

How to get colour approved rapidly and maintain it





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Best practice guide for web offset printers

Aylesford Newsprint, Kodak GCG, manroland, MEGTEC, Müller Martini, Nitto, QuadTech, SCA, Sun Chemical, Trelleborg Printing Solutions, System Brunner

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FOGRA Germany www.fogra.org

Specifications Eurostandard/Globalstandard,

Picture Contrast Theory, Quality Categories

www.systembrunner.ch

"Quality and productivity in the Graphic arts"

Miles and Donna Southworth Graphic Arts

publishing ISBN0-933600-05-4.

This guide addresses both the on-press aspects of Colour OK and, equally as importantly, the total process that begins with the specification and creation of the printed job. Adopting this approach implies that the workflow begins with the finished job.

Correct colour setting, one of the primary tasks for obtaining a press OK, depends significantly on how humans see, understand and communicate colour.

Print production methods have changed from a process of separate analogue steps to a continuous digital workflow from image creation to printing. The trend to 'print by numbers' is also being driven by customer requirements for verifiable quality control, the growth of CtPlate, use of industry standards, closed-loop production control, globalisation and remote-site printing using pre-press data transmitted with numeric control values. The primary elements for improved performance include:

- An integrated industrial manufacturing strategy that combines standardisation, process-control and defined procedures is essential to achieve higher quality and productivity benefits. Standardisation and process-control are core elements of effective colour management. Without them, colour management loses the "ground from under its feet", is "process blind" and cannot fulfil its objectives .
- Adequate planning, specification and job preparation by the customer and the printer.
- Complete and coherent control of the printing workflow. Each output step needs to be controlled (PDF, digital proof, CtPlate, printing) with measuring techniques and methods that achieve a predictable outcome. Success requires that the customer, pre-press supplier and printer work together within this approach.
- Appropriate on-press colour approval method. Human factors are often overlooked in the colour approval process. These include subjective and varying perceptions of colour, communication and expectations also different viewing environments between customer, agency and printer.
- Effective maintenance and standard operating procedures are key success factors to ensure rapid start-up, optimum quality, productivity and on-time delivery (see guide N° 4 "Productivity Maintenance").

IMPORTANT SAFETY NOTE !

Always check a machine is in its specified safe position before working on any component (e.g. with compressed air, electrical power and gas disconnected). Only trained maintenance personnel adhering to safety regulations should perform maintenance work. A general guide cannot take into account the specificity of all products and procedures. We therefore strongly recommend that this guide be used in addition to information from your suppliers, whose safety, operating and maintenance procedures take preference.

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Glossary

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This guide is produced for printers worldwide. However, there are some regional variations of terminology, materials and operating procedures that are not always included. (e.g. Some world regions like the USA mostly use negative processing in heatset, whilst Europe tends to be positive working – note that the levels of TVI for negative are not valid for positive and vice versa.

To assist readers we have used a number of symbols to bring attention to key points:

Best practice	Poor practice	Machine stop	Poor runnability	Avoidable cost	Safety risk	Quality issue

Process colour system

Getting colour approved rapidly and maintaining it is essential to

- Satisfy printing customers and their readers.
- Minimise total production costs and time.
- Improve production reliability and consistency.
- Avoid/minimise risks and costs from sub-standard products.

Objectives: Improve cost, time and quality performance

These objectives are frequently not met when printers and their customers do not systematically use good process methodology and/or have unrealistic expectations. The prerequisites for rapid colour OK, consistent colour and high productivity are:

- Adequate planning, specification and job preparation by the customer and the printer.
- A complete and coherent control of the printing workflow (standardised and controlled prepress, proof, plate and print) to make colour OKs more rapid and predictable and to help maintain consistency during the run. This also reduces the relative importance of on press customer approval for many types of printing categories.
- Well-maintained production equipment.
- Appropriate on press approval method

What is a colour OK?

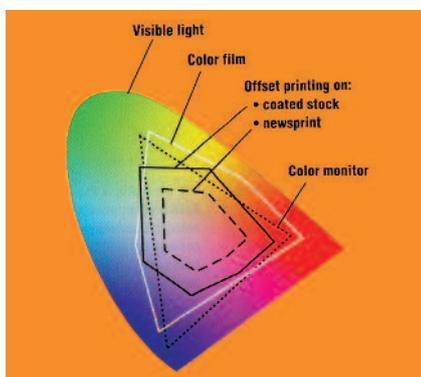
The type of colour OK is determined by the end application of the printed job and the materials used.

Commercial heatset: The colour OK is an objective comparison of the printed job with its proofs to help ensure it meets the order specification – the customer or agency may be present to approve the colour. In some cases specific ink density targets may be used to “print by numbers” using densitometer values. In magazine printing “soft” screen or inkjet proofs are increasingly used with more expensive proofs specified for high value jobs such as advertising catalogues.

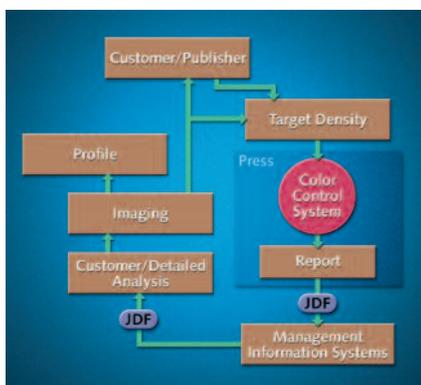
Newspaper coldset: The colour OK is an internal control with responsibility normally delegated to the head printer. The principal criteria are rapid continuity of colour throughout the pages and an even black. Generally, there is no on press customer approval and the use of proofs is not universal (some digital proofing is used both by newspapers and advertisers in which case they should integrate a digital media control wedge —UGRA/FOGRA— to check the proof). At its basic level, acceptable colour can be defined as an absence of complaints from editorial staff or claims from advertisers on colour and marking. When printing external jobs and highly demanding 4-colour advertisements, newspapers may need to take a colour approval approach similar to that of commercial printers.

What is ‘good’ copy?

The minimum requirement for ‘good copies’ is that they are in register (colour, cut-off and fold) and have reasonable colour – this is usually the defined end of makeready. However, what happens to production output between ‘good copies’ and the ‘colour OK’ is often a subject of discussion between the printer and customer (their different definitions, practice and expectations). The customer might determine that ‘good copies’ are only those run after the colour OK, while many printers will ‘save’ copies prior to the OK if they are in reasonably close tolerance to the colour OK and particularly if a long customer approval causes excessive waste.



1



2

1- The visible colour gamut is much larger than can be reproduced with RGB on digital screens, which in turn is larger than the gamut that can be achieved using CMYK ink on paper. The exact gamut on paper is determined by the process, the inks and the substrate. The challenge of printing is to optimise conditions to make reproduction as close as reasonably possible to the original image. Source: QuadTech

2- An example of data flow for printing by numbers: Print specifications originate with the publisher. The target densities are used by press colour control systems. Data from printing is generated by on press systems that report back to publishers to modify prepress profiles and settings. Source: QuadTech

✋ Best practice is to use non-saleable copy to makeready the finishing line. This minimises waste and saves money

The issue often arises when (a) the customer’s representative making the colour OK is not experienced and attempts to obtain an unrealisable result, or (b) there are faults in prepress that were not identified on the proof, or (c) the condition of the printing press is not optimised or there is an inexperienced crew.

✋ Best practice is to bring this problem into the open to identify and deal with its source(s). Failure to do so may lead to avoidable and repetitive cost and degraded relationships.

Productivity Maintenance

There is an essential relationship between productivity, reliability and maintenance. Planned maintenance of production equipment is essential to ensure rapid start-up, optimum quality, productivity and on-time delivery. All equipment used in digital workflows requires regular calibration and setting to ensure consistent results. A strategy of integration that combines standardisation, process control, maintenance and defined procedures is the best way to achieve this.

Production economics

Colour approval is influenced by the quality of prepress, specifications and the working relationship between printer and customer. Applying best practice production provides benefits of:

- Reduced paper waste costs (start-up and running). Poor practice and inadequate proofs can increase makeready waste by 100-200%. Inadequate proofs make fault diagnosis difficult.
- Shorter time on press. Delays in colour approval wastes expensive press time and disrupts schedules. In addition, printers can lose confidence and then tend to run the press at a lower speed that reduces net output even further.
- Fewer unscheduled press stop(s). Avoids the cost of shutting the press down when colour cannot be matched, plus possibly the need to re-make plates and/or produce more expensive proofs.
- More satisfied customers. Poor colour matching and inconsistency in a job can lead to rebates or reprints and the risk of losing a customer. In some market segments customer returns can be up to 20% of the total print run due to inaccurate and inconsistent colour.

Steps to effective and efficient press OKs

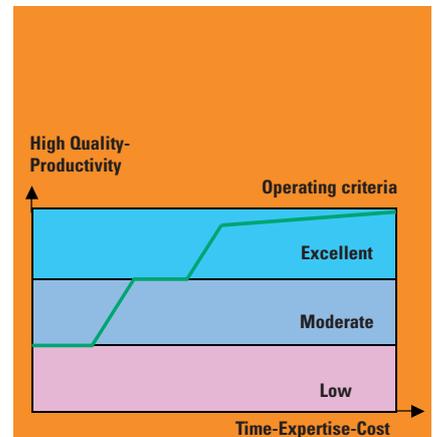
“Obtaining rapid colour approval is a team effort for which the essential key to success is the preparation of the job before it arrives on press. Efficient colour approval then requires effective working between the print buyer and the printer”. ‘9 Steps to Effective and Efficient Press OKs’ by Diane J. Biegert, GATF

The print buyer/designer prepares for the press OK by:

- Determining the quality expectation of the printed product (preferably with an objective standard).
- Identifying pages/images that are potentially difficult to print due to the design.
- Identifying the type of colour proof to be used.
- Identifying the surface and colour of the paper.
- Determining the degree to which these factors can match the printed job.

During the press OK, print buyer/designer:

- Examines the sheets/signatures after makeready is completed.
- Compares colour and register match to proof. Checks densitometer readings with proof spectrophotometer, including colorimetric readings.
- Requests any changes immediately and describes the end result desired (not how to achieve it).
- Signs off the sheets/signature when accepted.



Production excellence is built over time on multiple operating criteria. Source WOCG.

Integrated manufacturing strategy

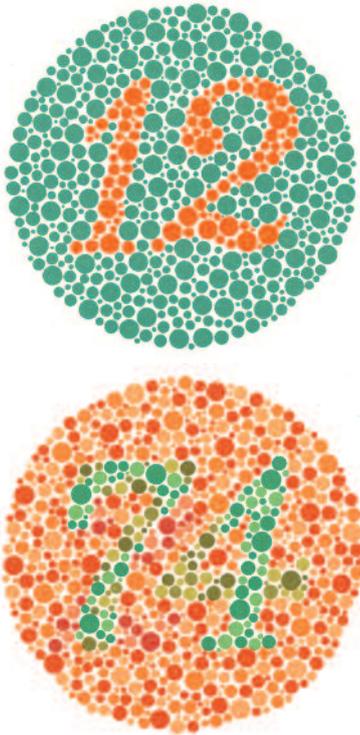
Colour management and process profiles alone will not deliver optimum results. Production excellence is built over time within a manufacturing strategy that integrates industry standards, procedures and control, effective maintenance and training, plus selective investment. As a generalisation, performance can be classed at three levels:

Low: No standards. Reactive maintenance. Investment based mostly on purchase price.

Moderate: Uses some industry standards. Selective use of operating procedures and training. Attention to consumable performance. Moderate preventive maintenance. Investment based on narrow ROI calculation.

Excellent: Comprehensive low tolerance industry standards and control. Systematic implementation of process procedures and training. Consumables selected as a high performance set. Proactive maintenance and total life cycle cost investment.

Some colour basics



Because of their reliability Ishihara's test charts are used worldwide. Most people will perceive the number 12 in plate N° 1 (top). In plate N° 9 (bottom) normal vision will perceive the number 74, but people with red-green deficiency will see the number 21. People with total colour blindness are unable to read any number. The principal and basis for the test chart are the quality of the colour and the colour arrangement. The charts reproduced here are not a qualified test because of the limits of 4-colour process reproduction. Any test should only be applied and interpreted by a qualified person. Source: Ishihara's Tests for Colour Deficiency published by Kanehara Trading Co., copyright of Isshin-kai Foundation

Human colour perception is subjective and varies with age, fatigue, heredity and even mood. Inherited colour blindness affects about one man in 12 but only one woman in 200. Even people with 'normal' vision can have variable perception because:

- Physical and intellectual fatigue reduces ability to accurately match colour.
- The eye has poor colour memory and can only be precise for direct comparisons.
- Ageing affects colour vision as a yellow filter forms on the eye.
- A colour's visual appearance is influenced by the colour adjacent to it.
- Perceived colour is significantly changed when viewed under different light sources.

Many people may be unaware that they have a deficiency in colour perception and some printers test their staff and customers to try and match similar perceptions together to better manage colour OKs. Tests should only be applied and interpreted by a qualified person using the correct materials to give reliable results. These include Ishihara's Tests for Colour Deficiency, Pilot Colour Tolerance Exercise, GATF/Rhem Light Indicator and Farnsworth-Munsell 100 Hue Test.

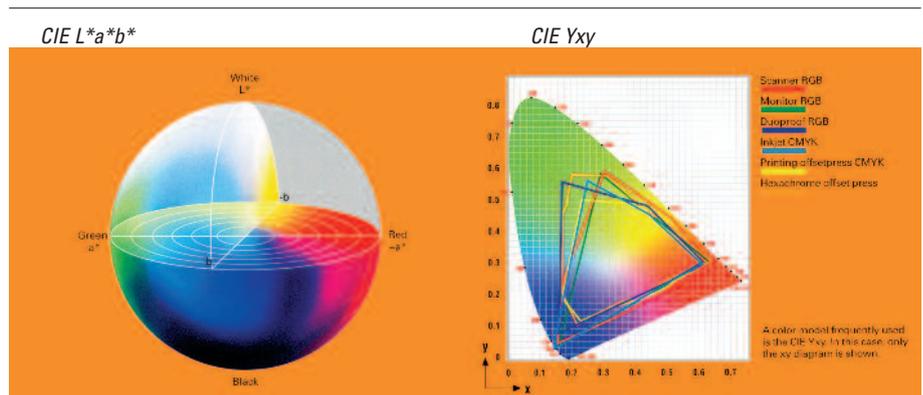
Additive colour RGB: (Red, Green, Blue): Used in digital cameras, scanners and computer screens. RGB lights are combined to create white and by varying their relative intensities generate a wide variety of different colours.

