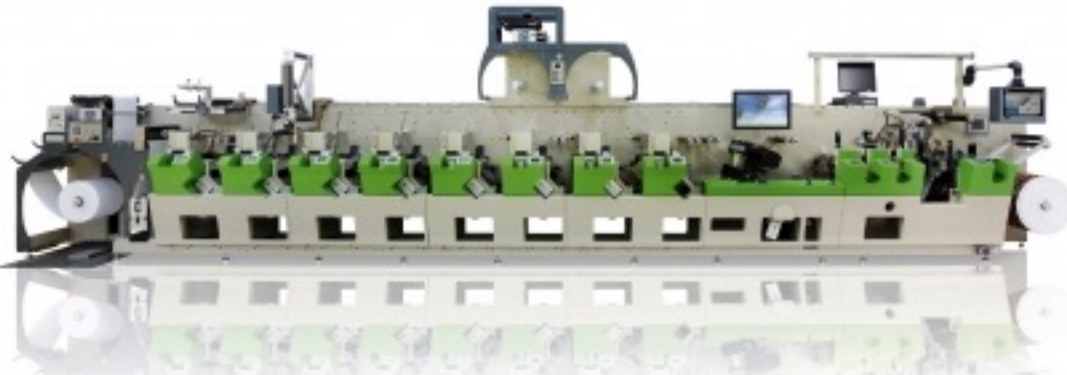# Color Reproduction & Process Control

Optimization/Fingerprints/Process Control/Characterization/Standards
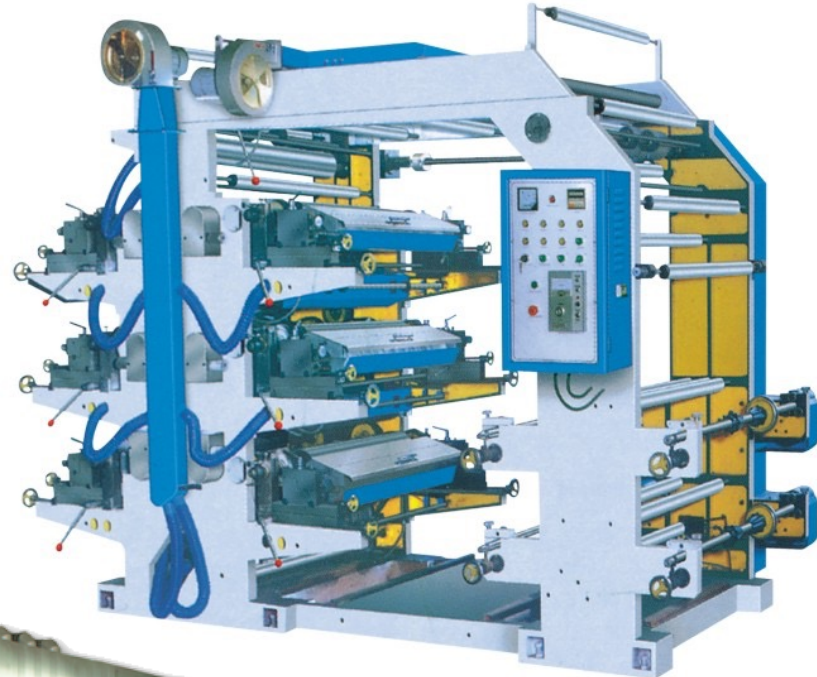
Catherine Haynes
chaynes@teamflexo.com

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3 Common Press Layouts

Inline Press

Stack Press

Central Impression Press

Flexography

Anilox Roller

Plate Cyl.

Impress Cyl.

Anilox Roller

Web

Ink Tray

Doctor Blade

Plate Cylinder

Anilox Roller
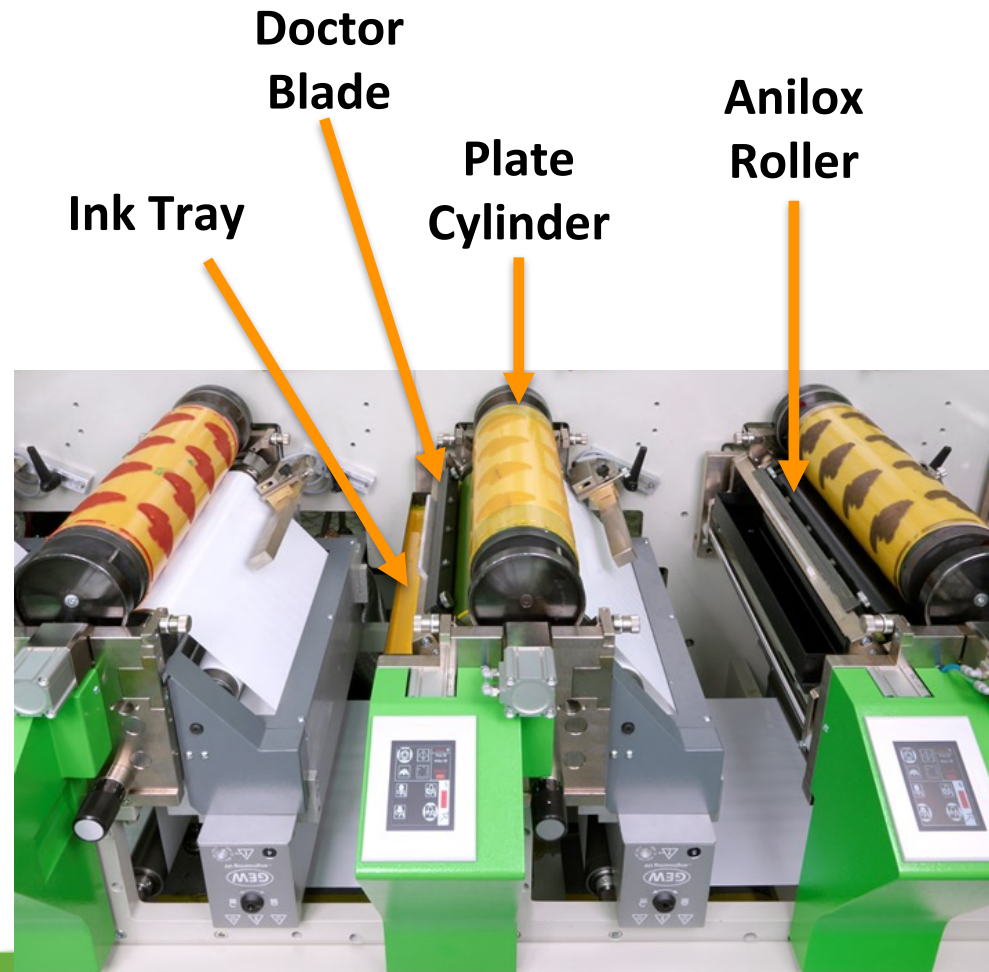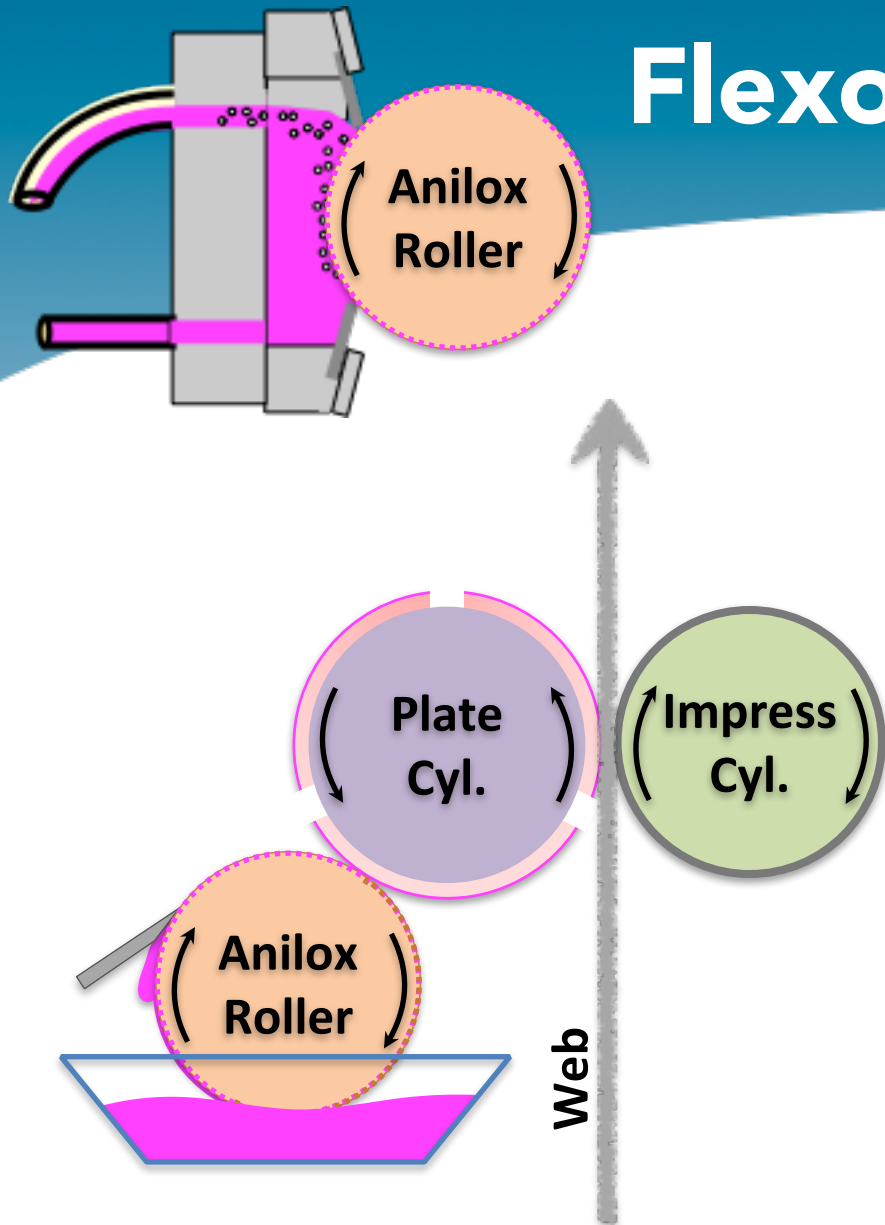
What Affects Ink Lay Down?

