MediaStandard Print 2018

Technical Guidelines for Data, Proof and Production Run Printing

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for Data, Proof and Production Run Printing (PDF)

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MediaStandard Print is based on international standards for standardized printing (ISO 12647 et al.) and contains recommendations for standardized workflows and standard printing conditions together with ICC profiles. The European Color Initiative (ECI) and the bvdm have made a major contribution to the development of these profiles and they are based, inter alia, on Fogra characterization data. It is supported by print and media federations in Europe and globally.

We would like to thank the members of the Bundesverband Druck und Medien MediaStandard Print work group for their commitment.

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Contents

Introduction

Goals

"Make printing simple" is the cry of the advertising industry, with its eye on products that use various different printing methods such as offset, gravure, newspaper, screen and flexo, as well as digital. In response, the Bundesverband Druck und Medien e.V. (bvdm) published its MediaStandard Print in 1998 and since then has regularly updated it. This standard provides a foundation for smooth technical cooperation between customer, prepress supplier and printer, making printed media more attractive and competitive. Premedia operators and printers, print customers, scientists and software developers have all contributed to its drafting and updating under the auspices of the bvdm.

Contents and Application

MediaStandard Print contains information about the components that are necessary for its correct application in the various printing methods. Section A provides a basic overview of colour and file formats together with print production output processes. Section B, the main section, provides guidelines for the supply of data, proofs and press proofs for printing on the basis of typical workflows. It includes aim value and tolerance tables for the standard ISO 12647 printing conditions. Section C, the Appendix, explains control means as well as appraisal and measurement conditions. Operators are offered further guidance through a comprehensive glossary, tables, illustrations, bibliography and sources of information.

About the base—the 2016 edition
MediaStandard Print 2016 is more comprehensive than the 2010 edition. The additional information, which primarily takes the form of numerous new tables, should satisfy the increasing demands on technical communication, which also encompasses other media besides print. Background information that is not absolutely vital is printed in grey to differentiate it more clearly from essential material. Cross references to the primary reference work, Process-Standard Offset, are also new. This is and remains the fundamental basis for standardized work in prepress and offset, which is the leading printing method, as well as for certification of the production process.

Since MediaStandard Print 2016 will only be available as a PDF file, this edition is being published in a landscape format so that entire pages of the document can be displayed on computer screens and read without having to scroll and more complex tables can be displayed without having to rotate pages.

The reason for the revision was the widespread switch to the reliable new printing conditions for offset printing (ISO 12647-2:2013). Initially, the two most important of these were released to the industry in the form of two generic ECI ICC profiles together with corresponding DeviceLink-Profiles and GrayCon files at the end of September 2015. Since there are still only ICC profiles for some of the ISO printing conditions that came into force in 2013, both the 2016 edition and the 2018 edition feature both the two most important new printing conditions, 1 and 5+, as well as the old printing conditions, which continue to be widely used by the industry. To coincide with MediaStandard Print 2016, ProcessStandard Offset 2012 (2016 Revision) and the Altona Test Suite 2.0 2013 (2016 Update) were updated to include the two newly added standard offset printing conditions.

Specifically, these two printing conditions are the first to take into account the effect of optical brighteners, having been drawn up and applied on the basis of the physically correct proportion of UV in the measurement and viewing light. They offer a level of colour reproduction quality that has not previously been achieved by considerably improving the agreement between measured values and the visual evaluation of proof and production prints. The two new ICC profiles—for Premium (multiple) coated, moderately brightened offset paper and heavily brightened, uncoated, wood-free paper—are based on FOGRA51 or FOGRA52 characterization data and are clearly identified by means of version number 'v3'.

Since film-based prepress workflows are no longer current, this edition no longer deals with them (refer to Process-Standard Offset 2012 for these). Typical digital printing scenarios have been included in MediaStandard Print in their place.

What is new in the 2018 edition?
The bvdm is responding to changes in the current standardization process. Specifically, the following additions have been made:

- New ECI working colour space, i.e. the eciCMYK CMYK exchange colour space (Tables 1 and 7, Figure 4);
- SCTV Tone value (increase) curves for spot colours in accordance with ISO 20654 (A.1.3, Tables 2A and 2B, Glossary);
- CxF/X-4 generation and exchange of spot colour data in accordance with ISO 17972 (Tables 2A, 2B and 12, C.2.2, Glossary);
- Separate 6-B standard printing condition with the PSO SC-B paper v3 (FOGRA54) ECI profile (Tables 3, 19C, 20 and 25);
- New ECI-PSR profiles for publication gravure (A2.2, Tables 4, 19C and 22);
- PDF/X for variable digital print content in accordance with ISO 16612-2 PDF/VT and ISO 16613-1 PDF/VCR-1 (Tables 7 and 12);
- Fogra MultiColor MediaWedge 3.0 (Table 11, B.4.2 and Figure 5C);

- New values for the white measurement backing (C.2.2) and more precise M0 and M1 measurement modes (Table 27) in accordance with the 2017 revision of ISO 13655:2009.

In addition, a number of misprints have been corrected (including figures in Tables 20 and 22), a number of statements have been made more precise or detailed (e.g. Tables 6 and 29), the glossary has been expanded and the references and Internet sources revised.

Validity

The 2016 edition (Art. No. 86036) ceases to be valid with the 2018 edition (same Art. No.) and is no longer available to download. The standard printing conditions described in the German 2010 edition that will be replaced by new standard printing conditions and those that will continue to be valid are described in the 2016 edition as well as the 2018 edition. This provides a clear indication of the altered reference parameters such as standardized characteristic printing curves and the CIEDE2000 tolerances for digital proof printing.

The new ECI v3 ICC profiles have been tested for a period of about 18 months in various printers in Germany, Austria and Switzerland and optimized to ensure their usability under production conditions. The differences from the ISO aim values for printing conditions 1 and 5, which are not typical of production practice and which have been replaced by the aim values from FOGRA51 and FOGRA52 characterization data that have been proven in practice, make clear that the ISO 12647-2:2013 approach conforms to production practice. As also explained in the 2016 Revision of ProcessStandard Offset, the "PSO Coated v3" and "PSO Uncoated v3 (FOGRA52)" standard profiles therefore fulfil ISO 12647-2:2013. Prepared by the ECI on the basis of consistent M1 characterization (FOGRA51, FOGRA52), these ICC profiles are compatible with papers that are typical of the European market. Consequently, the aim values for the new 1 and 5+ printing conditions published in the 2016 edition and the present 2018 edition in conjunction with the ISO 12647-2-based 2016 revision of Process Standard Offset reflect the current state of international standardization.

Please note: All references to ProcessStandard Offset and its 2016 Revision are related to explanations in German language.

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A

General Information and Overview

This section systematically specifies and describes the colour formats, the currently characterized reference printing conditions as well as the simulation processes and control means that are to be used. Relevant further or specific details are to be found in sections B and C.

A.1 — Colour formats and working colour spaces

Essentially, colour data that have been standardized or that are linked to an ICC profile should be used. Colour data or portions with three and four component are standardized, colour data with more channels are not standardized.

A.1.1 — Three component colour data: RGB and CIELAB

RGB data (red, green, blue) are generated by digital cameras, scanners and output neutral settings in image processing and page design programs. Gamut and colour space structure are defined by device dependent RGB working colour spaces (Table 1). In the printing industry, only those that relate to D50 (artifical daylight with a colour temperature as close to 5000 kelvin as possible) should be used on account of the referenced CIE illuminant. Consequently, D65 referenced working colour spaces such as AdobeRGB(1998) and sRGB(1999)— introduced into the workflow by many digital cameras —should be converted into a D50 working colour space at the start of the process chain. eciRGB_v2(2008) is suitable for this and, in any event, it is a prerequisite for softproofing applications.

However, in a CMYK workflow a prior conversion to eciRGB_v2 is not necessary, since each additional conversion step can worsen the quality of the detail. Since different colour space profiles are processed in PDF/X-4, sRGB images can in principle be 'fed through'.

→ See "ProcessStandard Offset 2012" A-111, B-7, B-14, B-30ff, B-44ff for the handling of working colour spaces.

Working colour space	Publisher	Process conditions	Model	Gamma	Remarks
CIELAB(1976)	Adobe, CIE	device independent (ICC device profiles unnecessary)	L*a*b*	L* ("L Star")	only in Adobe Photoshop; the previous limitation to 8 bit/colour channel no longer applies; largest possible working colour space, which is why colour rendering and colour gradation problems arise given the unstandardized methods for mapping to much smaller output colour spaces
AdobeRGB(1998)	Adobe	device dependent	RGB	2.2	different white point from D50 (D65); incomplete coverage (jn cyan) of offset printing and many monitors
Wide-Gamut RGB		device dependent	RGB	2.2	extensive coverage of six and seven colour printing; small deficits in cyan
sRGB(1999)	HP, Microsoft	device dependent	RGB	2.2	different white point from D50 (D65); limited to 8 bit/colour channel; too small for some professional monitors and offset printing (deficits in yellow, green, cyan)
eciRGB_v1(1999)	European Color Initiative (ECI)	device dependent	RGB	1.8	replacement by eciRGB_v2 (ISO/TS 22028-4:2012) recommended
eciRGB_v2(2008)		device dependent	RGB	L* ("L Star")	recommended working colour space; large enough to cover the usual colour spaces (all printing methods, monitors, digital cameras); required for softproofing
eciCMYK(2017)		device dependent	CMYK	mean of typical TVCs	exchange colour space suitable for digital printing that is larger than all other printing colour spaces. Based on FOGRA53 characterization data

TABLE 1
Working colour spaces used in the printing industry

A.1.2 — Four component colour data: CMYK

The overwhelming majority of printed products are produced using the four 'process colours' of cyan (C), magenta (M), yellow (Y) and black (K, 'key'). Four component colour data are therefore laid down in CMYK and can be linked to ICC output profiles in the CMYK colour space (Table 2A). It is also possible to use colour space expanding 'intensive process colours' in sheet-fed offset that can be printed with higher colour densities than normal process colours.

A.1.3 — Multi-component colour data: CMYK plus additional colours, duplex, spot colours

Multi-component colour data (Table 2A and 2B) are expected if the colour space has been expanded by means of additional colours. This involves either CMYK plus spot colours, that is an expansion using special colours as graphic design elements, or a tone value separation of all colours into six or seven components. In the latter case, the CMYK colours in question often differ from process colours in that they are spectrally optimized to complement the additional colours. n-channel ICC profiles are necessary for the separation characterization. In flexo printing CMYK data are often converted into two or three component separations in order to save ink and to lay dominant colour tones down as purely as possible. Duplex data are two channel data and can be described as a special case of multi-channel colour data. Printing with spot colours was standardized in ISO 20654:2017/Cor.1:2018 (SCTV) and is gradually being supported by means of colour measurement device updates.

→ See "ProcessStandard Offset 2012" A-161ff, B-38, B-61f, B-83, B-117 for the handling of spot colours

TABLE 2A
Colour data and preferred **file formats**

Colour data	Channels	Bit/Channel	Bitmap Formats	Vector, Object Formats	Colour standards	Monochrome
RGB	3	8, 16, 32	TIFF, JPEG, PNG	Ai, EPS, InD, PDF, PDF/X-4p, QXD, SVG	(see Table 1)	Greyscale
L*a*b*	3	8, 16	Ps, JPEG 2000, TIFF	PDF	CIELAB(1976)	–
CMYK	4	8, 16, grey also 32	Ps, TIFF, JPEG	Ai, EPS, InD, QXD, PDF, PDF/X-1a, PDF/X-3, PDF/X-4	(see Table 20, 21, 22, 23)	Greyscale separation, poss. with 'grey profile'
CMYK + graphic spot colour(s)	4 + n	8, 16	Ps, TIFF, JPEG	Ai, EPS, InD, QXD, PDF/X-4	–	Spot colours graphically screened or not (line data)
K + screened spot colours ('duplex', 'duotone')	n = 2	16	Ps, TIFF, JPEG	Ai, EPS, InD, QXD, PDF/X-4, PDF/X-5n, PDF/X-6n	spot colour data: CxF3 resp. CxF/X-4 (Table 2B); TVCs: SCTV	one greyscale and one SCTV separation
CMYKRG (Multi-colour 6c, e.g. 'hexachrome')	n = 6		Ps, TIFF, JPEG 2000	Ai, EPS, InD, QXD, PDF/X-5n, PDF/X-6n	proprietary, eg. Pantone; pre-built n-colour ICC profiles; spot colours: CxF3 resp. CxF/X-4 (Table 2B); TVCs: SCTV	–
CMYKRGB (Multi-colour 7c)	n = 7					
CcMmYyKk	n = 8				LFP inkjet inks with proprietary process colours and light colours	
only spot colours	n = 2, 3		TIFF in Offset and Flexo printing	Ai, ArtPro, PDF/X-5n, PDF/X-6n	colour data: CxF3 resp. CxF/X-4 (Table 2B); TVCs: SCTV	–

Process	Description
Generation of spot colour data	CxF/X-4 colour measurement data (CIELAB or spectral) must be generated on the substrate that will subsequently be used for printing.
	CxF/X-4 colour measurement data captured by means of a graduated series of measurements in measurement mode M0 or (fundamentally better) M1 in accordance with ISO 13655: • Full CxF/X-4: solid colours on substrate as well as at least 3 different (11 recommended) tone values in each case on substrate (including its colouring) and on black background; • CxF/X-4a: solid colours on substrate as well as at least 3 different (11 recommended) tone values on substrate (including its colouring); • CxF/X-4b: solid colours on substrate. Colour measurement devices with an SCTV function can use CxF/X-4a measurement values to calculate the tone value curves for spot colours from both CIELAB and spectral data without doing so via CxF3.
Forwarding and use of spot colour data by means of a CxF3-data container	There must be an interface for exporting (colour measurement device, software), importing or embedding (application, e.g. PDF workflow) the CxF3 file. In the PDF/X-4 workflow only the CxF/X-4 CIELAB colour data from the CxF3 container are interpreted. CxF/X-4 spectral data can only be interpreted from PDF/X-6 onwards. CxF/X-4-CIELAB data can currently be imported and exported from Adobe Illustrator CS6, with Illustrator palettes being retained in the optional PDF/X-5n workflow. The interpretation of CxF/X-4 spectral data in n-channel ICC profiling tools, colour proof printing software and workflow applications as well as in colour palettes of image processing, graphics and page design software is still in its early stages.

TABLE 2B
Exchange of **spot colour data** with CxF/X-4 in accordance with ISO 17972-4

A.2 — Output processes for print production (characterized reference printing conditions)

Standard printing conditions for the various printing methods are defined in ISO 12647, and the parts of this standard are regularly revised.

A reference printing condition contains
- the printing method (e.g. offset printing),
- the substrate categories (e.g. premium-coated white), plus, if necessary, the grammage range (e.g. 80 g/m² to 250 g/m²), the gloss (e.g. matt) and, since 2013, also the brightener content (e.g. moderate),
- for periodic screens a permitted range of screen rulings (e.g. 60/cm to 80/cm), for non-periodic screens the diameter of the smallest dot (e.g. 20 µm).

The following are assigned to a reference printing condition
- the characteristic printing curves for the primary colours (e.g. A) and
- the L*a*b* values for the solid primary and secondary colours (see Table 3, 19a/b/c and 20, 21, 22, 23).

The printed result of the described reference printing condition in question can be characterized by
- the characterization data measured by a spectrophotometer for a colour chart produced under printing condition in question in accordance with ISO 12647-2 (e.g. FOGRA51), and
- an ICC output profile generated from it (e.g. the standard "PSO Coated v3" profile) (see Table 3 and 19a/b/c).

A.2.1 — Offset printing: standard printing conditions in accordance with 2016 revision of ProcessStandard Offset

ISO 12647-2:2013 redefines and rearranges the standard offset printing conditions. For the first time these take into account the typical optical brightener content of the various offset printing papers. The aim of this has been to achieve the long-demanded better match between the visual and quantitative evaluation of optically brightened production and proof prints.

The technical requirements have been satisfied since about 2012—the availability of light sources that correspond more closely to the D50 CIE illuminant, especially in the proportion of UV (ISO 3664:2009, confirmed 2015), and of M1 measurement mode spectrophotometers (ISO 13655:2009, minor 2017 revision)—in order to be able to more effectively evaluate the UV-stimulated fluorescence, the physical effect of which is a brightening in the visible spectrum.

The old paper types together with the additional heatset web offset conditions have been redefined and arranged by the ISO standard as eight printing substrates. Continuous forms papers are no longer separately specified and the printing conditions for positive and negative platemaking from film originals have also been removed, since they have been completely supplanted by CtP.

At the end of September 2015, after a year and a half of printing trials, the bvdm and its partners the ECI, Fogra and ugra released two ICC output profiles that reflect industrial practices for the two most important new printing conditions. The two new v3 standard profiles—namely 'PSO Coated v3' and 'PSO Uncoated v3 (FOGRA52)' for sheet-fed offset printing and heatset web offset printing—have now replaced the corresponding old standard profiles. Assignment of the number 5+ to the printing condition for 'Uncoated, woodfree white paper' indicates that it is a printing condition in its own right because ISO printing substrate 5 exhibits paper colouring with too little brightening that is not typical of industry practice. The bvdm considers the aforementioned standard profiles to be the only practical profiles and recommends them as the basis for application in practice in accordance with ProcessStandard Offset 2012, Revision 2016.

Due to insufficient use in the past, the ECI has not generated new v3 standard profiles for tone value sums of 330 % or 320 % as well as for non-periodic and fine screens.

For the time being, the other current heatset web offset printing conditions continue to be valid. Subject to the availability of personnel resources, since January 2016 the ECI Web Offset Working Group (WOWG) has been examining the existing heatset standard profiles in terms of need (i.e. the significance of the differences between M0 and M1 characterization with little brightening), market relevance (distribution of the papers), brightening (assignment to the new printing substrates) with a view to determining the necessity and possibility of replacing or supplementing them with new heatset standard profiles. At the end of August 2017 the ECI WOWG published its first profile, the M1-based PSO SC-B Paper v3 (FOGRA54) profile for heatset web offset and supercalendered B substrate. This does not cover SC-A. Consequently the existing M0-based SC paper profile remains valid alongside it. Table 3 shows which old and new printing conditions are valid.

Free-of-charge download of the new v3 profiles, including DeviceLink profiles: www.eci.org/en/downloads#eci_offset_profiles_current_versions. The 'WAN-IFRA-newspaper26v5' profile replaced the old 'ISO Newspaper 26' profile in mid 2015 in line with ISO 12647-3. The coldset printing condition is included in ProcessStandard Offset as C8.

TABLE 3

New printing conditions and ones that continue to be valid or used in parallel in accordance with the 2016 revision of ProcessStandard Offset; the inks conform to ISO 2846-1 for sheet-fed offset and heatset web offset as well as ISO 2846-2 for coldset web offset; for tone value sums and increases see Table 19a, b and c; for primary and secondary colour aim values see Table 21

Printing method	Paper classification	Characterization data: 'standard profiles'; validity
coated papers		
Sheet-fed offset and heatset web offset	**Printing substrate 1 (new):** premium coated; moderate brightening, 80...250 g/m²; typical: • WFC (Wood-Free Coated) glossy, semi-matt, matt; • HWC (High Weight Coated), • some MWC (Medium Weight Coated) limited, since brightening somewhat lower: • coated folding box board (GG, G-grades)	**FOGRA51: 'PSO Coated v3';** replaces all profiles that were generated with M0-based characterization data FOGRA39, FOGRA43 and FOGRA31; for CMYK-CMYK conversion at delivery/forwarding of old v2 profiles the ECI offers the following profiles 'ISO Coated v2 to PSO Coated v3 (DeviceLink)' and 'PSO Coated v3 to ISO Coated v2 (DeviceLink)'
	Paper type 1/2 (old): illustration printing glossy/matt; >70 g/m²	**replaced by printing substrate 1 (new, Fogra51):** • FOGRA39, periodic screens: 'ISO Coated v2 (ECI)' and 'ISO Coated v2 300 (ECI)'; • FOGRA43, non-periodic screens: 'PSO Coated NPscreenISO 12647 (ECI)' and 'PSO Coated 300 NPscreenISO 12647 (ECI)'; • FOGRA31, continuous forms offset: 'ISO Continuous Forms Coated' (no longer in use)
Heatset web offset	**Paper type LWC-I (old), printing substrate 2 (new):** improved; low brightening, 51...80 g/m²; typical: • some MWC (Medium Weight Coated), • LWC-I (LWC Improved)	**FOGRA45: 'PSO LWC Improved (ECI)';** remains valid for the time being
	Paper type LWC-S (old), printing substrate 3 (new): standard glossy; low brightening, 48...70 g/m²; typical: • LWC glossy, some semi-matt;	**FOGRA46: 'PSO LWC Standard (ECI)';** remains valid for the time being
	Printing substrate 4 (new): standard matt/semi-matt; low brightening, 48...70 g/m²; typical: • MFC (Machine Finished Coated), • some LWC semi-matt	**FOGRA41: 'PSO MFC Paper (ECI)';** remains valid for the time being

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Printing method	Paper classification	Characterization data: 'standard profiles'; validity
uncoated papers		
Sheet-fed offset and heatset web offset	**Printing substrate 5+ (new):** wood-free uncoated white paper; strong brightening, 70...250 g/m²; the '+' indicates a stronger brightening of the average, market representative paper colouring than specified in ISO 12647-2; typical: • WFU (Wood-Free Uncoated) limited, since brightening somewhat lower: • uncoated folding box board (U grades)	**FOGRA52: 'PSO Uncoated v3 (FOGRA52)';** replaces all profiles that were generated with the M0-based characterization data • FOGRA47, • FOGRA44, • FOGRA32 and • FOGRA30
	Paper type 4 (old): Uncoated, wood-free white paper; >70 g/m²	**The following are replaced by printing substrate 5+ (new, FOGRA52):** • FOGRA47, periodic screens: 'PSO Uncoated ISO12647 (ECI)'; • FOGRA44, non-periodic screens: 'PSO Uncoated NPscreenISO 12647 (ECI)'; • FOGRA32, continuous forms offset: 'ISO Continuous Forms Uncoated' (no longer in use)
Heatset web offset	**Paper type 5 (old):** uncoated paper, yellowish; typical: book printing	**FOGRA30: 'ISO Uncoated Yellowish';** not relevant for four colour printing, deleted and not replaced
	Paper type SC (old), printing substrate 6 (new): SC paper; low brightening, highly calendered, 38 to 60 g/m²; typical: • SC-A, SC-B (**new: 6-B**)	**FOGRA40: 'SC Paper (ECI)';** remains valid for the time being, particularly for SC-A papers **FOGRA54: 'PSO SC-B Paper v3 (FOGRA54)';** replaces FOGRA40 'SC Paper (ECI)' when SC-B papers are being printed
	Paper type INP (old), printing substrate 7 (new): improved newsprint; weak brightening, 40...56 g/m²; typical: • UMI (Uncoated Mechanical Improved), • INP (Improved News Print)	**FOGRA48: 'PSO INP Paper (ECI)';** remains valid for the time being
	Paper type SNP (old), printing substrate 8 (new): Standard News Print; weak brightening, 40...52 g/m², newsprint for heatset	**FOGRA42: 'PSO SNP Paper (ECI)'** (deliberately based on black instead of white measurement backing and for reasons of consistency it continues to be unsupported by ProcessStandard Offset and MediaStandard Print)
Coldset web offset	**C8 (new printing substrate):** Standard News Print; 'C8' stands for paper category 8 as newsprint for coldset	**IFRA26: 'WAN-IFRAnewspaper26v5'** has replaced 'ISO Newspaper 26' ('26v4') since 07-2015

A.2.2 — Publication gravure: printing conditions in accordance with ECI Process-Standard Rotogravure 2009, Update 2018

For four of five papers, their M0-based characterization data and standard profiles for publication gravure will be supplemented by M1-based standard profiles; both M0- and M1-based profiles are compliant with the slightly revised ISO 12647-4:2014 (Table 4) standard. Packaging gravure including heavily finished sheet-fed gravure is, like flexo, not universally standardizable.

