Color Standards & Specifications
Wide Format Series

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Session overview

• Knowledge of the latest color-industry standards is a must to satisfy today’s customer needs
• Why standards exist, what they are used for, and where they play a part in the print process
• Advice on document types and settings when working with standards and specifications
• Take a quick poll
Today’s topics

• Standards, specifications, and methods
  – Why we need them
  – Why we are wrong...

• Specifications
  – Document
  – Printing
  – Evaluation
  – Measurement
  – Viewing
Standards, specifications & methods

What do you want?
Standards

If you don’t set standards...
Standards

you won’t know what’s right.
Standards (Not what you think) - ISO

A document established by consensus and approved by a recognized body that provides for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.
Specifications - ISO

A detailed description of the criteria for a piece of work. Specifications for printing can include characterization-data, ICC-profiles, PDF preflight criteria, calibration targets for the print process, etc.
Methods - ISO

A way, technique, or process for doing something.
In simpler terms...

- **Standards**
  - A car
In simpler terms...

- **Standards**
  - A car

- **Specifications**
  - How fast, mpg, which parts, what color...
In simpler terms...

• Standards
  – A car
• Specifications
  – How fast, mpg, which parts, what color...
• Methods
  – How to assemble
In our world...

• Standard
  – A printed piece

• Specifications
  – What stock, which inks, matching what?

• Methods
  – How to get the look you want
Document standards

Who built this?
Document standards

• There aren’t any!
• But there are recommendations...
Document standards - GIF

• 256 colors per file
• Websites
• Animations
Document standards - PNG

• No CMYK support
• Websites
Document standards - JPG

- RGB, CMYK, L*a*b*
- ICC Profile
- Lossy Compression
JPG artifacts
JPG artifacts

morale booster
indulgent bath soak
Document standards - TIFF

• RGB, CMYK, L*a*b*
• ICC Profile
• Lossless Compression
PDF recommendations

≠
PDF recommendations

• PDF/X-1a
  – Least flexible
  – CMYK only
  – No ICC Profiles
  – No transparency or layers
  – Least likely to cause reproduction problems
PDF recommendations

• PDF/X-4
  – Most flexible
  – CMYK, RGB, Gray, Spot colors
  – ICC Profiles allowed
  – Transparency and layers allowed
  – Most likely to cause reproduction problems
Production checklist

✓ File prepared
Printing standards specifications

What should it look like?
Printing specifications - Americas

- **SWOP**
  - Specifications for Web Offset Publications

![TIME Magazine](TIME.png)

![Forbes Magazine](Forbes.png)
Printing specifications - Americas

- **SWOP**
  - Specifications for Web Offset Publications
- **SNAP**
  - Specifications for Newsprint Advertising Production
Printing specifications - Americas

- **SWOP**
  - Specifications for Web Offset Publications
- **SNAP**
  - Specifications for Newsprint Advertising Production
- **GRACoL**
  - General Requirements for Applications in Commercial Offset Lithography
Printing specifications - Americas

- **SWOP**
  - Specifications for Web Offset Publications
- **SNAP**
  - Specifications for Newsprint Advertising Production
- **GRACoL**
  - General Requirements for Applications in Commercial Offset Lithography
- **First**
  - Flexographic Image Reproduction Specifications & Tolerances
Printing specifications - International

- **Fogra**
  - Fogra 39 (Coated stock)
  - Fogra 48 (Newsprint)
  - Fogra 50 (Gloss laminated)

- **3DAP**
  - Australia
  - 3 paper types

- **Japan Color**
  - Japan
  - 4 print conditions

- **ISO**
  - ISO Coated
  - ISO Uncoated
  - ISO Newspaper
## Printing specifications - GRACoL

### GRACoL® Print Characterization

<table>
<thead>
<tr>
<th>Profile</th>
<th>GRACoL2006 Control/...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper/Substrate</td>
<td>Grades 1 &amp; 2</td>
</tr>
<tr>
<td>LPR (for reference only)</td>
<td>175</td>
</tr>
<tr>
<td>TAC</td>
<td>340%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Paper L<em>a</em>b*</th>
<th>L*</th>
<th>a*</th>
<th>b*</th>
</tr>
</thead>
<tbody>
<tr>
<td>95</td>
<td>0</td>
<td>-2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>L<em>a</em>b* (after 550°C over white backing):</th>
<th>K</th>
<th>L*</th>
<th>a*</th>
<th>b*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>K</td>
<td>15</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>0</td>
<td>-37</td>
<td>-50</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>48</td>
<td>74</td>
<td>-3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Density</th>
<th>25% CMYK</th>
<th>50% CMYK</th>
<th>75% CMYK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutral Density Aims minus Paper Density</td>
<td>.25/.22</td>
<td>.54/.50</td>
<td>.90/.90</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pre-2007 Press Control Guidelines (Historical Reference only):</th>
<th>Paper/Substrate</th>
<th>Solid Ink Densities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>K</td>
<td>1.75</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>1.40</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>1.50</td>
</tr>
<tr>
<td></td>
<td>Y</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>TMI</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Y</td>
<td>18</td>
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</table>

