP) and output device used to create it
- Whether the output device was profiled and which profile was used
- The proof's suitability for judging color





**3.6a Type of Proofs:** *Different stages of the process require different types of proofs. Color managed devices like monitors, proofers and presses should be aligned to the same color space.*



**3.6b Contract Proof:** *Contract proofs describe all aspects of the customers intentions and predicts the color space the printer has agreed to replicate on press.*

## Creative intent or Concept Proof

A creative intent or concept proof is a tool frequently used in the early stages of a project. It is used to capture the intentions of the brand and goals of the design. This type of proof may be output through a standardized color space such as Fogra, GRACoL, or one of 7 CRPCs. If it is, many color inferences may be made and translated into production. If it is not, some color inferences can still be made, though they may not translate as directly into production. The proof can also be used to express desired color breaks and content. Proofs like this ought to be labeled to indicate if they are color managed and how.

## Prototype or Mock-up

This proof is formed and sealed to the shape of the filled package or container. It is often output on production or similar substrate. In some cases, it can be color-close, though not color accurate. In other cases, some prepress providers provide a proof that is color accurate, separation accurate, show white ink and registered varnish, as well as indicate multiple line screens, multiple dot structures and press gain.

## Contract Proof

A contract proof is an expression of agreement between the printer and the customer and is the basis for negotiations on project performance. It describes all aspects of the customers intentions, predicts the color space the printer has agreed to replicate on press, and is an important quality control and communication tool.

A contract proof is made using a Raster Image Processor (RIP) which applies color management to the file before output. It must exhibit a common visual and measurable appearance to agreed-upon press conditions, which can be achieved with continuous tone or screened proofing methods. A Characterized Reference Printing Condition (CRPC) is a dataset that defines a printing condition. ISO DIS 15339-2:2013, CGATS 21-2 defines 7 of the most common. One of these may be the basis of the color space used for contract proofing if the press has been synchronized. If the press has not been synchronized a custom proofing condition will be created. For more information about press profiling and synchronization consult the Communication and Implementation, Prepress, and Print sections of the *FIRST* manual.

A contract proof must contain a control target that is processed and output as part of the proof. A control target acts as a snapshot of the proofing color space and is used to verify accuracy and consistency of the RIP and output device used to make the proof. A control target and its corresponding verification data must remain on the proof for the proof to be considered “color managed”. A control target must conform to ANSI CGATS.21/ISO 12647 (See Appendix B for all parts).

### Soft Proof

Soft proofs can be used at any stage from concept to contract. Soft proofs can be as simple as a shared pdf viewed for content and/or color break. To utilize soft proofs to make color decisions, each party ought to have access to a monitor that can maintain a high level of color accuracy when calibrated and depict a controlled color space when color managed.

If intended for press side use, soft proofs must be viewed on a calibrated monitor aligned to the same color space used by the other output devices. Soft Proofing is defined in ISO 14861:2015 Graphic technology — Requirements for color proofing systems using electronic displays (See Appendix B).

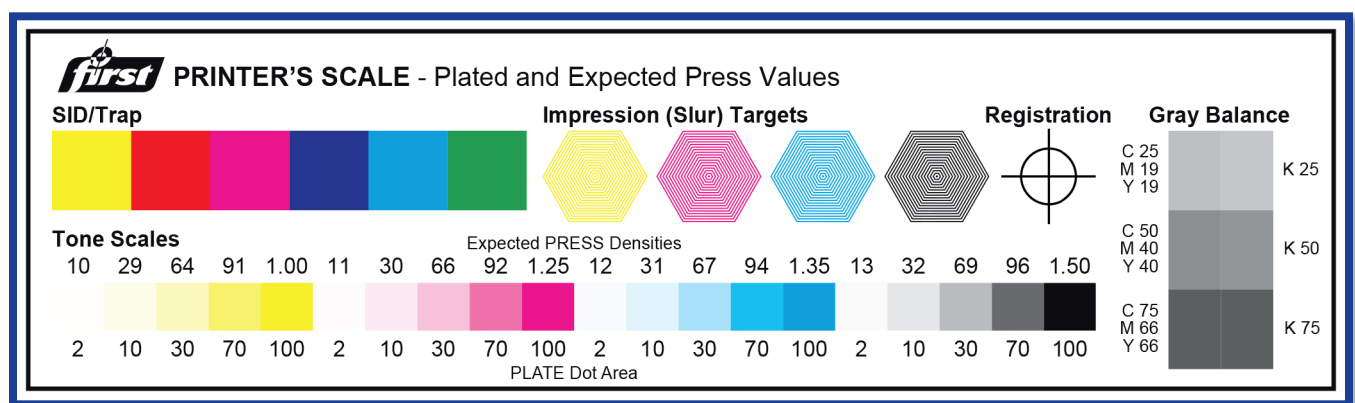
## 3.7 Process Control Test Elements

### Application

Process control test elements allow press rooms to measure and report the accuracy with which spot colors, gray balance, process colors, and dot gain expectations are matched during a press run. Tools like  $L^*a^*b^*C^*h^\circ$  data, gray balance reports, solid in density (SID) readings, and tone value increase (TVI) results are used to help the printer deliver repeatable, consistent, and cost-effective product.

Test elements used to measure the print characteristics are used to establish press capabilities, color conformance to standards, and repeatability of live projects. The test elements included will vary based on the print characteristics pertinent to the job being printed and space constraints.

Using process control test elements during trials and production allows the printer to evaluate and address changes in press conditions.



## 3.7 Process Control Test Elements

| 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 CGATS.5 2009

## Contents

The contents of process control test elements ought to encompass all press to print variables in need of measurement and reporting. Ideally, these five test elements should be on all process color designs:

- Registration: color-to-color and print-to-cut
- Color/Solid Ink Density
- Grey Balance
- Ink Trap
- Tone Value Increase (dot gain) scales

## Placement

Some packaging lends itself to placing test elements under flaps, in a glue zone, or on the waste matrix. *FIRST* recognizes certain press configurations (narrow web) and product types (e.g.: poly bags, envelopes, and newsprint) may not have large enough trim areas or glue zones to maintain all recommended process control elements. On these products, with approval of the brand, test elements used to verify color/density, gray balance, and at least one dot area can be placed in the live area of the product. Different print applications will have different interests and placement preferences for test elements. Prepress and/or production art will consult with the printer on the necessary test elements and, in conjunction with representatives from the brand, determine placement on the package/sheet/web when preparing separations.

### Format

The measurement & Verification sections describes the key print characteristics for both line and process work as well as test elements used to measure each characteristic. The test elements discussed are available for use in optimization or fingerprint tests. They are available to both FTA members and nonmembers and can be found 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 and Size

In some circumstances, and with guidance from the brand, room in the live print area can be allocated for test elements. When this is the case, consideration needs to be given to space requirements. 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, so the prepress provider will confirm individual test element size with the printer. For direct-print corrugated, for example, each test patch (solid or tint) should be 2-3 times the flute width.

### Imaging

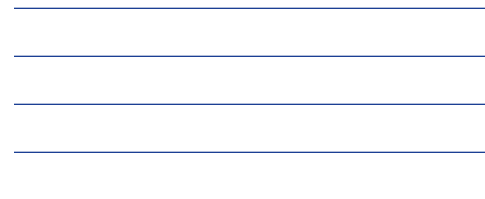
Test elements image with the same line screen, angle, dot shape, etc. as live work. Surprinting, plate slugs, or plate buildup of the test elements does not provide an accurate representation of press conditions.

## 4.0 TYPE AND DESIGN ELEMENTS

### 4.1 Typography: Understanding Process Capabilities and Limitations

The nature of the flexographic print process requires that additional consideration be given to font selection. Under some circumstances, copy printing positive may fatten while copy reversing out of a color or colors may fill in. Bolder versions of a font may be required to overcome this, though as copy is stroked or bolded the counters (holes in letters such as a, d, o, e and R) may begin to fill in during print causing detail to be lost.

