



Designation: D 2066 – 97

Standard Test Methods for Relative Tinting Strength of Paste-Type Printing Ink Dispersions¹

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1. Scope

1.1 These test methods cover procedures for determining the relative tinting strength of paste-type printing ink dispersions by visual or instrumental evaluation.

1.2 These test methods are applicable to paste-type printing inks, flushed pigments, and other pigment dispersions that are essentially nonvolatile under ordinary room conditions and for which there is a wet reference standard of the same pigmentation and consistency. With proper choice of tinting base, they are applicable to dispersions of any color, including black and white.

NOTE 1—The instrumental procedures for tinting strength are similar in principle to those described in Test Methods D 387, D 2745, and D 4838.^{2,3}

1.3 *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:

- D 16 Terminology Relating to Paint, Varnish, Lacquer, and Related Products²
- D 387 Test Method for Color and Strength of Colored Pigments with a Mechanical Muller²
- D 2244 Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates²
- D 2745 Test Method for Relative Tinting Strength of White Pigments by Reflectance Measurements²
- D 4838 Test Method for Determining the Relative Tinting Strength of Chromatic Paints³
- E 284 Terminology of Appearance²
- E 1331 Test Method for Reflectance Factor and Color by Spectrophotometry Using Hemispherical Geometry²

¹ These test methods are under the jurisdiction of ASTM Committee D-1 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D1.56 on Printing Inks.

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² Annual Book of ASTM Standards, Vol 06.01.

³ Annual Book of ASTM Standards, Vol 06.02.

E 1347 Test Method for Color and Color-Difference Measurement by Tristimulus (Filter) Colorimetry²

E 1349 Test Method for Reflectance Factor and Color by Spectrophotometry Using Bidirectional Geometry²

2.2 ANSI Standards:

PH 2.17 Geometric Conditions for Reflection Density⁴

PH 2.18 Spectral Conditions for the Measurement of Optical Density⁴

PH 2.30 Viewing Conditions for Graphic Arts and Photography—Color Prints, Transparencies and Photomechanical Reproductions⁴

3. Terminology

3.1 Definitions relating to color attributes and color differences are covered in Terminology D 16 and E 284.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *tinting strength*—the ability of a material to impart its color to a standard base; the reciprocal of the relative concentration required to match the reference material in a standard base.

3.2.2 *masstone (or masscolor)*—the color of a material that is thick enough to mask any background.

3.2.3 *undertone (or undercolor)*—the color of a thin film of a material.

4. Summary of Test Methods

4.1 Thin and thick films of the standard and unknown dispersions are drawn down in juxtaposition on bond and on coated paper. Visual evaluation of the relative undertone and masstone provides a check on color equivalency.

4.2 The standard and unknown dispersions are each reduced to the same concentration in a suitable tinting base. Thick wet drawdowns of the two tints are evaluated for tinting strength by Test Methods A or B.

4.2.1 *Test Method A—Visual Evaluation:* If the strength of the tints is judged unequal, aliquots of the stronger tint are further reduced until equivalence is obtained. The tinting strength of the unknown dispersion is calculated from the weight of extra tinting base added per unit weight of the stronger tint.

⁴ Available from American National Standards Institute, 13th Floor, 11 W42nd St., New York, NY 10036.

4.2.2 *Test Method B—Instrumental Evaluation*: Reflectance measurements are made on thick wet films of the original tints. The tinting strength of the unknown dispersion is calculated according to the Kubelka-Munk equation.

4.3 Preparation of a confirming tint is recommended as an unbiased method of verification. The preferred approach is to prepare a new tint of the unknown at a concentration calculated to match the standard tint.

5. Significance and Use

5.1 Tinting strength is an essential property of printing ink dispersions. Although test results on wet drawdowns and tints do not guarantee equivalency of dry printed ink films, they provide useful parameters for quality assurance of established formulations, gaging relative degree of dispersion, and estimating the color value of colorants from different batches, sources, or grades.

6. Apparatus

6.1 *Laboratory Balance*, sensitive to at least 1.0 mg, preferably 0.1 mg.

6.2 *Spatulas*, (2) with flexible blades 80 to 120 mm in length (for weighing and mixing).

6.3 *Mixing Surface*, such as a glass or similar slab fixed to a work bench.

