Designation: D2386 – 06

Standard Test Method for Freezing Point of Aviation Fuels[1]

This standard is issued under the fixed designation D2386; 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 the determination of the temperature below which solid hydrocarbon crystals may form in aviation turbine fuels and aviation gasoline.

NOTE 1—The interlaboratory program that generated the precisions for this test method did not include aviation gasoline.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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.* For specific warning statements, see 5.4, Section 6, and 8.2.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D910 Specification for Aviation Gasolines

D1655 Specification for Aviation Turbine Fuels

D3117 Test Method for Wax Appearance Point of Distillate Fuels

D4057 Practice for Manual Sampling of Petroleum and Petroleum Products

D4177 Practice for Automatic Sampling of Petroleum and Petroleum Products

E1 Specification for ASTM Liquid-in-Glass Thermometers

E77 Test Method for Inspection and Verification of Thermometers

2.2 *Energy Institute Standard:*

IP Standards for Petroleum and Its Products, Part 1 [3]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *freezing point, n—in aviation fuels*, the fuel temperature at which solid hydrocarbon crystals, formed on cooling, disappear when the temperature of the fuel is allowed to rise under specified conditions of test.

4. Significance and Use

4.1 The freezing point of an aviation fuel is the lowest temperature at which the fuel remains free of solid hydrocarbon crystals that can restrict the flow of fuel through filters if present in the fuel system of the aircraft. The temperature of the fuel in the aircraft tank normally falls during flight depending on aircraft speed, altitude, and flight duration. The freezing point of the fuel must always be lower than the minimum operational tank temperature.

4.2 Freezing point is a requirement in Specifications D910 and D1655.

5. Apparatus

5.1 *Jacketed Sample Tube*—A double-walled, unsilvered vessel, similar to a Dewar flask, the space between the inner and outer tube walls being filled at atmospheric pressure with dry nitrogen or air. The mouth of the sample tube shall be closed with a stopper supporting the thermometer and moisture-proof collar through which the stirrer passes (Fig. 1).

5.2 *Collars*—Moisture-proof collars as shown in Fig. 2 shall be used to prevent condensation of moisture.

5.3 *Stirrer*—Shall be made of 1.6-mm brass rod bent into a smooth three-loop spiral at the bottom.

NOTE 2—The stirrer may be mechanically actuated as described in the apparatus section of Test Method D3117.

5.4 *Vacuum Flask*—An unsilvered vacuum flask (**Warning**—Implosion hazard) having the minimum dimensions shown in Fig. 1 shall be used to hold an adequate volume

[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.07 on Flow Properties.

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This test method has been approved by the sponsoring committees and accepted by the Cooperating Societies in accordance with established procedures. DOI: 10.1520/D2386-06.

[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 Energy Institute, 61 New Cavendish St., London, WIG 7AR, U.K.