Subtractive colour CMY + K (Cyan, Magenta, Yellow + Black): Used in printing when colour perception is dependent on a pigment to absorb (subtract) various portions of visible light to produce a desired colour. Theoretically, black is produced when the three primary colours overlap but, because pigments are imperfect, a separate black ink (K) has been added to the process. The overlaid (trapped) colours produce secondary colours.

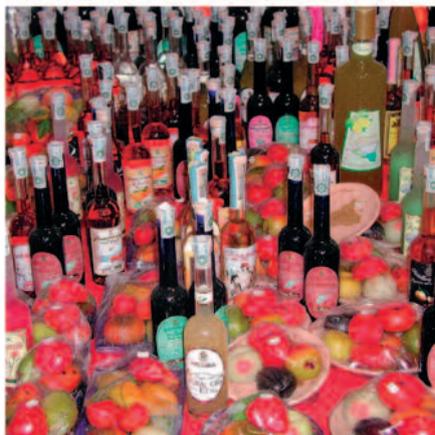
Colour description: Sensing of colour requires a light source, an object and an observer. If any one of these three components is changed the perception of colour may also change. All three components have been measured and standardised to describe and calculate colour attributes in the 1976 CIE L*a*b* (or CIE Lab).

Grey balance: Used to assess colour objectively because the eye easily detects any shift from neutrality when neutral areas are compared side-by-side and also whether there is any colour cast in an area that should be neutral. Grey balance is a necessary characteristic of high quality colour reproduction. If the grey balance is wrong and the light to dark axis of the colour space is not 'aligned' properly with a relative neutral, then all colours will be 'shifted' and reproduced with a corresponding colour cast. This applies to monitors, proofing devices and to printed colour spaces. When used correctly grey balance is a powerful solution for colour control and consistency.

CIE L*a*b* (or CIE Lab), and CIE Yxy colour models. Source: Agfa "The Secrets of Color Management"



Picture Contrast Theory

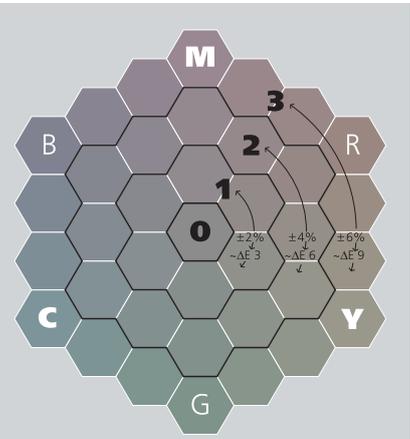


The colour deviations in the egg (low contrast and grey content) are perceived more strongly than the other photo that has more colour light/dark contrasts. However, these photos have the same colorimetric deviation (created as a difference in mid-tone grey balance during printing) meaning that Delta E readings do not correlate with the perceived colour deviations in photographs. TVI variations are the primary cause of image colour deviations in offset printing and these first become visible as shifts of colour balance. Source System Brunner.

The theories currently used to describe colour deviations are only valid for the comparison and measurement of colour patches in a contrast-less surrounding. However, they are not appropriate for photographic images with a wide range of contrasts. Picture Contrast Theory (PCT) is a method to understand colour perception better within the technical process in order to provide answers to problems that are not addressed within standards. PCT quantitatively examines picture contrasts and classifies them into groups that describe the quality of printed pictures better than any other method. Experience shows that some photos are much easier than others to match in makeready and consistently print; homogenous screen tints are more critical of colour deviations than photographs – especially those with three process colours.

Normally a photo consists of hundreds of different colour shades. When the eye sees more than one colour tone at the same time it becomes influenced and confused by the different contrasts. Contrasts define the perception of the colour variation in every photo (colour, light/dark and formal contrasts) and human perception reacts to these differently:

- Low sensitivity to colour variations in images with pronounced contrasts = wider threshold for acceptance of colour variations.
- High sensitivity to colour variations in low contrast images = narrower threshold for acceptance of colour variations.



Color Balance Hexagon System Brunner*

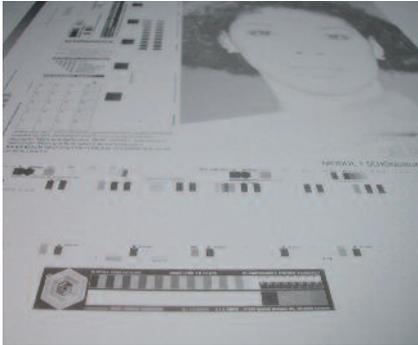
© System Brunner AG

Colour Balance Hexagon

PCT helps in understanding that the visible differences between the proof and printing are related to the photographic image. PCT classes photographs according to their contrast profiles:

0. Homogeneous areas of three overprinted colours that cannot be reproduced by the offset process without visible variations. The tolerance limit is within the centre of the hexagon.
1. Low-contrast photos, predominantly grey and brown, or skin tones over a large area. The question of acceptance is with colour balance fluctuations of $\pm 2\%$ in the midtones. The tolerance limit lies within the first ring of the hexagon.
2. Average to strong contrast photos. Their acceptance arises with colour balance fluctuations of $\pm 4\%$ in the midtones. The tolerance limit lies within the second ring of the hexagon.
3. Photos with very strong colour contrasts. Their acceptance arises with colour balance fluctuations of approx. $\pm 6\%$. The tolerance limit lies within the third ring of the hexagon.

Process control & standards



Standards, measuring devices, quality procedures and Statistical Process Control (SPC) are established industrial operating practices that reduce total production costs and provide accountable quality control when correctly used. Effective process control measures defined variables and monitors their output in comparison to a standard definition – any deviations from optimal values can then be corrected. All printing manufacturing steps are influenced by variables that may create colour deviations. The benefits of standardisation in printing include:

- Prepress has a clearer target of how to create the right profiles for printing.
- More predictable and faster colour makeready with a good match to an optimised proof.
- Better colour matching of advertisements from different sources printed on the same forme.
- Higher consistency in the run, from job to job, and between different press crews and sites.
- Fewer customer complaints and related costs (reprints, rebates, refusal to pay).
- A clear view of the total process (and its deviations) that increases internal and external confidence.
- Lower total cost of production (consumables, time, higher productivity).

A printing standard is the definition of optimal process target values and tolerances for the technology and production conditions. They should provide an optimal average result related to a guideline that avoids extremes – they cannot reflect every variable. ISO 12647 is a first step towards an internationally acceptable standard: ISO 12647-3 (currently under review) is used by newspapers globally (SNAP in the USA is compatible); ISO 12647-2 is available for heatset and sheetfed printers (SWOP and GRACoL are widely used in the USA). However, for some companies ISO tolerances are too wide and incomplete for their needs. An alternative process control and open printing standard is System Brunner (who pioneered this field from the 1970s) their GlobalStandard is the most comprehensive system in use worldwide.

 Printers should select an industry standard (ISO, WAN-IFRA, FOGRA, SNAP, SWOP, System Brunner) that meets the need of the company and its type of printing. Start with implementing key elements, e.g.

- Ensure all production equipment systems are operating within the tolerances of the standard selected (correct setting, operation and maintenance, defined consumables).
- Apply prepress profiles for each paper grade (ink density, TVI, grey balance, print contrast, etc.).
- Ensure that all plates include colour bars, solid and halftone grey patches.
- Systematically use quality control tools (densitometers, colorimeters, gloss meters etc.).

ISO 2846 defines the colorimetric characteristics of 4-colour process ink set when printed on one of five reference papers. However, variations in ink film thickness and substrate properties make meaningful control outside of laboratory difficult.

Over 90% of deviations in 4-colour printing of photographs are process-related. These should be measured and controlled with methods that give a close relationship to the printing process. A photograph consists mainly of halftone dots and it is the variations of the dot size that are the main reason for colour deviations in printing. Other variables include screen ruling and shape, border zone of the screens, plate, blanket, ink, paper, ink/water balance, printing pressure and press settings.

1- All plates should include colour bars, solid and halftone grey patches.
Photo System Brunner.

Parameters of a printing standard

Key control parameters

1. Colour/grey balance

Colour balance in printing is the relationship between the four process colours and is the key factor for a good production match. Human perception is highly sensitive to technical deviations affecting the colour balance – particularly in midtones. Divergent TVI in the CMY process inks are the main reason for a shift of balance in printing.

To obtain visually consistent results for images with low contrast, or mainly grey areas, the deviations in midtone balance should ideally not be larger than +/-2% in TVI spread between the highest and lowest values. However, large printing variations often allow a tolerance of +/- 4% TVI spread in midtones — improving process consistency is the major prerequisite to achieve narrow tolerances. The gap between perception of colour deviations and the technical limits can be reduced with grey stabilization (GCA). It is better to keep the neutral balance on a higher or lower level of TVI because human perception is less sensitive to changes in gradation (darker or lighter) than to colour balance shifts (GlobalStandard controls a neutral grey balance in the mid-tone area to define equal values of C-M-Y TVI in each process colour as well as for 3-colour overprints).

 Mid-tone grey balance patch is an effective visual control method.

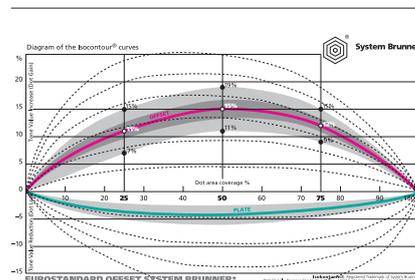
2. TVI (Tone Value Increase)

This is best measured in the midtones at 50% where TVI has the highest impact and the largest variations. There is a 6-8% difference in TVI between analogue positive and negative plates. With CTP plate, this systematic difference can be corrected by a different transfer curve on the RIP making TVI closer to the results of analogue positive plates. However, for many other reasons CTP plate have more variations and the process has to be closely monitored. Screen ruling and paper grade have a high influence on TVI and need to be specified.

3. SID (Solid ink density)

SID affects the total contrast (saturation) of a picture and to a lesser extent its shadow balance (if SIDs in the CMY inks have divergent variations). The SID value changes with type of density measurement, e.g. ISO Status E or Status T (Status T shows a lower SID value than E for yellow). Polarization filters reduce the measurement difference between wet and dry ink, but these densities show higher values than without filters. GlobalStandard defines SID guidelines for the different measuring specifications. Magenta is typically higher than Cyan and Yellow to compensate for the typical reduction in 3-colour overprint shadows.

 Care should be taken before applying US printing reference values outside of North America as variations may include different ink strengths; densitometry filters; screen rulings (often finer in Europe and Asia); and analogue platemaking (US mainly uses negative processing and any slight over exposure spreads the dot whereas in positive processing this sharpens the dot).



1

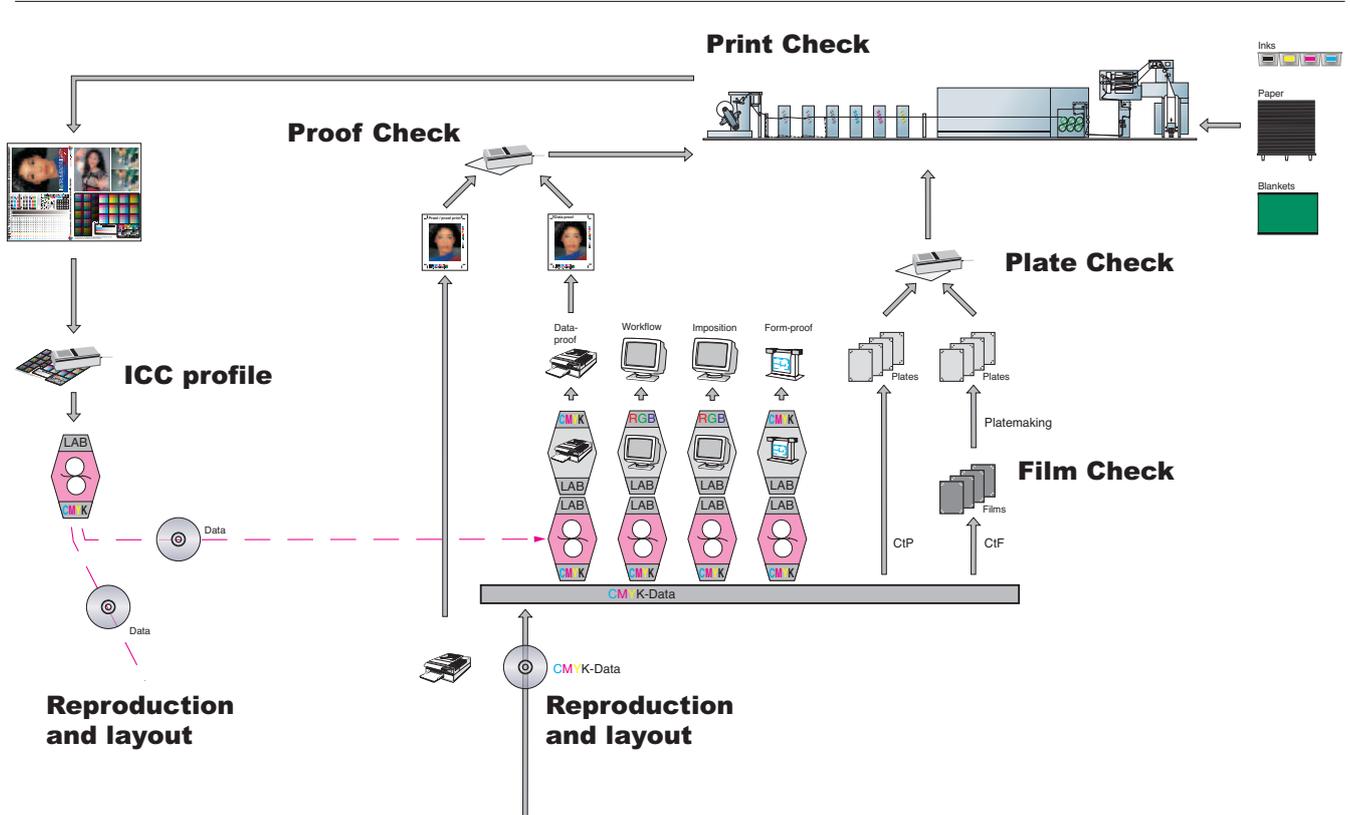


2

1- Isocontour* diagram showing TVI and CTP plate GlobalStandard. System Brunner.

