



Designation: D 3242 – 98

An American National Standard



Designation: 354/98

Standard Test Method for Acidity in Aviation Turbine Fuel¹

This standard is issued under the fixed designation D 3242; 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. This test method has been approved by the sponsoring committees and accepted by the cooperating societies in accordance with established procedures.

1. Scope

1.1 This test method covers the determination of the acidity in aviation turbine fuel in the range from 0.000 to 0.100 mg KOH/g.

1.2 The values stated in SI units are to be regarded as the 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 664 Test Method for Acid Number by Potentiometric Titration²

D 1193 Specification for Reagent Water³

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *acid number*—the quantity of base, expressed in milligrams of potassium hydroxide per gram of sample that is required to titrate a sample in a specific solvent to a specific end point.

3.1.1.1 *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.

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

¹ This test method is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.06 on Analysis of Lubricants.

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² *Annual Book of ASTM Standards*, Vol 05.01.

³ *Annual Book of ASTM Standards*, Vol 11.01.

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.

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 D 1193.

7.3 *p-Naphtholbenzein⁵ 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 ± 0.01 g/L.

7.4 *Nitrogen*, dry-type, carbon dioxide-free.

NOTE 3—**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**—See Note 4.) to approximately 1 L of anhydrous isopropyl alcohol (**Warning**—See Note 5.) (containing less than 0.9 % water) in a 2-L Erlenmeyer flask. Boil the mixture gently for 10 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**—See Note 6.) and again boil gently for 5 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 (CO₂) 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 4—**Warning:** Highly corrosive to all body tissue both in solid form and in solution.

NOTE 5—**Warning:** Flammable. Vapor harmful. Keep away from heat, sparks, and open flame.

NOTE 6—**Warning:** Poisonous if ingested. Strongly alkaline, causes severe irritation producing dermatitis.

NOTE 7—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.

7.5.1 *Standardization of Potassium Hydroxide Solution*—Standardize frequently enough to detect changes of 0.0002N. 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 and dissolve in 40 ± 1 mL of water, free of CO₂. Titrate with the potassium hydroxide alcoholic solution to either of the following end-points: (a) 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; (b) 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 of pure solid phenolphthalein in 50 mL of water, free of CO₂, and 50 mL of ethanol.

7.6 *Titration Solvent*—Add 500 mL of toluene (**Warning**—See Note 8.) and 5 mL of water to 495 mL of anhydrous isopropyl alcohol.

NOTE 8—**Warning:** Flammable. Vapor harmful. Keep away from heat, sparks, and open flame.

8. Procedure

8.1 Introduce 100 ± 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 to 8 mm outside diameter glass tube to a point within 5 mm of the flask bottom at a rate of 600 to 800 mL/min. Bubble the solution for 3 min ± 30 s with occasional mixing.

8.1.1 The vapor from this treatment contains toluene and should be removed with adequate ventilation.

8.2 Continue the nitrogen addition and titrate without delay at a temperature below 30°C. Add 0.01 N KOH solution in increments and swirl to disperse until a green end point is reached that persists for 15 s.

NOTE 9—The temperature can be measured by any suitable temperature measuring device.

8.3 *Blank*—Perform a blank titration on 100 mL of the titration solvent and 0.1 mL of the indicator solution, introducing the nitrogen in the same manner and titrating to the same end point as above.

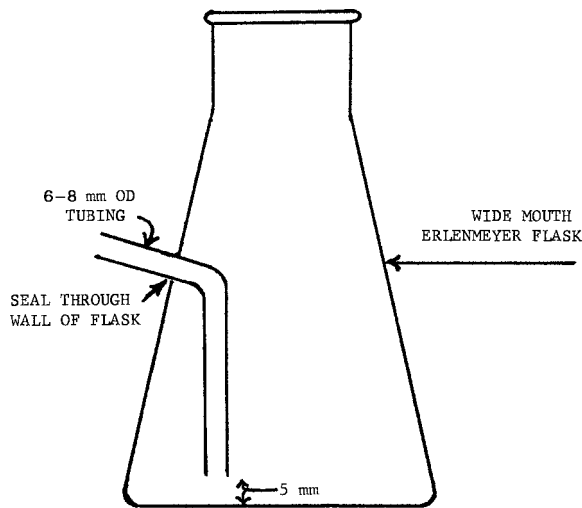


FIG. 1 Titration Flask

⁵ In a 1992 study, only Kodak and Fisher *p*-naphtholbenzein were found to meet the specifications in Annex A1. The Fisher Reagent Solution was the only commercially available solution to meet the specifications.