TABLE 4

Gravure printing conditions in accordance with ECI ProcessStandard Rotogravure 2009 and update 2018; see Table 19a; for tone value sums and increases; see Table 22 for the primary and secondary colour aim values.

Printing method	Paper classification	2009 ECI profiles (M0)	2018 ECI profiles (M1)
Publication gravure	LWC Plus	PSR LWC PLUS V2 PT	PSR LWC PLUS V2 M1
	LWC Standard	PSR LWC STD V2 PT	PSR LWC STD V2 M1
	SC Plus	PSR SC Plus V2 PT	PSR SC Plus V2 M1 (from mid year)
	SC Standard	PSR SC STD V2 PT	PSR SC STD V2 M1
	News Plus	PSR gravure MF	(not replaced)

A.2.3 — Screen printing: printing conditions in accordance with ISO 12647-5

Standardized four colour screen printing has lost a great deal of importance, with screen printing increasingly establishing itself as a high quality industrial printing method. ISO 12647-5:2015 describes gamut classes, ink categories and coloration tolerances for white substrates (Tables 5 and 23), that are not supported by the tone value control required by the standard due to the reference to IDEAllance G7, which is not current in Europe. Since there are no standard ICC profiles, ECI offset profiles can be used as an alternative.

TABLE 5

Screen printing conditions in accordance with ISO 12647-5:2014; see Table 23 for primary and secondary colour aim values

Printing method	Classification			
Screen printing	Gamut classes			
	1	low gamut		
	2	medium gamut (offset oriented)		
	3	large gamut		
	Coloration tolerance for white substrates (ISO 13655, wb, M1)			
		90 ≤ L* ≤ 100	−3 ≤ a* ≤ +3	−5 ≤ b* ≤ +5
	Ink categories			
	1	water-based UV inks	conventional inks	solvent-based inks
	2	conventional UV inks	water-based inks	air-dried inks

A.2.4 — Flexo: printing conditions in accordance with ISO 12647-6

Flexo is a printing method that can only be standardized to a very limited degree because of the need to print on a very wide variety of packaging materials. Flexo is seen as a finishing rather than a printing method fine for flexible packaging materials within an overall packaging production process. High resolution, laser-based plate imaging technologies have now enabled flexo to close the quality gap between it and gravure and offset. In practice, numerous inks are used in non-standardizable spot colour colour tones and in some cases with special substitution models for colour separations with fewer than four process colours.

ISO 12647-6:2012 describes screen ruling dependent tone value tolerances, the coloration tolerance for white substrates and ink categories (Table 6). The standard is largely irrelevant for data exchange. Independently of this, there are numerous separate standards for inks and substrates with special physical and chemical properties, which cannot be dealt with here.

Printing method	Classification			
Flexo	Tone value tolerances for the plate depending upon screen ruling			
	1	screen rulings ≤ 48/cm: tone values ≤ 10 % ± 1 %, over ± 2 %		
	2	screen rulings > 48/cm: tone values ≤ 10 % ± 2 %, over ± 3 %		
	Coloration tolerance for white substrate (ISO 13655, wb, M1)			
	L* > 88		−3 ≤ a* ≤ +3	−5 ≤ b* ≤ +5
	Ink categories			
	1	UV inks	solvent-based inks	water-based inks
	2	non-light-fast inks	light-fast inks	
	PDF/X conformity of flexo-typical colour separation models			
	1	PDF/X-4, -4p: CMYK		
	2	PDF/X-5n, -6n: CMYK + spot colour(s), CMYK + Orange, Green, Violet (extended colour space with fixed colour palette), CMYK substituted by 2 or 3 spot colours (by means of ink formulation and concentrate mixing system)		
	Deviation and variation tolerances in printing processes (for practical suitability of ΔE^*_{00} see Table 28)			
	1	K: deviation tolerances $\Delta L^* < 5$ and $\Delta C^*_{ab} < 3$		
	2	CMY: deviation tolerances $\Delta h_{ab} < 6$; variation tolerances $\Delta E^*_{00} < 2$		
	3	Palettes (OGV), spot colours: deviation tolerances $\Delta h_{ab} < 8$; variation tolerances $\Delta E^*_{00} < 1{,}5$		

TABLE 6
Flexo printing conditions
in accordance with ISO 12647-6:2012; aim values for primary and secondary colours are not defined.

Application		Working colour spaces; criteria	Workflow	Exchange data quality
1a	Combined with offset or in approximation to offset colour space	eciRGB_v2; printing substrate 1 (new) or paper type 1/2 (old) – see Table 3, with film finishing see Table 19b	as offset (without platemaking)	Composite: PDF/X-1a, PDF/X-4
1b		eciRGB_v2; printing substrate 5+ (new) or paper type 4 (old) – see Table 3		
2	Digital printing with expanded colour space	Adobe Wide-Gamut RGB, Full Gamut RGB, eciCMYK (FOGRA53)	as offset or media specific	Composite: PDF/X-1a, PDF/X-4; TIFF or TIFF/IT: RGB, n-colour
3	Large format printing (LFP)	Outdoor or indoor locations; resolution dependent on size or viewing distance; ink system dependent on light-fastness, substrate and gamut; FOGRA39/ 'ISO Coated v2 (ECI)'	as offset or media specific	Composite: PDF/X-1a, PDF/X-4; TIFF or TIFF/IT: RGB, n-Color (300 ppi, often 180 ppi)
4a	Photobook	Amateur market: sRGB, AdobeRGB; web-supported layout production; printing substrate 5+ (new) or paper type 4 (old 'glossy') – see Table 3	consumer web-to-print	Files from MS Office, digital cameras or smartphone, medium resolution
4b		Pro market: RAW-RGB, eciRGB_v2; professional layout production; printing substrate 1 (new) or paper type 1/2 (old) – see Table 3	as offset or media specific	TIFF or TIFF/IT: RGB (min. 300 ppi)
5	Fine Art Printing (Photo poster, Giclée)	CIELAB, Full RGB, RAW-RGB, eciRGB_v2; high quality materials (eg. canvas) and methods (multi-colour-inkjet), short runs	media specific	
6a	Variable Data Printing (invoices, advertising mailings, label, packaging)	Transactional printing: b/w or CMYK; mainly text	as offset or media specific	PDF/X-4, variable template and data base for PDF/VT-1, -2
6b		CMYK printing: eciRGB_v2, eciCMYK, other CMYK profiles		VDP design file with variable template, for PDF/X-4 generated in PDF/VCR-1 RIP

TABLE 7
Typical applications for **digital printing** methods

A.2.5 — Digital printing methods

The term digital printing encompasses an array of dynamic printing technologies. These differ from each other either in using a temporarily generated and deletable charge profile on the forme cylinder (e.g. electrophotography) or the temporary addressing of an array of activatable elements instead of a forme (e.g. inkjet and thermal sublimation printing). They also differ in whether the transfer of the printing image is direct or indirect, whether sheet or reel fed, and in printing on flexible or rigid materials, as well as in industrial applications. There are no reference printing conditions for digital printing.

If dynamic printing technologies are intended to supplement static printing methods (A.2.1 to A.2.4) and therefore to print on similar papers, then statically and dynamically printed products should exhibit as little difference in colour rendering as possible when directly compared.

Consequently, it is recommended that files for digitally printed products should be forwarded with a standard offset printing profile that corresponds to the printing substrate being used or that is widely distributed (Table 7).

This embedded standard profile primarly serves as an exchange profile, i.e. the digital printing service provider uses colour management, e.g. a DeviceLink Profile, to suitably adjust it for the characteristics of the press in question.

When forwarding files for printing on n-channel inkjet printing systems that support process colours with light colours, it may be advantageous to use media neutral (RGB) preparation. It is recommended that data exchange be based on an agreement or the individual technical specifications of the printing company.

A.3 — Simulation of the production run

A.3.1 — Monitor proof

The printed result should be simulated on the monitor by means of a suitable colour management solution. Frequently, this will be done as early as the creation and premedia phase whilst the page data are being generated and edited in order to check the anticipated visual effect.

In order to save the proof or press proof production and delivery costs, it is also possible to proof the pages that are to be printed on a monitor on the press control desk ('softproof-to-press', 'pressroom proof'). This technology places extreme demands on the monitor and lighting. It is primarily encountered in heatset web offset but also in newspaper and sheet-fed offset printing, as well as in packaging and industrial printing.

Such softproofing systems are made up of the following components

- one or more wide gamut flat screens that are shielded as effectively as possible from ambient light and with hardware that can be calibrated,
- monitor controls,
- ICC monitor profiles,
- dimmable appraisal lighting,
- a spectral measurement device.

The simulation must take place under calibrated and ICC characterized conditions and standard printing condition profiles (Table 8) are used for this.

→ See "ProcessStandard Offset 2012" A-36ff, B-10f, B-48ff, B-85ff as well as the "2016 revision", Ch. 4.2. for monitor and lighting requirements, softproof scenarios, aim values and tolerances

Criteria	Contents
ISO 12646:2015 – Properties of colour proofing monitors	
Device class A	like B, plus angle dependent gradation stability ΔY(TRC) < 10%
Device class B	angle dependent colour differences ΔE_{00} < 10 – in the individual colour tone, chroma and lightness differences
Homogeneity	Stability of colour rendering (ΔE00 < 4) and gradation over the surface (normative), pixel error class 0 in accordance with ISO 9241-307 (informative)
Warming up behaviour	Time to achieve stable, reproducible properties after switching on (informative)
ISO 14861:2015 – Requirements for softproofing systems	
Suitability of monitors	Wide gamut flat screens in device classes A and B with hardware that can be calibrated.
Monitor measurements	Use of spectral measurement devices, inclusion of the surroundings (tele-spectroradiometry)
Monitor profiling	Suitability of spectral measurement devices (bandwidth & scanning rate), pos. incl. surroundings (tele-spectroradiometry)
Standard illuminant and geometry	ISO 3664:2009 – Viewing conditions (here in relation to D50 standard illuminat in booths and workplaces for comparison with originals in creation/prepress or with printed copies in soft-proof-to-press applications)
Monitor control	Homogeneity, target gradation (Gamma), gradations free from breaks, accuracy of the ICC display profile, maximum contrast ratio, gamut
Simulation	Contrast ratio, correlated colour temperature, luminance, grey balance, RGB primary values, CMYK-RGB conversion (normative)
Visual judgements	Gradations free from breaks, white point, comparison of softproof to reference print, e.g. roman16 bvdm images or bvdm Altona Test Suite 2.0
Data formats that can be simulated	ISO 15930 (PDF/X-1a, either with information about standard printing condition in the output intent or alternatively with embedded ICC output profile), ISO 12639 (TIFF/IT-CMYK with embedded ICC output profile)
ISO 3664:2009 – Viewing conditions (booths and viewing stations in softproofing applications)	
Conformity classes P1 (high) and P2 (low)	General and special colour rendering index, metamerism index, UV component confirms physically to D50, homogeneity of the illumination, neutral surroundings, servicing devices
Range of illuminance	maximum 2000 lx ± 500 lx, minimum 500 lx ± 125 lx (when dimming the colour temperature should reman as similar as possible, i.e. white point does not shift)

TABLE 8
Standards and criteria for the **use of monitors** for the visual simulation of the printed result and—in conjunction with the viewing lighting—for the comparison of the monitor proof with reflection copy originals and printed copies; suitable products can be certified by Fogra

A.3.2 — Digital colour proof printing (digital proof)

Film-based production has been very largely replaced by filmless computer-to-plate technologies and digital proof printing (digital proofs) or, in some cases, monitor proofs. Digital proofing involves colour management optimized inkjet printing on special paper (proofing medium, proof printing substrate) usually in a A3+ format. The Fogra media wedge placed in the margin and its evaluation table make it possible to measure whether the proof print adheres to the all the aim values and tolerances of the printing method being simulated or make it visually apparent (see also B.3, B.4, C.1.1).

For the first time, the revised 12647-7:2016 part of the standard for digital proof printing incorporates the improved technical resources for lighting and measurement that allow the user to evaluate the differing proportion of optical brightener in the various printing papers

TABLE 9
Suitable areas for digital proof printing.

Process monitoring	Aim values and tolerances
job related	see Table 30 in section C.3
periodic and/or cause related	see Table 31 in section C.3.1

TABLE 10
Selection criteria for **proof printing substrates**
(See Table 29 for figures)

Criterion	in agreement with the production substrate	Simulation of the production paper colouring
Colouring	'white'	–
Fluorescence (optical brightening)	'moderately brightened' for new printing condition 1	no (the standard profile already takes into account the colouring and fluorescence of the appropriately chosen proof substrate)
	'strongly brightened' for new printing condition 5+	
	'brightener-free' for all printing conditions that continue to be valid	yes (production paper colouring plus bluish adjustment of the fluorescence)
Gloss	'matt, 'semi-/satin matt' or 'glossy'	–

(especially printing substrates 1 and 5+; see Table 3) and to take this into account in proof and production run printing quality assurance. Recently launched proof printing substrates with graduated levels of OBA in three different gloss grades are available for this (Tables 10 and 29).

Production in accordance with the new offset printing conditions 1 and 5+ allows a noticeable improvement in quality and consequently an enhanced perception of technically challenging printed messages, which is important to many customers. The switch entails adoption of a D50 standard illuminant with optimized UV component in accordance with ISO 3664:2009 and M1 measurement mode in accordance with ISO 13655:2017 (Table 27). Compared with previously, both standards support better visual and quantitative agreement between brightened proof and production prints.

If, in parallel to the above, old printing conditions (e.g. offset printing with profiles based on FOGRA39 and FOGRA47 characterization data) continue to temporarily be used in production, this does not mean that the adjustment of the standardized lighting on the press desks should be delayed. At least one central approval position should be retained in order to view brightener-free proof prints and offset copies under a low-UV standard illuminant and approve the OK sheet. In accordance with the characterization data (cf. Table 19a/b/c) measurement mode M0 should then be selected on the measurement device.

The proofing medium should always be chosen on the basis of the brightener content of the substrate. Uncoated, woodfree white papers are generally strongly brightened (new printing condition 5+), premium-coated offset papers moderately (new printing condition 1). In other cases the brightener content is determined by measuring the substrate—either the absolute difference between the measurement modes | M1–M2 | (see Table 27) on the CIELAB yellow-blue axis, i.e. Δb*, or the 'D65 brightness' ΔB in accordance

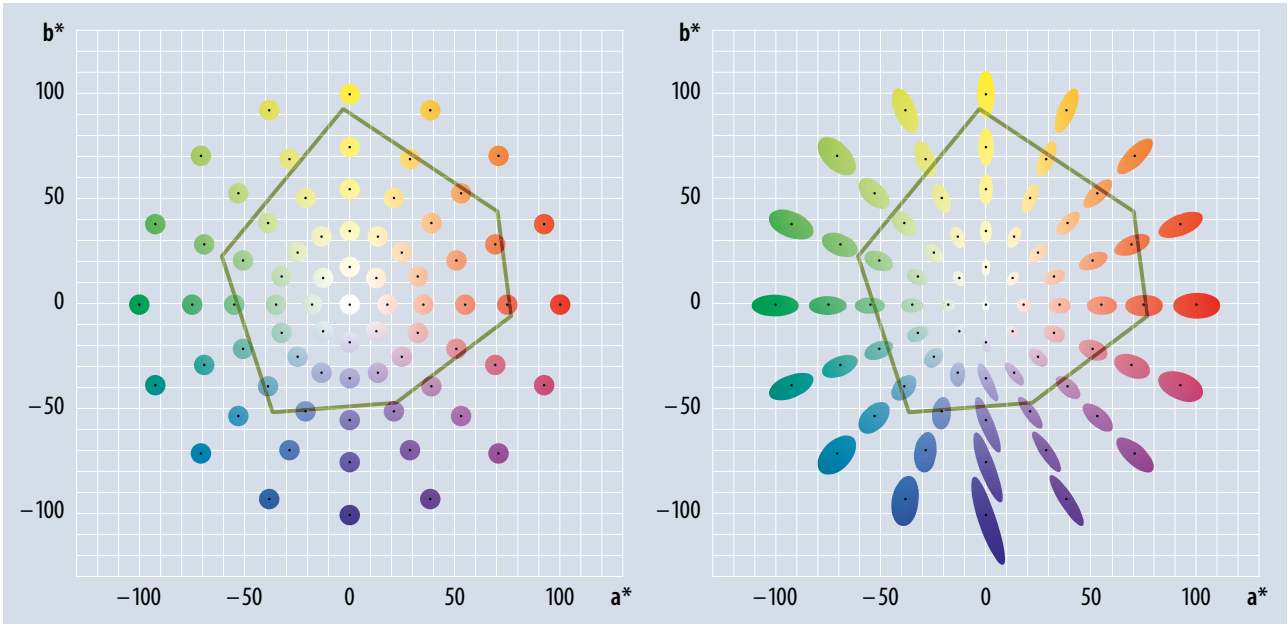

FIGURE 1
Comparison of the ΔE^*_{ab} (left, tolerance level 5 DeltaE units) and ΔE^*_{00} (right, tolerance level 2 DeltaE units) **colour difference formulae** in the a*b* colour chart of the CIELAB colour space. The Fogra51 gamut is marked to make the diagrams easier to understand. [based on a Colorware.eu chart]

with ISO 15397:2014 or ISO 2470-2:2008 (see Tables 10 and 29). As a result, in most cases it is not necessary to colorimetrically simulate the production paper colouring, including a bluish cast for the fluorescence, for the two new printing conditions with significantly brightened papers. Furthermore, the gloss of the proof substrate (glossy, matt, semi-matt, matt satin etc.) should be adjusted to that of the production substrate.

A.3.3 — New colour difference formulae in proof printing

In ISO 12647-7:2016 the new CIE ΔE^*_{00} ('CIEDE2000', 'dE2000') colour difference formula replaces the previous CIE ΔE^*_{ab} ('CIELAB(1976)') colour difference formula, which is still valid in other parts of the standard (cf. Table 28). CIEDE2000 responds to the need to achieve greater perceptual uniformity in the colour space. Weighted parameters mean that old ΔE^*_{ab} and new ΔE^*_{00} values cannot be converted into one another. Fig. 1 clearly shows the primarily chroma dependent differences of the two formulae in the colour space.

The colour differences and tolerances that are now calculated with CIEDE2000 do indeed exhibit altered values but fundamentally the real room for manoeuvre in the proof printing process remains almost unchanged, with few exceptions (Table 30). In order to avoid misunderstandings, in future, when evaluating the Fogra media wedge, the colour difference formula used should always be specified in the records—with the subscript '00' instead of 'ab' after the DeltaE, i.e. ΔE^*_{00} instead of ΔE^*_{ab}. This is particularly important because during the transitional phase old and new printing conditions are being processed in parallel in the workflow and so proof prints will still be produced in accordance with the old criteria.

→ See 'ProcessStandard Offset 2012' A-36ff, B-98ff as well as the '2016 revision' Ch. 3.2, 4.3 and 4.4 for the production and use of digital proofs.

A.3.4 — Press proof

Press proofs produced on special proofing presses are a thing of the past. Today, short proofing runs are produced on the target press with authentic papers and inks (Section B.3.2). Frequently this is an opportunity to test the feasibility (material compatibility, technical possibilities) and effect (eg. gloss, feel) of demanding finishing jobs.

→ See 'Process Standard Offset 2012' B-81ff, B-115ff and the '2016 revision' pp. 47ff for the production of press proofs

A.4 — Control means and resources

→ See 'ProcessStandard Offset 2012' A-91ff, B-175ff, C-13ff for the structure and application of control means and resources

TABLE 11
Control means and resources
for various process stages

Application	Control means	in MSP section
Digital proof print	Fogra CMYK media wedge 3.0 new: MultiColor 3.0 CMYK5c/6c/7c/8c	C.1.1
Offset platemaking, including newspaper printing	Ugra/Fogra digital plate wedge	C.1.4
Offset printing	Fogra damping monitoring test forme	C.7.2
Offset printing	Ugra/Fogra PCS press control strip	–
Newspaper printing	Ugra/Fogra-DKL-Z	–
Grey balance in offset printing	ECI/bvdm Gray Control Strips	C.4.3
Visual colour temperature evaluation for proof and production printing	Ugra colour temperature indicator	–
Colour rendering or softproofing capabilities of monitors	Ugra Display Analysis and Certification Tool (UDACT)	B.5.1
Comprehensive application	**Work resource**	**in MSP section**
Prepress and printing	bvdm 'roman16' reference images	C.4.1
Prepress and printing	'Altona Test Suite 2.0' application package	C.4.2

B

Guidelines for the Delivery of Data and Proof Prints for Printing

B.1 — File formats

B.1.1 — Delivery of complete composite documents and image files

Generally, the ICC profiles of the media-neutral data (RGB) and the reference printing condition (CMYK, multi-colour printing method) should be embedded in the documents or made available to the recipient. By agreement, the latter option can take the form of a clear reference to a generally known profile source.

Essentially, for the exchange of made up documents, use of the ISO 15930 (PDF/X) series of international standards is recommended for the generation and delivery of PDF/X composite files. It is possible to directly generate print-ready PDF/X files in layout and graphics programs such as Adobe Acrobat. The loss-free bitmap-TIFF/IT or TIFF formats can be used for the exchange of individual images. Conversely, 'open' files (from design programs such as Adobe InDesign and QuarkXPress for made up documents or Photoshop for images) should only be delivered once specific agreement to do so has been reached.

For a PDF workflow that is as fault-free as possible PDF/X specifications should be used that are based on at least PDF 1.4 and that support a complete exchange—with the exception of multi-colour applications (n component). Incomplete exchange and external references (PDF/X-4p, /X5-g, /X-5pg) can certainly be helpful but they are unsuitable for consistent, standarized workflows. The same is true for the PDF/X-6 versions expected in 2018. These are already based on PDF 2.0, which offers stronger multimedia functionality.

Table 12 offers an overview of the relevant PDF/X conventions. The use of PDF/X-1a is recomended for the 'Early Binding' (early in terms of adopting print-oriented CMYK output) and 'Intermediate Binding' (later adoption) workflow strategies. PDF/X-4 is recommended for 'Late Binding' (working with three-channel data for as long as possible). PDF/X-4 preserves numerous document settings such as transparencies, layers and device

independent colour information i.e. it is open for documents whose elements are in different colour spaces and described through their own ICC profiles. Generally, the printing condition is determined by means of the output intent, and the data are therefore only converted into the colour space of the reference printing profile just before printing (or before the output of a monitor proof or proof print).