Tables 4.1a and 4.1b provide general guidelines sorted by flexographic print segment. Since minimum type size and rule width are print system dependent, the designer or production artist



**4.1a Typography:** *As copy is stroked or bolded the counters (holes in letters such as a, d, o, e and R) may begin to fill in during print.*



**4.1b Minimum Type Size:** *Using type sizes below a printer's minimum recommended size can result in type filling in.*



| 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 |  |         |  |
|                                                                                                              |                     |                                          | Serif    | Sans Serif | Serif   | Sans Serif | Positive         |  | Reverse |  |
| 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       |                  |  |         |  |
| Narrow Web                                                                                                   | Newsprint           | Uncoated Paper                           | 10 pt    | 7 pt       | 11 pt   | 10 pt      |                  |  |         |  |
|                                                                                                              | 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 Minimum Type Size

|                     |  |  |        |
|---------------------|--|--|--------|
| 0.25 pt.            |  |  | 0.003" |
| 0.50 pt.            |  |  | 0.007" |
| 0.75 pt.            |  |  | 0.010" |
| 1.0 pt.             |  |  | 0.014" |
| 2.0 pt.             |  |  | 0.027" |
| 3.0 pt.             |  |  | 0.042" |
| 4.0 pt.             |  |  | 0.055" |
| <b>1 COLOR (1C)</b> |  |  |        |
| 0.25 pt.            |  |  | 0.003" |
| 0.50 pt.            |  |  | 0.007" |
| 0.75 pt.            |  |  | 0.010" |
| 1.0 pt.             |  |  | 0.014" |
| 2.0 pt.             |  |  | 0.027" |
| 3.0 pt.             |  |  | 0.042" |
| 4.0 pt.             |  |  | 0.055" |
| <b>4 COLOR (4C)</b> |  |  |        |

**4.1c Line Weight:** Acceptable line thickness will vary depending on whether it is printing positive or reverse and whether it is made up of a single or multiple colors.

ought to verify minimum rule widths, type style and minimum point sizes with their prepress or print provider.

#### Type Size Considerations

**Serif vs. Sans Serif:** Sans serif fonts can be printed successfully and remain more legible at smaller point sizes than serif fonts, as serif fonts may lose detail and fill in easier when used at smaller point sizes. Prepress and/or print partners in the supply chain will have relevant specifications on hand regarding minimum allowable point size for serif and sans serif fonts.

**Positive vs. Reverse:** Positive copy will remain legible at smaller point sizes than reverse type, as press conditions like ink volume and impression settings can cause reverse type to fill in and lose detail.

**Single-Color vs. Multi-Color:** Single-color copy can remain legible at smaller point sizes than multi-color copy. The prepress or print provider will have information about the minimum allowable point size of multi-color copy for a given press condition.

**Other Factors:** Other factors that can influence minimum type size for a given press condition include: ink coverage, anilox volume, substrate treatment, substrate absorbency plate durometer, and

| 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 Minimum Rule Width

tape compression. These factors, as well as others, are taken into consideration when print specifications are compiled, documented, and published by the print and prepress supplier.

#### 4.1.1 Registration Tolerance

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



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

| Total Trap Tolerance: General Guidelines                                                                                                                      |                     |                    |                    |                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------|--------------------|------------------|
| Trap tolerance is print system dependent;<br>determine minimum trap with press & print optimization<br>(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 Total Trap Tolerance

### 4.1.2 Process Color Type

When identifying colors for text copy, the designer should be aware which colors will be built from process inks and which will use dedicated spot colors. In general, text copy should be printed with a single color or built from no more than 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. Because the values provided are general guidelines, the designer or production artist should confirm the trap requirements with the prepress and print providers. If a holding line is not used, the darkest or predominant color should be made full size and the remaining color must be choked back the width of one row of dots as determined by the screen ruling. If possible, the background color should be limited to one color.

### 4.1.4 Line Reverse/Knockout

Reverse copy should be limited to one color. If copy is to be reversed from two or more colors, a hold-back or choke must be created for register. Refer to Table 4.1.1 and the specific print segment. Because the values are general guidelines and print system dependent, the designer or production artist 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.

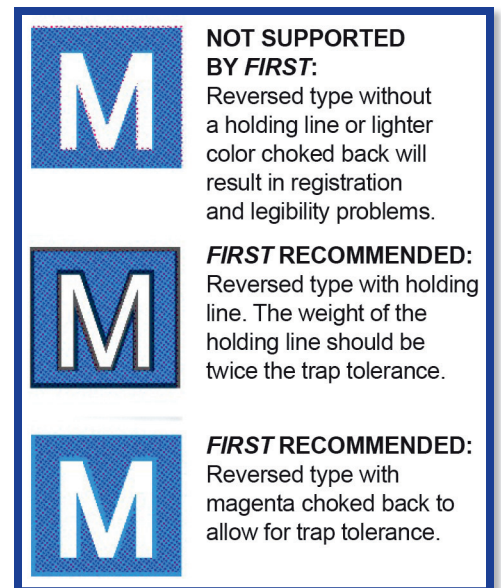
It is best to use drop shadows only for larger type, unless the color selected for the type is darker than the color it is abutting as abutting colors will have to overprint each other to form the image trap. Drop shadows that fade ought to be limited to a single color to allow special screening to support the light tones of the gradient.

### 4.1.6 Spaces and Tabs

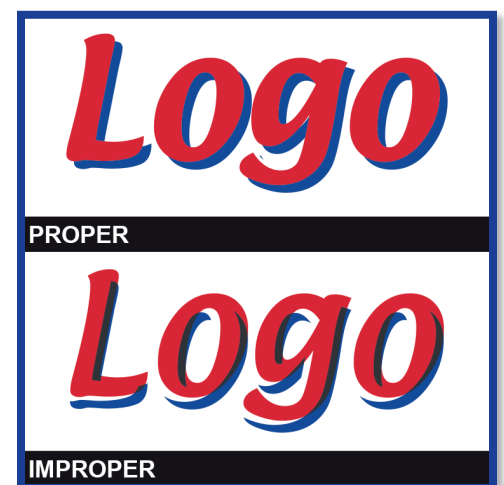
Always use tabs rather than multiple spaces to position text. If a font change is required, the spaces will change size, while tabs will not change.

### 4.1.7 Text Wrap

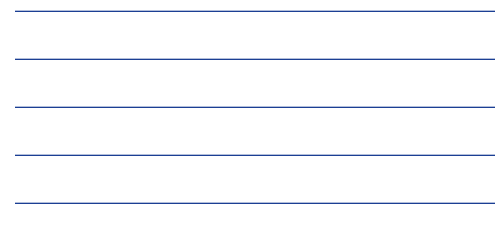
Most graphics programs can wrap text around images. However, there is potential for text reflow if automatic text wrapping features are used to define the text wrap area when a position only image is replaced with its hi-res counterpart during production. This can be avoided by using another shape that tracks, but is not dependent on, image contours to define text wrap.



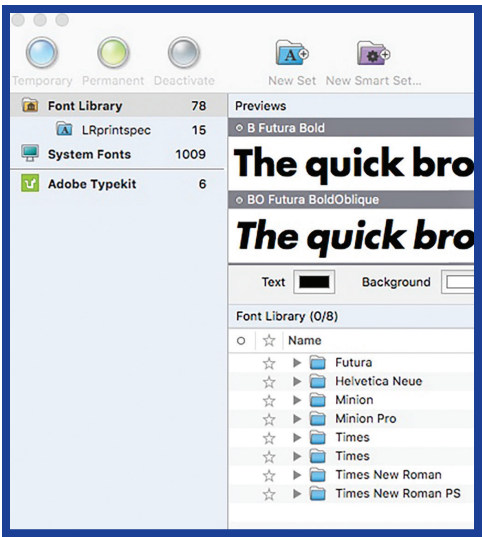
### 4.1.3 FIRST Process Reverse Knockout Recommendations



### 4.1.5 Drop Shadow: *Trapping drop shadows helps prevent unwanted print results.*







**4.1.8a Font Utilities:** *There are many applications available to help manage fonts effectively.*



**4.1.8b Outline Effect:** *To create an outline, apply a stroke of the desired color to the type with a fill of none or white. The stroke ought to be at least twice the specified image trap for the applicable print segment.*

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4.1.8 Fonts

Fonts with the same name can exist in different file formats. Two companies (foundries) that make the same font may name it the same way and use the same file format, but build it differently. Substituting a font file format or a font from a different foundry can cause unwanted text reflow and alter the design.

It is also possible for a font to vary in appearance or performance in downstream operations based on its source. For these reasons, it is good to provide a copy of final files with type converted to outlines and confirm that prepress has access to the proper font libraries when delivering files containing active fonts.

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.

OpenType and TrueType Fonts

There are several advantages to the OpenType format:

- The entire font is housed in a single file.
- The same file can be used on a Mac or Windows platform.
- An OpenType font can contain either PostScript or TrueType outline data.
- 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.

