INTERNATIONAL STANDARD

ISO 12647-2

Second edition
2004-11-15

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

Part 2: Offset lithographic processes

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

Reference number
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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:

a) introduction of digital data as input;

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

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*

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.

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.

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”.

This part of ISO 12647 is

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

— 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*

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

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.

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.

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.

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

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}.

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.

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.

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.

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.

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.

4.3.2.3 Ink set colours

For the five paper types defined in 4.3.2.1, the CIELAB colour coordinates of the process-colour solids on the proof shall agree with the aim values specified in Table 2, within the deviation tolerance specified in Table 3. The colour coordinates of the two-colour overprints and the three-colour overprint, both without black ink, should agree with Table 2.

The primary colour solids of digital-proof prints should agree with Table 2 within one half of the deviation tolerance specified in Table 3.

The deviation of the process-colour solids of the OK print of the production run is restricted by the condition that the colour differences between proof and OK print shall not exceed the deviation tolerances specified in Table 3. If no conforming proof is supplied, the colour values of Table 2 shall provide the aim.

The variability of the process-colour solids in production is restricted by the following condition. For at least 68 % of the prints, the colour differences between a production copy and the OK print shall not exceed, and should not exceed one half of, the pertinent variation tolerances specified in Table 3.

NOTE 1 Conformance to the CIELAB values given in Table 2 usually requires the use of an ink set that conforms to ISO 2846-1[1] and the printing sequence cyan, magenta, yellow.

NOTE 2 The distribution of ΔE^*_{ab} values is not gaussian but skewed. For reasons of consistency, the variation tolerance is defined here as the upper limit for 68 % of the production copies. This is analogous to a gaussian distribution where 68 % are within plus or minus one standard deviation of the mean.

NOTE 3 Comparison of the values in Table 2 for black and white (in brackets) backing shows that the colour coordinates a^* and b^* remain largely the same. However, the L^* values are between 2 and 3 higher, depending on paper opacity.

NOTE 4 Density values can be very valuable for process control during a print run, where the instrument, the ink and the print substrate remain the same; see ISO 13656[3]. However, in a general situation, density values do not define a colour to the required degree. Therefore, for the purpose of this part of ISO 12647, reflection density values are only recommended for the determination of tone values. Following ISO 13656[3], the production press operator first achieves the correct colour of the solids on the press, then reads the densities with the instrument from the OK print. The densities are then used as aim values for process control during the production run.

NOTE 5 If the final print is subjected to surface finishing, the final colours might deviate appreciably from those of the unfinished print. See also Note 2 of Table 1 and Note 2 in 4.3.2.2.

NOTE 6 The secondary colours red, green, blue depend on conditions that include the printing sequence, the rheological and transparency properties of the inks, the mechanics of the press and the surface characteristics of the print substrate. Thus, conformance of the primaries C, M, Y to Table 2 is not sufficient for the conformance of the secondary colours to Table 2.

NOTE 7 Tolerances for special (spot) colours and for package printing need be lower than those given in Table 3, especially for the colour difference attributable to differences of L^*.

Table 2 — CIELAB coordinates of colours for the printing sequence cyan-magenta-yellow

