~~Designation:D7451–08~~ Designation: D 7451 – 08a

An American National Standard

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 D 7451; 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*

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, as measured in Test Method D 86, 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 D 396, D 975, D 2880, D 3699, D 4814, and D 6985). 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. ~~Note1—This test method is not meant for testing of aviation fuels.~~

~~1.4The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.~~

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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]

D 86 Test Method for Distillation of Petroleum Products at Atmospheric Pressure
D 396 Specification for Fuel Oils
D 975 Specification for Diesel Fuel Oils
D 1193 Specification for Reagent Water
D 2274 Test Method for Oxidation Stability of Distillate Fuel Oil (Accelerated Method)
D 2880 Specification for Gas Turbine Fuel Oils
D 3699 Specification for Kerosine
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 4814 Specification for Automotive Spark-Ignition Engine Fuel
D 6985 Specification for Middle Distillate Fuel OilMilitary Marine Applications

2.2 *ASTM Adjuncts:*

Distillate Fuel Bar Chart[3]
Fuel Clarity Rating Standard[4]

[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.

~~Current edition approved May 1, 2008. Published June 2008.~~

Current edition approved Dec. 1, 2008. Published January 2009. Originally approved in 2008. Last previous edition approved in 2008 as D 7451–08.

[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 ASTM International Headquarters. Order Adjunct No. ADJD417601. Original adjunct produced in 1991.

[4] 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% scum that extends into either of the two layers or forms an emulsion (1 mL or greater in volume), or both.

3.1.3 *scum*, *n*—layer thicker than film (up to 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 with ½-mL graduations from 1 to 10 mL and 2-mL graduations from 10 to 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 ± 5 mm.

6.1.2 Outer diameter of the tube portion = 38 mm.

6.1.3 Neck length = 25 mm.

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

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

NOTE ~~2~~1—Contact Subcommittee D02.14 for a list of possible suppliers for the tubes and caps.

6.2 *Shaking Apparatus (Optional)* —An 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.

NOTE~~3~~ 2— No suitable vendor for such a machine has been identified. It remains the responsibility of the user to select an apparatus that meets these criteria.

6.3 *Rating Chart*— The line card and fuel clarity rating chart from ASTM Adjuncts ADJD417601 and ADJD7451, respectively. (See 10.4.2.)

NOTE~~4—If~~ 3—If the line card is not available or fuel clarity is not readily discernible from using the line card, then printed text as described in Table 1 may be used to assess fuel clarity.

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 Chemical Society, where