2- System Brunner includes today more than 30 parameters – which influences the printing colour space - in the GlobalStandard* definition.

Colour Management & Profiles



An ICC profile describes single standards and the quality of an entire workflow – including conversion from RGB to CMYK. Elements should be profiled using a specific method and measurement for each, from which an ICC profile can be created using a software programme.

Source manroland-System Brunner.

Colour management helps adjust and control the colour space differences arising from monitor screens and digital proofing (RGB) to the printing colour space (CMYK) that is largely defined by the substrate. The objective is to ensure optimum reproduction throughout the entire process. The three keys for success are (1) using defined standards, (2) calibration of the entire workflow and (3) profiling the workflow.

Without effective standardisation and process control, colour management cannot fulfil its objectives because it is process blind. Colour management assumes that all process components are consistent and stable – which is not the case! Therefore process profiles must properly simulate the printed product at the prepress and proofing stages using a specific method and measurement, from which an ICC profile can be created and repeated.

Base layout, repro and proof on print standards:

Define uniform colour management settings in software with consistent application of ICC profiles and colour spaces intent, RGB colour space, device and output profiles). Agreed black composition and TAC.

Standardise the data workflow:

Printer communicates to customer the standards being used with the appropriate ICC profiles and prerequisites for simulation in layout and repro. The EPS/PDF data generated by the customer or agency determines how to set software applications, generate PDFs and transfer data with RGB/CMYK profiles to the printing plant.

Colour scanner settings:

These are now mostly controlled by the process colour management system. Grey balance calibration defining dot ratios of process colours for scanner output will determine the colour content and contrast of the final printed product to reproduce a neutral grey. Once the scanner is grey balanced, the colour contained in the separations is a default of these settings. The choice of gradation in scanning influences the amount of TVI a job will have. The % UCR setting determines how much yellow, magenta and cyan are printed to make a 3-colour shadow neutral (greys and browns) and affects how well inks will trap and what shadow colours can be reproduced.

Proofing system:

Calibrate the device then process an IT8 chart using the complete colour space available and measure with a spectrograph.

CTP plate:

Most commercial RIPS can specify press profiles and store individual press-paper combinations. They can compensate for different screens, dot sizes and plate types (that may generate variable TVI on the press). Constant plate quality must be regularly checked.

Press:

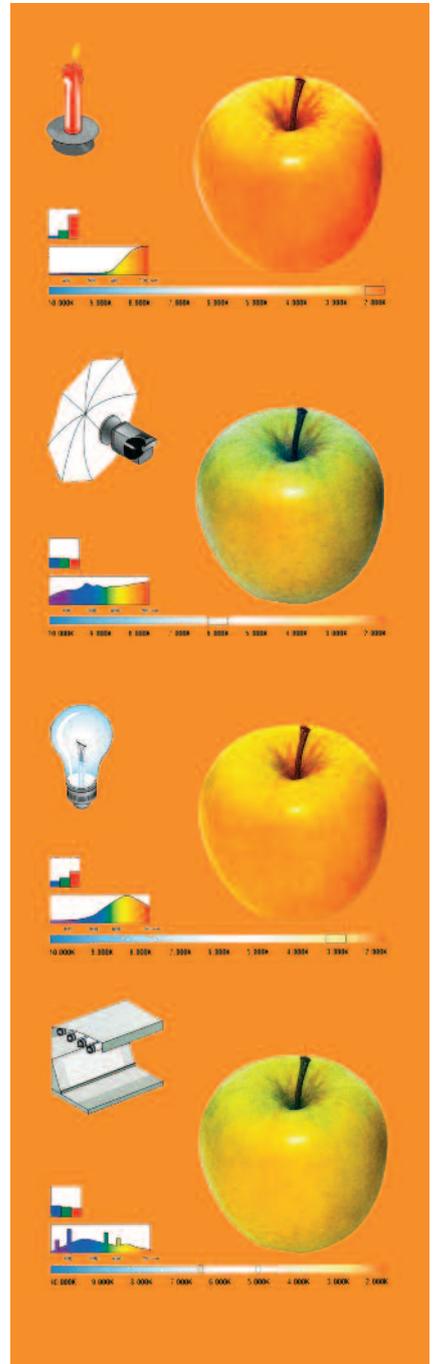
The objective is to obtain equal printed results from every press in a plant. The prerequisites for maintaining uniform production quality include defined consumables, correctly maintained presses and the use of standard operating procedures. Before printing the image test to get a profile, ensure that the press is running under standard conditions. Then print the IT8 chart several times to ensure a range of representative readings. Measure the charts and enter into the profile software.

 It is not enough to check the printing system just once as conditions can change daily, sometimes hourly, and are influenced by the consumables, the press settings and maintenance as well as by the operators. Therefore, considerable care has to be taken to prepare reference prints for ICC-profiles otherwise they may give unreliable results of limited value.

Light changes perception

What are the lighting conditions when proofs are viewed at the design agency, the customer and on press?

White light is a mixture of all of the colours of the spectrum. Colour temperature describes how 'red' or 'blue' the light will be and this will influence the perception of colour being viewed. Due to the huge variations in natural and synthetic light they are incompatible with industrial printing control and, for this reason, a standard light source for viewing has been specified at 5000 Kelvin by international standards (CIE, ISO, ANSI). Effective viewing conditions require a dedicated physical environment with lamps that conform to an international standard (CIE, ISO, ANSI). Ensure that the lamps are clean and within their specified life. Many lamps require 45 minutes to warm up to their target colour temperature.



1

1- The importance of correct lighting conditions is illustrated by this graphic that simulate the effect of different light sources on an identical image. Source Agfa "The Secret of Color Management".

Print job preparation

Comparative paper characteristics

Paper selection is a semi-objective assessment of different paper service qualities related to a specific application and end use. This assessment provides a simple summary of the differences between the three principal web offset paper grades. Brightness, coating, gloss, weight, light fastness are variable qualities. Each combination is selected to match different requirements ranging from high quality fashion magazines to mass circulation newspapers. The printing process to be used is another key factor. Distribution methods can also play an important factor in paper selection. Source WOCG/SCA.

Obtaining rapid colour approval is a team effort and a key to success is the planning and preparation of the job before it arrives on press. The print buyer/designer should:

- Define clear specifications including paper and bindery.
- Minimise or avoid pages and images that are potentially difficult to print due to the design.
- Determine the quality expectation and industry standard to be used.
- Identify the type of proof required and viewing conditions.

The buyer and printer can determine from these factors the possible level of matching for the printed job

Specifications and workflow planning begins with the finished job

Working backwards from the final required job qualities and functions will better define the appropriate technical and materials specifications. These should include the type of paper, reproduction standards, proofs and measurement. Finishing specifications are also important, as there is no point in getting the colour perfect if the finished job has other quality defects.

Consistent colour on press also means less variation in the product to bindery. A common problem is cross aligned forms coming from different presses, others issues include: roll or log delivery, perfect or saddle stitched binding, paper grain direction, and covers that have varying characteristics.

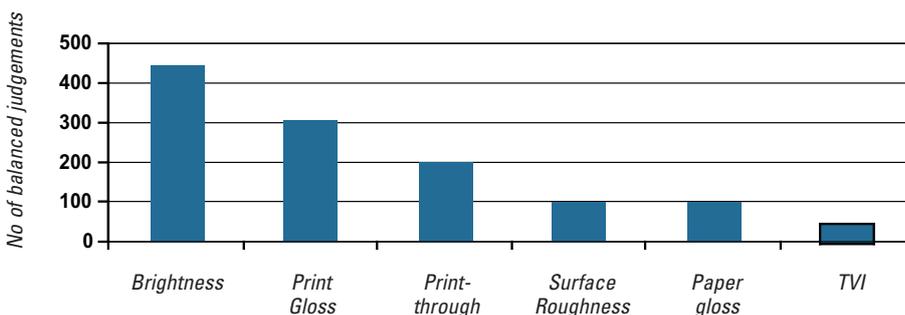
Paper selection

Paper is usually the single biggest factor that discriminates quality among printed products and is generally selected on the combination of suitability for use and cost.

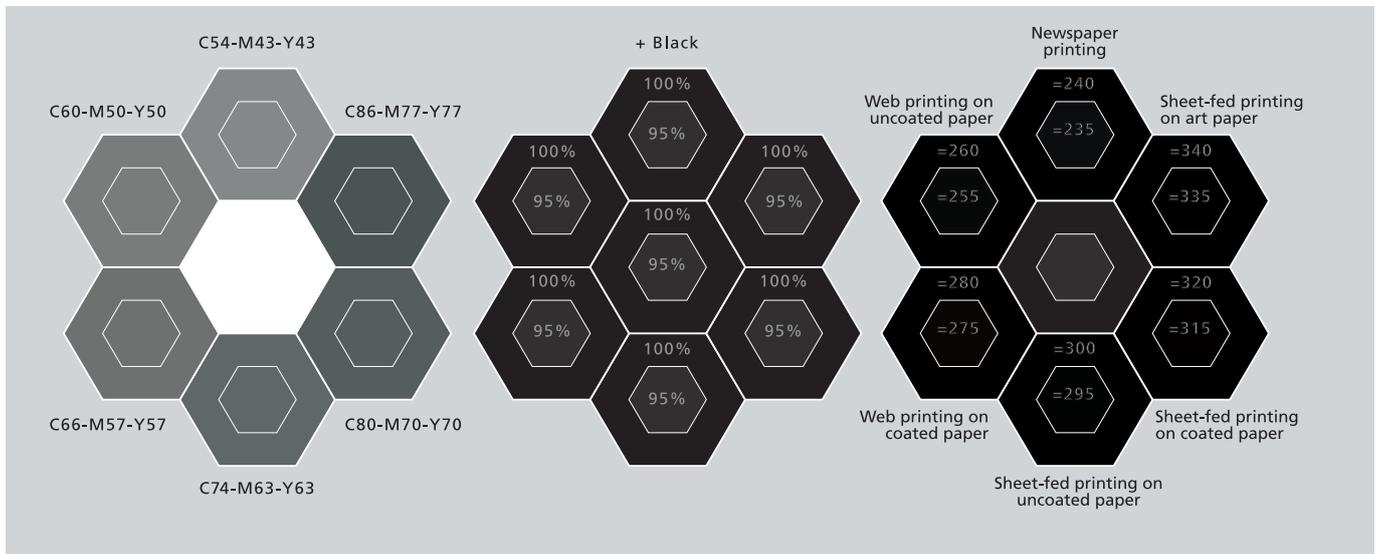
- Suitability for use: Includes desired paper and print quality perception; end product suitability to target reader; printing process, bindery, finishing and/or distribution needs; environmental aspects.
- Total economic costs: Paper and ink (ink consumption variable with paper surface); printing and binding; and distribution.

The available colour gamut is largely determined by the properties of the paper selected (particularly its smoothness and brightness). There is a direct correlation between paper surface and the maximum level of ink density (SID) obtainable. SID is a measurement of how much light is either absorbed or reflected by the paper. The highest SID level is achieved on very smooth, bright and high gloss substrates –this combination provides the largest colour gamut.

According to Printers, publishers, advertisers,



The ranking of relative importance of paper qualities by printers, publishers, advertisers and print users. Source SCA.



1

Each paper grade has a recommended prepress specification to achieve its optimal printing potential. These profiles are the single most important factor for achieving good printing results. A change in any one of the prepress variables can negatively affect the printed result and production cost. To achieve the maximum colour gamut in offset printing the following steps are important:

- Select the smoothest substrate available within the context of the job type and its budget.
- Print to recommended standard densities for the paper grade.
- Use the specified printing colour sequence to achieve the correct trapping.
- Ensure that the press settings and consumables are correct so that a uniform ink film and correct trapping can be achieved.

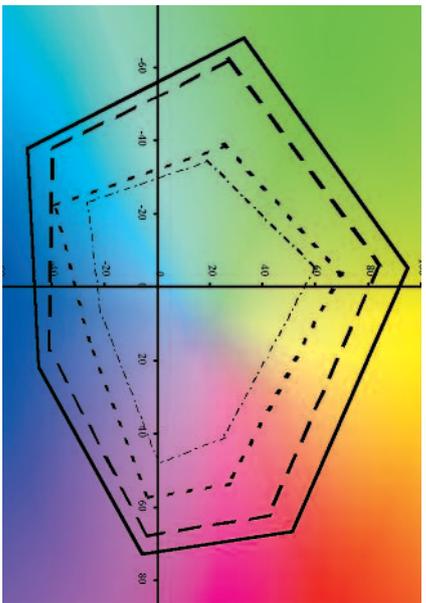


Ideally the best mix of paper-production characteristics should be optimised by a round-table discussion between the publisher/advertising agency, designer, prepress manager, paper supplier, printer and distributor. A written specification including prepress profiles should be made.

The final printed job is the perception of print and paper as a combination of colour, whiteness and gloss. To describe the visual impression different measurements can be made with different equipment. However, there are no common standards between the US and the rest of the world, or between printers and papermakers. Papermakers do not normally use special equipment and printers may use spectrophotometers. This equipment differs in its construction and use, making it impossible to compare values. The influences of FWA (fluorescence whitening agents) also affect the measurement depending on how much UV light is in the light source in the instrument.



For optimum reproduction printers should use the paper ordered to calibrate colour management for their presses.



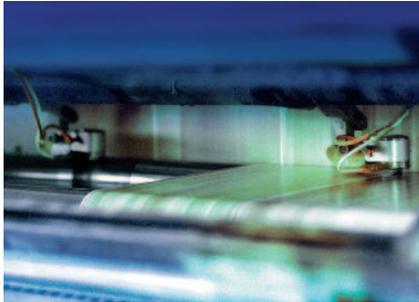
— FOGRA - coated
 - - - SWOP - TR001 - LWC
 . . . FOGRA - uncoated
 - . . . SNAP - Newsprint

2

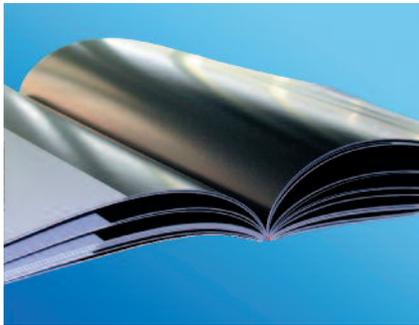
1- The range of maximum tonal reproduction is primarily related to the quality of paper grade used. Source: System Brunner.