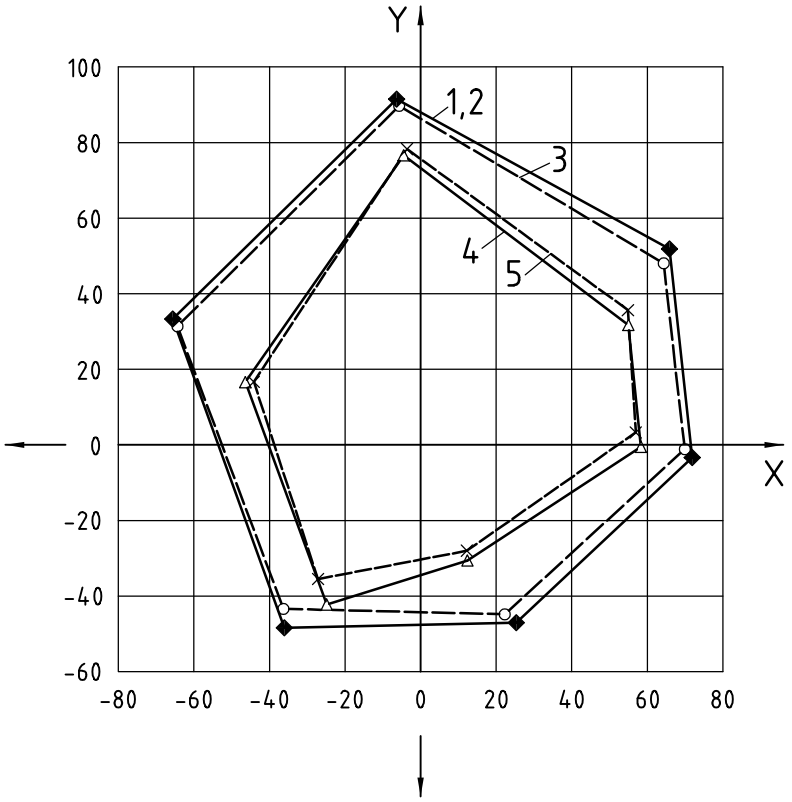
unit: 1

Colour	Paper type[a,b]											
	1, 2			3			4			5		
	Coordinates			Coordinates			Coordinates			Coordinates		
	L^{*} [b,c]	a^{*} [b,c]	b^{*} [b,c]	L^{*} [b,c]	a^{*} [b,c]	b^{*} [b,c]	L^{*} [b,c]	a^{*} [b,c]	b^{*} [b,c]	L^{*} [b,c]	a^{*} [b,c]	b^{*} [b,c]
Black	16	0	0	20	0	0	31	1	1	31	1	2
	(16)	(0)	(0)	(20)	(0)	(0)	(31)	(1)	(1)	(31)	(1)	(3)
Cyan	54	–36	–49	55	–36	–44	58	–25	–43	59	–27	–36
	(55)	(–37)	(–50)	(58)	(–38)	(–44)	(60)	(–26)	(–44)	(60)	(–28)	(–36)
Magenta	46	72	–5	46	70	–3	54	58	–2	52	57	2
	(48)	(74)	(–3)	(49)	(75)	(0)	(56)	(61)	(–1)	(54)	(60)	(4)
Yellow	88	–6	90	84	–5	88	86	–4	75	86	–3	77
	(91)	(–5)	(93)	(89)	(–4)	(94)	(89)	(–4)	(78)	(89)	(–3)	(81)
Red, M+Y	47	66	50	45	65	46	52	55	30	51	55	34
	(49)	(69)	(52)	(49)	(70)	(51)	(54)	(58)	(32)	(53)	(58)	(37)
Green, C+Y	49	–66	33	48	–64	31	52	–46	16	49	–44	16
	(50)	(–68)	(33)	(51)	(–67)	(33)	(53)	(–47)	(17)	(50)	(–46)	(17)
Blue, C+M	20	25	–48	21	22	-46	36	12	–32	33	12	–29
	(20)	(25)	(–49)	(22)	(23)	(–47)	(37)	(13)	(–33)	(34)	(12)	(–29)
Overprint of C+M+Y	18	3	0	18	8	6	33	1	3	32	3	1
	(18)	(3)	(0)	(19)	(9)	(7)	(33)	(2)	(3)	(32)	(3)	(2)

[a] Paper types according to 4.3.2.1.

[b] The values without brackets are measurements in accordance with ISO 12647-1: D50 illuminant, 2° observer, 0/45 or 45/0 geometry, black backing. Values in brackets pertain to measurement on the white backing specified by CGATS.5 [5] and are informative only.

[c] The colours were derived from those of ISO 2846-1 [1] by the method given in the informative Annex A of this part of ISO 12647.



