Press Operator’s Guide to

WORKING DRAFT

2007 12 08
October, 2008
Copyright and Legal Notices

Copyright (c) International Digital Enterprise Alliance, Inc. [IDEAlliance] (2007).

All Rights Reserved.

This document and translations of it may be copied and furnished to others, and derivative works that comment on or otherwise explain it or assist in its implementation may be prepared, copied, published and distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice and this paragraph are included on all such copies and derivative works. However, this document itself may not be modified in any way, such as by removing the copyright notice or references to IDEAlliance, except as needed for the purpose of developing IDEAlliance specifications, in which case the procedures for copyrights defined in the IDEAlliance Intellectual Property Policy document must be followed, or as required to translate it into languages other than English. The limited permissions granted above are perpetual and will not be revoked by IDEAlliance or its successors or assigns.

NO WARRANTY, EXPRESSED OR IMPLIED, IS MADE REGARDING THE ACCURACY, ADEQUACY, COMPLETENESS, LEGALITY, RELIABILITY OR USEFULNESS OF ANY INFORMATION CONTAINED IN THIS DOCUMENT OR IN ANY SPECIFICATION OR OTHER PRODUCT OR SERVICE PRODUCED OR SPONSORED BY IDEAlliance. THIS DOCUMENT AND THE INFORMATION CONTAINED HEREIN AND INCLUDED IN ANY SPECIFICATION OR OTHER PRODUCT OR SERVICE OF IDEAlliance IS PROVIDED ON AN "AS IS" BASIS. IDEAlliance DISCLAIMS ALL WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY ACTUAL OR ASSERTED WARRANTY OF NON-INFRINGEMENT OF PROPRIETARY RIGHTS, MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE.

NEITHER IDEAlliance NOR ITS CONTRIBUTORS SHALL BE HELD LIABLE FOR ANY IMPROPER OR INCORRECT USE OF INFORMATION. NEITHER IDEAlliance NOR ITS CONTRIBUTORS ASSUME ANY RESPONSIBILITY FOR ANYONE'S USE OF INFORMATION PROVIDED BY IDEAlliance. IN NO EVENT SHALL IDEAlliance OR ITS CONTRIBUTORS BE LIABLE TO ANYONE FOR DAMAGES OF ANY KIND, INCLUDING BUT NOT LIMITED TO, COMPENSATORY DAMAGES, LOST PROFITS, LOST DATA OR ANY FORM OF SPECIAL, INCIDENTAL, INDIRECT, CONSEQUENTIAL OR PUNITIVE DAMAGES OF ANY KIND WHETHER BASED ON BREACH OF CONTRACT OR WARRANTY, TORT, PRODUCT LIABILITY OR OTHERWISE.

IDEAlliance takes no position regarding the validity or scope of any intellectual property or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available. IDEAlliance does not represent that it has made any effort to identify any such rights. Information on IDEAlliance's procedures with respect to rights in IDEAlliance specifications can be found at the IDEAlliance website. Copies of claims of rights made available for publication, assurances of licenses to be made available, or the result of an attempt made to obtain a general license or permission for the use of such proprietary rights by implementers or users of this specification, can be obtained from the President of IDEAlliance.

IDEAlliance requests interested parties to disclose any copyrights, trademarks, service marks, patents, patent applications, or other proprietary or intellectual property rights which may cover technology that may be required to implement this specification. Please address the information to the President of IDEAlliance.

