Emulation Proofing for Digital Presses

Your digital press should be a press - not a proofing device.

Mark Samworth
Color Specialist
Let’s start with something slightly off topic that you could only do at the PIA color conference!
Which Do You Prefer?

Chroma Level A

Chroma Level B
What is an Emulation Proof?
The Use Case for Emulation Proofing

When your digital press is emulating something else and it can’t emulate it perfectly

Conventional Press  →  Digital Press  →  Proofer
What is an Emulation Proof?
What is a Proof?

- high fixed cost / low variable cost
- low fixed cost / high variable cost
What is a Proof?

Source

Destination
What is a Proof?

Source

Destination

Substrate Corrected

GRACoL2006.icc
What is an Emulation Proof?
What is Emulation?

Source

Destination
What is Emulation?

Source

Destination
What is Emulation?

Source

Substrate Corrected
GRACoL2006.icc

Destination

[Image of printing equipment]
What is an Emulation Proof?
What is an Emulation Proof?
Master Colors (as mixed by Pantone with 14 liquid based inks)

Dependent Aim Colors (as printed on Sue’s HP Indigo 20000 with CMYK dots)
What is an Emulation Proof?

CMYK + Spot
CMYK
CMYKOGV
What is an Emulation Proof?

CMYK + Spot

CMYK

CMYKOGV
What is an Emulation Proof?
What is an Emulation Proof?

Source → Destination / Source → Destination
What is an Emulation Proof?

Source → Destination

Digital Printing Strategy
What is an Emulation Proof?
What is an Emulation Proof?

Source → Destination / Source → Destination

Digital Printing Strategy

Proofing Strategy
The Best Way to Understand Emulation Proofing

Make a Proof Using Two Separate Workflows
You Don’t Need Emulation Proofing Software to Make an Emulation Proof.

But is sure does help!
Step 1 – Match Your Digital Press to Your Source

Source

Raw Flexo Press Profile

Destination

Raw Digital Press Profile

= Digital Press Emulating Flexo Press
3 Profiles to Create

- Raw Flexo Press Profile
- Raw Digital Press Profile
- Digital Press Emulating Flexo Press
3 Profiles to Create

Goal of Step 1

- Raw Flexo Press Profile
- Raw Digital Press Profile
- Digital Press Emulating Flexo Press
Step 2 – Match Your Proof to Your Digital Press

*Digital Press Emulating Flexo Press

Source

+ Raw Proofer Press Profile

= Emulation Proof

*
The Proofer Profile
(same for “normal” or “emulation” proofing)

Raw Proofer Profile
4 Total Profiles to Create

1. Raw Flexo Press Profile
2. Raw Digital Press Profile
4. Raw Proofer Profile
An Emulation Proof Workflow Uses 3 Profiles

1. Raw Flexo Press Profile
2. Raw Digital Press Profile
4. Raw Proofer Profile
**Emulation Proof Workflow**

1. **Fred’s Flexo Press on White**
   - Raw Flexo Press Profile

2. **Sue’s HP Indigo 20000**
   - Raw Digital Press Profile

3. **Dayton Epson P7000**
   - Raw Proofer Press Profile

- **Color Strategy:** Sue’s HP Indigo 20000 to Fred’s Flexo Press
- **Source Profile:** Fred’s Flexo Press on White 7c
- **Destination Profile:** Sue’s HP Indigo 20000

- **Color Strategy:** Dayton Epson P7000 to Sue’s HP Indigo 20000
- **Source Profile:** Sue’s HP Indigo 20000
- **Destination Profile:** Dayton Epson P7000
Emulation Proof Workflow

1. Fred’s Flexo Press on White
   - Raw Flexo Press Profile

2. Sue’s HP Indigo 20000
   - Raw Digital Press Profile
   - Source Profile: Fred’s Flexo Press on White 7c
   - Destination Profile: Sue’s HP Indigo 20000

