MATERIAL SPECIFICATION FOR EMULSIFIED ASPHALT

TABLE OF CONTENTS

1103.01 SCOPE

This specification covers the requirements for different types and grades of emulsified asphalt suitable for both roadway construction and as a straw mulch adhesive.

1103.02 REFERENCES

This specification refers to the following standards, specifications, or publications:

Ontario Ministry of Transportation Publications

MTO Laboratory Testing Manual:
LS-220 Demulsibility of Emulsified Asphalts
LS-224 Coating for Emulsified Asphalts
LS-226 Test for High Float Emulsified Asphalt

ASTM International

D5/D5M-20	Standard Test Method for Penetration of Bituminous Materials
D36/D36M-14(2020)	Standard Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)
D113-17	Standard Test Method for Ductility of Asphalt Materials
D139-16	Standard Test Method for Float Test for Bituminous Materials
D244-09(2017)	Standard Test Methods and Practices for Emulsified Asphalts

D1310-14(2021)	Standard Test Method for Flash Point and Fire Point of Liquids by Tag Open-Cup Apparatus
D6084/D6084M-21	Standard Test Method for Elastic Recovery of Asphalt Materials by Ductilometer
D6930-19	Standard Test Method for Settlement and Storage Stability of Emulsified Asphalts
D6933-18	Standard Test Method for Oversized Particles in Emulsified Asphalts (Sieve Test)
D6935-17	Standard Test Method for Determining Cement Mixing of Emulsified Asphalt
D6997-12(2020)	Standard Test Method for Distillation of Emulsified Asphalt
D7402-09(2017)	Standard Practice for Identifying Cationic Emulsified Asphalts
D7496-18	Standard Test Method for Viscosity of Emulsified Asphalt by Saybolt Furol Viscometer
D8078-18e1	Standard Test Method for Ash Content of Asphalt and Emulsified Asphalt Residues

American Association of State Highway and Transportation Officials (AASHTO)

R 66-16 (2020)	Standard Practice for Sampling Asphalt Materials
T 59-16 (2021)	Standard Method of Test for Emulsified Asphalts
T 300-11 (2020)	Standard Method of Test for Force Ductility Test of Asphalt Materials

Others

Environment and Climate Change Canada - Code of Practice for the Reduction of Volatile Organic Compound (VOC) Emissions from the Use of Cutback and Emulsified Asphalt - Feb, 2017
Ozone Annex (2000) of the Canada-United States Air Quality Agreement (1991)
Canadian Environmental Protection Act, 1999 (CEPA 1999)

1103.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Emulsified Asphalt means asphalt cement milled into microscopic particles and dispersed in water using a chemical emulsifier and other additives. Based on the electrical charges surrounding the asphalt particles, it can be anionic, cationic and non-ionic. It can be classified based on setting time of the asphalt droplets (RS, MS, QS, SS), viscosity of the emulsions (1,2), hardness of the base asphalt cement (H, HH), polymer content (P), and float & flow properties (HF).

Ozone Season means the period of May 1 through September 30 (warm-season months, when the days are warmer and longer), as defined in the Ozone Annex (2000) of the Canada-United States Air Quality Agreement (1991).

Tack Coat means an emulsified asphalt applied to the surface of a new or existing asphalt layer to enhance the bond between the asphalt layers, prior to placing an overlaying layer.

Volatile Organic Compounds (VOC) means the Item 65 components on the List of Toxic Substances in Schedule 1 of the Canadian Environmental Protection Act, 1999 (CEPA 1999).

1103.05 MATERIALS

1103.05.01 Emulsified Asphalt

Emulsified asphalt shall be of the type and grade as specified in the Contract Documents and shall be supplied from a source named on the ministry's DSM. Under no circumstances shall the source of supply or the product be changed, or partial or total supply allocated to another supplier without prior written approval of the Owner.

1103.05.02 Physical Requirements

Emulsified asphalts shall consist of suitable paving asphalts dispersed in water and shall meet the requirements specified in Tables 1, 2, 3, 4, 5, and 6. The addition of polymers or other additives after the manufacture of an emulsified asphalt shall not be permitted.

Emulsified asphalts shall be homogeneous after mixing and show no signs of separation within 30 Days of delivery.

1103.05.03 Straw Mulch Adhesive

Emulsified asphalt used as a straw mulch adhesive shall be:

a) A specially refined petroleum asphalt emulsified in water;

b) Designed to have a fluid consistency for cold spray applications;

c) Designed with no petroleum solvents nor other components toxic to plant life; and

d) According to Table 1.