NOTE: IDEAlliance wishes to thank alliance partners from PIA/GATF, BRIDGES, FTA and Rochester Institute of Technology for their contributions to this effort.
# Table of Contents

Press Operators Guide to G7™ ................................................................. 1  

## Background ....................................................................................... 1  

## Roadblocks and Complications ....................................................... 2  

## Press Controls .................................................................................. 2  

### Density .......................................................................................... 2  

### Dot Gain ....................................................................................... 3  

### Gray Balance ............................................................................... 3  

### Neutral Print Density Curves ....................................................... 4  

## Introducing Color Management on Press ....................................... 4  

## Viewing Conditions ......................................................................... 4  

## Measurement Devices ...................................................................... 5  

## UV Control .................................................................................... 5  

## Verify Plates .................................................................................. 5  

## Verify Inks .................................................................................... 5  

## Verify Paper .................................................................................. 5  

## Testing a Press ............................................................................... 5  

### What to Look For ......................................................................... 5  

### Areas to Standardize ................................................................... 6  

## Procedure ....................................................................................... 6  

## Printing Process Controls and Assumptions ................................... 7  

## Press Calibration ............................................................................ 7  

### Choose the Standard Reference Printing Condition .................... 7  

## Labeling and Organization ............................................................. 7  

## Achieve Aim Conditions on Press ............................................... 7  

## Run Stabilizing Speed-Cycle ......................................................... 8  

## Measure the P2P Target ................................................................. 8  

## Calculate Curve Corrections ......................................................... 8  

## Press Characterization and Profiling ............................................. 8  

## Production Runs ............................................................................ 9  

## Press Make-Ready ......................................................................... 9  

## Achieve Press Color OK ............................................................... 9
Press Operators Guide to G7®

The G7 method outlines an easy-to-follow recipe for implementing ISO printing standards and additional metrics. The result is a simple but powerful way to match from proof to press. As published in 2007, the G7 method provides a wealth of detail outlining the general concept, but does not provide specific information for press operators.

Being a press operator is like being a taxi cab driver. When a customer gets into a car, all they need to know is where they want to go. This WHERE or destination is represented by the proof. The driver/press operator must decide, based on their knowledge and experience about the local area and the driving conditions, what route is best to take. This is the HOW of the procedure. Of course, they shouldn’t drive down any one way streets the wrong way or violate any other road rules. Also, using modern technology and tools, such as Global Positioning Satellites (GPS) may help so they don’t get lost! We hope the GRACoL Press Operator’s Guide does just that, provide some guidance for getting where the customer wants to go.

Background

In most printing markets the press operator’s job is to match the proof or the previous press run! This is despite the fact that they may have no control on the upstream workflow of how the files, proofs and plates were made. Over the years this has resulted in a craft of visually matching the press to proof rather than a predictable scientific process of printing to the numbers. However, in an ideal world, the press operator would run the press to known process targets and tolerances. The upstream workflow would be set so that the total process would automatically produce the image anticipated by the print buyer despite reasonable changes in the dynamic system of paper, ink and press operation.

How do we bring the industry from the visual craft to this more desirable controlled process? It will require all the quality control wisdom developed over the years but adjusted to properly anticipate the use of color management. Color management is a very predictable way to make an image look the same on two different devices and media, combinations like a proof and a press. Color Management uses a more sophisticated color measurement device called a spectrophotometer that measures color in CIE Lab color space. Unfortunately, a process aimed at measured VISUAL consistency has been proven worthless on a press that, in the past, has constantly been adjusted by the press operator to visually match supplied images from different customers. Today we have modern process control techniques that can verify by measurement that a proof has a close visual match to a printing specifications like SNAP®, GRACoL® or SWOP®. We can now use those same techniques to verify the press printing also matches the proof and specification.
Challenges

A major issue for the press operator is attempting to keep the press printing result or output predictable and repeatable over time. This is much easier said than done. In the print production process there are things the press operator can and cannot control. Obviously, they have direct control over the mechanical operation of the press and achieving targeted Solid Ink Density (SID). Nearly everything else has already been determined by someone else farther up stream in the print production workflow (prepress or customer) or perhaps farther up in company management. The press operator has no control over the way prepress outputs files, proofs and plates. Likewise, the press operator has no control over raw material quality of paper and ink. The paper is specified or even supplied by the customer. So, if the paper has performance problems, little or nothing can be done on press to correct it. Also, company management usually dictates the choice of blankets, rollers, ink, and fountain solution. Management also determine the standard operating procedures (SOP) used during make-ready and production. Management also determines press service maintenance schedules. These are all business decisions that management arrives at after considering the compromise tradeoff of quality and customer satisfaction versus productivity and profitability.