- Substrate & Coatings
- Dyne Level
- Temperature
- Antifoaming Agents
- Chemical Properties

- Color Sequence
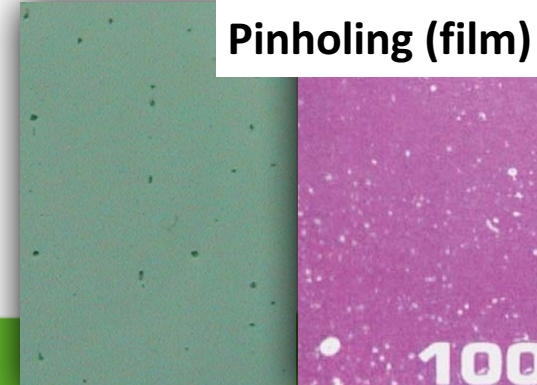- Absorbency
- Press Speed
- Ink Film Thickness
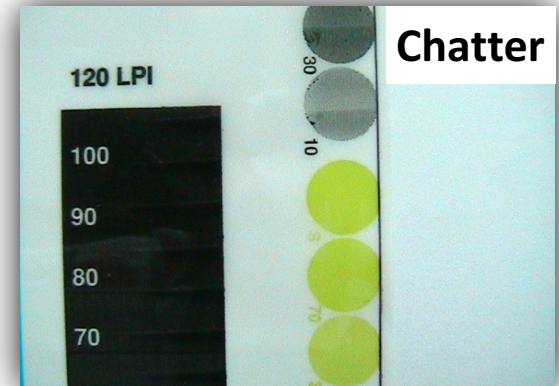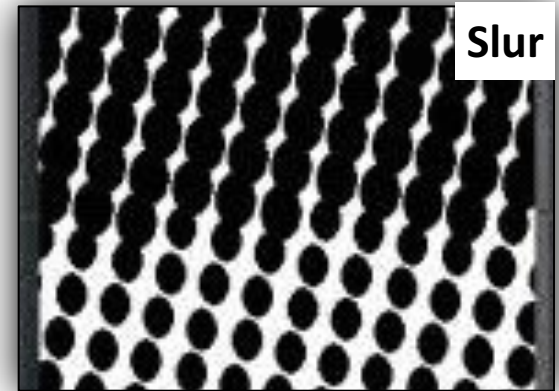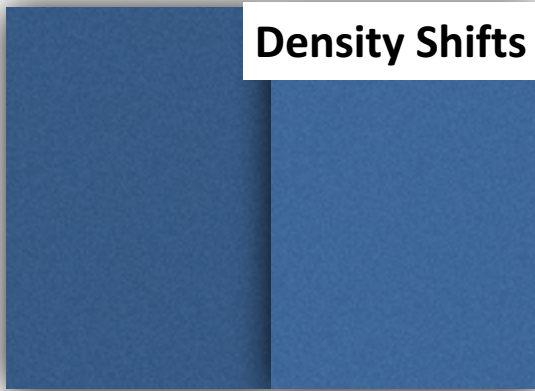- Impression

Water Inks - Viscosity & pH

Solvent Inks - Viscosity

UV Inks - Viscosity

A Few Common Print Issues Related to Inks

Density Shifts

Dirty Print

Slur

Registration

Skip Out

Chatter

Ink Starvation

Pinholing (film)

Mottle (paper)

The Fundamentals

CGATS TR012-2003

Graphic Technology - Color reproduction and process control for packaging printing

This Technical Report outlines the steps necessary to understand and objectively define the color and tone reproduction capabilities (and limitations) of a printing process. These steps include <mark>optimization</mark>, <mark>fingerprinting</mark>, <mark>process control</mark>, and <mark>characterization</mark>, which provide the information required in the package development workflow defined in ANSI CGATS TR 011. This report also suggests steps that may be taken to control the printing processes to achieve consistent and predictable color. 28 pp.

1.

2.

3.

4.

Process Control On Press

- Starts with Optimization and Press Maintenance
- Consistent Maintenance of Production Run Variables During the Run
  - Ink Viscosity, pH and temperature control
- Image Color and Quality Control
  - Inspecting print an web for flaws
- Ideally, want to automate what can be automated and provide proper tools and materials for measurement and data collection

Optimization (*FIRST* 19.1)

- **GOAL:** Identify best combination of print variables to achieve design requirements

- Test conditions MUST represent normal production behavior and quality

- Completed for the intended graphics of each print deck (process/line/combo/solid)

- Not usually necessary to perform or *every* print variable.

What are the Variables?