2- The relative colour gamut (space) has a direct correlation with paper grade. Lower grades have lower colour gamut which means that matching certain PMS colours becomes increasing difficult.

Bindery considerations



1



2

Many factors can affect the finished product quality, including incompatible types of binding and/or certain production characteristics (ink type and film weight, paper and drying) or incorrect job preparation.

Saddle stitched magazines & booklets

High ink coverage on the centre pages can lead to the paper cracking around the stitches and the pages then pulling out – a high risk on LWC papers.

 **Planning/production:** Avoid by specifying either (a) spine gluing of the centre signature so that centre pages are not just held by the stitches, or (b) using fold softening for the centre signature to minimise cracking.

 **Production:** Avoid high drying temperatures as too much heat increases the risk of cracking. Ensure that stitching heads produce a clear cut and the staple legs are not overly bent.

Inadequate glue adhesion in perfect binding

Covers may not adhere correctly to the book spine, or may pop off from the sides of the book, if ink or coating inhibits glue adhesion. This occurs if ink free glue areas are not left on the spine and sides of the inside cover (incorrect design and lay down). Alternatively, ink solvents (particularly those with high oil content) can dissolve the glue and reduce its adhesion.

 **Preparation:** Create an ink free recess on the inside of the cover, e.g. thickness of book block plus 8 - 12mm (0,32 - 0,48") for a 4-6 mm (0,16-0,24") side gluing line.

 **Production:** If a recess is not possible, then

- Use a primer 2-shot cold PVA glue system: firstly apply a controlled thin PVA primer coating, followed by hot melt for the second pass. This prevents the penetration by the second main glue; or
- Use PUR glue applied in one shot as a thin coating of 0,3 - 0,4mm (012 - 016"). PUR offers outstanding pull value characteristics and is compatible with any type of material used for covers or signatures.

Glue penetration

Glue can seep into the printed area of the book block when cold emulsion glue (PVA) is used on coated paper and also in thread sewn products. The causes include: poor spine preparation using worn-out or improperly adjusted tools; signatures and book spines that have not been correctly compressed before binding; too much pressure by the glue rollers on the book spine; low-viscosity cold glue seeping into the book block (increased surface tension and capillary effect of the printed area on coated paper stock).

 **Preparation:** Create a recess along the spine of each page by the depth of the spine cut off (normally in the range of 2 - 4mm (0,08 - 0,16").

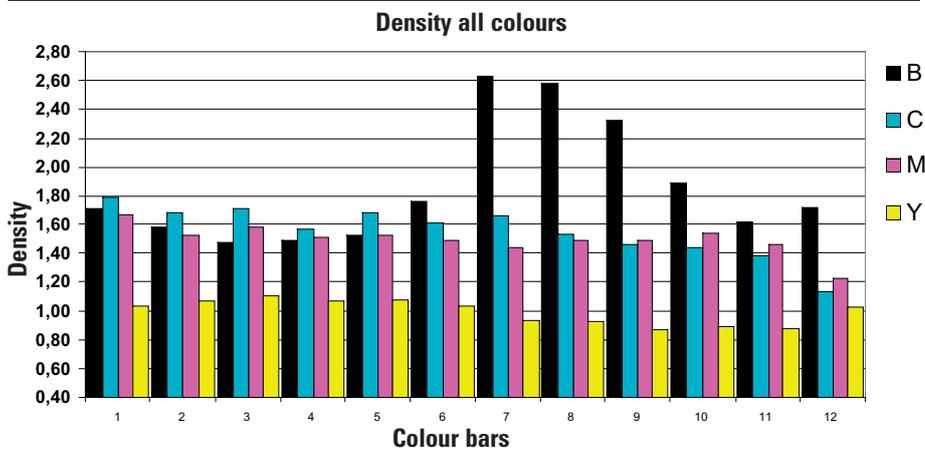
 **Production:** Ensure line and tools are correctly maintained and adjusted. If a recess is not possible, then:

- Use a primer 2-shot cold PVA glue system: firstly apply a controlled thin PVA primer coating, followed by hot melt for the second pass. This prevents the penetration by the second main glue; or
- Use PUR glue applied in one shot with a thin coating of 0,3 - 0,4mm (012 - 016"). The chemical characteristics prevent glue penetration into the printed area of coated stock and also allows binding-in of laminated, UV coated or plastic sheets.

1- On saddle stitched centre signatures with heavy ink coverage use spine gluing to minimise the risk of paper cracking around the stitches and the centre pages pulling free. Source Planatol.

2- Application of PUR glue. Source Müller Martini.

Design & Prepress



Overinking is common on black forms where local solid areas exceed the ink film weight limit of 1,8 gsm. This chart, from a printed job, shows that across 20% of the width, ink density was double the average (at 2,6 gsm) and was the cause of severe running and quality problems on the press. The use of UCA in these areas would avoid this problem.

Source: Sun Chemical

Many printing problems can be avoided or minimised in the design stage by working within the process limitations (coldset or heatset) and the reproduction qualities of the paper (newsprint to coated). Printers and paper suppliers can provide valuable advice in these areas. Ideally discuss these issues with the printer at the concept stage when modification of the design layout can be made to make it more appropriate to printing constraints. Images that are difficult to print include:

Register: Small and fine serif type or images made from multiple colours.
 Small and fine serif type or images reversed out of multiple colours.
 Borders with fine tolerances.

Colour: Type and images that are printed on facing pages, or adjoining sections.
 Pages with large solid and/or significant tint areas (also subject to hickeys and ghosting).
 Large solid areas, tints combined with solids.
 Critical colour areas such as logos, product colours and skin tones.

Avoid: Double page spreads with sensitive matching running across different sides of the web, or printing them on multiple webs.

Colour matching limitations: 4-colour process can reproduce about 5 000 - 10 000 different tones. Certain specific colours are difficult or impossible to match (e.g. product catalogues with certain consumer goods, paints or fabrics). For this type of work use the highest quality proof available and view this with your client under standard viewing conditions – this will avoid disappointment arising from unrealistic expectations.



Printers should be supplied with prepress adjusted to paper grade with specifications for SID, TVI and contrast; colour bars and patches on all formes; and ideally proofs that are compatible to the process.

Key prepress techniques



Applying these techniques (which add little or no cost) will improve printing quality, run performance and reduce ink consumption.

GCR (Grey Component Replacement):

Black replaces process colour ink that has a greying effect and can be applied to any portion of the reproduction. GCR is distinct from UCR (which reduces process colours in dark neutral areas) it is also important to use UCA to add colour under black ink to maintain gloss and density. WAN-IFRA recommends GCR and not UCR for newspaper reproduction.

UCA (Under Colour Addition):

Addition of chromatic colours to ensure acceptable density and gloss in shadow areas. When combined with GCR and UCR, UCA ensures acceptable densities and gloss of black solids to minimise over-inking, drying and blocking problems.

UCR (Under Colour Removal):

Reduces process ink content in dark, neutral areas of the reproduction and replaces them with extra black content. Not recommended for newspaper by WAN-IFRA due to loss of chromaticity if not correctly applied.

Select proofing system

Proof	Proof use	Proofing systems
Creative proof/ concept proof	Design discussion stage	Inkjet or laser printer (non-Postscript 300 – 600 dpi)
Production content proof	Imposition, typeface, text breaks, text overflow, layout and style, type fonts	Inkjet or laser printer (Postscript capability) Colour from this type of proof can be acceptable in meeting some production proofing requirements
Production contract proof	Guide for onpress colour approval	Halftone digital colour proofing systems, Inkjet



1

The goal of the press OK is to have the printed product closely resembling the proof. However, proofs only approximate the final job because they are made offpress and do not use the same printing process or materials used to print the job. Proofs should be integrated into the process (press profiles, colour management systems) and standardised in the same way as other consumables (like plates). The appropriate proofing system should be selected for its purpose in the process chain:

Creative proof: From the designer to the customer to check creative prepress. These proofs are usually inadequate for printing and often cause significant production problems. They may also create unrealistic expectations due to the potential gap between the proof and finished job (variations in proof type and consistency) and non-standard viewing conditions at the customer and/or agency premises.

Intermediate production content proof: Used to communicate data for imposition, typeface, text breaks, text overflow, layout and style.

Production proof: This is the common quality control tool for customer, prepress and printer, it should simulate as closely as possible the printed result, process and substrate to give the printer an industrial guide for on press colour matching. The selected system should match the desired quality level, include measurable control wedges and conform to international standards (such as ISO 12647-2).



2



Criteria for 'good colour' to select a proofing system:

- Proof-to-proof consistency.
- Adequate colour gamut.
- Appropriate proofing substrate.
- Adjustable colour set-up to meet the requirements of different printing applications.
- Calibration system for proofer-to-proofer consistency.
- Incorporated colour control bars.
- Ideally, use the same manufacturer's RIP that will generate the final film or printing plates. As an alternative, some systems can proof one-bit TIFF files that are typically produced by a CTP plate device.

Digital proofs

The widespread use of CTP plate means that proofs are now directly made from digital data. The result is a wide range of proofing devices with variable quality, output and cost. The use of inkjet devices and computer screen "soft" proofs is increasing in publication printing as a means of reducing time and costs (accompanied by a trend to 'print by numbers'). To be useful, digital proofs need to be produced to agreed specifications and procedures (e.g. the Pass4Press initiative in the UK) and within their limitations for specific functions (to ensure content is complete, clearly depict what needs to be approved and for tracking/audit purposes). Colour-accurate remote proofing is now becoming more accepted and widespread using purpose-designed systems. Ideally, digital proofs should have an integrated digital media wedge (e.g. UGRA, FOGRA, System Brunner) to check the proof.

Remote proofing often requires a local hardcopy because most people are not used to judging colour on screens. However, low cost non-colour-reliable layout proofing devices do not meet the quality requirements of many job categories. Attempts to manipulate the print results to match these 'colour prints' in order to reach a reasonable compromise frequently creates non-optimal printing conditions (disturbance of ink/water balance, irregular over print behaviour and trapping,

1- Digital halftone proofing production proofing device for contract proofs.
Photo: Kodak GCG.

2- Intermediate inkjet proofing device.
Photo: Kodak GCG.

unfavourable ink film thickness and hue changes on CMY, increased colour variations and drying problems). This also makes it very difficult to identify the origin of a problem. The result is lost press time and increased makeready costs.

High quality screenless proofs can provide consistency given a suitable calibration regime without the need for permanent recalibration along with a high degree of uniformity over the entire format. They can simulate standardised printing process conditions and provide high colour fastness.

Large format digital 'poster' printing devices (mainly dot-on-demand technology) are inexpensive but without the necessary tools to calibrate and colour manage are not suitable for high quality proofs. They must also be continually monitored since these devices cannot necessarily offer good consistency. Other technologies such as digital colour laser printers or office inkjet printers without colour management profiles should not be used for anything but creative proofs. A number of manufactures are introducing monitor systems for colour proofing to help with today's ever-shortening job timelines. It is essential these are set up and used in accordance with the manufactures recommendations.

The 'real' cost of a proof?

Although digital proofs can cost 70 - 80% less than other proofing methods they are often not adequate for job categories that have variable content and high quality demands. Difficulties in matching colour from inappropriate proofs affects the printing press – the most expensive link in the production chain – where the cost of a proof is a minor part of the total production cost. For example, interrupting the makeready of a 16-page press to obtain adequate new proofs and plate output can lead to the loss of one hour of press time with an additional cost of around € 1100, whereas a correct quality original proof would cost around € 500.

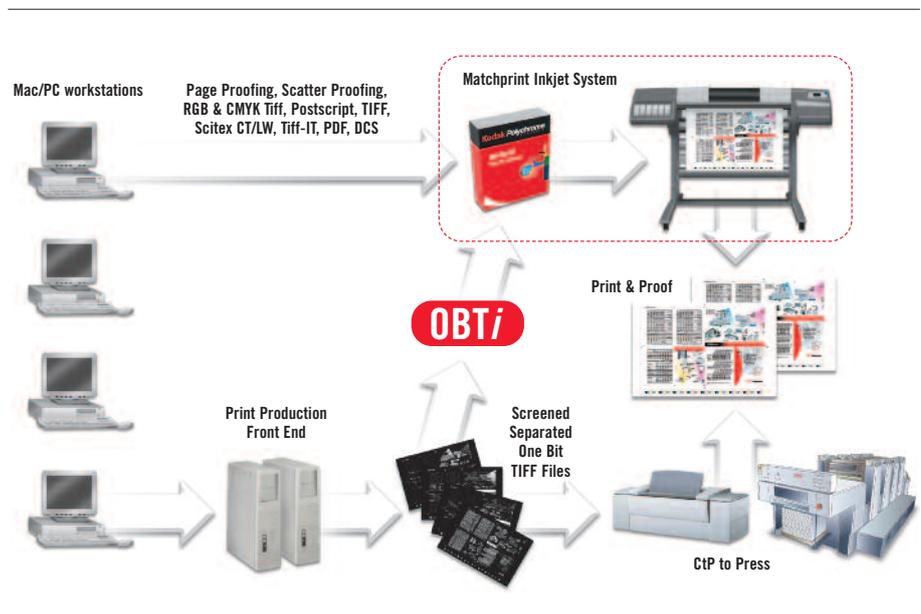
 Best practice is to prevent these problems from occurring. Production proofs should be supplied with integrated measurement elements that can be checked and evaluated – if they do not conform to the required standard, they should be re-made and resubmitted to the customer for approval.

What is a contract proof?

There is no standard definition for what this means. It can best be described as a representation of the appearance of the result that will be reproduced by the selected printing process. In this sense, it serves as the agreed contract between the job originator, prepress and printer. It is better to use the term 'production proof' because this is more clearly an industrial guide for printing.



1



1- Creative proofing device.
Photo: Kodak GCG.

2- Example of production workflow.
Photo: Kodak GCG.

