



Standard Test Method for Penetration of Bituminous Materials¹

This standard is issued under the fixed designation D 5; 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 determination of the penetration of semi-solid and solid bituminous materials.

1.2 The needles, containers and other conditions described in this test method provide for the determinations of penetrations up to 500.

1.3 The values stated in SI units are to be considered 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

C 670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials²

D 36 Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)³

E 1 Specification for ASTM Thermometers⁴

E 77 Test Method for Inspection and Verification of Liquid-in-Glass Thermometers⁴

2.2 ANSI Standard:

B46.1 Surface Texture⁵

2.3 ISO Standard:

ISO Standard 468 Surface Roughness—Parameters, Their Values and General Rules for Specifying Requirements⁵

3. Terminology

3.1 Definitions:

3.1.1 *penetration, n*—consistency of a bituminous material expressed as the distance in tenths of a millimeter that a standard needle vertically penetrates a sample of the material under known conditions of loading, time, and temperature.

¹ This test method is under the jurisdiction of ASTM Committee D-4 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.44 on Rheological Tests.

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² *Annual Book of ASTM Standards*, Vol 04.02.

³ *Annual Book of ASTM Standards*, Vol 04.04.

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

⁵ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

TABLE 1 Precision Criteria

Material	Standard Deviation or Coefficient of Variation (Is) or (Is %)	Acceptable Range of Two Test Results (d2s) or (d2s %)
Single-operator precision:		
Asphalts at 77°F (25°C) below 50 penetration, units	0.35	1
Asphalts at 77°F (25°C) 60 penetration and above, percent of their mean	1.4	4
Tar pitches at 77°F (25°C) ^A percent of their mean	5.2	15
Multilaboratory precision:		
Asphalts at 77°F (25°C) below 50 penetration, units	1.4	4
Asphalts at 77°F (25°C) 60 penetration and above, percent of their mean	3.8	11
Tar pitches at 77°F (25°C) ^A units	1.4	4

^AEstimates of precision for tar pitches are based on results from 2 pitches with penetration of 7 and 24. Estimates may not be applicable to appreciably harder or softer materials.

4. Summary of Test Method

4.1 The sample is melted and cooled under controlled conditions. The penetration is measured with a penetrometer by means of which a standard needle is applied to the sample under specific conditions.

5. Significance and Use

5.1 The penetration test is used as a measure of consistency. Higher values of penetration indicate softer consistency.

6. Apparatus

6.1 *Penetration Apparatus*—Any apparatus that permits the needle holder (spindle) to move vertically without measurable friction and is capable of indicating the depth of penetration to the nearest 0.1 mm, will be acceptable. The weight of the spindle shall be 47.5 ± 0.05 g. The total weight of the needle and spindle assembly shall be 50.0 ± 0.05 g. Weights of 50 ± 0.05 g and 100 ± 0.05 g shall also be provided for total loads of 100 g and 200 g, as required for some conditions of the test. The surface on which the sample container rests shall be flat and the axis of the plunger shall be at approximately 90° to this surface. The spindle shall be easily detached for checking its weight.

6.2 Penetration Needle:

6.2.1 The needle (see Fig. 1) shall be made from fully hardened and tempered stainless steel, Grade 440-C or equal,