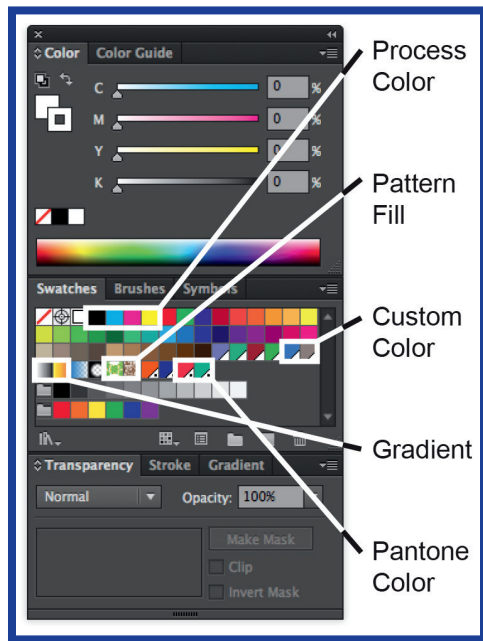
Styles of Fonts

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.

Proprietary Fonts

Fonts are usually proprietary software. It is not best practice and often against font foundry guidelines to share fonts without secured





**4.2a Custom Colors:** *Custom colors used in a file will not properly or consistently reproduce on a physical proof without corresponding color data at the proofing RIP.*



**4.2b Fan books and Swatch Libraries:** *Using swatch palettes from commonly referenced sources such as Pantone® or TOYO® fan books will help downstream partners prepare for production and understand creative intent.*

palettes from commonly referenced sources such as Pantone® or TOYO® fan books will also help downstream partners prepare for production and understand creative intent.

### **Differentiating White Ink from Unprinted Areas**

When white is a printing ink, a custom color can be created in the file and used to specify which areas will print white. This color ought to be named “white ink” or similar in the color palette. Creating an additional color named “clear” is also a useful way to distinguish areas that are to be left unprinted. A light percentage of gray is frequently used to designate clear areas for film printing.

### **Spot Color Proofing**

Spot colors in proofs target, but are not intended to replace, standards separately established by the customer. Proofing RIPs use lookup tables to transfer spot color information from a file to a proof. Color managed proofing RIPs come preloaded with many standardized spot color lookup table libraries such as those from Pantone®. Pantone Solid Coated and Pantone Solid Uncoated are examples of standardized spot color libraries. RIP manufacturers pay licensing fees for the right to offer these color libraries to their users and users pay RIP manufacturer for the right to access them.

Companies like Adobe® also pays licensing fees to companies like Pantone® which gives them the right to offer these color libraries as well, though the libraries in software like Adobe’s products do not contain the same level of color data as libraries on proofing RIPs. A Pantone® spot color in an Illustrator file proofs accurately through a color managed device because the name of that spot color matches a piece of instruction in a color lookup table at the proofing RIP.

A spot color that is not part of a standardized spot color library is considered a custom color. Custom colors used in a file will not properly or consistently reproduce on a physical proof without corresponding color data at the proofing RIP. When a file is delivered to prepress containing custom colors, some form of color information, from either a physical drawdown or in a digital format like a .cxf file, will have to be added to the proofing RIP and use naming protocols that align with those used in the art file. Without color data, the proof will not output in an accurate way.

Strides have been made towards the inclusion of full spectrum color data as a rider to, or a part of the file itself, but this data is generally not added automatically and requires communication between the file provider and prepress. When vignetted color is critical, an on-press test of a tint ramp printed over black and over white may be necessary to create a full spectrum tint ramp. Alternately, several companies also offer software with the ability to calculate tint ramps of full spectrum color.

### 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](http://www.unspsc.org)).

For more information on prepress and print considerations for bar codes, refer to the Measurement & Verification section. GS1 US and UNSPSC contact information is included in Appendix A. For more information regarding 2D Bar Codes reference Appendix E.

#### 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:

- 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 Responsibilities

All parties in the supply chain bear responsibility for producing quality bar code symbols. The customer and designer both play an important role in assuring bar codes are given the proper level of consideration during design development while the prepress and print provider will both verify that the final code is created correctly and scans properly.

When creating an FPO (for position only) symbol, the designer ought to determine and communicate the symbol type and size, the color used to print it, as well as the location and orientation on the printed product. Refer to the Measurement & Verification section for more information.

It is beneficial for designers to be aware of the criteria for bar code performance since they are frequently involved in the substrate and color selection process, bar code placement, orientation, and size determination. Designers also need to 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 its purpose, where it will be scanned, and how it will be printed. The customer will identify which bar code type(s) to use for a project.

Some of the common bar code types printed flexographically include:

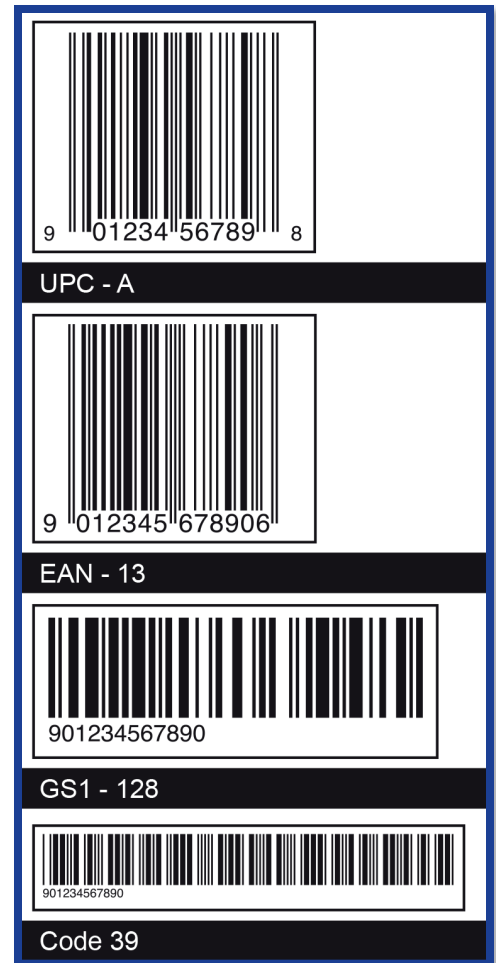
- UPC-Version A and Version E (including add-on and composite component)
- GS1-128 (formerly known as UCC/EAN-128)
- EAN-8 (including composite component)
- EAN-13 (including add-on and composite component)
- ITF-14 (interleaved 2-of-5 also referred to as Code 25)
- Code 128 (full ASCII character set 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 (E.g., Quick Response and DataMatrix codes)
- Digital Watermarks (E.g., Digimarc DWCODE®)
- 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

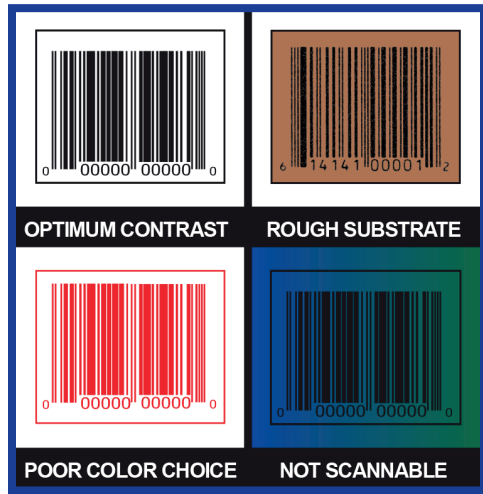
**Texture & Porosity:** Bars and spaces are most accurately produced on smooth substrates with high ink holdout. The rougher, more textured and more porous a substrate, the greater the potential for printing bars with voids and/or printing specks in the spaces, either of which can reduce scanning rates. 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.



**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.*

[illegible]



**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.*

**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 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 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 the Measurement & Verification section for more information.

### 3. Determining Optimal Size and Location

**Location Considerations:** Correct placement of the bar code is crucial to meet regulations and for accurate scanning. 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 or production artist should also consult with the package engineer to ensure the symbol will not be creased, scored, sealed or folded since placement of codes in these areas may cause the ink to crack which could lead to voids in the bars or spots in the symbol background. Digital watermarks ought to be mapped into the part of the design that encompasses the largest amount of surface coverage.

**Orientation Considerations:** It is strongly recommended that the bars in a symbol be oriented parallel to the direction the substrate is moving through the press (around the web direction) to avoid slurring. In rare situations the bars in a bar code may need to be oriented perpendicular to the direction the substrate is moving through the press (across the web direction). In these cases, the

customer and printer must be consulted since it may be necessary to use a larger symbol to meet minimum print quality requirements.