2

Specify quality category

The word “quality” without any qualification is meaningless in process production. Quality needs to be defined in relation to different applications (newspaper, magazine, retail catalogue, high-end advertising, low end advertising). It begins with creative content (particularly the type of photography) and continues with substrate selection (that largely determines colour gamut range) through to type of proof, printing process and binding.

Therefore it is important to communicate clearly the desired finished quality and select proofing appropriate to different print applications. This approach will largely eliminate the potential gap between what is ordered and what is delivered.

Printing buyers have very different quality demands for their products but they are rarely defined. For this reason System Brunner has classified criteria into five categories to enable buyers and printers to identify the most appropriate market-related quality requirements (rather like the system used by hotels and restaurants). Each class has distinct proof requirements and defined achievable printing quality and tolerances.

*Different market-related quality requirements have different criteria that can be classified into printed product categories.
Source System Brunner.*

QUALITY - CATEGORIES



INSTRUMENT FLIGHT

Top:

Complete visual match between proof and production printing. Example, full-page colour advertisements for beauty products with faces of young women using large format professional studio photographs.

Luxury:

Very close match between proof and production printing. Example, full-page colour advertisements and catalogues for international brands of luxury products using studio photographs.

Commercial:

Good colour match between proof and production printing. Example, product advertising, printed matter with prestige character for the areas of culture, fashion, art, architecture –often using location photography.

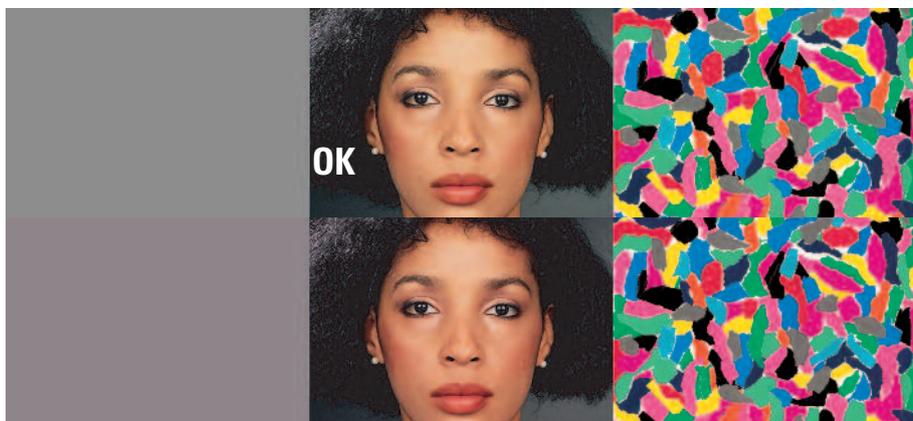
Periodicals:

Colour match between proof and printing production is less critical, but must be credible. Example, printed matter of a non-luxury nature, editorial section of periodicals, publications for travel, leisure activities, careers.

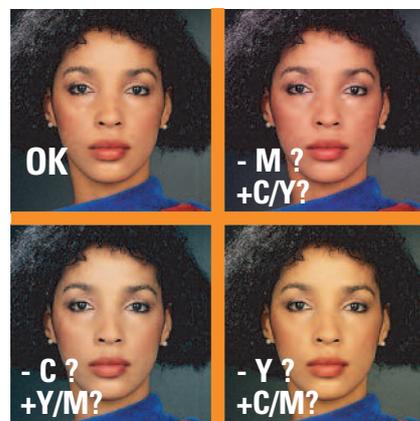
Minimal:

Colour match between proof and printed picture needs to be acceptable for lower demands. Example, use of non-compliant proofs and low end desktop publishing without standards or colour management.

Printing plates



Example 1



Example 2

Influence of printing plates on colour OK

The plate transports to the press the desired image with its upstream calibration, specification and colour profiles. On press it must provide good lithographic qualities and consistency throughout the press run. Plates that are not within specified tolerances can affect colour. The plate must provide a clear baseline for colour approval but only begins to influence colour once it is on the press. There should be no factor from the prepress and/or plate production that requires over correction of inking or dampening on the press. The area in which CTP plate imaging and processing parameters can affect colour approval and consistency are:

- Picture contrast.
- Density control.
- Colour balance – plate exposure and plate processing tolerance.
- Image gradation – plate exposure and plate processing tolerance.

Picture contrast (Example 1)

The sensitivity of an image to printing process fluctuations mainly depends on the content of the picture, e.g. images with flesh tones or strong, saturated colours. Flesh tones are very sensitive to dot size changes on press – so shifts in TVI can have a significant effect. To maintain the stability of saturated colours, the ink density has to be controlled. Usually both image types are present in most print jobs and this means that all printing tolerances are critical parameters to control. In this example, the priority would normally be given to TVI to maintain colour balance in the flesh tone image. The balance of TVI is visualised through a grey balance element in the printing control strip (patches to measure ink density, TVI and grey balance). The upper row of images has a grey balance element labelled 'OK' that indicates that TVI are balanced and in tolerance for a neutral grey to be achieved in print. The tolerance for these sensitive images is around $\pm 2\%$ midtone shift measured on a 50% screen patch. Under this condition the woman's face and the photo with strong saturated colours are correctly reproduced. In the lower row, a strong shift to magenta is present – clearly seen in the grey balance element and the woman's face. However, the image with strong saturated colours is virtually unaffected. This is a no-win situation on press – ink densities cannot be used to recover the flesh tones picture because these adjustments would significantly affect the saturated colours. In this case TVI are out of control causing the colour shift.

Colour variation – Density control

Example 2

This example highlights three variations in colour balance against the OK sheet. Ink density adjustments is the press operator's main tool to make colour corrections during production.

However, the variations in colour balance are more important to the viewer than ink densities in tolerance. Therefore, maintain correct colour balance is key for consistency in 4-colour printing.

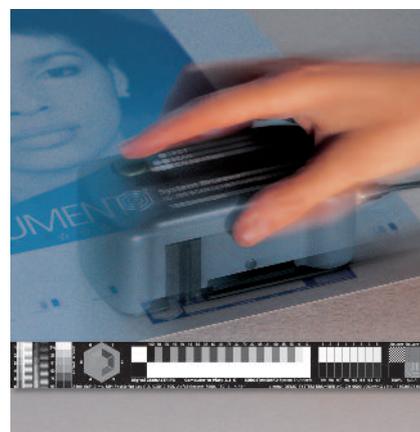


Plate measurement using a scanning plate reader with the appropriate digital plate control strip. Dot meters are also widely used for plate measurement (eg X-rite ccDOT, Techkon DMS). Photo: System Brunner.

Colour balance - plate exposure and plate processing tolerance (Example 3)

The plate has a major influence in print colour approval because the stability of dot reproduction within specified tolerances is critical to obtain colour approval.

Example 3 demonstrates the potential effect of uncontrolled plate exposure and processing conditions. The Isocontour diagram shows the whole tonal range of plate measurements using a scanning reader with appropriate digital plate control strip. The example shows a series of exposures (from under- to overexposure) and a wide range of changes in developing temperatures and processing speeds to show the huge range of variability if these areas are not controlled.

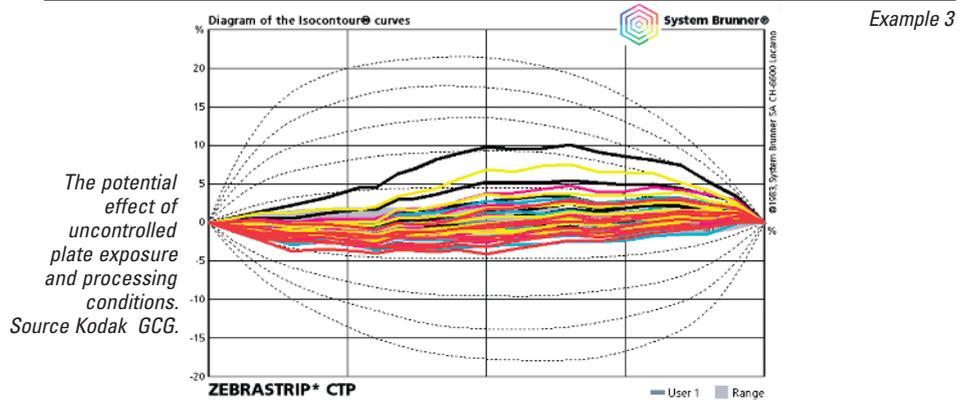


Plate exposure tolerances (Example 4)

The plate exposure tolerance ($\pm 2\%$ mid-tone shift) is applied to a linear output (note this is a demonstration example and ISO does not recommend linear output). At the correct exposure, a 50% dot is transferred to the plate with its linearity in tolerance. The second curve shows underexposure where the 50% dot is $+4\%$ (54%), moving the magenta plate out of specification. The effect of this is visualised in the photo of the woman's face. The whole tonal curve shows that the three-quarter and shadow tones are also badly affected resulting in the loss of detail in this area of the photo.

Maintain manufacturers plate processing specifications and tolerances to stabilise plate output.

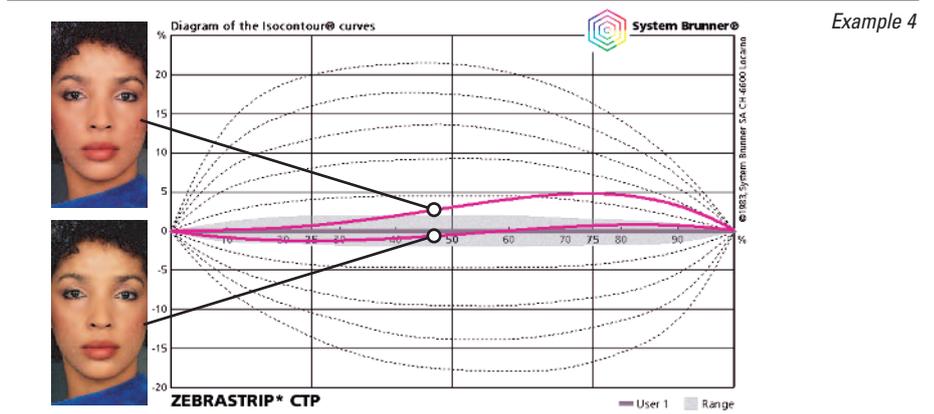


Image gradation - plate exposure and plate processing tolerance (Example 5)

Incorrect dot transfer to plate affects colour balance. If imaging or processing conditions also change, then it can affect the printed gradation of an image. The symptom is that the same variation in dot transfer occurs on all plates.

The example shows the effect of under- and overexposure when all plates are affected to the same degree. The centre image is the 'OK'. The left-hand image has a + 5% shift in CMY at 50% – this darkens the whole image. The right hand image has a -5% shift in CMY at 50% and causes an overall lightening of the image. This effect is less critical to the eye than a colour balance shift and confirms that the regulation to stabilise dot transfer to plate ($\pm 2\%$ midtone shift) provides controlled gradation stability in print.



Example 5

Printing plates have a major influence on colour OK

Measurement, control and ability to track in the platemaking process are vital to deliver consistency on press. Process stability requires best practice techniques, including:

- Correct storage of plates to manufacture's recommendations for temperature and relative humidity.
- The use of correct development temperatures and processing speeds.
- The use of correct recommendations for developer life m2/litre.
- The use of correct developer replenishment to maintain development activity.
- Replacement of processing chemicals at the recommended intervals.
- Cleaning and maintenance of the plate processor.

Alternative screening technologies (Stochastic, FM, AM/FM hybrid, XM)

Alternative screening technologies (to the traditional AM) are increasingly being used in both heatset and coldset production, facilitated by the high accuracy of CTP plate devices and promoted as value-added to printing quality and productivity. There are a variety of alternative screens. Feedback from users indicates that the window of operating variability is much tighter, requiring better control of all process variables.

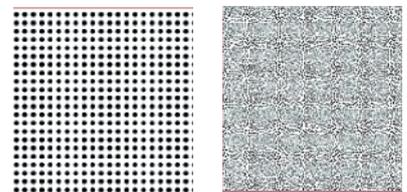
For best results:

The prerequisite for success is that the printer has mature process control standards along with rigorous maintenance including frequent control of press settings: ink and dampening rollers, plate and blanket packing, and dampening system (PH, temperature, conductivity, alcohol %).

All materials need to be optimised as a system (ink, blankets, paper and plates).

Alternative screen technologies can have a different print characteristic curve. Ensure that the CTP plate system is calibrated with the correct transfer curve.

Caution there are significant differences between the alternative screen technologies such as stochastic, FM, AM/FM hybrid, XM. It is recommended to test several types on typical print jobs to ascertain which is best suited to specific types of print jobs and production conditions (See Guide 7 pages 224-254).



AM 1880

FM 1993



AM/FM Hybrid 1997

XM 2003

Screening techniques were almost unchanged for a century until the introduction of CTP plate that permitted the development of alternative screening technologies. Source Agfa.

On press approval



The customer's role

Before printing

- Identify in advance any graphic elements that may be difficult to print and use the proofs to discuss them with the printer.

At the printing plant

- Be well rested before going to make a colour OK – fatigue impairs colour perception. Allow your eyes time to adjust if you have come from a bright sunlit area (45 minutes).
- Ensure that you have proofs made from the digital data used to make the plates – otherwise they will have poor comparative validity.
- If you view the job in the pressroom, ask where you should stand in order to avoid being in the way of the press crew. Don't comment on the job until you are given a printed sheet to review.
- The printer is your ally to achieve the optimal result from the materials supplied.

When comparing proof to printing

- Are all of the graphic elements present (less of a problem in complete CTP plate workflows)?
- The sheet should be free of ghosting with no tinting or scumming in non-printing areas.
- Look at the overall print impression. Stand at arm's length from the sheet and look at it for about 10 seconds, then look away. Are there any images or colours that appear incorrect?
- From the general impression identify the areas that require some adjustment and examine them closely.
- Clearly and rapidly communicate the end result of any adjustment requested (not how to achieve it).
- The limits of the process may mean that not all changes can be made. Work with the printer to find the best compromise and clearly communicate your priorities to help him.
- Work to the quality parameters established at the time of order.
- Register tolerance of around half a dot is relatively normal on dark colours. Yellow can be up to two dots out without visual impairment in many cases. The importance is the printing effect to the naked eye. There is generally less visual register tolerance of borders, reverse type and overlay tints than on photographs.
- Caution when requesting increased ink film density because the human eye evaluates optical stimuli on a logarithmic scale, e.g. a perceived 5% increase in a colour may require 25% more ink – which may be beyond the paper's ink density limit.
- If a densitometer is used, then the SID and TVI values should have been defined in advance.
- When satisfied with the result, sign off two OK sheets and keep one for your records. The other is the printer's reference to maintain continuity during the print run.
- There will always be some SID variations during printing; these need to be within an agreed tolerance.

