

04005 Bituminous Binder**Index**

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04005-1 General**1.1 Description**

These Specifications apply to the manufacture of asphalt binders to be used for the construction of asphalt pavements and ancillary work. The types and grades of asphalt to which this Specification will apply shall be those indicated under execution.

1.2 Definitions**1.2.1 Bitumen**

A class of black or dark coloured (solid, semisolid, or viscous) cementitious substance, natural or manufactured, composed principally of high molecular weight hydrocarbons, of which asphalts, tars, pitches, and asphaltites are typical.

1.2.2 Asphalt

A dark brown to black cementitious material in which the predominating constituents are bitumens which occur in nature or are obtained in petroleum processing.

1.2.3 Asphalt Cement

A fluxed or unfluxed asphalt specifically prepared as to quality and consistency for direct use in the manufacture of bituminous pavements, and having a penetration at 25°C (77°F) of between 5 and 300, under a load of 100 g applied for 5 seconds.

1.2.4 Cut-Back Products

Petroleum or tar residuums which have been blended with distillates. Also referred to as liquid asphalts.

1.2.5 Bituminous Emulsion

1. a suspension of minute globules of bituminous material in water or in an aqueous solution.
2. a suspension of minute globules of water or of an aqueous solution in a liquid bituminous material.

1.2.6 Performance Graded Asphalt Binders

Asphalt binder grade designation used in Superpave. It is based on the binder's mechanical performance at critical temperatures and aging conditions.

1.2.7 Polymer Modified Asphalt

Conventional asphalt cement to which one or more polymer compounds have been added to improve resistance to deformation at high pavement temperatures and often cracking resistance at low temperatures.

04005-2 Materials

All asphalt binders shall be prepared from petroleum oils. They shall be free from water and other impurities and shall not foam when heated to 175°C. Solvents used in the manufacture of cut-back asphalts shall be derived from petroleum oils. Emulsifiers used to stabilize asphalt emulsions shall not be harmful to the performance of the asphalt in service.

04005-3 Execution**3.1 General**

The refining process shall be selected by the supplier provided that the resulting product conforms to all applicable requirements of this Specification when tested in accordance with methods shown.

3.2 Asphalt Cements**3.2.1 Asphalt Cements - Neat**

All grades of this type of asphalt shall conform to requirements listed in Table 1, Table 2, and Figure 1, and shall be homogenous and uniform in character throughout.

Table 1: Asphalt Cement Grade Requirements

Requirements	ASTM Test Method	Asphalt Cement Grade					
		150- 200(A)	200- 300(A)	300- 400(A)	400- 500(A)	200- 300(B)	300- 400(B)
Visc.@60°C,Pa.s	D2171	(1)	(1)	(1)	(1)	(1)	(1)
Penetration @ 25°C,100g 5s	D5	(1)	(1)	(1)	(1)	(1)	(1)
Ductility @15°C, 5cm/ min, minimum cm	D113	-	100	100	-	100	-
Ductility @25°C(3)	D113	100	-	-	-	-	-
Flashpoint (COC),°C	D92	205	175	175	175	175	175
Solubility in Trichloroethylene min %	D2042	99.5	99.5	99.5	99.5	99.5	99.5
Thin Film Oven Test Weight Loss, Maximum %	D1754	1.0	1.5	2.0	2.5	1.5	2.0
Penetration at 25°C of minimum % or original	D5	50	45	-	-	45	-
Viscosity @60°C of residue Maximum % of original	D2171	-	-	300	400	-	300

Note:

1. Viscosity @60°C and Penetration @25°C shall fall within the area described in Figure 1.

Table 2: Asphalt Cement Viscosity and Penetration Requirements

Asphalt Cement Grade	Point	Absolute Viscosity	Pen
150-200A	A	155	150
	B	78	150
	C	50	200
	D	92	200
200-300A	C	50	200
	D	92	200
	E	45	300
	F	26.5	300
300-400A	E	45	300
	F	26.5	300
	G	17	400
	H	27	400
400-500A	H	27	400
	G	17	400
	M	12.5	500
	I	19	500
200-300B	C	50	200
	J	30	200
	K	17.5	300
	F	26.5	300
300-400B	F	26.5	300
	K	17.5	300
	L	12	400
	G	17	400

