55.5 SUPPLY OF ASPHALT

55.5.1 GENERAL

The Work consists of supplying asphalt materials including ordering, scheduling, delivering, supplying storage facilities, handling, storing, sampling, testing and other related work.

For purposes of this specification, the term "Asphalt Supplier" shall mean the party awarded an order by the Contractor for the supply of asphalt.

55.5.2 MATERIALS

55.5.2.1 General

The Contractor shall supply the types and grades of asphalt specified for the Work. Asphalt suppliers' products must be pre-qualified by the Department. The Contractor shall ensure that the asphalt supplied meets all requirements for the types and grades specified.

All asphalt binders shall be prepared from petroleum oils. They shall be free from impurities. Solvents used in the manufacture of cut-back asphalt shall be derived from petroleum oils. Emulsifiers used in the production of asphalt emulsions shall not be harmful to the performance of the asphalt in service.

The Contractor may be required to use more than one type or grade of asphalt for a particular purpose. Any change in asphalt type or grade shall be subject to the approval of the Engineer.

The Engineer reserves the right to discontinue the use of any asphalt product that fails to handle or perform to expectation or satisfaction, regardless of its compliance with the specifications.

55.5.3 EQUIPMENT

The Contractor shall supply all equipment necessary to complete the Work.

55.5.4 PROCEDURE

55.5.4.1 Delivery, Handling and Storage

The Contractor shall provide and maintain adequate asphalt storage facilities and reclaim the storage site to a condition equivalent to or better than that which existed at the time his storage and handling of material commenced.

Storage facilities for asphalt cement shall be capable of heating the material under effective and positive

control at all times and shall contain provision for measuring and sampling.

No asphalt type or grade shall be diluted or mixed with a different type or grade, or with any other material, without the specific approval of the Engineer.

The Contractor shall prevent contamination of the asphalt by asphalt of another type or grade, by solvent, or by any other material. Asphalt storage tanks shall be emptied of one type or grade of asphalt, and cleaned as necessary to prevent detrimental contamination of the asphalt, before placing another type or grade of asphalt therein. Asphalt emulsions shall be protected from freezing.

55.5.5 SAMPLING AND TESTING

All asphalt delivered to the storage site shall be subject to inspection, sampling and testing by the Engineer. The Contractor shall provide safe, convenient access, acceptable to the Engineer, for inspection and sampling of the asphalt, and shall cooperate in the inspection and sampling process when requested to do so.

The Contractor shall ensure that all asphalt delivery tanks are equipped with sampling valves maintained in good operating condition which are designed and located to enable safe, representative sampling into one litre containers.

55.5.6 MEASUREMENT AND PAYMENT

Payment for the supply of asphalt material will be included in the unit price bid for the item of work for which the material is being used.

SPECIFICATIONS FOR ASPHALT CEMENTS: Asphalt cements shall conform to the requirements specified in the following table:

ASPH-1

TEST CHARACTERISTICS	A.S.T.M. TEST METHODS	PREMIUM GRADES OF ASPHALT CEMENTS			REGULAR GRADES OF ASPHALT CEMENTS	
		150-200(A)	200-300(A)	300-400(A)	200-300(B)	300-400(B)
Absolute Viscosity, 60°C, Pa.s Penetration, 25°C , 100 g, 5 s, dmm	D2171 D5	The viscosity and penetration values must fall within the area bounded by A - B - C - D - A, plotted as straight lines on a full logarithmic plot (log-log), with the co-ordinates of the points as follows: Pt. / Abs. Visc. / Pen. A 155 150 B 78 150 C 50 200 D 92 200	The viscosity and penetration values must fall within the area bounded by C - D - E - F - C, plotted as straight lines on a full logarithmic plot (log-log), with the co-ordinates of the points as follows: Pt. / Abs.Visc. / Pen. C 50 200 D 92 200 E 45 300 F 26.5 300	The viscosity and penetration values must fall within the area bounded by E - F - G - H - E, plotted as straight lines on a full logarithmic plot (log-log), with the co-ordinates of the points as follows: Pt. / Abs. Visc. / Pen. E 45 300 F 26.5 300 G 17 400 H 27 400	The viscosity and penetration values must fall within the area bounded by C - J - K - F - C, plotted as straight lines on a full logarithmic plot (log-log), with the co-ordinates of the points as follows: Pt. / Abs. Visc. / Pen. C 50 200 J 30 200 K 17.5 300 F 26.5 300	The viscosity and penetration values must fall within the area bounded by F - K - L - G - F, plotted as straight lines on a full logarithmic plot (log-log), with the co-ordinates of the points as follows: Pt. / Abs. Visc. / Pen. F 26.5 300 K 17.5 300 L 12 400 G 17 400