Check folded signatures

Some expensive and time consuming postpress problems can be prevented by:

- Inspecting a trimmed copy of the printed section as soon as 'good folding' is achieved. Ensure that printing is correctly positioned on the pages.
- Inspect a copy that has been bundled and strapped (depending on press delivery system) to ensure that it is not creased.

Heatset

Key printer control parameters

makeready steps	Printer's task	Customer's tasks
1 Pre-set ink keys, tension, register, cut-off		
2 Start-up press makeready	Achieve register and cut-off Adjust dampening to optimise ink/water balance	
3 Compare printed copy to proof Adjust ink keys & press settings	Achieve rapid overall colour balance	Check that all graphic elements are on printed copy
4 Ramp 1: Increase running speed	Adjust ink keys & press settings to higher speed Produce saleable copy	Identify where colour adjustment needed
5 Ramp 2: Increase running speed	Adjust ink keys & press settings to higher speed Produce saleable copy	Communicate simple instructions
6 Ramp 3: Increase running speed	Adjust ink keys & press settings to higher speed Produce saleable copy Measure with densitometer.	Communicate simple instructions Check register back-to-back & fold
7 Adjust settings with customer to achieve colour OK If OK	Adjust settings with customer to achieve colour OK Start good OK copy count	Sign off 2 sheets, keep 1
8 Monitor samples to colour OK, visually & with densitometer	Adjust press to maintain printing to OK Collect print samples of run	



Priorities during make-ready (and running):

1. Colour/grey balance: The effective use of the grey bar is a powerful tool for colour control and consistency. Monitor midtone grey balance patches to get rapid overall colour balance.

2. TVI (dot gain): Can vary between 15-35% depending on the screen size, press, process, paper, ink flow/thickness (for variables affecting TVI see page 181).

- Measure the midtones at 50% where TVI has the highest impact and the largest variations.
- The control of TVI consistency and balance is much more important than absolute values.
- To maintain grey balance, the TVI values between the three colours should not differ by more than $\pm 4\%$ (traditional procedures) or $\pm 2\%$ if the right tools and procedures are used (grey balance control). See also page 157.

3. Monitor SID: Measure and control Ink film thickness.

- The balance between the values of process colours is more important than their absolute values, e.g. frequent densitometer measurement of the SID solid patch in the colour bar will prevent ink film weight from continuously creeping up during running (and keep job consistency closer to colour OK sheet).

Quality control devices

The effective use of quality control devices is essential to ensure optimal process results. However, many printers either do not use densitometers, or use them ineffectively. Automatic closed loop colour control systems overcome the issue of manual measuring.

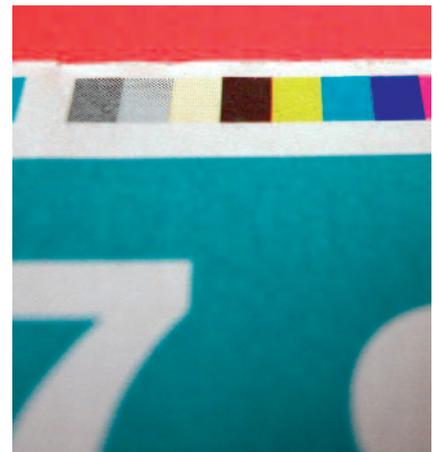
The measurement of different attributes (grey balance, TVI, SID, print contrast, highlight and trap) gives a more effective control of the print process to achieve the best results with the materials available. While measurement assists makeready and output monitoring, some final manual settings adjustment may still be required. Key considerations are:



There is no single attribute to measure, all must be considered together.

Quality control tools should be systematically used, calibrated and maintained.

Printers should be supplied with prepress adjusted to paper grade with specifications for SID, TVI and contrast; with colour bars and patches on all formes. Ideally proofs should be compatible to the process and paper surface to be printed.



Typical commercial printing grey bar with SID patches that are placed in trim areas of commercial printing. Source: System Brunner

Heatset printing sequence is normally K C M Y. Black is expected to achieve a good density for solids and type (from bold to very fine) on a wide variety of substrates. It is the only colour printed on to dry paper and its tack is kept low to minimise linting and picking. CMY are then tack graded from high to low.

Closed loop colour control

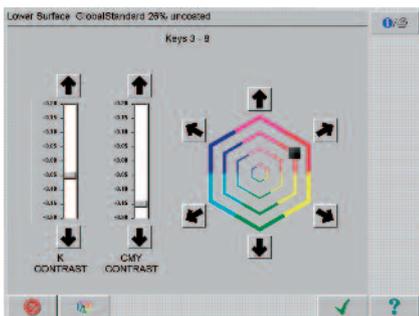
Color OK - traditional method	Speed m/s (fpm)	Color OK with automatic colour control	Speed m/s (fpm)
1 Pre-set ink keys, tension, register,		1 Pre-set ink keys, tension, register, cut-off	
2 Start-up press makeready bringing in register and cut-off	3 (600)	2 Start-up press makeready bringing in register and cut-off	
3 Adjust dampening to optimise ink/water balance	3 (600)	3 Adjust dampening to optimise ink/water balance	6 (1200)
4 Compare printed copy to proof	3 (600)	4 Compare printed copy to proof	6 (1200)
5 Adjust ink keys & press settings to higher speed		5 Adjust ink keys to bring colour to match press proofs	6 (1200)
6 Ramp 1: Increase running speed	6 (1200)	6 Increase running speed	
7 Adjust ink keys & press settings to higher speed		7 Ramp 1: Adjust ink keys & press settings to higher speed	12 (2400)
8 Produce saleable copy		8 Make any necessary adjustments to CCS targets	12 (2400)
9 Ramp 2: Increase running speed		9 Possibly minor final settings with customer to achieve colour OK	12 (2400)
10 Adjust ink keys & press settings to higher speed	9 (1800)	10 Pull printed samples	
11 Produce saleable copy		11 Use print attribute information to monitor press conditions	
12 Ramp 3: Increase running speed			
13 Adjust ink keys & press settings to higher speed	12 (2400)		
14 Produce saleable copy			
15 Adjust settings with customer to achieve colour OK			
16 Pull samples			
17 Monitor and adjust press to maintain printing to colour OK due to changing press conditions			

Makeready

Run



1



2

1- Operator screen of an inline colour control system showing ink key zones. SID and TVI are shown at top and overall colour balance is displayed in the hexagons at the bottom.

2- One CCS system has a colour balance function that eliminates the need for press operators to translate desired customer modifications into ink zone adjustments. This means a request for a little more red or green or higher contrast can be simply applied to a selected zone or surface with a new 3-colour aim point.

Source QuadTech & System Brunner

Closed-loop colour systems (CCS) are the final stage in the process of standardisation, colour management and printing by numbers. These systems automate many steps in the colour approval process; double press makeready speed and reduce speed steps by one third in comparison with conventional systems. They also overcome many of the issues of manual measuring difficulties and subjective evaluation, as well as providing significant economic advantages. Closed loop colour control was developed for heatset in the late 1990s and is now in widespread use. The first newspapers systems became available in 2003.

Advantages of closed loop colour systems v conventional colour setting

- 100% faster makeready press speed with 30-60% less waste.
- Both sides of the web are set simultaneously (v. one side at a time).
- Improved cold start performance.
- Target references achieved automatically (v. manual sampling with handheld densitometer).
- Convergence to colour 25-40% faster and independent of press operator's skills.
- Objective colour setting 300% faster (v. subject visual setting).
- Early saved copies are of much higher quality.
- Faster printing speed earlier in the run & higher net printing speed.
- More consistent colour during press speed changes.
- Prevents overinking (cost), reduces emulsification and press cleaning time.
- Up to 50% fewer blanket washes.
- Cleaner paper edges.
- Data reports for the entire run provide trend analysis and reduce customer claims.

Users report high levels of consistency for images across pages, between presses and crews. Operators have more time to set folder and cut-off because colour approval is faster; they also spend less time on cleaning. Customers enjoy faster colour approval with a reliable consistency over the entire run accompanied by SPC reports. Economic benefit from these systems is high with an ROI of normally less than 12 months from reduced paper waste, faster makeready and net running speed, reduced ink consumption and maintenance.

Printing with metallic inks

Metallic inks can provide attractive added value, but their use can be technically demanding. Good results require process optimisation of paper, prepress, ink, press set up, preparation of rollers and chemistry. The ink needs correct selection of tack as viscosity and gloss are the most important factors in getting a good result.

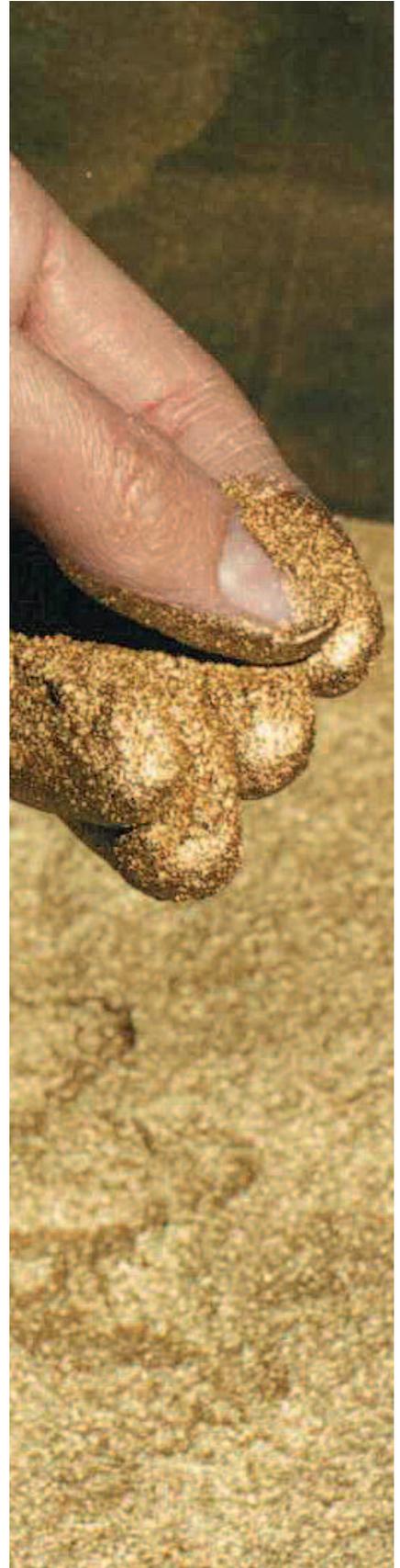
Metallic Inks

Metallic offset inks are similar to conventional 4-colour ink pigments – the main difference is the metallic pigment size and structure. Gold (bronze) inks are made from brass powder by atomising a molten blend of copper and zinc and then ball milled to reduce particles to required size (typically 2-3 microns which is 100 times larger than a yellow or red pigment). Silver inks are made from aluminium pigments using a similar milling technique. Silver inks are now also available using vacuum metallized pigments that give a much thinner, smoother metal flake with a higher gloss than ball-milled pigments.

Best practice:

- Ideally, to avoid the risk of marking and rub off, the metallic ink should be printed on the inside of the signatures and not on the outside.
- Use baked plates to resist staining.
- For optimal results use new blankets.
- When printing metallics for the first time preferably use the first unit (if the design will allow this). If problems of plate staining occur then a slight increase of the dampening solution may help, if not move the metallic to the last unit.
- A 60% yellow screen under metallic gold minimises film weight (require printing metallic on the last unit).
- If using IPA, keep the alcohol level between 8-10%.
- Maintain dampening solution circulation water temperature below 14 °C.
- Keep ink duct level low to avoid water logging and top up ink regularly.
- At start-up, get the 4-colours correct first, then add the metallic.
- Maintain press temperatures as low as possible.
- Disengagement of the bridge dampening roller may help reduce emulsification.
- If the pH in the dampening solution circulating system varies during the run, consider partially draining the tank to improve the situation. If necessary, drain the tank at the end of the job, change filters and refill. This will help reduce any chance of contamination of the next job.
- Keep pH as high as possible (>5) to avoid corrosion of metallic pigments.

Colour reference swatches are printed by silkscreen and the density is far higher than can be achieved on a web offset press – this means a web offset printed job will appear less intense and lighter in density than the sample. To minimise colour approval problems, a special laboratory proof of the offset ink can be made to densities that are normal for heatset printing.



Source Wolstenholme International.

Newspaper coldset

makeready steps	Printer's task
1 Pre-set ink keys, tension, register, cut-off	
2 Start-up press makeready	Achieve register and cut-off Adjust dampening to optimise ink/water balance
3 Compare printed copy to proof Adjust ink keys & press settings	Achieve rapid overall colour balance
4 Ramp 1: Increase running speed	Adjust ink keys & press settings to higher speed Produce saleable copy
5 Ramp 2: Increase running speed	Adjust ink keys & press settings to higher speed Produce saleable copy
6 Ramp 3: Increase running speed	Adjust ink keys & press settings to higher speed Produce saleable copy Measure with densitometer.
7 Adjust settings with customer to achieve colour OK If OK	Adjust settings with customer to achieve colour OK Start good OK copy count
8 Monitor samples to colour OK, visually & with densitometer	Adjust press to maintain printing to OK Collect print samples of run

ISO 12647-3 (currently under review) is used by newspapers globally (SNAP in the USA is compatible). It is an important step towards an internationally acceptable standard that is partly being driven by advertisers who want a single publication standard rather than a multitude of national and company specifications.

The newspaper approval sequence is basically the same as heatset but customers are not normally present and proofs are rarely supplied (this is changing as more and more newspapers are printing commercial work in both heatset and coldset). A major difference is the concept of saleable copy, where it is often acceptable to allow some early printed newspapers to be sold, even though the quality has not yet been optimised. The allowed variation from "final approved quality" may differ considerably between publishers and is as much a commercial consideration as a technical one.