Viscosity & Penetration shall be within graphic regions described by the lettered coordinates

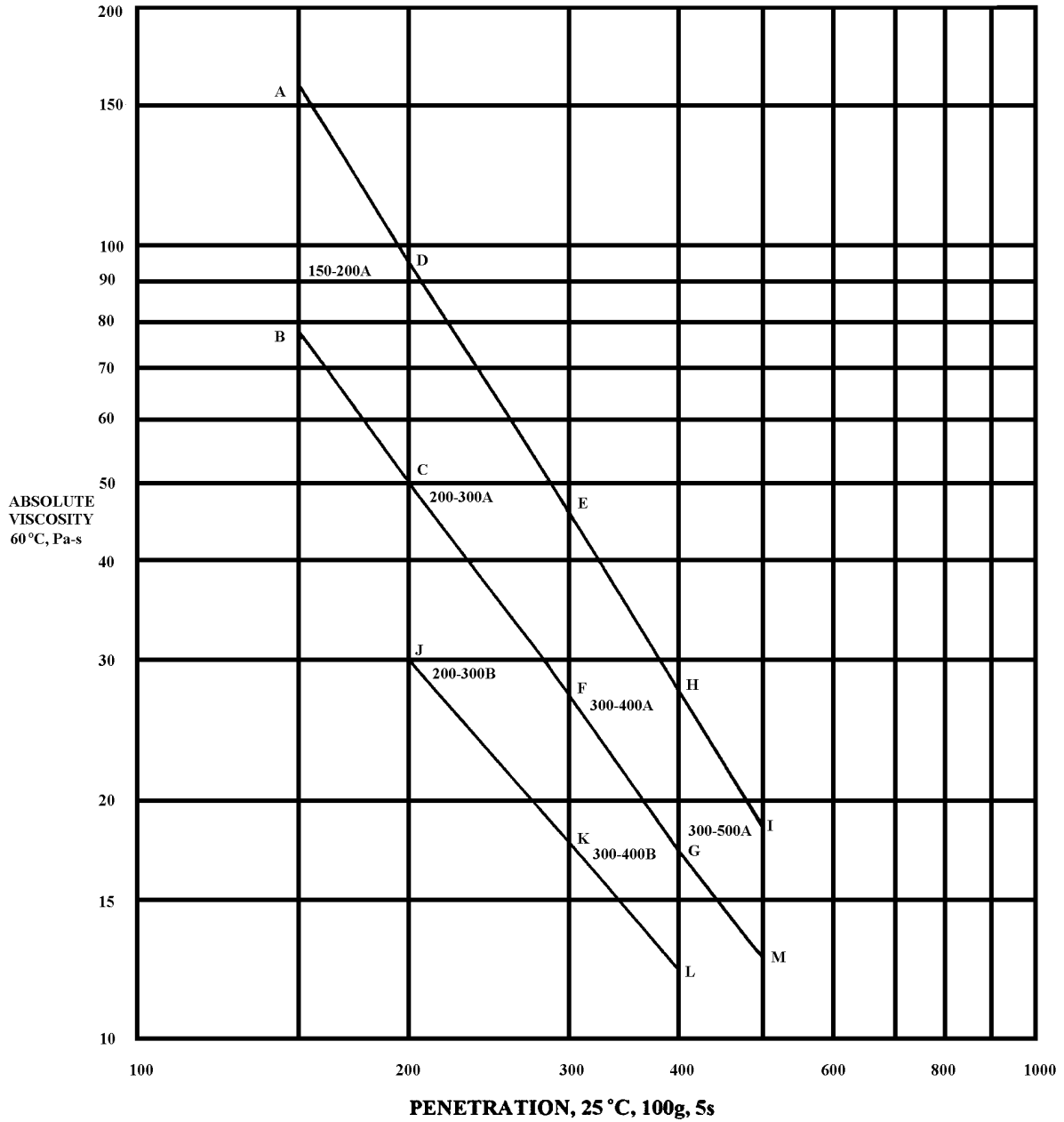


Figure 1: Asphalt Cement Viscosity and Penetration Requirements

3.2.2 Asphalt Cements – Modified

The polymer modified asphalt cement shall be performance graded as determined by the current edition of AASHTO M320. Polymer modified asphalt cement shall meet or exceed the performance grade PG64-37, unless otherwise specified.

3.3 Slow Curing Liquid Asphalt Binder

All grades of this type of asphalt shall conform to the requirements listed in Table 3 and shall be homogenous and uniform in character throughout.

Table 3: Slow Curing Liquid Asphalt Binder Requirements

Requirements	Asphalt Grade	SC-70		SC-250		SC-800		SC-3000	
	ASTM Test Method	Min	Max	Min	Max	Min	Max	Min	Max
Flash Point (C.O.C.), °C	D92	65	-	80	-	90	-	105	-
Kinematic Viscosity at 60°C mm ² /s	D2170	70	140	250	500	800	1600	3000	6000
Distillation Test Total Distillate to 360°C % by Volume	D402	10	30	4	20	2	12	-	5
Distillation Residue Kinematic Viscosity at 60°C mm ² /s	D2170	400	7000	800	10000	2000	16000	4000	35000
Asphalt Residue of 100% Penetration % by mass	D243	50	-	60	-	70	-	80	-
Ductility of 100 Penetration Residue at 25°C cm	D113 ⁽¹⁾	100	-	100	-	100	-	100	-

Requirements	Asphalt Grade	SC-70		SC-250		SC-800		SC-3000	
	ASTM Test Method	Min	Max	Min	Max	Min	Max	Min	Max
Solubility of Distillation Residue to 360°C cm % by mass	D2042 ⁽²⁾	99.0	-	99.0	-	99.0	-	99.0	-
Water, % by Mass or Volume	D95	-	0.5	-	0.5	-	0.5	-	0.5

