SLOVENSKI STANDARD
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Procesne tiskarske barve za knjigotisk - Kolorimetrične značilnosti

Set of printing inks for letterpress printing -- Colorimetric characteristics

Gamme d'encres primaires pour la typographie -- Caractéristiques colorimétriques

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INTERNATIONAL STANDARD ISO 2845

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Set of printing inks for letterpress printing — Colorimetric characteristics

Gamme d'encres primaires pour la typographie — Caractéristiques colorimétriques

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up has the right to be represented on that Committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2845 was drawn up by Technical Committee ISO/TC 130, *Graphic technology*, and circulated to the Member Bodies in August 1972.

It has been approved by the Member Bodies of the following countries :

Austria*	Germany	Spain
Chile	India	Sweden
Czechoslovakia	New Zealand	Switzerland
Egypt, Arab Rep. of	Poland	Thailand
Finland**	Romania	Turkey
France	South Africa, Rep. of	United Kingdom

* with the exception of sub-clause 4.4.

** with the exception of sub-clause 4.3.

No Member Body expressed disapproval of the document.

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Set of printing inks for letterpress printing — Colorimetric characteristics

0 INTRODUCTION

This International Standard is in technical conformity with CEI specification 12-66 of the European Committee of the Paint and Printing Ink Manufacturers' Association defining a "European set of primary colours for letterpress printing".

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a set of colours for a series of primary inks intended for three- or four-colour letterpress printing, in defined order of printed colour, and describes the control method.

It will enable

a) photo-engravers to prepare blocks based on the same colours and suitable for application on the same printing forme irrespective of origin;

b) photo-engravers and printers to obtain printing inks which, when they are applied to a reference paper and at standard thickness, give results complying with the specifications of this International Standard.

NOTE — This International Standard does not apply to fluorescent inks. Pigments are not covered by this International Standard thereby avoiding prejudice to future development in pigment production.

2 REFERENCES

ISO 2834, *Printing inks — Preparation of standard prints for determination of resistance to physical and chemical agents.*

ISO 2835, *Prints and printing inks — Assessment of light fastness.*

ISO 2837, *Prints and printing inks — Assessment of resistance to solvents.*

ISO 2846, *Set of printing inks for offset printing — Colorimetric characteristics.*

3 DEFINITIONS

For the purpose of this International Standard the following definitions apply :

3.1 reference inks : Yellow, magenta and cyan inks from which primary and secondary colours are obtained conforming to the set defined in this International Standard when printed on reference paper and with the reference ink film thickness given in 3.3.

3.2 standard set : A complete series of primary inks intended for three- or four-colour printing of which the colorimetric characteristics comply with the specifications of this International Standard.

3.3 reference film thickness of ink : Thickness of a printed film when printed solid on reference paper, of which the value is exactly 1 μm.

3.4 reference paper : Coated paper as specified in ISO 2834.

3.5 primary colours : Colours of individual prints from yellow, magenta and cyan inks produced under standard conditions, and of which the colorimetric definitions correspond to the numerical values given in 4.2.

3.6 secondary colours : Colours obtained by overprinting primary colours two at a time :

yellow + magenta,

yellow + cyan,

magenta + cyan,

in the conditions specified in this International Standard and with the colorimetric definitions corresponding to the numerical values shown in 4.2. The order of the overprinting of the primary colours is not — subject to specification to the contrary — laid down, but it must be stated in the test report.

4 TEST METHOD

4.1 Principle

Each colour in the set obtained by printing (or overprinting) reference inks under the conditions specified in 5.2 is assessed according to its visual appearance by the values of the colorimetric steps established from measurements made in accordance with the spectrophotometric methods of colorimetry.

Reference inks are printed solid, either alone (primary colours) or overprinted (secondary colours) at the reference thickness and on reference paper.

NOTE – The colours chosen are those which offer the best possible lightfastness (see ISO 2835) and resistance to solvents (see ISO 2837) in order that prints may be varnished.

