



Designation: D5386 – 05

## Standard Test Method for Color of Liquids Using Tristimulus Colorimetry<sup>1</sup>

This standard is issued under the fixed designation D5386; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope\*

1.1 This test method covers an instrumental method for the CIE (Commission International de l'Eclairage) tristimulus measurement of the color of near-clear liquid samples. The measurement is converted to color ratings in the platinum-cobalt system.

1.2 This test method has been found applicable to the color measurement of clear, liquid samples, free of haze, with nominal platinum cobalt color values in the 0 to 100 range. It is applicable to nonfluorescent liquids with light absorption characteristics similar to those of the platinum cobalt color standard solutions. Test Methods D1686, D2108, and E450 deal with the visual and instrumental measurement of near-clear liquids.

1.3 In determining the conformance of the test results using this method to applicable specifications, results shall be rounded in accordance with the rounding off methods of Practice E29.

1.4 *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. For specific hazard statements, see Section 8.*

### 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

D1193 Specification for Reagent Water

D1209 Test Method for Color of Clear Liquids (Platinum-Cobalt Scale)

D1686 Test Method for Color of Solid Aromatic Hydrocarbons and Related Materials in the Molten State (Platinum-Cobalt Scale)

D2108 Test Method for Color of Halogenated Organic Solvents and Their Admixtures (Platinum-Cobalt Scale)

D3437 Practice for Sampling and Handling Liquid Cyclic Products

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E179 Guide for Selection of Geometric Conditions for Measurement of Reflection and Transmission Properties of Materials

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

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

E450 Method for Measurement of Color of Low-Colored Clear Liquids Using the Hunterlab Color Difference Meter<sup>3</sup>

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

2.2 *Other Document:*

OSHA Regulations, 29 CFR paragraphs 1910.1000 and 1910.1200<sup>4</sup>

### 3. Summary of Test Method

3.1 Color is measured by tristimulus values of light transmitted by a sample as percent of light transmitted by distilled water. Convert the measured tristimulus values by appropriate equations to the platinum-cobalt scale.

### 4. Significance and Use

4.1 The major objective of the visual platinum-cobalt (Pt-Co) method of color measurement, as defined in Test Method D1209, is to rate specific materials for yellowness. This yellowness is frequently the result of the undesirable tendency of liquid hydrocarbons to absorb blue light due to contamination in processing, storage or shipping.

4.2 Clear liquids can be rated for light absorbing yellowish or brownish contaminants, using scales that simulate the long-established visual-comparison method just cited. Where

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D16 on Aromatic Hydrocarbons and Related Chemicals and is the direct responsibility of Subcommittee D16.04 on Instrumental Analysis.

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<sup>2</sup> 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.

<sup>3</sup> Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.

<sup>4</sup> Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, http://www.access.gpo.gov.

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

needed, dimensions of color can be reported to identify any pinkness or greenness (one dimension), or grayness.

## 5. Apparatus

5.1 *Instrument*, with the following provisions:

5.1.1 *Instrument Sensor*, shall provide a beam for illuminating the sample cell in transmission. The instrument shall be capable of converting light measured in total transmission through the sample cell to CIE X Y Z tristimulus color values for the measurement conditions of CIE illuminant C and the CIE 1931 2 degree standard observer as described in Guide E179 and Practice E308.

5.1.2 The CIE X Y Z tristimulus color values shall be convertible to the instrumental yellowness index (YI) defined by Practice E308 and Practice E313. A correlation between measured yellowness index (YI) (Practice E313) values and the Pt-Co standard solutions shall be used to yield an equivalent instrumental Pt-Co rating for liquid hydrocarbon samples.

5.1.3 *Sample Cells*, shall have clear, colorless, parallel entrance and exit windows. Internal distance between faces shall be selectable. Path lengths from 20 to 150 mm have been used for near-clear liquid hydrocarbons. If measuring samples using cells of the same path length, a path length tolerance of  $\pm 3\%$  or less would be appropriate. Matched cells would be beneficial but not required.

## 6. Reagents

6.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.<sup>5</sup> Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

6.2 *Purity of Water*—References to water shall be understood to mean colorless distilled water, conforming to Type IV of Specification D1193.

6.3 *Cobalt Chloride*, (CoCl<sub>2</sub>·6H<sub>2</sub>O).

6.4 *Hydrochloric Acid* (*sp gr 1.19*)—Concentrated hydrochloric acid (HCl).

6.5 *Potassium Chloroplatinate*, (K<sub>2</sub>PtCl<sub>6</sub>).

6.6 *Platinum-Cobalt Stock Solution*—Dissolve 1.245 g of potassium chloroplatinate (K<sub>2</sub>PtCl<sub>6</sub>) and 1.00 g of cobalt chloride (CoCl<sub>2</sub>·H<sub>2</sub>O) in water. Carefully add 100 mL of hydrochloric acid (HCl *sp gr 1.19*) and dilute to 1 L with distilled water. The absorbance of the 500 platinum-cobalt stock solution in a cell having a 10-mm light path with distilled water in a matched cell as the reference solution must fall within the limits given in Table 1.

<sup>5</sup> *Reagent Chemicals, American Chemical Society Specifications*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.

**TABLE 1 Absorbance Tolerance Limits for No. 500 Platinum-Cobalt Stock Solution**

Wavelength	Absorbance
430	0.110 to 0.120
455	0.130 to 0.145
480	0.105 to 0.120
510	0.055 to 0.065

## 7. Materials

7.1 *Platinum-Cobalt Standards*—From the stock solution prepare color standards in accordance with Table 2 by diluting the required volumes to 100 mL with water in volumetric flasks. When properly sealed and stored these standards are stable for at least one year. 500 APHA Platinum-Cobalt standards may also be purchased.

## 8. Hazards

8.1 Consult current OSHA regulations, suppliers' Material Safety Data Sheets, and local regulations for all materials used in this test method.

## 9. Sampling and Handling

9.1 Refer to Practice D3437 for proper sampling and handling of liquid hydrocarbons analyzed by this test method.

## 10. Calibration

10.1 Prepare instrument for operation by following the instrument manufacturer's instructions.

10.2 Use instrument standardizing adjustments or program to obtain a Pt-Co value of 0 for a sample of distilled water.

10.3 It is advisable to read back distilled water to verify that the instrument reads a Pt-Co value of 0 as an operational qualification (OQ) step.

10.4 Run QA samples to verify the analytical system is in control. It is desirable for the user to be able to adjust the instrument to match the Pt-Co standard solutions as defined in 7.1.

## 11. Procedure

11.1 Check to be sure that the instrument is operating in accordance with the manufacturer's operations manual.

11.2 Take three (3) instrumental readings without sample replacement, with the average taken as being a representative Pt-Co measurement of the sample. Exercise care to avoid sample contamination.

**TABLE 2 Platinum-Cobalt Color Standards**

Color Standard Number	Stock Solution, mL	Color Standard Number	Stock Solution mL
1	0.20	10	2.00
2	0.40	11	2.20
3	0.60	12	2.40
4	0.80	13	2.60
5	1.00	14	2.80
6	1.20	15	3.00
7	1.40	20	4.00
8	1.60	25	5.00
9	1.80	30	6.00