Note (1) If the ductility at 25°C is less than 100, the material will be acceptable if its ductility at 15°C is more than 100.

Note (2) Using trichloroethylene as solvent or use of ignition burn furnace.

3.4 Medium Curing Liquid Asphalt Binder

All grades of this type of asphalt shall conform to the requirements listed in Table 4 and shall be homogenous and uniform in character throughout.

Table 4: Medium Curing Liquid Asphalt Binder Requirements

Requirements	Asphalt Grade	MC-30		MC-70		MC-250		MC-800		MC-3000		
	ASTM Test Method	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
Flash Point (Open Tag), °C	D92	38	-	38	-	65	-	65	-	65	-	
Kinematic Viscosity at 60°C, mm ² /s	D2170	30	60	70	140	250	500	800	1600	3000	6000	
Distillation Test % of total distillate to 360°C	D402	225°C	-	25	-	20	-	10	-	-	-	-
		260°C	40	70	20	60	15	55	-	35	-	15
		315°C	75	93	65	90	60	87	45	80	15	75
Residue from Distillation to		50	-	55	-	67	-	75	-	80	-	

Requirements	Asphalt Grade	MC-30		MC-70		MC-250		MC-800		MC-3000	
	ASTM Test Method	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
360°C, Volume % by difference											
Tests on Residue from Distillation											
Penetration at 25°C 100g 5s 0.1mm	D5	120	250	120	250	120	250	120	250	120	250
Ductility at 25°C, cm ⁽¹⁾	D113	100	-	100	-	100	-	100	-	100	-
Solubility % by Mass	D2042 ⁽²⁾	99.0	-	99.0	-	99.0	-	99.0	-	99.0	-
Water, % by Mass or Volume	D95	-	0.2	-	0.2	-	0.2	-	0.2	-	0.2

Note (1) If the ductility at 25°C is less than 100, the material will be acceptable if its ductility at 15°C is more than 100.

