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Graphic technology — Process control for the production of half-tone colour separations, proof and production prints —

Part 2: Offset lithographic processes

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Technologie graphique — Maîtrise des procédés pour la fabrication des séparations de couleur en ton tramé, des épreuves et des tirages en production —

Partie 2: Procédés lithographiques offset

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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 2.

The main task of technical committees is to prepare International Standards. 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 12647 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 12647-2 was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

This second edition cancels and replaces the first edition (ISO 12647-2:1996), which has been extensively revised. The revisions include the following:

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a) introduction of digital data as input;

b) reduction of the tone value increase by roughly 3 %;

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c) changes in the colouration of the primary and secondary solids (Table 2);

d) introduction of an additional measurement condition with a specified white backing;

e) general clean-up.

In view of the misconceptions about the use of density and grey balance values, it was decided to move this information to an informative annex.

ISO 12647 consists of the following parts, under the general title *Graphic technology — Process control for the production of half-tone colour separations, proof and production prints*:

— *Part 1: Parameters and measurement methods*

— *Part 2: Offset lithographic processes*

— *Part 3: Coldset offset lithography and letterpress on newsprint*

— *Part 4: Publication gravure process*

— *Part 5: Screen printing*

— *Part 6: Flexographic printing*

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Introduction

Part 1 of ISO 12647 serves to provide definitions, the general principles, the general order of the material to be covered in the subsequent parts 2 to 6, the definition of the data, the measurement conditions and the reporting style.

This part of ISO 12647 lists values or sets of values of the primary parameters specified in ISO 12647-1 and related technical properties of a half-tone offset lithographic print. Primary parameters include the screening parameters, the tone value increase, the colours of the solids and the print substrate. Conformance to the specified values in proof and production printing assure, in principle, a good visual match between specimens produced. Exceptions from this general observation are discussed in the following paragraph.

The purpose of a proof print is to simulate the visual characteristics of the finished print product as closely as possible. In order to visually match a particular print, off-press proofing processes often require values for solid-tone coloration and tone-value increase that are different from those of the printing process they are meant to simulate. This is caused by differences in phenomena such as gloss, light scatter (within the print substrate or the colorant), metamerism and transparency. Such differences are likely for those off-press proofing processes in which the print substrate, the colorants and the technology for applying them are significantly different from offset press printing. In such cases the user or the supplier needs to ensure that appropriate corrections are specified.

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Another problem area is the matching of a digital off-press proof on an opaque substrate to a double-sided print on a less-than-opaque, lightweight printing paper as used in heat-set web printing. If the proof is made with colour management profiles based on measurements with white backing, there will be an unavoidable difference between proof and production prints, placed on a black backing in accordance with the specifications of this part of ISO 12647. The possible occurrence of such differences needs to be well communicated, in advance, to the parties concerned.

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Graphic technology — Process control for the production of half-tone colour separations, proof and production prints —

Part 2: Offset lithographic processes

1 Scope

This part of ISO 12647 specifies a number of process parameters and their values to be applied when preparing colour separations for four-colour offset printing or when producing four-colour prints by one of the following methods: heat-set web, sheet-fed or continuous forms process printing, or proofing for one of these processes; or offset proofing for half-tone gravure.

The parameters and values are chosen in view of the complete process covering the process stages "colour separation", "film setting", "making of the printing forme", "proof production", "production printing" and "surface finishing".

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This part of ISO 12647 is

— directly applicable to proofing and printing processes that use colour separation films as input;

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— directly applicable to proofing and printing from printing formes produced by filmless methods as long as direct analogies to film production systems are maintained;

— applicable to proofing and printing with more than four process colours as long as direct analogies to four-colour printing are maintained, such as for data and screening, for print substrates and printing parameters;

— applicable by analogy to line screens and non-periodic screens.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the reference document (including any amendments) applies.