Kinematic Viscosity, 135°C, mm^2/s Penetration, 25°C, 100g, 5s, dmm	D2170 D5	The viscosity and penetration values must fall within the area bounded by A - B - C - D - A, plotted as straight lines on a full logarithmic plot (log-log), with the co-ordinates of the points as follows: Pt. / kin.Visc. / Pen. A 360 150 B 255 150 C 205 200 D 285 200	The viscosity and penetration values must fall within the area bounded by C - D - E - F - C, plotted as straight lines on a full logarithmic plot (log-log), with the co-ordinates of the points as follows: Pt. / Kin.Visc / Pen. C 205 200 D 285 200 E 205 300 F 150 300	The viscosity and penetration values must fall within the area bounded by E - F - G - H - E, plotted as straight lines on a full logarithmic plot (log-log), with the co-ordinates of the points as follows: Pt. / Kin.Visc. / Pen. E 205 300 F 150 300 G 120 400 H 165 400	The viscosity and penetration values must fall within the area bounded by C - J - K - F - C, plotted as straight lines on a full logarithmic plot (log-log), with the co-ordinates of the points as follows: Pt. / Kin.Visc. / Pen C 205 200 J 165 200 K 125 300 F 150 300	The viscosity and penetration vaues must fall within the area bounded by F - K - L - G - F, plotted as straight lines on a full logarithmic plot (log-log), with the co-ordinates of the points as follows: Pt. / Kin.Visc / Pen. F 150 300 K 125 300 L 102.5 400 G 120 400
Flash Point, Cleveland Open Cup, °C minimum	D92	205	175	175	175	175
Solubility in Trichloroethylene, % minimum	D2042	99.5	99.5	99.5	99.5	99.5
Tests on Residue from Thin-Film Oven Test: Ratio of Absolute Viscosity of Residue from Thin-Film Oven Test to Original Absolute Viscosity, maximum	D1754 D2171	4.0	4.0	4.0	5.0	5.0
Ductility, 25°C, cm, minimum	D113	100	---	---	---	---
Ductility, 15.6°C, cm, min.		---	100	100	100	100

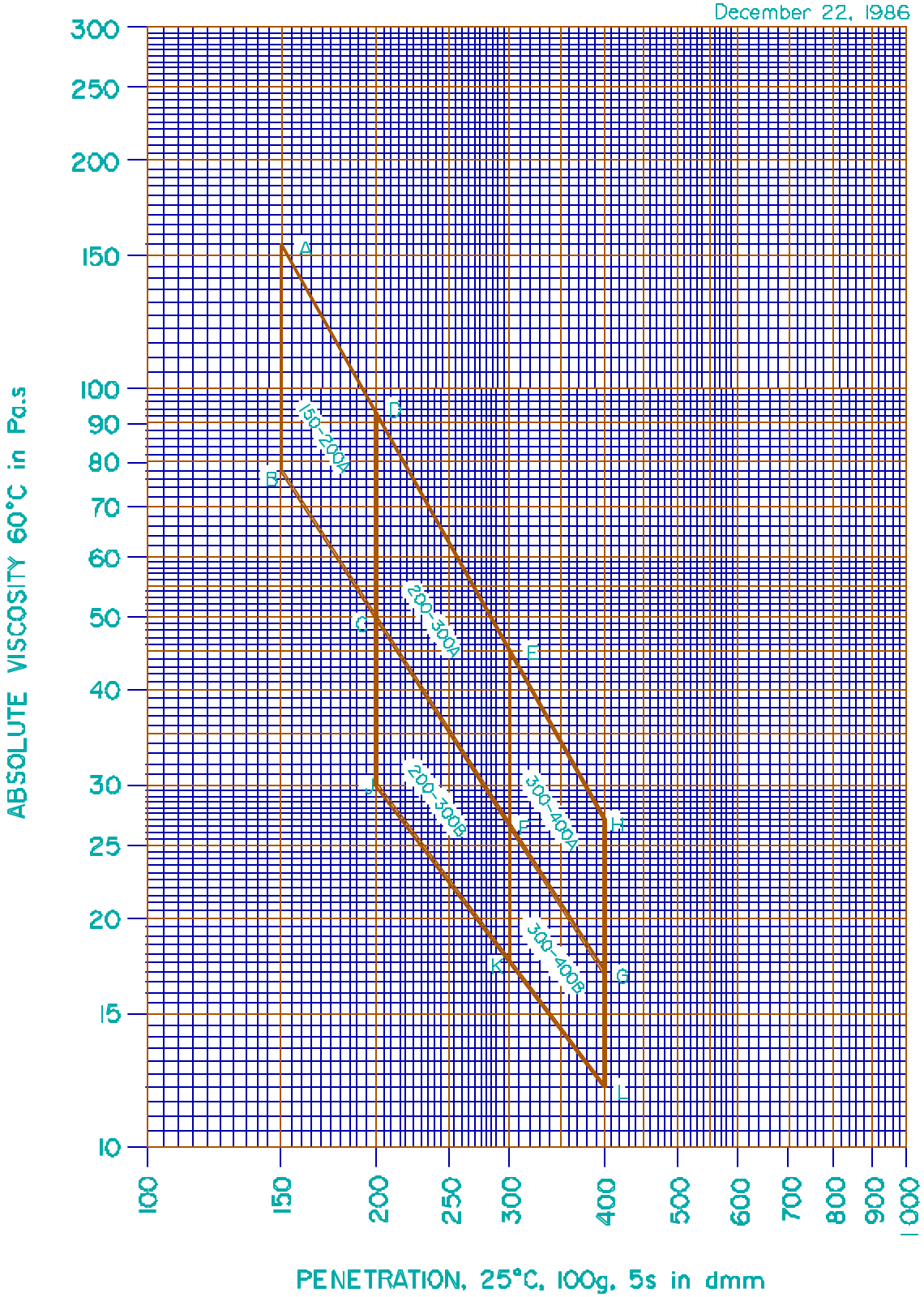
General Requirement - The asphalt shall be prepared by the refining of petroleum. It shall be uniform in character and shall not foam when heated to 175 °C.