3. Dayton Epson P7000
   - Raw Proofer Press Profile
   - Source Profile: Sue’s HP Indigo 20000
   - Destination Profile: Dayton Epson P7000
Emulation Proofing is More Than Just Reducing the Number of Profiles!
More Profiles = More Measurement Error

Reduced Measurement Error = Increased Color Accuracy

Source

- Raw Flexo Press Profile

Destination

- Raw Digital Press Profile

= Digital Press Emulating Flexo Press
* No “additional” profiles are required. In most cases, all profiles are already made and used in “normal” workflows.
Color Conversion Example

Source: Flexo Press

- C: 100%
- M: 0%
- Y: 0%
- K: 0%

Destination/Source: Digital Press

- C: 100%
- M: 4%
- Y: 2%
- K: 1%

Destination: Epson Proofer

- C: 93%
- M: 9%
- Y: 6%
- K: 3%
How Do I Check the Process Color Accuracy of my Emulation Proof?
Checking Color Accuracy of the Emulation Proof

1. Proof Chart
2. Measure Chart
3. Compare to Aim
What is the Aim?

- **Color Accuracy**

  - **Aim**
  - **Actual Measurements**

<table>
<thead>
<tr>
<th>Color</th>
<th>Aim</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delta E 2000</td>
<td>0.92</td>
<td>3.22</td>
</tr>
<tr>
<td>Delta E Average</td>
<td>0.78</td>
<td>0.78</td>
</tr>
<tr>
<td>Delta E Maximum</td>
<td>0.79</td>
<td>0.79</td>
</tr>
<tr>
<td>Delta E Grey</td>
<td>0.84</td>
<td></td>
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</table>

**Result**
Million Dollar Question

What is the Aim?
4 Total Profiles to Create

1. Raw Flexo Press Profile
2. Raw Digital Press Profile
4. Raw Proofer Press Profile
4 Total Profiles to Create

1. Raw Flexo Press Profile
2. Raw Digital Press Profile
4. Raw Proofer Press Profile
What is the Aim?
Aims for Emulation Proofing

The Ultimate Aim: The print specification for your shop
- GRACoL
- Your flexo press in its “natural” state (bad idea)
- Your flexo press matched ACAP to GRACoL

The True Aim: Your digital press matched ACAP to your substrate corrected ultimate aim.

The Compromise Aim:
The True Aim

Source → Destination / Source → Destination
The True Aim

Source  ➔  Destination / Source  ➔  Destination

C 100%
M 0%
Y 0%
K 0%
Flexo Press ➔ L 55 A -37 B -50 ➔ C 100%
M 4%
Y 2%
K 1%
Digital Press ➔ L 57 A -36 B -49 ➔ C 93%
M 9%
Y 6%
K 3%
Epson Proofer
Aims for Emulation Proofing

The Ultimate Aim: The print specification for your shop
- GRACoL
- Your flexo press in its “natural” state (bad idea)
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The True Aim: Your digital press matched ACAP to your substrate corrected ultimate aim.

The Compromise Aim: Your substrate corrected ultimate aim.
The Compromise Aim

Source → Destination / Source → Destination

Flexo Press → Digital Press → Digital Press → Epson Proofer

C 100%  M 0%  Y 0%  K 0%
L 55 A -37 B -50

C 100%  M 0%  Y 0%  K 0%
C 100%  M 4%  Y 2%  K 1%
L 57 A -36 B -49
C 93%  M 9%  Y 6%  K 3%
The Compromise Aim

Source → Destination / Source → Destination

C 100%
M 0%
Y 0%
K 0%

Flexo Press

L 55
A -37
B -50

substrate corrected

C 100%
M 4%
Y 2%
K 1%

Digital Press

C 93%
M 9%
Y 6%
K 3%

Epson Proofer
Color Pilot
Digital Press
Strategy

Relative Colorimetric = Substrate Correction to Destination
Will match GRACoL2006.Coated1 substrate corrected to the substrate of Sue’s HP Indigo 20000 profile.
Substrate Correction to Destination
Mean No Dots in Print

pure substrate
Substrate Correction in Color Pilot 16.1

GRACoL2006.Coated1

Substrate of Digital Press
Million Dollar Question

What is the Aim?
Million Dollar Question

What is the Aim?

aim
actual measurements
Color Accuracy Result
What is the Aim?