→ See "ProcessStandard Offset 2012" B-38, B-60ff for the generation and forwarding of PDF/X composite files as well as the 'PDFX-ready' website in order to download detailed instructions for Adobe InDesign and QuarkXPress including PDF/X-Preflights: www.pdfx-ready.ch/index.php?show=485

→ "PDFX-ready textbook 2016" www.pdfx-ready.ch/files/PDFX-ready_Leitfaden_2016_Screen.pdf including reference to the new standard printing conditions

TABLE 12
Use of **PDF/X** composite-files

Conformity	ISO 15930	PDF	Exchange	ICC profiled contents	Output-oriented	Media neutral	Use
PDF/X-1a	-4:2003	1.4	complete	not allowed	CMYK, spot colours	no	recommended for 'Early Binding' and 'Intermediate Binding'
	-1:2001*	1.3	complete	not allowed	CMYK	no	
PDF/X-3	-6:2003	1.4	complete	allowed (ICC v2)	Grey, CMYK	RGB, CIELAB	replaced by PDF/X-4
PDF/X-4	-7:2008/ Rev.2010	1.6	complete	allowed (ICC v2, v4 to embed as output intent)	Grey, CMYK, spot colours (CxF3; CIELAB)	device independence retained; RGB	recommended for 'Late Binding'; supports transparencies, layers, 16 bit, OpenType, JPEG2000, variable content (PDF/VT, PDF/VCR-1: Table 7)
PDF/X-4p			incomplete	allowed (external profile reference)			
PDF/X-5n	-8:2010/ Cor.1:2011	1.6	incomplete	reference to external n-channel ICC profile for output intent allowed	n-component	no	only recommended for multi-colour jobs
PDF/X-5g, 5pg				allowed (profile reference combinable in 5pg)	Grey, CMYK	RGB	extended PDF/X-4 workflow; external referencing of HiRes data (5g)
PDF/X-6	-9:201X	2.0	complete	allowed (ICC v2, v4 to embed as output intent)	Grey, CMYK	device independence retained; RGB	replaces PDF/X-4, as soon as available; different output intents on page level
PDF/X-6p			incomplete	reference to external profile allowed			
PDF/X-6n				allowed (n-channel output intent)	n-component; spot colours: CxF/X-4	no	only recommended for multi-colour jobs, as soon as available (CIELAB, spectral)

* still in use for Adobe InDesign

B.1.2 — Printing conditions and ICC profiles in digital supply chains

The workflows portrayed in Table 13 and figures 2, 3, 4 are filmless, in line with current practice. Here, the transition to digital data (digitization) occurs with the scanning of an original, if not before. Nowadays, however, it is normal for a scene to be captured by a digital camera as well as for the documents that are forwarded to be fully digitized. This means that the application of ICC profiles at the various stages in the process is of great importance.

→ See "ProcessStandard Offset 2012" B-7ff, B-33ff for ICC profiles in conjunction with typical workflows

Supplied data type	Media specific workflow (see fig. 2)	Media neutral workflow (see fig. 3)		Classic media specific workflow (see fig. 4)
Colour format of 'scanner' and 'digital camera' data sources	RGB with input profile	RGB with input profile		Direct separation in the CMYK target colour space of the reference printing condition
Colour formats for editing	CIELAB, RGB (e.g. eciRGB_v2), CMYK, eg. gravure colour space. CMYK separation with rendering intent: perceptual	CIELAB, RGB (e.g. eciRGB_v2)		CMYK
Proof print generation	Absolute colorimetric from the CMYK simulation colour space to the CMYK proof print colour space, with original paper relative colorimetric	Perceptual rendering intent: from three channel colour space to the proof print colour space		Directly from the CMYK data of the printing condition to the CMYK proof printer
Delivery for printing as	CMYK data, 8 bit	CIELAB, RGB data (e.g. eciRGB_v2), 8/16 bit		CMYK data, 8 bit
Proof print delivery, ICC profiles	Proof print for reference printing condition, reference printing profile	Proof print without reference print profile (not recommended)	Per printing condition: 1 proof print and 1 reference print profile	Proof print for reference printing condition, possibly reference printing profile
Significance of proof print	Contract	Non-contract	Contract	Contract

TABLE 13
Typical digital workflows from the original to delivery for printing.

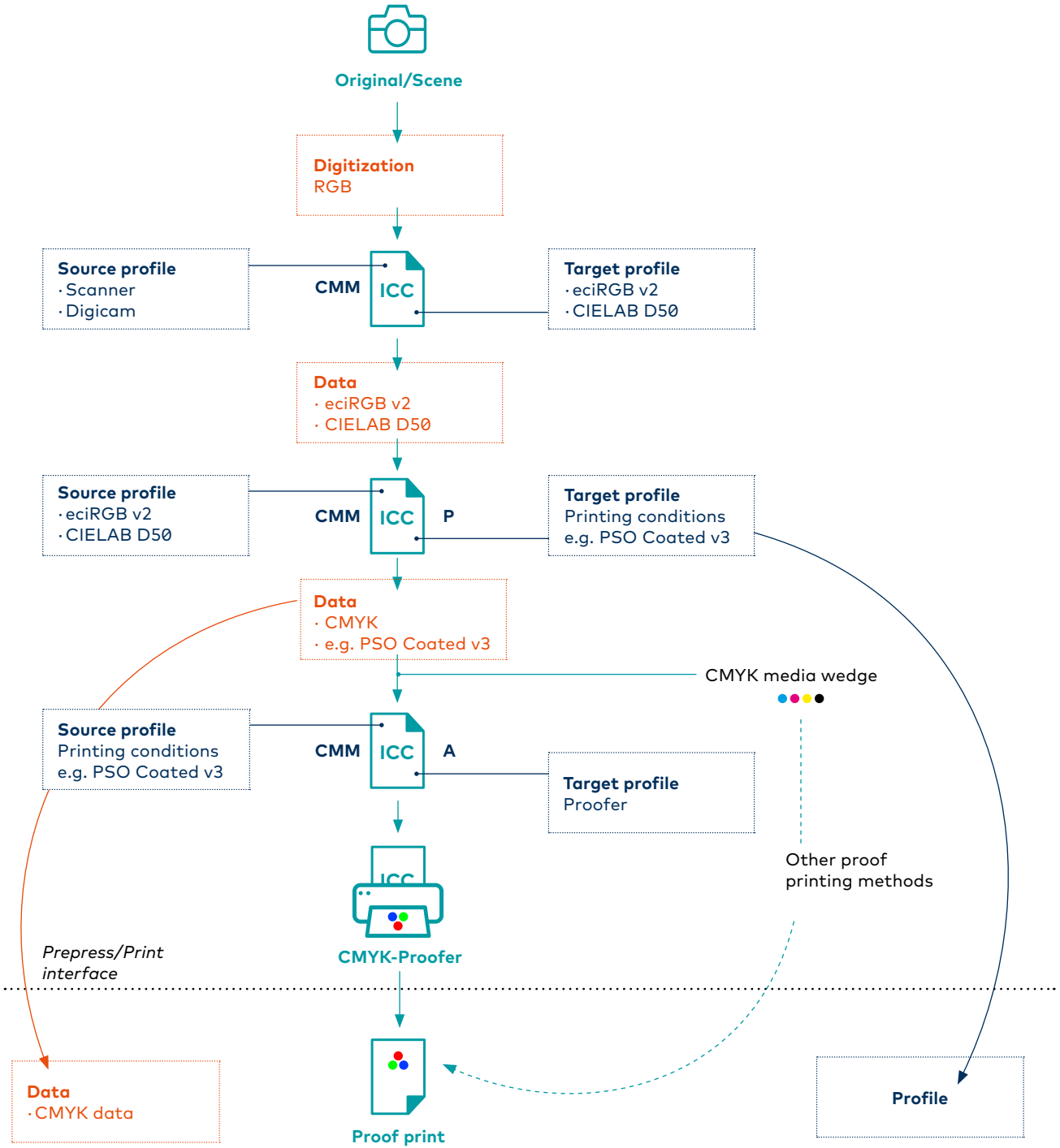

FIGURE 2

In the **media specific workflow** the data is left at the three-channel stage for as long as possible. It only has to be converted into the CMYK for the intended printing condition for the proof printing and the page composition. Clearly therefore the relevant ICC profile and an associated proof print must be supplied for each printing condition.

Key

- Workflow
- Alternative path
- Profile
- Colour space
- CMM Colour transformation

Rendering intent:

- P Perceptual
- A Absolute colorimetric

Also see:

→ CMM
→ Rendering intent
→ Perceptual
→ Absolute colorimetric

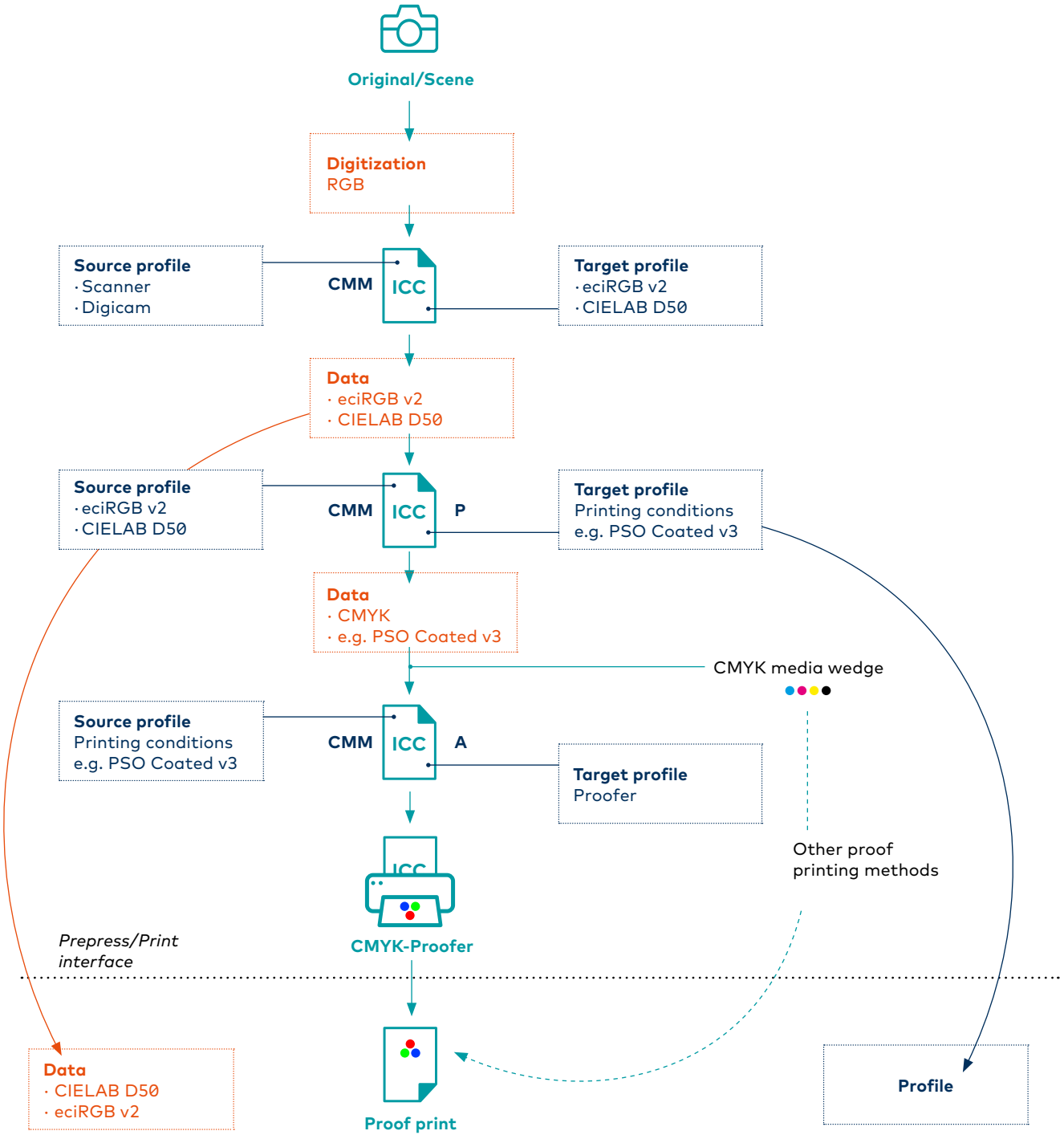

FIGURE 3
Three-channel image data are delivered in the **media neutral workflow**. The CMYK separation for the relevant printing conditions therefore only takes place at the printing company. CMYK data only need to be generated at the repro stage for proof printing but this needs to be done individually for each intended printing condition.

Key

- Workflow
- Alternative path
- Profile
- Colour space
- CMM Colour transformation

Rendering intent:
- P Perceptual
- A Absolute colorimetric

Also see:
- → CMM
- → Rendering intent
- → Perceptual
- → Absolute colorimetric

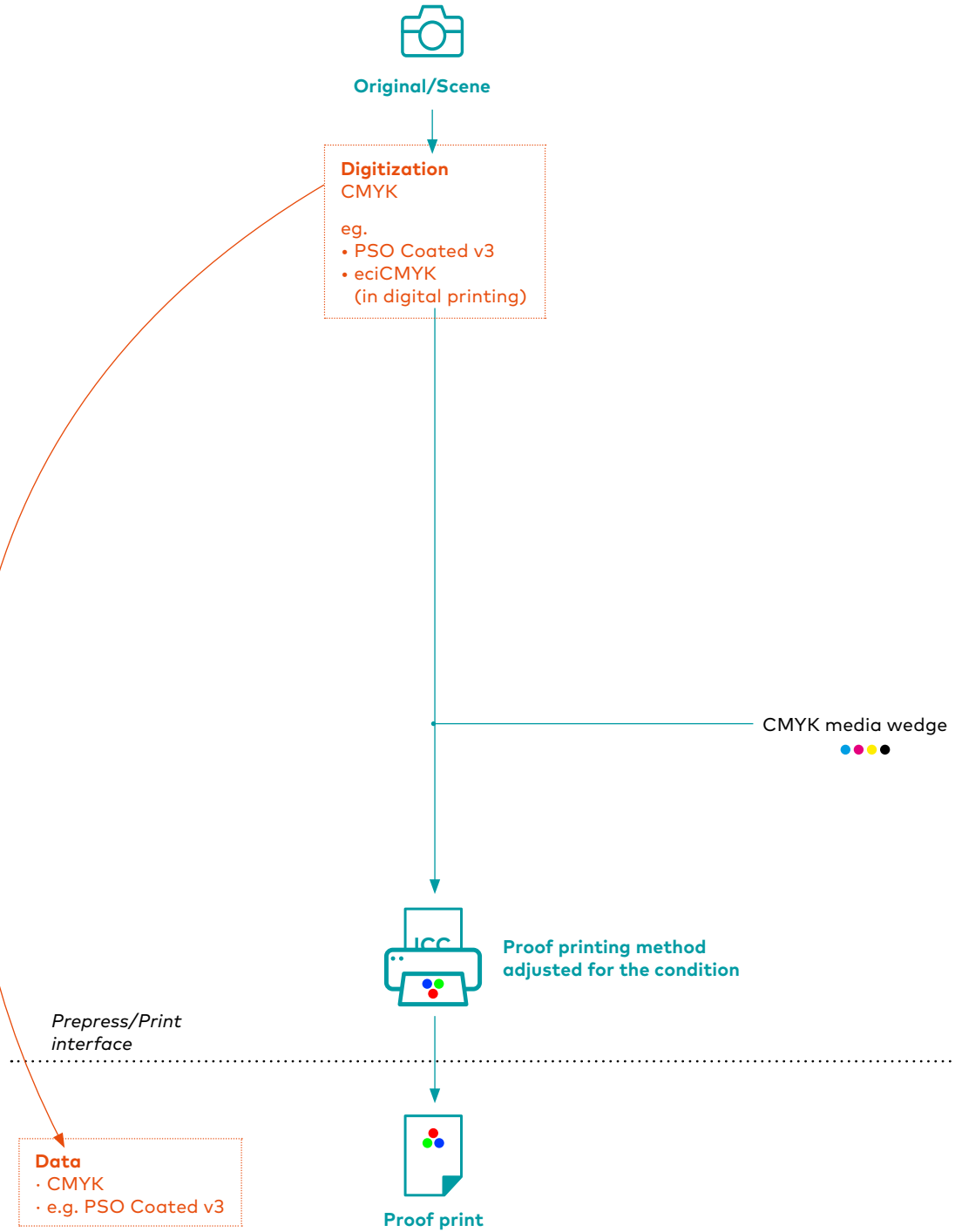

FIGURE 4
The **classic media specific** reproduction method, which is still sometimes encountered today, generates CMYK data for the intended printing condition right from the scanning in of the original. Image editing takes place in the CMYK colour space. A press or a proof printing system adjusted for the printing condition in question is used to check the printing formes after their production.

The eciCMYK working colour space (Table 1) introduced in 2017 should only be used as an exchange colour space for digital printing in order to avoid unnecessarily restricting the large gamut with a profile typical of offset. In offset itself it is preferable to use either classic, media-specific 'Early Binding' with an offset profile such as PSO Coated v3 or 'Late Binding' with eciRGB v2 (Figures 2 and 3). If eciCMYK is used with any other printing method (not recommended), including proof printing, an adjustment must be made for the actual printing conditions.

Key

Workflow

Colour space

B.2 — General guidelines (data, proof and production prints)

B.2.1 — Screen angle and dot shape

The part of the ISO 12647 series of standards that is relevant depends upon the printing method. The angles and **screen rulings** of the colours are subject to the usual small variation due to the screening program in question.

With non-standardized multi-colour applications each secondary colour defined as a separation in its own right takes an angle of the CMY primary colours that have been replaced in the image motif, e.g. red (orange) takes M, green Y and blue (violet) C. In the case of non-periodic screens (FM and hybrid screens), colour separations do not exhibit regular dot shapes and distributions and, consequently, no preferred angles. Print control strips should be generated using the chosen screening mode (dot shape, ruling). In the usual screening programs the 'screen ruling' and 'screen angle' parameters are both varied slightly from one colour to another in order to minimize moiré formation. Consequently, the classic set of angles is seldom encountered in its pure form.

B.2.2 — Screen ruling

The screen ruling is linked to the printing method and is chosen in accordance with the guidelines of the corresponding part of the ISO 12647 series of standards. For example, in offset a range of screen rulings (54/cm to 80/cm) can be used depending upon tone value increase curves ('characteristic printing curves') A to F from ISO 12647-2 (see 'CtP screen' and 'Tone value increase' columns in Table 19a/b/c). If screens with higher or lower screen rulings than those envisaged are used then the values in the CtP-RIP should be adjusted accordingly, since the characteristic printing curve is altered. The ISO standard and ProcessStandard Offset provide appropriate mathematical relationships. In the case of very fine screens the colour space and colour rendering also change.

The diameter of the smallest screen element in non-periodic screens (FM and hybrid screens) should be in the region of 20 µm (coated papers) and 30 µm (uncoated papers). Smaller screen elements are unstable whilst significantly larger ones can be visible and form disruptive patterns.

→ See "ProcessStandard Offset 2012" B-69ff for screening as well as, in particular, its influence on tone value increase and colour space

Dot type	Angular spacing	Main colour ref. angle	Dot closure (in data set)
Chain dot (recommended)	60° between C, M and K; Y 15° from one of the former	45° or 135° (= 45° + 90°)	Two dot closures between 40 % and 60 %
Circular and square dot	30° between C, M and K; Y 15° from one of the former	45°	One dot closure at 50% (therefore no longer normal)

TABLE 14
Angles and dot shapes for periodic screening in the case of offset printing in accordance with ISO 12647-2

B.2.3 — Trim and trim allowance

Trim values also have to be specified in PDF/X for complete format information. Table 15 explains the significance of the various boxes in PDF document pages.

B.2.4 — Printing tone value range

Important parts of an image should not employ tone values that lie outside the printable tone value range in the data. For the usual screen rulings the regions in question are as follows.

- Sheet-fed offset, heatset and narrow web offset: 2% to 98%, safe 3% to 97%, on uncoated paper 4% to 96%
- Coldset web offset printing (newspaper printing): 3% to c. 90%, even larger in waterless coldset
- Gravure: 3% to 95%
- Flexo: depending on substrate (film, paper, corrugated) and use of a hybrid screen spreading in highlights and shadows.

B.2.5 — Maximum tone value sum

Total ink coverage for solids of the four CMYK inks in superimposed printing theoretically amounts to 400%. In order to save ink and to achieve faster drying, redundant components of the colour separations are underprinted or replaced in a stable and beneficial way. Such separation settings are supported in the ICC profiles of the standard printing conditions (see the 'TVS' column in Table 19a/b/c) and elsewhere or if necessary can be achieved with individual DeviceLink profiles.

- Sheet-fed offset: ≤ 330%, usually 300%
- Heatset web offset: coated papers ≤ 300%, uncoated papers ≤ 270%
- Coldset web offset: ≤ 240%, in the v5 standard profile 220%
- Gravure: ≤ 360% (ProcessStandard Gravure), frequently ≤ 340%

TABLE 15
Boxes in PDF documents

PDF box	Meaning	Reference to the trim
Media Box	Outer limit	Encompasses all the other boxes incl. trimmed areas and register crosses; all elements extending outside it are ignored
Bleed Box	Bleed box	Trim allowance; should be at least 3 mm larger than the trim box on all four sides.
Trim Box	Trim box	Trimmed page format
Art Box	Object box	Includes all objects found on a document page; PDF/X files align with the Trim Box and ignore the Art Boxes
Crop Box	Mask box (only virtual)	Internal setting, that has an effect whether the trimmed (Trim box) or untrimmed (Media box) document pages appear in the monitor simulation.

Parameter	Explanation	Values, region	In the new ICC profiles 'PSO Coated v3 (FOGRA51)' 'PSO Uncoated v3 (FOGRA52)'	'WAN-IFRA-newspaper269v5'
GCR strength	Pre-set in separation and profile generation programs	Not above 70% without print trials	50%	n/a
Max. black	Maximum tone value of the black separation in the image shadows	85% and 100%, preferably > 95%	96%	100%
Black lengths and start point ('Start-black' in %)	Black composition along the L* axis of the CIELAB colour space; gives the tone value from which chromatic primary colours are supplemented or replaced by black	'Short black' only in dark tones, 'long black': up to and into high-light region	9 (Start point 10%)	Max. (EP 0%)
Black width	Black composition along the C^*_{ab} axis of the CIELAB colour space; the higher the value the stronger the black used even for colours with higher chroma	'Narrow black': only in colours on or near the grey axis, black supplements or replaces the chromatic primary colours	10	100
Max. tone value sum	Total ink coverage of the solids of the four inks	See B.2.5	300%	220%

TABLE 16
Colour composition settings

B.2.6 — Colour composition

Conventional black composition with long black (Under Colour Removal, UCR) has largely been supplanted by achromatic composition (Grey Component Replacement, GCR).

→ See "ProcessStandard Offset 2012" B-16f, B-30, B-53ff, B-64f for colour composition

B.2.7 — Printing marks

Corner, fold, centre and cutting marks must be positioned at the right angles. Register crosses should be applied between 2 and 4 mm from the edge of the image. In the case of bled motifs, register crosses should be positioned directly at the edge of the image. Printing mark lines should be no more than 0.1 mm wide.

B.2.8 — Black solids

In multi-colour printing black solids can be underlain with c. 50% cyan.

B.2.9 — Trapping

When line and image elements are combined, appropriate trapping is advisable just before output to the RIP. Its normal extent (0.1 mm, more for light substrates and large formats) is based on the register tolerances of the relevant part of the ISO 12647 series of standards. The customer needs to provide details of the extent of the trapping (in the PDF/X trapped key).

