



Designation: D 1747 – 99

An American National Standard

Standard Test Method for Refractive Index of Viscous Materials¹

This standard is issued under the fixed designation D 1747; 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 measurement of refractive indexes, accurate to two units in the fourth decimal place, of transparent and light-colored viscous hydrocarbon liquids and melted solids which have refractive indexes in the range between 1.33 and 1.60, and at temperatures from 80 to 100°C. Temperatures lower than 80°C can be used provided that the melting point of the sample is at least 10°C below the test temperature.

1.2 This test method is not applicable, within the accuracy stated, to liquids having colors darker than ASTM Color No. 4 ASTM color as determined by Test Method D 1500, to liquids which smoke or vaporize readily at the test temperature, or to solids melting within 10°C of the test temperature.

NOTE 1—The instrument can be successfully used for refractive indices above 1.60; but since certified liquid standards for ranges above 1.60 are not yet available, the accuracy of measurement under these conditions has not been evaluated.

1.3 The values stated in SI units are to be regarded as standard. The values stated in inch-pound units are for information only.

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 hazards, see Note 4, Note 5, and Note 6.*

2. Referenced Documents

2.1 ASTM Standards:

D 362 Specification for Industrial Grade Toluene²

D 841 Specification for Nitration Grade Toluene³

D 1218 Test Method for Refractive Index and Refractive Dispersion of Hydrocarbon Liquids⁴

¹ This test method is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.04.00 on Physical Methods.

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² Discontinued—See 1988 *Annual Book of ASTM Standards*, Vol 06.03.

³ *Annual Book of ASTM Standards*, Vol 06.04.

⁴ *Annual Book of ASTM Standards*, Vol 05.01.

D 1500 Test Method for ASTM Color of Petroleum Products (ASTM Color Scale)⁴

E 1 Specification for ASTM Thermometers⁵

3. Terminology

3.1 Definition:

3.1.1 *refractive index*—the ratio of the velocity of light (of specified wavelength) in air, to its velocity in the substance under examination. The relative index of refraction is defined as the sine of the angle of incidence divided by the sine of the angle of refraction, as light passes from air into the substance. If absolute refractive index (that is, referred to vacuum) is desired, this value should be multiplied by the factor 1.00027, the absolute refractive index of air. The numerical value of refractive index of liquids varies inversely with both wavelength and temperature.

4. Summary of Test Method

4.1 The refractive index normally is measured by the critical angle method using monochromatic light from a sodium lamp. The instrument is previously adjusted by means of calibration obtained with certified liquid standards.

5. Significance and Use

5.1 Refractive index is a fundamental physical property that can be used in conjunction with other properties to characterize pure hydrocarbons and their mixtures.

5.2 The use of refractive index in correlative methods for the determination of the gross composition of viscous oils and waxes often requires its measurement at elevated temperatures.

6. Apparatus

6.1 *Refractometer*, precision Abbé-type,⁶ having a range in refractive index from 1.30 to 1.63. Other instruments reading to at least four decimal places may be used..

NOTE 2—When other instruments are used, follow the manufacturer's instructions for operation, maintenance, calibration, and analysis. For accepting the instrumentation for use, analysis of a NIST traceable

⁵ *Annual Book of ASTM Standards*, Vol 14.03.

⁶ The Abbé-type precision refractometer is no longer available but may be obtainable from instrument exchanges or used equipment suppliers. Other precision refractometers may be suitable, but they have not as yet been tested cooperatively.