Designation: D5482 – 07 (Reapproved 2013)

Standard Test Method for Vapor Pressure of Petroleum Products (Mini Method—Atmospheric)[1]

This standard is issued under the fixed designation D5482; 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 a procedure for the determination of total vapor pressure of petroleum products using automatic vapor pressure instruments. The test method is suitable for testing samples with boiling points above 0°C (32°F) that exert a vapor pressure between 7 and 110 kPa (1.0 and 16 psi) at 37.8°C (100°F) at a vapor-to-liquid ratio of 4:1. The test method is applicable to gasolines containing oxygenates. No account is made of dissolved water in the sample.

NOTE 1—Because the external atmospheric pressure does not influence the resultant vapor pressure, this vapor pressure is an absolute pressure at 37.8°C (100°F) in kPa (psi). This vapor pressure differs from the true vapor pressure of the sample due to some small vaporization of the sample and dissolved air into the air of the confined space.

1.1.1 Some gasoline-oxygenate blends may show a haze when cooled to 0 to 1°C. If a haze is observed in 8.5, it shall be indicated in the reporting of results. The precision and bias statements for hazy samples have not been determined (see Note 6).

1.2 This test method is a modification of Test Method D5191 (Mini Method) in which the test chamber is at atmospheric pressure prior to sample injection.

1.3 This test method covers the use of automated vapor pressure instruments that perform measurements on liquid sample sizes in the range from 1 to 10 mL.

1.4 This test method is suitable for the determination of the dry vapor pressure equivalent (DVPE) of gasoline and gasoline-oxygenate blends by means of a correlation equation (see 13.2). The calculated DVPE is considered equivalent to the result obtained on the same material when tested by Test Method D4953.

1.5 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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.* (For specific warning statements, see 7.2 through 7.7.)

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D4057 Practice for Manual Sampling of Petroleum and Petroleum Products

D4175 Terminology Relating to Petroleum, Petroleum Products, and Lubricants

D4953 Test Method for Vapor Pressure of Gasoline and Gasoline-Oxygenate Blends (Dry Method)

D5190 Test Method for Vapor Pressure of Petroleum Products (Automatic Method) (Withdrawn 2012)[3]

D5191 Test Method for Vapor Pressure of Petroleum Products (Mini Method)

3. Terminology

3.1 *Definitions:*

3.1.1 *dry vapor pressure equivalent (DVPE), n*—value calculated by a defined correlation equation, that is expected to be comparable to the vapor pressure value obtained by Test Method D4953, Procedure A.

3.1.2 *gasoline-oxygenate blend, n*—spark-ignition engine fuel consisting primarily of gasoline with one or more oxygenates.

3.1.3 *oxygenate, n*—oxygen-containing ashless organic compound, such as an alcohol or ether, which may be used as a fuel or fuel supplement. **D4175**

3.1.4 *platinum resistance thermometer, n*— temperature measuring device with platinum wire, whose electrical resistance changes in relation to temperature.

[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.08 on Volatility.

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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.

3.1.5 *total vapor pressure, n*—observed pressure measured in the experiment, that is the sum of the partial pressure of the sample and the partial pressure of the dissolved air.

3.1.6 *vapor pressure, n*—pressure exerted by the vapor of a liquid when in equilibrium with the liquid. D4175

3.2 *Abbreviations:*

3.2.1 *DVPE, n*—dry vapor pressure equivalent.

3.2.2 *MTBE, n*—methyl *t*-butyl ether.

4. Summary of Test Method

4.1 A known volume of chilled, air-saturated sample is introduced into a thermostatically controlled test chamber, the internal volume of which is five times that of the total test specimen introduced into the chamber. The test chamber is at atmospheric pressure prior to introduction of the sample. After introduction of the sample into the test chamber, the test specimen is allowed to reach thermal equilibrium at the test temperature, 37.8°C (100°F). The resulting rise in pressure in the chamber is measured using a pressure transducer sensor and indicator.

