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Email of secretary: tc170_cyc@126.com
Secretariat: SAC (China)

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Graphic technology — Process control for the production of half-tone colour separations, proofs and production prints — Part 6: Flexographic printing

Technologie graphique — Contrôle des processus de confection de sélections couleurs tramées, d'épreuves et de tirages — Partie 6: Processus flexographique

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Foreword

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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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 12647-6 was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

This second edition cancels and replaces the first edition (ISO 12647-6:2006), which has been technically revised. This revision of this part of ISO 12647 has changed the intent of the document from a process control definition to a specification of the way to exchange the information necessary to define the printing characteristics of the desired product. To do this it has built on colour management technology and the exchange of colour characterization data.

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

— *Part 1: Parameters and measurement methods*

— *Part 2: Offset lithographic processes*

— *Part 3: Coldset offset lithography on newsprint*

— *Part 4: Publication gravure printing*

— *Part 5: Screen printing*

— *Part 6: Flexographic printing*

— *Part 7: Proofing processes working directly from digital data*

— *Part 8: Validation print processes working directly from digital data*

Introduction

Historically the ISO 12647 series of International Standards established the process control parameters and their aim values and tolerances for the most important professional printing processes of the graphic arts industry. The initial concept was that the groundwork for the series was laid down in ISO 12647-1. This part of ISO 12647 differs from that concept because flexographic printing has changed significantly since ISO 12647 was initially conceived.

This edition of this part of ISO 12647 differs from the earlier edition by not defining specific printing condition aims but instead requires that a specific reference printing condition (characterization data set) be specified. Flexographic printing differs from other printing procedures by using a variety of printing machine architectures, ink sequence, ink types, anilox rollers, substrate types, etc. Each of these involve different printing condition and process control aims. This part of ISO 12647 requires that the colour of the printed product match a characterization data set or a printing condition agreed upon by the provider and the receiver and specifies minimum requirements and tolerances to be communicated and produced.

The purpose of a proof is to simulate the visual characteristics of the finished printed product as closely as possible, which often becomes a contractual agreement between provider and receiver. In order to visually simulate a particular printed product, off-press proofing processes might require values for various process control aims (e.g. solid tone colouration, tone value increase) which 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 colourant), ink trap or overprint efficiency, metamerism and transparency. Such differences are likely for those off-press proofing processes in which the print substrate, the colourants and the technology for applying them are significantly different from flexographic printing. In such cases the user or the supplier needs to ensure that appropriate corrections are specified.

Although this market uses colour proofing on electronic displays, and it was the intent of the authors to reference the requirements for such proofing techniques, ISO/TC 130 has not yet defined a standard in this area that can be referenced. It is hoped that such work will progress and be available in the near future.

In addition, work has started on ISO 17972, *Graphic technology — Colour data exchange format*. ISO 17972-4 will include exchange specifications for spot colour characterization data to facilitate the communication of spot colour data.

Graphic technology — Process control for the production of half-tone colour separations, proofs and production prints — Part 6: Flexographic printing

1 Scope

This part of ISO 12647 specifies the requirements for the exchange of data and information necessary for the definition of the aims for four-colour flexographic printing of packaging and publication materials, including newsprint. It is based on the use of colour characterization data to define the colourimetric printing aims and includes appropriate assignment of responsibility for and recommended tolerances on critical parameters of the flexographic printing process. This part of ISO 12647 is directly applicable to:

— publication flexographic printing including magazines, catalogues and commercial materials and packaging flexographic printing including labels, boxes, and flexible packages;

— half-tone and continuous tone proofing processes that predict the colourimetric results of flexographic printing.

Guidance is also provided concerning the definition of spot colours used in flexographic printing.

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, *Photography and graphic technology — Density measurements — Part 3: Spectral conditions*

ISO/TS 10128, *Graphic technology — Methods of adjustment of the colour reproduction of a printing system to match a set of characterization data*

ISO 12647-7, *Graphic technology — Process control for the production of half-tone colour separations, proof and production prints — Part 7: Proofing processes working directly from digital data*

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

ISO 15930 (all parts), *Graphic technology — Prepress digital data exchange using PDF*

ISO 17972-4 *Graphcic Technolgoy — Color Exchange Format Pt 4 Spot Colour Characterizaiton*

ISO 20654 *Graphic Technology—Spot Colour Tone Value*

~~*ISO* ISO 18619 *Graphcic Technolgoy — Black Point Comensation*~~

ISO 15397

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
printing forme for flexography
cylinder or sleeve covered with a relief type rubber or photopolymer plate for application of printing ink to print substrate

[SOURCE: ISO 2834-2:2007, definition 3.3]

3.2
provider
organization that prepares the data for printing, distributor of a digital data file, designer, consumer products company or trade shop

3.3
receiver
organization that receives the file, or to whom a digital data file is delivered, in the context of this part of ISO 12647 usually a prepress company, printer or converter

3.4
replacement colour
spot colour used, with altered separations, in place of a process colour

3.5
spot colour
non-process colour that is used in addition to, or in place of, a process colour and is normally applied with a single impression

NOTE When associated with a corporate product identity, a spot colour is also known as brand colour.

4 Requirements

4.1 General

In all cases, digital data files, colour separation film sets or printing formes delivered for printing shall be accompanied by a contract proof or a soft-copy proof unless there is agreement between all parties concerned that no proof is required. If delivered, the contract proof shall simulate the intended printing condition including finishing and shall conform to ISO 12647-7. This fact shall be verifiable by measuring a well-specified control strip or a similar control target suitable for measured verification that is printed on the proof print along with the subject. The use of soft-copy proofs requires agreement between sender and receiver.

NOTE Where intermediate proofs are needed to simulate the printed product without finishing applied, these are typically prepared by the printer.

4.2 Material input requirements

4.2.1 General

Input for flexographic printing may be either film, digital data or printing formes. It should be noted that the use of film or printing formes as the interchange format between provider and receiver may include additional details (such as image distortion) not covered in detail in this International Standard.

4.2.2 Distortion correction

There is currently no agreement as to a single formula for image distortion. Therefore, the computation to be used shall be agreed upon between the provider and receiver.

4.2.3 Proof requirements

All input for flexographic printing (film, digital data or printing formes) shall be accompanied by a proof prepared in accordance with ISO 12647-7 unless there is prior agreement that a proof is not required, or that an agreed upon soft-copy proof will be used.

4.2.4 Digital data files

Data delivered for printing shall be in the colour formats of CMYK, CMYK plus spot colours, or CMYK with replacement colours. The actual data delivered may be either final format data or three-component colour data sets with associated colour profiles to allow the data to be converted to the final data format. The intended printing condition shall be defined with sufficient data to allow at least one of the three methods described in ISO/TS 10128 to be applied for establishing the printing aims. Where the intended printing condition is included in the registry of characterizations maintained by the ICC, and the digital data is CMYK, the name used in the ICC registry may be 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 is other than CMYK, the data shall be defined colourimetrically using an ICC destination profile that shall be referenced; the rendering intent to be used with the output profile shall be communicated.

The file format used for data exchange shall be PDF/X in accordance with ISO 15930 (all parts). ISO 15930 provides solutions many versions of PDF, for global continuity PDF/X-4 for blind transferdelivers files containing fonts, images, and color requirements and should be used.

NOTE 1 Communication of spot colours as part of digital data exchange is defined. See Annex A .

4.2.5 Film/printing forme requirements

4.2.5.1 Colour separations

In order to permit the reproduction of at least 100 tone value steps, the resolution of the image setter or printing forme setter should be set to the appropriate resolution for the screen ruling required for the printing application.

The fringe width shall not be greater than one fortieth of the screen width.

4.2.5.2 Printing forme digital (laser ablative mask) (til?)

In the case of digital plate making process based on laser ablative mask, the mask material and plate sensitivity varies substantially from manufacturer to manufacturer. It is therefore not possible to provide recommendation that would apply to all plate types. Users shall follow the recommendations for ablation and plate exposure specified by the manufacturer.

4.2.5.3 Film

When film is provided, the matte negative colour separation film shall have a core density of 4,0 or above. 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 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 need to be within an printing density range of 0,10. Experience has proved that 0,05 represents the lowest commonly found value for ISO 5 Type 1 printing density. For half-tone films with clear film densities above 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 4,0 above the clear film density will normally be achieved if the density of large solid areas is more than 4,0 above the clear film density.

NOTE 3 Other than for the clear film density requirement, the colour separation film quality can be evaluated according to the informative Annex D.

NOTE: This tolerance includes image or printing forme setter repeatability and material stability.

4.2.5.4 Printing forme verification for delivery

Flexographic printing formes, whether prepared by the provider or the receiver, shall be created with both an uncompensated and a compensated set of control patches representing the tonal steps of at least the minimum dot size, and tonal values of 10 %, 30 %, 50 %, 70 %, and a solid.

For the uncompensated set of patches, the tone values measured on the printing forme shall be within the tolerances shown in Table 1. Verification of the accuracy of these values shall be based on agreement between provider and receiver concerning the measurement system to be used, including any relevant settings and conditions, for measuring dot area on the printing forme. This requires that the control patches be exposed independent of the image content.

For the compensated set of patches, the data in the file associated with these patches shall be the tone values necessary to produce the indicated value when printed on the substrate. These control patches, measured on the printing forme, shall be within tone value tolerance shown in Table 1. Verification of the accuracy of these values shall be based on agreement between provider and receiver concerning the measurement system to be used, including any relevant settings and conditions, for measuring dot area on the printing forme.

Table 1 —Tone value tolerances for printing forme delivery

Tone value range	**Screen rulings equal to or below** 48 cm^{-1}	**Screen rulings above** 48 cm^{-1}
Tone values below or equal to 10 %	± 1	± 2
Tone values above 10 %	± 2	± 3

NOTE 1 Because the tone value measured on the printing forme does not necessarily represent the tone value that will be achieved on the printed sheet, a common calibration process is to expose a digital scale representing the full tonal scale and use this to calibrate the relationship between tone value measured on the printing forme and tone value achieved on the printed sheet.

NOTE 2 Because the exposed area of a flexographic printing forme is not necessarily representative of the tone value that will be achieved after processing of the printing forme, a common calibration process is to expose a digital scale representing the full tonal scale and use this to calibrate the relationship between exposed tone value and tone value achieved on the processed printing forme.

NOTE 3 The minimum physical dot printable (min dot) is dependent upon, among other things, the screen ruling, printing forme technology and anilox roller being used and requires agreement between the provider and receiver of the printing formes.

4.2.5.5 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 printing forme setter repeatability and material stability.

4.3 Printing aims

4.3.1 General

The flexographic printing process as practiced today is largely based on the use of reference characterization data and colour management profiles to define the printing aims for the single and two-colour tone scales and the associated overprint colours. The printer is free to use the appropriate combination of anilox rollers, printing formes, inks, sleeves and electronic data manipulation (for example using the principles of ISO/TS 10128) to achieve final printed images that colourimetrically match the provided characterization data adjusted if necessary to match the substrate colour as described in 4.3.3".. The primary responsibility of the printer is to provide a consistent reproducible printing process.

However, there are some parameters that need to be controlled and some general aims that should be used as guidance for printing. These are addressed in the following clauses.

4.3.2 Halftoning parameters

4.3.2.1 General

The manufacturers of raster image processors generally recommend specific screen angles and output resolution for an imaging device in order to provide the smoothest screening. Agreement shall be reached between provider and receiver concerning the particular screening parameters to use.

4.3.2.2 Screen frequency

Agreement shall be reached between the provider and the receiver.

4.3.2.3 Screen angle

Where screen angle is critical, agreement shall be reached between the provider and the receiver.

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 for yellow separated by 15° from another colour. No colour should align with engraving pattern on the anilox roller.

NOTE Typically ceramic anilox rollers are engraved at 60° and mechanically engraved rollers are engraved at 45°. The provider needs to communicate with the receiver in order to avoid conflict with the actual anilox engraving angle.

4.3.2.4 Dot shape and its relationship to tone value

Round dots are recommended since they provide the best process consistency for a given resolution, and the best available resolution for process consistency. When delivering printing formes, agreement shall be reached between provider and receiver.

4.3.2.5 Tone value sum

The tone value sum should be equal to or less than 320 % for four colours unless there is prior agreement between provider and receiver.

NOTE The tone value sum requirement is intended for general guidance as a maximal limit only. The actual limitations on tone value sum are a function of, among other things, the type of ink used (solvent, water-based, UV cured, etc.), the substrate, dryer configurations, and inline converting processes. Press trials provide the appropriate tone value sum for a particular process.

4.3.2.6 Tone value reproduction limits

The receiver shall convey to the provider of films, files or printing formes the physical size of minimum stable printable dot that can be supported by the printing system to be used. The upper and lower tone value limits of half-tone dot patterns which shall transfer to the print substrate in a consistent and uniform manner shall be agreed between the provider and the receiver.

NOTE Press trials provide the appropriate minimum stable printable dot. The actual minimum stable printed dot is, among other things, a function of machine configuration, plate type, printed substrate, type of ink and speed.

4.3.3 Reference substrates

Identification of the substrate to be used for printing, and its colour and gloss, shall be conveyed from the printer to the provider of films, printing formes or data.

Substrate colour typically should fall within the ranges tabulated in Table 2. ISO 15397 provides guidance for communication of substrate colours and properties.

Table 2 — Recommended print substrate colour range

L*	a*	b*
> 88	-3 to +3	-5 to +5

Where the substrate colour falls within the range shown in Table 2, the characterization data set provided in accordance with 4.2.4 may be modified using the backing correction method outlined in ISO 13655. Where the substrate colour falls outside of the range shown in Table 2 the characterization data set provided shall be modified using the backing correction method outlined in ISO 13655. Where the substrate is transparent, the method described in ISO 13655 for the correction of measurements made on transparent materials may be combined with the backing correction method to adjust the characterization data appropriately. Such adjustments shall be agreed upon by the provider and receiver of the data file.

NOTE 1 The ISO 13655 backing correction method has been shown to work equally well for changes in substrate as it does for changes in the backing used for measurement of a substrate. This method is now being referred to as a substrate correction method rather than as a backing correction method.

NOTE 2 If the final product is subjected to surface finishing, this step is expected to affect the print substrate colour. The aim of the proof and characterization data needs to match the final condition after surface finishing. To facilitate the printing operation, characterization data and proofs based on the appearance of the final product prior to finishing are useful data to exchange.

NOTE 3 Where printing is on the reverse side of a transparent media or over a pre-printed white background, the requirements of this clause can be modified appropriately to allow communication between the provider and receiver.

4.3.4 Ink set colours

The hue angle aims for solid CMY of both traditional inks and extreme light-fast flexographic process inks shall be the values listed in Table 3. A metric hue angle is not specified for black because the aim for black ink is CIELAB a*= b* =0."

The CIELAB colour coordinates *L*, a*, b** of the process colour solid tones on the print shall be as defined in the characterization data set provided. The CIELAB colour coordinates *L*, a*, b** of the spot colour solid tones on the print shall be defined either in the characterization data or in the PDF/X data file exchange. Where accurate spot colour replication is required, spectral data shall to be provided as described in Annex A.

The deviation of the process colour solids of the OK print is restricted by the condition that the colour differences between characterization data and the OK print shall not exceed a CIE DE2000 of 6 and in addition shall meet the deviation tolerances specified in Table 4.

The deviation of the spot colour solids of the OK print is restricted by the condition that the colour differences between specified aims and the OK print shall not exceed a CIE DE2000 of 6 and in addition shall meet the deviation tolerances specified in Table 4.

Table 3 — CIELAB metric hue (h_{ab}) aim values for the solids of the process colours

Colour	Metric hue angle (degrees)	
	Traditional inks	Light-fast inks
Cyan	233	233
Magenta	357	12
Yellow	93	100
Red[a]	36	40
Green[a]	160	162
Blue[a]	290	296
Note: Tolerance for CMY hue angles shall be +/- 6 degrees [a] Secondary colours are provided for information only.		

4.3.5 Reproducibility of ink colour set

Unless there is an agreement between print buyer and the print provider the variability of solid colours is restricted by the following conditions.

— For at least 68 % of the measured production prints, the colour differences between the printed sheets and the OK sheet shall not exceed the appropriate variation tolerance specified in Table 4.

— For at least 68 % of the measured production prints, the colour differences between the printed sheets and the OK sheet should not exceed one-half of the appropriate variation tolerance specified in Table 4.

— The computation of colourimetric parameters shall be as defined in ISO 13655. Typical tolerancing from a ConsumerProducts company would be DE00<3.01 or 2.01.

— Color variation within a printing run is below 2 $\Delta E_{00.}$ (defined as 95th percentile of color variation between the OK print and a sample set of 15 boards without image quality artifacts, measured in a color strip containing C, M, Y, K primaries, when the variation of the media white point is less than 0.6 ΔE_{00}). ISO 15311-1 Annex ()

NOTE The variation tolerance is defined as the upper limit for 68 % of the production measured samples . This is in analogy with a Gaussian distribution where 68 % are within plus or minus one standard deviation of the mean. Appropriate upper control limits can be established based on these statistical limits and the desired coverage factor

Note: The number of samples is generally agreed between print buyer and print supplier. ISO 186 is often used as a reference for this type of sampling.

Table 4 — Colourimetric tolerances for the solids of the process colours and spot colours

	Black	Cyan	Magenta	Yellow	Spot colours
Deviation tolerance	$\Delta L^* < 5, \Delta C^* < 3$	$\Delta h_{ab} < 6^\circ$	$\Delta h_{ab} < 6^\circ$	$\Delta h_{ab} < 6^\circ$	$\Delta h_{ab} < 8^\circ$
Variation tolerance	CIE DE2000 **<3**	CIE DE2000 **<2**	CIE DE2000 **<2**	CIE DE2000 **<2**	CIE DE2000 <1.5

4.3.6 Ink set gloss

If it is deemed necessary to specify the gloss of solid tone colours, then the specular gloss of the ink set sample shall be requested by the provider or defined by the receiver.

4.3.7 Tolerance for image positioning

The maximum distance between the image centres of any two printed colours shall not be more than 2/(screen ruling) and should be not more than 1/(screen ruling).

4.3.8 Tone Value Increase (TVI)

The tone value increase of flexographic printing strongly depends on the particular combination of ink, anilox rolls, printing formes, printing substrate and “press” used. Therefore no specific TVI curves are provided. The aim is to match a characterization data set (which describes the customers’ expectations). An initial estimate of the aim TVI can be obtained from the characterization data itself (see ISO 13655).

There are situations where colour-managed systems for data input and preparation are either not available or not appropriate in a particular workflow. However, use of a consistent set of references can enable a higher degree of consistency between output from unrelated sites.

The use of the ISO 20654 is should be use where the requirements described in the body of this part of ISO 12647 cannot be applied, for both CMYK and Spot Colours.

The ISO 20654 can be used to define reference this could be linear or predefined.

4.3.9 Reproducibility of printing

Over the press run, the difference between the measured value of the printed image of the 50 % tint of the C, M, Y and K control strip, and the values of the OK print, shall be less than ±4 in tone value (%).

Where a control strip is not included, a single colour portion of the image having an input tone value between 30 % and 70 % may be used for this evaluation.

The minimum stable printable dot (referred in the control tonal value as min dot) of the C, M, Y and K tint of the process control strip shall not vary more than a maximum of ± 3 in tone value (%) over the press run.

5 Reporting

When requested by the provider of the printing data, the receiver shall provide a summary of the values associated with the variables identified in this part of ISO 12647 requiring agreement between the provider and receiver. This report may also include any additional printing aims and process control data deemed appropriate by the provider or receiver.

Annex C shows a tabulation of information that might be provided as part of the data exchange between provider and receiver.

Annex A
(informative)

Communication of spot colour data

A spot colour is a non-process colour that is used in addition to, or in place of, a process colour, where the consistent appearance of that colour produced is critical to the appearance of the finished product or the area coverage of that colour dictates the use of a single ink. It is normally applied with a single impression. When associated with a corporate product identity, a spot colour is also known as brand colour.

Where spot colours are used, they need to be defined by spectral reflectance measurement data of the spot colour ink printed over the substrate to be used for printing (or a reference substrate similar to the actual substrate to be used) and over a black area printed on this substrate (the adhesion or trap of the ink over the black can result in a different ink transfer and hence film weight than when printed over the unprinted substrate). Spot colours incorporating tints need to be defined at a minimum with prints on the substrate and on the printed black area at tone values of 0 (%), 50 (%) and 100 (%). Spot colours incorporating tints are better defined with prints on the substrate and on the printed black area with at least 9 tone values that include a 0 (%), 50 (%) and 100 (%) tone value and are otherwise evenly distributed in tone value between the substrate and the solid. Unless otherwise agreed between provider and receiver, colour measurements are made as defined in ISO 13655, condition M1, over a white backing.

Calibration of Spot Colour tints should be aligned with ISO 20654 – Spot Colour Tone Value

Brand or Spot Colours for communication should be in the format or ISO 17972-4, *Graphic technology — Colour data exchange format — Part 4: Spot colour characterization data (CxF/X-4 delivers a xml formot that delivers data required*

The substrate ideally is the substrate on which the job will be printed. The black ink needs to be printed at the standard L^* value ($L^* \leq 11$). A commercial “contrast card” can be used where the actual printing substrate is not known or available.

The measurement data file needs to include the model of measurement instrument used, the printing procedure, ink identification, and substrate used.

Annex B
(informative)

Information exchange

The following tabulation includes one possible information that might be provided as part of the data exchange between provider and receiver of the data for flexographic printing, or agreed to as a separate communication.

a) Proofing requirements (required, type).

b) Exchange medium:

   1) film – type of film, density requirements, etc.;

   2) digital data – file format, reference printing condition, etc.;

   3) printing formes – type, printing forme measurement procedure, etc.

c) Characterization data.

d) Spot colour description.

e) Minimum printable dot.

f) Screening parameters.

g) Tone value sum.

h) Surface finishing requirements.

i) Ink set gloss.

j) Reporting requirements.

k) Metamerism under a secondary illuminant of the printed colour to the aim.

Table C.1 shows a possible reporting format for some of the more useful data that might be reported.

Table C.1 — Possible reporting format for useful data

Parameter	Data set value	OK Print [a]	Production [a]
Cyan solid	L* = a* = b* =	Δh_{ab} = CIE DE2000=	CIE DE2000 [b] =
Magenta solid	L* = a* = b* =	Δh_{ab} = CIE DE2000=	CIE DE2000 [b] =
Yellow solid	L* = a* =	Δh_{ab} =	CIE DE2000 [b] =

	b* =	CIE DE2000=	
Black solid	L* = a* = b* =	ΔL^* = CIE DE2000=	CIE DE2000 [b] =
Cyan midtone TVI (%)	TVI =	TVI =	TVI (mean) =
Magenta midtone TVI (%)	TVI =	TVI =	TVI (mean) =
Yellow midtone TVI (%)	TVI =	TVI =	TVI (mean) =
Black midtone TVI (%)	TVI =	TVI =	TVI (mean) =
Cyan min dot TV (%)	NA	TV =	TVI (mean) =
Magenta min dot TV (%)	NA	TV =	TV (mean) =
Yellow min dot TV (%)	NA	TV =	TV (mean) =
Black min dot TV (%)	NA	TV =	TV (mean) =

[a] All differences recommended for reporting are with respect to the data set values.

[b] 68th percentile.

Annex C
(informative)

Determination of quality parameters of half-tone dots on a colour separation film

