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Grafisk teknik – Spektral mätning och kolorimetrisk beräkning av bilder för grafisk produktion (ISO 13655:2017, IDT)

Graphic technology – Spectral measurement and colorimetric computation for graphic arts images (ISO 13655:2017, IDT)

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If you want to know more about SIS, or how standards can streamline your organisation, please visit www.sis.se or contact us on phone +46 (0)8-555 523 00

Den internationella standarden ISO 13655:2017 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av ISO 13655:2017.

Denna standard ersätter SS-ISO 13655:2010, utgåva 1.

The International Standard ISO 13655:2017 has the status of a Swedish Standard. This document contains the official version of ISO 13655:2017.

This standard supersedes the Swedish Standard SS-ISO 13655:2010, edition 1.

Upplysningar om sakinnehållet i standarden lämnas av SIS, Swedish Standards Institute, telefon 08-555 520 00. Standarder kan beställas hos SIS Förlag AB som även lämnar allmänna upplysningar om svensk och utländsk standard.

Information about the content of the standard is available from the Swedish Standards Institute (SIS), telephone +46 8 555 520 00. Standards may be ordered from SIS Förlag AB, who can also provide general information about Swedish and foreign standards.

Denna standard är framtagen av kommittén för Grafisk teknik, SIS/TK 434.

Har du synpunkter på innehållet i den här standarden, vill du delta i ett kommande revideringsarbete eller vara med och ta fram andra standarder inom området? Gå in på www.sis.se - där hittar du mer information.

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 130, *Graphic technology*, in collaboration with Technical Committee ISO/TC 42, *Photography*.

This third edition cancels and replaces the second edition (ISO 13655:2009), which has been technically revised to:

— clarify the requirements of measurement mode M1;

— restrict the use of unnecessarily wide bandpass and sampling intervals;

— provide more realistic specification for the optical properties of a white backing material;

— restrict the adjustment method of predicting the fluorescent reflectance factor to UV activated substrates.

Introduction

There are many choices allowed when making spectral measurements and performing colorimetric computations. The specific choices made can result in different numerical values for the same property for the same sample. Thus, it might not be possible to make valid comparisons unless the data being compared are all based on the same set of measurement and computational choices. The purpose of this document is to specify a limited number of such choices for the measurement and computation of the colorimetric characteristics of graphic arts images and specimens, such as test charts, to allow valid and comparable data to be obtained. While this document references ISO 3664, the International Standard established for viewing conditions in graphic arts and photography, it is not expected that measured colorimetric data will provide an absolute correlation with visual colour appearance.

When the prior revision of this document was started, it was observed that almost all graphic arts specimens exhibited fluorescence. In most cases, this was due to optical brightening agents (OBA) contained in the paper substrates. In rare cases, the printing inks were fluorescent. According to the recommendations of the 1996 version of this document, this would have meant that the source used for the measurements (i.e. the spectral power distribution of the specimen illumination) was required to closely match CIE illuminant D50. Yet when the 2009 revision was started, not a single colour-measuring instrument sold for the graphic arts market provided an illumination system that closely matched CIE illuminant D50. Instead, most instruments used incandescent lamps for light sources. The spectral power distributions of such lamps have varying amounts of UV content. The variation in UV content between instruments could easily amount to a colour difference of 5 Δb^* when measuring substrates with a high level of optical brightening agents. Consequently, the measurement results for unprinted paper substrates and lighter colours differed appreciably between different instrument models. For a thorough study of fluorescence effects, see CIE Publication 163.

It had also been observed that graphic arts viewing booths vary with respect to UV content, even those that comply with the 1996 version of ISO 3664. The practical result was that specimens that have nearly identical measured colorimetric properties, at times will not visually match when viewed in the viewing booth, and vice versa. Only part of such discrepancies can be attributed to fluorescence. There can also be metameric effects due to “non-standard” observers and to instrument wavelength errors, in addition to deviations in the measurement source away from CIE D50. Despite these other potential influences, it was deemed important to provide measurement solutions that would minimize the systematic errors introduced by the interaction of paper fluorescence and variations in the spectral power distribution of the sample illumination. Methods for the correction of instrument errors and procedures for reliable visual evaluation of colour images are outside of the scope of this document.

