ANSI/CGATS.5:2018
Revision of ANSI/CGATS.5:2009
(National Adoption of ISO 13655:2017)

AMERICAN NATIONAL STANDARD

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

SECRETARIAT
THE ASSOCIATION FOR PRINT TECHNOLOGIES

APPROVED June 22, 2018
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CGATS

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AMERICAN NATIONAL STANDARD

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Foreword

ANSI CGATS.5:2009 is an identical adoption of ISO 13655:2009. ISO 13655:2009 was prepared by ISO Technical Committee 130, *Graphic technology*, in collaboration with ISO Technical Committee 42, *Photography* and with the support of the ANSI Committee for Graphic Arts Technologies Standards (CGATS).

Minor edits have been made to this standard to prepare it as an ANSI CGATS standard. No technical changes have been made.

CGATS Subcommittee 3 is the consensus body that approved the national adoption of ISO 13655:2009 for issuance as CGATS.5:2009 in accordance with the *ANSI Procedures for the National Adoption of ISO and IEC Standards as American National Standards* and the CGATS Operating Procedures.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. Neither ISO, ANSI, CGATS nor APTech shall be held responsible for identifying any or all such patent rights.

This standard cancels and replaces CGATS.5:2003.

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 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 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 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 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 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.

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1 Scope

This standard establishes procedures for the measurements and colorimetrical computations appropriate to objects that reflect, transmit, or self-illuminate, including flat-panel displays. It also establishes procedures for computation of colorimetric parameters for graphic arts images. Graphic arts include, but is not limited to, the preparation of material for, and volume production by, production printing processes that include offset lithography, letterpress, flexography, gravure and screen printing.

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

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 5-2, *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 11664-1:2007, *Colorimetry — Part 1: CIE standard colorimetric observers*

ISO 11664-2:2007, *Colorimetry — Part 2: CIE standard illuminants*

ISO 11664-4:2008, *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.

3 Terms and definitions

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

3.1
adopted white
spectral radiance distribution as seen by an image capture or measurement device and converted to colour signals that are considered to be perfectly achromatic and to have an observer adaptive luminance factor of unity, i.e. colour signals that are considered to correspond to a perfect white diffuser

[ISO 22028-1]