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

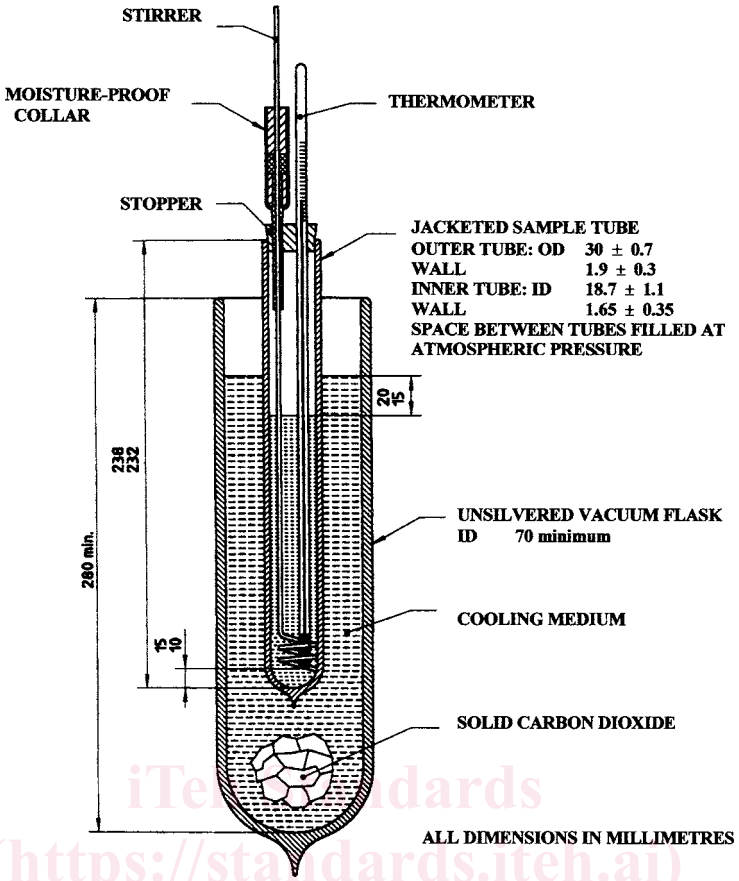

FIG. 1 Freezing Point Apparatus

of cooling liquid and permit the necessary depth of immersion of the jacketed sample tube.

5.5 *Thermometer*—A total immersion type, having a range from −80 to +20°C, designated as ASTM No. 114C/IP No. 14C. (See Specification E1, or Appendix A, IP Standard Thermometers, Volume 2, IP Standard Methods for Analysis and Testing of Petroleum and Related Products.)

NOTE 3—The accuracy of this thermometer is to be checked in accordance with Test Method E77, at temperatures of 0, −40, −60, and −75°C.[4]

6. Reagents and Materials

6.1 *Acetone*—Technical Grade acetone is suitable for the cooling bath, provided it does not leave a residue on drying. (**Warning**—Extremely flammable.)

6.2 *Ethanol or Ethyl Alcohol*—A commercial or technical grade of dry ethanol is suitable for the cooling bath. (**Warning**—Extremely flammable.)

6.3 *Isopropyl Alcohol*—A commercial or technical grade of dry isopropyl alcohol is suitable. (**Warning**—Extremely flammable.)

6.4 *Methanol or Methyl Alcohol*—A commercial or technical grade of dry methanol is suitable for the cooling bath. (**Warning**—Extremely flammable and toxic.)

6.5 *Carbon Dioxide (Solid) or Dry Ice*—A commercial grade of dry ice is suitable for use in the cooling bath. (**Warning**—Extremely cold, −78°C. Carbon dioxide (solid) liberates gases that can cause suffocation. Contact with skin causes burns, freezing, or both.)

6.6 *Liquid Nitrogen*—A commercial or technical grade of liquid nitrogen is suitable for the cooling bath when the freezing point is lower than −65°C. (**Warning**—Extremely cold, −196°C. Liquid nitrogen liberates gases that can cause suffocation. Contact with skin causes burns, freezing, or both.)

7. Sampling

7.1 Obtain a sample in accordance with Practice D4057 or Practice D4177.

7.2 At least 25 mL of specimen is required for each test.

7.3 Keep the sample in a tightly sealed container at ambient room temperature to minimize introduction of any moisture. Minimize exposure of the sample to sources of heat.

8. Procedure

8.1 Measure out 25 ± 1 mL of the fuel and transfer it to the clean, dry, jacketed sample tube. Close the tube tightly with the cork holding the stirrer, thermometer, and moisture proof collar and adjust the thermometer position so that its bulb does not touch the walls of the tube flask and is approximately in the center. The bulb of the thermometer should be 10 to 15 mm from the bottom of the sample tube.

NOTE 4—Performance of this test method can be difficult, since the

[4] The U.S. National Bureau of Standards, Gaithersburg, MD, and the British National Physical Laboratory, Teddington, England are able to certify thermometers at these temperatures.