



Standard Test Method for Needle Penetration of Petroleum Waxes¹

This standard is issued under the fixed designation D 1321; 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 empirical estimation of the consistency of waxes derived from petroleum by measurement of the extent of penetration of a standard needle. This test method is applicable to waxes having a penetration of not greater than 250.

NOTE 1—This test method is similar to the needle method for determining the penetration of bituminous material, Test Method D 5. Cone methods applicable to greases and to petrolatum are described in Test Methods D 217 and Test Method D 937, respectively.

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

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.*

2. Referenced Documents

- 2.1 *ASTM Standards:*
 - D 5 Test Method for Penetration of Bituminous Materials²
 - D 217 Test Methods for Cone Penetration of Lubricating Grease³
 - D 937 Test Method for Cone Penetration of Petrolatum³
 - D 938 Test Method for Congealing Point of Petroleum Waxes, Including Petrolatum³
 - E 1 Specification for ASTM Thermometers⁴

3. Terminology

3.1 Definitions:

3.1.1 *penetration, n, of petroleum wax*—the depth in tenths of a millimetre to which a standard needle penetrates into the wax under defined conditions.

3.1.2 *penetrometer, n*—an instrument that measures the consistency or hardness of semiliquid to semisolid materials by

measuring the depth to which a specified cone or needle under a given force falls into the material.

3.1.2.1 *Discussion*—In this test method, a standard penetrometer needle (6.3) is used to determine the hardness of petroleum wax. The penetration force is determined by the total mass (100 g) of the needle, plunger, and 50 g weight.

4. Summary of Test Method

4.1 The sample is melted, heated to 17°C (30°F) above its congealing point, poured into a container, and then air cooled under controlled conditions. The sample then is conditioned at test temperature in a water bath. Penetration is measured with a penetrometer, which applies a standard needle to the sample for 5 s under a load of 100 g.

5. Significance and Use

5.1 Petroleum waxes differ in hardness. Needle penetration is a measurement of hardness. Hardness may have a significant effect upon other physical properties.

6. Apparatus

6.1 *Penetrometer*, for applying the standard needle to the surface of the sample specimen and for measuring the extent of penetration at the conclusion of the test. The penetrometer shall be constructed in such a manner that the accurate placement of the tip of the needle at the level surface of the specimen may be made while maintaining a “zero” reading on the indicator. The apparatus shown in Fig. 1 represents a composite drawing illustrating the two available types of instrument, one with an adjustable table and the other with an adjustable needle assembly; the use of either type instrument is permissible. The loaded needle must fall, when released, without appreciable friction. The instrument shall be provided with leveling screws and a spirit level to maintain the plunger shaft in a true vertical position. The indicator scale shall be calibrated in tenths of a millimetre divisions and shall have a range of at least 250 tenths of millimetres.

6.2 *Timing Device*—An automatic timing release mechanism attached to the penetrometer may be used. Alternatively, a stop watch graduated in 0.1-s intervals may be used.

6.3 *Needle and Plunger*—The needle shall be approximately 83 mm in length and conform to the dimensions shown in Fig. 2. It shall be symmetrically tapered at one end to a cone whose angle shall be within the range from 8° 55 min to 9° 25

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 D02.10 on Petroleum Wax.

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² *Annual Book of ASTM Standards*, Vol 04.03.

³ *Annual Book of ASTM Standards*, Vol 05.01.

⁴ *Annual Book of ASTM Standards*, Vol 14.03.