- The temperature at delivery to the site shall be between 135°C and 175°C.

ASPH-2

SPECIFICATIONS FOR ASPHALT CEMENT
ABSOLUTE VISCOSITY vs PENETRATION
FOR FIVE SPECIFIED GRADES

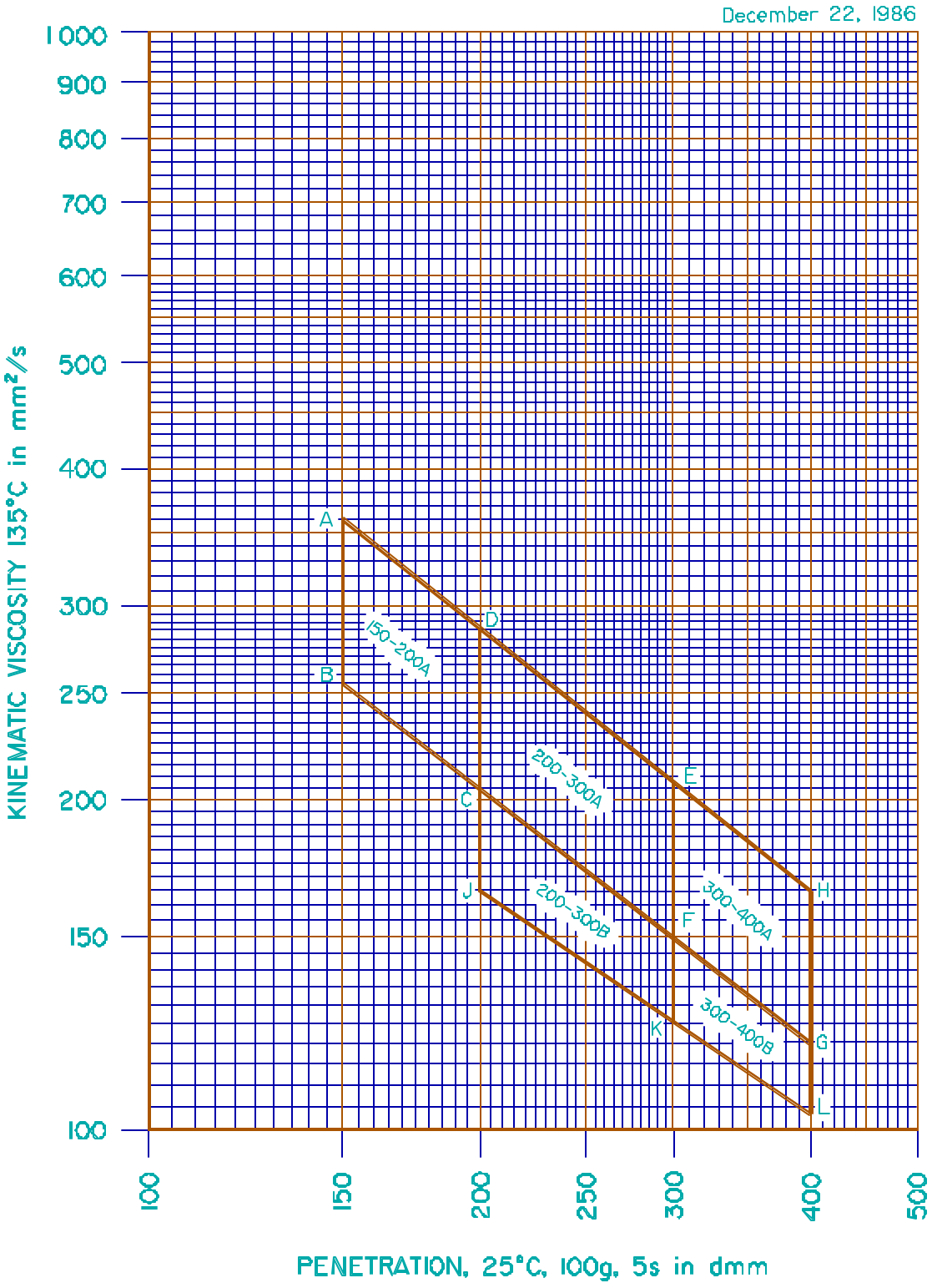
December 22, 1986



ASPH-3

SPECIFICATIONS FOR ASPHALT CEMENT
KINEMATIC VISCOSITY vs PENETRATION
FOR FIVE SPECIFIED GRADES

December 22, 1986



SPECIFICATIONS FOR SLOW CURING LIQUID ASPHALTS: Slow curing liquid asphalts shall conform to the requirements specified in the following table, for the grade designated by the Engineer:

ASPHALT GRADE	SC-70		SC-250		SC-800		SC-3000		A.S.T.M. TEST METHOD
REQUIREMENTS	**min.**	**max.**	**min.**	**max.**	**min.**	**max.**	**min.**	**max.**	
Flash Point, Cleveland Open Cup, EC	65	-	80	-	90	-	105	-	D92
Kinematic Viscosity at 60EC, mm^2/s	70	180	250	500	800	1 600	3 000	6 000	D2170
Distillation Test: Total distillate to 360EC, % by volume	10	30	4	20	2	12	-	5	D402
Distillation Residue Kinematic Viscosity at 60EC, mm^2/s	400	7000	800	10 000	2 000	16 000	4 000	35 000	D2170
Asphalt Residue Residue of 100 penetration, % by mass	50	-	60	-	70	-	80	-	D243
Ductility of 100 penetration residue at 25EC, cm(1)	100	-	100	-	100	-	100	-	D113
Solubility of Distillation Residue to 360EC, in Trichloroethylene, % by mass	99.0	-	99.0	-	99.0	-	99.0	-	D2042
Water, % by mass or volume	-	0.5	-	0.5	-	0.5	-	0.5	D95
Delivery Temperature, EC	55	75	75	95	90	110	110	130	

NOTE:

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

General Requirements:
- The asphalt shall not foam when heated to the application temperature range recommended by the Asphalt Institute.
- The asphalt shall be uniform in character.

SPECIFICATIONS FOR MEDIUM-CURING LIQUID ASPHALTS: Medium curing liquid asphalts shall conform to the requirements specified in the following table, for the grade designated by the Engineer:

ASPHALT GRADE	MC-30		MC-70		MC-250		MC-800		A.S.T.M. TEST METHOD
REQUIREMENTS	min.	max.	min.	max.	min.	max.	min.	max.	
Flash Point, Open Tag, °C	38	-	38	-	65	-	65	-	D1310
Kinematic Viscosity at 60°C, mm^2/s	30	60	70	140	250	500	800	1 600	D2170
Distillation Test:									D402
% by volume of total distillate to 360°C,									
-to 225°C	-	25	-	20	-	10	-	-	
-to 260°C	40	70	20	60	15	55	-	35	
-to 315°C	75	93	65	90	60	87	45	80	
Residue from distillation to 360°C,									
Volume % by difference	50	-	55	-	67	-	75	-	
Test on Residue from Distillation:									
a) Penetration at 25°C, 100 g, 5 s, dmm	120	250	120	250	120	250	120	250	D5
b) Ductility at 25°C, cm(1)	100	-	100	-	100	-	100	-	D113
c) Solubility in Trichloroethylene, % by mass	99.5	-	99.5	-	99.5	-	99.5	-	D2042
Water, % by mass or volume	-	0.2	-	0.2	-	0.2	-	0.2	D95
Delivery Temperature, °C	35	55	55	75	75	95	90	110	

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.

General Requirements:
- The asphalt shall not foam when heated to the application temperature range recommended by the Asphalt Institute.
- The asphalt shall be produced by the refining of petroleum and shall be uniform in character.

