Designation: D7305 – 08a (Reapproved 2013)

Standard Test Method for Reflection Density of Printed Matter[1]

This standard is issued under the fixed designation D7305; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This test method describes a procedure for measuring reflection density of printed matter using a reflection densitometer or spectrodensitometer.

1.2 This test method is intended primarily for process colors (yellow, magenta and cyan) and black. With appropriate instrumentation, it may also be used for other colors.

1.3 This test method applies to prints made by any printing process on a flat surface, with reflection density values ranging from just above zero, on the unprinted substrate, through to around 2.5 for very dense prints.

1.4 This test method can be used for prints on paper, film or board but not for those on metal or foil. It can be conducted in the pressroom or laboratory.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E284 Terminology of Appearance

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

2.2 *ANSI Standards:*[3]

CGATS.4-1993 Graphic Technology – Graphic Arts Reflection Densitometry Measurements — Terminology, Equations, Image Elements and Procedures

CGATS.6 Graphic Technology — Specifications for Graphic Arts Printing

CGATS.11-1999 Graphic Technology — Certified Reference Materials for Reflection and Transmission Metrology – Documentation Requirements and Recommended Procedures

PH 2.17 Geometric Conditions for Reflection Density

PH 2.18 Spectral Conditions for the Measurement of Optical Density

2.3 *ISO Standard:*[3]

ISO 15790 Graphic technology and photography — Certified reference materials for reflection and transmission metrology — Documentation and procedures for use, including determination of combined standard uncertainty

2.4 *Other Standard:*[3]

DIN 16536-2:1986 Testing of prints and printing inks in graphic technology — Colour density measurements on on-press or off-press prints

3. Terminology

3.1 Definitions related to appearance are in Terminology E284.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *reflection density, n*—the light-absorbing property of a material, expressed as the logarithm of the reciprocal of the reflectance factor (i.e. higher density indicates more light is absorbed). [$D = \log_{10} (1/R) = -\log_{10} (R)$]

3.2.2 *reflection densitometry, n*—the practice of characterizing the amount of light absorption of materials by measuring reflectance and calculating and reporting reflection density.

3.2.3 *spectrodensitometer, n*—a spectrophotometer with appropriate software to convert the measured reflectance values to reflection density.

3.2.4 *process color, n*—a color having the main attribute of absorbing approximately one-third (1/3) the visible spectrum and transmitting the other two-thirds (2/3).

3.2.5 *dry back, n*—the reduction in density that occurs over time after printing on paper and other absorbent substrates due to ink penetration into the substrate.

3.2.6 *status T, n*—an ISO Reflection Status Density.

[1] This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.56 on Printing Inks.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

***A Summary of Changes section appears at the end of this standard**

NOTE 1—ISO Reflection Status Density is defined by its Spectral Products (Fig. 1), that is, the wavelength by wavelength combination of a standard influx spectrum (CIE illuminant A) and the filter-modifed efflux spectrum. Originally, these modifiers were defined by combinations of Wratten filters but today, either more durable materials, such as glass are used or the Spectral Products are computed numerically from tables of weights and the spectral reflectance factors measured with a spectrodensitometer.

The status T spectral products are applicable to the measurement of artwork for color separation and graphics arts materials such as ink-on-paper printed sheets, and off-press proofs. Status T was originally defined to closely match the spectral products historically used in evaluating original artwork to be color separated but were later applied, notably in the USA, to the measurement of most other printed graphic arts materials.

The status E spectral products are also applicable to the measurement of graphics arts materials such as ink-on-paper printed sheets, and off-press proofs. They evolved from the wider of the two passband filter specifications of DIN 16536-2:1986 for the Yellow and the Magenta and Cyan spectral products were chosen to match those of Status T. Status E spectral products have been applied, primarily in Europe, to the measurement of graphic arts materials. The narrower passband of the Yellow filter (compared to Status T) produces values that are more similar for all three chromatic inks at typical printing densities.

4. Symbols

4.1 *Symbols*: The following symbols are defined or referred to in this standard.