→ See "ProcessStandard Offset 2012" B-68 for trapping, register crosses, printing marks and labelling of the imposed sheet

Tone value range	Cyan	Magenta	Yellow	L*	a*	b*
Quarter tone	25.0%	18.4%	18.6%	75.6	0.8	–3.1
Mid tone	50.0%	40.9%	40.1%	56.7	0.5	–2.2
Three quarter tone	75.0%	68.9%	69.9%	39.0	0.3	–1.4

TABLE 17
Non-contract grey balance values in accordance with ISO 12647-2:2013 that typically serve as a guide if no standard ICC profile is applied

B.2.10 — Grey balance recommendation

The values in Table 17 do not apply in conjunction with reference printing conditions (characterization data and ICC profiles); in the latter case actual grey balance conditions should be used and the grey balance should be checked and controlled with the aid of the 'GrayCon' wedge (see section C.4.3)

→ See "ProcessStandard Offset 2012" B-225ff for colour or grey balance

B.2.11 — Appraisal

An opaque, matt white backing (lightness L* > 92, chroma C* <3) without optical brightener should be used for appraising proof prints. Reflection copy, press proofs and image proof prints as well as production copies should be compared under the following lighting conditions in accordance with ISO 3664:2009:

- D50 (5000 kelvin) standard illuminant with physically correct UV component
- Illuminance; 2000 lx ± 500 lx
- Glare-free angle between illumination (angle of incidence 0°) and observation (viewing angle 45°)

→ See "ProcessStandard Offset 2012" A-33ff for appraisal

B.2.12 — Completeness of the data

If, contrary to recommendations, PDF/X files are not suppplied, then fonts contained in the document should be embedded and imported image files and fine data should also be delivered. For PDF/X documents containing low volumes of data 'Open Prepress Interface' (OPI) automatically swaps coarse data for fine data on output; alternatively PDF/X-5g and /X-5pg allow external fine data to be referenced. OPI comments are suppressed in PDF/X.

B.2.13 — Resolution of the image data

In order to avoid excessive imaging times during the computer-to-plate process, the resolution of the supplied data should be limited to the suggested values (Table 18).

Screen type	Rule of thumb	Typical resolution
Periodic	2 pixels per screen line, eg. 120 pixel/cm for screen ruling of 60/cm	300 ppi
Non- periodic	1 pixel per five times smallest screen dot diameter, eg. 100 pixel/cm for a 20-µm dot	250 ppi
Gravure	1 pixel per advance step	–

TABLE 18
Suggested **resolution values** (pixels per inch) for the delivery of unscreened data. These pixel values should not be exceeded by more than a half

B.3 — Proof print when supplying media neutral data (eg. eciRGB_v2)

In this instance, a specific proof print or press proof is supplied (see Table 13, Fig. 3 as well as sections B.3.1 and B.3.2) for every printing condition (Table 19a/b/c and 20, 21, 22, 23). When delivering data the ICC reference printing profile for the printing condition used for proof print generation or separation should also be delivered.

B.3.1 — Digital proof print

A Fogra CMYK media wedge (see section C.1.1) must be placed on the proof print and its colour values must correspond to the aim values of the reference printing condition. Section C.3 describes the requirements for monitoring the colour accuracy and other criteria of proof prints. Special notice should be taken of the Fogra CMYK media wedge tolerances in accordance with ISO 12647-7:2016 and the required status information (status line) on the proof print. The proof print substrate should match the production substrate in terms of brightening and gloss (Table 10). The footer on the proof print should contain the file name and the production date, as well as the name of the software, the proof printing system and the source and reference printing profiles used.

B.3.2 — Press proof

The press proof should be made on the production substrate by the target press or, alternatively, on the same type of substrate or in the same gamut class of the printing method in accordance with ISO 12647. A press control strip must be present on the sheet and this must allow the **solid colourings** and the **tone value increases** of the CMYK and spot colours to be measured. In all cases, the tone value increases must lie within the tolerances laid down in the appropriate part of the ISO 12647 standard for proof prints/press proofs.

In all cases, the solid colouring on the sheet must correspond to the CIELAB specification of the relevant part of ISO 12647. The comparison should be made by means of colour measurement. In the case of offset it should also be made visually on the basis of colour specimens for CMY. In the case of black ,densitometric comparison is preferable.

The footer of the press proof should contain the file name and the productiuon date as well as the names of the source and reference printing profiles used for making the press proof plate.

B.4 — Proof print when delivering print-ready data (CMYK and spot colours)

A proof print or press proof should be delivered that is tailored for the intended printing condition (Table 19a/b/c), see Fig. 2 and Table 13. The ICC output profile (reference printing profile) used for proof print production or separation should also be delivered along with the data.

B.4.1 — General information for the delivery of CMYK separated data

The maximum value for the tone value sum (C+M+Y+K) should not exceed the value given in section B.2.5. The tone value range should be based on the specifications of the relevant part of the ISO-12647 series. This also applies to the tone value range laid down in the image data set. The tone values for an image should not lie outside the tone value range specified for the printing method variant in question.

Additional infomation (eg. job ticket info): the characterization data and the colour composition (tone value sum, UCR, GCR, black gradation) or black primary colour (beginning and end of tone value range) settings, the ICC output profile for the output printing condition used for the separation of the colour data should be specified. Trapping details should also be provided.

B.4.2 — Digital proof print

A Fogra CMYK media wedge (see section C.1.1) must be placed on the proof print. Its colour values must correspond to the aim values of the relevant part of the ISO 12647 series of standards (see Table 20, 21, 22, 23). Section C.3 describes requirements for monitoring the colour accuracy and other criteria of proof prints. Special care should be taken over the Fogra CMYK media wedge tolerances in accordance with ISO 12647-7 and the required status information (status line) for the proof print. If the proof printing system supports it, the new Fogra MultiColor 3.0 media wedge (for 5c, 6c, 7c and 8c) should be used. Remember: ISO 12647-7:2016 uses a different colour difference formula (see Table 30 and 31), which is indicated by the DeltaE subscript ('00' instead of the previous 'ab'). The footer of the proof print should contain: file name, date, name of the proofer profile as well as the ICC reference printing profile for the printing condition, and possibly also details of the proofer RIP software and proof printer.

B.4.3 — Press proof

A press control strip allowing the solid colourings and tone value increases for CMYK and spot colours to be measured must be present on the sheet. Press proof and production substrate should be identical or belong to the same gamut class. Accordingly, the values for the solid colourings, tone value increases and tolerances are the same as those for the corresponding part of the ISO 12647 series of standards. For offset printing, appropriate colour specimens (reference prints) from the 'Altona Test Suite' can be used. The comparison is then carried out either visually or by means of colour measurement, preferably densitometrically in the case of black. The footer of the press proof should contain the following details: file name, output date, as well as the source and reference printing profiles used to make the press proof plate.

TABLE 19A

Printing conditions and profiles in MediaStandard Print 2010; see also Table 3; measurement conditions for characterization data: modes M0 and M1 (see Table 27) and white backing (wb = 'white backing') or intentional deviations (bb = 'black backing' or sb = 'substrate/self backing')

Printing method	Paper type (PT)	Screen	TVS	ICC profile 'Title', file name	Characterization data FILENAME.txt	Measure	Tone value inc. at 40% Chromatic	Black
References: bvdm ProcessStandard Offset 2001/2003, ISO 12647-2:2004 and ISO 12647-2:2004 supplement/Amd.1:2007, ECI 2003–2009								
Offset (K–C–M–Y)	1/2 'illustration printing, wood-free, white, glossy/matt coated'	60...80/cm	330%	'ISO Coated v2 (ECI)', ISOcoated_v2_eci.icc	FOGRA39L	M0, wb	A (13%)	B (16%)
			300%	'ISO Coated v2 300 (ECI)', ISOcoated_v2_300_eci.icc	FOGRA39L	M0, wb	A (13%)	B (16%)
		120...160/cm, NP 20µm	330%	'PSO Coated NPscreenISO 12647 (ECI)', PSO_Coated_NPscreen_ISO12647_eci.icc	FOGRA43L	M0, wb	F (28%)	F (28%)
			300%	'PSO Coated 300 NPscreenISO 12647 (ECI)', PSO_Coated_300_NPscreen_ISO12647_eci.icc	FOGRA43L	M0, wb	F (28%)	F (28%)
	3 'LWC paper' (Light Weight Coated, divided into improved LWC-I and standard LWC-S since 2009)	60...80/cm	300%	'PSO LWC Improved (ECI)', PSO_LWC_Improved_eci.icc	FOGRA45L	M0, wb	B (16%)	C (19%)
			300%	'PSO LWC Standard (ECI)', PSO_LWC_Standard_eci.icc	FOGRA46L	M0, wb	B (16%)	C (19%)
	4 'uncoated paper, wood-free white'	60...80/cm	320%	'PSO Uncoated ISO12647 (ECI)', PSO_Uncoated_ISO12647_eci.icc	FOGRA47L	M0, wb	C (19%)	D (22%)
		120...160/cm, NP 20µm	300%	'PSO Uncoated NPscreenISO 12647 (ECI)', PSO_Uncoated_NPscreen_ISO12647_eci.icc	FOGRA44L	M0, wb	F (28%)	F (28%)
	5 'uncoated, yellowish paper (book printing)'	60...80/cm	320%	'ISO Uncoated Yellowish', ISOuncoatedyellowish.icc	FOGRA30L	M0, wb	C (19%)	D (22%)
Ciontinuous forms offset (K–C–M–Y)	2 'illustration printing, wood-free, white, matt coated'	60...80/cm	350%	'ISO Continuous Forms Coated', ISOcofcoated.icc	FOGRA31	M0, wb	A (13%)	B (16%)
	4 'uncoated, wood-free, white paper'	60...80/cm	320%	'ISO Continuous Forms Uncoated', ISOcofuncoated.icc	FOGRA32	M0, wb	C (19%)	D (22%)

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Printing method	Paper type (PT)	Screen	TVS	ICC profile 'Title', file name	Characterization data FILENAME.txt	Measure	Tone value inc. at 40% Chromatic	Black
References: bvdm ProcessStandard Offset 2001/2003, ISO 12647-2:2004 and ISO 12647-2:2004 supplement/Amd.1:2007, ECI 2003–2009								
Heatset-web offset (K–C–M–Y)	SC 'Super Calendered' (supplements heatset printing conditions)	60…80/cm	270%	'SC Paper (ECI)', SC_paper_eci.icc	FOGRA40L	M0, wb	B (16%)	C (19%)
	MFC 'Machine Finished Coated' (supplements heatset printing conditions)	60…80/cm	280%	'PSO MFC Paper (ECI)', PSO_MFC_paper_eci.icc	FOGRA41L	M0, wb	B (16%)	C (19%)
	SNP 'Standard News Print' (newsprint; supplements heatset printing conditions)	60…80/cm	260%	'PSO SNP Paper (ECI)', PSO_SNP_paper_eci.icc	FOGRA42 (not supported because bb measurement)	M0, bb	C (19%)	D (22%)
References: WAN-IFRA 2004, ISO 12647-3:2005, WAN-IFRA Special Report 2.37 'Revision of ISO 12647-3' 2005								
Coldset-web offset (C–M–Y–K)	SNP 'Standard News Print' (newsprint)	40…48/cm	240%	'ISO Newspaper 26', ISOnewspaper26v4.icc, ISOnewspaper26v4_gr.icc (grey profile, primarily for internal application)	IFRA26L	M0, wb	A_c (26.2% at 40%, 26.0% at 50%)	
References: ISO 12647-4:2005, ECI ProcessStandard Gravure 2009								
Publication gravure	LWC Plus (Improved LWC, replaces HWC)	Y 54…70/cm, CM 60… 80/cm, K 60… 100/cm (in profiles CMYK 68/cm)	360%	'PSR LWC PLUS V2 PT', PSR_LWC_PLUS_V2_PT.icc	ECI_PSR_LWC_PLUS_V2	M0, sb	17% (for information)	
	LWC Standard			'PSR LWC STD V2 PT', PSR_LWC_STD_V2_PT.icc	ECI_PSR_LWC_STD_V2	M0, sb		
	SC Plus			'PSR SC Plus V2 PT', PSR_SC_Plus_V2_PT.icc	ECI_PSR_SC_Plus_V2_PT	M0, sb		
	SC Standard			'PSR SC STD V2 PT', PSR_SC_STD_V2_PT.icc	ECI_PSR_SC_STD_V2	M0, sb		
	News Plus (for gravure on improved newsprint)			'PSR gravure MF', PSRgravureMF.icc	PSRgravureMF_ECI2002	M0, sb		

TABLE 19B

Printing conditions and profiles – 2012 changes and extensions; also see Table 3; measurement conditions for characterization data: M0 mode (see Table 27) and white backing (wb = 'white backing')

Printing method	Paper type (PT)	Screen	TVS	ICC profile	Characterization data		Tone value increase at 40 %	
				'Title', file name	FILENAME.txt	Measure	Chromatic	Black
References: bvdm ProcessStandard Offset 2012, ECI INP and Surface Finishing 2012, bvdm Altona Test Suite 2.0 2013								
Finished sheet-fed offset	1/2 + OPP matt film	60…80/cm	300 %	'PSO Coated v2 300% Matte laminate (ECI)', PSO_Coated_v2_300_Matte_laminate_eci.icc	FOGRA49 (modified for special application)		13 % plus 10 % film 5…7 % UV coat 2…4 % disp. coat	16 % plus 10 % film 5…7 % UV coat 2…4 % disp. coat
	1/2 + OPP gloss film	60…80/cm	300 %	'PSO Coated v2 300% Glossy laminate (ECI)', PSO_Coated_v2_300_Glossy_laminate_eci.icc	FOGRA50 (modified for special application)			
Heatset web offset (K–C–M–Y)	LWC-I 'Light Weight Coated Improved (heatset printing condition replaces 3)	60…80/cm	300 %	'PSO LWC Improved (ECI)', PSO_LWC_Improved_eci.icc	FOGRA45L	M0, wb	B (16 %)	C (19 %)
	LWC-S 'Light Weight Coated Standard' (heatset printing condition replaces 3)	60…80/cm	300 %	'PSO LWC Standard (ECI)', PSO_LWC_Standard_eci.icc	FOGRA46L	M0, wb	B (16 %)	C (19 %)
	INP 'Improved News Print' (supplements heatset printing conditions)	48…60/cm	260 %	'PSO INP Paper (ECI)', PSO_INP_Paper_eci.icc	FOGRA48L	M0, wb	C (19 %)	D (22 %)

TABLE 19C

Printing conditions and profiles – 2016 changes;
also see Table 3; measurement conditions for
the characterization data: M1 mode (see Table 27)
and white backing (wb = 'white backing');

Printing method	Printing substrate (PS)	Screen	TVS	ICC profile 'Title', file name	Characterization data FILENAME.txt	Measure	Tone value increase at 50 % Chromatic and black
References: bvdm ProcessStandard Offset 2016 revision, ISO 12647-2:2013, ECI Offset 2015, bvdm Altona Test Suite 2.0 2016 update							
Sheet-fed offset and heatset-web offset (K–C–M–Y)	1 'multiple coating', moderately brightened	60…80/cm	300 %	'PSO Coated v3', PSOcoated_v3.icc	FOGRA51	M1, wb	2013-A (16 %)*
	5+ 'uncoated paper, wood-free, strongly brightened'	52…70/cm	300 %	'PSO Uncoated v3 (FOGRA52)', PSOuncoated_v3_FOGRA52.icc	FOGRA52	M1, wb	2013-C (22 %)*
	6-B "SC-B paper", super-calandered, faintly brightened	52…70/cm	270 %	„PSO SC-B Paper v3 (FOGRA54)", PSOsc-b_paper_v3_FOGRA54.icc	FOGRA54	M1, wb	2013-B (19 %)
References: ISO 12647-3:2013, WAN-IFRA Report 'ISO 12647-3:2013 – Quality standard for newspaper production' 2015							
Coldset-web offset (C–M–Y–K)	C8 'SNP, Standard News Print' (newsprint)	40…48/cm, NP 30…50µm	220 %	'WAN-IFRAnewspaper26v5', WAN-IFRAnewspaper26v5.icc, WAN-IFRAnewspaper26v5_gr.icc (grey profile, primarily for internal application)	IFRA26L	M0, wb	A_c (26 %)
References: ISO 12647-4:2014, ECI ProcessStandard Gravure 2009, Updates 2018							
Publication gravure	LWC Plus	Y 54…70/cm, CM 60…80/cm, K 60…100/cm (in profiles CMYK 68/cm)	360 %	„PSR LWC PLUS V2 M1", PSR-LWC-PLUS-V2_M1.icc	ECI-PSR-LWC-PLUS-V2_M1	M1, sb	17 % (for information)
	LWC Standard			„PSR LWC STD V2 M1", PSR-LWC-STD-V2_M1.icc	ECI-PSR-LWC-STD-V2_M1		
	SC Plus			„PSR SC Plus V2 M1", PSR-SC-Plus-V2_M1.icc	ECI-PSR-SC-Plus-V2_M1		
	SC Standard			„PSR SC STD V2 M1", PSR-SC-STD-V2_M1.icc	ECI-PSR-SC-STD-V2_M1		

* Anyone wishing to print with NP, very fine or hybrid screens can generate their own profiles from FOGRA51 and FOGRA52 and print with the 2013 E (28 %) characteristic printing curve.

TABLE 20

Solid colouring aim values and tolerances for press proofs and production prints (rounded CIELAB colour values for the solid vertex colours) for sheet-fed offset printing and heatset web offset (inks in accordance with ISO 2846-1) for the new and still currently valid printing conditions listed in Table 3 (except for coldset web offset, see Table 21); measurement in accordance with ISO 13655, D50 standard illuminant, 2° normal observer, 0°:45 or 45°:0° geometry, M1 mode for 'new 1' (moderately brightened) and 'new 5+' (strongly brightened), others still M0 in the characterization data. CIE Whiteness in accordance with ISO 11475 under D65 illuminant. Values for the red, green and blue secondary colours are generally for information (not normative). In accordance with ISO 12647-2:2013, the aim chromaticity coordinates for the primary colour solids are now now normative on white backing rather than on black backing (ISO 12647-3:2013 for newspaper printing continues to specify bb). However, in many instances it does not make sense to apply this new requirement, since show-through from the reverse would influence the measurement values. Consequently, the previous recommendations from "ProcessStandard Offset 2012"remain valid unaltered: in each case, apply the aim values for whichever backing should be used for viewing and measurement in accordance with section A2.1 (page A-27ff.). The bb values relate to papers with typical grammages because of the dependence on opacity.

	NEW (M1-based ECI profiles)		**OLD (M0-based ECI profiles)**		**Still being checked by ECI WOWG** (Consequently the old M0-based ECI profiles remain valid for time beeing. Supplemented by a new M1-based profile since 2017.)					**not currently valid**
Printing substrate	**1** (replaces old 1/2)	**5+** (replaces old 4 and 5)	**1/2** (will be replaced by new 1)	**4** (will be replaced by new 5+)	**2** (old LWC-I)	**3** (old LWC-S)	**4** (old MFC)	**6** (old SC/M0 for SC-A)	**6-B** (new SC/M1 for SC-B)	**7** (alt INP)	**8** (SNP Heatset)
g/m² range	80…250 [115]	70…250 [120]	ca. 115	ca. 115	51…80 [70]	84…70 [51]	51…65 [54]	38…60 [56]		40…56 [49]	40…52 [45]
Gloss below 75°	35…70	5…15	65 (1) resp. 38 (2)	ca. 6	25…65 [55]	60…80 [55]	7…35 [21]	30…55 [43]		10…35 [21]	5…10
CIE Whiteness	105…136	140…175	105…136	140…175	90…105	60…90	75…90	45…85		40…80	35…60

Solid colourings on white backing (wb) – for measurements on proof prints (Proofs) as well as test formes for producing characterization data or profiles for proof and production printing conditions

Colour values	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L* a* b*
Black (K)	16	0	0	33	1	0	16	0	0	31	1	1	20	1	2	20	1	2	24	1	2	22	1	2	28	1	2	32	1	3	Not supported by Process-Standard Offset due to intentional deviation in measuring on black backing in the characterization data.
Cyan (C)	56	−35	−53	59	−22	−48	55	−37	−50	60	−26	−44	57	−37	−46	56	−37	−42	55	−33	−42	55	−36	−38	55	−30	−37	58	−29	−36	
Magenta (M)	48	75	−5	55	60	−4	48	74	−3	56	61	−1	48	73	−6	47	71	−4	49	67	−2	48	66	−3	49	62	−1	52	58	−2	
Yellow (Y)	89	−4	92	88	−3	72	89	−5	93	89	−4	78	86	−2	89	84	−1	88	84	−2	81	83	−1	86	83	−3	82	82	−1	72	
Red (M +Y)	48	69	46	53	56	26	47	68	48	54	55	26	48	66	44	47	65	44	48	62	39	47	62	40	48	58	37	50	56	30	
Green (C +Y)	49	−66	24	52	−41	11	50	−65	27	54	−44	14	50	−59	26	50	−56	28	50	−52	24	49	−53	25	49	−48	21	52	−43	17	
Blue (C + M)	25	21	−47	38	10	−32	24	22	−46	38	8	−31	28	16	−46	28	15	−42	28	17	−38	28	13	−39	32	9	−35	37	8	−31	
C + M +Y	23	−1	−2	35	1	−4	23	0	0	33	0	0	27	−4	−2	27	−2	0	28	2	−3	27	−1	−3	30	−2	−4	34	−3	−5	
Paper tone	95	1	−6	94	2	−10	95	0	−2	95	0	−2	92	0	−2	90	0	1	90	0	0	89	0	5	88	−1	4	88	0	2	

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Printing substrate	NEW (M1-based ECI profiles) 1 (replaces old 1/2)			5+ (replaces old 4 and 5)			OLD (M0-based ECI profiles) 1/2 (will be replaced by new 1)			4 (will be replaced by new 5+)			Still being checked by ECI WOWG (Consequently the old M0-based ECI profiles remain valid for time beeing. Supplemented by a new M1-based profile since 2017.) 2 (old LWC-I)			3 (old LWC-S)			4 (old MFC)			6 (old SC/M0 for SC-A)			6-B (new SC/M1 for SC-B)			7 (alt INP)			not currently valid 8 (SNP Heatset)		
Solid colourings on black backing (bb) – only for measurements on production prints, reference print specimens (press proofs, OK sheets, first runs) and single page prints																																		
Colour values	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	Not supported by Process-Standard Offset due to intentional deviation in measuring on black backing in the characterization data.
Black (K)	16	0	0	32	1	0	16	0	0	31	1	1	19	1	2	19	1	2	23	1	2	22	1	2	28	1	2	31	1	3				
Cyan (C)	55	–34	–52	58	–22	–47	54	–36	–49	58	–25	–43	56	–36	–45	54	–35	–41	54	–32	–41	54	–35	–38	54	–29	–37	56	–28	–36				
Magenta (M)	47	74	–5	54	58	–4	46	72	–5	54	58	–2	46	70	–7	45	68	–5	48	64	–3	47	63	–3	48	59	–3	50	56	–3				
Yellow (Y)	87	–4	90	86	–3	70	87	–6	90	86	–4	75	84	–4	86	82	–3	85	81	–2	77	80	–2	83	80	–3	78	79	–1	69				
Red(M +Y)	47	68	45	52	55	25	46	67	47	52	53	25	46	62	42	45	61	42	47	60	37	46	59	39	47	55	35	48	54	29				
Green (C +Y)	49	–65	24	51	–41	11	49	–63	26	53	–42	13	49	–57	26	49	–54	28	49	–51	23	48	–52	25	48	–46	20	50	–42	16				
Blue (C + M)	25	21	–47	38	10	–31	24	21	–45	37	8	–30	27	16	–45	27	15	–41	28	17	–38	27	12	–39	32	9	–34	36	8	–31				
C + M +Y	23	–1	–2	34	1	–4	22	0	0	32	0	0	27	–4	–1	27	–2	1	27	2	–3	26	–2	–3	30	–2	–4	33	–3	5				
Paper tone	93	1	–7	92	2	–10	93	0	–3	92	0	–3	89	0	–1	87	0	0	87	0	–2	86	–2	3	85	–1	2	86	–1	2				