Press Controls

Again, the press operator has direct control over how the press is mechanically and chemically set up during make-ready and the production run. This includes blanket tension, blanket packing squeeze pressure, back cylinder impression pressure, form roller stripe pressure, fountain solution chemistry conditions, etc. During make-ready they try to achieve a press to proof color match by first aiming for some predetermined shop, house or industry density targets. This is done by adjusting the water and ink metering keys or zones so the density is uniform and even across the sheet or web. So, the press operators direct adjustments for color are limited basically to ink settings.

Density

Density is the traditional primary control parameter for most printers. But the ISO 12647-2 standard (written in 1996/2004/2007) doesn’t specify solid ink color targets in density, it specifies CIE Lab values for the primary (CMYK) and the resulting secondary (RGB) overprints. The tolerances are specified as color difference values or “delta E”. So, the new GRACoL v7 and SWOP v11 specifications no longer specify density targets. That information is only for comparative reference.

Some printers still only have densitometer based measuring instruments and are not comfortable with color measurement. So, the printer must conduct some internal testing to determine what density best correlates with the ISO targets. The ISO values are for dry, uncoated inks so compensations must be made for dry-back between wet and dry density, as well as coating.

Another issue is once proper CMY CIE Lab values have been achieved, there is no guarantee the RGB secondary colors will also be correct. These RGB overprints are affected by ink tack and changes in the ink film thickness that affect trapping or ink transfer. The 1-color primary and 2-color secondary solids determine the outer boundary parameter of the color gamut. To achieve optimum secondary colors, the printer may need to seek help from their ink manufacturer. A prerequisite for ISO 12647-2 is that the ink
“in the can” also complies with ISO 2846-1 to ensure it has the correct CIE Lab color and transparency at the proper ink film thicknesses (IFT).

**Dot Gain (TVI)**

After arriving at the correlated solid ink density (SID) that meets the ISO 12647 standard, the next process control variable the press operator checks is dot gain, which by ISO is now called Tone Value Increase (TVI). Dot Area or Tone Value is an absolute measure of how large the halftone dot is. When compared to a reference, the net difference is called dot gain or TVI. The 50% screen tint is the normal reference in the US. As the TVI increases the color gets darker. Likewise, as TVI decreases, the color gets lighter. The lightness or darkness of a image is called weight or tone. However, a single point (50%) does not accurately define a TVI curve or tone reproduction curve (TRC). Tone Reproduction is best defined by the entire tone scale from 0 to 100%. In G7, this is called the Neutral Print Density Curve (NPDC). In ranking visual importance, the highlight is most important, followed by mid-tones, with dark shadows being least important.

Unlike density, if TVI is not within tolerance, the press operator cannot directly change it. With eye eyeball color matching, the operator would change density (SID) because that would change the ink film thickness (IFT), which would change dot gain (TVI). But, if the density change is significant, the resulting density and/or CIE Lab value will fall outside of tolerance. With the Computer-to-Plate (CtP) exposure devices, TVI can be adjusted by using RIP calibration curve during plate making. In this way, the individual C, M, Y, and K calibration curves can be changed to achieve gray balance and tone reproduction independent of the ink densities.

**Gray Balance**

The eye is extremely sensitive to the neutrality of gray. Photographers call it color balance, printers call it gray balance (GB). ISO 12647-2 defines gray balance as being C50%, M40%, Y40%, K0%. Presses that are properly calibrated should print a C50, M40, Y40 as neutral gray. The challenge is having full compliance and conformance to ISO tolerances for SID (Lab), TVI, and GB all at the same time. Gray balance includes all the combined effects of SID, TVI, and trapping. This makes it an efficient single measurement but also difficult to control.