Press Component Variables

- Dryers
- Registration Controls
- Tension Controls
- Press Mechanics
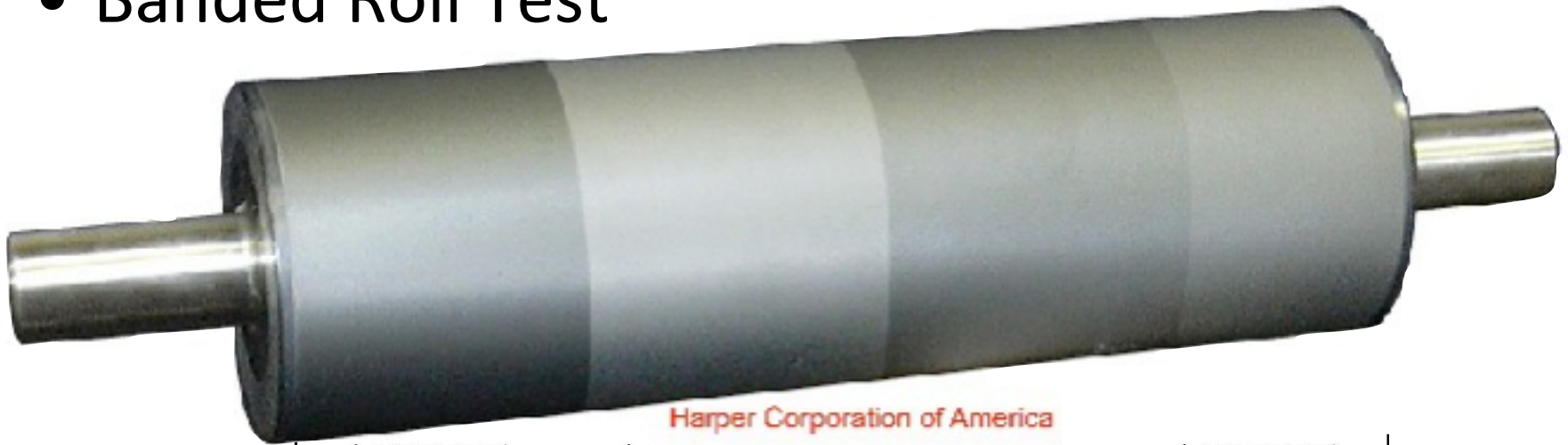
Is the press operating in sound condition?

Job Specific Variables

- Substrate
- Inks/Coatings
- Plate
- Mounting Tape
- Anilox
- Sleeve

Optimization for intended graphics (solid, line, screen, process)

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Anilox Optimization

- Banded Roll Test
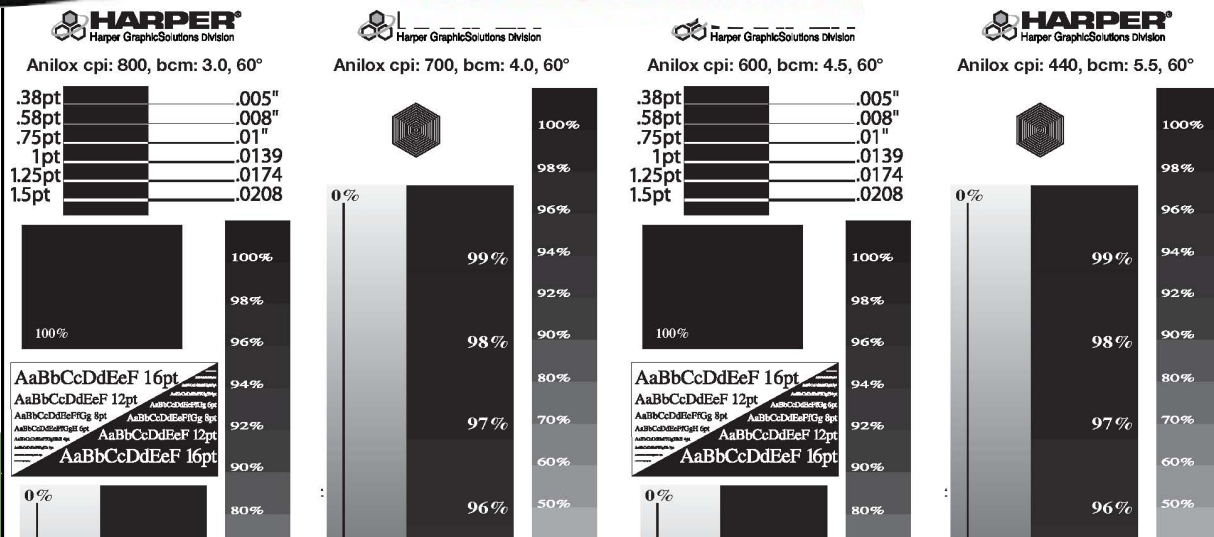
Inks and Coatings Optimization

- Inks
  - Balancing max pigment load to achieve solids and minimize dot gain but run stably
  - Matching Color Standards
- Coatings
  - Min coat weight to achieve gloss and CoF requirements