ISO 5-3:1995, *Photography — Density measurements — Part 3: Spectral conditions*

ISO 8254-1:1999, *Paper and board — Measurement of specular gloss — Part 1: 75° gloss with a converging beam, TAPPI method*

ISO 12642:1996, *Graphic technology — Prepress digital data exchange — Input data for characterization of 4-colour process printing*

ISO 12647-1:2004, *Graphic technology — Process control for the production of half-tone colour separations, proof and production prints — Part 1: Parameters and measurement methods*

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3 Terms and definitions

For the purposes of this document, the definitions given in ISO 12647-1 and the following apply.

3.1
positive-acting plate
⟨offset printing⟩ offset printing plate for use with positive-polarity film

3.2
negative-acting plate
⟨offset printing⟩ offset printing plate for use with negative-polarity film

3.3
four-colour continuous forms printing
offset process performed on small width web-fed presses for use with personalized mailings

3.4
commercial/speciality printing
general-purpose sheet-fed and non-magazine heat-set web offset printing

3.5
heat-set web printing
lithographic offset printing on web-type print substrates with printing ink that requires heat for drying

3.6
tone value
⟨printing forme⟩ percentage of surface area that appears to be receptive to printing ink

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NOTE 1 With some plate types, the tone value thus defined is smaller than the percentage of surface area that is visibly distinct from the background.

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NOTE 2 Formerly known as the film printing dot area. “Dot area” is now a deprecated term.

4 Requirements

4.1 General

The following subclauses are arranged in accordance with the order set out in ISO 12647-1; they also depend on this part for the general principles, the definition of the data, the measurement conditions and the reporting style.

4.2 Data files, colour-separation films and printing formes

4.2.1 General

Data delivered for printing shall be in the colour formats CMYK or three-component. In all cases, digital data files or colour separation film sets delivered for printing should be accompanied by a proof print that simulates the intended printing condition and that conforms to 4.3. This fact shall be verifiable by measuring a well-specified control strip or a similar control device that is printed on the proof print along with the subject.

In the case of digital data, the intended printing condition shall be indicated. Where the latter is included in the registry of characterizations maintained by the ICC and the digital data is CMYK, the name used in the ICC registry is usually used for identification in lieu of including an ICC output profile. If the intended printing condition is not included in said registry, an ICC output profile shall be included. If the data are other than CMYK, the data shall be defined colorimetrically using an ICC input profile or another mechanism and an ICC CMYK output profile shall be included. The rendering intent to be used with the output profile shall be communicated.

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4.2.2 Film or printing forme quality

In order to permit the reproduction of at least 100 tone-value steps, the resolution of the image setter or plate setter should be set accordingly.

EXAMPLE 1 If, for a screen employing single half-tone cell modulation, the intended nominal screen ruling is 70 cm^{-1}, the resolution of the image setter or the plate setter should not be smaller than 700 cm^{-1} (1 800 dpi). For a screen with super-cell technology, it is possible to set the resolution to a smaller value.

Unless otherwise specified, the core density of colour-separation films shall be at least 2,5 above the transmission density of the clear film (film base plus fog). The transmission density in the centre of a clear half-tone dot shall not be more than 0,1 above the corresponding value of a large clear area. The transmission density of the clear film shall not be higher than 0,15. Both measurements shall be made with a (UV) transmission densitometer whose spectral products conform to ISO type 1 printing density as defined in ISO 5-3.

NOTE 1 The clear-film density requirement is based on the understanding that the density range of the clear areas of all films that are to be exposed onto the same plate are not expected to exceed 0,10. Note further that 0,05 represents the lowest commonly found value for ISO type 1 printing density. For half-tone films with clear film densities outside this range, agreements between the supplier of colour separations and the recipient are required. Contacting or duplicating can also be used to bring half-tone films with dissimilar clear film densities into agreement.

NOTE 2 As a practical guide, a core density of 2,5 above the clear-film density will normally be achieved if the density of large solid areas is more than 3,5 above the clear-film density.