Tolerances for solid colouring on white and black backing						
Criterion	**Press proof** (differences over the format ≤ 8 % of the lowest measured solid density for the primary colour in question)		**Production print differences**		**Production print fluctuations**	
	normative	informative	normative	informative	normative	informative
Black (K)	$\Delta E^*_{ab} = 5$	$\Delta E^*_{00} = 5$	$\Delta E^*_{ab} = 5$	$\Delta E^*_{00} = 5$	$\Delta E^*_{ab} = 4$	$\Delta E^*_{00} = 4$
Cyan (C)	$\Delta E^*_{ab} = 5$	$\Delta E^*_{00} = 3{,}5$	$\Delta E^*_{ab} = 5$	$\Delta E^*_{00} = 3{,}5$	$\Delta E^*_{ab} = 4$; $\Delta H^*_{ab} = 3$	$\Delta E^*_{00} = 2{,}8$
Magenta (M)	$\Delta E^*_{ab} = 5$	$\Delta E^*_{00} = 3{,}5$	$\Delta E^*_{ab} = 5$	$\Delta E^*_{00} = 3{,}5$	$\Delta E^*_{ab} = 4$; $\Delta H^*_{ab} = 3$	$\Delta E^*_{00} = 2{,}8$
Yellow (Y)	$\Delta E^*_{ab} = 5$	$\Delta E^*_{00} = 3{,}5$	$\Delta E^*_{ab} = 5$	$\Delta E^*_{00} = 3{,}5$	$\Delta E^*_{ab} = 5$; $\Delta H^*_{ab} = 3$	$\Delta E^*_{00} = 3{,}5$

Backing	black (bb), normative			white (wb), informative		
Colour values	L*	a*	b*	L*	a*	b*
Black (K)	36	1	4	37	1	5
Cyan (C)	57	–23	–27	59	–25	–27
Magenta (M)	54	44	–1	56	47	–1
Yellow (Y)	78	–3	58	81	–1	62
Red (M + Y)	52	41	25	54	45	27
Green (C + Y)	53	–34	17	54	–35	18
Blue (C + M)	41	7	–22	42	7	–22
C + M + Y	40	0	1	41	0	2
Paper tone	82	0	3	85	1	5

TABLE 21

Aim values for production run solid colouring (rounded CIELAB colour values for the solid vertex colours) in **coldset web offset** in accordance with ISO 12647-3:2013; inks in accordance with ISO 2846-2; Standard News Print (SNP Coldset): grammage c. 45 g/m², gloss (below 75°) < 5; measurement in accordance with ISO 13655, D50 standard illuminant, 2° normal observer, 0°:45° or 45°:0° geometry, M0 mode in the characterization data; tolerances see Table 20, corresponding colour density fluctuation c. 13 %.

Paper type	LWC Plus						LWC Standard			SC Plus						SC Standard			News Plus		
Meas. mode	M0 (2009)			M1 (2018)			M0 (2009) = M1 (2018)			M0 (2009)			M1 (2018)			M0 (2009) = M1 (2018)			M0 (2009)		
Colour values	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*
Black (K)	17	1	1	17	1	0	18	1	2	18	1	1	*values expected*			18	1	1	28	1	1
Cyan (C)	48	–25	–47	47	–25	–49	48	–28	–41	47	–27	–40	*June 2018*			47	–27	–40	48	–19	–33
Magenta (M)	47	72	–8	48	73	–7	46	68	–4	46	66	–5				46	66	–5	50	61	–3
Yellow (Y)	83	7	93	83	6	93	82	7	93	81	6	90				81	6	90	81	10	84
Red (M +Y)	45	69	52	45	68	54	44	66	50	44	64	47				44	64	47	48	62	38
Green (C +Y)	41	–48	31	41	–49	30	40	–46	31	40	–44	28				40	–44	28	39	–32	20
Blue(C + M)	18	20	–48	17	21	–49	19	16	–43	20	14	–41				20	14	–41	26	7	–35
C + M +Y	14	–2	2	14	–2	1	15	–1	2	15	–4	1				15	–4	1	23	–3	–2
Paper tone	94	0	0	93	1	–2	90	0	3	91	0	2				89	–1	5	89	–1	5

TABLE 22

Aim values for production run solid colouring (rounded CIELAB colour values for the solid vertex colours) in **illustration gravure** in accordance with ISO 12647-4:2014; inks in accordance with ISO 2846-3; colour values for paper backing (substrate/self backing); measurement in accordance with ISO 13655, D50 standard illuminant, 2° normal observer, 0°:45° or 45°:0° geometry, M0 mode in the characterization data, colour sequence Y-M-C-K. The values for the red, green and blue secondary colours are for information (not normative). Paper types cf. Table 19a.

Gamut class	1			2			3		
Colour values	L*	a*	b*	L*	a*	b*	L*	a*	b*
Black (K)	24	0	0	18	0	0	8	0	0
Cyan (C)	59	–35	–43	52	–33	–51	46	–32	–54
Magenta (M)	51	70	–15	47	74	–5	42	79	10
Yellow (Y)	90	–11	66	89	–9	83	88	–7	100
Red (Y + M)	50	59	42	47	67	50	44	66	47
Green (Y + C)	55	–68	32	49	–65	30	43	–62	28
Blue (C + M)	28	27	–41	21	26	–40	16	29	–39

TABLE 23

Solid colouring aim values (rounded CIELAB colour values for the solid vertex colours) in **screen printing** in accordance with ISO 12647-5:2015; inks in accordance with ISO 2846-4, colour sequence Y-C-M; gamut class 2 approximately corresponds to offset printing on glossy coated substrate, i.e paper type 1 (old) or printing substrate 1 (new); also see Table 5

Criterion	Details
Process inks	In accordance with ISO 2846 for reproduction in a printing method described in ISO 12647
Colour labels	C (Cyan), M (Magenta), Y (Yellow), K (Key, black); spot colours should be named in full
Solid colouring	See Table 20/21/22 or to be matched to reference prints
Print control strip	e.g. Fogra print control strip; screen 60/cm, usual circular dot screen or authentic dot model, control patches for mid tone, shadow and solids for primary and secondary colours over the full width of the format; slur/doubling and plate monitoring must be possible in one position
Plate imaging (digital)	Predetermined characteristic printing curves on the linearized RIP setter configuration, see Table 25
Printing tone range	See B.2.4
Colour sequence	Generally K-C-M-Y in offset, C-M-Y-K in newspaper printing
Corrections	Image correction marks in accordance with DIN 16549, substantial corrections require a fresh press proof
Offline finishing	An additional, finished press proof sheet is required
Image orientation	In accordance with imposition scheme
Image register	As for production print (maximum differences of 80µm for all screen rulings)

TABLE 24

Further information for **newspaper printing press proofing** on the production substrate

B.5 — Softproof-to-Press (pressroom proof)

As described in A.3.1, it is increasingly common for data that is supplied to be prepared for ouput on special softproofing workstations (see Table 8 for requirements) on the actual press control desk.

B.5.1 — Monitor validation

First of all, the day-to-day colour accuracy of the monitor has to be validated by a suitable softproofing software module such as UDACT (see "ProcessStandard Offset" A-136) as soon as it has warmed up. For validation it needs to be possible to calibrate the monitor hardware ('hardware LUT': Look-up Table, up to 16 bit or 65536 levels per colour channel), and the characterizing ICC monitor profile ('matrix profile': 8 bit or 256 levels per colour channel) must be regularly checked or updated. Ideally, characterization requires a measurement device that measures from the usual viewing distance (remote measurement) and that is therefore exposed to the influence of the typical ambient lighting.

B.5.2 — Data interpretation and reconstruction

As a rule, page data are delivered as a PDF/X composite file with a CMYK printing condition as the output intent. The Softproof-to-Press system interprets the page data in such a way that ICC monitor profile (RGB) and CMYK profile of the target press (or reference print profile of the relevant printing condition) use absolute colorimetric gamut mapping to correctly simulate the colour, including the paper white, of the resulting output.

TIFF/G4-based softproofs are generated in newspaper printing and some heatset web offset printing. Since screening has already taken place and profiles and characteristic printing curves have been applied, the softproof RIP must take the colour separation data that have already been output by the CtP RIP and reconstruct suitable colour data in three stages:

1. Descreen → return the screened colour separation files (1-bit TIFF, TIFF/G4) to greyscale, continuous tone TIFFs and reconstruct them as a single 8-bit colour TIFF;
2. Decalibrate (at the same time as descreening) → Remove the active profile links and characteristic printing curves, possibly by manually editing the settings;
3. Call up the softproof settings → Link the 8-bit colour TIFF file to the reference printing profile on the profiled, calibrated and validated monitor.

Most TIFF softproof solutions can also simulate screens and colour separations. In gravure, softproofs can be TIFF/IT8 or PDF-based.

B.5.3 — Adjusting the illuminance of the viewing light to the monitor luminance

In order to be able to compare the self-luminous monitor image with lit originals or printed copies, the illuminance of the viewing lighting (ISO 3664:2009) must be adjusted ('dimmed') to match the limited luminance of the monitor, without thereby altering the colour temperature, which needs to be as close to 5000 kelvin as possible. A luminance limit of 160 cd/m² was imposed before the revision of the standard in 2015 due to the ageing of CRT and LCD monitors but it no longer applies today. As a result, the illuminance no longer needs to be dimmed to 500 lx ± 125 lx. What is, however, crucial is a match between the individual choice of monitor luminance, eg. 200 or 300 cd/m², and a corresponding reduction in the maximum

illuminance of 2000 lx that reflects industry practice.

The higher the luminance of the monitor, the better the simulation of the print on brightened papers. Since in both the new standard offset profiles, 'PSO Coated v3' (FOGRA51) and 'PSO Uncoated v3 (FOGRA52)', the fluorescent effects have already been quantified, it is strongly advised not to enhance the fluorescent effect with a bluish monitor white point of more than 5000 K, as was often done in the past. The calibration and profiling of the monitor must be carried out at 5000 K (D50).

Fluorescent lamps (fluorescent tubes) and monitors 'age' and as they do so their spectrum changes. Whilst lamps must be swapped after an operating lifespan specified by the manufacturer, daily or regular calibration of the monitor can compensate for some time for the ageing of the display back lighting, delaying the need to replace the monitor.

B.6 — Production printing

B.6.1 — Control means

Control strips should be used for all multicolour jobs in a quality conscious and standardized production and not just when there is a need to subsequently provide proof of the quality. The latter is the norm with jobs where a specimen has been provided for the production run in the form of a contract proof (digital proof print, press proof). Likewise, it should be possible to check platemaking through a digital control means that can be placed outside the printing area.

B.6.2 — Quantities

Tone value increases must lie within the tolerances for the relevant values laid down for production printing in the corresponding part of the ISO 12647 series of standards. Solid colouring is based on the contract proof or press proof. If these are not uniformly coloured then the colour value information in the relevant part of the ISO 12647 series of standards or, in the case of offset and gravure printing, the colour standard in question should be used. The comparison should then be made either visually or by means of colour measurement and preferably densitometrically in the case of black.

↘ On the next page

TABLE 25

Tone value increases in accordance with ISO 12647-2 (sheet-fed offset and heatset web offset) and ISO 12647-3 (coldset web offset) to be achieved in CtP imaging; values rounded to the nearest whole number are used as aim values for characteristic printing curves in offset printing. General changes from 2013: 50% instead of 40% halftone control patch as reference, one characteristic curve for CMYK instead of two curves for CMY and K

Tone value increase (in %) in accordance with ISO 12647-2/3:2013 for new printing conditions						Tone value (in %) in the data	Tone value increase (in %) in accordance with ISO 12647-2:2004/2007 for the old printing conditions which continue to be used					
Conventional screen				Conventional and NP screen	NP-, X-, fine screen		Conventional screen					NP-, X-, fine screen
2013-A	2013-B	2013-C	2013-D	A_C (Coldset)	2013-E		A	B	C	D	E	F
0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
3.3	4.6	5.8	6.4	6.0	6.8	5	2.0	3.0	3.9	4.8	5.7	6.7
6.1	8.3	10.6	11.6	11.1	12.6	10	4.0	5.6	7.3	8.9	10.6	12.3
8.5	11.4	14.3	15.9	15.5	17.4	15	5.9	8.1	10.3	12.5	14.7	17.0
10.5	13.9	17.2	19.3	19.0	21.2	20	7.6	10.2	12.8	15.5	18.1	20.8
12.2	15.8	19.4	21.8	21.8	24.2	25	9.3	12.1	15.0	17.9	20.8	23.8
13.5	17.2	20.9	23.7	23.9	26.4	30	10.7	13.7	16.7	19.8	22.8	25.9
14.6	18.2	21.9	24.9	25.4	27.8	35	12.0	15.0	18.1	21.1	24.2	27.3
15.3	18.8	22.3	25.4	26.2	28.5	40	13	16	19	22	25	28
15.8	19.1	22.4	25.5	26.4	28.6	45	13.8	16.7	19.5	22.4	25.2	28.0
16	19	22	25	26	28	50	14.3	17.0	19.6	22.3	24.9	27.5
15.9	18.6	21.3	24.1	25.2	26.9	55	14.6	17.0	19.4	21.7	24.1	26.4
15.6	17.9.	20.3	22.8	23.8	25.3	60	14.5	16.6	18.7	20.8	22.8	24.8
14.9	17.0	19.0	21.1	22.0	23.2	65	14.1	15.9	17.7	19.4	21.1	22.7
14.0	15.7	17.4	19.1	19.8	20.7	70	13.4	14.9	16.3	17.6	19.0	20.3
12.7	14.1	15.4	16.7	17.2	17.9	75	12.3	13.4	14.5	15.5	16.5	17.5
11.0	12.1	13.2	14.0	14.3	14.7	80	10.7	11.5	12.3	13.0	13.7	14.4
9.0	9.8	10.6	11.0	11.1	11.3	85	8.7	9.3	9.8	10.2	10.7	11.0
6.5	7.0	7.5	7.7	7.6	7.7	90	6.3	6.6	6.9	7.1	7.3	7.5
3,5	3.8	4.0	4.0	3.9	3.9	95	3.4	3.5	3.6	3.7	3.8	3.8
0.0	0.0	0.0	0.0	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0	0.0
Printing substrate (new)						**Typical papers**	**Paper type (old)**					
1: CMYK					1: CMYK	WFC, HWC, MWC	1/2: CMY	1/2: K				1/2: CMYK
	2: CMYK, 3: CMYK, 4: CMYK				(2: CMYK, 3: CMYK, 4: CMYK)	LWC-S, LWC-I, MWC		3/LWC: CMY	3/LWC: K			
		5+: CMYK			5+: CMYK	WFU			4/5: CMY	4/5: K		4/5: CMYK
						Continuous (old)			2: CMY	2: K, 4: CMY	4: K	
		7: CMYK			(7: CMYK)	UMI, INP						
	4: CMYK				(4: CMYK)	MFC		MFC: CMY	MFC: K			
	6-B: CMYK				(6: CMYK)	SC		SC: CMY	SC: K			
		8: CMYK			(8: CMYK)	SNP Heatset			SNP: CMY	SNP: K		
				SNP: CMYK		SNP Coldset						

C

Appendix

C.1 — Control means

C.1.1 — Digital proof printing

A Fogra CMYK media wedge must be placed on every contract proof print. The control block (Fig. 5) is delivered as a data set and in version 3.0 Proof it comprises 59 single and multi-colour patches. In addition, a chromatic grey wedge and an achromatic grey wedge as well as an unprinted patch are also present. If a proof print is to serve as a contract proof for a printing condition the CIELAB colour values of the patches of the FOGRA CMYK media wedge must agree with those of a reference print produced under standardized conditions that correspond to the planned production run. Spectral colour measurement is normative for proof printing and determining colour accuracy.

The aim value colour patches of the Fogra media wedge are a selection of key colour patches from the standard colour chart. A corresponding 'MediaWedge3 subset' of 72 measurement patches (Table 26) is assigned to each of the characterization data sets (FOGRA28 to FOGRA51) that are to be found in practice.

→ All aim values for the standard printing conditions for producing the characterization data and the corresponding media wedge aim value subsets can be downloaded from Fogra at: https://www.fogra.org/index.php?menuid=316&reporeid=225&getlang=en

Colour chart	Measurement patches	Characterization data
IT8.7/3:1993	Basic: 928	S ('Small')
ECI 2002 Target	Superset: 1485	Standard up to FOGRA47
IT8.7/4:2005, ISO 12647-2:2013	Superset: 1617	L ('Large' up to FOGRA47), Standard from FOGRA48
IT8.7/4, spread over 2 pages	Superset: 1638	Use for individual profile generation
MediaWedge3 (Fogra CMYK media wedge 3.0)	20 Subsets: 72	MW3_Subsets (FOGRA28 to FOGRA52 linked to media wedge)

TABLE 26
Data sets for the characterization data and media wedge **aim values**

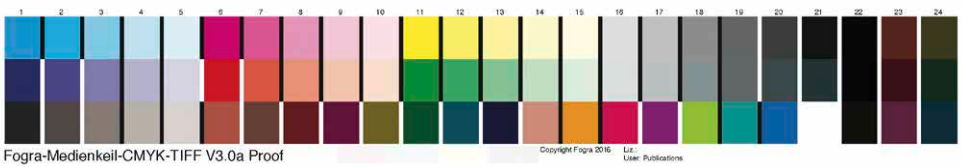


FIGURE 5A
Fogra media wedge CMYK 3.0, available as TIFF and EPS version in different layouts as well as with and without markings to differentiate measurement patches or for the beginning and end of the strip depending upon the colour measurement device. The bvdm recomments the layout 'V3.0a Proof' with its patch size of 8.5 mm × 10.0 mm and overall dimension of 228.6 mm × 37.4 mm applicable for scanning (auto-scanning and hand-guided) devices.

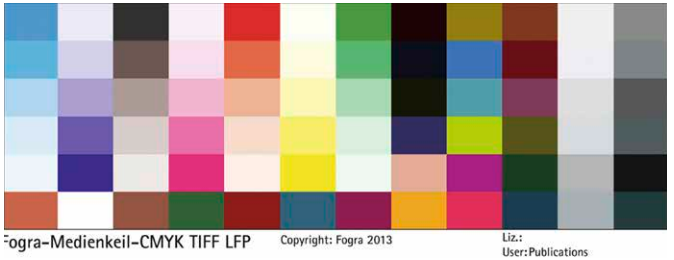


FIGURE 5B
The layout of the Fogra CMYK 3.0 LFP media wedge was configured for large format printing rather than specifically for digital applications. The 19 mm × 13 mm patches are laid out over an area measuring 257 mm × 107 mm, which is suitable for auto-scanning devices.

For detailed instructions for 5A and 5B go to
https://www.fogra.org/index.php?menuid=35&downloadid=772&reporeid=17
and https://www.fogra.org/index.php?menuid=35&downloadid=526&reporeid=17

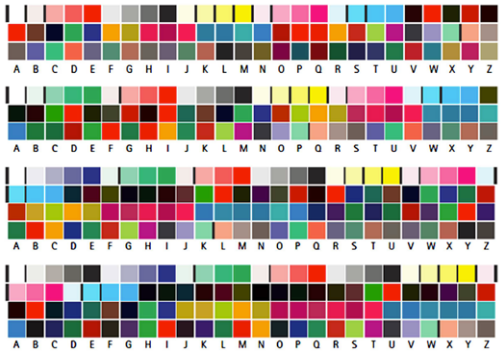


FIGURE 5C
As of autumn 2017 Fogra MediaWedge MultiColor 3.0 is available. Top-down: versions for 5-, 6-, 7- and 8-colour printing.

C.1.2 — Press proof

In accordance with ISO 13655 and ISO 12647-1, a press proof control strip must allow measurement of at least the following control patches: mid and three-quarter tone halftone patches with circular dots if at all possible as well as CMYKRGB solids. Control strips should be positioned at right angles to the direction of printing over the full width of the format. Ideally in the middle of the print but alternatively at the end or the beginning. Examples:

Offset: Ugra/Fogra digital plate wedge Ugra/Fogra PCS print control strip.

Newspaper printing: Ugra/Fogra digital plate wedge, Ugra/Fogra-DKL-Z.

C.1.3 — Production print

In accordance with ISO 13655 and ISO 12647-1, a press proof control strip must allow measurement of at least the following control patches: mid and three-quarter tone halftone patches as well as CMYKRGB solids. The control strip should be positioned at right angles to the direction of printing. Ideally in the middle of the print but alternatively at the end or the beginning.

For examples see section C.1.2.

C.1.4 — Plate/Forme making

The Ugra/Fogra digital plate wedge should be imaged on the plate in order to check the tone value behaviour of the RIP-setter configuration in relation to specific offset plate products. Preferably it should be evaluated with a plate measurement device that employs image analysis. The results are fed into the RIP for the tone value correction of the linearly adjusted configuration or, alternatively, used for tone value compensation in prepress.

→ *For a detailed description of the procedure and the set up of standard compliant tone value transfer see "ProcessStandard Offset 2012" B-146ff*

C.2 — Viewing and measurement conditions

C.2.1 — Viewing conditions (visual colour appraisal)

Matching procedures and other critical appraisals require a high illuminance of 2000 lx ± 500 lx, because it is only then that minor differences become apparent. A standard D50 (5000 K) illuminant must be used. The specimens must be placed on a matt white backing and surrounded by a matt grey surface with a colour density of 0.7 (in relation to ideal white) that is at least one third as wide as the diameter of the specimen. One possibility is to make board masks. For ease of comparison the specimens should also be placed edge to edge.

NB: The contents of the "Normlicht nach ISO 3664:2009" [ISO 3664:2009 standardized lighting] publications (bvdm 2012 and Fogra Sonderdruck 28 2012) are now largely out of date and should no longer be used as a basis on which to work.

ISO 3664:2009 (confirmed 2015) specifies how large the UV component of the appraisal lighting has to be in order to generate D50 standardized lighting physically correctly. In the new M1 measurement mode ISO 13655:2009 (revised 2017) defines a corresponding UV component for the measurement light, which has been implemented in spectrophotometers since Drupa 2012. This means that for the first time apparaisal lighting and measurement devices can stimulate the brighteners and make the blue shift and brightening of the paper colouring visible or measure it in an almost identical way. Expensive inline measurement systems are unaffected by this and only their external reference measurement device must be M1 capable.