Note (2) Using trichloroethylene as solvent or use of ignition burn furnace

3.5 Anionic Emulsified Binder

All grades of this type of asphalt shall conform to the requirements listed in Table 5 and Table 6 and shall be homogenous and uniform in character throughout.

Table 5: Anionic Emulsified Binder Testing (Rapid & Medium)

Requirements	Grade	Rapid Setting				Medium Setting			
		RS-1		RS-2		MS-1		MS-2	
ASTM Test Method		Min	Max	Min	Max	Min	Max	Min	Max
Tests on Emulsion									
Saybolt Viscosity Furol									
Seconds at 25°C	D244	20	100	-	-	20	60	-	-
Seconds at 50°C	D244	-	-	50	300	-	-	35	400

	Grade	Rapid Setting				Medium Setting			
		RS-1		RS-2		MS-1		MS-2	
Requirements	ASTM Test Method	Min	Max	Min	Max	Min	Max	Min	Max
Residue by Distillation %	D244	55	-	60	-	55	-	59	-
Storage Stability 24hr, %	D244	-	1	-	1	-	1	-	1
Sieve Test, % retained on a 1000um Sieve, % by weight	D244	-	0.1	-	0.1	-	0.1	-	0.1
Demulsibility 35ml of 0.02 NCaCL ₂ , %	D244	-	-	-	-	-	-	-	-
Demulsibility 50ml of 0.01 NCaCL ₂ , %	D244	-	-	-	-	-	-	-	-
Coating Test	D244	-	-	-	-	No appreciable separation uniform coating of the stone			
Cement Mixing Test, %	D244	-	-	-	-	-	-	-	-
Dilution Test	Note 1	-	-	-	-	-	-	-	-
Particle Charge	Note 2	Negative							
Test on Residue									
Penetration at 25°C, 100g 5s	D244	100	200	100	200	100	200	100	200
Ductility at 25°C, cm	D244	60	-	60	-	60	-	60	-
Solubility in Trichloroethylene, %	D2042	97.5	-	97.5	-	97.5	-	97.5	-

Note 1 Method for Dilution Test

- Mix together 50 g SS-1C emulsified asphalt and 450 g soft or demineralized water until homogenous.
- Pour into 500 mL graduated cylinder.
- After 2 hours observe cylinder to determine if a line of separation of asphalt from water has appeared. If separation is apparent in 2 hours, emulsion is not acceptable.
- After 24 hours, if asphalt has visually separated from water, re-mix contents of cylinder. Material is acceptable if homogenous liquid is re-established.

Note 2 N.S.C. CAN 2-16.2, par.6.2.1.

Table 6: Anionic Emulsified Binder Testing (Slow)

Requirements	Grade ASTM Test Method	Slow Setting					
		SS-1		SS-1C		SS-1H	
		Min	Max	Min	Max	Min	Max
Tests on Emulsion							
Saybolt Viscosity Furol							
Seconds at 25°C	D244	20	60	20	100	20	60
Seconds at 50°C	D244	-	-	-	-	-	-
Residue by Distillation %	D244	55	-	55	-	55	-
Storage Stability 24hr, %	D244	1	-	1	-	1	-
Sieve Test, % retained on a 1000um Sieve, % by weight	D244	0	0.1	0	0.1	0	0.1
Demulsibility 35ml of 0.02 NCaCL ₂ , %	D244	-	-	-	-	-	-
Demulsibility 50ml of 0.01 NCaCL ₂ , %	D244	-	-	-	-	-	-
Coating Test	D244	No appreciable separation uniform coating of the stone					
Cement Mixing Test, %	D244	-	2.00	-	-	-	2.00
Dilution Test	Note (1)	-	-	Must Pass		-	-
Particle Charge	Note (2)	Negative					
Test on Residue							
Penetration at 25°C, 100g 5s	D244	100	200	150	275	40	100
Ductility at 25°C, cm	D244	60	-	60	-	60	-
Solubility in Trichloroethylene, %	D2042	97.5	-	97.5	-	97.5	-

