



Standard Test Method for Epoxy Content of Epoxy Resins¹

This standard is issued under the fixed designation D1652; 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 Department of Defense.

^{ε1} NOTE—Editorial corrections were made throughout in May 2012.

1. Scope*

1.1 This test method covers the procedure for manual and automatic titration of epoxy resins for the quantitative determination of the percent epoxide content from 0.1 to 26 % epoxide.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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.* For specific hazard statements, see Section 6.

2. Referenced Documents

2.1 *ASTM Standards*:²

D1193 Specification for Reagent Water

2.2 *Other Documents*:

OSHA Regulations, 29 CFR paragraphs 1910.1000 and 1910.1200³

3. Summary of Test Method

3.1 The resin is dissolved in a suitable solvent and the resulting solution is titrated with hydrogen bromide either directly or in situ. The hydrogen bromide reacts stoichiometrically with epoxy groups to form bromohydrins; therefore, the quantity of acid consumed is a measure of the epoxy content.

3.1.1 In the Manual Titration Method, the titration is with standard perchloric acid in the presence of an excess of tetraethylammonium bromide. Hydrogen bromide generated in situ by the addition of perchloric acid to the quaternary ammonium halide rapidly opens the oxirane ring.

3.1.2 In the Automatic Titration Method, the reaction is measuring the millivolt (MV) potential as perchloric acid is added, which combines with the bromide to form the hydrobromic acid, which reacts with the epoxide group. As the reaction progresses, the potential will gradually increase until the reaction nears completion at which point the potential increases very quickly. The titrator measures the rate of the reaction by calculating the change in potential between perchloric acid addition increments. When the change in potential begins to decrease, the titrator determines that the titration is complete. The epoxide content is calculated using the reagent factor entered by the user during standardization, the weight of the sample, and the volume of perchloric acid added during titration.

4. Significance and Use

4.1 The epoxy content of epoxy resins is an important variable in determining their reactivity and the properties of coatings made from them. These test methods may be used to determine the epoxy content of manufactured epoxy resins and confirm the stated epoxy content of purchased epoxy resins.

5. Reagents

5.1 *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

¹ This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.33 on Polymers and Resins.

Current edition approved Nov. 1, 2011. Published January 2012. Originally approved in 1969. Last previous edition approved in 2004 as D1652 – 04. DOI: 10.1520/D1652-11E01.

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 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.