6.4 *Putty Knife*, with an 80–120 mm wide blade having a smooth straight edge (for use as a drawdown blade).

6.5 *Standard Daylight*, preferably a D50 light source conforming to ANSI Standard PH 2.30.

6.6 *Reflectance Measuring Instrument*, (for instrumental evaluation). Unless otherwise agreed upon, the instrument shall be a spectrophotometer with hemispherical (integrating-sphere) geometry conforming to Test Method E 1331, a spectrophotometer with bidirectional (45/0 or 0/45) geometry conforming to Test Method E 1349, or a tristimulus (filter) colorimeter with either geometry conforming to Test Method E 1347. Alternatively, a reflection densitometer conforming to ANSI Standard PH 2.17 and having a set of Status T or Status E filters⁵ (see 12.3.2), conforming to ANSI Standard 2.18 may be used for certain colors.

NOTE 2—The filter systems in typical densitometers are suitable only for use with black, white, and the three process colors (yellow, magenta and cyan). Instrumental evaluation of other colors requires a spectrophotometer or a colorimeter.

7. Materials

7.1 *Reference (Standard) Dispersion*, having the same pigmentation and consistency as the test (unknown) dispersion.

7.2 *Tinting Base*, as agreed upon between the producer and user, consisting of a suitable pigment well dispersed in a vehicle that is compatible with the vehicle in the test dispersion. The consistency of the base should not be appreciably lower than that of the test dispersion. Driers are not generally used because they may affect the color of the base and corresponding tints.

⁵ Status T filters are available in the USA, Status E in other countries. The major difference is in the peak transmission of the blue filter.

7.2.1 *White Base*,⁶ for testing colored and black dispersions. A suitable white base may contain by weight 30–60 % of either zinc oxide or titanium dioxide and 40–70 % vehicle.

7.2.2 *Black Base*, for testing white dispersions. A suitable black base may contain by weight 4 % black pigment (preferably non-flocculating), 43 % precipitated calcium carbonate, and 53 % vehicle. Alternatively, a neutral black nondrying printing ink such as a news ink.

7.2.3 *Dark Blue Base* (optional), for visual testing of white dispersions. A suitable dark blue base may contain by weight 42 % ultramarine blue, 18 % precipitated calcium carbonate, and 40 % vehicle.

7.2.4 *Light Blue Base* (optional), for visual testing of yellow dispersions. A suitable light blue base may contain by weight 1 % phthalocyanine blue dispersion and 99 % white base.

NOTE 3—Mixtures of a light blue base with yellow samples produce green tints, differences between which are more easily detected by eye than are mixtures of white and yellow. However, false results may be obtained. The use of a blue base is not recommended for visual tests on greenish-yellow colorants and is not permitted for instrumental evaluation of any yellow colorant.

7.3 *Weighing Substrate*, nonabsorbent, such as skin paper or small glass plates ca 75 to 100 mm square.

7.4 *Drawdown Substrates*, one consisting of white bond paper at least 50-mm wide and 150-mm long with a black bar at least 20-mm wide imprinted across the short dimension about half way down the length of the sheet, and a second one consisting of white coated paper.

7.5 *Microscope Cover Glasses* (optional, for instrumental measurements), made of finest optical glass, 50 by 45 mm, 0.13- to 0.17-mm thick.

7.6 *Standard Spacer* (optional, for instrumental measurements), such as cardstock the same size as the cover glass described in 7.5, about 1-mm thick, with a 35-mm diameter hole.

8. Sampling

8.1 These test methods do not include a method for preparation of dispersions. If colorants from different batches or sources are being evaluated, it is important that the standard and unknown samples be dispersed either in the identical manner or to the maximum degree, as agreed upon between the producer and the user.

8.2 Carefully select a dispersed sample that is free of skin and other contamination and representative of the lot being evaluated. Transfer to a clean container, protect with skin paper, close and seal.

⁶ Spectrophotometrically controlled white bleaches are available from National Printing Ink Research Institute (NPIRI), Lehigh University, Sinclair Laboratory, 7 Asa Drive, Bethlehem, PA 18015-3192. Universal White Bleach contains by weight 60 % zinc oxide and 40 % hydrogenated methyl abietate plasticizer. White Bleach 95 contains by weight 30 % titanium dioxide and 70 % vehicle consisting of oxidizing oils, petroleum distillates and resins.