D reflection density
R reflectance factor

5. Summary of Test Method

5.1 The densitometer or spectrodensitometer is calibrated and set for the desired spectral response and color.

5.2 Multiple reflection density measurements are taken in specified positions on the print in order to determine an average result.

6. Significance and Use

6.1 One of the key properties for printing in the lab or on production equipment is the intensity of the color, color balance and uniformity. This test can be used to ensure that the proper amount of ink is transferred to the substrate by obtaining a target density value, in addition to determining whether the print is uniform by measuring the reflection density over a wide print area. This then allows the use of the print for controlled testing of other appearance properties, such as gloss and color, and performance properties, such as resistance to abrasion and chemicals.

6.2 This test can be used to help achieve consistent color reproduction of printed color on flat surfaces.

6.3 Transfer of density readings from one set of inks to another, or from one substrate to another, carries a high risk of producing a color or tone shift. It is not in the scope of this test

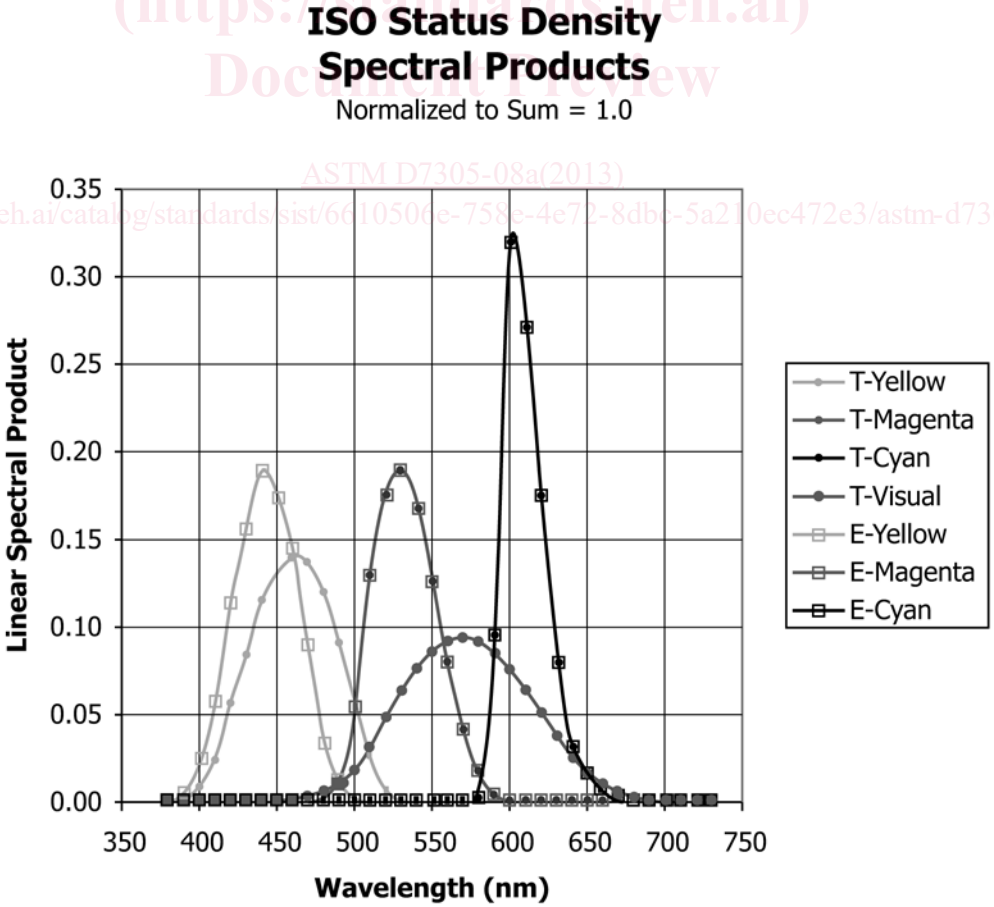

FIG. 1 ISO Status Density Spectral Products