<table>
<thead>
<tr>
<th>Print Contrast</th>
<th>K</th>
<th>C</th>
<th>M</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40+</td>
<td>35+</td>
<td>35+</td>
<td>30+</td>
</tr>
</tbody>
</table>

*Note: The image contains additional data and charts related to printing specifications.*

[Image of GRACoL® Print Characterization table and chart]

*EFI Logo*
G7 – a method

• 7 = CMYK & RGB
G7 – a method

- 7 = CMYK & RGB
- G = Gray balance
G7 – a method

- 7 = CMYK & RGB
- G = Gray balance
- Based on L*a*b* measurements
What is G7?

Where are you going?
What is G7?

Where are you going?
What is G7?

Where are you going?

Driving

New York

Paris

Tokyo
What is G7?

What are you trying to match?
What is G7?

What are you trying to match?

- GRACol
- Fogra 39
- Japan Color
What is G7?

What are you trying to match?

G7
GRACol
Fogra 39
Japan Color
# G7 Compliance levels

<table>
<thead>
<tr>
<th></th>
<th>Gray Balanced</th>
<th>Conforms to a Specification</th>
<th>Uses Correct Media</th>
<th>Uses Correct Ink</th>
<th>Uses ICC Profiles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grayscale</td>
<td>✔️</td>
<td>✖️</td>
<td>✖️</td>
<td>✖️</td>
<td>✖️</td>
</tr>
<tr>
<td>Targeted</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✖️</td>
</tr>
<tr>
<td>Colorspace</td>
<td>✔️</td>
<td>✔️</td>
<td>✖️</td>
<td>✖️</td>
<td>✔️</td>
</tr>
<tr>
<td>Extreme</td>
<td>✔️</td>
<td>✖️</td>
<td>✖️</td>
<td>✖️</td>
<td>✖️</td>
</tr>
</tbody>
</table>
Expanded gamut printing (G7 Extreme)

- Traditional (GRACoL – ISO Coated)
  - 100% red = 97% magenta + 89% yellow
Expanded gamut printing

• Traditional (GRACoL – ISO Coated)
  – 100% red = 97% magenta + 89% yellow

• Expanded gamut
  – 100% red = 100% magenta + 100% yellow
Production checklist

✓ File prepared
✓ Specification selected
Evaluation standards

Where is your proof?
Color bars

IDEAlliance 2009

IDEAlliance 2013

Japan

3DAP

Fogra v3
## Aims (GRACoL)

<table>
<thead>
<tr>
<th></th>
<th>Paper</th>
<th>C</th>
<th>M</th>
<th>Y</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L*</td>
<td>a*</td>
<td>b*</td>
<td>L*</td>
<td>a*</td>
</tr>
<tr>
<td>2006</td>
<td>95</td>
<td>0</td>
<td>-2</td>
<td>55</td>
<td>-37</td>
</tr>
<tr>
<td>2013</td>
<td>95</td>
<td>1</td>
<td>-4</td>
<td>56</td>
<td>-37</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Red</th>
<th>Green</th>
<th>Blue</th>
</tr>
</thead>
<tbody>
<tr>
<td>L*</td>
<td>a*</td>
<td>b*</td>
</tr>
<tr>
<td>2006</td>
<td>47</td>
<td>68</td>
</tr>
<tr>
<td>2013</td>
<td>47</td>
<td>68</td>
</tr>
</tbody>
</table>

| L*  | a*    | b*   |
| 2006| -68   | 25   |
| 2013| -66   | 26   | 20

| L*  | a*    | b*   |
| 2006| 24    | 17   | -46|
| 2013| 25    | 20   | -46|
Small number difference....