1103.07 PRODUCTION

1103.07.01 Shipping

The material shall be shipped in clean containers. Containers that are being reused shall be inspected and cleaned, if required, prior to loading to ensure there is no contamination.

When shipping is by tank truck or railway tank car, the material shall arrive at the destination at a temperature at least 5 °C higher than the minimum spraying temperature specified in Table 7 and not more than the maximum spraying temperature specified in Table 7.

When no spraying temperatures are specified in Table 7, the material shall arrive at a temperature meeting the manufacturer’s requirements.

1103.08 QUALITY ASSURANCE

1103.08.01 Compliance

Emulsified asphalts shall be according to Tables 1, 2, 3, 4, 5, and 6 for the particular type and grade when tested according to the test methods designated in the tables.

1103.08.02 Inspection

The Owner may inspect shipping containers for cleanliness at any time.

1103.08.03 Sampling

Representative samples of material being supplied may be taken from either the supplier's plants, maintenance yards, construction sites, or any shipment using the sampling methods according to AASHTO R 66 in the presence of the Contract Administrator. Sample material taken prior to delivery shall be at no additional cost to the Owner.

The samples shall remain in a condition that maintain their original physical and engineering properties of the samples for quality acceptance testing and referee testing, if invoked by the Contractor. The samples shall be protected from freezing, heat, pressure and agitation during the storage period and transportation process.

Duplicate sample shall be taken. The sample size for each sample shall be 3.8 L, or quantity as required by the specific testing. The containers for samples shall be new clean plastic wide-mouth jars or bottles with tight screw caps. The caps and the containers shall fit together tightly. The containers shall be free from contamination, and shall not be submerged in solvent, nor wiped with a solvent saturated cloth. Transferring samples from one container to another shall be avoided if possible.

If the sample appears to be inhomogeneous after reconditioning and mixing, or the sample was subjected to freeze–thaw cycling prior to receipt, the sample shall be discarded and resample for testing shall be required.

1103.08.04 Testing

Samples may be tested by the Owner according to the tests listed in Tables 1, 2, 3, 4, 5, and 6.

Before performing the tests, the samples shall be conditioned and stirred thoroughly to a homogeneous mixture according to AASHTO T 59 to ensure that the emulsified asphalt is in its optimal state for determining its true properties.

1103.08.05 Acceptance

Failure of any sample to conform to any of the material requirements shall be cause for rejection of the material, unless payment adjustments are as specified in the Contract Documents.

TABLE 1
Anionic Emulsified Asphalts

Require-ments	Type	Rapid Setting						Medium Setting				Slow Setting								Test Method
	Grade	RS-1		RS-2		RS-1HH		MS-1		MS-2		SS-1		SS-1H		SS-1HH		Straw Mulch Adhesive		
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Tests on Emulsion																				
Viscosity, Saybolt Furol Seconds: at 25 °C at 50 °C		20 --	100 --	-- 75	-- 300	20 --	60 --	20 --	60 --	-- 35	-- 400	20 --	60 --	20 --	60 --	20 --	60 --	17 --	40 --	ASTM D7496
Residue by Distillation, % by Mass		55	--	60	--	55	--	55	--	65	--	55	--	55	--	55	--	55	--	ASTM D6997
Settlement, %, 5 Days 7 Days		-- --	3 --	-- --	3 --	-- --	5 --	-- --	3 --	-- --	3 --	-- --	5 --	-- --	5 --	-- --	5 --	-- --	-- 5	ASTM D6930
Demulsibility, % 35 ml, 0.02 N $CaCl_2$ 50 ml, 0.1 N $CaCl_2$		60 --	-- --	60 --	-- --	60 --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- 2.0	LS-220
Oil Portion of Distillate, % by Volume/Mass		--	--	--	--	--	1	--	--	--	10	--	--	--	--	--	1	--	--	ASTM D6997
VOC Content as determined by Oil Portion of Distillate, % by Volume (Note 1)		--	3	--	3	--	3	--	3	--	3	--	3	--	3	--	3	--	3	ASTM D6997
Sieve Test, % by Mass		--	0.1	--	0.1	--	0.1	--	0.1	--	0.1	--	0.1	--	0.1	--	0.1	--	0.1	ASTM D6933
Cement Mixing Test, % by Mass		--	--	--	--	--	--	--	--	--	--	--	2.0	--	2.0	--	--	--	--	ASTM D6935
Particle Charge		NEGATIVE OR NEUTRAL																		ASTM D7402
Coating Ability and Water Resistance, %, (Note 2)		--	--	--	--	--	--	80	--	80	--	--	--	--	--	--	--	--	--	LS-224
Fire Resistance		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	PASS		(Note 3)
Tests on Residue																				
Penetration (at 25 °C, 100 g, 5 s), 0.1 mm		100	200	100	200	20	55	100	200	100	250	100	200	40	100	20	55	100	200	ASTM D5M
Ductility (at 25 °C, 5 cm/min), cm		60	--	60	--	40	--	40	--	40	--	40	--	40	--	40	--	40	--	ASTM D113
Ash Content, % by Mass of Residue		--	1.0	--	1.0	--	1.0	--	1.0	--	1.0	--	1.0	--	1.0	--	1.0	--	1.0	ASTM D8078

