



Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction¹

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This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers asphalt cements graded by viscosity at 60°C [140°F] for use in pavement construction. Four sets of limits are offered in this specification. The purchaser shall specify the applicable table of limits. In the event the purchaser does not specify limits, **Table 1** shall apply. For asphalt cements graded by penetration at 25°C [77°F]. See Specification **D946**. If needed, volume corrections for asphalt cements should be made according to Practice **D4311**.

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.

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
- D36** Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)
- D70** Test Method for Density of Semi-Solid Bituminous Materials (Pycnometer Method)
- D95** Test Method for Water in Petroleum Products and Bituminous Materials by Distillation
- D113** Test Method for Ductility of Bituminous Materials
- D140** Practice for Sampling Bituminous Materials
- D946** Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction

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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.

- D1754** Test Method for Effects of Heat and Air on Asphaltic Materials (Thin-Film Oven Test)
- D2042** Test Method for Solubility of Asphalt Materials in Trichloroethylene
- D2170** Test Method for Kinematic Viscosity of Asphalts (Bitumens)
- D2171** Test Method for Viscosity of Asphalts by Vacuum Capillary Viscometer
- D2872** Test Method for Effect of Heat and Air on a Moving Film of Asphalt (Rolling Thin-Film Oven Test)
- D4311** Practice for Determining Asphalt Volume Correction to a Base Temperature
- D7553** Test Method for Solubility of Asphalt Materials in N-Propyl Bromide

3. Manufacture

3.1 The asphalt cement shall be prepared from crude petroleum by suitable methods.

4. Physical Requirements

4.1 The asphalt cement shall be homogeneous, free from water, and shall not foam when heated to 177°C [350°F].

4.2 The asphalt cements shall conform to the requirements given in **Table 1**, **Table 2**, **Table 3**, or **Table 4**, as specified by the purchaser.

5. Methods of Sampling and Testing

5.1 Sample and test asphalt cements in accordance with the following methods:

- 5.1.1 *Sampling*—Practice **D140**.
- 5.1.2 *Water*—Test Method **D95**.
- 5.1.3 *Viscosity at 60°C [140°F]*—Test Method **D2171**.
- 5.1.4 *Viscosity at 135°C [275°F]*—Test Method **D2170**.
- 5.1.5 *Penetration*—Test Method **D5**.
- 5.1.6 *Flash Point, Cleveland Open Cup*—Test Method **D92**.
- 5.1.7 *Solubility in Trichloroethylene*—Test Method **D2042**.
- 5.1.8 *Thin-Film Oven Test*—Test Method **D1754** (see **Table 1** and **Table 2**).
- 5.1.9 *Rolling Thin-Film Oven Test*—Test Method **D2872** (see **Table 3** and **Table 4**).
- 5.1.10 *Ductility*—Test Method **D113**.

**TABLE 1 Requirements for Asphalt Cement, Viscosity Graded at 60°C [140°F] Based on Original Asphalt**

Test	Viscosity Grade					
	AC-2.5	AC-5	AC-10	AC-20	AC-30	AC-40
Viscosity, 60°C [140°F], Pa·s	25 ± 5	50 ± 10	100 ± 20	200 ± 40	300 ± 60	400 ± 80
Viscosity, 135°C [275°F], min, mm ² /s	80	110	150	210	250	300
Penetration, 25°C [77°F], 100 g, 5 s, min	200	120	70	40	30	20
Flash point, Cleveland open cup, min, °C [°F]	165 [325]	175 [350]	220 [425]	230 [450]	230 [450]	230 [450]
Solubility in trichloroethylene, ^A min, %	99.0	99.0	99.0	99.0	99.0	99.0
Tests on residue from thin-film oven test:						
Viscosity, 60°C [140°F], max, Pa·s	125	250	500	1000	1500	2000
Ductility, 25°C [77°F], 5 cm/min, min, cm	100 ^B	100	50	20	15	10

^ASolubility in N-Propyl Bromide can be an alternate method to Solubility in TCE.

^BIf ductility is less than 100, material will be accepted if ductility at 15°C [60°F] is 100 minimum at a pull rate of 5 cm/min.

TABLE 2 Requirements for Asphalt Cement Viscosity Graded at 60°C [140°F] Based on Original Asphalt

NOTE 1—Table 2 specifies asphalts that are less temperature susceptible than those specified by Table 1. Asphalts that meet Table 2 requirements will also meet Table 1 requirements of the same grade.

