



Designation: E202 – 24

Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols¹

This standard is issued under the fixed designation E202; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 These test methods cover the chemical and physical analysis of the commonly available grades of ethylene glycol, diethylene glycol, triethylene glycol, propylene glycol, and dipropylene glycol. The key sections appear in the following order:

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Color	10
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1.2 The following applies for the purposes of determining the conformance of the test results using this test method to applicable specifications, results shall be rounded off in accordance with the rounding-off method of Practice E29.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 Review the current appropriate Safety Data Sheets (SDS) for detailed information concerning toxicity, first aid procedures, and safety precautions.

1.5 *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.*

1.6 *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:²

- D850 Test Method for Distillation of Industrial Aromatic Hydrocarbons and Related Materials
- D1193 Specification for Reagent Water
- D1209 Test Method for Color of Clear Liquids (Platinum-Cobalt Scale)
- D4052 Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter
- D5386 Test Method for Color of Liquids Using Tristimulus Colorimetry
- 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
- E180 Practice for Determining the Precision of ASTM Methods for Analysis and Testing of Industrial and Specialty Chemicals (Withdrawn 2009)³
- E203 Test Method for Water Using Volumetric Karl Fischer Titration
- E394 Test Method for Iron in Trace Quantities Using the 1,10-Phenanthroline Method
- E1064 Test Method for Water in Organic Liquids by Coulometric Karl Fischer Titration
- E1615 Test Method for Determination of Trace Quantities of Iron by Visible Spectrophotometry
- E2409 Test Method for Glycol Impurities in Mono-, Di-, Tri- and Tetraethylene Glycol and in Mono- and Dipropylene Glycol (Gas Chromatographic Method)

¹ These test methods are under the jurisdiction of ASTM Committee D16 on Aromatic, Industrial, Specialty and Related Chemicals and are the direct responsibility of Subcommittee D16.14 on Alcohols & Glycols.

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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 last approved version of this historical standard is referenced on www.astm.org.

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

E2679 Test Method for Acidity in Mono-, Di-, Tri- and Tetraethylene Glycol by Non-Aqueous Potentiometric Titration

2.2 Other Document:

OSHA Regulations, 29 CFR paragraphs 1910.1000 and 1910.1200⁴

3. Significance and Use

3.1 These test methods measure certain chemical and physical properties of ethylene glycols and propylene glycols and may be used to determine compliance with specification in which limits are established for these properties. For those tests that use the procedure of another ASTM test method, that test method should be consulted for additional information on the significance and use of that test.

4. Purity of Reagents

4.1 *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.⁵ 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.

4.2 Unless otherwise indicated, references to water shall be understood to mean reagent water conforming to Specification D1193, Type I or II.

5. Relative Density

5.1 Procedure:

5.2 Determine the relative density of the sample at 20/20 °C in accordance with Test Method D4052.

6. Distillation Range

6.1 Procedure:

6.2 Determine the distillation range of the sample in accordance with Test Method D850.

7. Acidity

7.1 Procedure:

7.2 Determine the acidity of the sample in accordance with Test Method E2679.

8. Water

8.1 Procedure:

8.2 Determine the water content of the sample using Test Methods E1064 or E203.

9. Iron

9.1 Procedure:

9.2 Determine the iron content of the sample in accordance with Test Methods E394 or E1615.

10. Color

10.1 Procedure:

10.2 Determine the color of the sample in accordance with Test Methods D5386 or D8005.

11. Precision and Bias

11.1 *Additional Information*—This precision information was determined using Test Method D1209. Test Methods D1209 and D8005 are the same except Test Method D8005 requires standards to be 1 Pt-Co unit apart. Test Method D1209 only recommends that the Pt-Co standards be 1 unit apart. For this ILS, standards were 1 Pt-Co unit apart.

11.1.1 The following criteria should be used for judging the acceptability of results (see Note 1).

11.1.2 *Repeatability (Single Analyst)*—The standard deviation for a single determination has been estimated to be 0.0 unit at 40 dF. The 95 % limit for the difference between two such runs is two units.

11.1.3 *Laboratory Precision (Within-Laboratory, Between-Days)*—The standard deviation of results (each the average of duplicates), obtained by the same analyst on different days, has been estimated to be 0.64 unit at 46 dF. The 95 % limit for the difference between two such averages is two units.

11.1.4 *Reproducibility (Multilaboratory)*—The standard deviation of results (each the average of duplicates), obtained by analysts in different laboratories, has been estimated to be 2.47 units at 9 df. The 95 % limit for the difference between two such averages is seven units.

NOTE 1—These precision estimates are based on interlaboratory studies performed in 1962 and 1963 on a total of six samples of the five glycols whose color ranged from 2 to 21 platinum-cobalt units. Because the test results are based on visual comparison of the untreated sample with standards, duplicate determinations at low levels of color are almost always in perfect agreement. This was confirmed in the 1962 study of two samples of ethylene glycol with average colors of 2 and 21 platinum-cobalt units. The standard deviation for duplicate determinations was estimated to be 0.0 units at 40 dF. Therefore, the stated 95 % limit in the repeatability statement is based on the reporting of results to the nearest one unit. The 1963 study omitted the duplicate determinations. A total of ten laboratories cooperated in the studies in which each analyst performed duplicate determinations on each sample on each of two days. Practice E180 was used in developing these precision estimates.

11.1.5 *Bias*—The bias of this test method has not been determined due to the unavailability of suitable reference materials.

12. Gas Chromatographic Analysis

12.1 Procedure:

12.2 Determine the purity of Ethylene Glycol samples in accordance with E2409.

13. Keywords

13.1 acidity; color; distillation range; ethylene glycols; gas chromatography; iron; propylene glycols; relative density; water

⁴ Available from U.S. Government Printing Office, Superintendent of Documents, 732 N. Capitol St., NW, Washington, DC 20401-0001, <http://www.access.gpo.gov>.

⁵ ACS Reagent Chemicals, Specifications and Procedures for Reagents and Standard-Grade Reference Materials, 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.