4.2 Colorimetric characteristics and tolerances

The table below gives the numerical values of the colorimetric characteristics of the specified primary and secondary colours. Tristimulus coefficients X, Y and Z have been established in accordance with the recommendations of the 1931 meeting of the CIE[1]. They are determined for Illuminant C.

Numerical values of the uniform colour space coefficients U^*, V^* and W^* derived from the above and the colour difference ΔE_{CIE} are calculated according to the 1964 CIE recommendations (CIE vocabulary – definition 45-15-185).

The chromaticity co-ordinates x and y and the luminance Y have been included in the table below and may if desired be calculated from X, Y and Z.

4.3 Preparation of test specimens

In order to check whether a primary set conforms to this International Standard test specimens are prepared with primary colours and secondary colours. In the absence of precise instructions printing in the order : yellow, magenta – cyan is recommended. Prints shall be prepared on reference paper and at the reference thickness. The first print must be quite dry and well set before overprinting is attempted. The thickness of the film obtained, expressed in micrometres, is equal to the quantity of ink applied, expressed in grams per square metre, divided by the density of the ink used, in grams per cubic centimetre.

The print is prepared solid either on a proof press or on a printability tester, the type of apparatus being stated in the report. The quantity of ink applied is checked by weighing the printing plate before and after printing.

In practice, a number of test proofs are prepared under constant conditions of temperature and humidity which fall on either side of the required reference thickness of 1 μm. By interpolation the precise colorimetric values are determined which relate to a given film thickness.

4.4 Colorimetric measurement of test specimens

The prints (or overprints), when completely dry, are spectrophotometrically measured in accordance with the recommendations of the CIE[2], placing them on a pile of at least five unprinted sheets of the reference paper before assessment.

The spectrophotometric curve is plotted using a spectrophotometer with 45/0 geometry, in other words with the incident light at 45° to the specimen and measurement at right angles to it. The percentage spectral reflectance is expressed relative to a reference surface of pure magnesium oxide, freshly prepared and obtained by gradually depositing small quantities of vaporized magnesium oxide until an increase in reflectance is no longer obtained between successive deposits (at least 0,5 mm thickness).

Calculations from the spectrophotometric curves are made for illuminant C, either from ordinates at 10 nm intervals by multiplication with the appropriate normality coefficients, or using the 30 selected ordinates method for this illuminant. This gives the tristimulus coefficients X, Y and Z.

4.5 Expression of results

The colour difference ΔE_{CIE} is given by the formula

$$\Delta E_{CIE} = [(U_2^* - U_1^*)^2 + (V_2^* - V_1^*)^2 + (W_2^* - W_1^*)^2]^{1/2}$$

In this formula U_2^*, V_2^* and W_2^* are the values given in the table in 4.2 and U_1^*, V_1^* and W_1^* are the corresponding values for the test specimens under examination.

The ΔE_{CIE} colour difference values calculated for primary and secondary colours shall be compared with the tolerances given in the table in 4.2.

A set of inks will be considered to comply with this International Standard, therefore constituting a "standard set", if all ΔE_{CIE} colour difference values are respectively less than the corresponding tolerances shown in the table in 4.2.

Primary and secondary colours	Chromaticity co-ordinates		Luminance	Uniform colour space coefficients CIE 1964			Tolerance
	x	y	Y	U^*	V^*	W^*	ΔE_{CIE}
Yellow	0,437	0,494	77,8	19,1	70,9	89,7	2,3
Magenta	0,464	0,232	17,1	112,0	−12,7	47,4	5,0
Cyan	0,153	0,196	21,9	−54,5	−50,9	52,9	3,0
Yellow + magenta	0,613	0,324	16,3	139,8	21,8	46,4	7,3
Yellow + cyan	0,194	0,526	16,5	−69,1	28,1	46,7	5,3
Magenta + cyan	0,179	0,101	2,8	− 3,6	−35,4	18,1	8,0

The plate attached to this International Standard, made with reference inks, gives an idea of the prints obtainable.