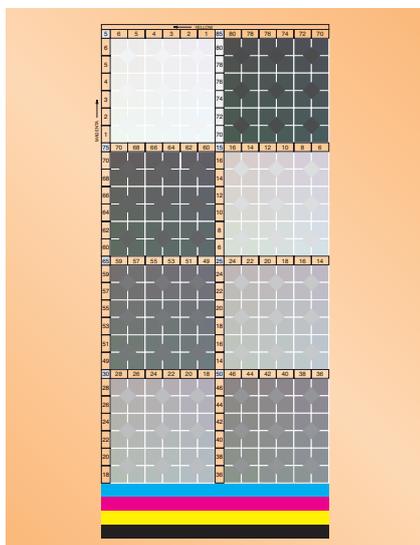
Presses equipped with ink zone presetting can achieve saleable copy from 800 cylinder revolutions — to reduce this figure requires an extremely high investment in maintenance, training and process control. In entirely manual systems, recording average settings and adjusting them by experience is the only systematic approach possible to reduce start-up waste.

The first start-up priority is ink/water balance and register. Then adjust the overall colour balance and density by eye using a 3-colour grey patch – the goal is a grey with neutral tones and no colour casts to obtain saleable copy quickly. Observing differences between colour samples is reasonably accurate because newsprint is a relative standard colour – providing that lighting and viewing conditions are adequate.

Grey bars

For publication printing with advertising content supplied from diverse sources, it is critical that grey balance is within industry standard tolerances. A grey bar is created from a test form (WAN-IFRA, SNAP, GATF, NAA, System Brunner) and printed with a constant ink film thickness. The key to success is that results from all print units fit within industry standard tolerances – it is only then that prepress profiles for TVI and adjustment of process colour tones can be made to achieve correct greyness and colour. The condition of the printing system may change and care has to be taken that reference print profiles are representative, otherwise they can give unreliable results of limited value leading to colour quality complaints.

An ideal grey patch configuration is a semicircle composed of the three colours, using grey values derived from the press signature or footprint (if unavailable use recommended ISO 12647-3 values). Butted against this patch is a second semicircle consisting of a black only screen, selected to give a similar density when everything is correctly set. With the black SID adjusted by eye, the colour densities are adjusted to give a 3-colour patch that is both neutral grey and approximately the same density as the monochrome grey patch. The colour balance should then be reasonable even if the overall densities may be incorrect (but colour imbalance is much more readily noticed than incorrect density). With saleable copy quickly achieved, the final adjustments can then be made to correct density.



WAN-IFRA Greybalance target based on the ISO 12647-3 Standard. WAN-IFRA Values

GCR: WAN-IFRA's Special Report 2.16 and 3.20 "Colour variations & deviations in newspaper printing" finds that a black ink halftone tint is three times less sensitive to colour variations than black produced by 3-colour overlap and for this reason recommends the use of GCR — UCR is not recommended for newspaper reproduction.

Grey bar densitometer control

Newspapers increasingly use densitometry as a tool to improve colour printing standards and consistency. Densitometers are typically used after 'saleable' copies are sent to the publishing area.

Measuring individual colours with a densitometer is not a practical proposition for many newspapers. A good alternative is the single measurement of a 3-colour mid-tone grey bar (using all three filters). The readings should all be equal; if not, corrective action can quickly be taken. Many newspapers use quarter-tone bars because they are more sensitive to visual variation, yet still give reliable densitometer readings.



Considerations when using a newspaper grey bar:

- Check the platesetter imaging output regularly with a plate reader or plate densitometer to ensure correct tone values to support stable grey balance in print.
- To ensure reliable readings the width of the grey bar should be as wide as the target windows for both transmission and reflection densitometers (around 6 mm / 3/8").
- Check densitometer calibration daily.
- Grey bar SID specification range has to be within the density variation capability of the press.



The grey bar is a powerful tool for good colour reproduction and consistency if used correctly. The following steps are recommended at makeready:

- Once in register and when ink densities are in accepted tolerance range. Measure the printed grey bar with a reflection densitometer. Always measure in the same area of the grey bar for consistency of data (high side or low side). Avoid any areas where the layout of the image may cause dot disturbance to the grey balance bar (tracking).
- Adjust the density as required. Always make corrections from dark colour to light because components of cyan and magenta pigments affect the yellow of the grey bars. (If yellow were adjusted first, it would then have to be reset after the other colours are adjusted.)
- Re-check the density after a few minutes in the same position and adjust as necessary.



Newspaper grey bars targets should be large enough to permit measurement. They do not need to be continuous and can be creatively designed across the width of the page as part of the page design.

Ink trapping: This has an impact on grey balance because the sequence in which colours are printed affects the colour gamut – CMYK or KCMY achieve the largest gamut. Newsprint ink process colour coldset inks are usually supplied with identical tack properties. Printability problems with the secondary and RGB overprint colours may be a trapping problem from too much water emulsification or too much dampening. The printed primary colours are generally weakened, leading to increased ink film weight. The reading of trapping is influenced by the transparency of the ink.

On satellite presses it is not unusual for each side of the web to be printed with a different 4-colour sequence and this determines the degree of trapping, e.g. magenta on top of yellow gives a very different result to yellow on top of magenta and the resultant red will be noticeably different. Therefore, a solid secondary or tertiary colour composed of two or more process colours should not bleed across two pages with different colour sequence. Normally blanket-to-blanket presses are printed both sides simultaneously with the same colour sequence.

Makeready

Some best practices

1: Prior to start-up

- Ensure that proofs are available at the press.
- Check that the press chemistry is correct.
- Always check blanket surface visually before starting new job to avoid an unplanned press stop to change the blankets after start-up.
- Check viewing conditions – are the lamps clean and within their specified life? Many lamps require 45 minutes to warm up to their target colour temperature.

2: Pre-set ink fountains: If presetting systems are to deliver efficient results they require continuous and rigorous maintenance of inking and dampening systems. Use pre-set input and choose density from a substrate chart that corresponds to that specific paper's ability for colour. Select the correct TVI that will closely match the supplied proofs.

3: Set up press with accurate job parameters: Adjust web tension, paster and folder if paper grade, weight or web width is changed. Pre-set dryer and chill. It's no good just having great colour if folding is inaccurate; this is a key point in final job acceptance.

4: Optimise web tension: This is fundamental to colour quality and high productivity. Poor tension can cause web breaks, web flutter, loss of folder, colour and back-up register and image slur. Web break risk increases during rapid web tension changes when the press starts up (as impression comes on) and to a lesser extent at normal press stop. The splice cycle creates tension peaks and troughs from the pasting action.



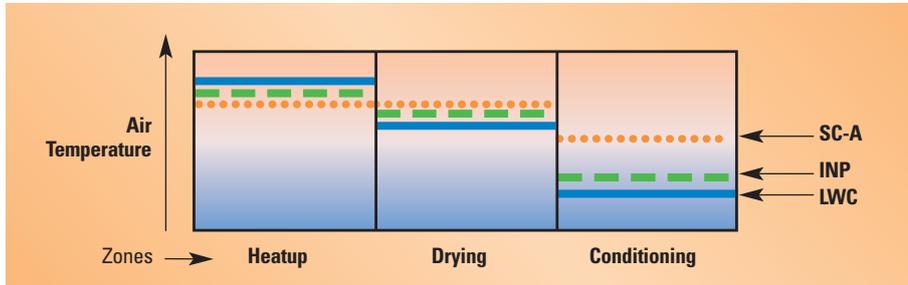
-  Always reset tension when changing paper weight.
Set low start-up tension level (to minimise risk of web break at low speed).
Fine tune tension during makeready and running.
Record settings for each paper and web width for faster future set-up with less waste.

Avoid start-up web breaks

When impression is switched on there is a tension peak up to the last unit, with a corresponding drop through the remainder of the press, which may result in a web break. On newspaper presses acceleration has to overcome the inertia of undriven lead rollers; high start-up speed increases tension peak and web break risk. To minimise web break risks (see also Guide N° 2):

-  Minimise dampening quantity to avoid weakening paper at start-up that may cause a web break. (Reduce dampening flow to the minimum to keep non-image areas of plate clean; if necessary, let the plate catch up during start and clean up when press is at running speed.)
 - An interim solution is to spray small quantities of de tack solvent onto ink rollers and blankets to reduce ink tack at start up.
 - Always ensure cylinder gaps are dry before start-up because water or solvent in cylinder gaps will deposit onto the web as the press rotates causing a weak wet strip across the web.
 - Make sure prepress plate gumming is not excessive, otherwise it may cause a wrap on start-up.

Dryer Air Temperature Profiles



Different paper grades have different temperature profiles. At makeready adjust the dryer and chill roll temperature profiles to the type and weight of paper to be printed and record the settings for future jobs (see Guide N° 3 page 26). Ensure that the automatic pyrometer is correctly adjusting the dryer temperature during speed changes. Source MEGTEC.

- Make sure web is straight at start-up, turn roll to take up slack to avoid risk of wrapping.
- Always follow correct start-up sequence or a web break may be caused in or after the first printing unit.

Start up press at a respectable running speed. A press team working faster and harder will reduce makeready copies and with less variation. A faster speed also helps avoid a web break due to excessive water in the plate gap. A slower start-up speed often means that, as speed is increased, the settings jump off and heavy re-adjustment is required leading to higher makeready waste and time.

Ink/water balance: Ink/water balance is related to the variable level of paper absorption and coating. Poor balance encourages fibre build-up on the blankets or feedback to the ink dampening solution. Ink/water balance requires special attention during makeready and start-up.



It is much easier to balance ink/water early during start-up than to try to recover balance after it is out of control.

Control ink film: Advertisers want “colour punch” and pressmen often please them by over-inking. When setting colour it is important to remember that the human eye works in a logarithmic scale, e.g. a perceived 5% increase in a colour may require 25% more ink. However, each paper grade has an optimal ink density limit, beyond which little additional perceived difference can be achieved.



Use a properly calibrated densitometer as a tool to control ink film weight and avoid overinking and drying problems detrimental to quality.



Do not exceed the density specifications appropriate to each paper grade. (UCR and UCA during prepress ensure good reproduction of solids without over inking).



If available, use smart automation tools to their fullest potential to adjust dampening to minimum level to achieve the least amount of water with the least amount of ink.



Overinking is the most frequent cause of a wide variety of process problems.

Common problems

Proofs	Inconsistent with substrate, process and standards Proofs not made from same digital files used to make plates.
Plates	Platesetter not calibrated. Absence of control wedges.
Paper quality	Unable to produce colour gamut required by customer.
Difficult images	Register and colour (see page 133).
Environment	Incorrect lighting conditions.
People	Competencies, motivation, physical condition. Variable colour perception among people, during and between shifts and between customers.
Press system	Mechanical condition, settings, consumables, chemistry.
Ink trapping	Ink formulation, blanket packing, choice of paper and plates.
SID of 100% solid prints.	Ink formulation & target SID values.
Hue error & process colour greyness	Ink formulation, paper colour, ink contamination.
Blanket washing frequency	Can cause colour variation during the run.
TVI	Paper, ink and blankets are the most significant influencers.
Paper	Brightness, whiteness, opacity, porosity/holdout, smoothness, web tension.
Screen	The coarser the screen size, the lower the impact on TVI – use the screen size appropriate to the paper grade.
Plate	Exposure time, temperature, processing, reactions (age, light, chemicals), tension.
Ink	Rheology (Tack, viscosity, pigment strength, temperature). Dampening solution: pH/conductivity, water hardness, type of dampening system, dampening solution formulation. Ink film coverage and thickness, ink/water balance.
Balance of dot sizes between colours	Scanner gradation, dot shape, screen ruling. Type of plate, paper, blanket, Ink

Ink film thickness has a major impact and it is critical to monitor and control ink density so that the TVI remains consistent. There is no direct correlation between SID and TVI; changing SID is an indirect way to manipulate TVI.

On press	The type of press design can influence TVI. Variable factors include:
Blanket	Compressibility, age, tension, surface characteristics. Making the right choice of blanket can compensate TVI variations with different paper grades (lower quality papers usually produce higher TVI, particularly with high ink coverage). Over- or under-packing.
Rollers	Durometer, setting, glazing.
Running	Low /high speed and temperature.

Tips for achieving & maintaining colour

Productivity Maintenance: The payback from a successful proactive maintenance strategy is improved productivity (See guide N° 4).

Standardised processes & operating procedures: Written procedures and effective operator training for all process steps. Define which standards and control measurement to use.

Customer and printer work together: Ensure all specifications and special instructions are clearly communicated to all staff. Define proof types and viewing conditions for each process step. Understand the issues of human perception and mutually define an objective colour approval approach.

Prepress: Use correct press and consumable profiles, GCR and UCA as required (See guide N°3). Ideally make imposed colour proof (profiled to press) that is approved by the customer. Ensure accurately-imaged plates by regular calibration and measurement.

Consistency during print run

Paper

There is a correlation between paper quality and the printed gloss of the final product. Gloss level can be influenced by printing process conditions; therefore, avoid excessive dampening and high dryer temperatures that cause avoidable fibre roughening that reduces printed gloss

For consistent quality during the run do not mix grades or papers from different suppliers. When possible run rolls from the same position on the mother roll to minimise register faults at roll changes (see Guide N° 2).

Regularly wash blankets as piling may affect TVI and print contrast. Automatic washing during the splice cycle reduces paper waste.

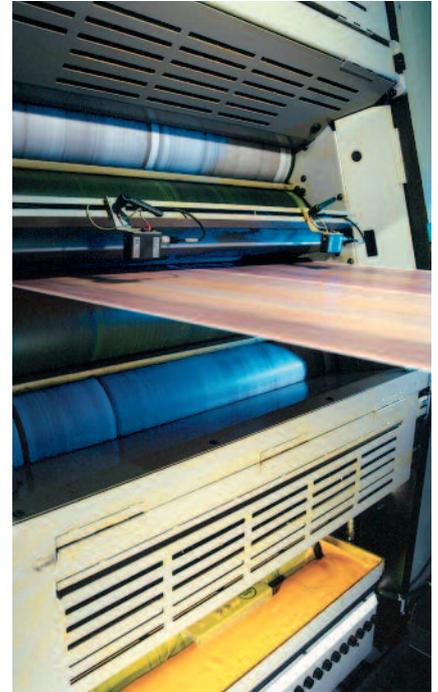
Other print run consistency considerations

- Constant ink and dampening unit temperature (temperature build-up on ink transfer roller will impact on colour).
- Constant dosage of dampening additives.
- Constant conductivity of dampening solution.
- Balanced filling of ink dampening solution.
- Periodically, clean blankets according to paper characteristics.
- Periodically, clean chill rollers according to paper characteristics.
- Maintain a constant production speed.
- Constant web tension through the press.
- Register dependent colour variations. If screen angles are correct small register shifts should not affect colour.
- A 2°C rise in temperature can produce a noticeable change in colour (research by TAGA in 1996).

