



Designation: D4539 – 16

# Standard Test Method for Filterability of Diesel Fuels by Low-Temperature Flow Test (LTFT)<sup>1</sup>

This standard is issued under the fixed designation D4539; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope\*

1.1 This test method covers estimating the filterability of diesel fuels in some automotive equipment at low temperatures.

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 **Warning**—Mercury has been designated by EPA and many state agencies as a hazardous material that can cause central nervous system, kidney, and liver damage. Mercury, or its vapor, may be hazardous to health and corrosive to materials. Caution should be taken when handling mercury and mercury-containing products. See the applicable product Material Safety Data Sheet (MSDS) for details and EPA's website (<http://www.epa.gov/mercury/faq.htm>) for additional information. Users should be aware that selling mercury or mercury-containing products, or both, in your state may be prohibited by state law.

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. For specific warning statements, see 1.3, 9.1, 9.2.1, 9.3, 9.5, and Annex A1.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

D97 Test Method for Pour Point of Petroleum Products  
D975 Specification for Diesel Fuel Oils  
D1655 Specification for Aviation Turbine Fuels  
D2500 Test Method for Cloud Point of Petroleum Products and Liquid Fuels

<sup>1</sup> This test method is under the jurisdiction of 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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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

D3117 Test Method for Wax Appearance Point of Distillate Fuels (Withdrawn 2010)<sup>3</sup>

D3699 Specification for Kerosine

D4057 Practice for Manual Sampling of Petroleum and Petroleum Products

D4177 Practice for Automatic Sampling of Petroleum and Petroleum Products

D7962 Practice for Determination of Minimum Immersion Depth and Assessment of Temperature Sensor Measurement Drift

E1 Specification for ASTM Liquid-in-Glass Thermometers

E1137 Specification for Industrial Platinum Resistance Thermometers

E2251 Specification for Liquid-in-Glass ASTM Thermometers with Low-Hazard Precision Liquids

E2877 Guide for Digital Contact Thermometers

2.2 Coordinating Research Council, Inc.

CRC Report No. 528 Diesel Fuel Low-Temperature Operability Field Test<sup>4</sup>

2.3 Canadian General Standards Board:

CAN/CGSB-3.0, No. 14.01-M86, Low Temperature Flow Test (LTFT) for Diesel Fuels<sup>5</sup>

NOTE 1—CAN/CGSB-3.0, No. 14.01-M86 is essentially equivalent to Test Method D4539, but the differences in apparatus and procedures may or may not yield different results.

## 3. Terminology

### 3.1 Definitions:

3.1.1 *digital contact thermometer (DCT), n*—an electronic device consisting of a digital display and associated temperature sensing probe.

3.1.1.1 *Discussion*—This device consists of a temperature sensor connected to a measuring instrument; this instrument measures the temperature-dependent quantity of the sensor, computes the temperature from the measured quantity, and provides a digital output. This digital output goes to a digital

<sup>3</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

<sup>4</sup> Available from Coordinating Research Council, Inc., 219 Perimeter Center Parkway, Atlanta, GA 30346.

<sup>5</sup> Available from CGSB Sales Centre, Ottawa, Canada K1A 1G6.

