



Designation: D6131 – 17 (Reapproved 2023)

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

This standard is issued under the fixed designation D6131; 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 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

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

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

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

E308 Practice for Computing the Colors of Objects by Using the CIE System

E1164 Practice for Obtaining Spectrometric Data for Object-Color Evaluation

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

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 liquid medium of the user's choice by a dispersion method applicable to the user's intended end use. Test and reference pigments are treated identically. The resultant white paints or colorants are drawn down on white and black cards 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 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 mechanical method of preparing the dispersion are left to the user. However, variation in these practices will lead to increased variance in the results, so users ought to fix these parameters, in-so-far as is possible, within any one laboratory. This will lead to reduced uncertainty of the results within that laboratory, and it is seldom that interlaboratory comparisons of this test result is needed.

5.3 Each user must decide whether the loss of accuracy in his measurements due to variation of these parameters is negligibly small for the purpose for which the data are obtained.

6. Apparatus

6.1 *Balance*, electronic scale with readability of 0.01 g and resolution of 0.02 g.

6.2 *Drawdown Cards*, black and white sealed drawdown charts.

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.

6.3 *Drawdown Bars*, capable of applying a coating typically 15.25 cm wide. The applicators must be capable of applying 200 microns wet film or other wet film thickness as appropriate. Bird type applicators are marked in thousandths of an inch at half the actual clearance.

6.4 *Color Measuring Instrument*, a colorimetric spectrophotometer meeting the requirements of Practice E1164 having a spectral range of at least 400 nm to 700 nm at 10 nm intervals and having a measuring port ideally 25 mm in size, and measuring *Total:Normal* (di:0), sometimes called SPIN or SIN. Alternatively, but less desirably, one may utilize a smaller measuring aperture and measuring geometry *Diffuse:Normal* (de:0), 45°:*Normal* (45:0) or (0:45), or a spectro-colorimeter, or tristimulus colorimeter, in descending order of desirability.

7. Procedure

7.1 Disperse both reference and test pigment separately into a liquid medium in a formula that emulates the desired end use for the pigment by a dispersion method that as closely as possible simulates the actual production method of dispersion.

7.2 Draw down the reference white sample and the test white sample side-by-side on a coated black and white draw-down card.

7.3 Dry the drawdown by air drying, warm air circulation, or microwave drying.

7.4 Inspect both sides of the drawdown visually to assure that both coatings are at complete hide. If either specimen is not at complete hide, terminate the test.

7.5 Measure both specimens on the drawdown over the white portion of the drawdown card and obtain the D65-10° tristimulus values of both specimens either directly from the instrument software, or by tristimulus integration following the methods of Practice E308. Make the measurement following the appropriate instructions in Test Methods E1331, E1347, or E1349 depending upon the geometry selected.

8. Calculation

8.1 Calculate the yellowness index of each specimen from Eq 1:

$$YI = \frac{100 (1.0313 X - 1.1498 Z)}{Y} \quad (1)$$

where X, Y, and Z are the D65-10° tristimulus values of the specimen and YI is the yellowness index and the test result.

8.2 Increasingly positive values of YI indicate increasing yellowness and increasingly negative values indicate increasing blueness.

9. Exceptions

9.1 It is presumed that the user knows the yellowness index of the standard material, and its presence is provided in each test as an anchor for the scale of blueness to yellowness. However, since the test will most often be performed for the purpose of assessing the yellowness property of an unknown material rather than for quality control it is permissible to run the test without the standard component. This is especially useful where the test results are for internal company consumption only. If data may be distributed outside the performing laboratory, it ought to include the standard component.

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 mass ratio of pigment to vehicle,

10.1.3 The measuring instrument used, and its geometry,

10.1.4 The instrument readings in the form of tristimulus values of the standard and of the trial, and

10.1.5 The yellowness index.

11. Precision and Bias

11.1 *Precision*—The precision statement is under development by the Subcommittee and will be available in July 2018.

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

12. Keywords

12.1 tint undertone; titanium dioxide pigment

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