Offset presses have a cyclic copy to copy variation to a varying degree. Although imperceptible in solid colours – when CMY are combined in neutral colours this can produce an oscillation in colour. The variation is due to the oscillation of ink rollers in the ink train. It can be minimised by the correct phase relationship of the oscillating rolls; UCR also minimise the effect.

Print by numbers using colour measurement tools (Densitometry, Spectrometry, CCS). The key is using all the right numbers correctly. The lower the tolerances between the numbers, the higher the waste.

 Always recheck benchmark process settings after changing a single variable – it becomes much more difficult to regain process control if several are changed without resetting.



1- Efficient press pre-setting requires that the inking and dampening systems are correctly set and consistently maintained. Photo manroland.

The key role of blankets



1



2

1-2- Magnified dots printed under identical conditions (plates, prepress, press, paper, ink). The improvement in quality was possible by using a modified blanket top surface. Note the visible difference in paper colour is due to different lighting angles.
Source Trelleborg Printing Solutions.

3- Cylinder distortion over time of three different blankets – C is better than A, and B will lead to streaks and loss of print.
Source Trelleborg Printing Solutions.

The blanket can influence press start-up duration up to colour OK for colour register and quality of dots and solids, as well as web break risk. The blanket also influences quality throughout the run through its mechanical and chemical stability. The prerequisite for best performance is that blankets need to be stored, installed and maintained correctly (see Guides N° 3 p 30 and N° 4 p 22).

Lateral colour registration: Fast and wide presses require blankets that maintain a larger area of paper for a very short time – this becomes more sensitive when the ratio of width to cut-off increases. The blanket has to transport the paper with a flat web (no wrinkles or waves at any speed); produce minimal natural paper fan-out (this can be corrected to some extent using the right blanket structure); and minimise use of bustle wheels that can cause mis-register and web breaks.

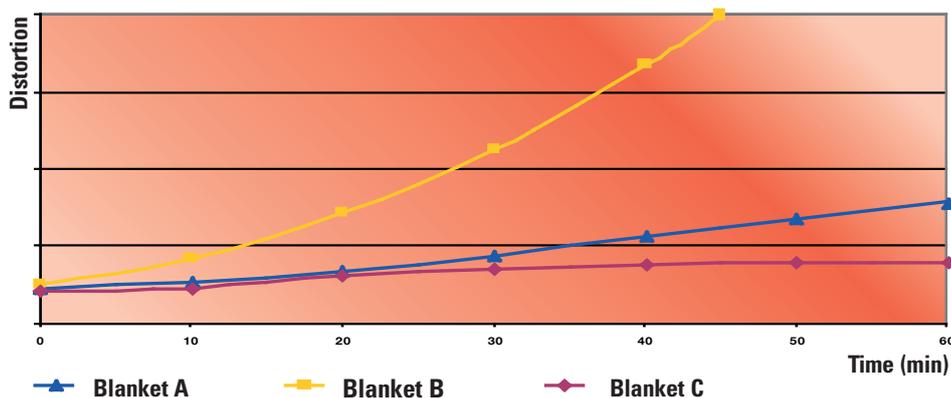
Circumferential register and web feed: Efficient printing requires a “soft” paper transport through the press line. This requires blankets with a neutral web feed (or slightly positive if the chill rollers and folder can be adjusted to the paster). Incorrect paper tension makes good colour register impossible and may cause a web break. A neutral web feed is given by the type of blanket and the press configuration. Blanket web feed behaviour is related to its structure and components – a press should normally only use a single blanket type – mixing different types risks “chaotic” paper transport.

Paper release: Poor release affects paper transport and print quality (slurring, mechanical ghosting smudging and even doubling); it can also be related to print-through. Paper release is a conjunction of many parameters (paper, ink, water dampening solution and blanket) and its improvement may require adjusting several of them. The blanket can help reduce release with a selected roughness, hardness or top chemistry.

Paper versatility: A single blanket type can be a good compromise for a variety of papers (quality, weight, thickness), but a specific design may be required to address a particular paper and colour registration issue.

Ink & water transport: A high performing printing process is only possible from an optimised combination of blanket + ink + dampening solution appropriate to the paper grades or printing quality levels. A blanket’s top surface chemistry, roughness and hardness play a major role in rapidly achieving ink/water balance and emulsification on the blanket surface. The blanket has to switch alternatively between picking up ink from the plate and transferring it onto the paper (on the same area of its surface and within a very short time).

Stability: Mechanical and chemical stability are essential. Dynamically unstable blankets (nip, surface, blanket cylinder) may cause poor ink transfer (blanket behaves like a sponge), and generate heat that changes ink/water balance (more evaporation on blanket surface) and creates loss of print and streaks..



3

Glossary

CMYK: 4-process colour sequence generally used for heatset (Cyan, Magenta, Yellow and Black). Coldset ink sequences are more variable.

Dot gain: see Tone Value Increase.

Dry-back: A chemical condition occurring 3-5 days after printing when image areas becomes dull and lifeless. Causes include using higher TAC than recommended; incorrect dot gain; abnormal press temperatures.

Emulsification: Dispersal of dampening water into ink.

Fountain solution (fount): Chemicals added to water in dampening solution.

Grey balance: Used to objectively assess colour as the eye easily detects any shift in neutrality when neutral areas are compared side-by-side and if there is any colour cast in the neutral area. Grey balance is the condition in a colour reproduction system where the values of the primary colours are balanced to give a visually neutral grey. A visually neutral grey cannot be achieved using equal values of each CMY colour. The grey balance values for a given set of inks, paper and tone transfer characteristic, describe the relationships of the three colours to each other necessary to maintain a grey throughout the tone scale.

GCR (Grey Component Replacement): A technique that has greying effect with black ink used to replace the process colour inks. The grey component of a printed colour is determined by the complimentary ink which darkens a colour (e.g. the amount of yellow in a blue, cyan in a red or magenta in a green). GCR identifies the combined effect of the three inks and replaces them with a single black. This stabilises the neutrals for illustrations, as grey is no longer dependent on the precise balance of CMY. If the black ink cannot reach a sufficiently high density then some CMY can be brought back to support very dark shadows (see UCA).

Print contrast: Calculation that compares the difference of density readings between a 100% and a 70 or 80% tint area to the density of a 100% solid area of the same colour. Good print contrast indicates a printing system's ability to hold open the shadow areas while still maintaining high solid saturation (density).

RIP: Raster Image Processor: Translates electronic file data into an array of dots and lines that can be printed.

Solid Ink Density (SID): A measure of how much complementary light (major filter) is absorbed by a solid patch in a colour bar as measured by a reflection densitometer.

TAC (Total Area Coverage): Defines by % the combined CMYK dot area (tonal value) by adding the values of each colour in the darkest area of the separation. Theoretically, laying down 100% solids of each colour (TAC of 400%) would achieve the best black area but this causes colour variability. TAC is measured on the original file and controlled during image preparation. TAC should be checked in the darkest area of the film or electronic file and read in the same spot for each colour on final film or CTP file. Maximum TAC is influenced by the substrate.

Trapping : The efficiency with which one wet ink film layer is accepted by an underlying wet ink layer.

TVI (Tone Value Increase) or dot gain: The physical enlargement of halftone dots during image creation, printing process and absorption of ink by the paper (mechanical dot gain); and light scatter around and under dots (optical dot gain). The combination of both results in tone value for total apparent dot gain during the print process.

UCA (Under Colour Addition): Addition of chromatic colours to ensure TAC in shadow areas.

UCR (Under Colour Removal): Reduces process colour content in dark, neutral areas of the reproduction and replaces them with extra black. UCR may be only made in dark, neutral portions of the picture.

Paper grades classifications:

NP: Newsprint

INP: Improved Newsprint
(also known as MF)

TD: Telephone Directory

SC-A: Super Calendered higher
brightness

SC-B: Soft Calendered

LWC: Light weight coated (US Grade 5)

MFC: Machine Finished Paper

MWC: Medium Weight Coated or high
brite LWC (US Grade 4, 3)

WFC: Wood-free Coated
(double coated)
(US Grades 1 & 2
& premium coated)

WF: Wood-free
(US Grades 1 & 2 & premium)

ICC (International Colour Consortium): International forum to define process-wide profiles for prepress file formats, paper and press for colour management systems.

For details see <http://www.color.org/>.

ISO (International Standards Organisation): Worldwide federation of national standards bodies. Printing references: 12647-1 general, 12647-2 commercial, 12647-3 newspaper.



BEST PRACTICE

Aylesford Newsprint

Aylesford Newsprint is a dedicated manufacturer of premium quality newsprint. Its "Renaissance" brand is widely used by many major European newspaper publishers. The mill specialises in 100% recycled newsprint of exceptional runability and superior printability — brighter, cleaner and with high opacity. All products are made exclusively by recycled paper using highly skilled staff operating the most advanced technology available. The company's continuous improvement programme helps ensure the attainment of the highest operational and environmental standards. Aylesford Newsprint is jointly owned by SCA Forest Products and Mondi Europe who bring a wealth of experience in quality paper manufacture.

www.aylesford-newsprint.co.uk

Kodak

Kodak GCG (Graphics Communications Group) provides one of the broadest product and solutions portfolios available in the graphic arts industry today, including a wide range of conventional lithographic plates and Computer to Plate solutions; Kodak GCG branded graphic arts films, digital, inkjet, analogue and virtual proofing products, as well as digital printing solutions and colour management tools. Kodak GCG is a leader in prepress technology and have received 16 Graphic Arts Technology Foundation (GATF) InterTech Technology Awards. With headquarters in Rochester, NY, USA, the company serves customers around the globe with regional offices in the United States, Europe, Japan, Asia Pacific and Latin America.

www.kodak.com

manroland

manroland AG is the world's second largest printing systems manufacturer and the world's market leader in web offset. manroland employs almost 8 700 people and has annual sales of some Euro 1,7 billion with an export share of 80%. Web fed and sheetfed presses provide solutions for publishing, commercial, and packaging printing.

www.man-roland.com



MEGTEC Systems is the world's largest supplier of weblines and environmental technologies for web offset printing. The company is a specialised system supplier for roll and web handling (loading systems, pasters, infeeds) and web drying and conditioning (hot air dryers, oxidisers, chill rolls). MEGTEC combines these technologies with in depth process knowledge and experience in coldset and heatset printing. MEGTEC has manufacturing and R&D facilities in the US, France, Sweden and Germany, China and India along with regional sales, service and parts centres. MEGTEC also provides energy and efficiency consulting and machine upgrades.

www.megtec.com



Muller Martini a globally active group of companies is the leader in the development, manufacture and marketing of a broad range of print finishing systems. Since its foundation in 1946 the family-owned business has focused exclusively on the graphic arts industry. Today, the company is segmented into seven operating divisions: Printing Presses, Press Delivery Systems, Saddle Stitching Systems, Softcover Production, Hardcover Production, Newspaper Mailroom Systems and OnDemand Solutions. Customers rely on a worldwide manufacturing, sales and service network of approximately 4 000 employees. Subsidiaries and representatives provide Muller Martini products and services in all countries of the world.

www.mullemartini.com



Nitto Denko Corporation is one of the world's specialist suppliers of polymer processing and precision coating. The company was formed in Japan in 1918 and employs 12 000 people all over the world. Nitto Europe NV is a subsidiary, which was founded in 1974 and is the group's leading supplier to the paper and printing industries with products like repulpable double-coated adhesive tapes for splicing systems. Nitto has also become the reference supplier to offset and gravure printers worldwide. Nitto Europe NV is ISO 9001 certified.

www.nittoeurope.com, www.permacel.com, www.nitto.co.jp

QuadTech.

QuadTech is a worldwide leader in the design and manufacture of control systems that help commercial, newspaper, publication and packaging printers improve their performance, productivity and bottom line results. The company offers an extensive range of auxiliary controls, including its best-selling register guidance systems (RGS), the award-winning Color Control System (CCS) and the widely-known Autotron. QuadTech, founded in 1979, is a subsidiary of Quad/Graphics and is based in Wisconsin, USA. The company was ISO 9001 registered in 2001.

www.quadtechworld.com



SCA (Svenska Cellulosa Aktiebolaget) is a global consumer goods and paper company that develops, produces and markets personal care products, tissue, packaging solutions, publication papers and solid wood products. Sales are conducted in 90 countries. SCA has annual sales in excess of SEK 101 billion (c. € 11 billion) and production facilities in more than 40 countries. SCA had approximately 51 000 employees at the beginning of 2007. SCA has a range of high grade, customised publication papers for newspapers, supplements, magazines, catalogues and commercial printing.

www.sca.com, www.publicationpapers.sca.com



Sun Chemical is the world's largest producer of printing inks and pigments. It is a leading provider of materials to packaging, publication, coatings, plastics, cosmetics, and other industrial markets. With annual sales over \$3 billion and 12 500 employees, Sun Chemical supports customers around the world and operates 300 facilities throughout North America, Europe, Latin America and the Caribbean. The Sun Chemical Group of companies includes such well-known names as Coates Lorilleux, Gibbon, Hartmann, Kohl & Madden, Swale, Usher-Walker and US Ink.

www.sunchemical.com, www.dic.co.jp



Trelleborg Printing Blankets is a product area within Trelleborg Coated Systems. Trelleborg is a global industrial group whose leading positions are based on advanced polymer technology and in-depth applications know-how. Trelleborg develops high-performance solutions that seal, damp and protect in demanding industrial environments. Trelleborg is represented in the printing industry with its brands Vulcan™ and Rollin™. With the market knowledge grown over many years combined with innovative technology, patented processes, vertical integration and total quality management, servicing 60 countries on five continents, both brands can be considered among market leaders worldwide, providing offset printing blankets for the web, sheetfed, newspaper, business forms, metal decorating and packaging markets. Its European production sites are certified with ISO 9001, ISO 14001 and EMAS certifications.

www.trelleborg.com



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