1) International Commission on Illumination.

2) Colorimetry document from the CIE (July 1969 – *Official Recommendations of the CIE*).

4.6 Test report

Quoting this International Standard, state : the ΔE_{CIE} values for primary colours and for secondary colours. State the overprinting order for the secondary colours together with any unusual features likely to have affected the results.

5 ALTERNATIVE TEST METHOD

This method is designed to test conformity of a specimen with the standard values of colorimetric characteristics without recourse on each occasion to the elaborate scientific equipment and expertise required when using the method specified in 4.4. In case of dispute the method specified in 4.4 is to be used.

5.1 Principle

Colour and colour strength shall be determined by visual comparison of a dry print with a dry print of the master standard ink made on the same paper at the same time under similar conditions of printing and film thickness. The comparison shall be made with film thickness between 1 and 1,5 μm and prepared as specified in 5.3.

The specimens shall produce a good commercial match when examined by a trained observer as specified by the Experts Committee E.1.3.1 of the CIE (illuminant D 6 500).

NOTES

1 Prints should not be regarded as "dry" until at least 24 h after printing.

2 In practice the error introduced by comparing under north skylight or colour-matching fluorescent tubes as specified by the CIE (see above) is usually negligible.

5.2 Colorimetric characteristics and tolerances

A master standard ink shall be prepared for the primary colours, yellow, magenta and cyan, such that they give colorimetric characteristics within the given tolerances as shown in 4.2.

The test specimens for this work shall be prepared according to the specifications in 4.3, but the film thickness of the reference specimen shall be 1,0 μm. The measurement of characteristics shall be made in accordance with 4.4.

Such master standard inks must receive approval from a recognized institution competent to carry out this standardization and to certify that such master standards are in conformity with the colorimetric data (see 4.2).

NOTE – The National Research Associations for the printing trades would normally offer such services. PIRA, Randalls Road, Leatherhead, Surrey, England, are able to give information on the availability of such master standards.

5.3 Preparation of reference prints

Reference prints shall be made using a suitable proofing press, the printing plate being weighed before and after printing, and the film thickness applied calculated from the difference in mass, the print area, and a knowledge of the relative density of the ink used. If, for instance, an ink of relative density 1 is used, and if 1 g of ink is transferred per square metre of printing surface, the ink film thickness will be deemed to be 1 μm. Overprinting shall be done wet on dry.

5.4 Transparency

The transparency of inks conforming to this International Standard shall be not less than those of the respective master standard inks when dry prints, made by the method described in 5.3 on paper printed with a black bar 10 to 15 mm wide, are visually compared. The area printed with each coloured ink shall extend on either side over the black bar a distance at least equal to its width.

5.5 Light fastness

The light fastness of inks conforming to this International Standard shall be not less than that of the respective master standard inks when dry prints on the same paper, under the same conditions of printing and with the same weight and colour strength, are compared by an exposure test as specified in ISO 2835. The exposure shall be continued until a just perceptible change in reference standard 4 of the grey scale is observed.

5.6 Solvent resistance

The solvent resistance of inks conforming to this International Standard shall be not less than that of the respective master standard inks when dry prints, made by the method described in 5.3, on the same paper, under the same conditions of printing are tested in accordance with ISO 2837.

ANNEX

FORMULAE FOR CALCULATING U^*, V^* AND W^*

A.1 Calculation formulae for the different colorimetric characteristics are :

$W^* = 25\ Y^{1/3} - 17$ with $0 < Y < 100$

$U^* = 13\ W^*\ (u - u_o)$

$V^* = 13\ W^*\ (v - v_o)$

where

$$u = \frac{4X}{X + 15Y + 3Z}$$

$$v = \frac{6Y}{X + 15Y + 3Z}$$

A.2 Where illuminant C is adopted as an achromatic colour, the u_o and v_o values of this light source are :

$u_o = 0{,}200\ 9$

$v_o = 0{,}307\ 3$