Designation: D 7261 – 06

An American National Standard

Standard Test Method for Determining Water Separation Characteristics of Diesel Fuels by Portable Separometer[1]

This standard is issued under the fixed designation D 7261; 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 a rapid portable means for field and laboratory use to rate the ability of diesel fuels (both neat and those containing additives) to release entrained or emulsified water when passed through fiberglass coalescing material.

1.2 This test method is applicable to diesel fuels such as D 975 Grade No. 1 and Grade No. 2 of all sulfur levels, and MIL-F-16884, naval distillate fuel (NATO F-76).

NOTE 1—This test method is similar to Test Method D 3948 which is applicable to aviation turbine fuels.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *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]

D 975 Specification for Diesel Fuel Oils

D 1193 Specification for Reagent Water

D 3948 Test Method for Determining Water Separation Characteristics of Aviation Turbine Fuels by Portable Separometer

D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products

D 4176 Test Method for Free Water and Particulate Contamination in Distillate Fuels (Visual Inspection Procedures)

D 4177 Practice for Automatic Sampling of Petroleum and Petroleum Products

D 4306 Practice for Aviation Fuel Sample Containers for Tests Affected by Trace Contamination

D 4860 Test Method for Free Water and Particulate Contamination in Mid-Distillate Fuels (Clear and Bright Numerical Rating)

D 6426 Test Method for Determining Filterability of Middle Distillate Fuel Oils

2.2 *Military Standard:*

MIL-F-16884 Fuel, Naval Distillate (NATO F-76)[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *Micro-Separometer rating (DSEP rating)*, *n*—a numerical value indicating the ease of separating emulsified water from fuel by coalescence as affected by the presence of surface active materials (surfactants) in the fuel.

3.1.2 *reference fluid*, *n*—a reference fluid base to which prescribed quantities of a known surface active agent have been added.

3.1.2.1 *Discussion*—The known surface active agent is typically bis-2-ethylhexyl sodium sulfosuccinate, commonly referred to as AOT, dissolved in toluene.

3.1.3 *surfactants*, *n—in petroleum fuels*, surface active materials that could disarm (de-activate) filter separator (coalescing) elements so that free water is not removed from the fuel in actual service.

3.1.3.1 *Discussion*—Technically, surfactants affect the interfacial tension between water and fuel which affects the tendency of water to coalesce into droplets or not.

3.1.4 *strong surfactants*, *n—in petroleum fuels*, surface active materials that disarm filter separator elements.

3.1.4.1 *Discussion*—Strong surfactants can be refinery process chemicals left in the fuel or contaminants introduced during transportation of the fuel.

3.1.5 *weak surfactants*, *n—in petroleum fuels*, surface active materials that do not adversely affect the performance of filter separator elements in actual service.

3.1.5.1 *Discussion*—Weak surfactants are typically certain types of additives used in fuels.

[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.14 on Stability and Cleanliness of Liquid Fuels.

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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.

[3] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *DSEP rating*, *n*—the Micro-Separometer rating of diesel fuels as measured by this test method.

3.2.1.1 *Discussion*—The "D" in DSEP stands for diesel fuel. (See 14.1 for more information.)

3.2.2 *reference fluid base*, *n*—a distillate diesel fuel that has been carefully cleaned in a prescribed manner to remove all surface-active contaminants, and having a minimum DSEP rating of 97.

3.2.2.1 *Discussion*—The reference fluid base should be a diesel fuel typical of fuels to be tested.

3.3 *Abbreviations:*

3.3.1 *ac*—alternating current

3.3.2 *AOT*—Aerosol OT (see 8.1)

3.3.3 *C/S*—collect sample

3.3.4 *dc*—direct current

3.3.5 *MSEP*—Micro-Separometer

3.3.6 *DSEP*—Micro-Separometer–Diesel

4. Summary of Test Method

4.1 A 50 mL water/fuel sample emulsion is created in a syringe using a high-speed mixer. The emulsion is then expelled from the syringe at a programmed rate through a standard fiber-glass coalescer and the effluent is analyzed for uncoalesced water by a light transmission measurement.

