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

Technologie graphique — Mesurage spectral et calcul colorimétrique relatifs aux images dans les arts graphiques

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
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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.

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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 13655 was prepared by Technical Committee ISO/TC 130, *Graphic technology*, in collaboration with Technical Committee ISO/TC 42, *Photography*.

This second edition cancels and replaces the first edition (ISO 13655:1996), which has been technically revised in the following parts:

Clause 4, “Spectral measurement requirements”, was revised concerning the spectral power distribution of the measurement source, the measurement of self-luminous displays, and the backing material to be used for reflectance measurement.

Clause 5, “Colorimetric computation requirements” was amended by inclusion of the CIE 1976 a, b colour space (see ISO 11664-4).

Some of the previous eight annexes were combined and shortened, two new annexes were introduced, and the Bibliography was updated.

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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 is all based on the same set of measurement and computational choices. The purpose of this International Standard is to specify a limited number of such choices for the measurement and computation of the colorimetric characteristics of graphic arts images to allow valid and comparable data to be obtained. While this International Standard 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 revision of this International Standard was started, it was observed that almost all graphic arts specimens exhibited fluorescence. In most cases, this was due to optical brightening agents contained in the paper substrates. In rare cases, the printing inks were fluorescent. According to the recommendations of the 1996 version of this International Standard, this would have meant that the source used for the measurements (i.e. the spectral power distribution of the sample illumination) was required to closely match CIE illuminant D50. Yet when this 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 distribution 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 papers 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 has 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 is 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 International Standard.

In this revision, four measurement choices are specified. 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 420 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 polarizing filter in the influx and efflux portions of the optical path with their principal axes of polarization in the orthogonal or “crossed” orientation.

The requirements of this International Standard 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.

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