



Designation: **D4877 – 14 D4877 – 19**

Standard Test Method for Polyurethane Raw Materials: Determination of APHA Color in Isocyanates¹

This standard is issued under the fixed designation D4877; 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 measures the color of clear liquids. It is applicable only to materials whose color-producing bodies have light-absorption characteristics similar to those of the platinum cobalt color standards used.² (See Test Method **D1209** and **Note 1**.) Suitable isocyanates include toluene diisocyanate, and pure or modified monomeric methylene di(phenylisocyanate).

1.2 The values stated in SI units are to be regarded as 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.*

NOTE 1—This standard is equivalent to ISO 6271-1:2004 and ISO 6271-1 address the same subject matter, but differ in technical content.

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:*³

[D883 Terminology Relating to Plastics](#)

[D1193 Specification for Reagent Water](#)

[D1209 Test Method for Color of Clear Liquids \(Platinum-Cobalt Scale\)](#)

[D4890 Test Methods for Polyurethane Raw Materials: Determination of Gardner and APHA Color of Polyols](#)

[D5386 Test Method for Color of Liquids Using Tristimulus Colorimetry](#)

[E456 Terminology Relating to Quality and Statistics](#)

[E2935 Practice for Conducting Equivalence Testing in Laboratory Applications](#)

2.2 *ISO Standards:*

[ISO 6271-1:2004 ISO 6271-1 Clear liquids—Estimation of colour by the platinum-cobalt scale—Part 1: Visual method](#)⁴

3. Terminology

3.1 ~~For definitions of terms Terms used in this test method see standard are defined in accordance with Terminology **D883**,~~ unless otherwise specified. For terms relating to precision and bias and associated issues, the terms used in this standard are defined in accordance with Terminology **E456**.

4. Summary of Test Method

4.1 The color of the material to be tested is compared to a series of platinum cobalt color standards, designated by mg of Pt/mL of standard solution. The results are reported as the color standard, which best matches the sample (**Note 2**).

NOTE 2—Test methods for measuring the platinum-cobalt color of liquids instrumentally are available—for example, Test Method **D5386**.

¹ This test method is under the jurisdiction of ASTM Committee **D20** on Plastics and is the direct responsibility of Subcommittee **D20.22** on Cellular Materials - Plastics and Elastomers.

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² See Standard Methods for the Examination of Water, Sewage, and Industrial Wastes, AM. Public Health Assn., 1015 15th St. NW Washington, DC 20005.

³ 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.

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

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

5. Significance and Use

- 5.1 This test method can be used for research or for quality control to characterize *isocyanates* used in polyurethane products.
- 5.2 For toluene diisocyanate, results from this test method can relate to reactivity or performance in polyurethane systems.

6. Apparatus

- 6.1 *Nessler Tubes*, matched, 100-mL tall-form.

7. Reagents and Materials

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

7.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean reagent water as defined by Type IV or better of Specification **D1193**.

7.3 ~~Cobaltous~~ *Cobalt (II) Chloride Hexahydrate* ($\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$).

7.4 *Concentrated Hydrochloric Acid* (sp. gr. 1.19).

7.5 ~~Potassium Chloroplatinate~~ *Hexachloroplatinate* (K_2PtCl_6).

8. Sampling

8.1 Since organic isocyanates react with atmospheric moisture, take special precautions in sampling. Usual sampling methods, even when conducted rapidly, can cause contamination of the sample with insoluble urea. Therefore, blanket the sample with dry air or nitrogen at all times. (~~Warning—Many diisocyanates are known or suspected sensitizers. Over-exposure to diisocyanates can lead to adverse health effects, which may include the development of occupational asthma and other respiratory, skin, and eye effects. Engineering controls, or personal protective equipment or both, including respiratory, skin, Diisocyanates are eye, skin and respiratory irritants at concentrations above the occupational exposure limit (TLV or PEL). Diisocyanates can cause skin and respiratory sensitization (asthma) in some people. Once sensitized, it is essential to limit further exposure to diisocyanates. Use a combination of engineering controls and personal protective equipment, including respiratory, skin and eye protection, are to be used when there is a potential for to prevent over-exposure to diisocyanates. The Consult the product suppliers' Safety Data Sheet (SDS) provides for more detailed information about potential adverse health effects and other important specific safety and handling information. Always follow the specific instructions provided on the SDS: instructions for the product.~~)

9. Preparation of Color Standards (See **Note 3**)

9.1 Add 500 mL distilled water to a 1000-mL volumetric flask. Add 100 mL HCl and mix well. Weigh 1.245 g of K_2PtCl_6 to the nearest 1 mg and transfer it to the volumetric flask. Add 1.00 g of crystallized $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$. Dilute the solution in the flask to the mark with distilled water and mix thoroughly. The color of this standard solution is equivalent to 500 color units (500 mg metallic platinum/L) and must fall within the limits specified in Test Method **D1209**. Alternatively, it is acceptable to use commercially available 500 platinum-cobalt stock solutions that meet the specifications of Test Method **D1209**.

NOTE 3—Color comparators having permanent sealed platinum-cobalt color standards are permissible provided it is first determined that the accuracy and precision of the measurements are not reduced.

9.2 Prepare the required color standards by diluting the No. 500 standard solution as shown in **Table 1**. If a more exact color comparison is desired, prepare additional standards to supplement those given (one color unit is equivalent to 1 mg metallic platinum/L). When not in use, standards are to be sealed to avoid evaporation and contamination.

10. Procedure

10.1 Fill one of a matched set of 100-mL tall-form Nessler tubes to the mark with the sample. Fill a second tube from the matched set to the mark with the standard that seems to best match the color of the sample.

10.2 Compare the colors of the sample and the standard by viewing vertically down through the tubes against a white background. Fill additional tubes from the matched set with lighter or darker standards until an exact match is obtained. (See **Note 4**.)

NOTE 4—When properly sealed and stored, standards can be kept in the Nessler tubes between use.

⁵ *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.