In the 2009 revision, four measurement choices were defined for reflective measurements. Measurement condition M0 requires the source illumination to closely match that of illuminant A; this provides consistency with existing instrumentation and ISO 5-3. Measurement condition M1 requires the colorimetry of the specimen illumination to closely match CIE illuminant D50. Measurement condition M2 only requires that the spectral power distribution of the specimen illumination be provided in the wavelength range from 400 nm to at least 700 nm and have no substantial radiation power in the wavelength range below 400 nm (often referred to as “UVCut”). Measurement condition M3 has the same sample illumination requirements as M2 and includes a linear polarizer in the influx and efflux portions of the optical path with their principal axes of polarization in the orthogonal or “crossed” orientation. For specimens in which the fluorescence is primarily that of a UV activated blue emission, it is possible to use the method of a virtual fluorescent standard reported by Imura of Konica Minolta[24][25] to determine the total radiance factors for M0, M1 and M2 conditions. In this revision, Annex A has been revised providing a slightly narrower and more realistic set of spectral tolerances on the white backing materials. The properties of the white backing material are critical to reproducibility of readings of packaging printing on clear or translucent films.

Finally, as the CIE has been recommending the use of 5 nm intervals for practical tristimulus integration since the second revision of CIE Publication 15 and as graphic images can be composed of colour stimulus functions with very narrow transitions from the low values to the high values, this revision recommends that tristimulus values be based on spectral data collected with a 5 nm interval and a 5 nm bandpass. Since many of the instruments now in use in the field are equipped with 10 nm

intervals and 10 nm bandpass spectrometers, such readings are allowed with the recommendation that tristimulus calculations be preceded by applying bandpass correction to the spectral data as specified in ASTM E2729. The use of instruments with wider sampling intervals and bandpass has been deprecated with the exception of the use of such non-standard instruments to monitor the state of previously characterized materials or objects.

The requirements of this document are focused on colorimetric measurement equipment intended for use in the graphic arts environment. Helpful information on issues such as substrate backing materials, reporting, standardization, standard and improved colour difference metrics, fluorescence and ways to improve the inter-instrument agreement are included. These will be useful to technical advisors of graphic arts associations, specialized graphic arts research institutes, and practitioners with an interest in the basics of measurement and process control.

Graphic technology — Spectral measurement and colorimetric computation for graphic arts images

1 Scope

This document specifies procedures for the measurements and colorimetric computations appropriate to objects that reflect, transmit and emit light, such as flat-panel displays. It also specifies procedures for computation of colorimetric parameters for graphic arts images. Graphic arts include, but are not limited to, the preparation of material for, and volume production by, production printing processes that include offset lithography, letterpress, flexography, gravure, screen and digital printing.

This document does not address spectral measurements appropriate to other specific application needs, such as those used during the production of materials, for example, printing paper and proofing media.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 and graphic technology — Density measurements — Part 2: Geometric conditions for transmittance density*

ISO 5-4:2009, *Photography and graphic technology — Density measurements — Part 4: Geometric conditions for reflection density*

ISO 3664, *Graphic technology and photography — Viewing conditions*

ISO 11664-1, *Colorimetry — Part 1: CIE standard colorimetric observers*

ISO 11664-3, *Colorimetry — Part 3: CIE tristimulus values*

ISO 11664-4, *Colorimetry — Part 4: CIE 1976 L*a*b* Colour space*

ISO 28178, *Graphic technology — Exchange format for colour and process control data using XML or ASCII text*

CIE Publication 15:2004, *Colorimetry, 3rd ed.*

CIE Publication 167:2005, *Recommended practice for tabulating spectral data for use in colour computations*

CIE Publication 176:2006, *Geometric Tolerances for Colour Measurements*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp