SLOVENSKI STANDARD
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Grafiķna tehnologija - Vodenje procesa izdelave rastriranih barvnih izvleķkov, preskusnih in proizvodnih odtisov - 1. del: Parametri in merilne metode

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

Technologie graphique -- Maîtrise de procédé pour la production des séparations de couleur en ton tramé, des épreuves et des tirages en production -- Partie 1: Paramètres et méthodes de mesurage

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

Part 1: Parameters and measurement methods

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

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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
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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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 12647-1 was prepared by Technical Committee ISO/TC 130, *Graphic technology.*

This second edition, which has been extensively revised by the introduction of digital data as input, the addition of several definitions and a general clean up, cancels and replaces the first edition (ISO 12647-1:1996).

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 printing*

— *Part 5: Screen printing*

— *Part 6: Flexographic printing*

Part 7: Processes using digital printing or reproductions made on various traditional printing processes from digital files is in preparation.

Introduction

When producing a colour reproduction, it is important that the persons responsible for colour separation, proofing and printing operations have previously agreed on a minimum set of parameters that uniquely defines the visual characteristics and other technical properties of the planned print product. Such an agreement enables the correct production of suitable separations (without recourse to “trial-and-error”) and subsequent production of analogue or digital off-press or on-press proof prints from these separations whose purpose is to simulate the visual characteristics of the finished print product as closely as possible.

It is the purpose of this part of ISO 12647 to list and explain the minimum set of primary process parameters (see below) required to uniquely define the visual characteristics and related technical properties of a proof or production print produced directly from digital data or from a set of half-tone separation films. Other parts of ISO 12647 define specific values for these parameters that are appropriate for specific processes (such as lithography, gravure, flexography, screen printing). For some processes certain parameters are more significant than others and may be specified as mandatory while the remainder are optional. However, in this part of ISO 12647, all parameters are treated equally.

Primary parameters are defined here as having a direct bearing on the visual characteristics of the image; secondary parameters are defined as those which may influence the image indirectly by changing the values of primary parameters. Secondary parameters include

— colour separation film thickness;

— image orientation (wrong-reading or right-reading);

— film polarity (negative or positive);

— roughness of the film emulsion surface;

— presence of colour marking or register marks;

— printing sequence.

Where necessary for specific process applications, secondary parameters and further related details may be specified in addition to primary parameters, but they are not included in this part of ISO 12647 except in the definitions.

During the process of colour separation for multi-colour printing, a digital data set comprising CMYK tone values ready for printing is normally produced from digital data that relate to a multi-coloured continuous-tone original. This usually consists of a photographic transparency or a reflection copy print, although any multicoloured graphic in analogue or digital form may be used as input.

The majority of printing processes covered by ISO 12647 requires continuous-tone images to be broken up into half-tone screens before they can be put on a printing forme. However, there are new processes like inkjet that do not require screening. For these processes, this part of ISO 12647 may be equally applied, with the exception of the specifications for screen width, screen angle, half-tone dot shape and, of course, film quality. It should be noted that a number of off-press proofing systems produce images without recourse to half-toning. In this case, the proof cannot be used to predict artefacts like moiré that may be caused by interferences between periodic structures of the image and half-tones used in production printing.

The process of colour separation does not provide a unique transformation of the colour values of the original into those of the production print. For every distinguishable spot of the original, the colour (characterizable by three colorimetric values, e.g. *X, Y, Z* or *L*, a*, b** or hue, saturation and lightness) has to be separated into tone values for four or more process colours. However, in most cases, the density range (and, hence, the

colour gamut) of the original is wider than that achievable in printing. As a result, the classical colour separation process requires some degree of interpretation of the original by the operator and the resultant transformation may differ from one original to another. With ICC colour management, the mentioned ambiguity is reduced to vendor-specific options for the user; within a given option set the results are reproducible. A further source of variation is the degree and manner by which the achromatic component of a colour is generated with black ink rather than by a suitable mix of the chromatic inks. Here again, a number of options exist, which may to some degree be vendor-specific.

Whatever freedom exists for the colour separation process, it is important that it take account of the values of the process parameters of the printing condition to be used for production. This is because the process steps that follow colour separation, namely output on film (if required), proofing (on- or off-press), the production of the printing forme (if required), production printing and print surface finishing, are normally carried out with a rigid set of process parameters which include

— the properties of the print substrate;

— the optical properties of solid prints of the process inks;

— the tone value increase curve.

Maintaining consistent values for the parameters at all steps in the process is important to ensure predictable reproduction. Any unforeseen variation of these values is usually to the detriment of the visual characteristics of the image.

The technical background discussed so far shows that the processes of colour separation and proofing require prior knowledge of the values of the process parameters encountered in production printing. It is virtually impossible to print all jobs with the same set of process parameters, irrespective of the type of printing press or digital printing unit, printing forme, printing ink, print substrate, or surface finishing used. Therefore, there has to be an efficient information exchange between the pre-press service provider, the proof printer and the production printer which defines the specific parameters for that job.

To facilitate the information interchange, this part of ISO 12647 defines a complete set of parameters whose values should be specified as a minimum when a pre-press job consisting of a digital file or a set of colour-separation films, both with accompanying proof print, is being ordered. Specific values for each parameter are assigned in other parts of ISO 12647; this part is only concerned with definitions, principal requirements, reporting and test methods.

Because the proof print is the principal means of communication between pre-press, print-buyer and printer, it is important that

— the proof print be made using the best achievable simulation of the intended printing condition, and

— production printing attempt to match the visual characteristics of the approved proof print.

One of the major variations between and within printing processes is between tone-value-increase curves (formerly “dot gain curves”), examples of which are shown schematically in Figure 1. One such curve, with appropriate tolerances, may be specified for every process colour, for each specific combination of print substrate type and printing process.

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

Part 1: Parameters and measurement methods

1 Scope

This and other parts of ISO 12647 specify parameters that define printing conditions for the various processes used in the graphic arts industry. Practitioners wishing to work to common goals may use the values of the parameters specified in the exchange of data to characterize the intended printing condition and/or for the process control of printing.

This part of ISO 12647

— defines vocabulary and establishes a minimum set of process parameters that uniquely determine a printed four-colour half-tone image (which are also referenced from other parts of ISO 12647). The parameters were selected based on the following process stages “colour separation”, “making of the printing forme”, “proofing”, “production printing” and “surface finishing”. These are directly applicable to proofing and printing processes that use colour separation films as input;

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

— is 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;

— is applicable to line screens and, where relevant, to those that do not have regular screen angles or regular screen rulings.

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 referenced document (including any amendments) applies.

ISO 5-2, *Photography — Density measurements — Part 2: Geometric conditions for transmission density*

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

ISO 5-4, *Photography — Density measurements — Part 4: Geometric conditions for reflection density*

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

3 Terms and definitions

For the purpose of all parts of ISO 12647 the following definitions apply, they are given in alphabetical order. For convenience, some definitions are included in anticipation of their use in subsequent parts of ISO 12647.

NOTE For quantities, the preferred unit is given together with the definition. By definition, the unit of the so-called dimensionless quantities is 1.

3.1
achromatic colour
perceived colour devoid of hue, in the perceptual sense

[adapted from 845-02-26 of CIE 17.4[3]]

NOTE 1 The colour names white, grey and black are commonly used or, for transmitting objects, colourless and neutral.

NOTE 2 In printing practice, achromatic colours can be produced either by a single ink or three chromatic inks suitably balanced.

3.2
axis of a screen
one of the two directions in which the half-tone pattern shows the highest number of image elements, such as dots or lines, per length

3.3
chromatic colour
perceived colour possessing hue, in the perceptual sense

[adapted from 845-02-27 of CIE 17.4[3]]

NOTE The process inks cyan, magenta and yellow are the chromatic colour inks.

3.4
CIELAB colour difference
CIE 1976 L^*, a^*, b^* colour difference
ΔE^*_{ab}
difference between two colour stimuli defined as the Euclidean distance between the points representing them in L^*, a^*, b^* space

[adapted from 845-03-55 of CIE 17.4[3]]

NOTE The unit is 1.

3.5
CIELAB colour space
CIE 1976 L^* a^* b^* colour space
three-dimensional, approximately uniform colour space produced by plotting L^*, a^*, b^* in rectangular co-ordinates

[adapted from 845-03-56 of CIE 17.4[3]]

3.6
colorimeter
instrument for measuring colorimetric quantities, such as the tristimulus values of a colour stimulus

[845-05-18 of CIE 17.4[3]]

NOTE A tristimulus colorimeter achieves this by the analogue integration of the spectral product of object reflectance or transmittance factor, illuminant and filters which are defined by standard illuminant and the standard observer functions. A spectrocolorimeter achieves this by calculation from the spectral data.

3.7
colour-separation film
one of a set of black-and-white half-tone films for process printing that pertains to one process colour

NOTE There are usually four colour-separation films in a set.

3.8
control patch
area produced for control or measurement purposes

3.9
control strip
one-dimensional array of control patches

3.10
core density
⟨half-tone film⟩ transmittance density in the centre of an isolated opaque image element such as a half-tone dot or line

NOTE The unit is 1.

3.11
deviation tolerance
permissible difference between the **OK print** (3.26) from a production run and the reference value

3.12
film emulsion orientation
orientation of a colour separation film relative to the observer with respect to the emulsion side

NOTE Normal orientation is emulsion up, i.e. towards the observer.

3.13
fringe width
⟨isolated opaque image element⟩ average distance between the density contour lines corresponding to 10 % and 90 % of the minimum core density specified for the printing process under consideration

NOTE Fringe width is expressed in units of micrometres.

3.14
grey balance
set of tone values for cyan, magenta and yellow on the **colour-separation films** (3.7) that appears as an achromatic colour under specified viewing conditions if printed under specified printing conditions

NOTE There are two practical definitions for grey: “a colour having the same CIELAB a^* and b^* values as the print substrate” and “a colour that has the same CIELAB a^* and b^* values as a half-tone tint of similar L^* value printed with black ink”.

3.15
half-tone film
film for use with a half-tone printing process showing image elements such as dots or lines

3.16
hard-dot film
colour-separation film with half-tone dots that reproduce reliably in film duplication and production of the printing forme