If print slur occurs with a bar code oriented around the web direction, the bars will grow in length only and remain scannable. When a bar code is oriented across the web direction and print slur occurs the bars will grow in width, likely causing the code on the printed product to be unscannable. Printing bar codes across the web direction is not supported by *FIRST*.

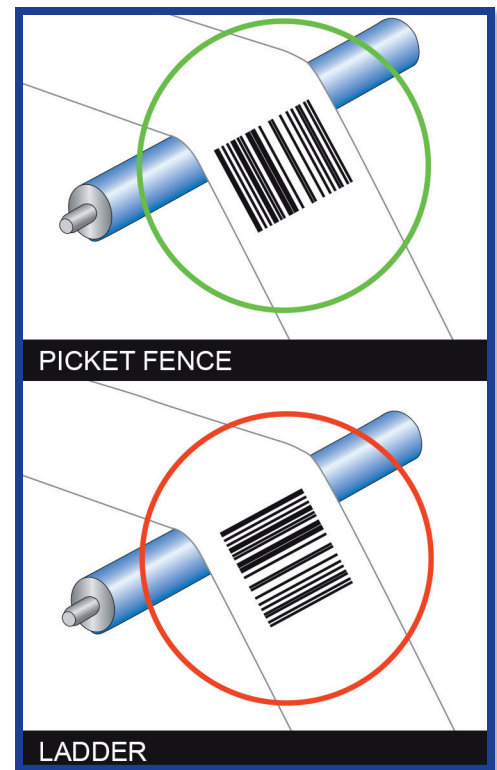
**Size Considerations:** The area reserved for a bar code depends on several interrelated specifications. It is important to know which symbol type is specified based on where the product will be scanned. For example, if the product will be scanned at the retail POS (point of sale), an EAN/UPC symbol is typically specified.

After the symbol type is known, it is important to know the allowable range of dimensions (height and width) for the symbol, including the human-readable text associated with it. Certain symbols have a fixed relationship between their height and width, while others have minimum heights specified. If necessary, resizing of codes ought to be done at the point of creation so factors like bar width reduction, proper scaling, and output resolution can be taken into consideration.

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 the Measurement & Verification section for more information.

**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 an ITF-14 symbol requires a quiet zone of 10 times the "X" dimension on each side.



**4.3.2c Bar Code Orientation:** *Bar codes should be oriented so that they print parallel to the direction the substrate is moving through the press to avoid slurring and ensure the code can be scanned.*

[illegible]



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

Table 4.3.2 Minimum Bar Code Magnification



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 code and its magnification.

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 the Measurement & Verification section for more 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.

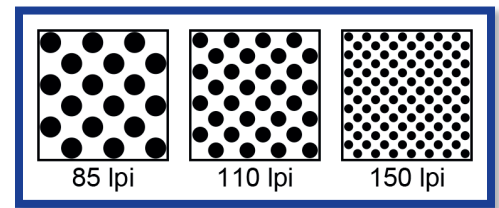
**Vertical Position:** When human-readable information is required, it shall be printed immediately above or below the bar code but outside of the quiet zone. The human-readable information shall be at least 0.04" (1.02mm) above or below the bar code but not more than 0.50" (12.7mm) above or below the 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 ruling is determined by the number of dots, on a uniform grid, that can fit into a square inch. 85-line screen dots are bigger and fewer than 150-line screen dots. Image 4.4 shows an enlarged example of this. Screen rulings vary based on print conditions like press width, anilox configuration, and substrate. The range for both conventionally and digitally imaged plates is determined by print and substrate constraints. The screen ruling, set by the printer and agreed to by the brand, will need to be considered during the design phase and graphics and images should be selected with screen ruling in mind. The designer ought to consult the prepress and print provider to determine the optimum line screen for a specific design. Table 4.4 provides general line screen guidelines by market segment and substrate category.



**4.4 Screen Ruling:** *Enlarged example of three screen rulings.*

#### 4.5 Tints

Tints are percentages of solid colors. In order to properly reflect creative intent as much as possible, the percentages of color often need to be adjusted by prepress using compensation curves designed to account for tone value increase (TVI) experienced on press. Some detail can be lost during print; for example, 1% dot can increase during print between 5% to 25%, and, depending on print conditions, tint values 80% and above may increase enough to appear solid. Your prepress partner can provide guidance on dot gain/TVI compensation considerations.

#### 4.6 Ink Colors

The customer and printer will determine how many colors are available for each design in a product line. Many products are printed with additional colors other than CMYK. Additionally, transparent and/or opaque inks may be used and ought to be identified and listed in the color palette because the characteristics and print sequence of inks used may require special considerations during the prepress phase.

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 then combined to create common or special spot colors (e.g., “PMS 347 green” or “Trisha’s Soda” pink). These pigments are recommended because they provide the largest color gamut with the appropriate degree of fade resistance required by most packaging applications. Standardizing ink pigments improves the consistency of the color match between press runs and press rooms and makes for a more cohesive shelf set while minimizing a phenomenon

| 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<br>(43 - 52 lpcm) | 85 - 110 lpi<br>(33 - 43 lpcm)  | 110 - 133 lpi<br>(43 - 52 lpcm)     |
|                                                                                                         |                     | Uncoated       | 100 - 133 lpi<br>(39 - 52 lpcm) | 85 - 110 lpi<br>(33 - 43 lpcm)  | 100 - 120 lpi<br>(39 - 47 lpcm)     |
|                                                                                                         | Combined Corrugated | All            | 55 - 110 lpi<br>(22 - 43 lpcm)  | 55 - 150 lpi<br>(22 - 59 lpcm)  | 55 - 110 lpi<br>(22 - 43 lpcm)      |
|                                                                                                         | Folding Carton      | SBS Board      | 120 - 150 lpi<br>(47 - 59 lpcm) | 85 - 110 lpi<br>(33 - 43 lpcm)  | 110 - 133 lpi<br>(43 - 52 lpcm)     |
|                                                                                                         |                     | CRB Board      | 110 - 133 lpi<br>(43 - 52 lpcm) | 100 - 120 lpi<br>(39 - 47 lpcm) | 110 - 120 lpi<br>(43 - 47 lpcm)     |
|                                                                                                         | Multiwall Bag       | Coated Paper   | 75 - 120 lpi<br>(30 - 47 lpcm)  | 65 - 110 lpi<br>(26 - 43 lpcm)  | 75 - 110 lpi<br>(30 - 43 lpcm)      |
|                                                                                                         |                     | Uncoated Paper | 65 - 85 lpi<br>(26 - 33 lpcm)   | 65 - 100 lpi<br>(26 - 39 lpcm)  | 65 - 100 lpi<br>(26 - 39 lpcm)      |
|                                                                                                         | Newsprint           | All            | 85 - 100 lpi<br>(33 - 39 lpcm)  | 85 - 110 lpi<br>(33 - 43 lpcm)  | N/A                                 |
| Narrow Web                                                                                              | Film Products       | All            | 110 - 133 lpi<br>(43 - 52 lpcm) | 85 - 120 lpi<br>(33 - 47 lpcm)  | 85 - 133 lpi<br>(33 - 52 lpcm)      |
|                                                                                                         | Paper Products      | Coated Paper   | 133 - 175 lpi<br>(52 - 69 lpcm) | N/A                             | 110 - 133 lpi<br>(43 - 52 lpcm)     |
|                                                                                                         |                     | Uncoated Paper | 110 - 133 lpi<br>(43 - 52 lpcm) | 110 - 133 lpi<br>(43 - 52 lpcm) | 100 - 120 lpi<br>(39 - 47 lpcm)     |
|                                                                                                         | Envelope            | Coated Paper   | 133 - 175 lpi<br>(52 - 69 lpcm) | N/A                             | N/A                                 |
|                                                                                                         |                     | Uncoated Paper | 85 - 133 lpi<br>(33 - 52 lpcm)  | N/A                             | N/A                                 |
|                                                                                                         |                     |                |                                 |                                 |                                     |

Table 4.4 Line Screen Guidelines

known as metamerism, which is the identical visual appearance of two colors that have different physical or spectral compositions.

Colors inside the gamut created from these twelve pigments are matchable, but colors falling outside the gamut will not be as achievable using *FIRST* pigments. In such cases, the printer may opt to include additional pigments to expand the color gamut. It is important to remember, though, that limitations in the pigments available for a given ink chemistry or application requirement means it is not always possible to match a color precisely.

Color outcome is also influenced by substrate. When useful, your print partners can provide drawdowns of relevant colors on production or similar substrate. 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. Under some circumstances, it can be useful if printers' proof *FIRST* pigments on substrates typically printed and plot the color gamut that will best predict their ability to match color on press.