C.2.2 — Colour measurement conditions

In order to be able to exchange colour measurements sensibly, uniform measurement conditions must apply or measurement device settings be used. These are clearly laid down for the printing industry by the ISO 13655 standard:

- gloss-free 0°:45° or 45°:0° measurement geometry
- colorimetry for the 2° standard observer (irrespective of the measurement patch size)
- D50 standard illuminant (5000 K)
- CIELAB values (L*, a*, b*), spectral reflectance if applicable
- matt white backing for the specimen (ceramics, plastic, board or 3 proof substrate sheets; gloss ISO 8254-1 [75°] < 40; optical brightener-free; chroma C^*_{ab} < 3.0 or better < 2.4; from ISO 13655:2017 onwards the white spectral values result in a lightness L^*_{ab} of between 91.2 and 96.4), matt black specimen backing with colour density of c. 1.5 for production run process control
- M1 measurement mode (with UV component in measurement light; no polarization, i.e. no polfilter in the measurement device beam path – see Table 27)
- Colour difference calculation (see Table 28)

The bvdm has reservations about the use of the new CIEDE2000 colour difference formula. Not only are the values calculated using CIELAB(1976) and CIEDE2000 not compatible, its application only makes sense for proof printing (ISO 126417-7:2016), because in this process a reverse control of the colour channels needs to be carried out from time to time. Whereas, during production printing (parts 2 to 6 of the standard), it is a matter of stabilizing the printing process, and where, in the best case, individual primary colours need to be balanced. CIELAB(1976) is tried and tested for this and is outstandingly suitable, whereas CIEDE2000 is not. Consequently, at least for parts 2 to 5 of the standard, the bvdm advises against the CIEDE2000 formula, which is in any case only informative. In the case of flexo printing (part 6) the normative requirement can at least be justified by the high proportion of spot and substitute colours.

ISO 12647	Method covered	Colour difference formula
-2:2013	Offset	Normative: CIELAB(1976); Informative: CIEDE2000 (not recommended)
-3:2013	Newspaper	
-4:2014	Illustration gravure	
-5:2015	Screen	
-6:2012	Flexo	CIEDE2000
-7:2016	Proofing	
-8:2012	Validation Print	CIELAB(1976)

TABLE 28
Colour difference formulae specified in the parts of the ISO-12647-standard for the various printing methods or prepress and associated processes

TABLE 27
Measurement modes in printing industry **spectrophotometers** in accordance with ISO 13655:2017

Mode	Applications	Device settings	Spectral range [nm]	UV component
M0: 'A, no polfilter'	**Conventional colour measurement** in prepress and printing, generating ICC output profiles (up to characterization data FOGRA50)	Degree of spectral reflection without polfilter under standard illuminant A (incandescent lamp, 2856 K)	Visible (from 380, mandatory 400...700)	Mathematically extended (extrapolated) as required
M1: 'D50, no polfilter'	**Physically correct colour measurement** in prepress and printing, generating high quality ICC output profiles taking brightening into account (from char'data FOGRA51/52)	Degree of spectral reflection without polfilter under standard illuminant D50 (LEDs, 5003 K) with physically correct UV portion	Near UV and visible (360...700 nm)	UV-LEDs necessary; radiation transition UV/vis (300...500nm) CIE D50 compliant if possible
M2: 'UV-Cut'	**UV-free colour measurement** by cutting the UV component out of measurement light	Degree of spectral reflection without polfilter, but with UV cut filter below 380 or 400nm	Near UV cut (from 400, mandatory 420...700)	Suppressed or excluded
|M1 – M2|	**Effect of optical brighteners** in substrates and fluorescent inks; determining Δb* on brightened papers, eg. with selection of papers and proof print substrates for the ECI-v3-Profile (2015)	M1 and M2 one after the other or vice versa	see M1 and M2	Isolated evaluation of UV effect
M3: 'Polfilter'	**Colour densitometry** for wet-dry compensation and selective densitometry (CMYK); **Spectral-densitometry** spot colours; **Colour measurement with Polfilter** on intensive scale, effect pigment inks and for formulation	Selective (RGB+V_{vis}) or degree of spectral absorption with crossed pair of polarization filters engaged under standard illuminants A or D50	Visible (from 400, mandatory 420...700)	Suppressed or excluded

C.2.3 — Density measurement conditions

Under the ISO 5 series of standards, CMYK primary colours should be measured densitometrically with a filter in accordance with 'Status E' (ISO 5-3). This means that compared with the US guidelines ('Status T') a narrow band evaluation takes place for colour channel Y. As a result the solid Y colour density is nearly as high as those for C and M. Spot colours are measured with the colour channel that yields the highest colour density, if no 'spectral density' function available. Measurements should normally be made with polarization filters. One exception is the measurement of offset plates (if no plate measurement device is available) and possibly the characterization of a proofer. The following also apply: matt white backing for the specimen (for details see C.2.2), matt black specimen backing for production run process control. When using spectrophotometers with densitomtric functions (spectraldensitometer) measurement mode M3 should be selected (see Table 27).

C.3 — Control of proof prints for colour accuracy and other criteria

A prerequisite for the authentic simulation of a print job under a given printing condition is to select the most suitable proof printing substrate. ISO 12647-7:2016 classifies the substrates and the corresponding values (see Table 29).

Checking the colour accuracy of digital proof prints involves the use of a Fogra-CMYK media wedge that fulfills the requirements of ISO 12647-7. This monitors those requirements for proof printing systems as they impact on print control strips in ISO 12647-7. The aim values for the media wedge (72 patches in each case for various standard printing conditions) are available on the Fogra website as 'MediaWedge3_ Subsets' text files (see C.1.1).

With the publication of the new version of the standard, ISO 12647-7:2016, differences and variations are to be calculated using the CIEDE2000-formula and this should be indicated by the appropriate subscript (see Table 30). This applies to the simulation of all printing conditions – irrespectively of whether thay are new or remaining valid for the time being.

The proof print must also display simple and easy to understand status information. This should be placed in the margin, usually in the vicinity of the Fogra media wedge:

- Producer of the proof print (company, possibly contact),
- Production data for the proof print (file name, date, time),
- Description of the proof printing system (RIP software, type of inkjet printer),
- Description of the materials used (inks, proof printing substrate),
- Reference printing condition (printing condition to be simulated),
- Colour management settings used ('source profile': input or working colour space profile; 'target profile': proof printer profile; 'simulation profile': reference printing profile: eg. name of the standard profile or the characterization data for the printing condition to be simulated).

Additional recommendation: nozzle test line for checking that all the nozzles in the inkjet printhead are functioning properly (RIP software option).

→ See "ProcessStandard Offset 2012" B-99ff for further requirements for proof prints and specifically for the simulation of gloss finishing see B-105f

Parameter	ISO ref.	Values, Steps	Selection of proof print substrate	Standard illuminant	Mode	Simulation of production paper colouring
Colouring	13655:2017	L* ≥ 95, a* = b* = 0 ± 2	'White'	D50	M0, M2	–
Fluorescence, 'D65 brightness difference' ΔB	15397:2014 bzw. 2470-2:2008	≤ 1 brightener-free 1 < weak ≤ 4 4 < low ≤ 8 8 < moderate ≤ 14 14 < strong/high ≤ 25	'Moderate' for new printing condition 1	D50 with high UV component in accordance with ISO 3664:2009	M1	No (the standard profile already takes into account the colouring and brightening effect of the appropriately selected proof printing substrate)
			'Strong/high' for new printing condition 5+			
			'Brightener-free' for all other printing conditions	D50 with low or cut UV component	M0, M2	Yes (production paper colouring plus bluish adjustment of brightener effect)
Gloss	8254-1	< 20 matt 20 ≤ semi-matt ≤ 60 > 60 glossy	'matt', 'semi-matt', 'matt-satin' or 'glossy' to match the production substrate	–	75° (TAPPI)	–

TABLE 29
Classification of unprinted proof printing substrates
in accordance with ISO 12647-7:2016 by fluorescence (spectrophotometrically determined optical brightening steps) and gloss (now only one method) as well as the bvdm application recommendation for suitable proof printing substrates and prevailing conditions

Note 1: The ΔB of the fluorescence levels have been determined by the paper industry using its normal standard illuminant/field of view settings of D65/10°/UV–UV_{ex} rather than values that can be converted into the normal printing industry settings of D50/2°/M1–M2. However, for practical purposes it is possible to relate the D65/10° ΔB values to D50/2° CIELAB Δb* values: So, 8 < ΔB ≤ 14 corresponds to approximately 3,7 < Δb* ≤ 6,2 and 14 < ΔB ≤ 25 corresponds to approximately 6,2 < Δb* ≤ 10,4.
Note 2: As a general point, the light-fastness of the proof printing substrate should now be as high as possible.
Note 3: Even if measurement modes M0 or M2 would suffice, the uniform use of measurement mode M1 is recommended for the sake of comparability and consistency.

Proof criterion	Measurement patches in Fogra media wedge	Tolerances in accordance with ISO 12647-7 (it is not possible to convert between new and old) **New** (-7:2016), based on CIEDE2000 colour difference formula		**Old** (-7:2007), based on CIELAB(1976) colour difference formula	
Paper white	C 21	Measured value	$\Delta E^*_{00} \leq 3{,}0$	Measured value	$\Delta E^*_{ab} \leq 3$
Overall colouring	all	Mean value	$\Delta E^*_{00} \leq 2{,}5$	Mean value	$\Delta E^*_{ab} \leq 3$
		Maximum value	$\Delta E^*_{00} \leq 5{,}0$	Maximum value	$\Delta E^*_{ab} \leq 6$
Primary colour solids	A1, A6, A11, A21	Maximum value	$\Delta E^*_{00} \leq 3{,}0$	Maximum value	$\Delta E^*_{ab} \leq 5$
	A1, A6, A11	Maximum value	$\Delta H^*_{ab} \leq 2{,}5$	Maximum value	$\Delta H^*_{ab} \leq 2{,}5$
Chromatic grey	B 16 to B 21	Mean value	$\Delta C_h \leq 2{,}0$	Mean value	$\Delta H^*_{ab} \leq 1{,}5$
		Maximum value	$\Delta C_h \leq 3{,}5$	–	
Solids, poss. spot colour con-/halftones	–	Maximum value	$\Delta E^*_{00} \leq 2{,}5$	–	

TABLE 30
Proof criteria and tolerances
for job-related process control with the aid of the digital proof print;

ΔE* = 'Colour difference',
ΔH* = 'Hue difference',
ΔC_h = 'Chroma difference'

TABLE 31
Tolerances in accordance with ISO 12647-7 for the certification of proof prints or proof printing systems (type certificatoin, manufacturer) using test charts in accordance with ISO 12647-2 (see Table 26)

Criterion	Tolerances in accordance with ISO 12647-7 (it is not possible to convert between new and old)	
Colour chart patches of the proof	**new (-7:2016), based on the CIEDE2000 colour difference formula**	**old (-7:2007), based on the CIELAB(1976) colour difference formula**
Compared with the characterization data for the printing condition in question		
95% of all patches (P95 percentile, Q095 quantile)	$\Delta E^*_{00} \leq 5$	$\Delta E^*_{ab} \leq 6$
Mean value for all patches	$\Delta E^*_{00} \leq 2.5$	$\Delta E^*_{ab} \leq 2.5$
Mean value for patches in the outer part of the colour space	$\Delta E^*_{00} \leq 2.5$	$\Delta E^*_{ab} \leq 4$
Maximum for the primary colour solids	$\Delta E^*_{00} \leq 3{,}0$, $\Delta H^*_{ab} \leq .2.5$	–
Mean value for all patches except spot colours	$\Delta E^*_{00} \leq 2.5$	–
Maximum value for all patches except spot colours	$\Delta E^*_{00} \leq 5$	–
Maximum for spot colour solid patches	$\Delta E^*_{00} \leq 3.0$	–
Compared with the production run, if the proof substrate is gloss overprinted and the brightening similar to the production substrate		
Maximum for all patches	$\Delta E^*_{00} \leq 3.0$	–

C.3.1 — Certification of proof prints

The production of contract proofs has become a key factor in quality control and the Fogra media wedge has established itself as a reliable and independent means of checking the colour accuracy of digitally printed originals in day to day prepress and printing practice. For example, when certifying proof prints, the printing and media industry federations (vdm) and Fogra check the prints in accordance with criteria that are based on ISO 12647-7:2016 and issue certificates that confirm this quality to the service provider (also see Table 31). Laser printing systems are not certified.

Checks when certifying proof prints in accordance with ISO 12647-7:

- Adherence to the tolerances of the Fogra-CMYK 3 media wedge
- Determination of the colour accuracy (ISO 12642-2 colour chart), the gamut and grey balance
- Gloss measurement in accordance with ISO 8254-1 (75°, TAPPI)
- Tone value transfer and gradations
- Register adherence and resolution
- Status information
- Colorimetric tone value transfer

C.3.2 — Certification of proof printing systems and substrates

Manufacturers of proof printing systems can have their products (specific inkjet printer hardware, software version) certified by Fogra ('type certification'). Certification is based on the criteria of ISO 12647-7:2016 (also see Table 31). Likewise, the manufacturers of proof printing substrates can also have their products (proofing papers in various grammages, levels of brightening and degrees of gloss) certified by Fogra (also see Table 29). These two certifications cover the product manufacturers not the users.

C.3.3 — Lifespan of digital proof prints

The length of time that a digital proof print preserves its colour accuracy in accordance with the accompanying media wedge evaluation depends upon the chemical stability of the components and, specifically, their lightfastness and resistance to ambient conditions. In the past, significant changes even within short spaces of time were not uncommon. Since then, both the proof printing substrates—and in particular those containing optical brighteners, which in the past were relatively unstable—and also the inkjet inks have become considerably more stable over time.

Every proof supplier should be aware of or determine the stability of the combinations of substrates and ink they use. Table 32 describes the test and the permitted tolerances.

→ Also see "ProcessStandard Offset 2012" B-108 for the lightfastness and resistance to ambient conditions of proof prints

Test step	Description			
Inkjet print, four examples	ISO-12647-2 colour chart with complete ink set on proof printing substrate			
Drying	In accordance with ISO 187: 24 hours at 23 °C ± 1 °C and 50% ± 2% relative humidity in darkness			
Reference colour measurement	Measure L*a*b* values of all the patches of the colour chart in accordance with ISO 13655:2017, M1 measurement mode			
Copies split between four different storage conditions	***Short timescale test 1:*** 24 hours at 25 °C ± 1 °C and 25% ± 2% in darkness	***Short timescale test 2:*** 24 hours at 40 °C ± 1 °C and 80% ± 2% in darkness	***Long timescale test 1:*** one week at 40 °C ± 1 °C and 10% ± 2% in darkness	***Longtimescale test 2:*** lightfastness in accordance with ISO 12040, i.e. Xenon lamps-dose corresponding to step 3 on the Wool Scale (bleaching of wool thread dyed with 'Acid blue 83')
Comparative colour measurement	Measure L*a*b* values of all patches (as above), In each case, calculate difference to reference colour measurement			
Tolerances	Glossy proof print substrates should not exceed a ΔE*00 of 2.5 and should lie below a ΔE*00 2, Matt proof printing substrates should deviate up to a ΔE*00 of 4			

TABLE 32
Course of a permanence test for digital proof prints and the permitted tolerances for the colour accuracy achieved in inkjet printing in accordance with ISO 12647-7:2016

C.4 — Resources for use in prepress and printing

C.4.1 — roman16 bvdm reference images

The roman16 bvdm reference images are specially composed test motifs for visual evaluation, processing and output in premedia and print. They allow comprehensive judgements to be made about the colour rendering and details of image reproduction over the entire production process. The publication was created by the Bundesverband Druck und Medien e.V. (bvdm) in conjunction with the European Color Initiative (ECI) and has been available worldwide for use since July 2007. The aim with the roman16 bvdm reference images was to develop a series of motifs that on the one hand formed an aesthetically closed family with a variety of dominant colour themes and on the other hand featured image criteria that are important for the planned proofing purposes.

The human eye is the most important arbiter for the evaluation of image quality. There are test images for the primary colours cyan, magenta, yellow and black (monochrome realizations of the first three motifs), the secondary colours red, green and blue as well as the tertiary colours brown, olive and pastel. The highkey, midtone and lowkey motifs together with their monochrome realizations focus on the highlight, midtone and shadow ranges in order to be able to check the grey balance. The highly chromatic image, '13_coloured', supplements this good overview of all the important colour tones of a colour space. The images contain various flesh tones where even the slightest colour variations quickly become apparent.

The main purpose of the roman16 bvdm reference images is to check the conversion from RGB to CMYK data for the chosen printing condition.

→ For further information go to:
www.roman16.com/en

FIGURE 6
The 16 motifs of the roman16 bvdm reference images:
01_highkey,
02_midtone,
03_lowkey,
04_cyan,
05_magenta,
06_yellow,
07_red,
08_green,
09_blue,
10_olive,
11_brown,
12_pastel,
13_coloured,
14_highkey_BW,
15_midtone_BW,
16_lowkey_BW

C.4.2 — Altona Test Suite 2.0 – composition and application

The Altona Test Suite is a joint project by the Bundesverband Druck und Medien (bvdm), Berlin, the European Color Initiative (ECI), Ugra St. Gallen and the Forschungsgesellschaft Druck (Fogra), Munich. The Altona Test Suite application package encompasses all the various printing conditions together with the related reference prints and test forme files as well as all the characterization data, ICC profiles and documentation. In addition, it contains the PDF/X files that have each been produced for specific applications. The carefully created reference prints have been produced under the corresponding standard printing conditions in accordance with the international ISO 12647. Table 33 lists the components following the '2016 update' (ATS2+).

→ Also see www.altonatestsuite.com English version and "ProcessStandard Offset 2012" A-128ff; on the ATS2 application package

→ Altona Test Suite 1.2 Online-Version: www.eci.org

TABLE 33
Components of the Altona Test Suite 2.0 (ATS2) incl. 2016 update (ATS2+)

Test formes	Description	on reference prints	as files on DVD
Measure (Fig. 7a)	Contains control means for the adjustment and checking of output systems like digital proof printers or conventional or digital printing systems through colorimetric or densitometric measurements; not limited in use to a specific printing condition	in ATS2 and ATS2+	PDF/X-3 in ATS2, PDF/X-4 in the update for ATS2+
Visual (Fig. 7b)	Serves for the visual checking of PDF/X-3 or PDF/X-4 compatibility. Since these PDF/X versions make a wokflow with colour management possible, this test forme contains various components with device independent colours, eg. ICC-based CIELAB and RGB as well as CMYK and spot colour data. In combination with the reference prints, the 'Visual' file allows visual checking and adjustment of the colour accuracy of print simulation on a proof printing system. All natural CMYK motifs (21 to 25) were produced in Adobe Photoshop from the same set of RGB images with 'profile conversion' and ECI-RGB as the source colour space, the corresponding output-intent profile for the PDF/X file as the target colour space and photographic rendering intent (Photoshop: perceptual). As a result, there are differing CMYK and overall ink application values depending upon the particular printing condition		
roman16 -1/-2/-3/-4 (Fig. 7c)	Reproduction of all 16 roman16 images distributed over four test formes with four motifs apiece		
Technical 1, 2 (Fig. 7d)	Deals with overprints and character set formats from a technical perspective. 'Technical' contains 864 carefully structured patches to thoroughly check whether a PostScript RIP is capable of correctly implementing overprinting. This test forme also contains text in all major character set formats (Type 0 CID, Type 1, Type 2 CID, Type 3, TrueType).	in ATS2	PDF/X-3-files in ATS2

Envelope	No.	Reference prints contained	Output test formes	AM screen	FM screen
ATS2	1	Sheet-fed offset: gloss coated paper (paper type 1)	Measure, Visual, roman16	6 × FOGRA39	6 × FOGRA43
	2	Sheet-fed offset: matt coated paper (paper type 2)	Measure, Visual, roman16	6 × FOGRA39	6 × FOGRA43
	3	Heatset web offset: LWC Improved (paper type LWC) and SC (paper type SC)	Measure, Visual, roman16	6 × FOGRA45, 6 × FOGRA40	–
	4	Sheet-fed offset: uncoated, wood-free white paper (paper type 4)	Measure, Visual, roman16	6 × FOGRA47	6 × FOGRA44
	5	Paper type 2 representative	Technical 1 and 2	spread over 4 A3 test formes	–
ATS2+ (2016)	6	Sheet-fed offset: premium-coated matt, moderate brightening (printing substrate 1 new) and uncoated, wood-free, white paper, strongly brightened (printing substrate 5+ new)	Measure, Visual, roman16	6 × FOGRA51, 6 × FOGRA52	–

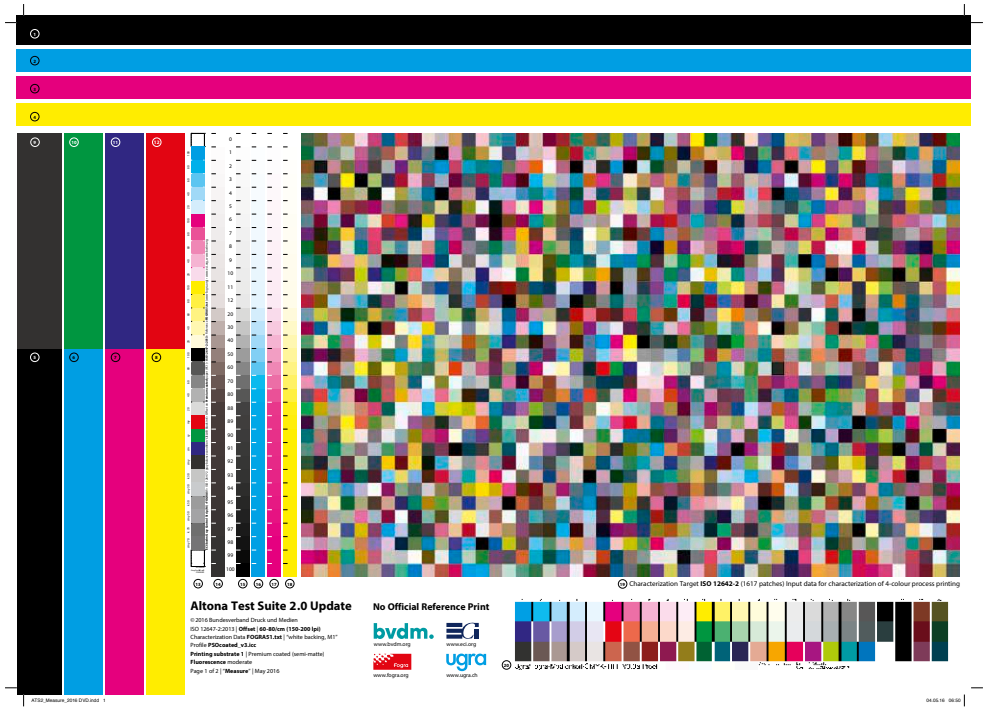


FIGURE 7A
Altona Test Suite 2.0, 2016 update, test forme page 1
'Measure' for standard printing condition 1 with the 1617 patch IT8.7/4:2005 colour chart in accordance with ISO 12647-2:2013 and the Fogra CMYK media wedge 3.0, positioned for the control of proof prints in accordance with ISO 12647-7:2016, as well as with KCMY solid strips and colour specimens, secondary colour patches and the ECI/bvdm Gray Control Strips M alongside KCMY step wedges