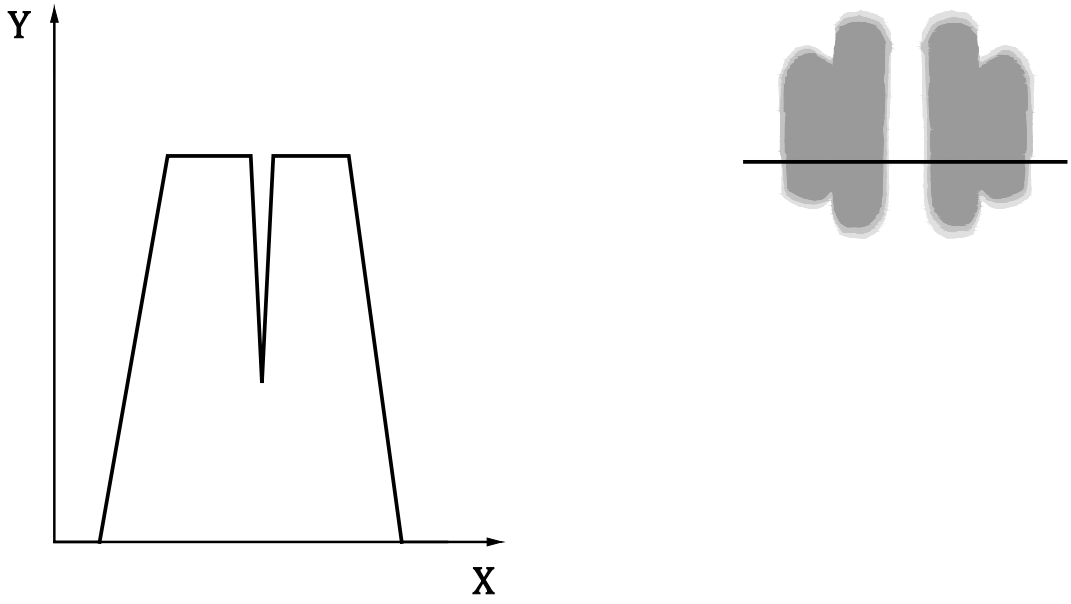
C.1 Microline target

A simple qualitative method for half-tone films with a base-plus-fog transmittance density of less than 0,1 is to place a control strip film with a microline target, emulsion oriented up, on a light table and to cover it with the film to be evaluated, emulsion oriented down. With a hand-held microscope of between 60- and 100-fold magnification, observe the isolated opaque half-tone dots which are found in those parts of the half-tone film, of positive or negative polarity, that appear lighter. If the microlines are distinctly visible below the half-tone dots, then the core density is too low. The fringe width can be estimated by comparing it to the width of the microlines as stated on the microline target. The colour-separation film should be illuminated from below at oblique angles of incidence, a condition known as dark-field illumination. With some experience, the compliance of half-tone dots to a specified maximum fringe width can be predicted with near certainty.

C.2 Scanning microdensitometer

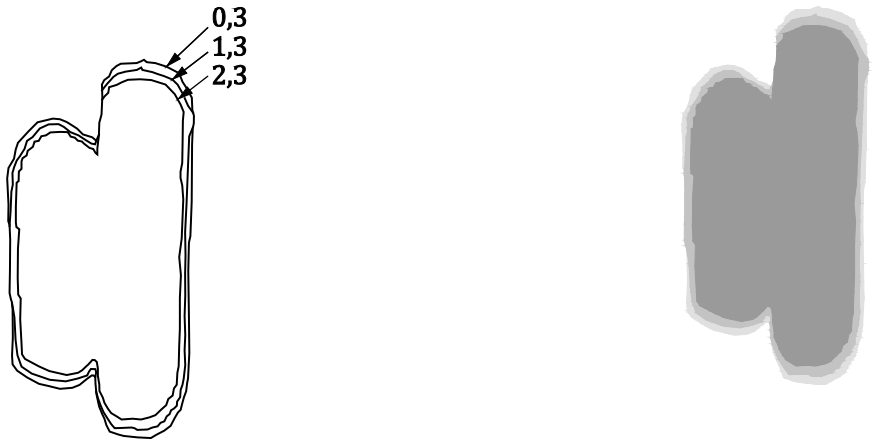
A quantitative method may be obtained using a scanning microdensitometer. This is an instrument in which the illumination stage of a transmission microscope is equipped such that an aperture, with an adjustable diameter of 3 µm or less, is formed in the centre of the object plane. The film is moveable, in a controlled way, in both x and y directions of the object plane. As the film is moved, the radiation transmitted by the film is measured with a photodetector, which has been calibrated in terms of transmittance density. The wavelength range of the radiation source should be selected in view of the spectral requirement of the process steps where the film is to be used. The data may be presented graphically, either as a transmittance density profile across a half-tone dot (see Figure D.1), or by drawing contour lines that connect points of equal transmittance density (see Figure D.2).

The effects depicted in Figures D.1 and D.2 may also be observed with directly imaged printing formes. The evaluation methods described in this annex may be applied by analogy.



a) b)

Figure D.1 — Transmittance density profile of a split half-tone dot on a colour separation film (a) and microscopic image of the same dot (b)



a) b)

Figure D.2 — Transmittance-density contour lines of the left part of the soft half-tone dot of Figure B.1 (a) and microscopic image of that same area (b)

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[1] Withdrawn.

[2] Withdrawn.