Notes:

1. Apply to emulsified asphalt used in paving material or in paving, construction and maintenance operations during the ozone season in accordance with 'Code of Practice for the Reduction of Volatile Organic Compound (VOC) Emissions from the Use of Cutback and Emulsified Asphalt' with distillation temperature to 260°C.
2. This requirement does not apply for tack coat or joint painting emulsified asphalts.
3. There shall be no flash or flare-up when the flame of a Bunsen burner is held in contact with the surface of the material, as received, for a period of 10 seconds.

TABLE 2
Cationic Emulsified Asphalts

Require-ments	Type	Rapid Setting						Medium Setting				Slow Setting						Slurry Seal		Test Method
	Grade	CRS-1		CRS-2		CRS-1HH		CMS-2		CMS-2H		CSS-1		CSS-1H		CSS-1HH		CSS-H		
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Tests on Emulsion																				
Viscosity, Saybolt Furol Seconds : at 25 °C at 50 °C		-- 50	-- 150	-- 100	-- 400	20 --	60 --	-- 50	-- 400	-- 50	-- 400	20 --	100 --	20 --	100 --	20 --	60 --	20 --	100 --	ASTM D7496
Residue by Distillation, % by Mass		62	--	67	--	55	--	65	--	65	--	57	--	57	--	55	--	57	--	ASTM D6997
Settlement, %, 5 Days		--	5	--	5	--	5	--	5	--	5	--	5	--	5	--	5	--	5	ASTM D6930
Demulsibility, % 35 ml 0.8% Dioctyl Sodium Sulfosuccinate Solution		40	--	40	--	40	--	--	--	--	--	--	--	--	--	--	--	--	--	LS-220
Oil Portion of Distillate, % by Volume/Mass		--	3	--	3	--	1	--	10	--	10	--	5	--	5	--	1	--	--	ASTM D6997
VOC Content as determined by Oil Portion of Distillate, % by Volume (Note 1)		--	3	--	3	--	3	--	3	--	3	--	3	--	3	--	3	--	3	ASTM D6997
Sieve Test, % by Mass		--	0.1	--	0.1	--	0.1	--	0.1	--	0.1	--	0.1	--	0.1	--	0.1	--	0.1	ASTM D6933
Cement Mixing Test, % by Mass		--	--	--	--	--	--	--	--	--	--	--	2.0	--	2.0	--	--	--	--	ASTM D6935
Particle Charge		POSITIVE																		ASTM D7402
Coating Ability and Water Resistance, % (Note 2)		--	--	--	--	--	--	80	--	80	--	--	--	--	--	--	--	--	--	LS-224
Test on Residue																				
Penetration (at 25 °C, 100 g, 5 s), 0.1 mm		100	250	100	250	20	55	100	250	40	125	100	250	40	125	20	55	40	125	ASTM D5M
Ductility (at 25 °C, 5 cm/min), cm		60	--	60	--	40	--	60	--	40	--	60	--	40	--	40	--	40	--	ASTM D113
Ash Content, % by Mass of Residue		--	1.0	--	1.0	--	1.0	--	1.0	--	1.0	--	1.0	--	1.0	--	1.0	--	1.0	ASTM D8078

Notes:

1. Apply to emulsified asphalt used in paving material or in paving, construction and maintenance operations during the ozone season in accordance with ‘Code of Practice for the Reduction of Volatile Organic Compound (VOC) Emissions from the Use of Cutback and Emulsified Asphalt’ with distillation temperature to 260°C.
2. This requirement does not apply for tack coat or joint painting emulsified asphalts.

