



Standard Specification for Asphalt Used in Roofing Measured by Dynamic Shear Rheometer¹

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1. Scope

1.1 This specification covers two types of asphalt intended for use in built-up roof construction, construction of some modified bitumen systems, construction of bituminous vapor retarder systems, and for adhering insulation boards used in various types of roof systems. The specification is intended for general classification purposes only and does not imply restrictions on the slope at which an asphalt must be used.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

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:²

D5 Test Method for Penetration of Bituminous Materials
D92 Test Method for Flash and Fire Points by Cleveland Open Cup Tester
D140 Practice for Sampling Bituminous Materials
D1079 Terminology Relating to Roofing and Waterproofing
D2042 Test Method for Solubility of Asphalt Materials in Trichloroethylene
D6510 Guide for Selection of Asphalt Used in Built-Up Roofing Systems
D7175 Test Method for Determining the Rheological Prop-

¹ This specification is under the jurisdiction of ASTM Committee D08 on Roofing and Waterproofing and is the direct responsibility of Subcommittee D08.03 on Surfacing and Bituminous Materials for Membrane Waterproofing and Built-up Roofing.

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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.

Properties of Asphalt Binder Using a Dynamic Shear Rheometer

3. Terminology

3.1 For definition of terms used in this specification, refer to Terminology D1079.

3.2 Definitions:

3.3 Viscosity, Eta^* @ 70°C [158°F], Pa.s

3.3.1 *Definition:* $\text{Eta}^* = G^* / \text{Angular Velocity}$. Complex dynamic shear viscosity is the ratio of the complex shear modulus (G^*) divided by the rate of shear in radians/second. In the SI, the unit of viscosity is in the pascal second (Pa.s).

4. Classification

4.1 Materials covered by this specification are of two types:

4.1.1 Type III (VG).

4.1.2 Type IV (VG).

5. Materials and Manufacture

5.1 The asphalt shall be prepared from crude petroleum.

6. Physical Properties

6.1 Asphalts shall be homogeneous and free of water.

6.2 Asphalts of each type must conform to the physical properties described in Table 1.

7. Sampling

7.1 Sample the material and determine the properties enumerated in this specification in accordance with the following methods:

7.1.1 *Sampling*—Practice D140.

7.1.2 *Flash Point*—Test Method D92.

7.1.3 *Penetration*—Test Method D5.

7.1.4 *Solubility*—Test Method D2042.

7.1.5 *Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer*—Test Method D7175.

7.1.5.1 *Handling Protocol:*

(1) Heat samples to $190 \pm 5^\circ\text{C}$ [$375 \pm 10^\circ\text{F}$] for preparing test specimen.

(2) Hold samples under heat for a period of not more than 1.5 h.

TABLE 1 Physical Properties of Asphalt in Roofing

Property	Type III (VG)		Type IV (VG)	
	Min	Max	Min	Max
Viscosity @ 70°C [158°F], Pa. s	6700		13 000	
Flash Point, °C [°F]	260 (500)		260 (500)	
Penetration, units:				
@ 0°C [32°F]	6		6	
@ 25°C [77°F]	15	35	12	25
@ 46°C [115°F]		90		75
Solubility in Trichloroethylene, %	99		99	

(3) Pour samples on plate to equilibrate at test temperature for 5 ± 0.5 min.

(4) Test shall begin no later than 10 min after sample reaches thermal equilibrium (Test Method **D7175**, Appendix X4)

7.1.5.2 Testing Protocol:

(1) Test samples at 70°C [158°F].

(2) Plate Size = 25 mm.

(3) Strain = 1 %.

(4) Gap = 2 mm.

(5) Frequency = 1.59 Hz.

8. Precision and Bias

8.1 The precision of this test method is based on an interlaboratory study conducted in 2007.³ Results in this study were obtained from five laboratories, testing the viscosity of 16 different asphalt materials at three different temperatures. Every “test result” reported represents an individual determination. Each participating laboratory was asked to report three replicate test results for every material.

8.2 *Repeatability*—Two test results obtained within one laboratory shall be judged not equivalent if they differ by more than the “*r*” value for that material; “*r*” is the interval representing the critical difference between two test results for the same material, obtained by the same operator using the same equipment on the same day in the same laboratory.

8.3 *Reproducibility*—Two test results shall be judged not equivalent if they differ by more than the “*R*” value for that material; “*R*” is the interval representing the difference between two test results for the same material, obtained by different operators using different equipment in different laboratories.

³ Supporting data are available from ASTM International Headquarters. Request RR: D08–1016.

8.4 Any judgment in accordance with statements 8.2 and 8.3 would normally have an approximate 95 % probability of being correct, however the precision statistics obtained in this ILS must not be treated as exact mathematical quantities which are applicable to all circumstances and uses. The small number of materials tested, and laboratories reporting results, guarantees that there will be times when differences greater than predicted by the ILS results will arise, sometimes with considerably greater or smaller frequency than the 95 % probability limit would imply. The repeatability limit and the reproducibility limit should be considered as general guides, and the associated probability of 95 % as only a rough indicator of what can be expected. See **Table 2**.

8.5 *Bias*—At the time of the study, there was no accepted reference material suitable for determining the bias for this test method, therefore no statement on bias is being made.

8.6 The precision statement was determined through statistical examination of 479 results, from five laboratories, on 16 asphalt samples at three temperatures. Identifiable outlier data were excluded from the final calculations.

9. Inspection

9.1 Inspection of the material shall be agreed upon between the purchaser and seller as part of the purchase contract.

10. Rejection and Rehearing

10.1 Failure to conform to any of the requirements prescribed in this specification shall constitute grounds for rejection. In case of rejection, the seller shall have the right to reinspect the rejected material and resubmit the lot after removal of those packages not conforming to the requirements.

11. Packaging and Package Marking

11.1 Asphalt shall be suitably packaged (if not shipped in bulk) to permit acceptance by the carrier and to afford adequate protection from the normal hazards of handling and shipment.

11.2 Each container or bill of lading on bulk shipments shall be plainly marked with the name of the manufacturer or seller and the ASTM designation and type of product, flash point and the equiviscous temperature (EVT) for mop and for mechanical spreader application.

12. Keywords

12.1 asphalt; built-up roof; dynamic shear rheometer (DSR); roofing; viscosity



TABLE 2 Data for Viscosity at 70°C

Asphalt	Average	Repeatability Standard Deviation	Reproducibility Standard Deviation	Repeatability Limit	Reproducibility Limit
	\bar{x}	s_r	s_R	r	R
Source I	3210	123	257	345	719
Type III low					
Source I	6123	153	1049	429	2936
Type III high					
Source I	10 351	376	1327	1052	3715
Type IV low					
Source I	18 159	972	2557	2721	7160
Type IV high					
Source II	3387	74	126	208	354
Type III low					
Source II	6890	299	1613	837	4517
Type III high					
Source II	14 298	684	3033	1915	8492
Type IV low					
Source II	23 180	993	4156	2781	11 636
Type IV high					
Source III	3060	99	297	276	831
Type III low					
Source III	7923	257	1542	721	4317
Type III high					
Source III	15 884	1008	2462	2822	6894
Type IV low					
Source III	24 395	939	2745	2630	7686
Type IV high					
Source IV	2402	106	323	295	903
Type III low					
Source IV	4225	210	650	589	1819
Type III high					
Source IV	12 427	684	4025	1916	11 269
Type IV low					
Source IV	17 226	688	4567	1927	12 787
Type IV high					

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