4.2 The results are reported on a 0-to-100 scale to the nearest whole number, however the effective range of the test equipment is from 50 to 100. High ratings indicate that water is easily coalesced, implying that the fuel is relatively free of surfactants.

4.3 A test can be performed in 5 to 10 min.

5. Significance and Use

5.1 This test method provides a measure of the presence of surfactants in diesel fuels, and can be performed in the field or in a laboratory. Like Test Method D 3948 used for jet fuel, this test method can detect traces of some refinery treating chemicals left in fuel. It can also detect surface active substances added to or picked up by the fuel during handling from point of production to point of use.

5.2 Certain additives, which can act as weak surfactants, give a slightly reduced DSEP rating. Other substances which are strong surfactants give much lower DSEP ratings.

5.3 While filter separators have not been common in diesel fuel systems, they could become more prevalent with ULSD containing increased additive content to ensure clean, dry fuels in new engine designs. Weak surfactants, with slightly reduced DSEP ratings, do not affect the ability of filter separators to separate free water from the fuel. Strong surfactants give a much lower DSEP rating and adversely affect the ability of filter separators to separate free water from the fuel.

5.4 Results from this test method do not have a known relationship to the rate of water settling in tanks.

5.5 The Micro-Separometer has a measurement range from 50 to 100. Values obtained outside of those limits are undefined and invalid.

NOTE 2—In the event a value greater than 100 is obtained, there is a good probability that light transmittance was reduced by material contained in the fuel used to set the 100 reference level. The material was subsequently removed during the coalescing portion of the test, thus, the processed fuel had a higher light transmittance than the fuel sample used to obtain the 100 reference level resulting in the final rating measuring in excess of 100.

6. Interferences

6.1 Any suspended particles, whether solids or water droplets or haze, in a fuel sample will interfere with this test method, which utilizes light transmission of a fuel sample after emulsification with water and subsequent coalescence.

6.2 Non-hydrocarbon components such as oxygenates, especially alcohols, or emulsified water have not been verified for this test method and will likely interfere.

7. Apparatus

7.1 A *Micro-Separometer*[4,5] *instrument* is used to perform the test. The unit is portable and self-contained, capable of operating on an internal rechargeable battery pack or being connected to an ac power source using power cords which are available for various voltages. Connection to an ac power source will provide power to the unit and affect battery recharge. The accessories can be packed in the cover of the lockable case.

7.1.1 The Emcee Model 1140 Micro-Separometer Mark V Deluxe and associated control panel is shown in Fig. 1. The emulsifier is on the right side of the raised panel and the *syringe drive mechanism* is on the left side. The control panel containing the operating controls (pushbuttons) is mounted on the fixed panel in the left side of the case. Table 1 lists the manual and audio operating characteristics of the instrument. A circuit breaker located on the control panel provides protection for the ac power circuit. The turbidimeter is located under the main control panel and consists of a well in which the sample vial is placed, a light source, and a photocell.

NOTE 3—Of the lettered (A-G) pushbuttons, only the D pushbutton is applicable to this test method.

7.2 *Beaker, Catch Pan, or Plastic Container*—(Supplied with each Micro-Separometer) used to receive the waste fuel during the coalescence period of the test.

7.3 *Pipet*—An automatic 50-µL hand pipet (supplied with each Micro-Separometer) designed to accept a disposable plastic tip.

8. Reagents and Materials

8.1 *Aerosol OT*, (AOT), solid (100 % dry) bis-2-ethylhexyl sodium sulfosuccinate.

[4] The sole source of supply of the apparatus known to the committee at this time is the Model 1140 Micro-Separometer Mark V Deluxe, available from EMCEE Electronics, Inc., 520 Cypress Ave., Venice, FL 34285, U.S.A. www.emcee-electronics.com If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee. This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.14 on Cleanliness and Stability of Liquid Fuels.

[5] The Model 1140 Micro-Separometers Mark III and Mark V Standard versions may also be used, but they are no longer supported by the manufacturer. For operating procedures using these instruments, the user is referred to Test Method D 3948–87.