Designation: ~~D7451 – 08a (Reapproved 2013)~~ D7451 – 16

Standard Test Method for Water Separation Properties of Light and Middle Distillate, and Compression and Spark Ignition Fuels[1]

This standard is issued under the fixed designation D7451; 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.

1. ~~Scope~~ Scope*

1.1 This test method covers the evaluation of the tendency of water and fuels with a final boiling point of less than ~~390°C,~~390 °C, as measured in Test Method D86, to separate cleanly rather than create emulsions when they may contain potential emulsion forming additives or components, or have been additized with potential emulsion forming additives, or components.

1.2 This test method applies primarily to gasoline, diesel, kerosine, and distillate grades of gas turbine, marine, home heating oils and furnace fuels (see Specifications D396, D975, D2880, D3699, D4814, and D6985). For fuel components such as biodiesel or alcohol, refer to X1.2 and X1.3.

1.3 This test method is not meant to certify or qualify fuels for sale, but it is intended for use by additive suppliers to determine the need for demulsifier components in their additive packages.

1.4 This test method is not meant for testing of fuels containing large amounts of aqueous soluble components, such as E85, or for testing of water emulsified fuels, or for testing of aviation fuels.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.6 *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]

D86 Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure
D396 Specification for Fuel Oils
D975 Specification for Diesel Fuel Oils
D1193 Specification for Reagent Water
D2274 Test Method for Oxidation Stability of Distillate Fuel Oil (Accelerated Method)
D2880 Specification for Gas Turbine Fuel Oils
D3699 Specification for Kerosine
D4057 Practice for Manual Sampling of Petroleum and Petroleum Products
D4176 Test Method for Free Water and Particulate Contamination in Distillate Fuels (Visual Inspection Procedures)
D4177 Practice for Automatic Sampling of Petroleum and Petroleum Products
D4814 Specification for Automotive Spark-Ignition Engine Fuel
D6985 Specification for Middle Distillate Fuel Oil—Military Marine Applications (Withdrawn 2010)[3]

2.2 *ASTM Adjuncts:*

Distillate Fuel Bar Chart[4]
Fuel Clarity Rating Standard[5]

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[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, 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] The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from ASTM International Headquarters. Order Adjunct No. ADJD417601. Original adjunct produced in 1991.

[5] Available from ASTM International Headquarters. Order Adjunct No. ADJD7451. Original adjunct produced in 2008.

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

3. Terminology

3.1 *Definitions:*

3.1.1 *film, n*—thin, translucent layer that does not adhere to the wall of the glass test tube.

3.1.2 *heavy scum, n*—assessment that the fuel/water interface is covered with more than ~~50%~~50 % scum that extends into either of the two layers or forms an emulsion ~~(1 mL~~ (1 mL or greater in volume), or both.

3.1.3 *scum, n*—layer thicker than film (up to ~~1 mL~~ 1 mL in volume) or that adheres to the wall of the glass test tube, or both.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *interface condition rating, n*—qualitative assessment of the tendency of a mixture of water and fuel to form interface films or precipitates.

3.2.2 *water separation rating, n*—qualitative assessment of the tendency of components in the fuel to produce emulsions or precipitates, or both, in separated fuel and water layers.

3.2.3 *water volume change, n*—qualitative indication of the presence of water-soluble components in fuels, or the decrease in water returned during the test due to the formation of scum or emulsions.

3.2.3.1 *Discussion—*

For example, the alcohol component in an ethanol-blended gasoline would be extracted into the aqueous phase, thus increasing the volume of the aqueous phase by the approximate volume of the ethanol present in the sample.

4. Summary of Test Method

4.1 The cleanliness of the glass test tube is tested prior to use in the test.

4.2 A sample of the fuel is shaken at room temperature using a standardized technique with an aqueous phase in thoroughly cleaned glassware.

4.3 The change in volume of the aqueous layer, the appearance of the interface and the clarity of the fuel are reported as an indication of the water separation properties of the fuel.

5. Significance and Use

5.1 The primary use of this test method is to evaluate new additive packages in specific fuels to ensure that fuel-water separability will not be compromised by the use of the additive package, either at their normal treat rates or at several times the intended treat rate to evaluate the impact of potential overtreatment.

5.1.1 *Water Volume Changes*—Using this technique reveal the presence of water-soluble components, such as alcohols, in the fuel.

5.1.2 *Interface Condition Ratings*—Using this technique reveal the presence of partially soluble components, such as surfactants, in the fuel.

5.2 Additives or contaminants that affect the interface could harm water separation properties of fuels in equipment and quickly inhibit the free flow of fuel through filters and injection equipment, causing a decrease in combustion performance.

6. Apparatus

6.1 *Graduated Glass Tube*—Sealable, blunt-tipped, ~~100-mL~~100 mL with ½~~-mL~~ mL graduations from ~~1~~1 mL to 10 mL and ~~2-mL~~2 mL graduations from ~~10~~10 mL to ~~100 mL~~ 100 mL not encompassing the whole diameter of the tube as to interfere with the clarity rating. The dimensions of the tube are as follows:

6.1.1 Overall length = ~~200~~200 mm ± ~~5 mm.~~5 mm.

6.1.2 Outer diameter of the tube portion = ~~38 mm.~~38 mm.

6.1.3 Neck length = ~~25 mm.~~25 mm.

6.1.4 Headspace from ~~100-mL~~100 mL graduation to tube neck = ~~50~~50 mm ± 5 mm.

6.1.5 Tip length = ~~30 mm~~ 30 mm with a 45° taper.

NOTE 1—Contact Subcommittee D02.14 for a list of possible suppliers for the tubes and caps.

6.2 *Shaking Apparatus ~~(Optional)—~~(Optional)*[6]—An ~~explosion–proof~~explosion-proof apparatus capable of shaking the tubes as prescribed in 10.2 is preferred for testing consistency. However, any method that facilitates shaking at the prescribed stroke length, frequency, and sample orientation as outlined in 10.2 is acceptable.

[6] The sole source of supply of the shaking apparatus known to the committee at this time is Part No. 215086, Laciny Brothers Inc., St. Louis, MO, http://www.lacinybros.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,[1] which you may attend.