INTERNATIONAL STANDARD

ISO
2846-2

Graphic technology — Colour and transparency of ink sets for four-colour-printing —

Part 2:
Coldset offset lithographic printing

Technologie graphique — Couleur et transparence des gammes d'encres d'impression en quadrichromie —

Partie 2: Impression lithographique offset rotatif coldset

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 2846 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 2846-2 was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

ISO 2846 consists of the following parts, under the general title *Graphic technology — Colour and transparency of ink sets for four-colour-printing*:

— *Part 1: Sheet-fed and heat-set web offset lithographic printing*

— *Part 2: Coldset offset lithographic printing*

— *Part 3: Gravure printing*

— *Part 4: Screen printing*

— *Part 5: Flexographic printing*

Annex A forms a normative part of this part of ISO 2846. Annexes B to D are for information only.

Introduction

A working group consisting of TC 130/WG 4 and WG 3 experts for materials and process control examined the colorimetric properties of coldset web offset inks from around the world and found that a single set of colour coordinates could adequately represent these, within reasonable tolerances. This part of ISO 2846 is the result of that activity. It will enable printers to obtain a reasonable consistency between one another and thereby ensure that separations and digital images supplied to them can be used to best advantage.

This part of ISO 2846 will allow printers to obtain sets of process inks from various sources which will produce a similar colour when printed on the reference substrate at the appropriate film thickness. This will allow colour separations for coldset web offset printing to be based on known colour standards. The colorimetric characteristics specified in this part of ISO 2846 may only be obtained when the inks are printed on the reference substrate. However, similarity of two inks on the reference substrate will ensure similarity on another substrate.

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Graphic technology — Colour and transparency of ink sets for four-colour-printing —

Part 2:
Coldset offset lithographic printing

1   Scope

This part of ISO 2846 specifies the colour and transparency to be produced by inks intended for four-colour coldset web offset printing when printed under specified conditions on a printability tester. It also describes the test method to ensure conformance.

This part of ISO 2846 does not apply to fluorescent inks and does not specify pigments (or spectral reflectance) in order not to preclude developments which may enable different pigment combinations to be used advantageously while still achieving the colorimetric requirements specified in this part of ISO 2846.

2   Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 2846. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 2846 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 536:1995, *Paper and board — Determination of grammage.*

ISO 2846-1:1997, *Graphic technology — Colour and transparency of ink sets for four-colour-printing — Part 1: Sheet-fed and heat-set web offset lithographic printing.*

ISO 2471:1998, *Paper and board — Determination of opacity (paper backing) — Diffuse reflectance method.*

ISO 8791-4:1992, *Paper and board — Determination of roughness/smoothness (air leak methods) — Part 4: Print-surf method.*

ISO 13655:1996, *Graphic technology — Spectral measurement and colorimetric computation for graphic arts images.*

3   Terms and definitions

For the purposes of this part of ISO 2846, the following terms and definitions apply.

3.1
coldset printing
web offset or letterpress printing without accelerated drying; ink sets by absorption into the substrate

3.2
standard ink
ink, intended for four-colour printing, which, when printed on the reference substrate and within the applicable range of ink film thicknesses, complies to the colorimetric and transparency specifications of this part of ISO 2846

3.3
primary colours
colours of individual prints from yellow, magenta and cyan inks

NOTE   If the prints are produced as specified in this part of ISO 2846 and conform to the colorimetric characteristics specified, they are standard primary colours.

3.4
transparency
ability of an ink film to transmit and absorb light without scattering

NOTE   It is generally expressed as some measure of the unwanted scattering.

3.5
transparency measurement value
T
reciprocal of the slope of the regression line between ink film thickness and colour difference for overprints of chromatic inks over black

4   Test method

4.1   Principle

Each ink shall be printed on the reference substrate described in annex A at a range of ink film thicknesses. The colours which result shall be measured colorimetrically. If one or more samples are found which conform to the values and tolerances specified in this part of ISO 2846 that ink complies with this part of ISO 2846.

Transparency shall be evaluated by printing each of the three primary colours on a black substrate at a range of film thicknesses. The CIELAB colour difference shall be determined for each sample, between the printed and unprinted black, and the linear regression coefficient (slope of the regression line) between ink film thickness and colour difference shall be calculated for each colour. An ink conforms to this part of ISO 2846 if the reciprocal of the coefficient is negative or greater than the value specified in Table 2.

For a detailed description of procedures, together with examples, see annex D.