**ISO: Fogra PSO and GRACoL G7**

Per DTR 10128, there are three methods for achieving ISO 12647-2 compliance. One is the German FOGRA PSO (Print Standard Offset) process which gives priority in the order of solids then TVI then gray balance. It’s referred to as the TVI method. The other is the American G7 process which gives priority in the order of tone and gray balance (NPDC), then solids, then TVI.
Comparison of GRACoL versus FOGRA

<table>
<thead>
<tr>
<th></th>
<th>GRACoL - G7</th>
<th>FOGRA - PSO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ink</td>
<td>ISO 2846-1</td>
<td>ISO 2846-1</td>
</tr>
<tr>
<td>Paper</td>
<td>ISO 12647-2</td>
<td>ISO 12647-2</td>
</tr>
<tr>
<td>Solids CMY, RGB</td>
<td>ISO 12647-2</td>
<td>ISO 12647-2</td>
</tr>
<tr>
<td>TVI</td>
<td>less important</td>
<td>ISO 12647-2</td>
</tr>
<tr>
<td>Gray Balance</td>
<td>CIE Lab</td>
<td>Mid-Tone Spread</td>
</tr>
<tr>
<td>Tone Reproduction</td>
<td>NPDC</td>
<td>TVI curves</td>
</tr>
<tr>
<td>Date Introduced</td>
<td>2005</td>
<td>2004</td>
</tr>
<tr>
<td>Country of Origin</td>
<td>America</td>
<td>Germany</td>
</tr>
</tbody>
</table>

NPDC

G7’s Neutral Print Density Curve (NPDC) has priority over traditional TVI curves. The NPDC represents a combined CMY curve and specifies the weight or tone and gray balance of colors throughout the tone scale. The G7 calibration method calculates RIP correction values that will force the press to replicate the desired NPDC curve based on how the press is currently printing.

Color Management on Press

In the past, a proof was made by the printer, then approved by the customer and finally used as a visual guide on press. This worked fairly well, because the printer calibrated their own proof and press to match each other. If the printer has multiple presses, each printing differently, this is an issue. Today, color management enables most proofs to be made and certified to a standard reference printing condition. A single, common target. A calibrated press should be able to match the color managed proof both visually and numerically. While this is a big challenge considering all the variables involved, it can be done if prepress correctly processes the job file, manages and controls the production of proof and plate, the printer uses the proper ink and paper, and the press operator properly establishes and controls the printing process using density, tone value and gray balance.

Viewing Conditions

The Press operator should verify that pressroom viewing conditions comply with ISO 3664. This standard specifies the color temperature white point at 5,000 K and the brightness level in lumens. Approximate verification of lighting can be done by using a lighting condition indicator like the “RHEM” strip available from most light booth vendors. A more precise method is to use an instrument and software to measure color temperature and brightness.
Measurement Devices
The press operator should verify that color measurement devices are set up to ANSI/CGATS 4 and 5 (ISO 13655). This standard specifies the illuminant, observer, and backer, etc. Polarizing filters and UV cut filters need to also be considered.

Verify Plates
The press operator should verify that prepress has approved the plates. After all, the press can only print what is on the plate.

- Determined optimum imaging resolution with correct laser power exposure and focus. Checking the 1x1 checkerboard spots provides this information.
- Determined optimum chemical or thermal processing conditions (speed, temperature, pH, and conductivity, pre-bake, post-bake).
- During calibration output to either raw or linear curves (at the discretion of the user). In either case the user should confirm that plates measure the same for all color channels. For raw plates, double check to make sure the channel is in fact cleared out to zero.
- When producing production plates, verify the correct tone reproduction curve for that color and press is applied by using a “smart” plate scale that compares raw to curved.
- Use a video plate reader to check that the plate is within +/- 1% all along the tone scale.
- Also, for color managed production plates, verify that the correct profile was applied.
- The pressroom must know if the color bar and quality control targets are raw, linear, curved or color managed for TVI and gray balance to be meaningful.

