Designation: D8630 – 26

# Standard Test Method for Freezing Point of Aviation Fuels (Micro CFP Method)[1]

This standard is issued under the fixed designation D8630; 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 determination of the temperature below which solid hydrocarbon crystals may form in aviation turbine fuels.

1.2 The reporting range of test results considered valid for the applicability of precisions (r and R), and for the purpose of test result reporting in accordance with Practice D6300, is –64.5 °C to –37.2 °C. For details, see 15.1.3 for ILS summary description and how the reporting range is calculated from the lowest and highest achieved ILS sample averages.

1.3 *Units*—The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1655 Specification for Aviation Turbine Fuels

D2386 Test Method for Freezing Point of Aviation Fuels

D4057 Practice for Manual Sampling of Petroleum and Petroleum Products

D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants

D4177 Practice for Automatic Sampling of Petroleum and Petroleum Products

D6300 Practice for Determination of Precision and Bias Data for Use in Test Methods for Petroleum Products, Liquid Fuels, and Lubricants

D6708 Practice for Statistical Assessment and Improvement of Expected Agreement Between Two Test Methods that Purport to Measure the Same Property of a Material

D7566 Specification for Aviation Turbine Fuel Containing Synthesized Hydrocarbons

2.2 *Energy Institute Standards:*[3]

IP 16 Determination of the freezing point of aviation fuels – Manual method

2.3 *ISO Standards:*[4]

ISO 10629 Raw optical glass – Resistance to attack by aqueous alkaline solutions at 50 °C – Test method and classification

ISO 17034 General requirements for the competence of reference material producers

2.4 *DIN/IEC Standards:*[5]

DIN EN IEC 60751 Industrial platinum resistance thermometers and platinum temperature sensors

2.5 *Other Standards:*

DEF STAN 91-091 Turbine Fuel, Aviation Kerosine Type, Jet A-1[6]

## 3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this test method, refer to Terminology D4175.

3.1.2 *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.

3.2 *Definitions of Terms Specific to This Standard:*

[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 D02.07 on Flow Properties.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. 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, W1G 7AR, U.K., http://www.energyinst.org.

[4] Available from International Organization for Standardization (ISO), ISO Central Secretariat, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, https://www.iso.org.

[5] Available from Deutsches Institut für Normung e.V.(DIN), Am DIN-Platz, Burggrafenstrasse 6, 10787 Berlin, Germany, http://www.din.de.

[6] Available from Defence Equipment and Support, UK Defence Standardization, Kentigern House, 65 Brown Street, Glasgow, G2 8EX, https://www.dstan.mod.uk.

3.2.1 *collimated light*—a beam of light with parallel rays so arranged for minimal dispersion of light.

3.2.2 *GRIN lens, n*—gradient index lens using varying refractive index to create a beam of collimated light (see 3.2.1).

3.2.3 *luminous flux, n*—the perceived power of light.

3.2.3.1 *Discussion*—The strength of a collimated light beam is used for the detection of hydrocarbon crystals.

## 4. Summary of Test Method

4.1 For the determination of freezing point, the test specimen situated in the microfiber-optic measurement cell is rapidly cooled at a rate up to 5 °C⁄min until hydrocarbon crystals are detected. Then, after a 5 min hold time, the test specimen is heated at a controlled rate, up to 5 °C⁄min until the hydrocarbon crystals no longer can be detected. The appearance of crystals and disappearance of crystals are determined once the luminous flux detected drops below a pre-defined threshold and rises above a pre-defined threshold. Heating rate, detection threshold and test parameters are designed to deliver a result consistent with Test Methods D2386 / IP 16 once the apparatus has been properly calibrated according to Section 10.

## 5. Significance and Use

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

5.2 Petroleum blending operations require precise measurement of the freezing point.

5.3 This test method produces results which can be used as a predicted Test Method D2386 result without any bias correction and expresses results to the nearest 0.1 °C, with improved precision over Test Method D2386. This test method also eliminates most of the operator time and judgment required by Test Method D2386.

5.4 This test method potentially covers the range of temperatures from –90 °C to –35 °C with temperature resolution of 0.1 °C.

## 6. Apparatus

6.1 *Automatic Apparatus*[7]—A 1.9 mm ± 0.05 mm inner diameter flow cell with a 650 nm ± 10 nm collimated light beam transmitted through fiber optics arranged opposite to an opto-diode detector. The source light is transmitted perpendicularly through the test specimen (see 6.3). The crystal formation in the test specimen is detected when the luminous flux falls below a set threshold, and the freeze point is identified when the luminous flux rises above a set threshold.

6.2 Cell cooling rates, heating rates, and detector thresholds are factory set so that test results can be deemed equivalent to those obtained by Test Method D2386. The default cooling and heating rate is nominally 1 °C⁄min.

6.3 *Schematics*—See Fig. 1.

6.4 The optical glass flow-through cell and GRIN lens is one integral component connected to sample inlets and outlets via stainless steel tubing. The sample volume of the cell is approximately 0.85 mL. The GRIN lens/flow-through cell must have resistance to acids and resistance to alkaline solutions to class AR3 according to ISO 10629.

6.5 The measuring cell is encapsulated in a temperature-controlled copper block and a thermo-electric cooling and heating device (Peltier). The cell may have provisions for connections to an external cooling device.

[7] The sole source of supply of the microCFP apparatus known to the committee at this time is Anton Paar GmbH, Anton-Paar-Str. 20, A-8054 Graz, Austria. 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.

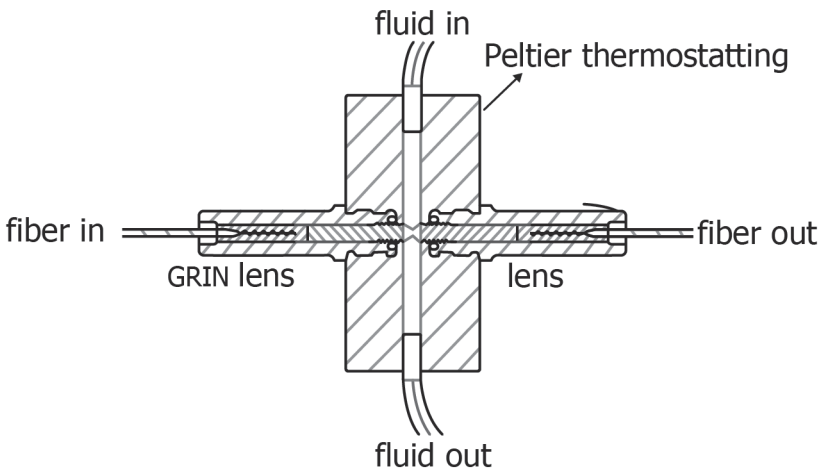


**FIG. 1 Schematics**