4.2   Test print preparation

4.2.1   Prints for colorimetric evaluation

For each of the inks to be evaluated a number of test prints shall be made, each produced at a different ink film thickness, according to the conditions specified below.

They shall be made on the reference substrate as specified in annex A. The range of ink film thicknesses produced shall encompass that specified in 5.3.

— The print shall be made using a printability tester.

— Printing shall be directly from the printing forme to the substrate.

— The ambient temperature shall be (24 ± 1) °C.

— Prints shall be produced with a printing line pressure of (225 ± 25) N/cm at a speed of (1 ± 0,1) m/s.

⎯ The printing forme, which shall be an elastomer or rubber blanket-covered roller, shall have a Shore A hardness of between 80 and 85.

⎯ The distribution time and the inking time shall not be greater than 60 s each. This does not include weighing time.

⎯ The inking unit and the printing forme shall be cleaned and re-inked after each print.

NOTE   Solvent used to clean the printing forme may penetrate the material. Time must be allowed to ensure full evaporation of the solvent. Using two printing formes alternately is recommended.

The amount of ink transferred to the substrate shall be determined by measuring the difference in mass of the printing forme before and after printing using an analytical balance, accurate to at least four decimal places. This amount shall be expressed in grams per square metre. Conversion to film thickness in micrometres shall be made by using the mass density of the ink and the printed area.

4.2.2   Prints for transparency evaluation

Test prints for transparency evaluation shall be produced by printing the inks to be tested on a black substrate. Measurements of the CIELAB values of the black substrate shall be made prior to overprinting. The black shall have a lightness ($L*)$ less than 30 when determined according to ISO 13655.

The ink to be tested shall then be printed on the black substrate[1], such that a range of samples, each with a different ink film thickness, is achieved. The range should approximate that defined in 5.3.

4.2.3   Setting of test prints

Prior to colour measurement all printed samples shall be left for at least 12 h to enable setting of the ink.

4.2.4   Colour measurement procedure

Test prints shall be measured in accordance with ISO 13655, except that a substrate backing consisting of at least seven sheets of the unprinted reference substrate shall be used.

NOTE   The colorimetric values are related to the measurement procedure according to ISO 13655. This means that the samples shall be measured spectrally, with a 0°/45° or 45°/0° geometry instrument, and for calculation of CIELAB values and for the colour difference the CIE 1931 (2°) standard colorimetric observer data shall be used together with CIE standard illuminant D_{50}.

5   Requirements for colour, transparency and ink film thickness ranges

5.1   Colour

For an ink to conform to this part of ISO 2846 it must meet the specifications for colour defined in Table 1, at some ink film thickness **within** the range specified in 5.3, **and** the specification for transparency defined in 5.2.

To meet the specification for colour an ink shall produce a colour that falls within the colour difference tolerances from the specified colorimetric values given in Table 1 at some ink film thickness within the range specified in Table 2 when printed as defined in 4.2.1.

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1)   Such a substrate (product code 1800399) is available at NPES The Association for Suppliers of Printing, Publishing and Converting Technologies, 1899 Preston White Drive, Reston, Virginia, 22091-4367.

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Table 1 — Colorimetric values

Ink	CIELAB values			Tolerances			
	L^*	a^*	b^*	ΔE_{ab}^*	ΔL^*	Δa^*	Δb^*
Yellow	80,90	− 2,85	61,79	4,0			
Magenta	54,60	49,95	0,39	5,0			
Cyan	59,00	− 25,07	−27,41	3,0			
Black	40,00	1,60	4,52		0 a −40	± 1,0	± 2,0

a This means that for black there is no symmetrical tolerance for L^* but an upper limit.

NOTE 1 Typical spectral data for inks conforming to this part of ISO 2846 are provided in annex B. Reference spectral data for 8°/diffuse or diffuse/8° (specular included) geometry are also included.

NOTE 2 Reference data for CIELAB values calculated from the CIE 1931 (2°) standard colorimetric observer, together with CIE illuminant D_{65}, are included in annex C for both geometries. CIELAB data for 8°/diffuse or diffuse/8° (specular included) geometry and illuminant D_{50} are also included.

5.2 Transparency characteristics

To meet the specification for transparency an ink shall produce a value greater than that specified below when determined by the procedures and principles outlined in 4.1 and 4.2.2.