Verify Inks
The press operator should verify the ink are ISO 2846-1 compliant for color, transparency and ink film thickness. Ask the ink company for a Certificate of Analysis (COA). Note that ink tack, water pick up and TVI are not part of ISO 2846 but will affect press performance results.

Verify Paper
The press operator should verify paper is to ISO 12647-2 or the same as the calibration conditions. Papers that are very blue (large –b value) may need special color adjustments.

Verify Press
The press operator should verify the press systems are in good mechanical and chemical conditions. The press should always follow the manufactures specifications. The press should print consistently over time, both short and long term. The press should also be capable of meeting the targeted reference printing condition. The press and consumables should be within tolerance of their specifications.
Press Test Procedure
After the above is accomplished the press is ready for testing. Normally the following tests are completed:

- Breakaway dry solids
- Wet Solids
- Mechanical Ghosting
- Streaking
- Image fit and Register
- Print Quality
- Digital Register Analysis (If Necessary)

**Breakaway Dry Solids:** Testing breakaway dry solids is done with cyan ink with a blank plate at a density of 1.40. The high point of density should be set at the center of the sheet with density falling off toward the lead and the trailing edge of the sheet. Once that is accomplished, then do breakaways by reducing blanket to impression cylinder pressure by .002”. This is done until an even break occurs. If an even break does not occur due to cylinders out of parallel, then a press mechanic needs to be brought in to correct this mechanical problem.

**Wet Solids:** Testing wet solids is done with an imaged plate with color bar and 1” of white around the image. The form should be printed with cyan at a density of 1.40. This test may show streaks, and if severe, will need to be corrected.

**Mechanical Ghosting:** Normally, this test is done with a PIA/GATF Mechanical Testing Form. This form has test elements that evaluate mechanical ghosting. A density difference of 0.06 in the difficult areas of the form should be attainable. If density differences are higher the condition will need to be corrected.

**Streaking:** Streaking tests are designed to show various types of streaking. Normally two types of tests are done. The first is with a 30% screen in four colors properly angled – four units will be tested at a time. This will show mechanical streaks as well as any transfer streaks. Another test that is popular is to run a 30% screen tint in cyan at a density of 1.40. If streaking is severe it will need to be corrected.

**Image Fit and Register:** Image fit and register is done with a PIA/GATF Register Grid. The digital grid is made one plate for each unit and printed at standard density. The press operator should strike in the lead edge in all colors and then the center of the trailing edge. This indicates fit. Naturally, the tolerances would have to be based on substrate and press size. Once the best fit is achieved, the press is run at production speed to determine if the press can hold register. If it can’t hold register, corrective action must be taken.

**Print Quality:** Print quality is measured using a PIA/GATF Print Test Form with has Ladder Targets. The procedure would is to run the sheets to density and adjust for gray balance. Once this has been done, run 3,000 sheets at production speed to insure the press can maintain print quality. If quality is not adequate, corrective action must be taken.

**Digital Register Analysis:** Digital register analysis is done when register variation is visible with a 100X microscope. This test is done by many of the press manufacturers and by PIA/GATF since it involves specialized equipment. If registration is not acceptable, corrective action must be taken.
Once the above tests are completed the press is ready for calibration and fingerprinting.

