



Designation: **D5386 – 10 D5386 – 16**

Standard Test Method for Color of Liquids Using Tristimulus Colorimetry¹

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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope*Scope

1.1 This test method covers an instrumental method for the CIE (Commission International de l'Eclairage)¹ tristimulus measurement of the color of near-clear liquid samples. The transmission measurement is values are converted to the color ratings scale in the platinum-cobalt (Pt-Co) 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 Pt-Co~~ color values in the 0 to 100 range. It is applicable to ~~nonfluorescent~~ non-fluorescent liquids with light absorption characteristics similar to those of the ~~platinum-cobalt Pt-Co~~ color standard solutions. ~~Test Methods D1686, D2108, and E450 deal with the visual and instrumental measurement of near-clear liquids.~~

1.3 The tristimulus colorimetry may be calculated from spectral measurements or be obtained directly from a colorimeter. Practice E1455 provides some guidance on colorimeters, while Test Methods D1686 and D2108 deal with the visual and instrumental measurement of near-clear liquids.

1.4 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.

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

2. Referenced Documents

2.1 *ASTM Standards:*²

[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](#)

[D6809 Guide for Quality Control and Quality Assurance Procedures for Aromatic Hydrocarbons and Related Materials](#)

[D8005 Test Method for Color of Clear Liquids \(Platinum-Cobalt Scale\)](#)

[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 Test Method for Measurement of Color of Low-Colored Clear Liquids Using the Hunterlab Color Difference Meter \(Withdrawn 1993\)](#)~~³

[E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method](#)

[E1455 Practice for Obtaining Colorimetric Data from a Visual Display Unit Using Tristimulus Colorimeters](#)

¹ 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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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.

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

2.2 Other Document:

OSHA Regulations, 29 CFR paragraphs 1910.1000 and 1910.1200³

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~~ The color of a liquid sample is measured as the difference between the tristimulus values for the light transmitted through the sample minus the tristimulus values for the light transmitted through the same path length of water (Specification ~~D1193~~ D1193 tristimulus values by appropriate equations to the platinum-cobalt scale, Type IV). The difference between the tristimulus values are used to calculate the color on the Pt-Co scale using the appropriate equations.

4. Significance and Use

4.1 The ~~major~~ primary objective of the visual ~~platinum-cobalt (Pt-Co)~~ method of Pt-Co color measurement, as defined in Test Method ~~D1209D8005~~, 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~~, contaminants using scales that simulate the long-established visual-comparison method just cited. ~~Where needed, dimensions of color can be reported to identify any pinkness or greenness (one dimension), or grayness.~~ method.

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.~~ measure the light transmitted through a liquid sample in a cell as described in Guide E179. The instrument shall be capable of converting ~~light measured in total transmission through the sample cell~~ the measurement to CIE X Y Z tristimulus color values for the measurement conditions of CIE illuminant C and the CIE 1931 2-degree 2-degree standard observer as described in ~~Guide E179 and Practice E308.~~ Guide E179 and Practice E308.

5.1.2 The ~~CIE X-Y-Z~~ difference between the tristimulus color values for the sample and water shall be ~~convertible~~ converted to the instrumental yellowness index (YI) defined by Practice ~~E308 and Practice E313.~~ E308 and Practice E313. A correlation between measured yellowness index (YI) (~~Practice YI E313~~) values and the Pt-Co color 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 ±3 % or less would be appropriate. Matched cells would be beneficial but not required.~~

5.2 *Sample Cells*, shall have clear, colorless, parallel entrance and exit windows. ~~The internal distance between the faces shall be user selectable. Path lengths from 20 to 150 mm have been used for near-clear liquid hydrocarbon samples. When measuring samples using cells of the same path length, a path length tolerance of ±3 % or less would be appropriate. Matched cells are preferred 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.⁴ 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 clear, colorless ~~distilled~~ water, conforming to Type IV of Specification ~~D1193~~.

6.3 *Cobalt Chloride*, (CoCl₂·6H₂O).

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

6.5 *Potassium Chloroplatinate*, (K₂PtCl₆).

6.6 *Platinum-Cobalt Stock Solution*—Dissolve 1.245 g of potassium chloroplatinate (K₂PtCl₆) and 1.00 g of cobalt chloride (CoCl₂·~~H~~·H₂O) in water. Carefully add 100 mL of hydrochloric acid (~~HCl sp gr 1.19~~) (HCl) and dilute to 1 L with ~~distilled~~ water.

³ 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>.

⁴ *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.