4.2 The measured total vapor pressure is converted to a DVPE by use of a correlation equation (see 13.2).

5. Significance and Use

5.1 Vapor pressure is an important physical property of volatile liquids.

5.2 Vapor pressure is critically important for both automotive and aviation gasolines, affecting starting, warm-up, and tendency to vapor lock with high operating temperatures or high altitudes. Maximum vapor pressure limits for gasoline are legally mandated in some areas as a measure of air pollution control.

6. Apparatus

6.1 *Vapor Pressure Apparatus*—The type of apparatus[4] suitable for use in this test method employs a small volume test chamber incorporating a transducer for pressure measurements and associated equipment for thermostatically controlling the chamber temperature.

6.1.1 The test chamber shall be designed to contain between 2 and 50 mL of liquid and vapor and be capable of maintaining a vapor-liquid ratio between 3.95 and 1.00 and 4.05 and 1.00.

6.1.2 The pressure transducer shall have a minimum operational range from 0 to 172 kPa (0 to 25.0 psi) with a minimum resolution of 0.1 kPa (0.01 psi) and a minimum accuracy of ±0.3 kPa (±0.05 psi). The pressure measurement system shall include associated electronics and readout devices to display the resulting pressure reading.

6.1.3 A thermostatically controlled heater shall be used to maintain the test chamber at 37.8 ± 0.1°C (100 ± 0.2°F) for the duration of the test.

6.1.4 A platinum resistance thermometer shall be used for measuring the temperature of the test chamber. The minimum temperature range of the measuring device shall be from ambient to 75°C (167°F) with a resolution of 0.1°C (0.2°F) and accuracy of 0.1°C (0.2°F).

6.1.5 The vapor pressure apparatus shall have provisions for introduction of the test specimen into the test chamber and for the cleaning or purging of the chamber following the test.

6.2 *Syringe,* if required, gas tight, 1 to 20 mL capacity with a ±1 %, or better, accuracy and a ±1 %, or better, precision. The capacity of the syringe shall not exceed two times the volume of the test specimen being dispensed, and shall be chosen so as to provide maximum accuracy and resolution for the volume to be injected.

6.3 *Iced-Water Bath or Air Bath ,* for chilling the samples and syringe to temperatures between 0 and 1°C (32 and 34°F).

6.4 *Pressure Measuring Device,* capable of measuring ambient and above ambient pressures with an accuracy of 0.20 kPa (0.03 psi) or better at the same elevation relative to sea level as the apparatus in the laboratory.

6.4.1 When a mercury manometer is not used as the pressure measuring device, the calibration of the pressure measuring device employed shall be periodically checked (with traceability to a nationally recognized standard) to ensure that the device remains within the required accuracy specified in 6.4.

6.5 *Pressure Source,* clean, dry compressed gas or other suitable compressed air capable of providing pressure for calibration of the transducer and cleaning of the cell.

NOTE 2—A vacuum source is an alternate means for cleaning of the cell.

7. Reagents and Materials

7.1 *Purity of Reagents*—Use chemicals of at least 99 % purity for quality control checks (see Section 11). Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available.[5] Lower purities can be used, provided it is first ascertained that the reagent is of sufficient purity to permit its use without lessening the accuracy of the determination.

7.2 *Cyclohexane,* (**Warning—**Cyclohexane is flammable and a health hazard).

7.3 *Cyclopentane,* (**Warning—**Cyclopentane is flammable and a health hazard).

7.4 *2,2-Dimethylbutane,* (**Warning—**2,2-dimethylbutane is flammable and a health hazard).

[4] The following instruments have been found satisfactory for use in this test procedure as determined by interlaboratory testing: Herzog Mini Reid Vapor Pressure Model MP970—available from Varlen Instruments, Inc., 2777 Washington Blvd., Bellwood, IL 60104 and ABB Model 4100—available from ABB Process Analytics, Lewisburg, WV. 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.

[5] *Reagent Chemicals, American Chemical Society Specifications*, American Chemical Society, Washington, DC. For Suggestions on the testing of reagents not listed by the American Chemical Society, see *Annual Standards for Laboratory Chemicals,* BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary,* U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.