



Standard Test Method for Evaluating the Relative Tint Undertone of Titanium Dioxide Pigments¹

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1. Scope

1.1 This test method is intended to be used to determine the tint undertone (blue or yellow) of titanium dioxide pigments. This relates to the effective particle size of the pigment. It is based upon tinting with a black iron oxide, but other blacks may be used if found suitable.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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:*²

D16 Terminology for Paint, Related Coatings, Materials, and Applications

D2745 Test Method for Relative Tinting Strength of White Pigments by Reflectance Measurements

E313 Practice for Calculating Yellowness and Whiteness Indices from Instrumentally Measured Color Coordinates

E1331 Test Method for Reflectance Factor and Color by Spectrophotometry Using Hemispherical Geometry

E1347 Test Method for Color and Color-Difference Measurement by Tristimulus Colorimetry

E1349 Test Method for Reflectance Factor and Color by Spectrophotometry Using Bidirectional (45°:0° or 0°:45°) Geometry

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 D01.26 on Optical Properties.

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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. Terminology

3.1 Any special terms used in this test method can be found in Terminology **D16**.

4. Summary of Test Method

4.1 Titanium dioxide pigments are dispersed in a black paste with a mechanical muller. Test and reference pigments are treated identically. The resultant grey pastes are applied to glass cover slips and read instrumentally. These readings are then used to calculate the yellowness index.

5. Significance and Use

5.1 This test method allows the user to make a quick determination of the blueness or yellowness of the tint undertone of titanium dioxide pigments, versus a reference pigment agreed upon by the parties to the test. This is an important measure of tone, since it gives both a measure of effective particle size, and quick approximation of the blue/yellow undertone that can be expected when a coating containing the titanium dioxide is tinted.

5.2 Such matters as the vehicle for preparing the dispersions, and the black for tinting have been suggested. However, changes in the components may be made by agreement between the buyer and the seller.

5.3 The results obtained with a mechanical muller do not necessarily correlate directly with a practice where different dispersion conditions exist. However, dispersion with a mechanical muller is a quick and inexpensive way of evaluating the undertone of a titanium dioxide pigment.

6. Apparatus

6.1 *Balances*, meeting the requirements of Test Method **D2745**.

6.2 *Mechanical Muller*, equipped with ground-glass plates to which a variable but known force may be added in 220–N increments. The driven glass plate shall have a speed of rotation of between 70 and 120 r/min and the apparatus shall have an arrangement for presetting the number of revolutions in multiples of 50.

6.3 *Rubbing Surfaces*, meeting the requirements of Test Method **D2745**.

6.4 *Small Glass Slab*, meeting the requirements of Test Method **D2745**.

6.5 *Spatula*, meeting the requirements of Test Method **D2745**.

6.6 *Glass Cover Slips*, No. 2 thickness, 45 by 50 mm.

6.7 *Color Measuring Instrument*, meeting the requirements of Test Methods **E1331**, **E1347**, or **E1349**, and having a measuring port 25 mm or smaller in diameter.

7. Materials

7.1 *Reference Standard*—A standard pigment as agreed upon between the buyer and the seller.

7.2 *Vehicle-Castor Oil*, (Grade AA).

7.3 *Tinting Paste*—A Vehicle/Parts by Weight paste such as one of the following:

(1)	Castor Oil	50
	Gypsum	47
	Thickener	6
	Iron Oxide Black	3
(2)	Petroleum Jelly	97
	Lampblack	3

8. Procedure

8.1 Disperse pigment into paste as described in Test Method **D2745**. Luminance should be approximately 40 %.

8.2 Apply the gray paste to the cover glass with a spatula. The area to which the paste is applied should be in the center of the cover glass, should be approximately 30 mm in diameter, and should be at least 2-mm thick.

8.3 View the paste through the glass from the side opposite that to which the paste was applied. Evaluate for evenness of coating, and any possible flaws. An irregular coating from this side mandates a repeat of the test.

8.4 Center the *uncoated* side of the cover glass over the port of the color measuring instrument, and read CIE XYZ values

on the specimen, using the applicable method for the instrument. Make sure that the port is entirely covered.

NOTE 1—A daylight illuminant (for example, C, D₆₅, D₇₅) must be used for the readings.

NOTE 2—Because of inherent differences in the readings obtained with different methods (that is Test Methods **E1331**, **E1347**, **E1349**), the buyer and the seller should agree on the method to be used.

9. Calculation

9.1 Calculate the yellowness index in accordance with Practice **E313**.

10. Report

10.1 Report the following information:

10.1.1 The type and identification of the test pigment and reference standard pigment,

10.1.2 The type and identification of the black and the dispersing vehicle,

10.1.3 The mass ratio of pigment to vehicle, and of black to titanium dioxide,

10.1.4 The manufacturer and model number of the mechanical muller used, and the color instrument used,

10.1.5 The total force applied to the muller plates, and the total number of revolutions,

10.1.6 The measuring method used,

10.1.7 The instrument readings, and

10.1.8 The yellowness index.

11. Precision and Bias

11.1 *Precision*—The precision will be written from Round Robin results.

11.2 *Bias*—Bias cannot be determined because there is no standard reference material for this test method.

12. Keywords

12.1 mechanical muller; tint undertone; titanium dioxide pigment

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