Designation: D7437 – 08 (Reapproved 2013)

Standard Test Method for Temperature and Hard Water Stability of Engine Coolants[1]

This standard is issued under the fixed designation D7437; 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 covers a simple glassware-type procedure for evaluating the effects of temperature and hard water on the stability of engine coolants at elevated temperatures under controlled laboratory conditions.

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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1193 Specification for Reagent Water

D1176 Practice for Sampling and Preparing Aqueous Solutions of Engine Coolants or Antirusts for Testing Purposes

E288 Specification for Laboratory Glass Volumetric Flasks

2.2 *British Standards:*[3]

BS 5117-1.5:1992 Coolant Hard Water Stability Test

BSI BS ISO 5725-2 Accuracy (Trueness and Precision) of Measurement Methods and Results–Part 2: Basic Method for the Determination of Repeatability and Reproducibility of a Standard Measurement Method

3. Summary of Test Method

3.1 A sample engine coolant concentrate is kept at 60°C in a controlled oven for 14 days and then cooled to room temperature and inspected. Synthetic hard water is then added and the test solution is returned to an oven set at 90°C for 14 days. At the end of this period, the test engine coolant solution is removed, cooled, and inspected. The cooled sample is cenrifuged and any precipitate treated with methanol. The volume of any precipitate left after the methanol wash is decanted is recorded.

4. Significance and Use

4.1 4.1 This test method provides information on the stability of the engine coolant concentrate when stored at elevated temperatures for two weeks. These test conditions might simulate the conditions that a product would be subjected to in transit and storage in warehouses before delivery to the customer.

4.2 This test method provides information on the stability of an engine coolant diluted with synthetic hard water at elevated temperatures. This test method provides a laboratory method to test the sensitivity of the engine coolant to hard water.

5. Apparatus

5.1 *Graduated Cylinder*—of capacity 50 ± 0.50 mL.

5.2 *Graduated Conical Centrifuge Tubes,* of capacity 100 mL with stoppers.

5.3 *Forced Ventilation Oven,* capable of being maintained at temperatures of 60 ± 2°C and 90 ± 2°C.

5.4 *Centrifuge*—capable of generating a relative centrifugal force of 900.

$$\textit{Relative centrifugal force} = (v/1335)^2 d \quad (1)$$

where:

v = rotational velocity (r/min) and,

d = diamter (mm) between the ends of the centrifuge tubes at the point of maximum swing.

5.5 *Pipette,* of capacity 20 ± 0.50 mL.

5.6 *Volumetric Balance,* one-mark, 1000 mL (compliant with Specification E288, Class B requirements).

6. Reagents and Materials

6.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specification of the Committee on Analytical Reagents of the American Chemical Society where

[1] This test method is under the jurisdiction of ASTM Committee D15 on Engine Coolants and Related Fluids and is the direct responsibility of Subcommittee D15.06 on Glassware Performance Tests.

Current edition approved May 1, 2013. Published June 2013. Originally approved in 2008. Last previous edition approved in 2008 as D7437-08. DOI: 10.1520/D7437-08R13.

[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] Orders for all British Standards Institution (BSI) International and foreign standards publications should be addressed to Customer Services, telephone: 020-8996 9001 and fax: 020 8996 7001.

such specifications are 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*—Unless otherwise indicated, references to water shall be understood to mean reagent water as defined by Type IV of Specification D1193.

6.3 *Synthetic Hard Water Stock Solution*—Prepare a stock solution by dissolving 44.10 g of calcium chloride dehydrate ($CaCl_2$ $2H_2O$) in water in a 1000-mL one-mark volumetric flask and diluting to the mark with water. Before use, dilute this stock solution 1:50 with water.

6.4 *Methanol,* CH_3OH (**Warning**—See 7.1).

7. Hazards

7.1 *Methanol*—Poison, extremely flammable, harmful if swallowed or inhaled. Flash point of 12°C.

8. Sampling, Test Specimens and Test Units

8.1 Take a representative sample of not less than 500 mL, preferably from previously unopened containers in which the product is normally offered for sale, in accordance with Practice D1176. Place the sample in clean, dry, stoppered glass bottles of a dark color. Take care to ensure that any method used for sealing the sample does not cause contamination.

9. Procedure

9.1 Using a graduated 50-mL cylinder, measure 50 mL of the product into two clean, dry 100-mL centrifuge tubes. Record the appearance of the product (see Section 10). Stopper the tubes and place them in the oven, maintained at 60 ± 2°C. After 14 days, remove the tubes and allow them to cool to room temperature for 1 h.

9.2 Inspect the cooled product and note any gelation or precipitation (see Section 10).

9.3 Prepare the synthetic hard water before use. Prepare by diluting the hard water stock solution by adding 1:50 by volume with water.

9.4 Add 50 mL of the synthetic hard water to each tube containing product, restopper the centrifuge tubes, and mix by shaking. Record the appearance of the solution (see Section 10). Place the tubes in the oven maintained at 90 ± 2°C. After 14 days, remove the tubes and allow them to cool to room temperature and maintain at room temperature for 1 h.

9.5 Inspect the cooled solution and note any gelation or precipitation. Centrifuge the cooled solution, using a relative centrifugal force of 900, for 15 min. Carefully decant the liquor from any precipitate present at the bottom of the centrifuge tubes.

9.6 Using the 20-mL pipette, add 20 mL of the methanol to the precipitate in the centrifuge tubes and shake vigorously until the precipitate is dislodged to ensure thorough washing. Recentrifuge for 15 min. Decant the methanol from any precipitate present at the bottom of the centrifuge tubes.

9.7 Record the volume of any precipitate present (in millilitres).

10. Report

10.1 The test report shall include the following information: reference to this test method, complete identification of the product and its composition if known, and identification notation of the test and the dates the test was run.

10.2 *Elevated Temperature Storage Stability of the Engine Coolant Concentrate*—Give a description of the samples before and after 14 days of storage at elevated temperature. List any changes seen in the samples. Include: color change, whether any gelation or precipitation occurred, or any other features noted during the test.

10.3 *Elevated Temperature Storage Hard Water Stability of the Engine Coolant Solution:*

10.3.1 Give a description of the samples before and after the addition of the synthetic hard water and a description of the samples after 14 days of storage at elevated temperature. List any changes seen in the samples. Include: color change, whether any gelation or precipitation occurred, or any other features noted during the test.

10.3.2 Give the individual and average volume of any precipitate present at the end of the test.

11. Precision and Bias

11.1 *Precision:*

11.1.1 The repeatability standard deviation of the precipitate volumes has been determined to be 0.08 mL. The repeatability and reproducibility of this test method is being redetermined and will be available on or before December 2012.

NOTE 1—The precision data were determined from an experiment conducted in 1990 involving six laboratories and three samples following the procedure outlined in BS 5117-1.5:1992, the test results being subjected to statistical analysis as described in BSI BS ISO 5725-2.

11.1.2 No precision information is provided about the other properties measured in this test method since the test results are nonquantitative.

11.2 *Bias*—No precision information can be presented on the bias of the procedures in this test method because these properties are defined in terms of this test method.

12. Keywords

12.1 antifreeze; elevated temperature; engine coolant; hard water; stability

[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., Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc., (USPC), Rockville, MD.