Table 2 — Transparency

Ink colour	Transparency measurement value T
Yellow	0,1
Magenta	0,2
Cyan	0,3

NOTE For highly transparent inks (usually cyan) the slope of the regression line may be zero or negative. In such a situation the transparency measurement value is considered to be approaching infinity and therefore the ink meets the specification.

For further information concerning transparency evaluation, see clause D.2

5.3 Ink film thickness range

The range of ink film thickness, within which a standard ink for coldset lithographic printing must conform to the colorimetric values specified in 5.1, is

0,7 µm to 1,3 µm

Annex A
(normative)

Reference substrate

For the purposes of this part of ISO 2846, a newsprint conforming to the Newsshade 95 specification shall be used as reference substrate. The characteristics of the reference substrate as specified in IFRA Special report 1.11, Newsshade 95, shall be as follows:

Colour

CIELAB values	$L^* = 82{,}02 \pm 2{,}0$
	$a^* = 0{,}28 \pm 1{,}0$
	$b^* = 2{,}91 \pm 1{,}5$

Method: ISO 13655 (0°/45°, D_{50}, 2°) with the exception: Reference substrate backing (4.2.4)

Mass per area

Specification: $(48{,}8 \pm 2)$ g/m^2

Method: ISO 536

Opacity: (94 ± 2) %

Method: ISO 2471

Roughness: $(3{,}4 \pm 0{,}2)$ μm at a pressure of 1 MPa

Method: ISO 8791-4

Annex B
(informative)

Spectral data

For some applications, such as calculating tristimulus values for a different observer or illuminant, it is useful to have recourse to spectral data. As already stated it was deliberately decided not to standardize such data since it can be very restrictive for ink manufacturing and future development of ink with improved properties. However, the following data may be taken as 'typical'. Since most inks are currently based on the same pigments any differences at the present time are likely to be small. It must be stressed that this annex is informative; inks cannot be assumed to be close to this data for standardisation purposes. It must also be remembered that these values are derived from measurements made on samples printed on the reference substrate backed by at least seven sheets of the same substrate.

Two tables of data are presented: Table B.1 is for 0°/45° geometry and Table B.2 is for 8°/diffuse (specular included). This data has been used to compute equivalent tristimulus values to those provided in Table 1 and annex A but for diffuse/8° geometry and for D_{65} (both geometries). These tristimulus values are given in annex C.

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**Table B.1 — Typical spectral reflectance data for inks conforming to
this part of ISO 2846, 0°/45° geometry**

Wavelength	Reflectance factor				
nm	Cyan	Magenta	Yellow	Black	Substrate [a]
380	0,084	0,096	0,067	0,051	0,132
390	0,131	0,119	0,078	0,058	0,187
400	0,194	0,146	0,087	0,067	0,281
410	0,263	0,176	0,095	0,076	0,370
420	0,320	0,204	0,100	0,082	0,446
430	0,379	0,227	0,104	0,088	0,507
440	0,444	0,244	0,108	0,093	0,544
450	0,494	0,249	0,115	0,096	0,571
460	0,522	0,240	0,125	0,100	0,593
470	0,540	0,222	0,135	0,102	0,610
480	0,547	0,202	0,156	0,105	0,625
490	0,546	0,182	0,209	0,107	0,636
500	0,533	0,163	0,321	0,109	0,642
510	0,505	0,144	0,472	0,110	0,644
520	0,456	0,128	0,573	0,111	0,637
530	0,394	0,121	0,605	0,111	0,622
540	0,330	0,119	0,616	0,110	0,604
550	0,266	0,114	0,617	0,110	0,588
560	0,210	0,110	0,617	0,110	0,575
570	0,172	0,117	0,615	0,110	0,568
580	0,153	0,152	0,611	0,111	0,562
590	0,142	0,240	0,604	0,112	0,557
600	0,135	0,376	0,605	0,113	0,561
610	0,133	0,511	0,624	0,117	0,586
620	0,138	0,613	0,662	0,123	0,636
630	0,144	0,683	0,704	0,130	0,693
640	0,152	0,732	0,745	0,136	0,742
650	0,162	0,767	0,777	0,141	0,776
660	0,174	0,793	0,805	0,145	0,800
670	0,182	0,813	0,825	0,148	0,814
680	0,181	0,826	0,838	0,150	0,820
690	0,177	0,837	0,849	0,152	0,825
700	0,170	0,844	0,856	0,154	0,828
710	0,168	0,848	0,861	0,156	0,830
720	0,177	0,852	0,865	0,157	0,832
[a] Reference substrate, see annex A.					