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

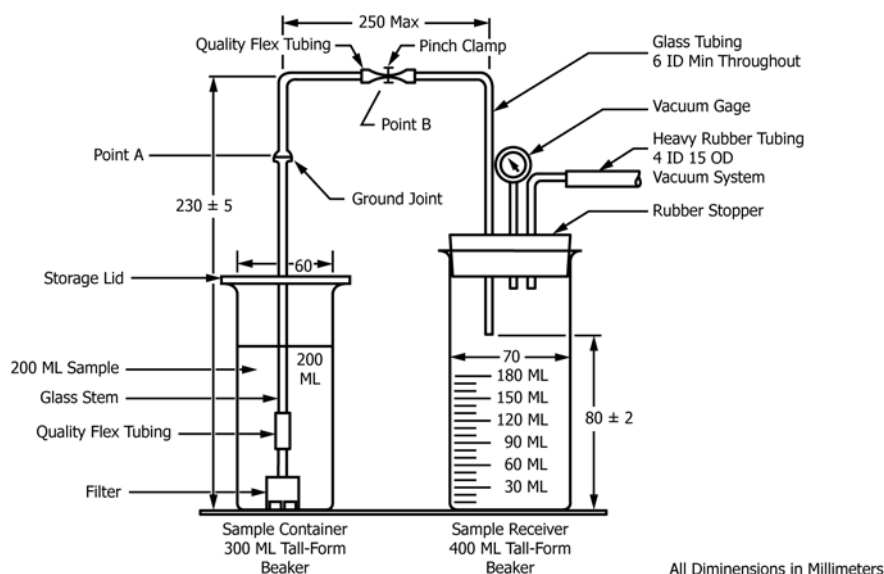


FIG. 1 LTFT Sample Filtration Assembly

display and/or recording device that may be internal or external to the device. These devices are sometimes referred to as a “digital thermometer.”

3.1.1.2 *Discussion*—PET is an acronym for portable electronic thermometers, a subset of digital contact thermometers (DCT).

## 4. Summary of Test Method

4.1 The temperature of a series of test specimens of fuel is lowered at a prescribed cooling rate. Commencing at a desired test temperature and at each 1 °C interval thereafter, a separate specimen from the series is filtered through a 17 µm screen until a minimum LTFT pass temperature is obtained. The minimum LTFT pass temperature is the lowest temperature, expressed as a multiple of 1 °C, at which a test specimen can be filtered in 60 s or less.

4.2 Alternatively, a single specimen may be cooled as described under 4.1 and tested at a specified temperature to determine whether it passes or fails at that temperature.

## 5. Significance and Use

5.1 The Low Temperature Flow Test results are indicative of the low temperature flow performance of the test fuel in some diesel vehicles (according to CRC Report No. 528). The test method is especially useful for the evaluation of fuels containing flow improver additives.

5.2 The test method can be used to supplement other measurements of diesel fuel low temperature behavior (in accordance with Test Methods D97, D2500, and D3117).

## 6. Apparatus

6.1 *Glass Specimen Vessels*, (Borosilicate heat-resistant glass or equivalent) several 300 mL, clear, heat resistant, wide-mouthed glass bottles having markings indicating

200 mL ± 10 mL and 50 mm to 60 mm ID or clear, heat resistant, tall form beakers with no pour spouts and equivalent dimensions.

6.2 *Glass Receiver Vessels*, clear, heat resistant, glass containers graduated through 180 mL in 10 mL ± 2 mL increments.

6.3 *Filtration Assembly* (see Fig. 1), including a storage lid or some other form of cover, glass tubing, flexible fuel resistant tubing, pinch clamp or valve, and rubber stopper, or other means to provide a vacuum seal.

6.4 *Filter Assembly*<sup>6</sup>, as shown in detail in Fig. 2, for each sample container (300 mL beaker). 304SS sintered screen<sup>7</sup> is a twill Dutch weave mesh with a nominal filtration rating of 17 µm. The mesh is 65 wires/cm by 303/315 wires/cm. The wire strands have diameters of 0.0071 cm and 0.0046 cm, respectively. The nominal filtration rating indicates a 98 % removal by mass weight of all particles equal to or greater than 17 µm.

6.5 *Programmable Cooling System*, capable of cooling multiple specimens to the desired temperature at a mean rate of 1.0 °C per hour between +10 °C and −30 °C. Absolute deviation of any single temperature point along the prescribed ramp function must not exceed 0.5 °C in any specimen. The system’s size and shape are optional. Either liquid or air baths are acceptable.

6.6 *Stop Watch or Electric Timer*, capable of measuring tenths of a second.

<sup>7</sup> The sole source of supply of suitable filter cloth known to the committee at this time is Pall Aerospace Co., Pall Aeropower Corp., 6301 49<sup>th</sup> St. N, Pinellas Park, FL 33781. 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<sup>1</sup>, which you may attend.