**Printing Process Controls and Assumptions**

a) The press will be most visually consistent when the three major variables (ISO primary and overprint values: Density, Tone Value, and Gray Balance) are all optimized at the same time.

b) These variables are interrelated and it can be difficult or even impossible to optimize all of them simultaneously.

c) Each press/ink/paper combination will have unique idiosyncrasies (ie. trap, transparency, mechanical issues etc.) that will make that press print differently than from other presses.

d) System calibration (bringing the press to initial values and trouble shooting when target values cannot be met) is best done by first addressing individual colors separately for density, TVI curves etc. However, proof match and consistent visual printing can only be done by addressing all colors together with all the system idiosyncrasies included. Measuring gray balance throughout the scale is the best practical representation short of looking at all colors as in a press characterization.

e) Density and dot gain are essential for process control and good printing. Gray balance is essential for visual match.

f) The seven solid colors determine the color gamut. They should be optimized to ISO 12647-2 using color measurement to achieve the lowest delta E. All other printing specifications (SWOP, GRACoL, FOGRA etc.) have now been change to reflect these 12647-2 target values.

g) Once completed, if desired, the resulting standard ink densities (SID’s) for that unique paper/ink/press combination may be used instead of CIELab values as targets during make-ready. Targets for the production run can only be determined after the “press OK” has been achieved.

h) Changes to the single color primaries (CMY) directly affect the two-color secondary overprints (RGB trapping), which can be more important to the overall reproduction of the job. Their target values are also specified in 12647-2.

**Press Calibration**

**Choose the Standard Reference Printing Condition**

Choose the appropriate standard reference printing condition (srpc) for your printing market. This is defined by the colorimetric Lab values in the characterization data set (cds) obtained from the IT8.7/4R target that consists or 1,617 patches. Common specifications are GRACoL, SWOP, SNAP and FOGRA.

**Achieve ISO Solid Targets**

1. Start with plates where the tone scales measure the same for all color channels; this can be either linear or uncurved plates.

2. Print to the CIE Lab target values as prescribed by ISO 12647-2.

3. Compare your numbers to ISO for solid color, TVI, and Mid-Tone spread.
4. The press operator now has several options depending on these results. The following steps are listed in order of the amount of adjustment required to bring the press to a calibrated state. See appendix A & B.

a. **CALIBRATION BY DEFAULT**
   In this condition, the press automatically falls into calibration with no special treatments. If all ISO parameters (Solids, Overprints, TVI, Gray Balance) are within tolerances, the press is calibrated as is. For G7 calibration, the NPDCs are also in tolerance. Achieving a calibrated condition with raw or linear plates, not requiring an additional curve, is an ideal situation.

b. **CALIBRATION BY SID ADJUSTMENT**
   In this condition, slight adjustments to density, typically +/- 0.07, brings the press into a calibrated condition. The adjustment is for minor tone reproduction and/or gray balance correction. These density adjustments still result in solid and overprints that remain in DE tolerance. If over time, the same adjustment is always required, then CtP curves or ink should be adjusted.

c. **CALIBRATION BY CTP-TV ADJUSTMENT**
   In this condition, it’s obvious that only new CtP curves will achieve calibration. SID adjustments within DE tolerances did not work. The adjustment is for major tone reproduction and/or gray balance correction. However, first make sure there is no slurring or doubling problem.

**Run Stabilizing Speed-Cycle**

After achieving aim conditions, run at least 2000 sheets at typical production speed (to warm-up the press) and re-check solid ink values, gray balance and evenness. If any metrics or cross-sheet evenness have strayed beyond from specs, adjust the press until desired conditions are reestablished. Then repeat the speed cycle as needed until a 1000 sheet speed cycle produces acceptably small changes from start to finish.

**Calculate Curve Corrections**

The G7 press calibration process uses measurements from the P2P target for the IDEALink Curve software which calculates CtP curve corrections to match the NPDC target.

**Press Characterization and Profiling**

It is not recommended to use a custom press profile to adjust proofs. However, it may be necessary to use this custom press profile to create a device link profile to bring a poorly performing press or inkset into specification as long as that press can consistently print in the same manner over time. An ICC profile does not remove the need for tight process control in the pressroom. At the very least, a custom press characterization data set can be useful in checking the press for compliance and conformance to the standard reference printing condition. It is recommended that official GRACoL or SWOP profiles be used for proofing rather than creating a custom profile from your pressruns.