SPECIFICATIONS FOR RAPID-CURING LIQUID ASPHALTS: Rapid curing liquid asphalts shall conform to the requirements specified in the following table, for the grade designated by the Engineer:

ASPHALT GRADE	RC-30		RC-70		RC-250		A.S.T.M. TEST METHOD
REQUIREMENTS	**min.**	**max.**	**min.**	**max.**	**min.**	**max.**	
Flash Point, Open Tag, EC	-	-	-	-	27	-	D1310
Kinematic Viscosity at 60EC, mm^2/s	30	60	70	140	250	500	D2170
Distillation Test:							D402
% by volume of total distillate to 360EC,							
- to 190EC -to 225EC	15	-	10	-	-	-	
- to 260EC	55	-	50	-	35	-	
- to 315EC	75	-	70	-	60	-	
	90	-	85	-	80	-	
Residue from distillation to 360EC,							
Volume % by difference							
	50	-	55	-	65	-	
Tests on Residue from Distillation:							
a) Penetration at 25EC, 100 g, 5 s, dmm	80	120	80	120	80	120	D5
b) Ductility at 25EC, cm(1)	100	-	100	-	100	-	D113
c) Solubility in Trichloroethylene, % by mass	99.5	-	99.5	-	99.5	-	D2042
Water, % by mass or volume	-	0.2	-	0.2	-	0.2	D95
Delivery Temperature, EC	35	55	55	75	75	95	

NOTE:

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

General Requirements:
- The asphalt shall not foam when heated to the application temperature range recommended by the Asphalt Institute.
- The asphalt shall be produced by the refining of petroleum and shall be uniform in character.

SPECIFICATIONS FOR ANIONIC EMULSIFIED ASPHALTS: Anionic emulsified asphalts shall conform to the requirements specified in the following table, for the grade designated by the Engineer:

ASPHALT TYPE	RAPID SETTING (RS)				MEDIUM SETTING (MS)		SLOW SETTING (SS)				A.S.T.M. TEST METHOD
ASPHALT GRADE	RS-1		RS-2		MS-1		SS-1		SS-1H		
REQUIREMENTS	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	
Viscosity at 25EC, SF s	20	100	-	-	20	100	20	60	20	60	D244
Viscosity at 50EC, SF s	-	-	50	300	-	-	-	-	-	-	
Residue by Distillation, % by mass	55	(1)	60	(1)	55	(1)	55	(1)	55	(1)	D244
Settlement in 5 d, % difference by mass(2)	-	3	-	3	-	5	-	5	-	5	D244
Storage Stability Test, 24 h, % by mass(3)	-	1	-	1	-	1	-	1	-	1	D244
Sieve Test, % retained on a No. 1000 Sieve, % by mass(4)	-	0.10	-	0.10	-	0.10		0.10	-	0.10	D244
Demulsibility, 35 ml of 1.11 g/l $CaCl_2$, % by mass	60	-	60	-	-	-	-	-	-	-	D244
Cement Mixing Test, % by mass	-	-	-	-	-	-	-	2.0	-	2.0	D244
Particle Charge (5)	Negative		Negative		Negative		-		-		
Tests on Residue from Distillation:											
a) Penetration at 25EC, 100 g, 5 s, dmm	100	200	100	200	100	200	100	200	40	100	D5
b) Ductility at 25EC, and 5 cm/min., cm	60	-	60	-	60	-	60	-	60	-	D113
c) Solubility in Trichloroethylene, % by mass	97.5	-	97.5	-	97.5	-	97.5	-	97.5	-	D2042
Delivery Temperature, EC	35	65	45	70	40	70	40	70	40	70	

NOTES:

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

(2) The test requirement for settlement may be waived when the emulsified asphalt is used in less than 5 days time.

(3) The 24 hour storage stability test may be used instead of the 5 day settlement test, however in case of dispute the 5 day storage settlement test shall govern.

(4) CGSB 8-GP-2M, Sieves, Testing, Woven Wire, Metric

(5) Particle Charge Test (Qualitative) - The rapid setting grades will be tested for particle charge according to the procedure described in ASTM D 244, with the modification that the asphalt deposit will, for anionic emulsions, be found on the anode (positive electrode), and shall be continuous and opaque. In the event of dispute, the test will be repeated using freshly distilled water as the wash water for the electrodes, before evaluating the asphalt deposit.

General Requirements:
- All tests shall be performed within 15 days of date of delivery.
- The asphalt shall be uniform in character, and shall have a refined petroleum base.

