Designation: D3242 – 23

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Standard Test Method for Acidity in Aviation Turbine Fuel[1,2]

This standard is issued under the fixed designation D3242; 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 This test method covers the determination of the acidity in aviation turbine fuel in the range from 0.000 mg⁄g to 0.100 mg⁄g KOH.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *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:*[3]

D664 Test Method for Acid Number of Petroleum Products by Potentiometric Titration

D1193 Specification for Reagent Water

D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this test method, refer to Terminology D4175.

3.1.2 *acid number, n*—the quantity of a specified base, expressed in milligrams of potassium hydroxide per gram of sample, required to titrate a sample in a specified solvent to a specified endpoint using a specified detection system.

3.1.2.1 *Discussion—in this test method*, the solvent is a toluene-water-isopropanol mixture and the end point is determined when a green/green brown color is obtained using the specified *p*-naphtholbenzein indicator solution.

4. Summary of Test Method

4.1 The sample is dissolved in a mixture of toluene and isopropyl alcohol containing a small amount of water. The resulting single phase solution is blanketed by a stream of nitrogen bubbling through it and is titrated with standard alcoholic potassium hydroxide to the end point indicated by the color change (orange in acid and green in base) of the added *p*-naphtholbenzein solution.

5. Significance and Use

5.1 Some acids can be present in aviation turbine fuels due either to the acid treatment during the refining process or to naturally occurring organic acids. Significant acid contamination is not likely to be present because of the many check tests made during the various stages of refining. However, trace amounts of acid can be present and are undesirable because of the consequent tendencies of the fuel to corrode metals that it contacts or to impair the water separation characteristics of the aviation turbine fuel.

5.2 This test method is designed to measure the levels of acidity that can be present in aviation turbine fuel and is not suitable for determining significant acid contamination.

6. Apparatus

6.1 *Buret*—A 25 mL buret graduated in 0.1 mL subdivisions, or a 10 mL buret graduated in 0.05 mL subdivisions.

[1] This test method is under the jurisdiction of ASTM International Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of ASTM Subcommittee D02.06 on Analysis of Liquid Fuels and Lubricants. The technically equivalent standard as referenced is under the jurisdiction of the Energy Institute Subcommittee SC-B-11.

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[2] This test method has been developed through the cooperative effort between ASTM and the Energy Institute, London. ASTM and IP standards were approved by ASTM and EI technical committees as being technically equivalent but that does not imply both standards are identical.

[3] 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.

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

NOTE 1—An automated buret capable of delivering titrant amounts in 0.05 mL or smaller increments can be used, but the stated precision data were obtained using manual burets only.

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 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 sufficiently high purity to permit its use without lessening the accuracy of the determination.

NOTE 2—Commercially available reagents may be used in place of laboratory preparations when they are certified in accordance with 7.1.

7.2 *Purity of Water*— References to water shall be understood to mean distilled water as defined by Type III water of Specification D1193.

7.3 *p-Naphtholbenzein*[5,6] Indicator Solution—The *p*-naphtholbenzein must meet the specifications given in Annex A1. Prepare a solution of *p*-naphtholbenzein in titration solvent equal to 10 g/L ± 0.01 g/L.

7.4 *Nitrogen,* dry-type, carbon dioxide-free. (**Warning—** Compressed gas under high pressure. Gas reduces oxygen available for breathing.)

7.5 *Potassium Hydroxide Solution, Standard Alcoholic* (0.01 *N*)—Add 0.6 g of solid KOH (**Warning—**Highly corrosive to all body tissue both in solid form and in solution.) to approximately 1 L of anhydrous isopropyl alcohol (**Warning—**Flammable. Vapor harmful. Keep away from heat, sparks, and open flame.) (containing less than 0.9 % water) in a 2 L Erlenmeyer flask. Boil the mixture gently for 10 min to 15 min, stirring to prevent the solids from forming a cake on the bottom. Add at least 0.2 g of barium hydroxide ($Ba(OH)_2$) (**Warning—**Poisonous if ingested. Strongly alkaline, causes severe irritation producing dermatitis.) and again boil gently for 5 min to 10 min. Cool to room temperature, allow to stand for several hours, and filter the supernatant liquid through a fine sintered-glass or porcelain filtering funnel; avoid unnecessary exposure to carbon dioxide (CO_2) during filtration. Store the solution in a chemically resistant dispensing bottle out of contact with cork, rubber, or saponifiable stopcock lubricant and protected by a guard tube containing soda lime.