Mounting Tape Optimization
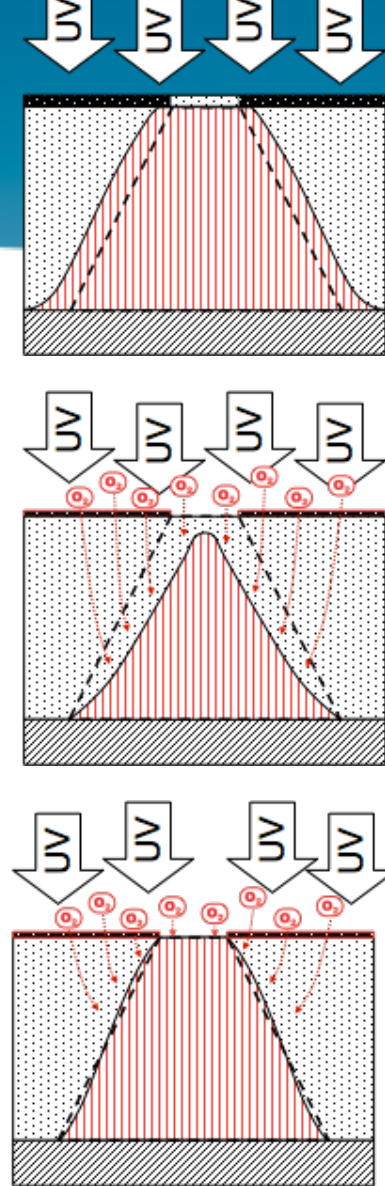
- Best tape for intended graphics - solid, line, screen, process and combination
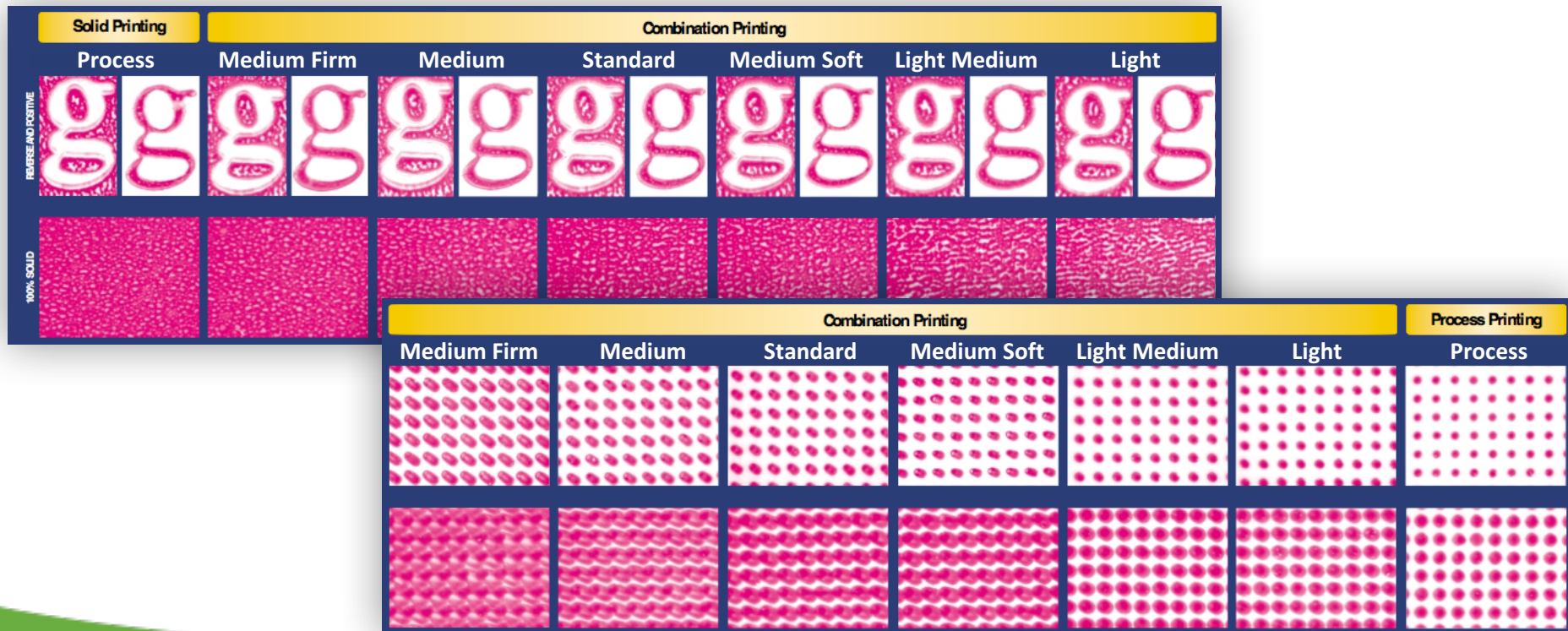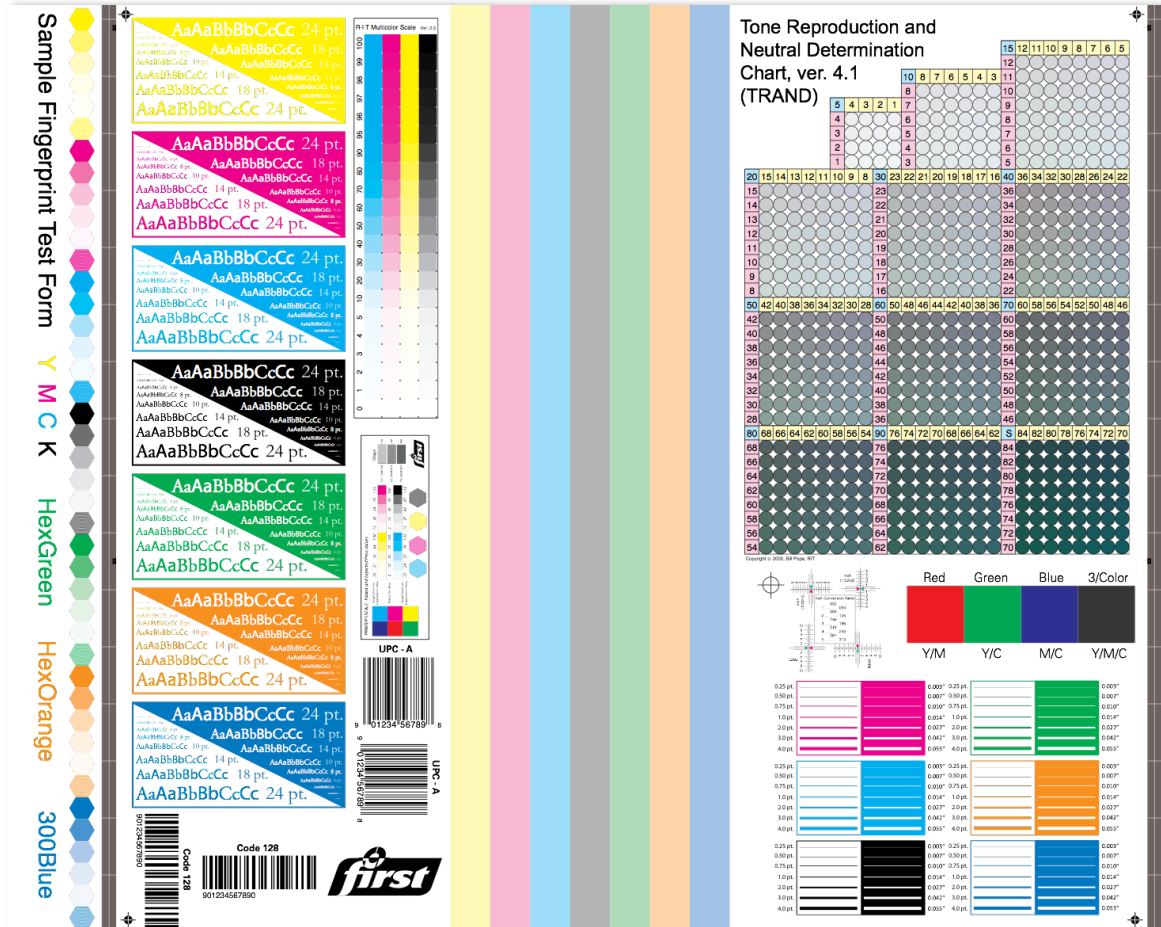
Plate Optimization

- Printability of screens and solids
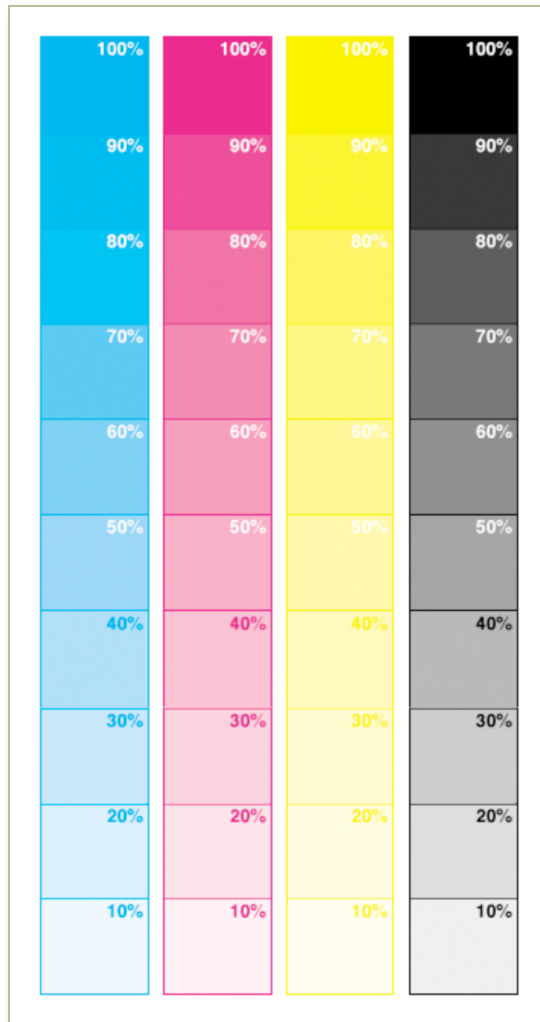- Plate life
- Special Screening and Dot Structure

The Fingerprint

- Normal Production Conditions

- Graphic Parameters

- Curves and Gray Balance

- Target Lab, Density, Dot Gain

AaAaBbBbCcCc 24 pt.
AaAaBbBbCcCc 18 pt.
AaAaBbBbCcCc 14 pt.
AaAaBbBbCcCc 24 pt.