TABLE 3
High Float Emulsified Asphalts

Require-ments	Type	High Float														Test Method
	Grade	HFRS-2		HFMS-2(ON)		HF-100S		HF-150S		HF-250S		HF-150M		HF-1000M		
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Tests on Emulsion																
Viscosity, Saybolt Furol Seconds at 50 °C		75	400	50	300	35	150	35	150	35	150	50	--	50	--	ASTM D7496
Residue by Distillation, % by Mass		63	--	62	--	62	--	62	--	62	--	62	--	65	--	LS-226
Demulsibility, % 35 ml 0.02 N $CaCl_2$ 50 ml 0.10 N $CaCl_2$ 50 ml 0.02 N $CaCl_2$		60 -- --	-- -- --	-- -- 40	-- -- --	-- 75 --	-- -- --	-- 75 --	-- -- --	-- -- --	-- -- --	-- -- --	-- -- --	-- -- --	-- -- --	LS-220
Oil Portion of Distillate, % by Volume/Mass		--	--	0.5	3	0.5	4	0.5	4	1	6	1	6	1	7	ASTM D6997
VOC Content as determined by Oil Portion of Distillate, % by Volume (Note 1)		--	3	--	3	--	3	--	3	--	3	--	3	--	3	ASTM D6997
Sieve Test, % by Mass		--	0.10	--	0.10	--	0.10	--	0.10	--	0.10	--	0.10	--	0.10	ASTM D6933
Particle Charge		--		Negative		--		--		--		--		--		ASTM D7402
Coating Ability and Water Resistance, %		--		(Note 2)		(Note 2)		(Note 2)		(Note 2)		(Note 3)		(Note 3)		ASTM D244
Storage Stability 24 h, % by Mass		--	1.0	--	1.5	--	1.5	--	1.5	--	1.5	--	1.5	--	1.5	ASTM D6930
Test on Residue																
Penetration (at 25 °C, 100 g, 5 s), 0.1 mm		100	200	90	200	100	175	150	250	250	500	150	--	--	--	LS-226
Ductility (at 25 °C, 5 cm/min), cm		40	--	--	--	--	--	--	--	--	--	--	--	--	--	ASTM D113
Ash Content, % by Mass of Residue		--	1.0	--	1.0	--	1.0	--	1.0	--	1.0	--	1.0	--	1.0	ASTM D8078
Float Test at 60 °C, s		1200	--	1200	--	1200	--	1200	--	1200	--	1200	--	1200	--	LS-226
Apparent Viscosity (at 60 °C), Pa·s		--	--	--	--	250	--	90	--	20	--	10	80	2	8	LS-226

Notes:

1. Apply to emulsified asphalt used in paving material or in paving, construction and maintenance operations during the ozone season in accordance with 'Code of Practice for the Reduction of Volatile Organic Compound (VOC) Emissions from the Use of Cutback and Emulsified Asphalt' with distillation temperature to 260°C.
2. Follow ASTM D244, except that the mixture of aggregate and emulsified asphalt shall be mixed vigorously for 5 min. at the end of which period the aggregates shall be thoroughly and uniformly coated. The mixture shall then be completely immersed in tap water and the water poured off. The aggregate shall then be at least 90% coated.
3. Follow ASTM D244, except that the mixture of aggregate and emulsified asphalt shall be mixed vigorously for 5 min. then allowed to stand for 3 hours after which the mixture shall be capable of being mixed an additional 1 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 washing the aggregate shall be at least 90% coated.