Key

X	CIELAB red-green coordinate a^*
Y	CIELAB yellow-blue coordinate b^*
1, 2, 3, 4 and 5	paper types

NOTE The data are taken from Table 2.

Figure 1 — Colour gamut for offset lithographic printing

Table 3 — CIELAB ΔE^*_{ab} tolerances for the solids of the process colours

unit: 1

Parameter	Colour			
	Black	Cyan[a]	Magenta[a]	Yellow[a]
Deviation tolerance	5	5	5	5
Variation tolerance[a]	4	4	4	5
[a] The contribution of the hue difference shall not exceed 2,5.				

4.3.2.4 Ink set gloss

The gloss of solid tone colours may be specified if deemed necessary.

The specular gloss of the print substrate or ink set single-print solid areas shall be measured with light incident at 75° (15° from the plane of the print substrate) and measured at 75°. The instrument used shall conform to ISO 8254-1. Report values in percent, quoting “ISO 8254-1:2003” as the method.

4.3.3 Tone-value reproduction limits

Half-tone dot patterns within the following tone value limits (on the film or in the digital data file) shall transfer onto the print in a consistent and uniform manner:

a) screen ruling between 40 cm^{-1} and 70 cm^{-1}: 3 % to 97 %;

b) screen ruling of 80 cm^{-1} or proof printing for the half-tone gravure process: 5 % to 95 %.

No significant image parts shall rely on tone values outside of the above tone value reproduction limits.

4.3.4 Tolerance for image positioning

The maximum deviation between the image centres of any two printed colours shall not be larger than 0,08 mm for middle format presses and printing paper with a mass-per-area greater than 65 g/m^2, and 0,12 mm for other conditions.

4.3.5 Tone-value increase

4.3.5.1 Aim values

The tone-value increase for printing and proofing shall conform to Table 4; see also Figure 2. For continuous forms printing, the tone-value increase in the 75 % shadow tone shall be 3 % greater than the curves shown in Figure 2.

NOTE 1 In practice, the tone-value increase of the black ink is found to be equal or up to 3 % higher in the mid-tone than that of a chromatic primary colour ink because black ink is usually printed on the first press unit and often, especially in sheet-fed offset, at a greater ink film thickness.

NOTE 2 If conversion of tone-value increase data from one screen ruling to another is desired, see informative Annex B. In the diagrams in Figures B.1 and B.2, values corresponding to offset press printing and control patches of 40 % or 80 % tone value (film or digital data file) can be identified. Conversions for off-press proofing often require different curve sets.

NOTE 3 The values given in Table 4 refer to densitometric measurement in a control strip with circular half-tone dots, with an ISO Status E response, with polarization, using the method specified in Clause 5; see also ISO 14981:2000[2]. For densitometers without polarization and with ISO Status T response, the tone-value increases for cyan, magenta, and black are approximately equal to those shown in Table 4; however the increases for yellow are 2 % less.

Table 4 — Tone-value increase for the 50 % control patch of a control strip with circular half-tone dots for a number of important printing conditions