SPECIFICATIONS FOR CATIONIC EMULSIFIED ASPHALTS: Cationic emulsified asphalts shall conform to the requirements specified in the following table, for the grade designated by the Engineer:

ASPHALT TYPE AND GRADE	RS-1K		RS-2K		CRS-2		QS-Kh		A.S.T.M. TEST METHOD
REQUIREMENTS	min.	max.	min.	max.	min.	max.	min.	max.	
Viscosity at 25EC, SF s Viscosity at 50EC, SF s	- 75	- 200	- 150	- 400	- 100	- 400	20 -	100 -	D244
Residue by Distillation, % by mass	65	(1)	65	(1)	65	-	57	(1)	D244
Settlement in 5 d, % difference by mass(2)	-	5	-	5			-	5	D244
Storage Stability Test, 24 h, % by mass(3)	-	1	-	1	-	1.5 (8)	-	1	D244
Demulsibility. 35 ml of 0.5 % by weight solution of sodium dioctyl sulphosuccinate, % by mass					-	0.1			
Oil Portion of Distillate, % by volume of emulsion	-	3	-	3	-	3	-	-	D244
Sieve Test, % retained on No. 1 000 Sieve (4)(5), by mass	-	0.10	-	0.10	-	0.10(8)	-	0.10	D244
Particle Charge (6)	Positive		Positive		Positive		Positive		
Tests on Residue from Distillation:									
a) Penetration at 25EC, 100 g, 5 s, dmm	100	250	100	250	100	250	40	125	D5
b) Apparent Viscosity at 60° C, Pa.s					See Figure 1				
c) Ductility at 25EC,(4) and 5 cm/min., cm(7)	60	-	60	-	60	-	60	-	D113
d) Solubility in Trichloroethylene, % by mass	97.5	-	97.5	-	97.5	-	97.5	-	D2042
Delivery Temperature, EC	60	80	60	85			-		

NOTES:

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

(2) The test requirement for settlement may be waived when the emulsified asphalt is used in less than 5 days time.

(3) The 24 hour storage stability test may be used instead of the 5 day settlement test, however in case of dispute the 5 day storage settlement test shall govern.

(4) CGSB 8-GP-2M, Sieves, Testing, Woven Wire, Metric

(5) Replace sodium oleate solution (2%) with distilled water, use distilled water in all operations including wetting and subsequent washing of wire cloth sieves.

(6) Particle Charge Test (Qualitative)- The emulsion will be tested for particle charge according to the procedure described in ASTM D 244, and it is required that the layer of asphalt deposited be continuous and opaque. In the event of dispute, the test will be repeated using freshly distilled water as the wash water for the electrodes, before evaluating the asphalt deposit.