Tone Reproduction and
Neutral Determination
Chart, ver. 4.1
(TRAND)

UPC - A

Code 128

first

Red   Green   Blue   3/Color

Y/M   Y/C   M/C   Y/M/C

Solid

70%

30%

10%

3%

Slur

Inch
(1/32nd)

Inch
(1/32nd)

Inch Conversion Table

	.032	
1	....	.063
	.094	
2	....	.125
	.156	
3	....	.188
	.219	
4	....	.250
	.281	
5	....	.313

mm

mm

AaAaBbBbCcCc 24 pt.
AaAaBbBbCcCc 18 pt.
AaAaBbBbCcCc 14 pt.
AaAaBbBbCcCc 10 pt.
AaAaBbBbCcCc 14 pt.
AaAaBbBbCcCc 6 pt.
AaAaBbBbCcCc 18 pt.
AaAaBbBbCcCc 10 pt.
AaAaBbBbCcCc 24 pt.
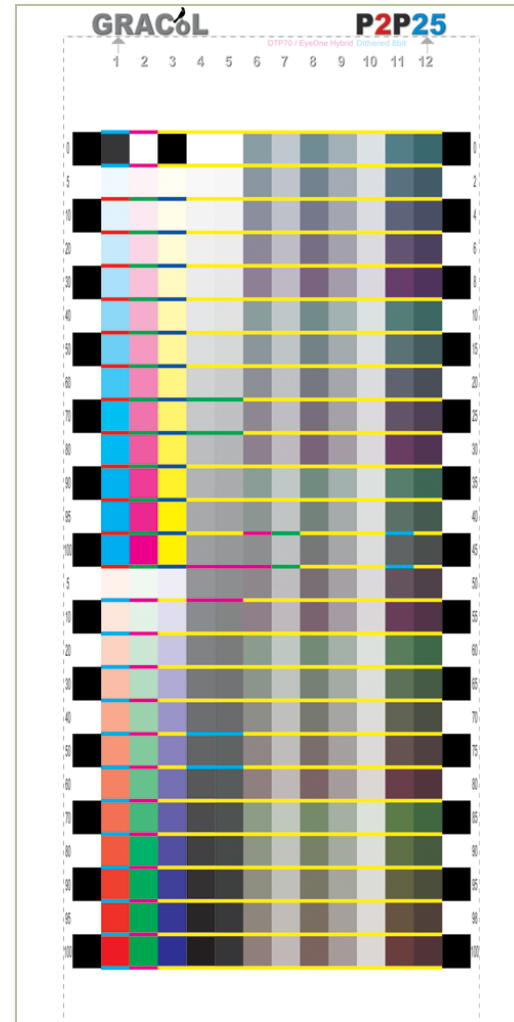AaAaBbBbCcCc 6 pt.

.25 pt
.50 pt
.75 pt
1 pt

.005"
.010"
.020"

Two Approaches to CMYK Curves

Individual Curves

CMY Neutral Curves

Press Fingerprint/Characterization Form

Company _____ Substrate _____ Temp. / Humidity _____

Press _____ Ink Type _____ Initials _____

Descrip. _____ Date _____

	Deck 1	Deck 2	Deck 3	Deck 4	Deck 5	Deck 6
Color						
Plate Type						
Mounting Tape						
Anilox Config.						
Print Screen Ruling						
Plate Cyl./Sleeve ID						
Press Speed						
Impression Setting						
Web Tension						
Dryer/UV Setting						
Ink ID						
Ink Viscosity / pH						
Ink SID						
L*a*b* Values						

	2%	10%	30%	50%	70%	90%	2%	10%	30%	50%	70%	90%	2%	10%	30%	50%	70%	90%	2%	10%	30%	50%	70%	90%	2%	10%	30%	50%	70%	90%	2%	10%	30%	50%	70%	90%
[LPI 1] Plate Dot Size																																				
[LPI 2] Plate Dot Size																																				
Plate Relief																																				
[LPI 1] Print Dot Size																																				
[LPI 2] Print Dot Size																																				
Print Contrast																																				
Solid Evaluation																																				
Mottle/Pinholing Eval																																				
Fine Line Evaluation																																				
Reverse Evaluation																																				
Banding Evaluation																																				
HL/Vign Dot Bridging																																				
Vignette Hard Edge																																				

Notes:
_____
_____
_____

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Sample Forms (*FIRST* 19.3)

Press Operating Data Sheet

Customer/Description: FIRST Strawberries
Graphics Order# 1234
Spec. # 5678
Substrate: Polyethylene 1.25mil
Width: 45"
Date: 11/12/98
Press: 11
Winding: R - 1

Deck#	Color	Ink Reference Code	Viscosity #2 zahn	Solvent Type	Anilox Specifications			
					Screen	Volume	ID#	Alternate Roll
1	BLACK	ABC-81031	30	100	650	1.96	A13	A22 or A25
2	Cyan	ABC-38163	30	100	650	1.94	A44	A22 or A25
3	Magenta	ABC-38925	30	100	650	1.96	A47	A22 or A25
4	Purple	ABC-37728A	30	100	650	1.9	A08	A22 or A25
5	Yellow	ABC-81024	30	100	650	2.27	A19	A18
6	WHITE	XYZ-35860	25	200	300	6	A10	A29

Temperatures	Target
Chill Roll Temperature	65
Between Color Dryer Temperature	175
Tunnel Dryer Temperature	150
Drum Temperature	90

Tensions	Target
Unwind Tension	8
Tunnel Tension	10
Rewind Tension	12

Quality Measure	Yellow Target	Magenta Target	Cyan Target	Black Target
Density	1.00	1.20	1.25	1.40
2% Dot Area	12%	12%	12%	12%
50% Dot Area	70%	70%	70%	70%

Density and Dot Area are measured using a densitometer calibrated in Status-T

Special Instructions: Run to FIRST specifications.
Run Speed Target: 700

This form is to remain at the press throughout the press run. When job is complete, turn in to shift supervisor.