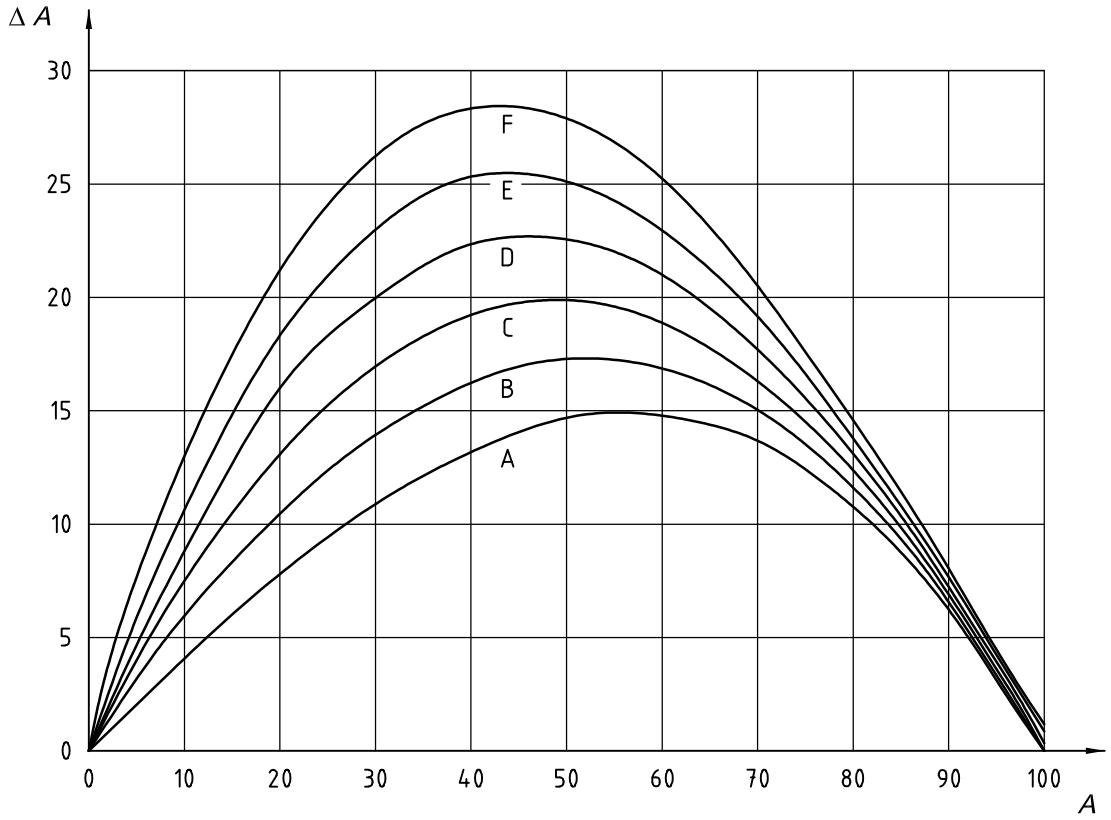
Printing characteristics	Tone-value increase % for screen rulings:		
	52 cm^{-1}	60 cm^{-1}	70 cm^{-1}
Four-colour continuous forms printing, chromatic colours[b]			
positive-acting[c] plates, paper types[a] 1 and 2	17	20	22
positive-acting[c] plates, paper type[a] 4	22	26	—
negative-acting[c] plates, paper types[a] 1 and 2	22	26	29
negative-acting[c] plates, paper type[a] 4	28	30	—
Heat-set web and commercial/speciality printing, chromatic colours[b]			
positive-acting[c] plates, paper types[a] 1 and 2	12	14 (A)[d]	16
positive-acting[c] plates, paper type[a] 3	15	17 (B)[d]	19
positive-acting[c] plates, paper types[a] 4 and 5	18	20 (C)[d]	22 (D)[d]
negative-acting[c] plates, paper types[a] 1 and 2	18	20 (C)[d]	22 (D)[d]
negative-acting[c] plates, paper type[a] 3	20 % (C)[d]	22 (D)[d]	24
negative-acting[c] plates, paper types[a] 4 and 5	22 % (D)[d]	25 % (E)[d]	28 % (F)[d]

[a] Paper types as defined in 4.3.2.1.

[b] Black may be equal or up to 3 % higher

[c] With computer-to-plate, the choice of the tone value category is independent of plate type but should, for compatibility reasons, follow legacy industrial practice which may be positive-acting for some geographical areas and negative-acting for others.

[d] The letters A to F refer to the curves shown in Figure 2



Key

A film or data tone value

ΔA tone-value increase

NOTE Curves labelled A to F correspond to printing conditions listed in Table 4.