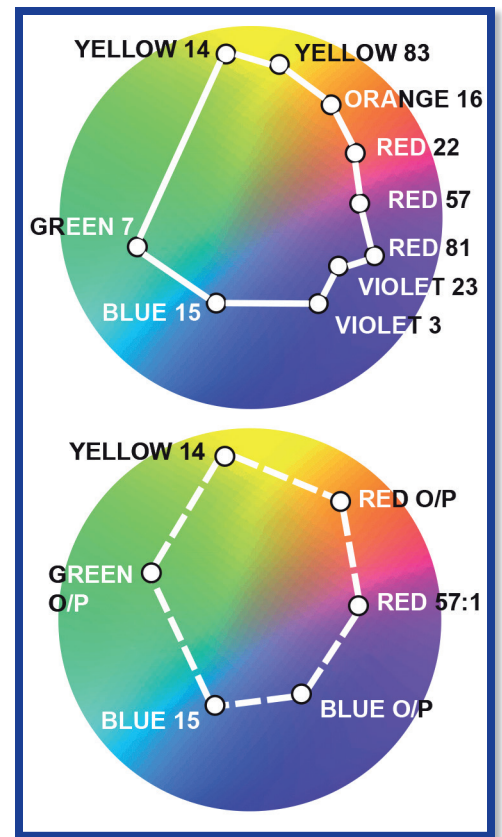
## 5.0 DIGITAL PHOTOGRAPHY

In this section, workflows and points of measurement are identified to help ensure that the aesthetic integrity of a photographer's image is maintained throughout the printing process. In addition, responsibilities for handling, processing, and repurposing are identified and discussed.

### 5.1 Additive and Subtractive Color Spaces

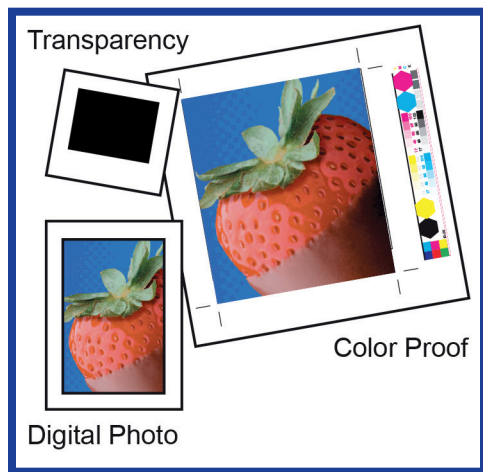
As noted in section 3.4, Digital cameras and scanners capture images in an additive color space-- some form of Red, Green, and Blue (RGB), while proofing devices and presses output or print images in a subtractive color space, utilizing Cyan, Magenta, Yellow, and Black (CMYK). Both proofers and presses often utilize additional colors beyond CMYK to increase the gamut, or size, of the potential color space.

RGB images must be converted to either a 4-color process or expanded gamut process color space in order to separate, proof, and print. Photographers often review and retouch images in RGB, which has a larger gamut than print capabilities. Therefore, data loss can be managed, but not eliminated, when images are moved from RGB to CMYK. It is the responsibility of your prepress partner to retain as much color as possible when performing color space conversions.



**4.6 FIRST Ink Pigments:** The top gamut map illustrates the range of color available using FIRST recommended line pigments. The bottom gamut map illustrates the range of color available using FIRST process inks.





### 5.1 Additive and Subtractive Color

**Spaces:** *An RGB image must be converted to CMYK in order to provide a color proof.*

## 5.2 Proofs for Digital Photography

A proof representing the creative intentions of the brand can be useful to your prepress partner as a color target. This type of proof can be output without consideration for print process or for an individual press' ability to match it. Because this proof is just a target, some of the color in this proof (and corresponding image) may not be attainable in the final print.

When possible, it is helpful to produce creative intent proofs with the same or similar conditions the press uses. If this is not yet known during the design stage, it is useful to provide information about how the proof was made and if a calibrated output was used for future reference.

Your prepress provider can be a source for relevant proofing profiles and special considerations for a given press condition.

*FIRST* encourages collaboration with your supply chain partners when determining optimal image capture settings, but the following setup recommendations are common industry starting points.

- **Recommended Computer Settings**

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

- **Recommended Camera Settings**

- » Color Space: Adobe RGB
- » Capture Settings: Raw or raw + largest TIFF available

- **White 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.

- **Black Settings**

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

### Grayscale in Shots

Including a standard photographer's grayscale test element positioned within the outline of the frame when capturing images is a good way to obtain and transfer information about grayscale conditions at the time of image capture.

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

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

X-Rite's ColorChecker® product series and Kodak's Q-14/Q-60 charts are examples of special color and grayscales test elements that can be used as density and color measurement targets for digital photograph. Place one of these test elements in the main light source of the image. If a full test element 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 Kodak's Gray Card (18% reflection) or X-Rite's ColorChecker® (24 Patch #22, Neutral 5) or comparable product. It is recommended that gray reference cards be replaced at least every two years for consistent color fidelity.

## 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



**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.*

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 File Formats**

Images sent to the prepress provider ought to be uncompressed RGB TIFF files. CMYK conversions ought to be done using the

agreed-upon destination profile and original (or retouched) RGB file. The prepress provider in the supply chain has the resources and know-how to make these conversions and can provide color profiles upstream as needed.

### 5.5 Unsharp Masking

Unsharp masking is a technique that produces the appearance of sharpness and detail in an image by accentuating edges where different densities and contrasting colors meet. Improper use of unsharp masking can make an image look bad. The amount of sharpening applied is determined by image quality, content, and other factors. Prepress is best positioned to make unsharp masking decisions and has the needed information to make the necessary unsharp masking determinations for your print partner.

### 5.6 Image Resolution

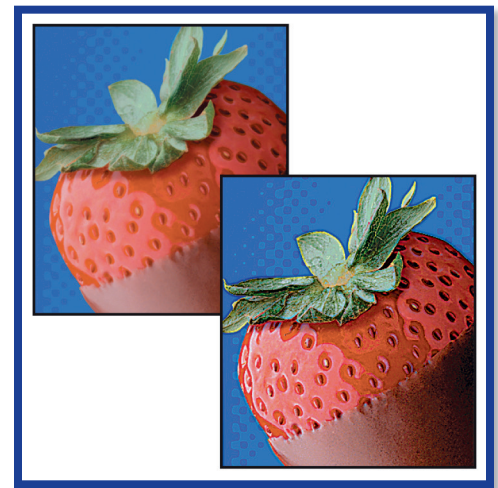
The number of pixels in a given area determines the resolution of an image and is typically specified as number of pixels per linear inch. 300 pixels per inch (ppi) is the typical resolution for color images at 100% size for a 133–150-line screen. The formula for calculating the optimum resolution is two times the output screen ruling. Then, if you need 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. Although this is the rule of thumb, the amount of captured resolution is related to the final image quality. Enlargement of an image, production screen ruling, and image content (particularly in detailed content) are considerations when determining proper image resolution.

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). This means, there should be no noticeable loss in detail when the answer to this formula is approximately 2.0.

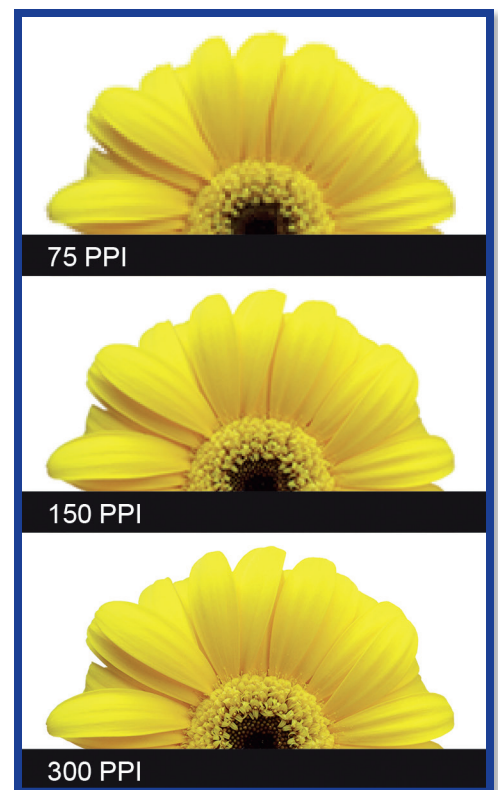
### 5.7 File Transfer Recommendations

File Transfer Protocol (FTP) is a common method of moving data from one supply chain partner to another. FTP services are hosted by your prepress and/or print partner, but other sources and methods of file transfer are available. Customer security policies ought to be a primary consideration when selecting a means of file transfer for a project. Below is a list of items commonly transferred in support of the project:

- A list of file names
- Files organized by directories/folders



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



**5.6 Image Resolution:** *Resolution determines the clarity and smoothness of printed images. Generally, the optimum resolution is 2 times the output screen ruling. 300ppi is the typical resolution for images printed using 133 and 150-line screen.*





## 6.0 Raster Image Example: *Raster images are made of many rows of small pixels, each capable of containing its own color data. They have a resolution value assigned when captured, created, or imported and cannot be greatly enlarged without compromises in detail.*

| Screen Ruling/Resolution    |                          |                              |
|-----------------------------|--------------------------|------------------------------|
| Screen Ruling<br>(lpi/lpcm) | Resolution<br>(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 Screen Ruling/Resolution

- High-resolution images
- Call out of source and destination profiles used
- A hard copy proof demonstrating creative intent
- Screen and printer fonts (when applicable)

## 6.0 GRAPHIC ARTS SOFTWARE

**Platform: PC or Mac**

The packaging industry generally uses the Macintosh platform for graphics production, though there are Windows versions of many common applications available.

## Applications

Applications used in the design and production art stages of graphics development can be thought of as serving three distinct purposes: vector drawing, image editing, and page layout. Adobe products are used as the default example software throughout the Design Section of the *FIRST* manual. The following are a few examples applications and typical uses:

## Vector-based drawing software examples: CorelDRAW® and Adobe Illustrator®

In vector-based drawing programs, a line is created by defining two points and instructing the software to connect them. The line can contain instructions about thickness and color. Shapes have more points and closed shapes can be filled with color.

There is no resolution to graphic elements created in a vector-based drawing program. This means, elements can be scaled up or down without loss of detail. These types of software can produce dimensionally accurate, detailed graphic elements at any size, which makes them useful for creating things that must fit to a die. Vector-based drawing programs are also useful when creating gradients, vignettes, and blends. *FIRST* recommends die-cut items such as labels, cartons, and, corrugated be produced entirely within a drawing program. Adobe Illustrator® is used as a reference for vector-based drawing software in the Design Section of this manual.

### **Image editing software examples: Aurora HDR® and Adobe Photoshop®**

Photographic images and/or art are edited and/or created in photo editing programs. They can contain thousands of shades of color and are referred to as “raster” files. The graphics are made of many rows of small pixels, each capable of containing its own color data. Files in these types of software have a resolution value assigned when captured, created, or imported and cannot be greatly enlarged without compromises in detail. When enlarging a previously captured image, check with the prepress provider for input on maximum enlargement without significant loss of image detail. Adobe Photoshop® is used as a reference for image editing software in the Design Section of this manual.

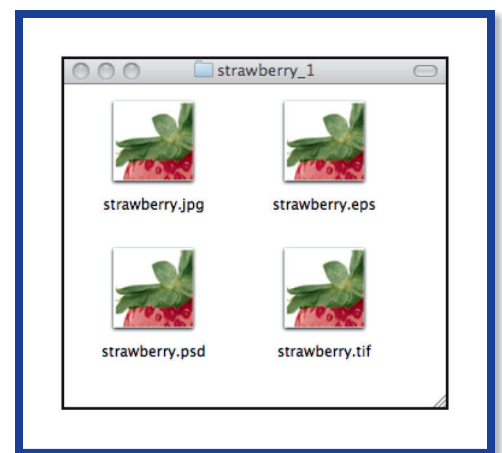
### **Page layout software examples: QuarkXPress® and Adobe InDesign®**

Page layout programs are not generally used to create packaging graphics. They are good at handling large numbers of scanned images and volumes of text in multipage documents like catalogs, books, and magazines. However, they are less adept at accurate placement of elements relative to a template. *FIRST* does not recommend using page layout programs for package design. Adobe InDesign® is used as a reference for page layout software in the Design Section of this manual.

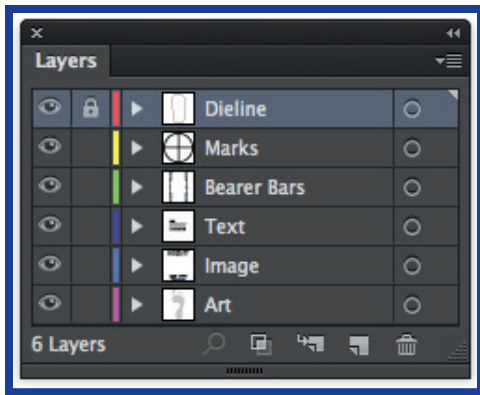
## **7.0 DOCUMENT STRUCTURE**

### **7.1 Naming Conventions**

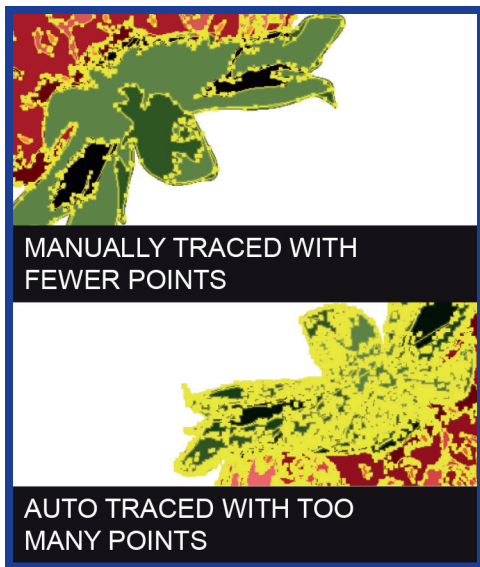
Identifying a common naming convention is in the best interest of all parties and can help smooth production. Keep in mind that the product being developed may be part of a larger project or product line, so it is important to coordinate a naming convention with the customer before design and production files are created in case a common naming convention has previously been established.



**7.1 File Names:** *File names ought to be concise and meaningful.*



**7.3 Layers Palette:** Use of separate layers for variations in designs such as special price banners or line extensions can assure that underlying graphics are identical in content, placement, and prepress execution.



**7.4 Auto-Traced or Rectorized 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.

## File Names

File names ought to be concise and meaningful: most modern prepress systems and RIPs can handle longer character counts in file names, but some older systems may truncate file names. Special characters such as !, @, #, \$, %, /, \, \* ought to be avoided. It is also useful to track the progression of a project by appending file names with version numbers rather than calling each iteration a completely new name. For larger or more complex projects, a cross-reference database can be useful to track naming conventions and current file names.

## Naming for Image Replacement

Low-resolution versions of high-resolution images destined for use in production are referred to as “For Position Only” (FPO) images. These images are used through various stages of concept, design, and approval and are smaller in file size and faster to process than the actual high-resolution version. With a proper and prearranged naming convention, the FPO can be linked to the high-resolution file and replaced automatically by prepress. Consult your prepress partner regarding image replacement options.

## 7.2 Document Size

Designs ought to be built to actual size. When possible, concept proofs ought to be at output or close to the final size (100%) of the printed product.

## 7.3 Layers Palette

The Layers Palette is a good file organization tool. Placing elements such as the template, marks, white ink, design elements, copy, and annotations on their own logically-named layers can be useful to downstream supply chain partners.

Use of separate layers for variations in designs such as special price banners or line extensions can assure that underlying graphics are identical in content, placement, and prepress execution. Working in layers also offers the opportunity to share common separations in a family of designs.

## 7.4 Appearance Effects & Layer Effects

There are many ways to produce or introduce transparency into a design. Opacity, soft shadows, blurs, feather, and glows are all examples of effects that may add transparency to a design. Most objects, groups, or even layers can have effects applied to them, but it is important to only apply effects to the objects needed to achieve the intended look. Overuse of these methods can create complications in prepress and can cause files to fail during calibrated proofing and ripping.

## 7.5 Transparency Opacity & Blending Modes

Extraneous elements from pick-up files and left-over design elements may carry instruction tags such as 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 files to your prepress partner.