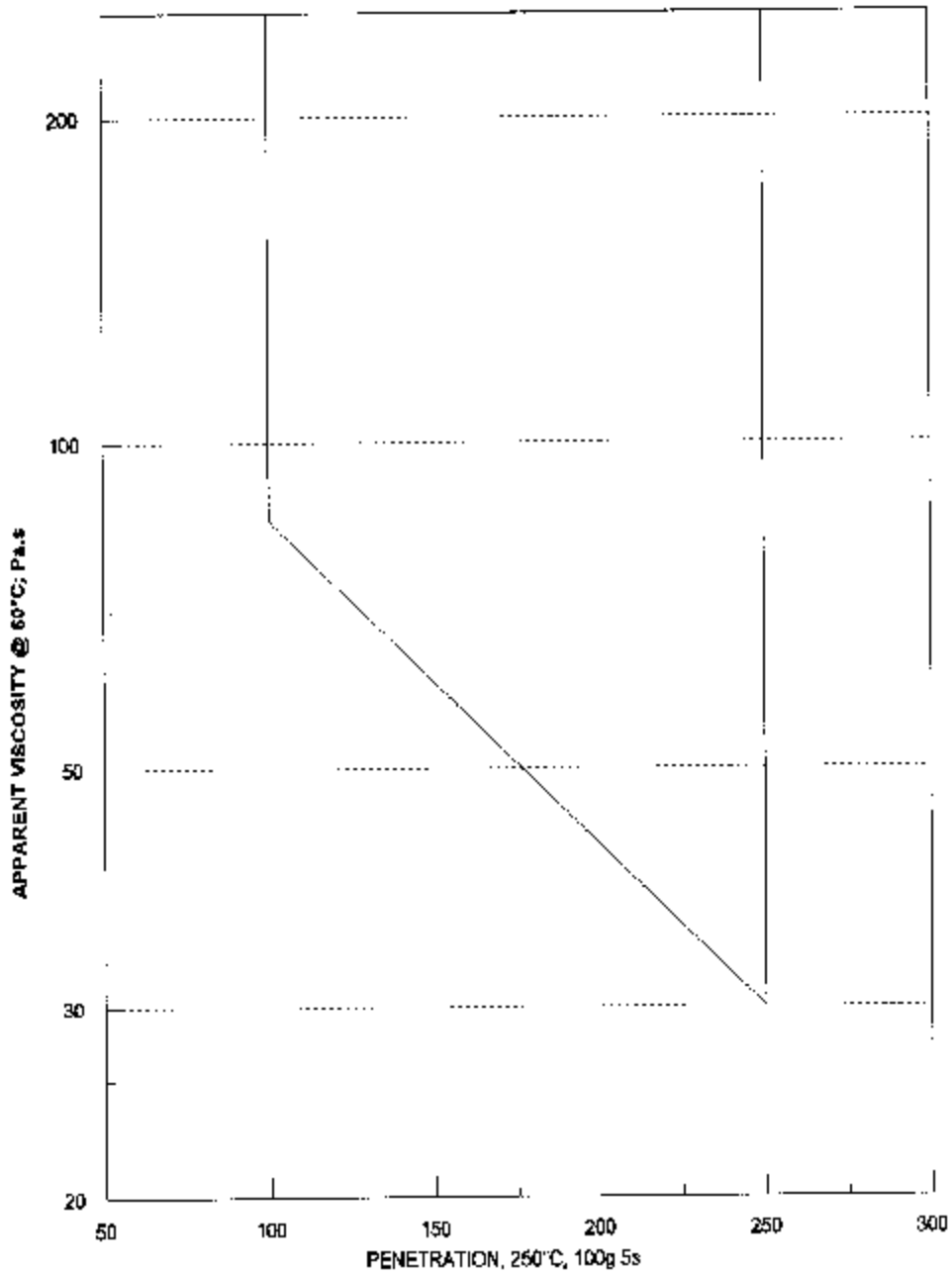
(7) Ductility - Ductility will be measured at 25EC for 100-200 penetration asphalts, and at 15EC for 200-250 penetration asphalts.

(8) Requirements for Storage Stability and Sieve Test are waived if emulsion per forms satisfactorily during application.

General Requirements:
- All tests shall be performed within 15 days of date of delivery.
- The asphalt shall be uniform in character, and shall have a refined petroleum base.

FIGURE 1

MINIMUM VISCOSITY FOR CRS-2 DISTILLATION RESIDUE



SPECIFICATIONS FOR HIGH FLOAT EMULSIFIED ASPHALTS: High Float emulsified asphalt shall conform to the requirements specified in the following table, for the grade designated by the Engineer:

GRADE	**HF-100S**		**HF-150S**		**HF-250S**		**HF-350S**		**HF-300M**		**HF-500M**		**HF-1000M**		**TEST METHODS**
REQUIREMENTS	**min.**	**max.**	**min.**	**max.**	**min.**	**max.**	**min.**	**max.**	**min.**	**max.**	**min.**	**max.**	**min.**	**max.**	**Note(1)**
Residue by Distillation, % by mass	62	(2)	62	(2)	62	(2)	65	(2)	65	(2)	65	(2)	65	(2)	Par./A1.6.2.1
Oil Portion of Distillate, % by volume of emulsion	1	4	1	4	1	6	1.5	6	1	6	1	2	1	7	A.S.T.M. D244 & Par./A1.6.2.2
Viscosity at 50°C, SF s	30	150	30	150	35	150	75	400	50	---	50	---	50	---	ASTM D244
Sieve Test, % retained on No. 1000 sieve % by mass (3)	---	0.10	---	0.10	---	0.10	---	0.10	---	0.10	---	0.10	---	0.10	Par. 6.2.3
Coating Test (see Notes 4 & 5)	Note (4)		Note (4)		Note (4)		Note (5)		Note (5)		Note (5)		Note (5)		ASTM D244
Workability at -10°C	---	---	---	---	---	---	---	---	---	---	---	---	Pass		Par./A1.6.2.4
Storage Stability Test, 24h, % by mass	---	1.5	---	1.5	---	1.5	---	1.5	---	1.5	---	1.5	---	1.5	ASTM D244
Demulsibility, 50 ml, 5.55 g/l $CaCl_2$, % by mass	60	---	60	---	---	---	---	---	---	---	---	---	---	---	ASTM D244
Tests on Residue from Distillation: a) Penetration at 25°C, 100 g, 5 s, dmm	90	150	150	250	250	500	350	750	300	---	500	---	---	---	Par./A1.6.2.5
b) Apparent Viscosity at 60°C, Pa·s	Requirements outlined on the chart beneath Figure 1								10	40	8	20	2	8	Par./A1.6.2.6
c) Float Test at 60°C, s	1200	---	1200	---	1200	---	1200	---	1200	---	1200	---	1200	---	Par./A1.6.2.7
d) Solubility in Trichloroethylene, % by mass	97.5	---	97.5	---	97.5	---	97.5	---	97.5	---	97.5	---	97.5	---	ASTM D2042
Delivery Temperature, °C	40	70	40	70	40	70	40	70	40	70	40	70	40	70	

NOTES:

(1) Test methods are as outlined in CGSB CAN2-16.5-M84.