Note (1) Method for Dilution Test

- Mix together 50 g SS-1C emulsified asphalt and 450 g soft or demineralized water until homogenous.
- Pour into 500 mL graduated cylinder.
- After 2 hours observe cylinder to determine if a line of separation of asphalt from water has appeared. If separation is apparent in 2 hours, emulsion is not acceptable.
- After 24 hours, if asphalt has visually separated from water, re-mix contents of cylinder. Material is acceptable if homogenous liquid is re-established.

Note (2) N.S.C. CAN 2-16.2, par.6.2.1.

3.6 Cationic Emulsified Asphalt Binder

All grades of this type of asphalt shall conform to the requirements in Table 7 and shall be uniform in character throughout.

Table 7: Cationic Emulsified Asphalt Binder Testing

Requirements	Grade	RS-1K		RS-2K	
	ASTM Test Method	Min	Max	Min	Max
Test on Emulsion					
Saybolt Viscosity, Furol seconds at 50°C	D244	35	150	150	400
Residue by distillation, %		62	(1)	67	(1)
Settlement in 5 days, %		-	5	-	5
Oil portion of distillate, %		-	3	-	3
Sieve test, % retained on 1000 µm sieve, by weight	D2397-71	-	0.10	-	0.10
Particle charge	(2)	Positive		Positive	
Tests on Residue					
Penetration at 25°C, 100g, 5s	D244	100	250	100	250
Ductility at 25°C, cm	D244	60	-	60	-
Solubility in trichloroethylene, %	D244	97.5	-	97.5	-

Note (1) Upper limit on % residue is governed by the viscosity limits.

Note (2) N.S.C. CAN 2-16.2, par. 6.2.1

3.7 High Float Emulsified Asphalt Binder

All grades of this type of asphalt shall conform to the requirements listed in Table 8, Table 9, Table 10, and Figure 2, and shall be homogenous and uniform in character throughout.

Table 8: High Float Emulsified Asphalt Binder Requirements, HF- 100S, 150S, 250S

Requirements	Grade ASTM Test Method	HF-100S		HF-150S		HF-250S	
		Min	Max	Min	Max	Min	Max
Tests on Emulsion							
Percent Asphalt Residue by Distillation	(1)	62	-	62	-	62	-
Oil Distillate % by Volume (7)	D244 and (2)	1	4	1	4	1	6
Saybolt Viscosity Furol Seconds at 50°C	D244	30	150	30	150	35	150
Sieve Test % Retained on 1000 um Sieve	D244	-	0.1	-	0.1	-	0.1
Coating Test	D244	(8)		(8)		(8)	
Settlement, 1 day %	D244	-	1.5	-	1.5	-	1.5
Demulsibility 50ml 0.1 N CaCl ₂ , %	D244	60	-	60	-	-	-
Workability @ -10°C	(3)	-	-	-	-	-	-
Tests on Residue							
Penetration at 25°C 100g, 5s	(4)	(10)		(10)		(10)	
Viscosity at 60°C, Pa-s	(5)	(10)		(10)		(10)	
Float Test at 60°C, S	(6)	1200	-	1200	-	1200	-
Solubility in Trichloroethylene, %	D2042	97.5	-	97.5	-	97.5	-