Test	Viscosity Grade					
	AC-2.5	AC-5	AC-10	AC-20	AC-30	AC-40
Viscosity, 60°C [140°F], Pa·s	25 ± 5	50 ± 10	100 ± 20	200 ± 40	300 ± 60	400 ± 80
Viscosity, 135°C [275°F], min, mm ² /s	125	175	250	300	350	400
Penetration, 25°C [77°F], 100 g, 5 s, min	220	140	80	60	50	40
Flash point, Cleveland open cup, min, °C [°F]	165 [325]	175 [350]	220 [425]	230 [450]	230 [450]	230 [450]
Solubility in trichloroethylene, ^A min, %	99.0	99.0	99.0	99.0	99.0	99.0
Tests on residue from thin-film oven test:						
Viscosity, 60°C [140°F], max, Pa·s	125	250	500	1000	1500	2000
Ductility ^B , 25°C [77°F], 5 cm/min, min, cm	100 ^B	100	75	50	40	25

^ASolubility in N-Propyl Bromide can be an alternate method to Solubility in TCE.

^BIf ductility is less than 100, material will be accepted if ductility at 15°C [60°F] is 100 minimum at a pull rate of 5 cm/min.

TABLE 3 Requirements for Asphalt Cement Viscosity Graded at 60°C [140°F] Based on Residue from Rolling Thin-Film Oven Test

Tests on Residue from Rolling Thin-Film Oven Test: ^A	Viscosity Grade				
	AR-1000	AR-2000	AR-4000	AR-8000	AR-16000
Viscosity, 60°C [140°F], Pa·s	100 ± 25	200 ± 50	400 ± 100	800 ± 200	1600 ± 400
Viscosity, 135°C [275°F], min, mm ² /s	140	200	275	400	550
Penetration, 25°C [77°F], 100 g, 5 s, min	65	40	25	20	20
% of original penetration, 25°C [77°F], min	...	40	45	50	52
Ductility, 25°C [77°F], 5 cm/min, min, cm	100 ^B	100 ^B	75	75	75
Tests on original asphalt:					
Flash point, Cleveland open cup, min, °C [°F]	205 [400]	220 [425]	225 [440]	230 [450]	240 [460]
Solubility in trichloroethylene, ^C min, %	99.0	99.0	99.0	99.0	99.0

^AThin-film oven test may be used but the rolling thin-film oven test shall be the referee method.

^BIf ductility is less than 100, material will be accepted if ductility at 15°C [60°F] is 100 minimum at a pull rate of 5 cm/min.

^CSolubility in N-Propyl Bromide can be an alternate method to Solubility in TCE..

5.1.11 *Softening point*—Test Method **D36**.

5.1.12 *Density*—Test Method **D70**.

5.1.13 *Solubility in N-propyl Bromide*—Test Method **D7553**.

6. Keywords

6.1 asphalt cements; bitumen; pavements; viscosity

**TABLE 4 Requirements for Asphalt Cement Viscosity Graded at 60°C [140°F] Based on Original Asphalt**

NOTE 1—Table 4 shows the limits typically used in Mexico, Central, and South America

Test	Viscosity Grade				
	AC-6	AC-10	AC-20	AC-30	AC-42
Viscosity, 60°C [140°F], P	600 ± 200	1000 ± 200	2000 ± 400	3000 ± 600	4200 ± 600
Viscosity, 135°C [275°F], min, cSt	175	250	300	350	400
Flash point, Cleveland open cup, min, °C [° F]	177 [350]	219 [425]	232 [450]	232 [450]	232 [450]
Solubility in trichloroethylene, ^c min, %	99.0	99.0	99.0	99.0	99.0
Specific gravity 25°C/25°C [77°F/77°F]	Report	Report	Report	Report	Report
Penetration index ^B	-1.5 to +1	-1.5 to +1	-1.5 to +1	-1.5 to +1	-1.5 to +1
Tests on residue from rolling thin-film oven test:					
Mass Change, %w/w max	1.5	1.0	1.0	1.0	1.0
Viscosity, 60°C [140°F], max, P	3000	5000	8000	12000	20000
Ductility ^A , 25°C [77°F], 5 cm/min, min, cm	100	75	50	40	25

^AIf ductility is less than 100, material will be accepted if ductility at 15.5°C [60°F] is 100 minimum at a pull rate of 5 cm/min.

$$^B \text{Penetration Index} = \frac{1952 - 500 \log \text{pen} - 20SP}{50 \log \text{pen} - SP - 120}$$

where:

 pen = penetration at 25°C [77 °F], 100g, 5s SP = softening point (°C)^c Solubility in N-Propyl Bromide can be an alternate method to Solubility in TCE..

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