1. Print the IT8.7/4 random target and measure it to create a characterization data set, which can be used to build a custom profile if needed.
2. Document all variables, press conditions, settings and adjustments for further reference. These become the “stake in the ground” or baseline targets for process control on all future print production.

3. Verify the level of press calibration accuracy by comparing compliance to the targeted standard reference printing condition.

Labeling and Organization
For proper recordkeeping and to prevent confusion or mistakes, it is advised an appropriate organization/labeling procedure is used from RIP to plates, to press sheets. Proper organization of the testing process and results with good labeling discipline will go a long way in helping to create and maintain repeatable results.

Press Production Procedures
These are recommended procedures for normal production after a press calibration has been performed.

Make-Ready

2. As much as possible, all normal production should now repeat and replicate all the same conditions that were used during the calibration process. This is why documentation is important.

3. Specifications with targets and tolerances should be established and used for each control point or parameter (SID, TVI, GB) for proper quality and process control.

4. The control points should be achieved in this sequence order, first SID, then TVI, and lastly GB.

5. The purpose of the press make-ready is to achieve a press sheet that has an ACCURATE visual match to the proof. However, compliance to specifications by the numbers must be the first step. It’s a good practice not to look at the proof until after the number are achieved.

Achieving a Color OK
1. After achieving all the make-ready targets listed above, blindly running to the numbers, we fully expect the press will closely simulate the proof.

2. However, visual subjective fine-tune adjustments may be necessary to improve color match accuracy for critical color matches. If the customer is present, they should only inform the press operator about what they see and what they want. They should NOT provide specific instructions about what to do or how to do it. For example, the customer should say “I see it being to warm, make it less warm.” The customer should not say “bring the magenta down 0.05 points”.

3. Fine tune adjustments to SID’s are considered to be within +/- 0.05. This should keep the press within the centerline or “sweet spot”.

4. Comparing the difference between the make-ready starting point and the OK is an indication of how well your process is calibrated. Ideally, an OK should be possible after SID, TVI and GB are brought into tolerance during the make-ready.

5. Giving a color OK after multiple short start and stop pulls, on a cold press, and at a different press speed than will be used for production, may result in an unachievable OK during the longer
production run. A good practice is for the customer to give the printer two separate OK’s. The first OK ends the make-ready and lets the production run start. All production is sellable because it’s within tolerances. The second OK is given after the press has run steady for some period of time and the process has stabilized.

**Start Press Production Run**

1. Once an OK is given, the current control points for SID, TVI and GB now become the new target aim values for the rest of the production run.

2. Classically, SID was given priority, then TVI and finally GB. However, the G7 process recommends a sequence order of first GB, then TVI, and finally SID.

3. Press run control is a continuous iterative process of “if…then…”. For example, if the gray balance is good, there is no need for further checks. However, if gray balance is out of tolerance, then first check TVI. If TVI is good, then next check SID.

4. The goal of the press production run is to maintain a **CONSISTENT** match to the OK sheet.

5. For presses without an in-line coater, care should be exercised when looking at a wet production sample and comparing it to the OK sheet that has already dried. Also, the printers should record the wet readings and calculate the dry-back compensation. Press coating in-line almost eliminates the affects of dry-back.

**Periodic QC Sampling**

1. Follow your standard operating procedure (SOP) for sampling and measurement frequency. At a press speed of 10,000 sheets per hour, every 1,000 sheets is about 6 minutes.

2. Save all press sheet samples that are measured to document the job history. If possible they should be dated and time stamped.

**Summary**

Remember, offset lithography by its nature is never totally consistent. Even the best press, operated by the most experienced press operators, under ideal conditions can vary considerably from run to run. Certainly, small changes in process variables can impact the final outcome. We must always remember most presses deviate somewhat from the target values. In the end, we still rely on our press operators to decide, based on their knowledge and experience, the best way to get the results the customer requires.