Figure 2 — Tone-value increase curves for the printing conditions defined in Table 4

4.3.5.2 Tolerances and mid-tone spread

The deviation of the mid-tone value increase of a proof or an OK print from the specified value shall not exceed the deviation tolerances specified in Table 5.

For production printing, the average mid-tone value shall be within 4 % of the specified aim value. The statistical standard deviation of the tone values shall not exceed, and should not exceed one half of, the variation tolerance specified in Table 5.

The mid-tone spread (variation of tone values between chromatic colours) of proof and production printing shall not exceed the values listed in Table 5.

Table 5 — Tone-value increase tolerances and maximum mid-tone spread for proof and production printing

unit: %

Tone value of control patch	Deviation tolerance		Variation tolerance
	Proof print	OK print	Production print
40 or 50	3	4	4
75 or 80	2	3	3
Maximum mid-tone spread	4	5	5

NOTE 1 It has to be recognized that in the worst case these tolerances produce a difference between proof and OK print of 7 % in the mid-tone.

NOTE 2 The values in Table 5 refer to measurements by densitometer or colorimeter and to control strips with a screen ruling of 50 cm^{-1} to 70 cm^{-1}.

NOTE 3 Percentage tolerances are calculated by subtracting the aim value from the measured value.

5 Test methods — Tone value and tone-value increase of a print

Refer to ISO 12647-1:2004, 5.3, and note the following additional requirements.

a) A control strip shall be printed along with the subject; its screen ruling shall be selected from the range 52 cm^{-1} to 70 cm^{-1}.

b) The half-tone dot shape should be circular.

c) If a film is used for the control strip, its core density shall be no less than 3,0 above the density of the clear film (film base plus fog) and the fringe width shall not exceed 2 µm.

NOTE 1 Half-tone screens with elliptical dots with a first dot link-up around 40 % tone value will show tone values which are about 1,5 % higher than those measured with circular half-tone dots.

NOTE 2 See notes 2 and 3 of 4.3.5.1.

6 Reporting of printing conditions

Reference to the printing conditions as specified in Tables 1, 2 and 4 of this part of ISO 12647 for the purposes of colour management, such as in colour-management characterization tables or colour-management profiles based on them, should be made in the following form:

> "Printing according to ISO 12647-2, <description of the process>, <platemaking modes>, <type of printing substrate>, <screen ruling in reciprocal centimetres>".

using the following options:

— <description of the process>: "Four-colour continuous forms printing", or "Heat-set web and commercial/speciality printing" or the optional short forms "OFCOF" or "OFCOM";

— <platemaking modes>: "positive-acting" or "negative-acting" or the optional short forms "PO" or "NE";

— <type printing substrate>: "paper type 1" to "paper type 5", or the optional short forms "P1" to "P5";

— <screen rulings in reciprocal centimetres>: 52 cm^{-1}, 60 cm^{-1} and 70 cm^{-1}, or the optional short forms "F52", "F60" and "F70".

EXAMPLE 1 "Printing according to ISO 12647-2, Heat-set web and commercial/speciality printing, negative-acting plates, paper type 3, screen ruling 52 cm^{-1}".

EXAMPLE 2 OFCOM_NE_P3_F52.

Annex A
(informative)

Methods for establishing the colour of a standard ink on the paper types

A.1 General

In practical printing, it is observed that the ink-film thicknesses commonly employed on various print substrates are not equal. Although lower grades usually show less colour intensity than higher grades, more ink is actually used for the lower grades. Thus, the press operator partly compensates for the reduced optical effectiveness of the ink colorant of the lower grades due to uneven distribution and loss to the volume.

It has been observed in extensive tests that the colour intensity used in practical printing for a particular combination of ink and paper is simulated very closely by presenting the paper with the same ink film thickness on the blanket that produces the colour specified in ISO 2846-1[1] on the reference paper also specified therein. Under these conditions, the lower grade papers, which tend to be rougher and more ink absorbent, take more ink off of the blanket than higher grades which are smoother and have a high-quality coating. The following two methods each provide printing conditions where papers are presented with the same ink-film thickness on the blanket, give results that agree very well. For well-coated matte paper grades, if the coating surface is rough, the method tends to give an unrealistic high coloration. Therefore, the results of coloration tests for gloss-coated papers are also useful for equivalent matte-coated papers.