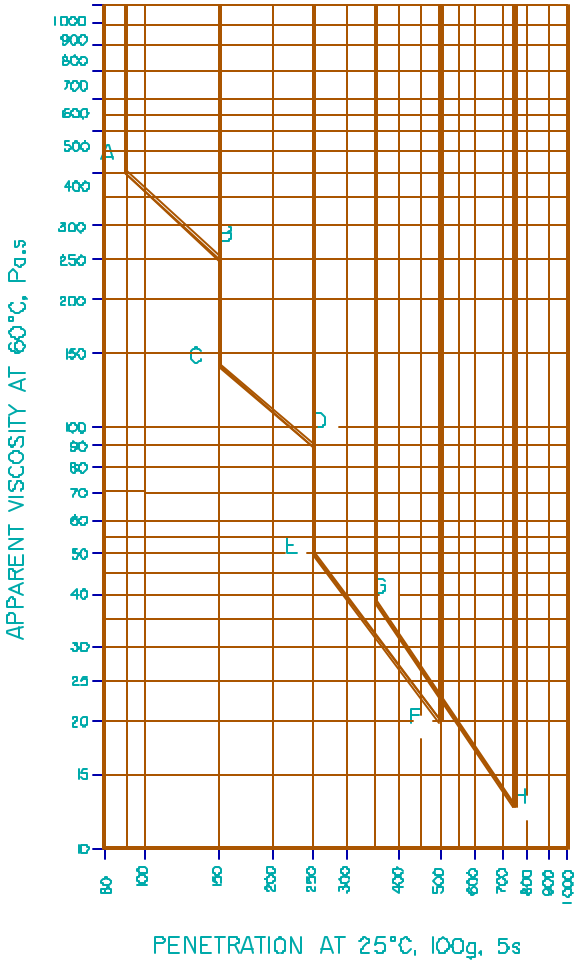
(2) Upper limit on % residue is governed by the viscosity limits.

(3) CGSB 8-GP-2M, Sieves, Testing, Woven Wire, Metric

(4) Follow ASTM D244, except that the mixture of limestone and emulsified asphalt shall be capable of being mixed vigorously for 5 min., 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 then not be less than 90% coated.

(5) Follow ASTM D244, except that the mixture of limestone and emulsified asphalt shall be mixed vigorously for 5 min., then allowed to stand for 3h, after which the mixture shall be capable of being mixed an additional 5 min. 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 mixing the aggregate shall be at least 90% coated.

ASPH-9 (cont.)



Viscosity shall be within the graphic regions above the line designated by specific letters, and between penetration limits contained in vertical lines extending upwards from these points.

Viscosity value shall be reported at $0.5s^{-1}$ for grades HF-100S and HF-150S and at $1.0s^{-1}$ for grades HF-250S and HF-350S.

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

FIGURE 1

Viscosity Requirements for Distallation Residues from High-Float Emulsified Asphalts

SPECIFICATIONS FOR EMULSIFIED ASPHALT PRIMER: Emulsified asphalt primers shall conform to the requirements specified in the following table, for the grade designated by the Engineer:

ASPHALT GRADE	SEP-1		SEP-2		A.S.T.M. TEST METHOD
REQUIREMENTS	min.	max.	min.	max.	
Viscosity at 25EC, SF s	-	-	15	100	D88
Viscosity at 50EC, SF s	35	200	-	-	D244
Flash point, open Tag, EC	45	-	90	-	D3143
Residue by Distillation, % by mass	40	(1)	40	(1)	D244
Oil Portion of Distillate, % by volume of emulsion	12	29	12	29	D244
Settlement in 5 d	no visible separation		-	2	D244
Miscibility with Water (2)	is not miscible with water		pass		D244
Tests on Residue from Distillation:					
a) Penetration at 25EC, 100 g, 5 s, dmm	100	300	100	300	D5
b) Solubility in Trichloroethylene, % by mass	97.5	-	97.5	-	D2042

NOTES:

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

(2) Follow ASTM D244 except add the emulsified primer to the water. After two hours the water should be clear.