NOTE 3 If a user wishes to use a blue filter for transmission density measurements on colour-separation films, it is necessary to determine, for the particular film type and processing conditions, the correlation between densities obtained with the blue filter and those obtained with an ISO type 1 printing density instrument; for the measurement of core density, an ISO type 2 printing instrument is applicable.

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The fringe width of a colour-separation film shall not be greater than one-fortieth of the screen width.

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A half-tone dot that is produced by several exposures of a focal spot shall be fully rendered and not be split up into distinct parts. This requirement also applies to direct platemaking.

Other than for the clear-film density requirement, the colour-separation film quality shall be evaluated according to the informative Annex B of ISO 12647-1:2004.

4.2.3 Screen frequency (film or printing forme)

For four-colour work, the screen ruling (screen frequency) should be within the range 45 cm^{-1} to 80 cm^{-1}. Preferred nominal screen rulings are

a) 45 cm^{-1} to 70 cm^{-1} for web-offset periodical printing;

b) 52 cm^{-1} to 70 cm^{-1} for continuous-forms process printing on coated paper, 52 cm^{-1} for uncoated paper;

c) 60 cm^{-1} and higher for commercial/speciality printing.

NOTE 1 Outside of the range 45 cm^{-1} to 80 cm^{-1}, the general principles specified in ISO 12647-1 remain valid but specific values might differ.

NOTE 2 With computer-generated screening, the “screen frequency” is often varied slightly from one process colour to another in order to minimize moiré patterns. For example, there might be a difference of 3 cm^{-1} or 4 cm^{-1} between the colours C, M, Y.

NOTE 3 For the black or yellow colour half-tone, a screen ruling is sometimes used which is substantially finer than the nominal screen ruling of the remaining colours, for example, 84 cm^{-1} versus 60 cm^{-1}.

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4.2.4 Screen angle (film or printing forme)

For half-tone dots without a principal axis, the nominal difference between the screen angles for cyan, magenta, and black shall be 30°, with the screen angle of yellow separated at 15° from another colour. The screen angle of the dominant colour should be 45°.

For half-tone dots with a principal axis, the nominal difference between screen angles for cyan, magenta and black shall be 60°, with the screen angle of yellow separated by 15° from another colour. The screen angle of the dominant colour should be 45° or 135°.

The preparation of colour-separation films for half-tone gravure printing should avoid screen angles between 75° and 105° with colours other than yellow.

NOTE See Note 2 in 4.2.3.

4.2.5 Dot shape and its relationship to tone value (film or printing forme)

Circular, square or elliptical half-tone dot shapes shall be used. For half-tone dots with a principal axis, the first link-up shall occur no lower than at 40 % tone value and the second link-up no higher than at 60 % tone value.

4.2.6 Image size tolerance (film or printing forme)

For a set of colour-separation films or printing formes in common environmental equilibrium, the lengths of the diagonals shall not differ by more than 0,02 %.

NOTE This tolerance includes image or plate-setter repeatability and material stability.

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4.2.7 Tone value sum (digital data file or film)

Unless otherwise specified, the tone-value sum should be less than but shall not exceed 350 % for sheet-fed and 300 % for heat-set web printing.

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NOTE At high levels of tone-value sum, press problems such as poor ink trapping, back transfer and set-off due to insufficient ink drying might be encountered.

4.3 Proof or production print

4.3.1 General

Colorimetric characterization data provided for the “basic set” array of patches, as specified in ISO 12642, contain all the data to be specified in accordance with 4.3.2.1, 4.3.2.3, 4.3.3 and 4.3.5 of this part of ISO 12647.