A.2 Printability tester

Cut half-width strips of the reference paper conforming to ISO 2846-1[1] and the practical paper type for which the ink colour is to be established. The thickness of the latter paper needs to be roughly the same as that of the reference paper. Tape both paper strips in parallel on the sample holder or the sector of a laboratory printability tester. Using a blanket-covered printing forme and a process ink that conforms to ISO 2846-1[1], produce a test print by following the test-print procedure specified in ISO 2846-1[1]. The amount of ink transferred is then adjusted such that the printing, when the ink is dry, results in an ink colour on the reference paper that conforms closely to ISO 2846-1[1]. When the ink colour on the reference paper is considered to be correct, the ink colour on the practical paper type that was printed at the same time is then measured in several spots. The average is the recommended ink colour for that paper. Instead of printing the paper samples side-by-side, it is also possible to tape one or two pieces of other paper onto a reference paper strip and to print on it. Again, the criterion is the correct colour on the reference paper. In the same way, two- and three-colour overprints are made. It has to be borne in mind though, that the overprints in the wet-on-wet printing mode described in A.3 come closer to practical conditions.

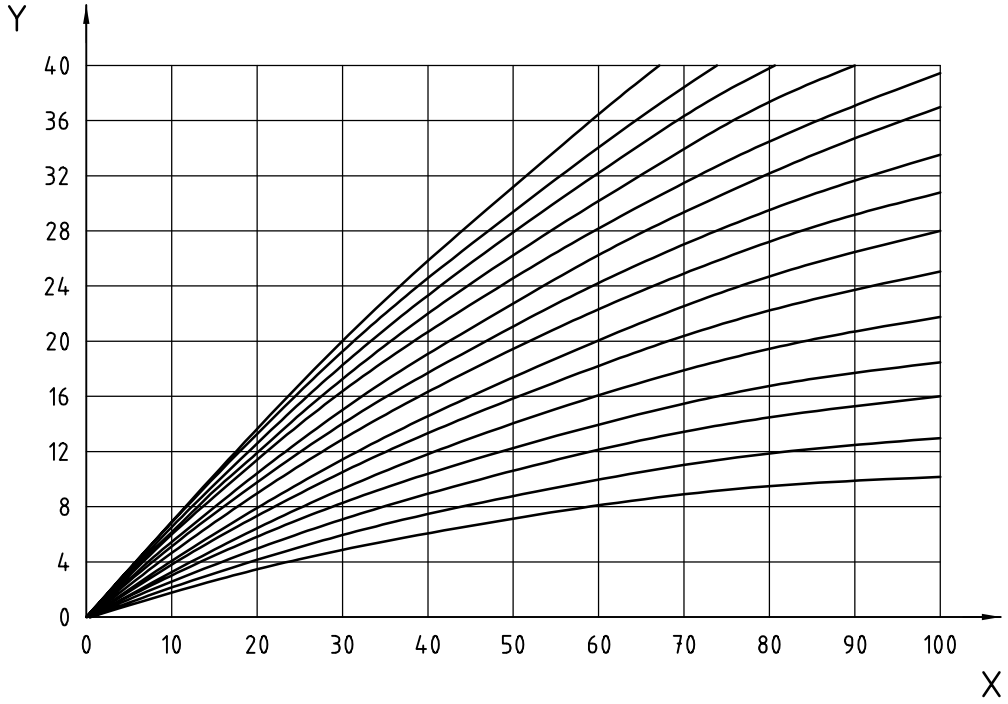
A.3 Sheet-fed offset press

