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## Standard Field Test Method for Water-Separation Characteristics of Aviation Turbine Fuels<sup>1</sup>

This standard is issued under the fixed designation D 3602; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This test method provides a rapid portable means for field and laboratory use to rate the ability of aviation turbine fuels to release entrained or emulsified water when passed through fiberglass coalescing material. It is intended to measure the water separation characteristics of fuel as produced, after it has been blended with additives or delivered to the point of use.

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 problems, 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 6.2.3, 7.2, 7.3, 7.4, 7.5, 8.3, 9.1, 10.4, 10.12, A1.2.3, A1.2.5, A2.4.4, and Annex A4.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

D 1655 Specification for Aviation Turbine Fuels<sup>2</sup>

D 2550 Test Method for Water Separation Characteristics of Aviation Turbine Fuels<sup>3</sup>

D 3948 Test Methods for Determining Water-Separation Characteristics of Aviation Turbine Fuels by Portable Separometer<sup>4</sup>

D 4306 Practice for Aviation Fuel Sample Containers for Tests Affected by Trace Contamination<sup>4</sup>

### 3. Terminology

#### 3.1 Description of Term Specific to This Standard:

3.1.1 *minisonic separometer surfactants (MSS)*—a numerical rating indicating the ease of separating emulsified water from fuel by coalescence as affected by the presence of surfactants.

### 4. Summary of Test Method

4.1 The fuel sample is emulsified with water in a syringe using an ultrasonic probe. The emulsion is then expelled from the syringe at a prescribed rate through a standard fiberglass coalescer and the effluent is analyzed for uncoalesced water by a light transmission measurement. The

results are reported on a 0-to-100 scale to the nearest whole number. High ratings indicate the water is easily coalesced, and, therefore, that the fuel is relatively free of surfactant materials. A test can be performed in 5 to 10 min. Cleaning is eliminated by use of disposable test parts.

### 5. Significance and Use

5.1 This test method provides a measure of the presence of surface active substances in aviation turbine fuels. Like Test Methods D 2550 and D 3948 it can detect carryover of traces of refinery treating residues in fuel as produced. This test method can also detect surface active substances added to or picked up by fuel during handling from point of production to point of use. Some of these substances affect the ability of filter separators to separate free water from the fuel.

5.2 Tests by this field method will not necessarily give the same rating of water separation characteristics of fuel as Test Method D 2550. However, tests by D 3602 should give the same results as Test Method D 3948.

### 6. Apparatus

6.1 The *Minisonic Separometer*<sup>5</sup> is portable and self-contained, requiring only a source of 115 V, 50 to 60-Hz ac power for its operation. (The *Minisonic Separometer* can be operated on 230 V, 50 to 60-Hz power with the addition of an accessory transformer.) The accessory operating parts as well as expendable materials for six tests can be packed in the lockable case.

6.2 The main features of the *Minisonic Separometer* are shown in Figs. 1 and 2. Figure 1 shows the ultrasonic converter (in clamp) with probe tip mounted on the left side of the raised case lid and the syringe drive mechanism on the right side. Figure 2 shows the operating controls which are fitted on two separate panels in the bottom of the case, and the hinged lid providing access to the storage area in the back.

6.2.1 *Main Power* controls located at the upper left of the rearmost control panel include the main power switch and the associated indicator light. A cooling and ventilating fan operates continuously when the main power is ON.

6.2.2 *Syringe Drive* controls located at the upper right of the rear panel include the speed control and a direction switch.

6.2.3 *Ultrasonic Emulsifier* controls are located in the center and include the power switch, indicator light, automatic timer, powerstat, power meter, a switch for continuous

<sup>1</sup> 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.J on Aviation Fuels.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 05.01.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 05.02.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 05.03.

<sup>5</sup> The *Minisonic Separometer* has been discontinued and replaced by the *Micro-Separometer* (ASTM D 3948) and is available from EMCEE Electronics, Inc., 520 Cypress Ave., Venice, FL 34292.


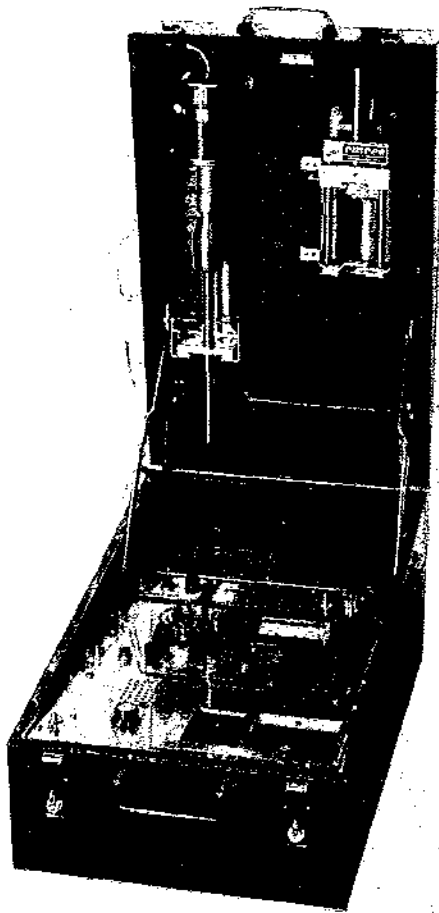
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FIG. 1 Minisonic Separometer

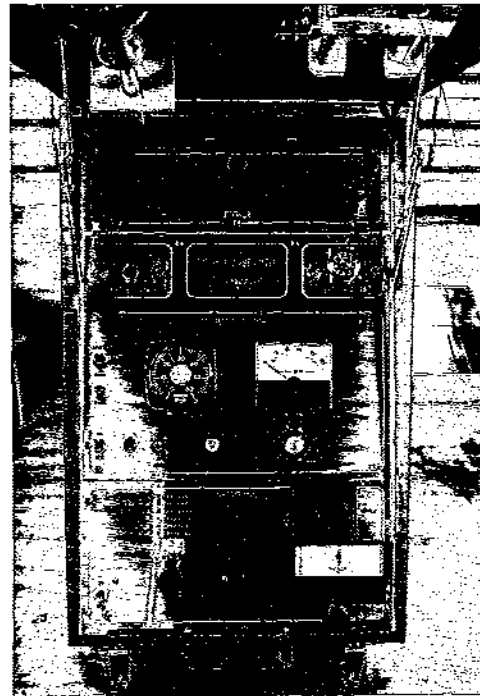


FIG. 2 Control Panels

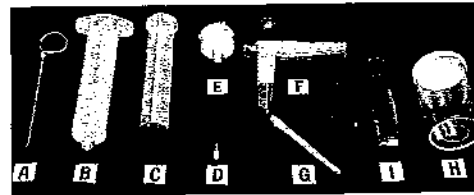


FIG. 3 Small Parts and Supplies

or timed operation, and a push-to-start (timer switch).

NOTE 1: **Caution**—Do not operate the emulsifier except with the probe immersed in a liquid sample. (However, see A1.2.4, tuning procedure.)

6.2.4 *Turbidimeter*, located on the front panel, comprises a power switch, sample and reference wells for test vials, a null meter and knob to balance and standardize the two light beams initially, and the MSS scale knob to re-null the meter for the final measurement. The sample and reference wells should be anchored into place by using tape.

6.3 The small parts and supplies needed to carry out the test are shown in Fig. 3 and consist of:<sup>6</sup>

6.3.1 *Wire Aid (A)*—A piece of 20 to 22-gage copper wire with a loop and hook twisted on one end used to release air when the syringe plunger is inserted.

6.3.2 *Syringe (barrel, B, and plunger, C)*—A disposable 50-mL plastic syringe.

6.3.3 *Syringe Plug (D)*—A plastic plug for the syringe.

6.3.4 *Coalescer Cell (E)*—A precalibrated aluminum (Alumicel<sup>7</sup> coalescer) throwaway coalescer cell with a tapered end to fit the syringe.

NOTE 2: **Caution**—This cell has 1.6-mm ( $\frac{1}{16}$ -in.) orifices and is not interchangeable with the cell for the standard Water Separometer in Test Method D 2550.

6.3.5 *Pipet (F)*—An automatic hand pipet with disposable plastic tip (g) with a plunger adapter (arrow) to limit the volume dispensed to 50- $\mu$ L (Pipet), (Tips), and (Adapter).

6.3.6 *Container (H)*—A clean container for water.

6.3.7 *Vials, (i)*—Standard 25-mm outside diameter vials used, two for blanks and one for the test sample (Emcee Part No. 5932).

6.4 A beaker can be used in the catch pan to receive waste fuel during the test.

6.5 A new syringe, pipet tip, test sample vial, plug, and Alumicel<sup>7</sup> are used in each test. These disposable parts are available from Emcee individually or in a kit containing all the disposables for six tests. This kit is designed to fit inside the Minisonic Separometer (Fig. 4).

## 7. Reagents

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 Chem-

<sup>6</sup> A kit containing six each of these throwaway items is available from Emcee Electronics, Inc.

<sup>7</sup> A registered trademark of Emcee Electronics, Inc.

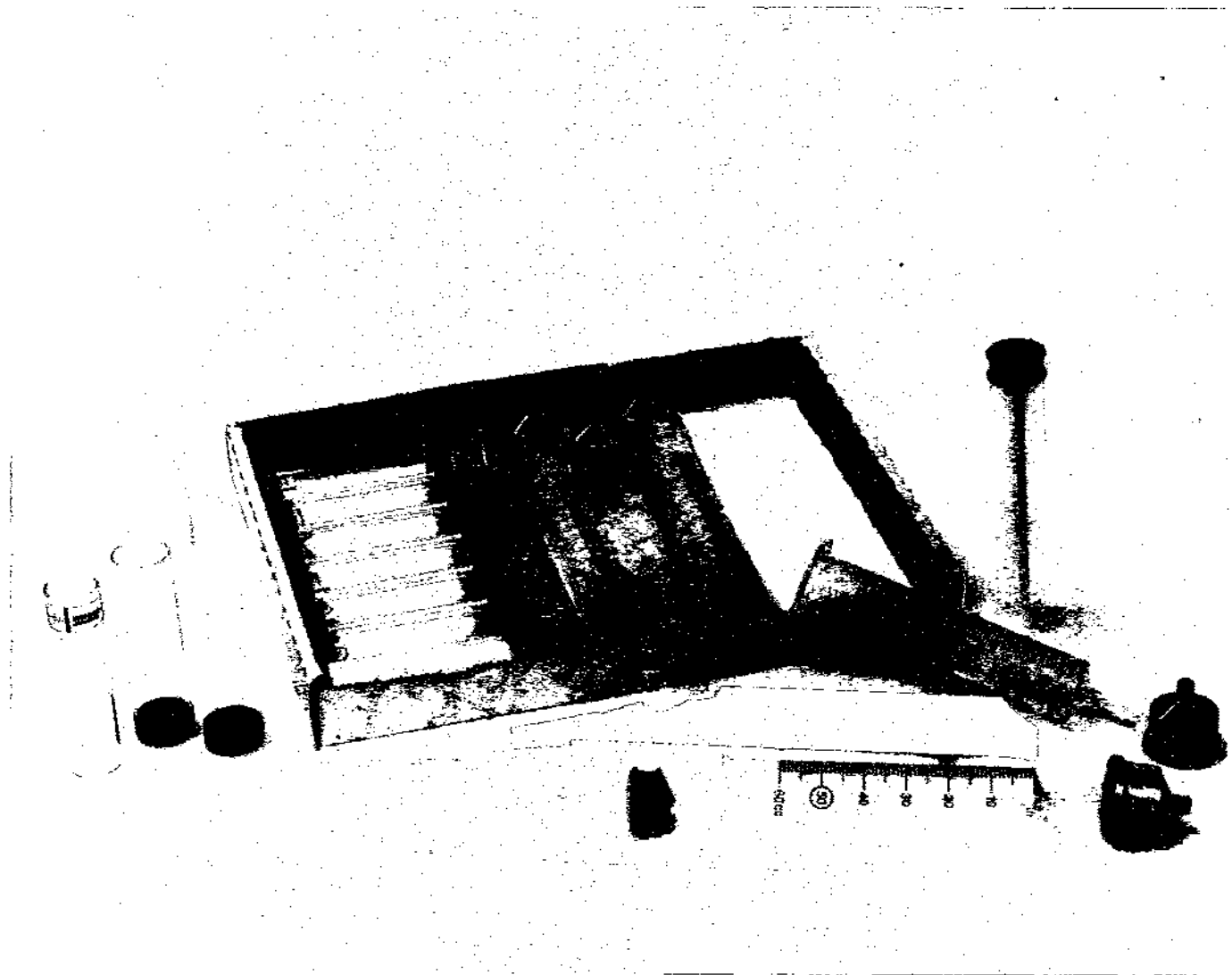


FIG. 4 Kit of Supplies

ical Society, where such specifications are available.<sup>8</sup> 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.

7.2 *Water*, clean, surfactant-free, preferably distilled.

7.3 *Reference Fluid Base* (**Warning**—see Note 3) is a surfactant-free clean hydrocarbon material prepared in the manner described in Annex A2.

NOTE 3: **Warning**—Combustible. Vapor harmful. See Annex A4.1.

7.4 *Dispersing Agent* is a toluene solution (**Warning**—see Note 4) containing 1 mg of solid (100 % dry) *bis*-2-ethylhexyl sodium sulfosuccinate per millilitre of toluene.

NOTE 4: **Warning**—Flammable. Vapor harmful. See A4.2.

7.5 *Reference Fluids* (for checking the condition of the

Minisonic Separator instrumentation) consisting of various concentrations (0 to 1.2 mL/L) of dispersing agent in reference fluid base. The MSS ratings for this range of concentration appear in Table 1 for Jet A fuel and Table 2 for Jet B fuel (**Warning**—see Note 5). The reference fluids shall be tested as described in Section 10. Results shall fall within the range of limits shown in Table 1 or 2 or shall be discarded and the reference fluid check repeated.

NOTE 5: **Warning**—Extremely flammable. Harmful if inhaled. Vapors may cause fire. See Annex A4.3.

TABLE 1 Expected Performance with Reference Fluid Type A

Concentration of Dispersing Agent, mL/L	Standard Rating	Limits for Acceptable Performance <sup>A</sup>	
		Min	Max
0	99	97	100
0.2	89	82	94
0.4	80	69	88
0.6	72	59	83
0.8	65	51	77

<sup>A</sup> 95 % confidence level based on results from eight laboratories.

<sup>8</sup> "Reagent Chemicals, American Chemical Society Specifications," Am. Chemical Soc., Washington, D.C. For suggestions on the testing of reagents not listed by the American Chemical Society, see "Reagent Chemicals and Standards," by Joseph Rosin, D. Van Nostrand Co., Inc., New York, NY, and the "United States Pharmacopeia."