Color Accuracy Result

<table>
<thead>
<tr>
<th>ΔE Form</th>
<th>ΔE Average</th>
<th>ΔE Maximum</th>
<th>ΔE Paper</th>
<th>ΔE Primaries</th>
<th>ΔE Grey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delta E 2000</td>
<td>0.82</td>
<td>2.05</td>
<td>0.03</td>
<td>0.59</td>
<td>0.82</td>
</tr>
</tbody>
</table>

Million Dollar Question

actual measurements
The Future:
Substrate Correct the Reference in the Compare Tool
Million Dollar Question

What is the Aim?

Color Accuracy Result

aim

actual measurements

1. Reference Profile: GRACoL2006.Coated1
2. Sample Profile: Proof of Indigo Emulating GRACoL2006_L87.3_a-1.0_b...
3. Substrate Correct Reference

<table>
<thead>
<tr>
<th>ΔE Items</th>
<th>ΔE Average</th>
<th>ΔE Minimum</th>
<th>ΔE Maximum</th>
<th>ΔE Paper</th>
<th>ΔE Primaries</th>
<th>ΔE Grey</th>
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<tbody>
<tr>
<td></td>
<td>0.80</td>
<td>2.03</td>
<td>0.00</td>
<td>0.57</td>
<td>0.79</td>
<td></td>
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</table>
What About Spot Colors?
Master Colors
(as mixed by Pantone with 14 liquid based inks)

Dependent Aim Colors
(as printed on Sue’s HP Indigo 20000 with CMYK dots)
Esko Emulation Proof Check

Checking the accuracy of a digital proof (e.g., Esko Proof/Proof) made to match a digital press (e.g., HP Indigo) which is emulating a conventional press (e.g., offset, flexo, or print shop) (e.g., GRACOL).
Spot Color Accuracy Check

Normal Proof

HP Indigo CMYK
Pantone Solid Coated
Master Standard
Pantone Solid Coated Master Standard

Sue’s HP Indigo CMYK Dependent Aim
Emulation Proof Verification Chart

CMYK Process (IT8.7-4)

Spot Colors
The Ultimate Spot Color Check?
The Esko SpotColorCheck_600 Chart
The science of process color matching is based on standardized data sets!

GRACoL2006.Coated1.icc

Sue’s HP Indigo 20000 Press
No Such Data Set Exists for Spot Colors Until Now ...
The SpotCheck_600 Color Data Set
A Standardized Data Set for Spot Color Assessment

SpotCheck_600 Aims

SpotCheck_600 Results
Where did the SpotCheck_600 Color Data Set come from?

Matt Furr Thesis
Clemson University - 2014
The SpotCheck_600 Color Data Set
A Standardized Data Set for Spot Color Assessment

RIT Results

AVG  =  0.99
MAX  =  4.42
95%  =  3.26
When Don’t You Need an Emulation Proof?

i.e. when can you just use a normal proof?
Case 1

When Your Digital Press Can Match Your Ultimate Aim
Case 1
When Your Digital Press Can Match Your Ultimate Aim
Case 2

You have a PDF in Your Digital Press Color Space

Source  →  Destination / Source  →  Destination
Case 3
When Your Digital Press is Not Emulating Anything

Source  Destination / Source  Destination
When Do You Need an Emulation Proof?

i.e. when can’t you just use a normal proof?
The Use Case for Emulation Proofing

When your digital press is emulating something else and it can’t emulate it perfectly

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