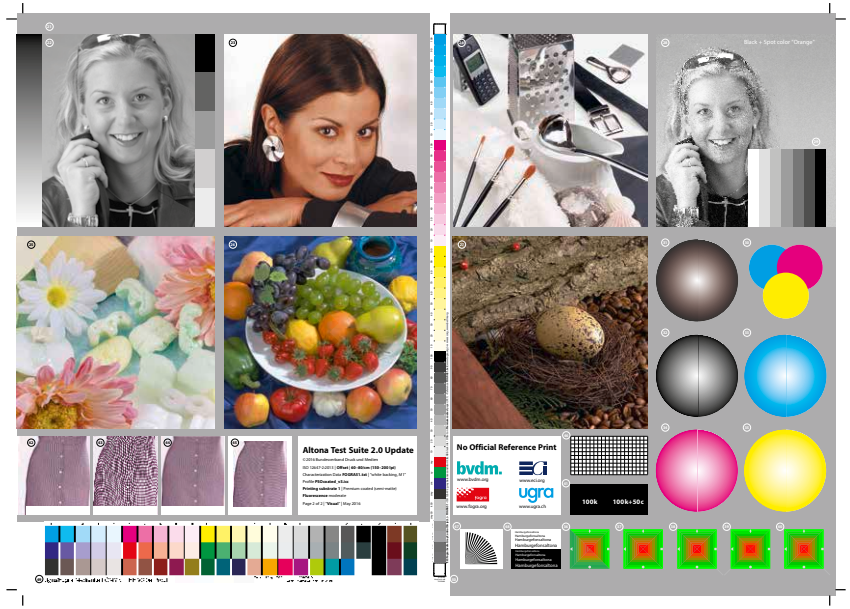


FIGURE 7B
Altona Test Suite 2.0, 2016 update, Test forme page 2
'Visual' with elements for visual checking such as primary colours, duplex/spot colour (here: orange), device independent colour definitions, overprints, gradations and print output resolution, that can be quantitatively checked in turn with the Fogra-CMYK media wedge 3.0

FIGURE 7C
Altona Test Suite 2.0, 2016 update, test forme **'roman16'**, page 1 of 4 with motifs 07, 08, 09 and 11, the secondary and tertiray colour patches that correspond to the motif colours and two ECI/bvdm Gray Control Strips M

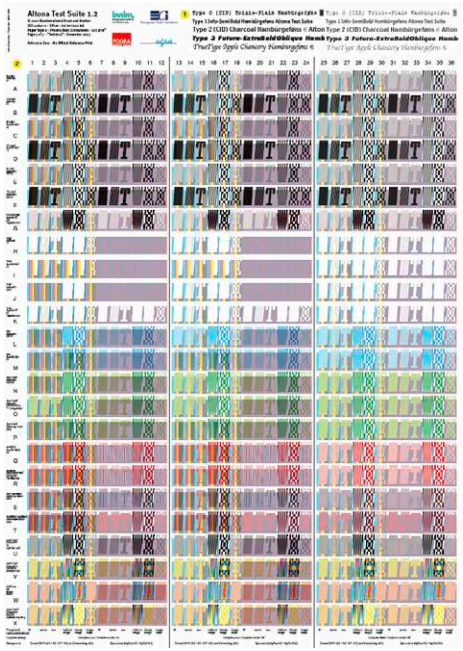


FIGURE 7D
Altona Test Suite 2.0, **'Technical 1'** test forme for PDF/X (trapping combined with character sets)

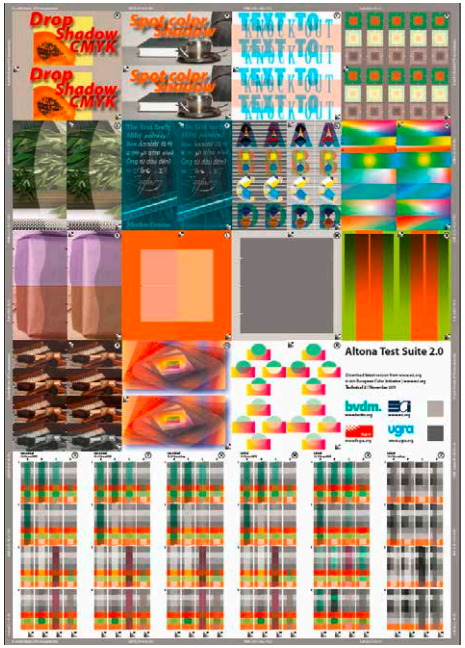


FIGURE 7E
Altona Test Suite 2.0, **'Technical 2'** test forme for PDF/X-4 (transparencies, layers, OpenType, JPEG2000); separate 'trapping' patches available

C.4.3 — ECI/bvdm Gray Control Strip ('GrayCon') for grey balance control

The goal of process control on the press is to be 'in colour' quickly. If the major process parameters such as standardized platemaking, tone value increase, paper and ink have been ensured then only a short space of time is required to optimally adjust the ink feed (colouring)—with inline controls this is now even possible non-stop.

The ECI/bvdm Gray Control Strip—referred to as 'GrayCon' in the trade—is designed to help printers bring the printing process into agreement with a proof printed under standardized conditions as closely as possible. Consequently, the GrayCon is based on the same characterization data as were used in prepress with the appropriate standard ICC profiles (e.g. ECI profiles v2 and v3) and evaluation of the Fogra CMYK media wedge 3. In the case of ECI offset profiles, these are Fogra characterization data.

Grey balance patches are a good indicator of correct ink feed and make visual monitoring quick and simple. To this end the GrayCon adopts one simple rule: **chromatic grey should look precisely the same as achromatic grey.**

By using the ink feed, the objective is therefore to bring the GrayCon chromatic grey patches into agreement with the achromatic grey patches.

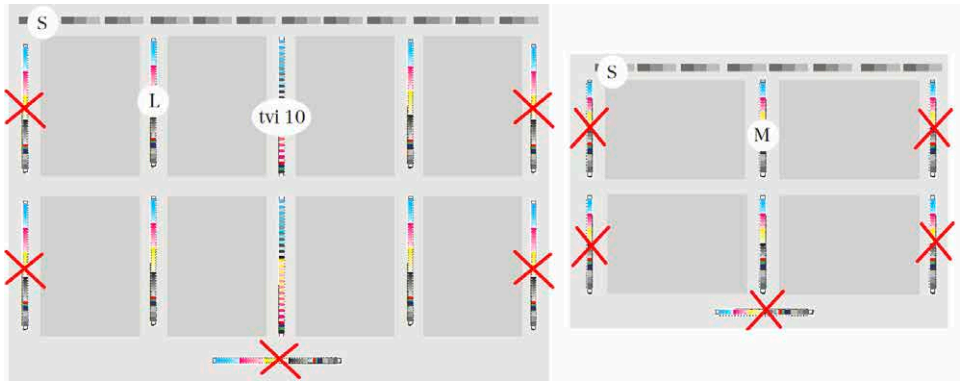


FIGURE 8
Positioning options for GrayCon versions on sheets or web cut-offs with long or short grain pages

This means that one is comparing a technical tone composed of defined values of cyan, magenta and yellow (chromatic grey) with a pure black tone value (achromatic grey). By 'balancing' the inks on the press the two differently composed patches are made to appear identical. Precise use of the GrayCon makes stable and reliable results possible and ISO 12647-2:2013 (Table 17) grey balance values should always be preferred for this purpose.

The GrayCon is available in four different layouts (see Fig. 9a–d). Depending upon intended purpose and the available space, each of these can be used individually or in combination (Fig. 8). The sets of strips (PDF, EPS) and German and English documentation (PDF) can be downloaded free of charge from the ECI website (www.eci.org/en/downloads#eci_bvdm_gray_control_strip_2017). The filename comprises the stem of the name 'ECI_GrayCon', the layout abbreviation 'S/MM_i1/L', the characterization file 'FOGRA##' and the version number—either v2, resource 'ECI bvdm Gray Control Strip (old versions)' or v3, resource 'ECI bvdm Gray Control Strip 2015' (also available from the bvdm website at bvdm-online.de/themen/technik-forschung/richtlinien-und-handreichungen/).
The v2 data also include the 'tvi 10' (10% tone value increase) measurement wedge, which contains solid and superimposed print as well as 10 % halftone patches but no grey balance patches. This makes it equally suitable for all old and new printing conditions. It is used to check production prints in accordance with ISO 12647.

FIGURE 9A–E
Layouts and functions of the **ECI/bvdm Gray Control Strip**

FIGURE 9A
Basic version 'S' (Small)

Dimensions (incl. identification line) 36 mm × 8 mm, made up of three achromatic/chromatic pairs of 6 mm × 6 mm patches:

- Achromatic patches in tone value steps of K = 70 %, K = 50 % and K = 30 %,
- The corresponding CMY chromatic grey patches were calculated by mans of absolute colorimetric CIELAB conversion of the K value in question from the corresponding characterization file and laid down with maximum chromatic composition (no black).

The identification line of the wedge allows the printing condition used to be checked and should therefore be present on the forme.

Due to the one-dimensional nature of inking control (more or less ink) on the press it is not always possible to adjust all three chromatic patches so that they are neutral. Since, in practice, black is used in the printing, the dark patches are less critical and attention should be focused on lighter patches. If necessary, the calibration of the process for tone value increase should be checked.

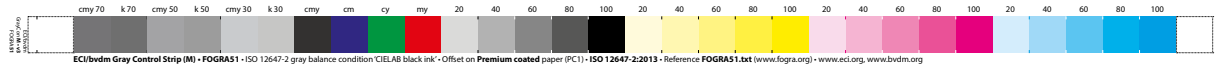
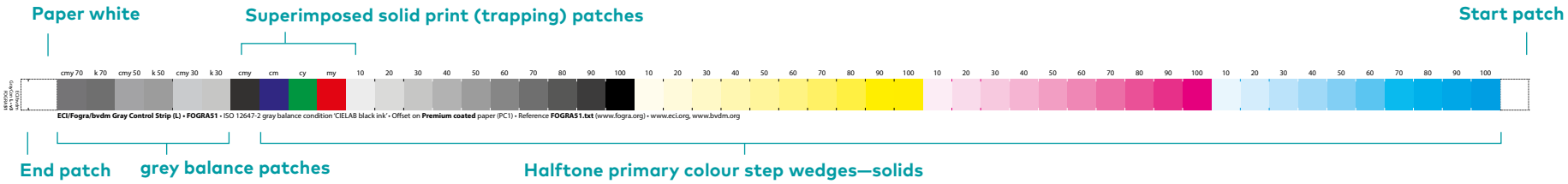


FIGURE 9B
Expanded version 'M' (Medium)

FIGURE 9C
Expanded version 'L' (Large)

FIGURE 9D

Expanded version 'L' (Large) with groups of patches



FIGURES 9B–D

Dimensions (incl. identification line) L: 291 mm × 10 mm composed of 5.5 mm × 6 mm patches (apart from end patch). The 51 monitoring patches can be divided into the following groups:

- Start and end patch (rquired for the positioning of a hand-held scanning device ahead of the first measurement patch and termination after the last patch),
- Paper white patch as white reference for densitometric measurements and determining the paper coloration,
- The three achromatic-chromatic grey pairs of the basic version S,
- Superimposed solid print patches (trapping patches) for visual and quantitative checking of the secondary colours (M + Y, C + Y, C + M) as well as tertiary black (C + M + Y), in order to be able to detect trapping problems,
- Halftone step wedges for each of the four primary colours K, Y, M, C, with tone values between 10 % and 100 % in 10-% steps. providing visual (by means of colour specimens) and quantitative control of the solid colouring as well as determination of the characteristic printing curves.

Since, in some cases, the boundaries between neighbouring control patches cannot be distinguished, narrow black or white guide lines have been included.

Dimensions (incl. identification line) M: 197.5 mm × 10 mm composed of 5.5 mm × 6 mm patches (apart from end patch). Reduced to 32 control patches by expanding the tone value steps to 20 %.

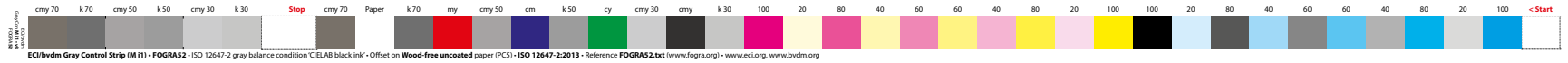


FIGURE 9E

Option M i1: contains patches for rapid i1 scanning measurement of the chromaticity coordinates and characteristic printing curves; the grey balance patches that it features are for visual evaluation only.

C.5 — Communicating paper properties

For many years, the consistent listing and communication of paper parameters were neglected. Since 2014, there has finally been a standard in the form of ISO 15397 —also known as the 'Paper Label'—which draws together the major paper-based substrate parameters (Table 34). All these parameters are described in their own ISO standards and this standard should be more widely used in professional communication for printed product planning and become inispensable.

Absorption properties such as wettability or absorption capacity do not form part ofISO 15397. For these, please refer to the Sappi publication "Papier. Normen & Maßeinheiten" [Paper, Standards & Measurement Units].

→ Also see "ProcessStandard Offset 2012, 2016 revision" pages 30/31 on communicating paper properties

TABLE 34
Paper parameters covered by ISO 15397:2014

Paper parameter or measurement method	ISO standards referenced	Relevance to ISO 12647
Product name		
Product or trade name, optionally, also name of paper manufacturer	–	–
Mechanical proprties: fibre material		
Relative grammage (density)	ISO 534	–
Thickness		–
Specific volume		–
Grammage	ISO 536	uses
Bending resistance (stiffness) for sheet-fed offset substrates	ISO 2493-1	–
Mechanical proprties: surface topography		
Parker Print Surf (PPS) roughness	ISO 8791-4	–
Bendtsen roughness	ISO 8791-2	–
Bekk smoothness	ISO 5627	–
Optical properties: gloss		
TAPPI 75° converging beam	ISO 8254-1	favours
75° parallel beam	ISO 8254-2 (or ASTM D7153)	refers to
TAPPI 20° converging beam	ISO 8254-3	–
Gloss on coloured surfaces at 20°/60°/85°	ISO 2813	–
Optical properties: transparency		
Opacity	ISO 2471, ISO 13655	–
Optical properties: colouring (paper white)		
Diffuse reflectance factor in blue region of spectrum with 'ISO Brightness'	ISO 2470-1	–
Diffuse reflectance factor in blue region of spectrum with 'D65 Brightness'	ISO 2470-2	–
CIE white D65/10° in outer region, also generally accepted	ISO 11475	uses
CIE white C/2° in inner region	ISO 11476	–
CIELAB paper colouring D50/2° general	ISO 13655	uses
CIELAB paper colouring D65/10° in the outr region	ISO 5631-2	–
Optical properties: fluorescence (paper white-brightening with OBA)		
Wide field of view with D65/10° ('D65 Brightness')	ISO 2470-2	uses
Narrow field of view with D50/2°, M1 or |M1–M2| modes	ISO 13655	uses
Viewing conditions (visual)	ISO 3664	uses
Durability properties		
Storage and ageing of proof printing papers	ISO 187	–

C.6 — Glossary

Absolute colorimetric
Type of colour transformation in which the colour values within the portrayable part of the source colour space are transformed into corresponding values in the target colour space, with the white of the source colour space being simulated (if it is darker than the white of the target colour space). Used in proof printing and softproofing; cf. Rendering Intent, perceptual, relative colorimetric, Fig. 11.

Appraisal
Critical visual comparison of two images.

Bitmap
Storage intensive because loss-free form of coding in which the lightness information is stored for every pixel and every colour. Commonly encountered bitmap formats includes RAW (digital photography), TIFF and TIFF/IT.

Characterization data (CharData)
Here: text files made available by Fogra containing characterization tables that serve as the basis for calculating ICC profiles for standard printing conditions; Download FOGRA51 and FOGRA52: https://www.fogra.org/index.php?menuid=316&reporeid=225&getlang=en

Characterization table
Table that serves as the foundation for profile generation and

- either compares the measured colour values of an original with data set values obtained once it has been input
- or compares data set values with the colour values measured on their ouptut to print or the screen.

ISO 12641 (previously ANSI IT8.7/1) characterization tables are particularly important for input and ISO 12642 tables are particularly important for print output. It is possible for a dozen profiles differing in black composition, manufacturer's profiling tool and other details to all be based on one characterization table. Therefore, in order to precisely specify an output intent it is sensible to provide the output profile.

Chromaticity locus, chromaticity coordinates
The colorimetric properties of a colour in the colour space defined by three colour values.

CIE (Commission Internationale de l'Éclairage)
French abbreviation for the International Commission on Illumination, which has headquarters in Vienna. It, together with the ISO and the IEC is responsible for internationl standardization in the field of illumination technology and colour measurement; www.cie.co.at/

CIELAB colour space
An approximately perceptually uniform colour space defined by the perpendicular L*, a*, b* coordonates, see Fig. 10. CIELAB was not originally developed as a colour space but for colour difference evaluations. It is based on the so-called complementary , colour system of mutually exclusive extremes: light-dark, red-green, yellow-blue.

CIELAB colour values L*, a*, b*
Colour values calculated from the CIE tristimulus values X, Y, Z: L* = lightness, a* = red-green chromaticity, b* = yellow-blue chromaticity. In accordance with ISO 13655 only CIELAB values are specified in the printing industry. Unit: 1. The CIELUV system does offer certain advantages for self-emitters such as monitors. However, in order to ensure

the comparability of measurement values, CIELUV should be confined to this limited number of applications.

CIELAB ΔE^*_{ab} colour difference, CIELAB(1976)
Difference between two chromaticity loci in the CIELAB colour space calculated using the following formula:

$$\Delta E^*_{ab} = \sqrt{\Delta L^{*2} + \Delta a^{*2} + \Delta b^{*2}}$$

The values ΔL*, Δa*, Δb* are the differences between the actual and the aim values of a chromaticity locus projected on to three axes. The quantities ΔE^*_{ab}, ΔL*, Δa*, Δb* are pure numbers and the unit is 1 and not, for example, ΔE. A colour difference of 1 corresponds, on average, to a difference between two sufficiently large, homogeneous colour patches that is just discernible.

CIELCH system
Intuitive portrayal of the CIELAB colour space in which the Cartesian coordinates a* and b* are replaced in the formula by the cylinder coordinates chroma C* and hue H* or hue angle h; cf. Table 30 and 31.

CIELCH ΔE^*_{00} colour difference, CIEDE2000
Difference using the modified CIELAB-colour difference formula between two chromaticity loci portrayed with specially weighted coefficients as LCH in the three dimensional CIELAB colour space. CIEDE2000 achieves an even greater perceptual uniformity in the evaluation of colour differences than CIELAB(1976). The weighting means that the calculated colour difference values cannot be converted between the two colour difference formmulae and they should therefore always be identified by an appropriate suffix after the DeltaE, i.e. ΔE^*_{00}, or ΔE^*_{ab}; also see sections A.3.2 and Fig. 1.

CMM (colour matching module) or colour engine
Software for the mathematical conversion of colour image data from one colour space to another colour space (colour transformation) through the use of one or more ICC profiles. Several ICC profiles are

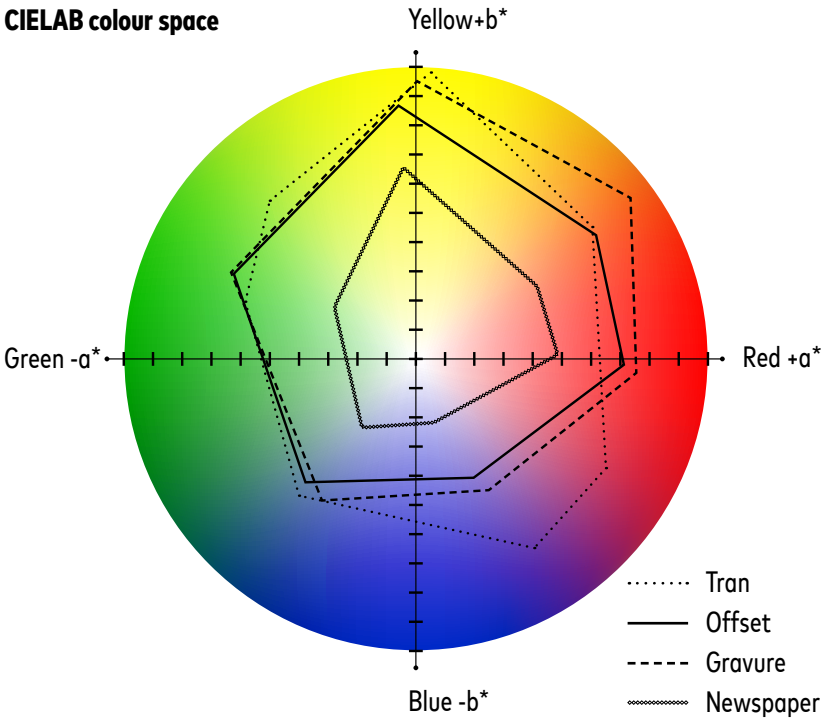


FIGURE 10
Representation of gamuts in the CIELAB-colour space: original (transparency or digital photo) and the ability of different printing methods to represent it. The outlined colour spaces represent examples from practice. The vertex values inevitably change with different paper-ink combinations.

usually linked to a profile before the colour transformation takes place, so saving time and increasing the accuracy of the transformation. A CMM may be a standard extension of an operating system (Apple ColorSync, Windows ICM) or a proprietary component ('3rd party CMM') of an application program. All major applications in the field of colour management are able to call on their own CMM.

CMYK composite
Type of file in which the tone values for the process colours required for printing have already been calculated (i.e. the separation has already taken place) but the splitting into individual files or separations has not yet occurrred or where for exchange or display reasons these have been reunited into a single file again.

Colour density D
Term in printing technology for the reflection density. The negative log to the base 10 of the reflectance factor:

$$D = -\lg R, \text{ unit: } 1$$

In order to measure it for chromatic printed specimenrs a densitometer is used with a narrow band spectral curve with a maximum for the complementary colour to the corresponding primary colour (red/orange filter for cyan, green filter for magenta and blue/violet filter for yellow). Black is measured with a broad band spectral curve that matches the brightness perception of the human eye ('vis-filter'). Colour density increases with increasing ink layer thickness up to a saturation value. In Europe, colour density values are placed after a decimal point.

Colour management
Methods for maintaining or the controlled adjustment of colour information in the workflow from original to print. It also includes calibration and monitoring.

Colour measurement device
Device for measuring colorimetric quantities, such as colour values and colour differences.

Colour space
The colour space is the three-dimensional (volumetric) representation of the colour values determined through colour measurement.

Colour temperature, similar/correlated
The colour temperature of a radiator is the temperature in kelvin (K) of an ideal black body radiator with the same chromaticity values (x, y) as the radiator in question.

Colour values
Colour space coordinates of a hue obtained from the spectral relectance levels. For example, the CIE tristimulus values X, Y, Z, the CIE chromaticity values x, y, z or the CIELAB colour values L*, a*, b*. Unit: 1.

Control strip
One-dimensional arrangement of patches for quantitative and/or visual evaluation.

Crossmedia publishing
Multiple use of the same digitally stored information for various media or printing conditions.

CxF3, color exchange format (Am. Engl.)
CxF 3.0 colour data container format in which the colour measurement device manufacturer X-Rite defines the XML core and the XML schema in accordance

with ISO 28178:2008. This allows both colour coordinates (CIEXYZ, CIEL*a*b*) and spectral data to be exchanged. The data container is supported manufacturer-independently by many applications such as ink formulation, colorimetric printing process control and in the laying out of colour libraries.