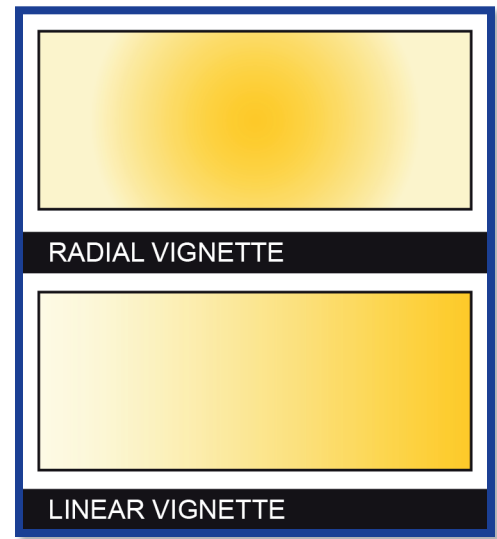
Transparency and effects are common ways to create design and production enhancements to vector and raster elements, but these techniques can often create poor or unexpected results if not constructed and applied properly. Additionally, the output of effects are often difficult to predict. On screen, these effects are live and appear correct, but final output requires flattening, which can influence underlying object quality and design intent.

Transparency and Effects Best Practices:

- Create effects or have software application resolution settings  $\geq 300$  dpi.
- Vector effects are defined in terms of measurement. Scaling or change in resolution generally will not affect the design.
- Raster effects are defined in pixel amounts. Remember that scaling or changes in resolution will have a direct impact on design.
- Text or artwork not intended to be affected by the transparency effect should be layered or stacked above the effect.
- Effect color space ought to be that of underlying objects.
- Avoid fade to zero situations by maintaining printer's minimum dot specifications.

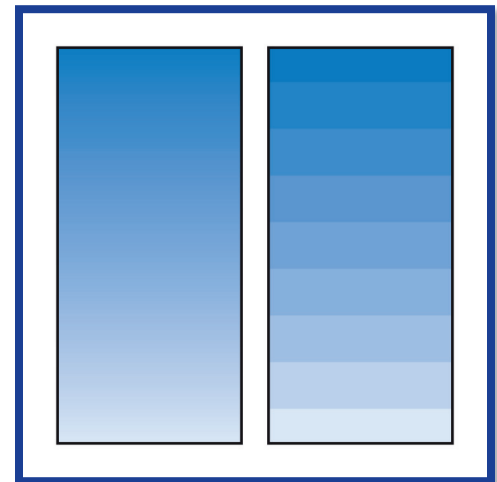
Factors influencing banding, hard edges and dirty print  
Many factors that influence banding in a vignette relate to the construction of the vignette. The length refers to the physical length of the vignette. The range refers to the difference in color across or down the vignette. For example, a vignette of 30% to 50% has a range of 20%. There is a mathematical relationship between the length, range, and number of steps in a vignette.

- 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



### 7.5a Radial and Linear Vignette

**Examples:** *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:** *Factors like Screen Ruling, Range, length, number of steps, and Tone Value Increase influence the final appearance of a vignette.*

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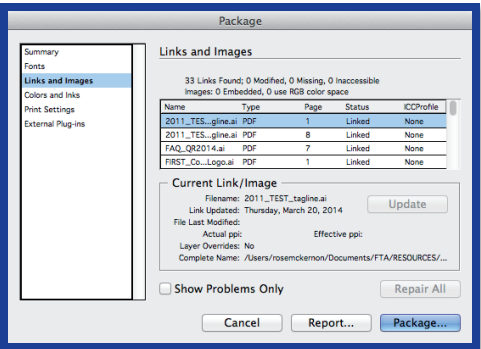
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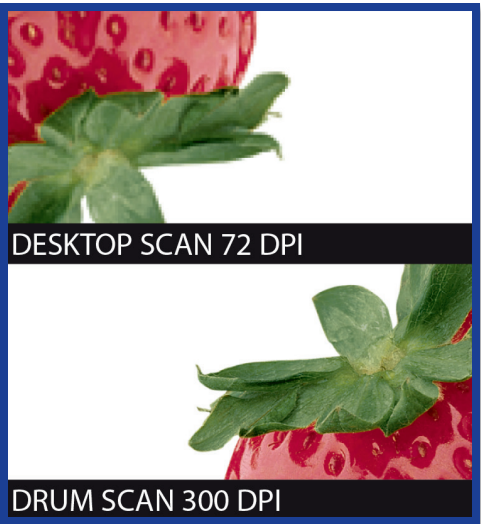
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**7.6 Imported Images:** *File names are important connections between linked images and the art file. Renaming a placed image will break the connections it has with art files.*



**7.7 Scan Resolution and Color Space:** *Entry-level scanners are generally not adequate for production scans. FIRST recommends images remain in RGB mode for delivery to prepress.*

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- Banding is more visible with darker inks
- Lower screen rulings are less likely to show banding
- Higher output resolutions help to minimize banding

Your prepress partner can provide information about the printer's minimum dot requirements and special highlight screening treatments available.

**7.6 Placed or Imported Images**

File names are important connections between linked images and the art file. Renaming a placed image will break the connections it has with art files. Images placed in an art file must travel with the art file if they are to be properly used. Always make certain that all links are updated properly before sending files. Also ensure that any modifications to placed images have been updated in the art file to assure proper positioning has been maintained.

Graphic arts applications allow images to be embedded or linked. Files with images embedded are larger than files with linked images. Embedding an image within the art makes moving the file from place to place more convenient, but can restrict editability. Your downstream prepress partner will prefer to have images linked rather than embedded and sent along with art the file.

**7.7 Image Capture Quality – Scanning Considerations**

Though still in practice for some circumstances, traditional drum scanning of film negatives and line art for packaging has all but been replaced by digital photography. Many of the considerations present in conventional scanning are useful to understand as they are still factors in digital image capture.

**Scan Resolution**

All scanners capture RGB data. Although some scanners can use hardware and/or software to translate the scanned data to CMYK, *FIRST* recommends capturing and supplying the image in the original RGB format to protect against data loss. Additionally, entry-level scanners are generally 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. 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.

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 at 200 line screen may need a scan resolution of 300 to 600 pixels per inch, depending on the detail required in the image.

### **Image Enlargement**

Enlarging a scanned image will reduce its effective resolution and can compromise 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. Image editing software like Adobe Photoshop® can enlarge images using interpolation, a mathematical process of creating new pixels. Depending on the image, some interpolation may be tolerable. Whenever possible, though, 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 will make for a smaller, more easily editable file.

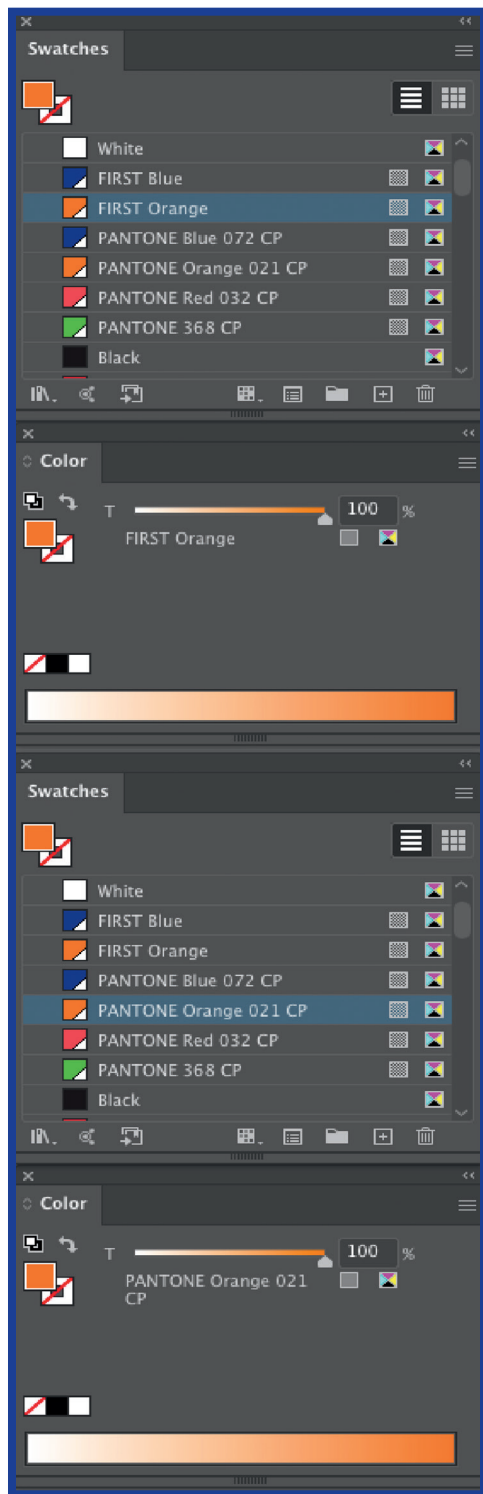
## **7.8 Scaling & Resizing**

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

## **7.9 Color Space**

Images in a design file (whether captured or created) ought to remain in their native RGB color space. The prepress partner in the supply chain is best positioned to convert images into the proper color space. Consult with your prepress partner when images need to be converted before being released. They can provide the printer's color space in the form of an industry standard or custom .icc profile.