Notes are located below Table 9

Table 9: High Float Emulsified Asphalt Binder Requirements, HF 350S, 500M, 1000M

Requirements	Grade ASTM Test Method	HF-350S		HF-500M		HF-1000M	
		Min	Max	Min	Max	Min	Max
Tests on Emulsion							
Percent Asphalt Residue by Distillation	(1)	65	-	65	-	65	-
Oil Distillate % by Volume (7)	D244 and (2)	1.5	6	1	6	1	7
Saybolt Viscosity Furol Seconds at 50°C	D244	75	400	50	-	50	-
Sieve Test % Retained on 1000 um Sieve	D244	-	0.1	-	0.1	-	0.1
Coating Test	D244	(9)		(9)		(9)	
Settlement, 1 day %	D244	1.5	-	-	1.5	-	1.5
Demulsibility 50ml 0.1 N CaCl ₂ , %	D244	-	-	-	-	-	-
Workability @ -10°C	(3)	-	-	-	-	Pass	-
Tests on Residue							
Penetration at 25°C 100g, 5s	(4)	(10)		-	-	-	-
Viscosity at 60°C, Pa-s	(5)	(10)		8	20	2	8
Float Test at 60°C, S	(6)	1200	-	1200	-	1200	-
Solubility in Trichloroethylene, %	D2042	97.5	-	97.5	-	97.5	-

Notes for Table 8 and Table 9 as follows:

- Note (1) CAN 2-16.5 par.6.2.1
- Note (2) CAN 2-16.5 par.6.2.1.3
- Note (3) CAN 2-16.5 par.6.2.3
- Note (4) CAN 2-16.5 par.6.2.4
- Note (5) CAN 2-16.5 par.6.2.5
- Note (6) CAN 2-16.5 par.6.25
- Note (7) Percent Oil in the emulsified asphalt is more accurately determined using ASTM Test Method D-2461, Section 6.

- Note (8) Coating Test: ASTM Method D-244 except that the mixture of limestone and emulsified asphalt shall be capable of being mixed vigorously for 5 minutes, at the end of which period the stone shall be thoroughly and uniformly coated. The mixture shall then be completely immersed in tap water and the water poured off. The stone shall not be less than 90% coated.
- Note (9) Coating Test: ASTM Method D-244 except that the mixture of limestone and emulsified asphalt shall be mixed vigorously for 5 minutes, then allowed to stand for 3 hours, after which the mixture shall be capable of being mixed an additional 5 minutes. The mixture shall then be rinsed twice with approximately its own volume of tap water without showing appreciable loss of bituminous film. After the second coating the aggregate shall be at least 90 percent coated. Note (1) viscosity at 60°C and penetration at 25°C shall fall within the area described in Figure 2.
- Note (10) Viscosity at 60°C and penetration at 25°C shall fall within the area described in Figure 2.

Table 10: Grade of HF Emulsified Asphalt

HF-100S	HF-150S	HF-250S	HF-350S
A,B	C,D	E,F	G,H

Viscosity as shown in Figure 2 shall be within the graphic regions above the line designated by specified letters, and between penetration limits contained in vertical lines extending upwards from those points.

Viscosity value shall be reported as 0.5 x⁻¹ for grades HF-100S and HF-150S and at 1.0s⁻¹ for grades HF-250S and HF-350S.

