

Print quality in Offset printing

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A large number of factors impact the print quality in modern printing technology. Therefore, they should be controlled on the basis of standard values in order to obtain predictable and repeatable results. In order to achieve the uniform high quality prints, the reproductive process has to incorporate colour management with good calibration and ICC profiles of the printing machines. This paper analyses the reproductive process based on ISO specifications.

Introduction

The goal of each printing process is obtaining the highest possible quality reproduction of the original and the minimum deviation of colours within the process.

The standardization of printing processes in offset printing is defined by international standard ISO 12647-2:1998. Two procedures of standardization are employed in order to correctly transfer the colour information from one medium to another and to ensure that the performance of the media remains stable.

These procedures are calibration and characterization. A difference between the definitions of these terms is given in 1996 by Johnson: Calibration is setting (tuning) of the medium, device or process so that it gives replicable values.

In order to achieve high accuracy in colour reproduction process, the first step is to ensure that the media can consistently reproduce the identical colours from identical input data (colour information).

Characterization defines the relationship between the space of colours of the media, devices or processes and a uniform colour space of the CIE system which the colorimetry is based on (CIE XYZ or CIE L*a*b*).

ISO specifications for Offset print

When it comes to colour management, there is always an issue related to the correction of the CIE L*a*b* values for process colours. These values are defined and described in the international standard ISO 2864 and ISO 12647-2. ISO 12647-2 (offset printing process and rotary offset magazine printing), which define the parameters and test methods, the necessary conditions for the development of proof print, as well as the production process. These standards do not contain only target colorimetric values for five classes of paper classification, but also the specifications related to working with colours, dot gain, halftoning rule and other parameters. The standards of production classify printing papers into five categories and specify the CIELAB colour values for the production dyes shown in Table 1.

Table 1. CIELAB values for five paper categories measured on white background [5]

Paper grade	L*	a*	b*	Gloss	Grammage g/m ²
1. glossy coated wood-free	95	0	-2	65	115
2. matt coated wood-free	94	0	-2	38	115
3. glossy LWC	92	0	5	55	65
4. uncoated white	95	0	-2	6	115
5. uncoated yellowish	90	0	9	6	115
Tolerance	±3	±2	±2	±5	

¹Specified values per ISO/CD 12 647 - 2.2: D50, 2°, 0/45 or 45/0

Table 2. CIELAB values of the primary and secondary colours measured in full fields on white background for five paper categories [5]

Paper grade	1+2			3			4			5		
	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*
on white substrate												
Black	16	0	0	20	0	0	31	1	1	31	1	3
Cyan	55	-37	-50	58	-38	-44	60	-26	-44	60	-28	-36
Magenta	48	74	-3	49	75	0	56	61	-1	54	60	4
Yellow	91	-5	93	89	-4	94	89	-4	78	89	-3	81
Red(M+Y)	49	69	52	49	70	51	54	58	32	53	58	37
Green(C+Y)	50	-68	33	51	-67	33	53	-47	17	50	-46	17
Blue(C+M)	20	25	-49	22	23	-47	37	13	-33	34	12	-29

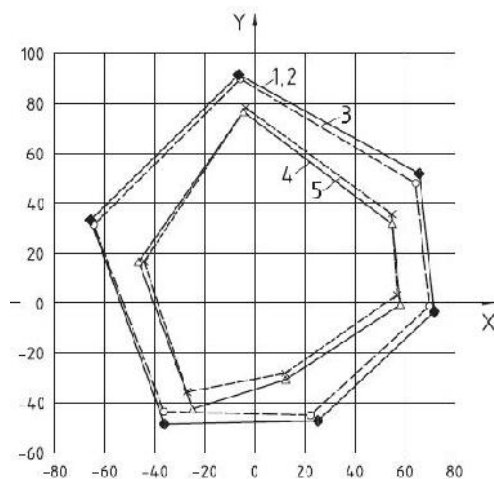


Figure 1. Gamut color for 5 different categories of paper shown in the CIELAB color space

Printing Press calibration

Printing press calibration depends on numerous factors which must be taken into account, including purchased dyes in accordance with ISO 2846-1, the type of printing substrate and the printing conditions. We must categorize the used printing substrate into one of the 5 given categories based on its properties in order to compare the measurement results with the appropriate values.

Creating linearized printing forms

The first step is the preparation of test form containing the control strips for controlling colour parameters using spectrometry and densitometry measurement methods.

It is necessary to calibrate the process for the preparation of printing forms, which is determined

by measuring the printing forms and defining the exposure curve. In this way, linearised printing forms are made.

Printing the test form

Printing starts by applying a small amount of CMYK colour dyes, increased steadily until the excessive application is reached. When the colouring of the print on the machine is brought into the framework of the ISO specifications, several best prints are chosen and inspected in terms of the transfer of dot values to the surface.

Measuring printed quire of paper

First, the change in density of coloration across the width of the sheet is checked. The difference between the minimum and maximum coloration density values may not exceed 10%, but in case they do exceed this given maximum allowed value, the dye riding rollers must be adjusted. CIELAB colour values (ISO 13655 measurement conditions: 0/45, D50, 2°, CIELAB) and the corresponding density values of full fields colorations are measured in a wet state. Afterwards, they are stored as values for a wet sheet and the obtained data will be used as target values for the upcoming steps. The individual sheets from the press lot are evaluated, as early as possible, 20 hours after the procedure because the standard CIELAB values refer to the dry sheet, based on the mean value of three measurements. Dot gain of the print is measured and is set as the basis for any change or adjustment of the LUT curve on the RIP for CMYK colour.

Creating corrected printing forms and re-printing

After the correction, the LUT curve on the RIP of the print form is re-lit. This is when the new densities full-field printing is made.

Conclusion

In this stage, we must check whether the changes or adjustments of the RIP LUT curves gave result on the print or not. The achieved values in the print must meet the densitometric specifications of rich tone and specifications related to the dot gain according to the categorization of dot gain depending on the type of the printing substrate. The individual parameters (CIELAB values, the density of coloration, tone value increase) are again noted as parameters of the print and set as the target values. All settings must be repeated for each type of paper and individually set

because colorimetric values and tone value increase depend on the printing material. The individual sheets from the lot of the press are evaluated the earliest 20 hours after the sheet is dry. Using the measuring device, in certain areas of measurement pins, color characteristics that are relevant for quality control in the print are measured. Mandatory elements of measurement evaluation of the print are CIELAB values and the calibration of the reproduction process is based on them, while the other color characteristics are the informative ones.

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Kvalitet štampe u Offset štampi

SAŽETAK

Na kvalitetu otiska u savremenoj grafičkoj tehnologiji utječe velik broj čimbenika. Stoga ih je potrebno kontrolirati na temelju standardnih vrijednosti kako bismo dobili predvidljiv i ponovljiv rezultat. Da bi se mogli ostvariti ujednačeni otisci visoke kvalitete, u reproduksijski proces je potrebno ukomponirati upravljanje bojama (eng. color management) s dobrom kalibracijom i izrađenim ICC profilima tiskarskih strojeva. U ovom radu analiziran je reproduksijski proces na osnovi ISO specifikacija.

Ključne riječi; kvalitet, offset tisak, upravljanje bojom.