CxF/X, colour data exchange format (Br. Engl.)
ISO 17972 series of standards based on CxF3 that besides the interpretation of exchanged scanner and output target data defines the generation of spot colour data (CIEL*a*b*, spectral data) and their exchange in prepress workflow (Table 2B, SCTV).

Densitometer
Measurement device for determining the colour density of reflection copy originals or the transmission density of transmission copy originals. The device may be either a densitometer in the classic sense that is fitted with colour filters and, ideally, with polarization filters or it may be a spectrophotometer with additional densitometer functions. In Europe, devices with narrow band spectral characteristics for yellow and polarization filters are preferred (see ISO 5). If polarization is not used then the density of wet and dry ink films differs; also see section C.2 and Table 27.

Destination profile
See ICC profile.

DeviceLink profile
ICC profile for the direct adjustment between two output colour spaces with the same number of channels, eg. $CMYK_1$ to $CMYK_2$, without going via a profile connection space (PCS) such as CIELAB or XYZ. This method simplifies the application of standard profiles under individual printing conditions and above all when the chromatic composition differs (goal: enhanced ink saving thanks to lower overall ink quantities), but also for stable output on digital printing systems.

Dot shapes
Chain dots (string of pearls or chain-like structures), circular dots (circular over the entire tone value scale) and square dots (which primarily exhibit a chequer board structure in the mid tone value region). Circular dots are specified because they can be compared with print control strips. Unlike chain dot screens, square and circular dot screens do not exhibit a principal axis.

dpi (dots per inch)
US unit used for the resolution of output devices. To convert from dpi values into the official cm^{-1} units divide by 2.54.

ECI (European Color Initiative)
Expert group that focuses on the media neutral processing of colour data in digital publication systems (www.eci.org). Founded in 1996 at the instigation of a series of publishers (Bauer, Burda, Gruner + Jahr and Springer) in Hamburg. Members include customers, agencies, premedia companies, printers, federations (the bvdm being one), research institutes, colleges and system suppliers. The original focus was ICC-based colour management, gravure printing, advertisement production but today it also includes data exchange standards (eg. PDF/X) and process standardization (eg. gravure, offset).

ECI-CMYK, eciCMYK
Largest possible CMYK colour space that, on the recommendation of the European Color Initiative, should be used as a working and exchange colour space but not as a standard printing condition. It is based on FOGRA53 characterization data with a tone value curve that is an average for all printing methods. This means that, on output, an adjustment must be made for the actual printing condition. The bvdm only recommends its use as an exchange colour space for Wide Gamut digital printing, also see Tables 1 and 7.

ECI-RGB, eciRGB_v2
Colorimetrically defined RGB colour space with an extended gamut with a link to CIEXYZ that is produced by a profile deposited with the ECI. eciRGB_v2 (2008) is recommended by the European Color Initiative as a working colour space in the field of prepress and data exchange and is standardized as an ISO technical specification (ISO/TS 22028-4:2012); also see section A.1 and Table 1.

EPS (Encapsulated PostScript)
Special PostScript format, used for the embedded transport of finished page elements within another file.

Euroscale
Obsolete term for the CMY chromatic offset inks that at the time fulfilled the conditions of the long since withdrawn DIN 16539:1971. The CMYK ink scales for all printing methods are today defined in ISO 2846. The chromaticity coordinates and tone value increases that are to be achieved on production papers are contained in the ISO 12647 series of standards.

Fogra CMYK media wedge
This digital control means (see Fig. 5) has been developed by Fogra (www.fogra.org) together with the expert committee of the bvdm from 1996 onwards. Today, the Fogra CMYK media wedge is recognized worldwide as a control means for digital proof printing. It is essential for professionally produced contract proofs and therefore it is integrated as a licensed component into many proof printing systems and RIPs. The media wedge can also be used as a digital control means in the workflow in order to observe the effect of image editing in CMYK mode and other prepress interventions. It is not intended for control of the production run. The current version, 3.0, also allows evaluation in accordance with the revised ISO 12647-7:2016 standard, and the measured parameters should therefore be clearly marked with the suffix '00' (for CIEDE2000) to distinguish them from the out of date 'ab' (for CIELAB(1976)). All Fogra's licensees make the target values available in their own evaluation programs. When choosing measurement devices and proof printing systems, users of the media wedge should check that these support the media wedge and display CIELAB measurement values that conform to ISO-13655. The standard media wedge package (TIFF and EPS file formats) contains several different layouts. This means that the user is able to check the entire process chain at any time, and this is always to be recommended when new application programs or new versions of programs are used or other changes are made in the workflow. In order to ensure a reliable output of proof prints with accurate colour and agreement between the image contents and the measurement values of the media wedge it is always essential to check both the workflows and the proof printing system. Checking output systems by themselves is not enough to consistently prevent problems arising.

Gamut
The maximum extent of the visible colour space that an original, method or output device (device colour space) uses. See also Rendering Intent.

Gamut Mapping
Non-standardized adjustment routine for mapping a larger colour space on one that is the same size or smaller; see Rendering Intent and Fig. 11.

GRACol
A process control concept from IDEAlliance (USA) that has been heavily marketed worldwide. GRACol is sometimes described as an 'application of ISO 12647-2'. This is incorrect, since it starts from differing premises. For a long time the GRACol method was not fully documented. GRACol is almost exclusively based on a grey balance (NPD, neutral print density curve) and is based on uniform tone value increases for all printing conditions, which demonstrably cannot be adhered to in practice; www.gracol.com

Grey balance
Set of tone values for cyan, magenta and yellow with which a print produced under specified printing conditions and under specified viewing conditions yields an achromatic colour (grey, chromatic grey).

ICC (International Color Consortium)
A common interest group (www.color.org) founded in 1993 at the instigation of the Forschungsgesellschaft Druck e.V. (Fogra) in Munich with the goal of making open, manufacturer-independent colour management possible. Besides specifying colour profile formats (ICC profiles) the ICC also supports efforts to apply them in so-called ICC conforming file formats, applications and conventions, including PDF or PDF/X amongst others.

ICC profile
Correction file with instructions for a CMM for conversion between device- or process-related (e.g. CMYK) and colorimetric colour data (e.g. CIELAB) and vice versa based on a characterization table and special software settings. There are input profiles (scanner and digital camera profiles in RGB), display profiles (monitor profiles in RGB) and output profiles (printing method and proof printer profiles, largely in CMYK). Profiles with different numbers of channels (e.g. RGB to CMYK) are transformed via a profile connection space (PCS) such as CIELAB or XYZ. DeviceLink Profiles are tailored for direct CMYK-CMYK conversion. A source profile is one that is delivered with the data and that describes the nature of the data and its relationship to an absolute colour space. On output for proofing, the target profile describes the monitor or the proof printer, as well as the simulation or reference printing profile of the printing condition to be simulated.

Illuminance
Light energy per unit area. Unit: Lux (lx); 1 lx = 1 lm/m² (Lumen per square metre).

Illuminant
Radiation with a defined spectral distribution within a wavelength range in which it can influence the perception of the colour of an object through absorption and reflection or transmission. An illuminant can also be described by its Colour temperature, e.g. a D50 illuminant corresponds most closely to daylight and a colour temperature of 5000 kelvin.

ISO (International Standardization Organization)
Based in Geneva, the ISO (www.iso.org) either sells ISO standards itself or through the national standards institutes. The activities of the printing industry are covered by Technical Committee 130

(ISO/TC 130) and members of its work groups are delegated by the corresponding national mirror committees. These members include individuals who have worked on the drafting of MediaStandard Print.

Lightness L*
The perception of a colour as lighter or darker than another one or, in other words, as giving off more or less light. Unit: 1. The symbol for differences in lightness is ΔL*.

lpi (lines per inch)
Imperial/US screen ruling unit. It can be converted into the metric cm^{-1} unit by dividing it by 2.54.

Luminance
Measure of the intensity of light in a given direction and at a given three-dimensional angle that passes though a given cross-sectional area. Unit: cd/m^2 (Candela per square metre).

Media neutral data
Data stored in output neutral form.

Micrometre
1 micrometre = 1 µm = 0.001 mm, used inter alia for stating the diameter of laser dots in imaging systems or register accuracy in multi-colour printing.

Mid-tone spread S
Difference between the highest and the lowest tone values at the same position on the print for C, M, Y. Unit: %.

Multicolor
Short for 'multi(ple) colo(u)r printing', i.e. more than the four primary colour of CMYK, e.g. C-M-Y-K-red-orange/green/violet-blue; can be standardized in accordance with ISO 20654; also see SCTV.

Non-periodic screen (NP screen), frequency modulated screen (FM screen)
Screen without fixed screen angle and ruling values (in contrast to a periodic or amplitude modulated screen or AM screen), since the elements are more or less randomly distributed or follow defined scattering rules. An NP screen is characterized by the program used to generate it and its smallest possible dot size. So-called hybrid screens or cross-modulated screens (XM screen) are configured as NP screens at tone values of less than 10 % and more than 90 %, with fluid transitions to AM screening.

OK sheet
Printed copy in production printing selected to serve as the reference for the remainder of the run and which itself has frequently been matched against a digital proof print or a press proof.

OPI (Open Prepress Interface)
A prepress concept that saves storage space and in which page layout programs (e.g. Adobe InDesign, QuarkXPress) use a low resolution monitor version as a placeholder for a higher resolution image that is held on the server. On output, the low resolution image is replaced by the higher resolution image. The current Adobe OPI specification is OPI 2.0:2000. PDF/X supports the OPI approach but not OPI comments.

PDF (Portable Document Format)
Platform independent, object oriented document description format developed by Adobe with the option to embed bitmap or vector images, as well as fonts. Primarily used for exchanges between systems.

PDF/X
ISO 15930 (PDF/X) is a series of standards based on PDF (Adobe Acrobat) that was developed with the aim of being able to make error-free ('blind exchange') PDF documents available for colour management-conforming print output; also see section B.1.1 and Table 12.

PDFX-ready
Swiss printing industry initiative that supplies training materials, program settings ('recipes'), preflight profiles, test pages for PDF/X-1a and PDF/X-4 workflows (incl. 'PDFX-ready courses'); www.pdfx-ready.ch/index.php?show=3

Perceptual
Form of colour transformation in which the colour values within the portrayable part of the source colour space are transferred in a perceptual way to the (usually) smaller gamut of the target colour space, so that the white of the source colour space becomes the white of the target colour space; also see Rendering Intent, Fig. 11.

Pixel (contraction of 'picture element')
Smallest resolved image element of an image capture system (scanner, digital camera), monitor or output device (plate-setter, digital press).

Polarization filter, Polfilter
Filter that only allows light through in a single plane of vibration. Densitometers with pairs of crossed polarization filters yield almost identical colour densities for wet and dry prints (wet-dry compensation), which are higher than those yielded by devices without a polarization filter.

PostScript
Vector-based page description and programming language from Adobe.

ppi (pixels per inch)
US/Imperial unit for the resolution of input devices (scanner, digital camera); ppi values are converted into the metric cm^{-1} unit by dividing them by 2.54.

Press proof
Print produced on a press for the purpose of portraying the result of the colour separation process in such a way that it represents the result on a production press as closely as possible. At any given point whilst corrections are being made or after they have been completed, the purpose of the press proof is to provide a visual preview that is as close as possible to the anticipated result of the production run. The standardized press proof supplied with the repro (film set) serves as evidence that the appearance of the image portrayed on it is essentially achievable in the production run under standard conditions, whatever press the proof was printed on. The evidence is provided by the values of an original control strip printed with the proof and adherence to the other conditions for a standardized press proof. A proof can be supplied instead of a press proof.

Primary colour
In multi-colour halftone printing the colour generated by just one of the colouring agents (pigment, dye). In normal cases, the colours C, M, Y, K are also referred to as process colours. In special cases there may be others. For example the replacement of M by orange.

ProcessStandard Offset
The 'PSO manual' (670 pages) is based on the international standardization guidelines and serves as the reference for quality-oriented industrial production. The objective is to configure a production process that is divided up between multiple participants and stages so that it is as efficient as possible and, at the same time, to ensure that intermediate and final results exhibit a predictable colour quality and that production quality is assured from data capture to finished printed product. The current 2012 edition has been completely revised and reorganized and covers all offset methods including newspaper and narrow web printing. The switch to the new ISO 12647-2:2013 printing conditions has been made with the supplementary '2016 revision' (56 pages). The resulting complete edition of manual and supplement therefore is and remains the basis for ProcessStandard Offset or ISO 12647-2 certification.

ProcessStandard Offset Certification
Time-limited certification of standardized production processes based on the qualitative and statistical criteria of the bvdm's ProcessStandard Offset, and therefore of ISO 12647-2. The certificate is not an end in itself and nor is it intended for advertising purposes. Rather it serves as evidence that a print or prepress company has successfully and systematically optimized production through standardized workflows (see www.PSOinsider.de).

Contents and workflow are regularly checked and updated to reflect the current guidelines. The certification inspection is undertaken jointly by the originators of ProcessStandard Offset—Fogra and the bvdm or one of its regional federations—with either Fogra or the relevant regional federation carrying out the on-site certification inspection and its certification partner checking the printed results. This neutral, four-eye approach is unique in the industry and guarantees a reliable and, above all, unchallengeable result, which is certified by the globally recognized regional printing and media federations and Fogra. Another unique feature of this procedure is that the certifying institutions reinvest a substantial portion of their fees in the advancement and adaptation of the international guidelines.

PSOaktiv is an enhanced, added value extension of this certification that is only available to companies holding a bvdm/Fogra PSO certificate. The PSO certificate is issued on the basis of a one-off inspection whereas for PSOaktiv companies are required to demonstrate compliance with PSO guidelines every three months.

Production print
Print from the production run.

Profile
See ICC profile.

Proof
See Proof print.

Proof print
Print, not produced on a press, that is intended to simulate the desired printed result on a production press. The English term 'proof' refers both to a press proof and an off-press proof. In contrast to an idealized proof print, with a gamut and characteristic printing curves that are not specifically tailored to a particular printing method, a method-related proof print serves as the contract simulation of the production run.

Publishing
Umbrella term for all the steps involved in the production of publications from design and editing of content up to output.

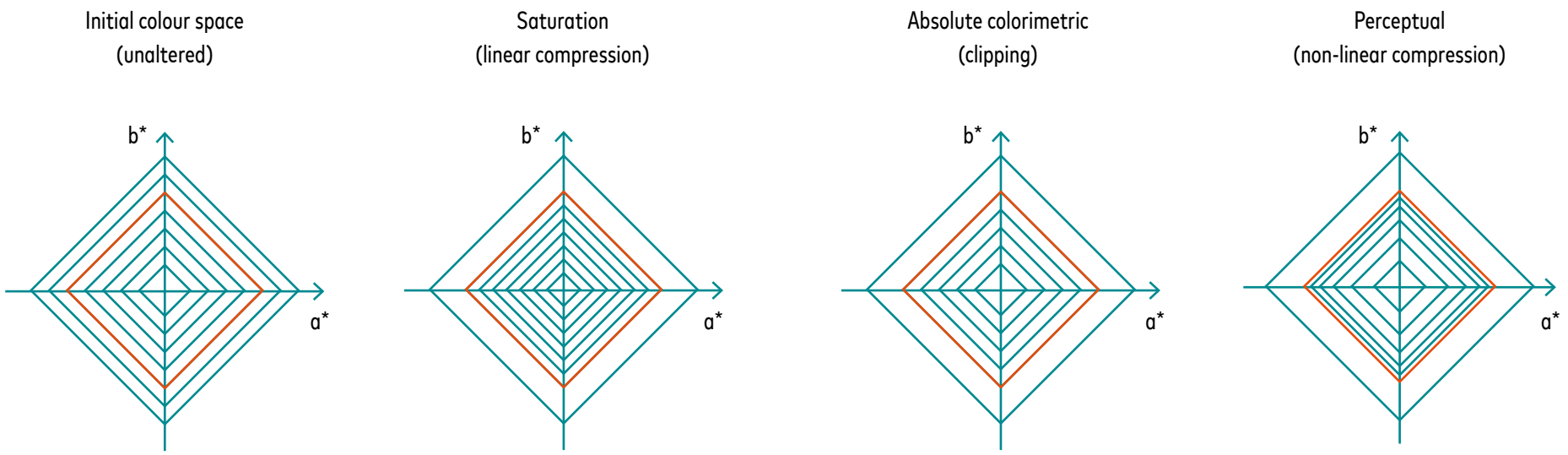


FIGURE 11
Models for gamut mapping (rendering intents in ICC profiles): in the first instance there are two models for mapping the input colour space on to the output colour space for the printing process being used: clipping and compression. In both cases, these two extremes only deliver satisfactory results for a very limited range of motifs. Non-linear compression offers a compromise.

Absolute colorimetric All portrayable colours are rendered unaltered colorimetrically, non-portrayable colours are replaced by the nearest protrayable colour.

Relative colorimetric Another fixed colorimetric conversion but this time in relation to the paper white. A neutral white from the originsl is laid down on the paper white.

Saturation Colours are strongly saturated and brilliantly protrayed at the expense of colour accuracy.

Perceptual (photographic) Perceptual mapping of the original colour space on to the output colour space.

- The neutral white is laid down on the paper white.
- The furthest non-portrayable colours are 'projected' on to the edge of the colour envelope. All the colours lying in between are more or less evenly 'shrunk' together with the portrayable colours.

→ See ProcessStandard Offset 2012 B 2.1.1 for working with black point compensation, which is usually used in conjunction with relative colorimetric rendering intent.

Reference printing condition
Standardized, generally known printing condition in which the quantities assume specified aim values. Example: offset with a screen ruling of 60/cm on 15 g/m² illustration printing paper, inks in accordance with ISO 2846-1.

Reference printing profile
See ICC profile.

Relative colorimetric
Form of colour transformation in which the colour values within the portrayable part of the source colour space are transformed into the corresponding values of the target colour space, so that the white of the source colour space becomes the white of the target colour space. Used for proof printing on original paper; see Rendering Intent, Fig. 11.

Rendering Intent
Description of the desired rendering of images and graphics on an output device or in an output process. The rendering intent is closely linked to (non-standardized) gamut mapping, see Fig. 11.

***absolute colorimetric*—**absolute colorimetric rendering is used for precise and checkable rendering of colour values, mainly when simulating (proof printing) an ouput process on a different output device or the output of defined colour values in printing.

***relative colorimetric*—**relative colorimetric is used for the precise and media-related rendering of colour values, mainly for a partial simulation that is related to the white of the medium of an output process on a different output device.

***perceptual*—**perceptual rendering is used for a harmonious rendering of colour values in printing that takes into account the differing gamuts of original and print, mainly for the colour separation of images.

***saturation*—**saturation oriented rendering is used to emphasize the chroma during the rendering in print of the colour values of the original, with the aim of maintaining the saturation of the colour values of the original, mainly for the colour separation of graphics and charts (business graphics).

Resolution
In the case of an input scanner the number of lines read per unit of length, in the case of an output device the number of addressable lines that can be written per unit of length. Units: cm^{-1}, also pixels per inch (ppi) in the case of input devices and dots per inch (dpi) in the case of output devices.

RGB data
Type of data in which the colour information is broken down into red, green and blue primary colour channels.

RIP (Raster Image Processor)
Software or computer for calculating the greyscale bitmap to be written by the output device.

Screen angle
In the case of dots with a long axis, the angle between the principal axis of the screen and the reference axis.
In the case of circular or square dots the smallest angle between one of the two axes of the screen and the reference axis. As in mathematics, the angle is measured in an anticlockwise direction. Angles are measured from a baseline of 3 o'clock on the right-reading image. Unit: degree.

Screen definition
Inverse of the screen ruling. Unit: cm or µm.

Screen resolution
One way of describing the resolution of a printing screen. In the case of periodic screens it corresponds to the **screen ruling** (number of image elements such as screen dots and lines per unit length in whatever direction results in the highest value. Unit: cm^{-1}), for non-periodic screens it corresponds to the **edge length of the smallest image element.**

SCTV, spot colour tone value
Halftone values for spot colours. It does not therefore relate to solid spot colours but to screened colour separations for spot colours in addition to the CMYK primary colours (Duplex / Duotone K+, Multicolor CMYK+/CMYK++/CMYK+++) completely replacing the primary colours (usually in flexo printing); standardized in ISO 20654:2017; for colour measurement data for SCTV characteristic printing curves see Table 2B, CxF/X-4a.

Source profile
See ICC profile.

TIFF (Tagged Image File Format)
Bitmap format administered by Adobe.

TIFF/IT
Special ISO 12639 TIFF format.

Tone value A
(on original, proof print and print) Percentage portion of the surface that appears to be covered by the colouring agent of a single colour (if light scattering processes in the substrate and other optical phenomena are disregarded), calculated by means of the Murray-Davies formula. Unit: %. Previously also referred to as the 'equivalent dot area'. The advantage of this definition is that it still makes sense if the measured tone is not screened, as is the case with, for example, many digital proof prints.

Tone value increase ΔA
Difference between the tone value in the data set and the print. Unit: %. The value is generally stated for a specific halftone value—for old printing conditions this was 40% and for the new ones it is 50%.

Tone value reproduction limits
The tone value range of a data set that can be transferred to the print.

Total ink coverage (TVI)
Sum of the tone values in all four colour separations of a set. Unit: %. For most colour sets the highest tone value sum occurs at the darkest point on the grey axis of the image.

Ugra/Fogra digital plate wedge
Digital control means for filmless platemaking.

Ugra/Fogra digital print control strip, DKL
Digital control means for monitoring press proofs and production prints.

Vector image, vector graphics
Space saving form of coding that represents lines through vectors, only the end points of which are saved. Examples: PostScript, EPS. cf. Bitmap.

C.7 — References and Internet sources

C.7.1 — Referenced ISO standards and series of standards

Valid standards in numerical sequence, as of February 2018; available from ISO, Geneva

ISO 5 → Photography and graphic technology – Density measurements;

- ISO 5-1:2009 – Geometry and functional notation.
- ISO 5-3:2009 – Spectral conditions.
- ISO 5-4:2009 – Geometric conditions for reflection density.

ISO 2470-2:2008 → Paper, board and pulps – Measurement of diffuse blue reflectance factor – Part 2: Outdoor daylight conditions (D65 brightness).

ISO 2846 → Graphic technology – Colour and transparency of printing ink sets for four-colour printing;

- ISO 2846-1:2017 – Sheet-fed and heat-set web offset lithographic printing.
- ISO 2846-2:2007 – Coldset offset lithographic printing.
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CIE – International Commission on Illumination, Vienna, www.cie.co.at, with CIE Division 8 'Image Technology', div8.cie.co.at

DIN – Deutsches Institut für Normung e.V. Berlin and Cologne, www.din.de, with Beuth Verlag GmbH, Berlin www.beuth.de; NA 017 – DIN-Normenausschuss Druck- und Reproduktionstechnik (NDR), www.din.de/de/mitwirken/normenausschuesse/ndr

ECI – European Color Initiative, www.eci.org, with its standard ICC profiles published in 2015, DeviceLink profiles v2/v3 and v3/v2 and updated GrayCon files www.eci.org/doku.php?id=de:downloads

ERA – European Rotogravure Association e.V., Munich, www.era.eu.org

Fogra Forschungsgesellschaft Druck e.V., Munich, www.fogra.org, with characterization data and media wedge subsets www.fogra.org/en/fogra-standardization/fogra-characterizationdata/a-icc-en.html

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