A pile of reference paper conforming to ISO 2846-1[1] is prepared for printing on a sheet-fed press by hand-inserting single, well-marked sheets of other paper types at intervals of approximately 100 sheets. The thickness of the paper types is selected to be roughly equal. The press is supplied with process inks conforming to ISO 2846-1[1]. At start-up, the inking levels on the reference paper are controlled such that the CIELAB values of the solid tones of cyan, magenta, yellow, and black conform to ISO 2846-1[1] in the dry state. If necessary, the dry-back effects have to be established before the press run. While printing the remainder of the pile, the inking levels are regularly checked on the reference paper and kept constant there. After drying, the inserted sheets of the other paper types are recovered from the pile; they show the ink colours to be established. If a multicolour test forme was used for the run, primary and overprint colours are accessed at the same time.

In the sheet-fed press, reference paper and inserted paper sheets are presented with the same ink film thickness on the blanket. The inserted sheets disturb the ink flow during subsequent printing, because depending on their roughness, they take off more or less ink from the blanket. However, the ink flow quickly returns to the previous state after, at most, 50 sheets.

Annex B
(informative)

Dependence of the tone value increase of press prints on screen frequency



Key

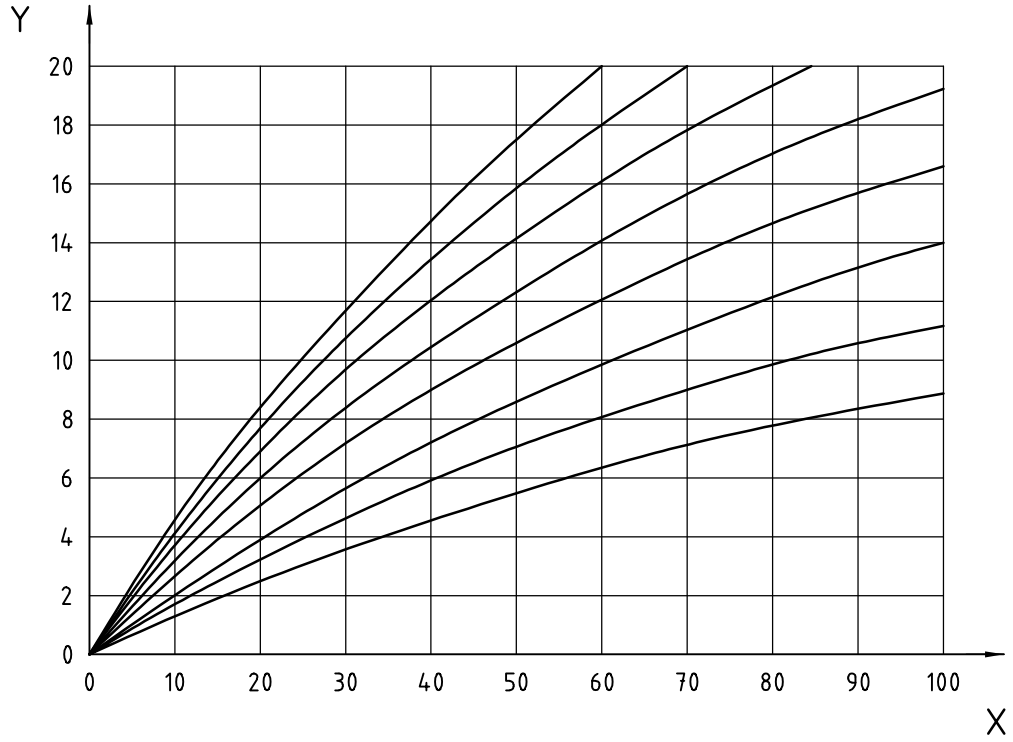
X Screen frequency

Y Tone-value increase

NOTE 1 Each curve belongs to a particular set of printing conditions.

NOTE 2 Applies only to press printing and not to off-press proofing.