Anilox Card

Anilox	B13	Volume	1.9
Screen	800	Angle	60
Date New.	8/2/97	Code:	PA12345

Press	Date In	Deck	Oper	Date Out	Oper

Photopolymer Plate Card
Identification/Log Card

Job name:
Cylinder size
Web Size
Gear size

Date In	Date Out	Impressions	Condition of plates			Date Returned	Comments
			Good	Bad	Initials		

Review Process Control

proc•ess

noun

a series of actions or steps taken in order to achieve a particular end

con•trol

verb

determine the behavior or supervise the running of

Process Control for Prepress

- Artwork
  - High-End Software
  - Workflow Solutions
  - Preflighting
  - Automation of Tasks
- Color Management
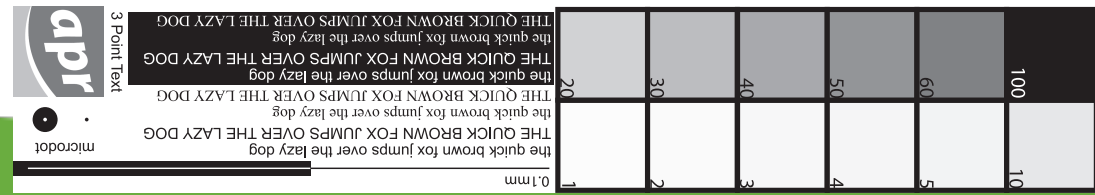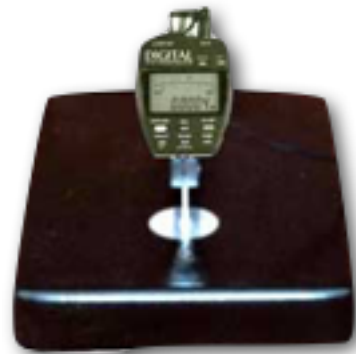 - Color Management Software
  - Spectrophotometer
  - Proofing Software

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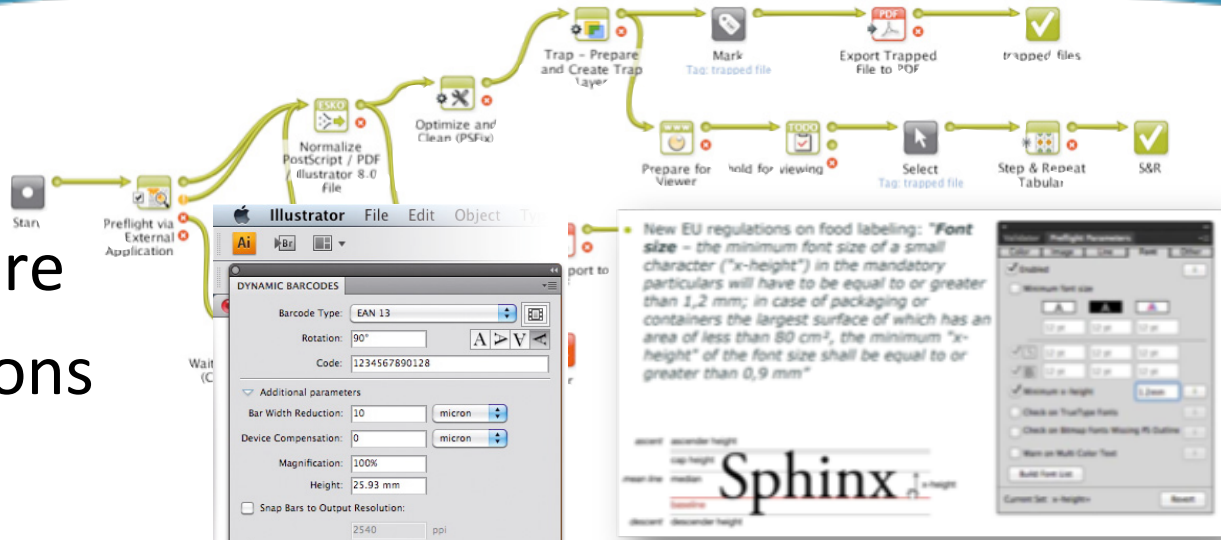
Process Control for Platemaking

- Imaging/Ablation
- Exposures
  - UVA & UVC Meters
  - Micrometer
  - Loop
  - Plate Reader
  - Shore A Gauge
  - Inspection Target
- Washout & Drying
  - Micrometer

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Process Control for Mounting

- T.I.R. Measurement

- Registration Target

- Consistent Tape Selection

Process Control for Inks

- Viscosity
- pH Meter (water-based)
- Temperature

- Automate measurement and adjustments if possible for consistent and continuous results
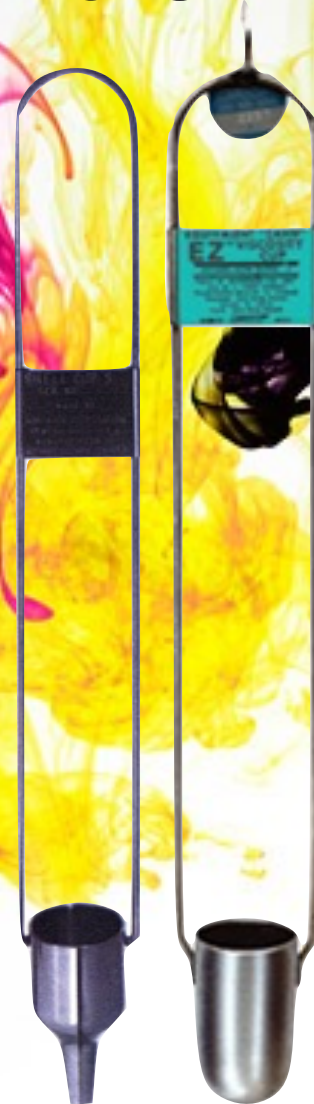
Process Control for Metering

APPLICATION	APPROPRIATE ANILOX LPI	APPROPRIATE ANILOX VOLUME
HEAVY LINE & SOLIDS	180-330	8-4 BCMs
LINE AND TYPE	200-400	7.5-3.5 BCMs
VIGNETTES	360-500	4.7-2.8 BCMs
PROCESS	500-1200	3.2-1.0 BCMs

- Consistent Anilox Selection

- Anilox Inspection

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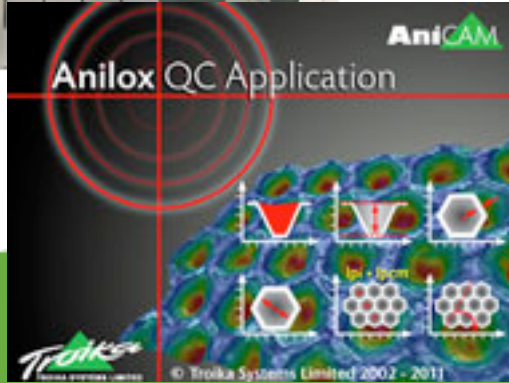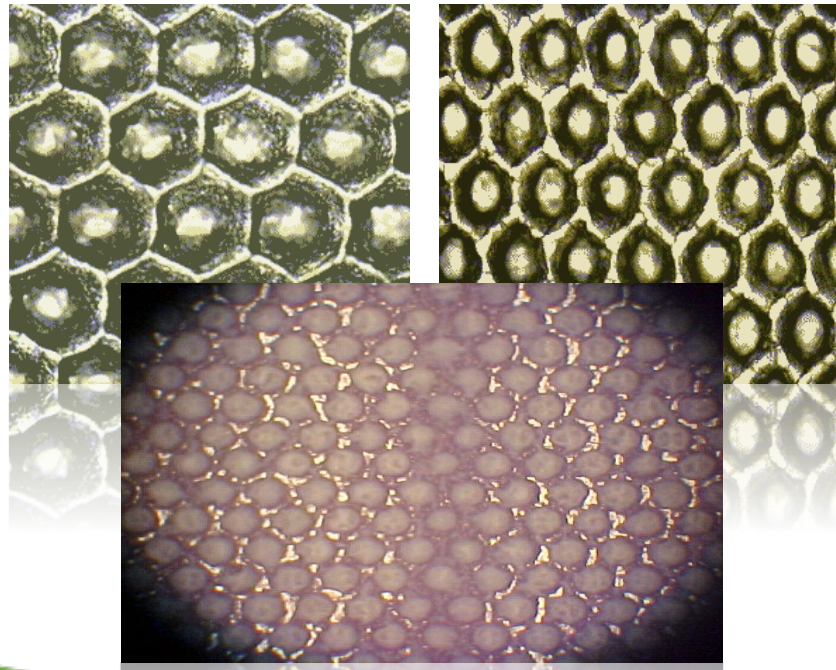
Process Control for Substrates

