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.

Designation: D2129 – 17

Standard Test Method for Color of Clear Electrical Insulating Liquids (Platinum-Cobalt Scale)[1]

This standard is issued under the fixed designation D2129; 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 standard describes a test method for the visual determination of the color of clear insulating liquids.

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

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1193 Specification for Reagent Water

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

D1500 Test Method for ASTM Color of Petroleum Products (ASTM Color Scale)

3. Summary of Test Method

3.1 The color determined by this test method is derived by comparing the color of the test specimen with that of a series of numbered color reference standards using transmitted light under prescribed conditions. The procedure described is based on that for measuring the color of water and clear liquids according to the platinum-cobalt scale. This scale is suitable for measurements over the color range from 5 to 300. The color of test specimens darker than 300 on the platinum-cobalt scale must be measured according to the ASTM Color Scale as described in Test Method D1500. The use of the platinum-cobalt scale in this way is primarily of value as an expansion of the lower part of the ASTM Color Scale, especially in the range between 0 and 1.

4. Significance and Use

4.1 Color is significant chiefly as an indicator of contamination in electrical insulating liquids. Frequently this contamination is the result of solvent action in the apparatus involved or it may indicate possible contamination. No definite relationship can be established between color and the physical and electrical characteristics of the liquid; for that reason color in itself has limited value as a measure of condition. For more precise determination of color, Test Method D1209 may be used.

5. Apparatus

5.1 *Color Comparison Tubes*—Matched, tall-form Nessler tubes, graduated at the 50-mL mark, and provided with ground-on, optically clear glass caps.

5.2 *Color Comparator*—A color comparator constructed to permit visual comparison of light transmitted through tall-form Nessler tubes in the direction of their longitudinal axes. The comparator should be constructed so that white light is passed through or reflected off a white glass plate and directed with equal intensity through the tubes, and should be shielded so that no light enters the tubes from the side.[3] Alternatively, a color comparator that uses glass color standards and Nessler tubes that conforms to Test Method D1209 can be used.

6. Reagents

6.1 *Purity of Reagents*—Use reagent grade chemicals in all tests. Unless otherwise indicated, all reagents will conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are

[1] This test method is under the jurisdiction of ASTM Committee on D27 on Electrical Insulating Liquids and Gases and is the direct responsibility of Subcommittee D27.07 on Physical Test.

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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] The sole source of supply of a unit that has been found suitable for this purpose, known to the committee at this time is Scientific Glass and Instruments, Inc. P.O. Box 6, Houston, TX 77001. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

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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*—Use reagent water conforming to Specification D1193.

6.3 *Solvent,* suitable, clear.

6.4 *Cobaltous Chloride ($CoCl_2 \cdot 6H_2O$).*

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

6.6 *Potassium Chloroplatinate (K_2PtCl_6).*

7. Preparation of Color Standards

7.1 *Platinum-Cobalt Stock Solution*—Dissolve 1.245 g of K_2PtCl_6 (containing 0.5 g of platinum) and 1.000 g of $CoCl_2 \cdot 6H_2O$ (containing about 0.25 g of cobalt) in water. Add 100 mL of HCl (sp gr 1.19) and dilute to 1 L with water. This solution has a color of 500.

NOTE 1—The color standard stock solution (platinum-cobalt solution) can be purchased with a color of 500 from laboratory supply firms.

7.2 *Platinum-Cobalt Standards*[5]—The unit of color is that color produced by 1 mg of platinum per litre. From the stock solution, prepare color standards, as given in Table 1, by diluting the required volumes to 50 mL with water in the Nessler tubes. Cap the tubes and seal the caps with shellac or a waterproof cement.

[4] "Reagent Chemicals, American Chemical Society Specifications," Am. Chemical Soc., Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see "Reagent Chemicals and Standards," by Joseph Rosin, D. Van Nostrand Co., Inc., New York, NY and the "United States Pharmacopeia."

[5] The preparation of these platinum-cobalt standards was originally described by Hazen, A., *American Chemical Journal,* ACJOA, Vol 14, 1982, p. 300. The description given in this Test Method D2129 is identical with that given in the *Standard Methods for the Examination of Water and Sewage,* American Public Health Assn., Ninth Edition, p. 14. A description is also given by Scott, W. W., *Standard Method of Chemical Analysis,* D. Van Nostrand Co., Inc., Fifth Edition, Vol 2, p. 2048.

TABLE 1 Platinum-Cobalt Color Standards (for 50-mL Tubes)

Color Standard Number	Stock Solution, mL	Color Standard Number	Stock Solution, mL	Color Standard Number	Stock Solution, mL
5	0.5	35	3.5	150	15.0
10	1.0	40	4.0	200	20.0
15	1.5	50	5.0	250	25.0
20	2.0	60	6.0	300	30.0
25	2.5	70	7.0	350	35.0
30	3.0	100	10.0	400	40.0
				450	45.0

8. Procedure

8.1 Introduce 50 mL of the test specimen into a Nessler tube, passing the sample through a filter if it has any visible test specimen turbidity. Cap the tube, place in the comparator, and compare with the standards.

8.2 If the recorded color of the test specimen is greater than 300, do not use the platinum-cobalt scale. Use Test Method D1500 to measure color.

9. Report

9.1 Report which method was used, Test Method D2129 or Test Method D1500.

9.2 Report as the color, the number of the standard that most nearly matches the test specimen. In the event that the color lies midway between two standards, report the darker of the two.

9.3 If, owing to differences in hue between the test specimen and the standards, a definite match cannot be obtained, report the range over which an apparent match is obtained, and report the test specimen as "off-hue."

9.4 Report the type of fluid.

10. Precision and Bias

10.1 An estimate of the repeatability has been developed based on data supplied by a single laboratory. These data are presented in Appendix X1. These results suggest that an estimate of the 95 % repeatability limit for color by Test Method D2129 is 15.1 % of the test result or approximately 4.5 when the mean color level is 30.

10.2 It is not possible to specify the reproducibility of the procedure in Test Method D2129 for measuring color of clear dielectric liquids because there is an insufficient number of laboratories available to participate in an interlaboratory round robin program required to produce the necessary data.

10.3 No information can be presented on the bias of the procedure in Test Method D2129 for measuring the color of clear dielectric liquids because no material having an accepted reference value is available.

11. Keywords

11.1 clear liquids; color; insulating liquids; platinum-cobalt color scale

APPENDIX

(Nonmandatory Information)

X1. REPEATABILITY DATA ESTIMATE FOR A SINGLE OPERATOR TEST SERIES OF ANALYSES

X1.1 Data are given from a single laboratory, single operator analysis for the visual determination of the color of clear electrical insulating liquids. The test results are from a single set of test results on a single sample and are presented in Table X1.1. The standard deviations and repeatability are calculated from a sample with a nominal color number of 30 and represent variations from that particular color number.

TABLE X1.1 Results of Separate Color Determination

Sample	Report
1	30
2	30
3	25
4	30
5	30
6	30
7	30
8	30
9	30
10	30
Average	29.5
S_r	1.58
CV, %	5.4
r, %	15.1

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