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Standard Test Method for pH of Engine Coolants and Antirusts¹

This standard is issued under the fixed designation D1287; 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.

1. Scope

1.1 This test method covers the determination of the pH of unused engine coolants and antirusts, and used or unused aqueous dilutions of the concentrated products.

NOTE 1—Antirusts in solid form are not included in this test method.

NOTE 2—It is believed that this procedure gives all the information required for determining the pH of samples of engine coolant or antirust likely to be encountered. Should additional information on pH determinations be needed, reference should be made to Test Method E70.

1.2 *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

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

E70 Test Method for pH of Aqueous Solutions With the Glass Electrode

3. Summary of Test Method

3.1 A sample, as received or after dilution with a specified volume of distilled water, is placed in a beaker or sample cup and the pH measured with a pH meter and combination electrode or associated glass-saturated calomel electrode pair.

NOTE 3—The readings of the meter in the case of the concentrated products are not pH values according to the accepted definition, but are apparent pH values which are useful in the interpretation of the condition of the product.

4. Significance and Use

4.1 pH is a measure of the hydrogen ion concentration and indicates whether an engine coolant, antirust, or a solution of these compounds is acidic, alkaline, or neutral.

4.2 The pH range includes values from 0 to 14. Values from 0 to 7 represent the acidic half of the scale. Values from 7 to 14 represent the alkaline or basic half of the scale. The pH value 7 is considered neutral, as it is neither acidic nor alkaline.

4.3 pH is sometimes used for production quality control. It is generally desirable that engine coolants have an alkaline pH.

4.4 pH is not significant from the standpoint of predicting service life. The pH of used engine coolants or antirust solutions is not a dependable indication of either existing effectiveness or remaining life of the solution.

5. Apparatus

5.1 The pH meter, glass electrode, and calomel electrode, shall be as specified in the Annex.

NOTE 4—In pH operation, the meter may be set up to perform one-, two- or up to five-point standardizations or may be set up to automatically recognize U.S. standard (pH 4, 7 and 10) buffers, NIST/International (pH 1.68, 4.01, 6.86, 9.18 and 12.46) buffers, or a custom user-centered set of buffers, or both.

6. Reagents

6.1 *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

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 D15.04 on Chemical Properties.

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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.

such specifications are available.³ 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 distilled water or water of equal purity. Distilled water shall be boiled thoroughly, or purged with carbon dioxide-free air, to remove carbon dioxide and shall be protected with a soda-lime tube or its equivalent while cooling and in storage. The pH of the water shall be between 6.2 and 7.2 at 25°C.

6.3 *Standard Buffer Solutions*—The buffer solutions for calibrating the pH meter and electrode pair shall be prepared from salts sold specifically for use, either singly or in combination, as pH standards. The salts shall be dried for 1 h at 110°C before use, except in the case of borax which shall be used as the decahydrate. The solutions with pH less than 9.5 shall be stored in chemically resistant bottles. The alkaline phosphate solution shall be stored in glass bottles coated on the side with paraffin.

NOTE 5—Commercially available buffer tablets or prepared buffer solutions may be used.

6.4 Standard Buffer Solution pH = 1.68, (Buffer pH 1.68 from Fisher Scientific FC Part Number 13-620-836) or equivalent could be used.

6.5 *Potassium Hydrogen Phthalate Buffer Solution* (0.05 M, pH = 4.01 at 25°C)—Dissolve 10.21 g of potassium hydrogen phthalate ($\text{KHC}_8\text{H}_4\text{O}_4$) in water, and dilute to 1 L. Standard Buffer Solution pH = 4.0, Potassium Hydrogen Phthalate (Red, pH 4.01) from Fisher Scientific (FC Part Number: SB 101-500; NIST-SRM 185 g) or equivalent could be used.

6.6 *Neutral Phosphate Buffer Solution* (0.025 M with respect to each phosphate salt, pH = 6.86 at 25°C)—Dissolve 3.40 g of potassium dihydrogen phosphate (KH_2PO_4) and 3.55 g of anhydrous disodium hydrogen phosphate (Na_2HPO_4) in water and dilute to 1 L. Standard Buffer Solution pH = 6.86, Potassium Phosphate (pH 6.86 from Fisher Scientific, or NIST-SRM 186 le/lle) or equivalent could be used.

6.7 Standard Buffer Solution pH = 7.0, Potassium Phosphate Monobasic (Yellow, pH 7.00) from Fisher Scientific (FC Part Number: SB 107-500) or equivalent could be used.

6.8 *Borax Buffer Solution* (0.01 M, pH = 9.18 at 25°C)—Dissolve 3.81 g of disodium tetraborate decahydrate ($\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$) in water, and dilute to 1 L. Protect this solution from atmospheric carbon dioxide; stopper the bottle at all times except when actually in use. Standard Buffer Solution pH=9.18, Sodium Tetraborate $\times 10 \text{ H}_2\text{O}$ (borax) (pH 9.18) from Fisher Scientific or NIST-SRM 187c) or equivalent could be used.

6.9 Standard Buffer Solution pH=10.00, Potassium Carbonate, Potassium (Blue, Buffer pH 10.00 from Fisher Scientific FC Part Number SB 115-500) or equivalent could be used.

6.10 *Alkaline Phosphate Buffer Solution* (0.01 M trisodium phosphate, pH = 11.72 at 25°C)—Dissolve 1.42 g of anhydrous disodium hydrogen phosphate (Na_2HPO_4) in 100 mL of a 0.1 M carbonate-free solution of sodium hydroxide and dilute to 1 L with water.

6.11 Standard Buffer Solution pH=12.46, (Buffer pH 12.46 from Fisher Scientific FC Part Number 13-620-837) or equivalent could be used.

6.12 *Potassium Chloride Electrolyte*—Prepare a saturated solution of potassium chloride (KCl) in water.

7. Sampling

7.1 Sample material in accordance with Practice D1176.

8. Preparation of Electrode System

8.1 *Maintenance of Electrodes*—Clean the glass electrode or combination electrode at frequent intervals (not less than once every week during continual use) in accordance with the manufacturer's instructions. Drain the calomel electrode at least once each week and fill with KCl electrolyte. Keep the electrolyte level in the calomel electrode above that of the solution being tested at all times. When not in use, immerse the lower halves of the electrodes in distilled water, or the appropriate buffer solution recommended by the manufacturer. Do not immerse the electrodes in the solution being tested for any appreciable period of time between determinations. Although the electrodes are not extremely fragile, they should be handled carefully at all times.

8.1.1 A combination electrode system can also be used for this test method.

8.2 *Preparation of Electrodes*—Before and after using, wipe the electrode or combination electrode thoroughly with a clean cloth, or a soft absorbent tissue, and rinse with distilled water. Follow the manufacturer's recommendations if further preparation is required. Prior to each pH determination, soak the prepared electrode in distilled water for at least 2 min. Immediately before use, touch the tips of the electrodes with a dry cloth or tissue to remove excess water.

9. Standardization and Testing of Electrode System in pH Units

9.1 The assembly shall always be standardized with more than one of the standard buffer solutions. A single standardization point serves to establish the electrodes actual zero potential, but the electrode's slope is assumed to be a default or already known

³ *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.