- Paper & Film
  - Tensile Test
  - Burst Test
  - CoF Test
  - Grain Test
  - Shrink Test
  - Tape Test
  - Dyne/Treatment

Felt vs. Wire Side Test

Basis Weight Scale
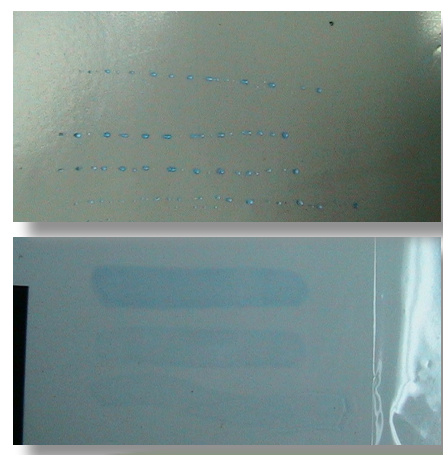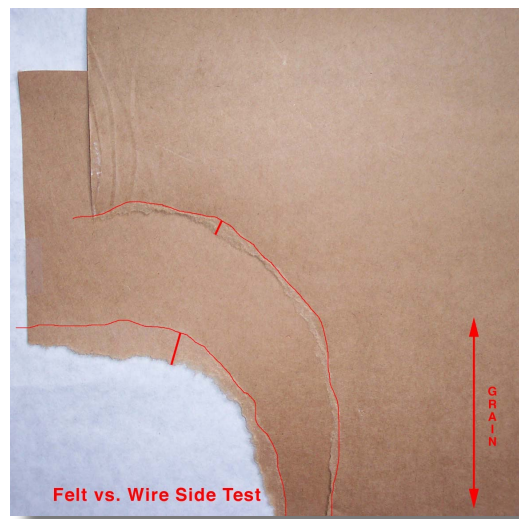
Process Control for Pressroom

- Stethoscopes - vibration
- Stroboscopes - speed
- Image Analysis - print quality

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Characterization

- MUST be repeatable conditions

- Averaged to represents production gamut

- Used in prepress for monitors, proofing and other processes
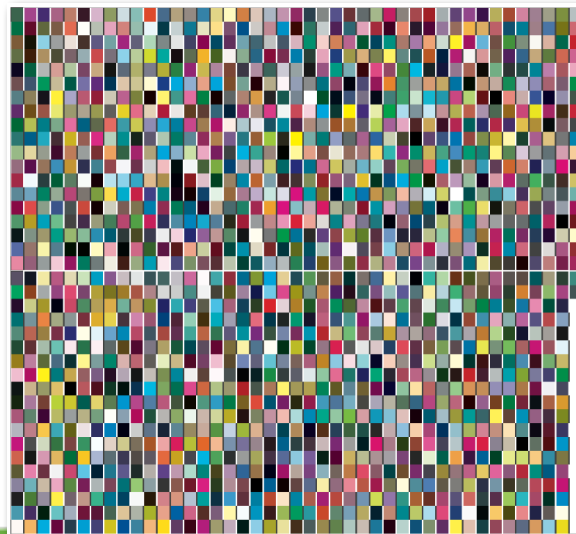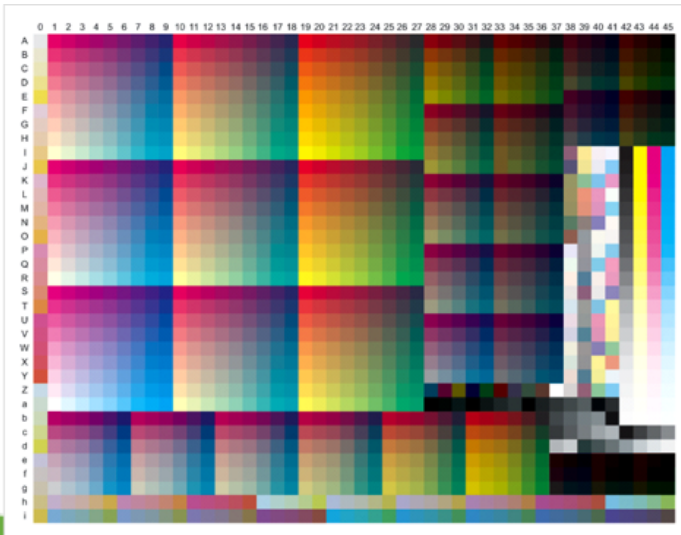
Approaches to Color Control

What is Profiling?

Sample Narrow Web Gamut
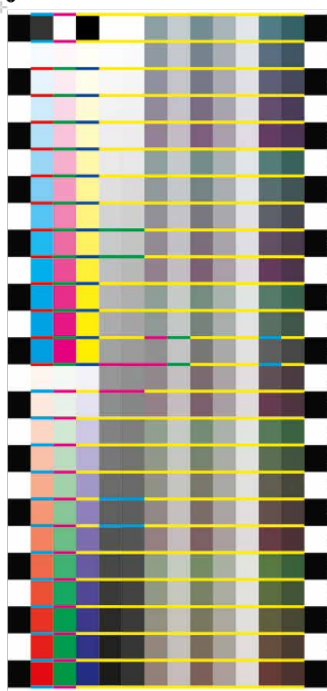
APR_IT8.7-4_iO, complete patch amount 1634

0 79729 03816 8

P2P25

apr

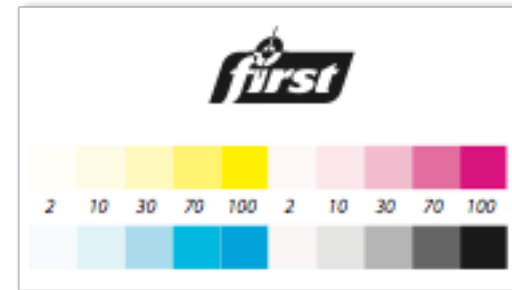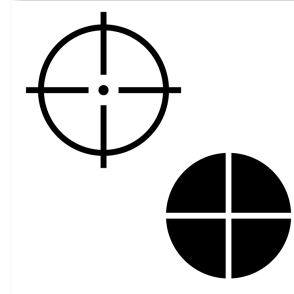| Date | LPI | Anilox Config / Ink SID |
Initials	Plate	C
Press	Tape	M
Speed	Subst	Y
	Ink	K
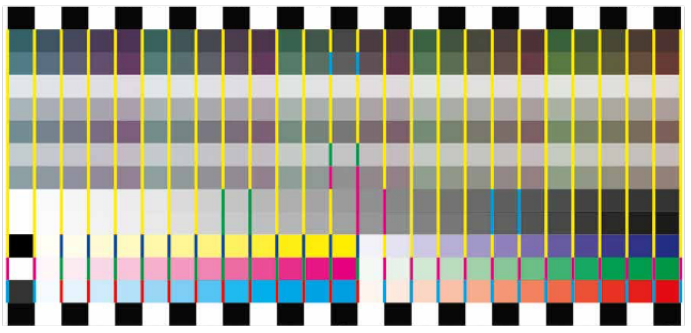
Process Control and Continuous Improvement