...large visual difference
# Tolerances

<table>
<thead>
<tr>
<th>Target</th>
<th>Tolerance $\Delta E_{00}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substrate</td>
<td>$\Delta E_{00} \leq 1.5$</td>
</tr>
<tr>
<td>CMY Solids</td>
<td>$\Delta E_{00} \leq 3.5$</td>
</tr>
<tr>
<td>K Solid</td>
<td>$\Delta E_{00} \leq 5$</td>
</tr>
<tr>
<td>Solids of RGB</td>
<td>Max $\Delta E_{00} \leq 4.2$</td>
</tr>
<tr>
<td>All patches of IT8.7/4</td>
<td>Average $\Delta E_{00} \leq 2$</td>
</tr>
<tr>
<td></td>
<td>95th percentile $\Delta E_{00} \leq 5$</td>
</tr>
</tbody>
</table>
Expanded gamut
Production checklist

✓ File prepared
✓ Specification selected
✓ Color bar, aims, & tolerance selected
Measurement standards

The “M” illuminants
Measurement standards

- Mo – UV Include
Measurement standards

- M0 – UV Include
- M2 – UV Exclude (UV Cut)
Measurement standards

- **M0** – UV Include
- **M2** – UV Exclude (UV Cut)
- **M1** – D50 (a little UV)
Measurement standards

• Mo – Old reference measurements
Measurement standards

- M0 – Old reference measurements
- M1 – New reference measurements
  - Match new viewing booth lamps
M1 capable measurement devices

ES-2000/i1 Pro 2
Konica Minolta FD-5BT
Barbieri Spectro LFP
Barbieri Spectro Pad
Production checklist

✓ File prepared
✓ Specification selected
✓ Color bar, aims, & tolerance selected
✓ Color bar measured and evaluated
Viewing standards

What color is your light?
Viewing standards

• Problems
  – Type of lamps
  – Color of light
  – Metamerism
  – Optical Brighteners
Type of lamps

- Incandescent
- Fluorescent
- LED
Color of light
Color temperature

Northlight/blue sky

High noon

Sunrise/Candle

Daylight fluorescent
Clear mercury vapor
Clear metalhalide
Cool white fluorescent
Halogen lamp
Warm white fluorescent
40W incandescent
Lamp standards

• CRI – Color rendering index
  – 100 = Perfection (The sun)
  – Fluorescent lamps = 50-90
  – LED = up to 98
Metamerism

- Sample colors match under one lighting condition but not under others
Metamerism

Under standard illumination of 5000 K

Light Indicator  No stripes = 5000K

Not under standard illumination of 5000 K

Light Indicator  No stripes = 5000K

PIAGAFF RH5M LIGHT INDICATOR
IF STRIPES ARE SEEN, LIGHT NOT 5000K
TUNGSTEN*

PIAGAFF RH5M LIGHT INDICATOR
IF STRIPES ARE SEEN, LIGHT NOT 5000K
FLUORESCENT, COOL WHITE*

PIAGAFF RH5M LIGHT INDICATOR
IF STRIPES ARE SEEN, LIGHT NOT 5000K
5,000K*
Optical brighteners

- UV light causes optical brighteners to fluoresce producing a blue shift
Optical brighteners

- Proofing media
- Production media
- Press sheets
- Inks
Use a booth!
Production checklist

✓ File prepared
✓ Specification selected
✓ Color bar, aims, & tolerance selected
✓ Color bar measured and evaluated
✓ Image properly viewed
Session summary

• We learned
  – The difference between standards, specifications, methods and compliance and how these differ globally
  – How important lighting and viewing conditions are when evaluating standardized results
  – Documents standards don’t exist but recommendations do!

• To learn more, we have some resources for you
Additional resources

- [www.idealliance.org](http://www.idealliance.org) – Just Enough Video Bank covering topics such as G7 & GRACoL
- [www.fogra.org](http://www.fogra.org) – Latest news and advice on standards and specifications
- [www.gwg.org](http://www.gwg.org) – Best practices for publishing and packaging workflows
- [www.xrite.com](http://www.xrite.com) – More information on “M” illuminants for measurement devices
Additional World of Fiery sessions

• **May 27 – Color Management Fundamentals**
  • Learn the foundations of color theory and management to get the most from your design software and color technologies.

• **June 17 – Color Standards & Specifications**
  • Gain knowledge of the latest industry standards and how they apply to wide and superwide format printing and proofing.

• **July 8 – Color Management Inside Fiery XF & Fiery proServer**
  • Put your knowledge into practice and understand RIP-level color controls.
  • Production Series for wide format printing starting this September, details can be found on the WoF [home page](#)
Color standards & specifications

Questions?
Color standards & specifications

Thank you!