NOTE 3—Because of the relative large coefficient of cubic expansion of organic liquids, such as isopropyl alcohol, the standard alcoholic solutions should be standardized at temperatures close to those employed in the titration of samples.

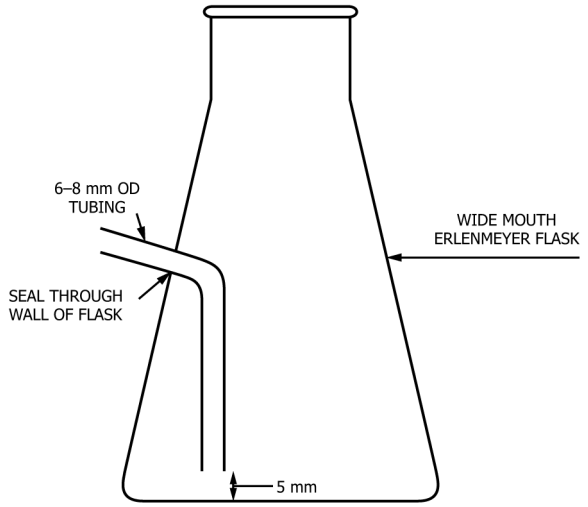

FIG. 1 Titration Flask

7.5.1 *Standardization of Potassium Hydroxide Solution*—Standardize frequently enough to detect changes of 0.0002*N*. One way to accomplish this is as follows. Weigh, to the nearest 0.1 mg, approximately 0.02 g of potassium acid phthalate, which has been dried for at least 1 h at 110 °C ± 1 °C and dissolve in 40 mL ± 1 mL of water, free of CO_2. Titrate with the potassium hydroxide alcoholic solution to either of the following end points: (*1*) when the titration is electrometric, titrate to a well-defined inflection point at the voltage that corresponds to the voltage of the basic buffer solution; (*2*) when the titration is colorimetric, add 6 drops of phenolphthalein indicator solution and titrate to the appearance of a permanent pink color. Perform the blank titration on the water used to dissolve the potassium acid phthalate. Calculate the normality using the equation:

$$Normality = \frac{W_p}{204.23} \times \frac{1000}{V - V_b} \quad (1)$$

where:

W_p = weight of the potassium acid phthalate, g,
204.23 = molecular weight of the potassium acid phthalate,
V = volume of titrant used to titrate the salt to the specific end point, mL, and
V_b = volume of titrant used to titrate the blank, mL.

7.5.2 *Phenolphthalein Indicator Solution*—Dissolve 0.1 g ± 0.01 g of pure solid phenolphthalein in 50 mL of water, free of CO_2, and 50 mL of ethanol.

7.6 *Titration Solvent*—Add 500 mL of toluene (**Warning—** Flammable. Vapor harmful. Keep away from heat, sparks, and open flame.) and 5 mL of water to 495 mL of anhydrous isopropyl alcohol.

8. Procedure

8.1 Introduce 100 g ± 5 g of the sample weighed to the nearest 0.5 g, into a 500 mL wide-mouth Erlenmeyer flask. (One type of suitable modified flask is shown in Fig. 1.) Add 100 mL of the titration solvent and 0.1 mL of the indicator solution. Introduce nitrogen through a 6 mm to 8 mm outside diameter glass tube to a point within 5 mm of the flask bottom

[4] *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.

[5] In a 2006 study, only Kodak, Baker (Mallinkrodt), Fluka, and Aldrich were found to meet the specifications in Annex A1. However, Kodak brand is no longer available.

[6] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D02-1626. Contact ASTM Customer Service at service@astm.org.