Converted images will generally require work in prepress to assure they are "flexo friendly" and take all printer specifications into consideration. Moving an image to a color space other than the one the press is aligned with can result in detail and data loss.



**7.10 Images with Custom Colors:** *Custom colors used in a placed image need to have the same name as the corresponding custom colors in the final design.*

## 7.10 Images with Custom Colors

Many programs will import colors from placed images into the swatches palette. Custom colors used in a placed image need to have the same name as the corresponding custom colors in the final design if the intention is to have them output as part of the same separation.

## 8.0 FILE FORMATS AND USAGE

Downstream supply chain partners utilize specialized software to color correct, separate, trap, and RIP art files in preparation for plate making. Before using a new version of software, designers and production artists ought to consult with prepress to ensure compatibility. In most cases, prepress will already have newer versions of a particular software even if their vendors have not released versions of their software that can take advantage of it. In those cases, it is often possible to save files created in newer versions of software down to older versions. Remember that there is a chance that data loss can occur when saving a file from a newer version of software into an older version.

### 8.1 Specified Formats

The primary specified formats for vector images are: .ai (Illustrator native), .pdf (Portable Document Format), and .eps (Encapsulated Postscript). For continuous tone (raster) images, the primary specified formats are: .psd (Photoshop native) or .tiff (Tag Image File Format). Layered .psd files are often preferred and it is good to coordinate deliverables with your downstream supply chain partners.

There are numerous types of file formats that can be generated from drawing, photo editing, and page layout programs that should not be used. For example, 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 important that all parties agree to the file formats. Your 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”.

PDF/X is a collection of standards defining several conformance levels, all of them targeted at ensuring predictable and consistent printing in a professional print environment. All 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).

While the Ghent PDF Workgroup (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 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, TIFFs, JPEGs, or EPS images. When using clip art, please consider the file format of the clip art being used with appropriate level of quality in mind. 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 but may need to be redrawn or reimaged for use in production.

The selected image may be one of several on a clip art page. Masking out the other images does not remove them: they will all be processed. It is better for downstream efficiency to save individual images under a new name and import the single image into the document.

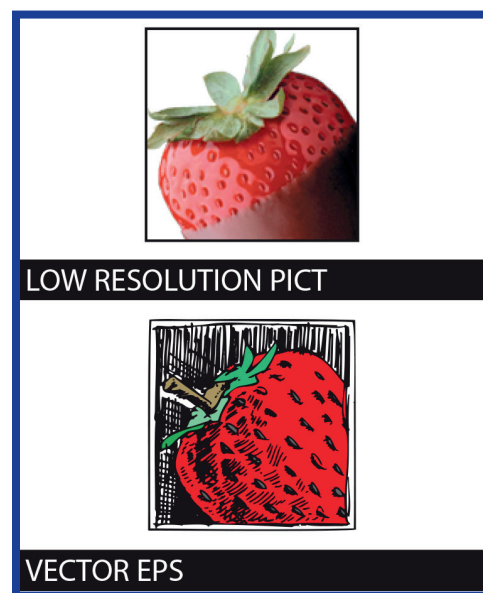
### 8.4 FPO Continuous Tone Images

It is common practice to put the letters “FPO” over a low-resolution version of a properly cropped and rotated image. These letters let the downstream partners know that the image needs to be replaced. The FPO (For Position Only) image ought to be created from the high-resolution original and helps prepress know which images in a library are destined for use in a particular location.

These images keep the art file size small throughout the design and prepress process, and many RIPs employ auto replacement features to easily update them to their high-quality versions when they’re ready to go to print.



**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.*

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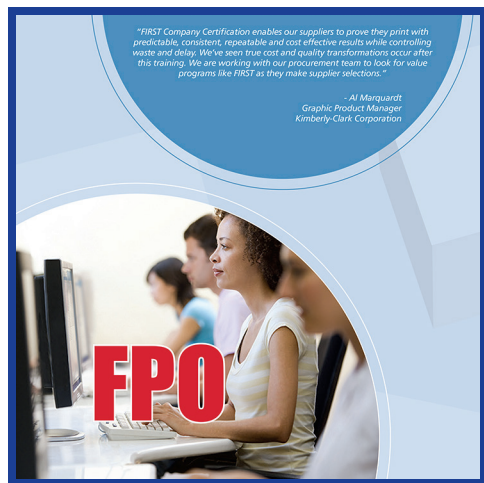
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## 8.4 Creating and Identifying FPO

**Images:** *If an image is not properly identified as a “for position only” image, it may not be replaced.*

[illegible]

## 8.5 Documenting Image Edits

Sharing image editing work for a common project across multiple sites can be a complicated process. It can be simplified by documenting the steps used to achieve the desired results. Action sets within Adobe's Creative Suite are a good way to do this in an interactive setting, as they allow the creator of the original file to record each step in the sequence. Once the work is complete, the action set can be saved and shared with the other parties responsible for replicating the edits.

## 8.6 Image Substitution

## Using Low-Resolution Files for Automatic Image Replacement

Though more common in publication workflows than packaging workflows, low-resolution images may be provided to the designer so that automatic image replacement functions can be used in later prepress stages. These low-resolution images are links to the corresponding high-resolution files located on the prepress provider's servers. Do not change the names of these files, as names are often a part of the connection to their high-resolution counterparts.

This method allows the designer to move, crop, or resize (within limitations) low-resolution proxy images as if they were high-resolution images. It places the control of exact positioning in the hands of the designer. Resizing a low-resolution image will cause the high-resolution image to be resized by the same factor, but remember that excessive enlarging of an image can reduce its effective resolution and cause a loss of detail. The designer and prepress provider ought to coordinate the use of automatic image replacement.

## 9.0 HANDING OVER FILES TO PREPRESS

When the design has been finalized and files have been completed, it is time to turn files over to prepress. This section provides recommendations meant to aid in a smooth transition between the design and prepress stages.

## 9.1 Documenting the Design

## Design Construction Report

One of the ways to make a design flow smoothly through production is to provide details about how the file(s) were built. Some programs have “report” features, which list details about a file. Comment layers created by the designer within the file itself can be a great benefit as well.

A Design Construction Report sent along with the other components of a project is another useful way to communicate the kind of details prepress needs. There is an example design construction report available for download on FTA's website in the "*FIRST* Extras Download" folder.

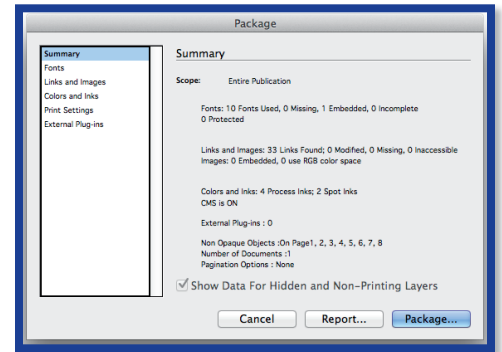
This list of information and support files ought to be included when delivering final files separate from, and in support of, a design construction report:

- Final file name(s)
- Application/version of files
- Placed images as Unflattened .psd
- Die drawing(s)
- Web link to usage seats and rights for active fonts
- A version of the files with outlined fonts
- List of colors used
- Explanation of Common and /or base layers used among multiple items
- Special instructions for vignettes or effects
- A hard copy proof depicting creative intent.

## DESIGN SECTION SUMMARY

Thank you for taking the time to read this document. The Design Section is a small part of a larger document known as *FIRST*. Like the larger document, it is created and maintained by members of the flexographic print industry and supported by the Flexographic Technical Association (FTA). The *FIRST* manual is available for purchase at the FTA's website, and the Design Section is available as a free download at the same website.

The members of the *FIRST* leadership committee are always working to maintain the usefulness and relevance of this and all documents associated with the *FIRST* manual. We welcome and encourage feedback and contribution from all stake holders in the packaging supply chain, and keep the notions of continuous improvement, technical excellence, and good communication at the core of our guiding principles.



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

[illegible]

[illegible]

This image shows a full page of blank, lined paper. It features approximately 28 horizontal blue lines spaced evenly across the page, typical of standard notebook paper. The lines are thin and light blue, set against a plain white background. There are no margins, text, or other markings on the page.