GRACoL’s G7 press calibration process helps printers match proof and press by adjusting the plate curves to a standardized tone reproduction and gray balance. G7 and Color Management are two new tools that can assist the press operator in printing consistently to a proof. This guide was designed to help the press operator use these new tools efficiently and effectively.
### Appendix A: Press Calibration Matrix

<table>
<thead>
<tr>
<th>Level</th>
<th>Step</th>
<th>Parameter</th>
<th>Within Tolerance? (Yes/No)</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>Solids</td>
<td>No</td>
<td>Make sure Inks are ISO2846</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>TVI/NPDC</td>
<td>?</td>
<td>Adjust until within delta E tolerances</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>GB</td>
<td>?</td>
<td>Also check secondary overprints.</td>
</tr>
<tr>
<td>II</td>
<td>1</td>
<td>Solids</td>
<td>Yes</td>
<td>Adjust TVI or NPDC</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>TVI/NPDC</td>
<td>No</td>
<td>Using CtP Plate Curves</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>GB</td>
<td>?</td>
<td>Check for doubling from paper or press</td>
</tr>
<tr>
<td>III</td>
<td>1</td>
<td>Solids</td>
<td>Yes</td>
<td>Adjust Solids</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>TVI/NPDC</td>
<td>Yes</td>
<td>Stay within +/- tolerance limits</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>GB</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>1</td>
<td>Solids</td>
<td>Yes</td>
<td>CALIBRATION ACHIEVED</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>TVI/NPDC</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>GB</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
**Appendix B: Process Control Specifications**

This table shows possible specification that include a target and tolerance.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>FOGRA Target</th>
<th>Tolerance</th>
<th>GRACoL Target</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solids</td>
<td>ISO 12647-2 CIE Lab</td>
<td>Delta E &lt; 5</td>
<td>Same</td>
<td>Same</td>
</tr>
<tr>
<td>TVI</td>
<td>ISO 12647-2</td>
<td>+/- 4%</td>
<td>Secondary variable</td>
<td>Want equal to ISO 12647-2 +/- 4</td>
</tr>
<tr>
<td>NPDC</td>
<td>-</td>
<td>-</td>
<td>NPDC Density</td>
<td>+/-0.02</td>
</tr>
<tr>
<td>Gray Balance</td>
<td>MidTone TVI Spread</td>
<td>&lt; 4%</td>
<td>NPDC 50 % Paper Dependent</td>
<td>C* 1.5</td>
</tr>
</tbody>
</table>
Appendix C: Introduction to Lab

What is Lab?
‘Lab’ is a color space. It’s 3-dimensional so has a volume. This volume is called the color gamut. Think of it like a compass having north, south, east, and west. To define the chromatic portion of the color, we use ‘a’ and ‘b’.
When a is +, it’s reddish. When a is - it’s greenish.
When b is +, it’s yellowish. When b is – it’s bluish.
For the 3rd dimension, think of altitude or vertical height.
This describes the lightness or darkness of the color.
When L is large (+), it’s lighter. When L is small (-), it’s darker. Any color has a unique location or position in this color space. Identifying the Lab values for that color will identify the location, thus it’s color.

What is Gray?
Where the two a and b axis’s cross at the center intersection, the color is neutral. The values would be a = 0 and b = 0. The farther outward or away a color is from the center, the more color saturation or chromaticity (chroma) it has.

Measuring Lab
To measure CIE Lab we need a device that does more than a regular densitometer. Technically, densitometers are trichromatic because they have three filters, RGB. But, through a single filter, it can only measure density or the thickness of inks and not the color of inks. Through 3 filters, it can crudely measure color, as in gray balance,
To measure CIE Lab a colorimeter, spectro-densitometer, or spectrophotometer is required. A “Spectro” can measure all the wave lengths of visible light that are reflected from a target and display it in Lab terms.