Being able to do it over and over
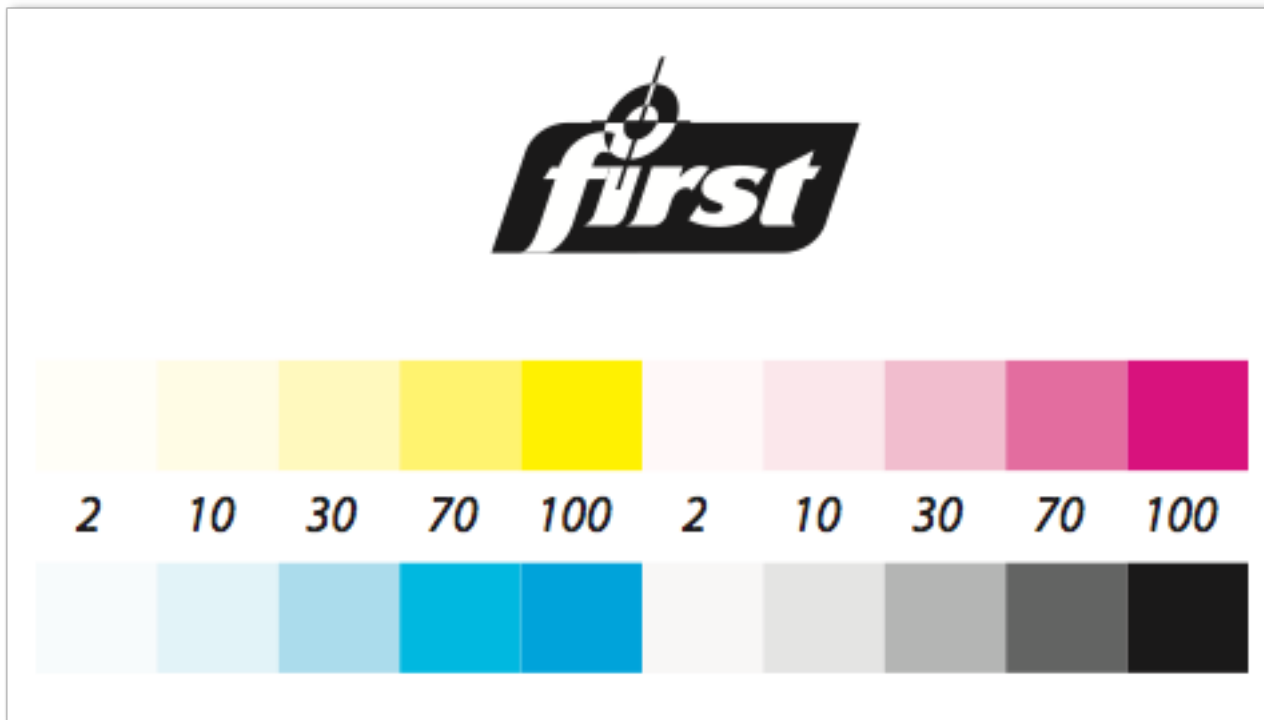
Print Marks
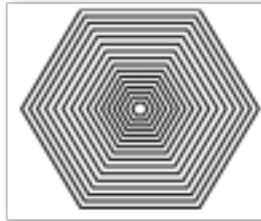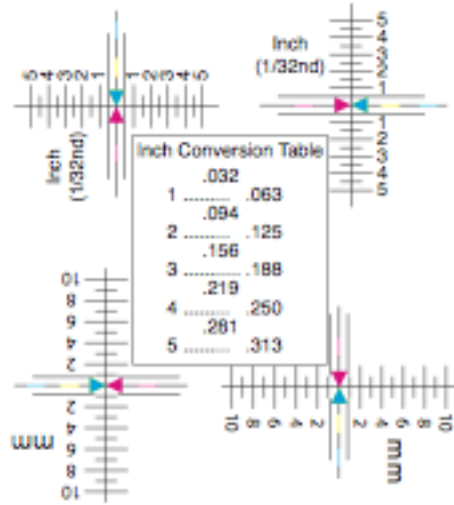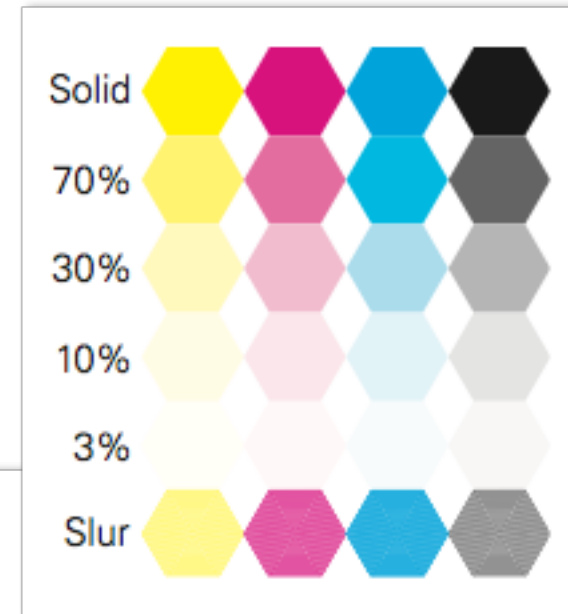
Measurement Tools

Solutions for the Pressroom

- What density range should you run process Magenta ???
- What density range should you run process Cyan ???
  - FTA FIRST 4.0 suggests 'Starting Points' for process colors

20.4.4   **Solid Ink Density**

Table 20.4.4

	Cyan			Magenta			Yellow			Black		
Solid Ink Density: Starting Point												
Density is print system dependent; determine optimum density with press fingerprint trial (ref. 19.2)												
	min.	Target	max.	min.	Target	max.	min.	Target	max.	min.	Target	max.
Paper Products	1.30	1.35	1.40	1.20	1.25	1.30	0.95	1.00	1.05	1.45	1.50	1.55
Film Products	1.25	1.30	1.35	1.15	1.20	1.25	0.95	1.00	1.05	1.35	1.40	1.45
Newsprint	0.95	0.97	0.99	0.93	0.95	0.97	0.77	0.79	0.81	1.03	1.05	1.07

Process for Achieving Color Balance:
(How to determine printer specific density targets)

Work with the ink supplier.
First Priority: Specify each ink hue value.
Second Priority: Check gray balance.
Third Priority: Confirm dot gain.
Fourth Priority: Obtain solid ink density (no pinholes).

	Cyan			Magenta			Yellow			Black		
	min.	Target	max.	min.	Target	max.	min.	Target	max.	min.	Target	max.
Printer Specific	-0.05		+0.05	-0.05		+0.05	-0.05		+0.05	-0.05		+0.05

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What about Spot Colors?

- What density range should you run Pantone 1375 ???
- What density range should you run APR logo Blue ??? or Coca Color Red or Pepsi Blue ???
- FTA FIRST 4.0 does not suggest anything for Spot or Special colors
- The truth is....no one knows!
  - Especially when you consider all of the unique substrates used in Flexo
- Usually Spot or Special colors are matched based on visually evaluation
- Introduction of Spot Color Tone Value measurement (SCTV) as of August 2017

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Pressroom Software

The Fundamentals

CGATS TR012-2003

Graphic Technology - Color reproduction and process control for packaging printing

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1.

2.

3.

4.

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Process Control On Press

- Starts with Optimization and Press Maintenance

- Proper Press Make-Ready

- Consistent Maintenance of Production Run Variables During the Run

  - Ink Viscosity, pH and temperature control

- Image Color and Quality Control

  - Inspecting print an web for flaws

- Ideally, want to automate what can be automated

  - Provide proper tools and materials for measurement and data collection

- Root-Cause Analysis Troubleshooting

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Thank You

Catherine Haynes
chaynes@teamflexo.com

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