4.3.2 Visual characteristics of image components

4.3.2.1 Print substrate colour

The print substrate used for proofing should be identical to that of the production. If this is not possible, the properties of the print substrate should be a close match to those of the production in terms of colour, gloss, type of surface (coated, uncoated, super-calendered, etc.) and mass-per-area. Press proofing should be carried out on the closest match, with regard to the attributes listed as normative, selected from five typical paper surface types whose attributes are listed in Table 1. For off-press proofing, the print substrate should be selected to conform as closely as possible to the attributes listed in Table 1 for the paper type representing the envisaged production paper. The type of paper shall be stated.

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Table 1 — CIELAB coordinates, gloss, ISO brightness and tolerances for typical paper types

Item	Characteristic					
	L^*[a] 1	a^*[a] 1	b^*[a] 1	**Gloss**[b] %	**ISO brightness**[c] %	**Mass-per-area**[d] g/m^2
Paper type						
1: gloss-coated, wood-free	93 (95)	0 (0)	–3 (–2)	65	89	115
2: matte-coated, wood-free	92 (94)	0 (0)	–3 (–2)	38	89	115
3: gloss-coated, web	87 (92)	–1 (0))	3 (5)	55	70	70
4: uncoated, white	92 (95)	0 (0)	–3 (–2)	6	93	115
5: uncoated, slightly yellowish	88 (90)	0 (0)	6 (9)	6	73	115
Tolerance	± 3	± 2	± 2	± 5	—	—
Reference paper[e]	94,8	–0,9	2,7	70 to 80	78	150

NOTE 1 In terms of gloss and colour, the paper types listed in Table 1 are representative of the range of print substrates used for the processes covered in this part of ISO 12647, with the following exceptions:

— the paper types 1 and 2 are not typical for web-fed magazine printing except for covers;
— paper types 3 and 5 are not typical for four-colour business forms printing.

NOTE 2 If the final product is subjected to surface finishing, this might severely affect the print substrate colour. See also note 2 in 4.3.2.2.

NOTE 3 For prints on papers or boards whose surface properties are identical to those of paper types 1 to 5 but whose mass per area is appreciably higher, the CIELAB colour coordinates given in brackets can be used.

NOTE 4 The mass per area specified for paper type 3 represents a compromise between web production papers with typically 60 g/m^2 to 65 g/m^2 and a well-known web proofing paper with 90 g/m^2. When measured with black backing, the difference in ΔL^* for papers that are similar but have mass-per-areas of 70 g/m^2 and 90 g/m^2 equals 0,7.

NOTE 5 Although less commonly used, some web papers in the mass-per-area range of type 3 papers have b^* values in the range 0 to –3.

a Normative: Measurement in accordance with ISO 12647-1:2004 only of the following: D50 illuminant, 2° observer, 0/45 or 45/0 geometry, black backing. The values in brackets pertain to measurements on a white backing as described in CGATS.5[4] and are informative only.

b Normative: Measurement in accordance with ISO 8254-1:2003, TAPPI method.

c Informative only. ISO 2470:1999, substrate backing.

d Informative only.

e Informative only: Paper used for ink set test. Original values given in ISO 2846-1:1997[1] of L^* = 95,5, a^* = 0,4, and b^* = 4,7 as measured on substrate backing are informative only. Note that some values differ slightly from ISO 2846-1 due to the black backing used for the purpose of this part of ISO 12647.

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4.3.2.2 Print substrate gloss

The gloss of the print substrate used for proofing should be a close match to that of the production print substrate. If this is not possible, press proofing may be carried out on the closest match selected from the paper types listed in 4.3.2.1.

NOTE 1 The gloss values of the paper types described in 4.3.2.1 are given in Table 1.

NOTE 2 If the final product is subjected to surface finishing, this will severely affect the gloss. In critical cases, the result of the colour-separation stage is best judged by means of a proof that closely matches the gloss of the final surface-finished print product. For processes with off-press finishing, in order to facilitate the matching of the production image to the proof image at the make-ready stage, it is a good plan to provide the press operator with two proof prints: a proof print whose gloss matches that of the (unfinished) production print substrate and a proof print which closely matches the gloss of the final surface-finished print product.

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