Trükitehnoloogia. Peegeldensitomeetria ja kolorimeetria kasutamine protsessi kontrollimiseks või trükiste ja proovitrükkide hindamiseks (ISO 13656:2000)

Graphic technology — Application of reflection densitometry and colorimetry to process control or evaluation of prints and proofs (ISO 13656:2000)

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NATIONAL FOREWORD

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INTERNATIONAL STANDARD

ISO 13656

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Graphic technology — Application of reflection densitometry and colorimetry to process control or evaluation of prints and proofs

Technologie graphique — Application de la densitométrie par réflexion et de la colorimétrie pour la maîtrise ou l'évaluation des procédés des imprimés et épreuves

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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

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

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

International Standard ISO 13656 was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

Annexes A to C of this International Standard are for information only.

Introduction

Reflection densitometers and reflection colorimeters (of tristimulus photometric or spectrophotometric type) are both reflectometers measuring the reflectance factor of reflection copy materials. Densitometers conforming to ISO 5-4 and ISO 14981, and colorimeters conforming to ISO 13655 possess a common geometry type, namely either 0°/45° or 45°/0°. It is further specified in ISO 5-4 that densitometric measurements shall be made on a specified black backing; ISO 13655 specifies the same condition for colorimetry in graphic arts. Finally, it is noted that reflectometers of the spectrophotometer type can, in principle, be used as both a densitometer and as a colorimeter.

Notwithstanding the similarities of the instruments, there are fundamental differences between them. The first of these is that the typical densitometer used in graphic arts, as its name implies, displays density values (logarithm of the reciprocal of a weighted average of the spectral reflectance factor) although it may also display other parameters calculated from these values. A colorimeter, on the other hand, normally displays differently weighted averages of the spectral reflectance factor, although frequently it can also display various transformations from these values which may be required for a number of reasons. One such reason is the need to define a more uniform colour space such as CIELAB.

ISO 5-3 requires that for reflection densitometry the incident flux has a spectral power distribution that conforms to CIE illuminant A. In colorimetry, ISO 13655 specifies a spectral power distribution that conforms to CIE illuminant D50 but accepts that such a source is not easily realisable. It requires that D50 be used to calculate the tristimulus values which, together with the weighting functions specified, effectively defines the spectral response whether it be achieved by the use of filters or calculation from spectrophotometric data. In practice most colour measurements in graphic arts today are made with spectrophotometers using a source with a spectral power distribution similar to illuminant A. The measured spectral reflectance data is used to calculate both densitometric and colorimetric data and illuminant D50 is used to calculate the tristimulus values as specified in ISO 13655. The implication of this for colour measurement is that it gives erroneous results when samples fluoresce.

The aim of colorimetry is to provide an instrument response which simulates, as well as possible, that of the standard observer. In graphic arts, colorimetry serves mainly for colour matching and the establishment of colour standards. The availability of inexpensive, hand-held colorimeters, with small sampling apertures, has also permitted the use of colorimetry in process control as a complement to densitometry.

Densitometers are primarily designed for indirect measurement and control of the amount of colorant material of a specified type present in, or on, a substrate. ISO 5-3 defines a number of statuses, each of which is deemed appropriate for a particular application. The primary aim of densitometry for graphic arts is to monitor the amount of colorant per area on a print or proof. For a half-tone print this is a function of the ink film thickness and tone values. However, densitometry is also used for the determination of other process control quantities. A distinctly different task is the evaluation of the density ranges of colour separation input material; this type of densitometry is not covered by this International Standard.

Historically, colour densitometers for reflection type material were first used in preparation for colour separation for determining the density ranges of continuous-tone, coloured original artwork, as measured through the wide-band filters used for colour separation. As the quality of the printed products improved, however, reflection densitometers were also applied to process control in printing. Here, the areas measured consist typically of single-colour patches contained in control strips, printed with the process colours cyan, magenta, yellow and black.

For the control of the chromatic colours, especially yellow, it was later discovered that measurements made with narrow-band filters, each centred on the main absorption maximum of one of the process ink colorants, provided features which can be advantageous for certain control applications. These are:

— reduction of the influence of slight hue shifts on density,

— bringing the yellow densities and tone values within the range of those of cyan and magenta,

— improvement of inter-instrument agreement,

— extension of the linear relationship between density and ink film thickness to higher densities,

— reduction of the magnitude of density additivity failure.

It was also found that the readings obtained from densitometers with a means for cross-polarisation to minimise the influence of first-surface reflection were less affected by ink dry-back. Polarisation also contributes to the last two features above. The need for the instrument designer to correct for it in computing the spectral response is described in ISO 5-3 and also in annex B of this International Standard. Standardisation of the minimum efficiency of polarisation is covered by ISO 14981.

The wide range of applications for which densitometry is used, mean that both wide and narrow band instruments, as well as the optional use of polarisation, are in common use in graphic arts. Furthermore, colorimetry is becoming increasingly widely used and all of these options present many alternatives for process measurement within the industry. It is for this reason that this International Standard has been produced. Since the industry increasingly needs to communicate process control information between various participants in production it is essential that this be defined unambiguously. By defining terms, specifying preferred test methods and the requirements for control strips, and defining reporting procedures, such ambiguity should be kept to a minimum.

Many of the parameters measured or calculated in graphic arts process control, including some of those defined later in this International Standard, do not require any specific spectral response to be effective. They are comparative measurements and are in many cases calculated directly from the reflectance data from which density and colorimetric parameters are themselves derived. In isolated production environments various parameters, each of which may be derived from any reasonable spectral product, can be equally effective for process control. It is not the intent of this International Standard to preclude their continued use in such a situation. However, in some situations there are advantages in using specific parameters or spectral products and, furthermore, to aid communication in a distributed production environment it is essential that graphic arts metrology is based on agreed procedures. It is in this context that this International Standard specifies colorimetric and densitometric test methods for the most common process control procedures in graphic arts and specifies the reporting procedures to be employed.

Graphic technology — Application of reflection densitometry and colorimetry to process control or evaluation of prints and proofs

1 Scope

This International Standard applies to process control and evaluation of single and multi-colour proofing and printing in the graphic arts using densitometry and colorimetry. This International Standard:

— defines terms;

— specifies minimum requirements for control strips;

— specifies test methods;

— specifies reporting procedures for the results.

2 Normative references

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

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

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

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

ISO 12647-2, *Graphic technology — Process control for the manufacture of half-tone colour separations, proof and production prints — Part 2: Offset lithographic processes*.

ISO 12647-3, *Graphic technology — Process control for the manufacture of half-tone colour separations, proofs and production prints — Part 3: Coldset offset lithography and letterpress on newsprint*.

ISO 12647-4[1)], *Graphic technology — Process control for the manufacture of half-tone colour separations, proof and production prints — Part 4: Gravure processes*.

ISO 12647-5[1)], *Graphic technology — Process control for the manufacture of half-tone colour separations, proof and production prints — Part 5: Screen printing*.

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

1) To be published.