Figure B.1 — Dependence of the tone-value increase of press prints on screen ruling for a 40 % tone value on the film or in a digital data file



Key

X Screen ruling

Y tone-value increase

NOTE 1 Each curve belongs to a particular set of printing conditions.

NOTE 2 Applies only to press printing and not to off-press proofing.

Figure B.2 — Dependence of tone-value increase of press prints on screen ruling for an 80 % tone value on the film or in a digital data file

Instructions for use: The experimentally obtained family of graphs in Figures B.1 and B.2 are used to convert a certain tone-value increase found with a periodical screen of screen frequency F1 to that of a similar half-tone dot shape screen but with screen frequency F2. Note that Figures B.1 and B.2 apply only to press printing and not to off-press proofing.

EXAMPLE 1 The tone-value increase of a moderately elliptical screen with a 60 cm^{-1} screen ruling is measured as 12 % in a 40 % mid-tone tint. What tone-value increase will be found with the same computer screening program if the screen frequency is set to 100 cm^{-1}? We look up “60” on the horizontal axis of Figure B.1, proceed vertically to “12 %” and follow the graph line till the right-hand edge which corresponds to 100 cm^{-1}. Moving horizontally to the left-hand scale, we read the resulting tone value increase as “16 %”.

EXAMPLE 2 The tone-value increase of a circular dot screen with 70 cm^{-1} is measured as 12 % in a 80 % shadow tint. What is the tone value for a moderately elliptical screen with a 52 cm^{-1} screen ruling? We look up “70” on the horizontal axis of Figure B.2, proceed vertically to 12 %, which is halfway between two curves. We follow the graph lines to the left till we are exactly above 52 cm^{-1}. If the point halfway between the curves is again taken, the result is just below 10 %. If the fact that a moderately elliptical screen has a slightly higher tone-value increase than a circular dot screen is considered, the final result is judged to be 10 % or slightly above.

Annex C
(informative)

Grey balance

The specification of a grey balance condition is redundant if the aim values for the tone-value increase and the coloration of the solids are specified. With the aid of colour-management profiles that are based on a given printing condition and its characterization table according to ISO 12642:1996, the grey balance conditions are accessible. A single grey balance condition is usually not sufficient to ensure an achromatic colour for all print substrates and printing inks that are used for a given printing condition. In addition, it usually depends on the particular black composition used.

Grey balance patches composed of suitable CMY mixtures serve a useful purpose for quickly checking whether the CMY tone values have changed, say, from one production print to another or from one proof print to the next. For this purpose, the CMY tone-value combinations in Table C.1 are useful, as they often result in a nearly neutral colour. These data are applicable to digital data or film.

Table C.1 — CMYK values for use in grey balance patches

unit: %

Tone value	Colour		
	Cyan	Magenta	Yellow
Quarter tone	25	19	19
Mid-tone	50	40	40
Three-quarter tone	75	64	64

There are two practical definitions for grey that are sometimes in conflict:

a) a colour having the same a^* and b^* CIELAB values as the print substrate;

b) a colour having the same a^* and b^* CIELAB values as a half-tone tint of similar L^* value printed with black ink.

The latter definition is particularly useful in the mid-tone and upwards, whereas the former is best applied to highlight tones.

Bibliography

[1] ISO 2846 (all parts), *Graphic technology — Colour and transparency of ink sets for four-colour-printing*

[2] ISO 14981:2000, *Graphic technology — Process control — Optical, geometrical and metrological requirements for reflection densitometers for graphic arts use*

[3] ISO 13656, *Graphic technology — Application of reflection densitometry and colorimetry to process control or evaluation of prints and proofs*

[4] ISO 2470:1999, *Paper, board and pulps — Measurement of diffuse blue reflectance factor (ISO brightness)*

[5] ANSI/CGATS.5:2004, *Graphic technology — Spectral measurement and colorimetric computation for graphic arts images*

[6] ICC.1:2004-10, *Image technology colour management — Architecture, profile format, and data structure* (Profile version 4.2.0). Available from Internet: http://www.color.org

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