



Designation: **D4877—10 D4877 – 14**

## Standard Test Method for Polyurethane Raw Materials: Determination of APHA Color in Isocyanates<sup>1</sup>

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 ( $\epsilon$ ) 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.<sup>2</sup> (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 and health practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—This standard is equivalent to ISO 6271-1:2004.

### 2. Referenced Documents

2.1 *ASTM Standards:*<sup>3</sup>

**D883** Terminology Relating to Plastics

**D1193** Specification for Reagent Water

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

**D5386** Test Method for Color of Liquids Using Tristimulus Colorimetry

2.2 *ISO Standards:*

**ISO 6271-1:2004** Clear Liquids—Estimation of Color by the Platinum-Cobalt Scale—Part 1: Visual method<sup>4</sup>

### 3. Terminology

3.1 For definitions of terms used in this test method see Terminology **D883**.

### 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—Color of liquids also can be measured by visible spectroscopy and the results converted to any of several color scales. These results can be converted to the APHA scale by appropriate manipulations, as for example in Test methods for measuring the platinum-cobalt color of liquids instrumentally are available—for example, Test Method **D5386**.

### 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.

<sup>1</sup> 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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<sup>2</sup> See Standard Methods for the Examination of Water, Sewage, and Industrial Wastes, AM. Public Health Assn., 1015 15th St. NW Washington, DC 20005.

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>4</sup> 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

## 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.<sup>5</sup> Other grades can 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.

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 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* ( $\text{K}_2\text{PtCl}_6$ ).

## 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, and eye protection, are to be used when there is a potential for over-exposure to diisocyanates. The product suppliers' Material Safety Data Sheet (MSDS)(SDS) provides more detailed information about potential adverse health effects and other important safety and handling information. Always follow the specific instructions provided on the MSDS-SDS.)

## 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 to the nearest 1 mg of 1.245 g of  $\text{K}_2\text{PtCl}_6$  to the nearest 1 mg and transfer it to the volumetric flask (flask, **Note 4**). Add 1.0100 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). 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**—Alternatively, use a Hellige Aquatester Model 611-A or equivalent instrument Color comparators having permanent sealed color standards (Hellige Model 611-10 color comparator disc of APHA cobalt-platinum color standards). platinum-cobalt color standards are permissible provided it is first determined that the accuracy and precision of the measurements are not reduced.

**NOTE 4**—If potassium chloroplatinate is not available, dissolve 0.500 g of pure metallic platinum in aqua regia with heating; then remove the  $\text{HNO}_3$  by repeated evaporations with fresh portions of HCl. Dissolve this product together with 1 g of crystallized  $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$  as directed in **9.1**.

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 two a matched set of 100-mL tall-form Nessler tubes to the mark with the sample. Fill the 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. Replace the liquid in the second tube. Fill additional tubes from the matched set with lighter or darker standards until an exact match is obtained. (See **Note 5**.)

**NOTE 4**—Rinse the second tube at least once with the replacement standard before filling the tube to the mark with it. When properly sealed and stored, standards can be kept in the Nessler tubes between use.

## 11. Report

11.1 Report the color number of the standard that is closest in color to the sample. If the sample appears exactly halfway between two standards, report the color number of the darker standard.

<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.