

APPENDIX A

Tables of Viscosity Tests and Specifications

Table A.1: Required Tests for Asphalt Cement in Paving Construction:

Test	Test Method		Asphalt Cement Spec.	
			AASHTO M226	AASHTO M20
	AASHTO	ASTM	Visc. grade	Pen. grade
Viscosity at 60 °C(140°F)	T202	D2171	×
Viscosity at 135°C (275°F)	T201	D2170	×
Penetration	T49	D5	×	×
Flash Point(C.O.C)	T48	D92	×	×
Thin Film Oven Test	T179	D1754	×	×
Rolling Thin Film Oven Test	T240	D2872	×
Ductility	T5	D113	×	×
Solubility in Trichloroethylene	T44	D2042	×	×
Spot Test	T102	×	×
Water	T55	D95	×	×

1. AASHTO M226 and ASTM D3381 have 3 tables of specification limits. The first two are based on original asphalt while Table3 is based on residue from rolling thin film oven test.
2. AASHTO optional test requirement.

Table A-2: Requirement for Asphalt Binder Standard Specification for

Penetration-Graded Asphalt Cement AASHTO Designation: M 20-70 (2004)

	Penetration Grade									
	40 - 50		60 - 70		85 - 100		120 - 50		200 - 300	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Penetration at 25°C(70°F),100g ,5 s	40	50	60	70	85	100	120	150	200	300
Flash ,Cleveland Open Cup , °C (°F)	232 (450)	-	232 (450)	-	232 (450)	-	218 (425)	-	177 (350)	-
Ductility at 25°C(77°F),5 cm/min ,cm	100	-	100	-	100	-	100	-	-	-
Solubility in trichloroethylene, percent	99.0	-	99.0	-	99.0	-	99.0	-	99.0	-
Thin-film oven test , 3.2mm(1/8 in) 163°C(325°F), 5 hours										
Loss on heating ,percent	-	0.8	-	0.8	-	1.0	-	1.3	-	1.5
Penetration of residue ,percent of original	58	-	54	-	50	-	46	-	40	-
Ductility of residue 25°C(77°F), 5 cm/min ,cm	-	-	50	-	75	-	100	-	100	-
Spot test (when and specified with) standard naphtha solvent										Negative for all grades
Naphtha-xylene solvent ,percent ,xylene										Negative for all grades
Heptane -xylene solvent ,percent ,xylene										Negative for all grades

According to AASHTO 2008-2009 This specification has been discontinued.

Table A-3: Requirements for Asphalt Binder Graded by Viscosity at 60°C (140°F)
(Grading Based on Original Asphalt) AASHTO Designation: M226-80(2004)

Test	AC - 2.5	AC - 5	AC - 10	AC - 20	AC - 40
Viscosity 60°C(140°F),Pa's (Poises)	25±5 (250±50)	50±10 (500±100)	100±20 (1000±200)	200±40 (2000±400)	400±80 (4000±800)
Viscosity 135°C(275°F) , mm ² /s minimum cst	80	100	150	210	300
Penetration at 25°C(77°F), 100g ,5 s minimum	200	120	70	40	20
Flash Point, COC, C ° (F°) - minimum	163(325)	177(350)	219(425)	232(450)	232(450)
Solubility in trichloroethylene, percent- minimum	99.0	99.0	99.0	99.0	99.0
Tests on residue from thin-film oven test :					
Viscosity 60°C(140°F) ,Pa's(Poises), maximum	100(1000)	200(2000)	400(4000)	800(8000)	1600(16000)
Ductility ,25°C(77°F), 5 cm/min ,cm	100 ^a	100	50	20	10
Spot test (when and specified) ^b with :					
Standard naphtha solvent	Negative for all grades				
Naphtha - xylene solvent ,percent ,xylene	Negative for all grades				
Heptane - xylene solvent ,percent ,xylene	Negative for all grades				

^a if ductility is less than 100 cm, material will be accepted if ductility at 15.6 °C (60°F) is 100 cm minimum.

^b The use of the spot test is optional, When it is specified, the engineer shall indicate whether the standard naphtha solvent, the naphtha – xylene solvent, or the heptane-xylene solvent will be used in determining compliance with the requirement, and also, in the case of xylene solvents, the percentage of xylene to be used.

Table A- 4: Requirements for Asphalt Binder Graded by Viscosity at 60°C (140°F) (Grading Based on Original Asphalt)

Test	AC - 2.5	AC - 5	AC - 10	AC - 20	AC- 40	AC- 40
Viscosity 60°C(140°F),Pa's (Poises)	25±5 (250±50)	50±10 (500±100)	100±20 (1000±200)	200±40 (2000±400)	300±60 (3000±600)	400±80 (4000±800)
Viscosity 135°C(275°F) , mm ² /s minimum	125	175	250	300	350	400
Penetration at 25°C(77°F), 100g ,5 s minimum	220	140	80	60	50	40
Flash Point, COC, C ° (F°) - minimum	163(325)	177(350)	219(425)	232(450)	232(450)	232(450)
Solubility in trichloroethylene, percent- minimum	99.0	99.0	99.0	99.0	99.0	99.0
Tests on residue from thin-film oven test :						
Loss on heating percent – maximum ^a	-	1.0	0.5	0.5	0.5	0.5
Viscosity 60°C(140°F) ,Pa's(Poises), maximum	100(1000)	200(2000)	400(4000)	800(8000)	1200(12000)	1600(16000)
Ductility ,25°C(77°F), 5 cm/min ,cm	100 ^b	100	75	50	40	25
Spot test (when and specified with) ^c :						
Standard naphtha solvent	Negative for all grades					

Naphtha - xylene solvent ,percent ,xylene	Negative for all grades
Heptane - xylene solvent ,percent ,xylene	Negative for all grades

^a the use of loss on heating requirement is optional.

^b if ductility is less than 100m, material will be accepted if ductility at 15.6 °C (60°F) is 100 cm minimum.

^c The use of the spot test is optional, When it is specified, the engineer shall indicate whether the standard naphtha solvent, the naphtha – xylene solvent, or the heptane-xylene solvent will be used in determining compliance with the requirement, and also, in the case of xylene solvents, the percentage of xylene to be used.

Table A-5: Requirements for Asphalt Binder Graded by Viscosity at 60°C (140°F)
(Grading Based on Residue from Rolling Thin-Film Oven Test)

Test On Residue from AASHTO Test Method T 240 ^a	AR - 10	AR - 20	AR - 40	AR - 80	AR - 160
Viscosity 60°C(140°F),Pa's (Poises)	100±25 (1000±250)	200±50 (2000±500)	400±100 (4000±1000)	800±200 (8000±2000)	1600±400 (16000±4000)
Viscosity 135°C(275°F) , mm ² /s – minimum cst	140	200	275	400	550
Penetration at 25°C(77°F), 100g ,5 s -minimum	65	40	25	20	20
Percent of original pen., 25°C(77°F)- minimum	-	40	45	50	52
Ductility ,25°C(77°F), 5 cm/min ,cm- minimum	100 ^b	100 ^b	75	50	40
Test of original asphalt :					

Flash point, COC, C ^o (F ^o) -minimum	205(400)	219(425)	227(440)	232(450)	238(460)
Solubility in trichloroethylene, percent - minimum	99.0	99.0	99.0	99.0	99.0

^a AASHTO T 179 (Thin –Film Oven Test) may be used, but AASHTO T 240 shall be the referee method.

^b if ductility is less than 100cm, material will be accepted if ductility at 15.6 °C (60°F) is 100 cm minimum.