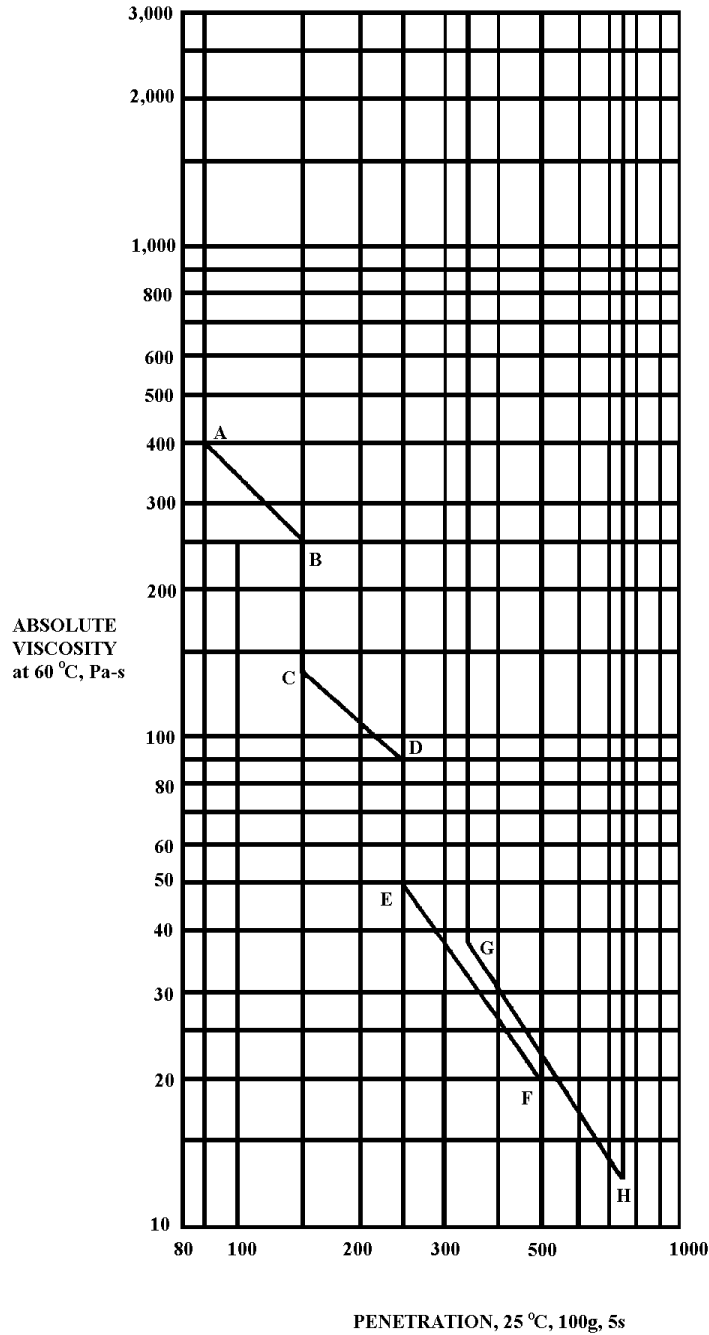


Figure 2: High Float Emulsified Asphalt Binder Viscosity and Penetration Requirements

04005-4 Testing

The supplier shall, prior to initial delivery, undertake standard control tests and provide test results to prove compliance with the requirements for the desired type and grade of bituminous binder stated in the Specification (04005-3 Execution).

On subsequent deliveries the suppliers shall provide the following test data:

Table 11: Test Data Requirements

Material	Frequency	Test Required
Asphalt Cement - Neat	Every 300 tonnes Every 150 tonnes	Viscosity at 60°C, Pas. Penetration at 25°C, 100g, 5 sec.
Asphalt Cement - Modified	Every 500 tonnes	AASHTO M320
Liquid Asphalt	Every 100 tonnes	All standard control tests
Emulsions	Every 100 tonnes	All standard control tests

If requested by the City, the supplier shall supply a representative 5 litre sample of the desired type and grade of bituminous binder prior to delivery of any order. The City shall also have the right to obtain samples of not more than 5 litres from each shipment during the course of delivery of any order.

All tests conducted by the City shall be in accordance with the procedures and methods of the American Society for Testing and Materials (ASTM) except where the Canadian Government Specification Board (C.G.S.B.) and the National Standard Council (N.S.C.) of Canada is indicated.

The Contractor, at their sole discretion, will secure samples of polymer modified asphalt cement from each 40-80 tonne shipment. These samples will be stored for a minimum period of six months and the contractor may test as many samples as they wish at their cost. The City will only accept test data from a certified testing lab. If it is discovered that a particular load of asphalt cement does not meet the PG grade the City will pay for the cost of the test and waive the mix adjustments that occur as a result of the lower grade of polymer modified asphalt cement.

04005-5 Measurement

All asphalt binders will be measured in litres corrected to 15°C, or tonnes.

End of Specification 04005