TABLE 5
Polymer-Modified Emulsified Asphalts

Require-ments	Type	Anionic				Cationic								High Float								Test Method
	Grade	RS-1P		RS-2P		CRS-1P		CRS-2P		CQS-1HP		CSS-1P		HFMS-2P(ON)		HF-100SP		HF-150SP		HF-150MP		
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Tests on Emulsion																						
Viscosity, Saybolt Furol Seconds: at 25 °C at 50 °C		20 --	100 --	-- 75	-- 300	-- 25	-- 150	-- 75	-- 400	20 --	100 --	20 --	100 --	-- 50	-- 300	-- 35	-- 150	-- 35	-- 150	-- 50	-- --	ASTM D7496
Residue by Distillation to 204°C, % by Mass		55	--	60	--	62	--	65	--	62	--	62	--	62	--	62	--	62	--	62	--	ASTM D6997 LS-226
Storage Stability, 24 h, % by Mass		--	1	--	1	--	1	--	1	--	1	--	1	--	1.5	--	1.5	--	1.5	--	1.5	ASTM D6930
Demulsibility, % 35 ml, 0.02 N $CaCl_2$ 50 ml 0.10 N $CaCl_2$ 50 ml 0.02 N $CaCl_2$ 35 ml, 0.8% Dioctyl Sodium Sulfo-Succinate Solution		60 -- -- --	-- -- -- --	60 -- -- --	-- -- -- --	-- -- -- 40	-- -- -- --	-- -- -- 40	-- -- -- --	-- -- -- --	-- -- -- --	-- -- -- --	-- -- -- --	-- -- 40 --	-- -- -- --	-- 75 -- --	-- -- -- --	-- 75 -- --	-- -- -- --	-- -- -- --	-- -- -- --	LS-220
Oil Portion of Distillate, % by Volume/Mass		--	--	--	--	--	--	--	--	--	--	--	5	0.5	3	0.5	4	0.5	4	1	6	ASTM D6997
VOC Content as determined by Oil Portion of Distillate, % by Volume (Note 1)		--	3	--	3	--	3	--	3	--	3	--	3	--	3	--	3	--	3	--	3	ASTM D6997
Sieve Test, % by Mass		--	0.2	--	0.2	--	0.2	--	0.2	--	0.1	--	0.1	--	0.1	--	0.1	--	0.1	--	0.1	ASTM D6933
Particle Charge		Negative or Neutral				Positive								Negative		--		--		--		ASTM D7402
Coating Ability and Water Resistance, %		--		--		--		--		--		--		(Note 2)		(Note 2)		(Note 2)		(Note 3)		ASTM D244
Test on Residue																						
Penetration (at 25 °C, 100 g, 5 s), 0.1 mm		100	200	100	200	100	250	100	250	40	90	100	250	90	200	90	150	150	250	150	250	ASTM D5M LS-226
Float Test at 60 °C, s		--	--	--	--	--	--	--	--	--	--	--	--	1200	--	1200	--	1200	--	1200	--	LS-226 ASTM D139
Ash Content, % by Mass of Residue		--	1.0	--	1.0	--	1.0	--	1.0	--	1.0	--	10	--	1.0	--	1.0	--	1.0	--	1.0	ASTM D8078
Elastic Recovery (at 10 °C), % (Note 4)		55	--	55	--	55	--	55	--	50	--	55	--	55	--	55	--	50	--	50	--	ASTM D6084M
Force Ductility at 800% Elongation, 5 cm/min. Pull Rate at 4 °C, kg		0.5	--	0.5	--	0.5	--	0.5	--	--	--	--	--	0.5	--	0.5	--	--	--	--	--	AASHTO T 300
Softening Point, R&B, °C		--	--	--	--	--	--	--	--	57	--	--	--	--	--	--	--	--	--	--	--	ASTM D36M

Notes for Table 5:

1. Apply to emulsified asphalt used in paving material or in paving, construction and maintenance operations during the ozone season in accordance with 'Code of Practice for the Reduction of Volatile Organic Compound (VOC) Emissions from the Use of Cutback and Emulsified Asphalt' with distillation temperature to 204°C for polymer-modified emulsified asphalts.
2. Follow ASTM D244, except that the mixture of aggregate and emulsified asphalt shall be mixed vigorously for 5 min. at the end of which period the aggregates shall be thoroughly and uniformly coated. The mixture shall then be completely immersed in tap water and the water poured off. The aggregate shall then be at least 90% coated.
3. Follow ASTM D244, except that the mixture of aggregate and emulsified asphalt shall be mixed vigorously for 5 min. then allowed to stand for 3 hours after which the mixture shall be capable of being mixed an additional 1 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 washing the aggregate shall be at least 90% coated.
4. Testing Procedure B of ASTM D6084M to be used for elongation of 20 ± 0.25 cm.

TABLE 5
Emulsified Asphalt Primer (EAP)

Requirements	Min.	Max.	Test Method
Viscosity, Saybolt Furol Seconds at 50 °C	35	150	ASTM D7496
Residue by Distillation to 260 °C, % by Mass	40	--	ASTM D6997
Oil Portion of Distillate, % by Volume/Mass	10	30	ASTM D6997 (Note 1)
VOC Content as determined by Oil Portion of Distillate, % by Volume (Note 2)	--	3	ASTM D6997
Particle Charge	Neutral		ASTM D7402 (Note 3)
Flash Point, Tag Open Cup, °C	45	--	ASTM D1310
Storage Stability, 24 h	No visible separation		ASTM D6930 (Note 4)
Tests on Residue			
Penetration (at 25 °C, 100 g, 5 s), 0.1 mm	100	300	ASTM D5M
Ductility (at 25 °C, 5 cm/min), cm	100	--	ASTM D113
Ash Content, % by Mass of Residue	--	1.0	ASTM D8078

Notes:

1. Since the total distillate exceeds 100 ml, follow ASTM D6997 with the following modification:

   Prior to reaching 100 ml of distillate, carefully replace the first 100 ml graduated cylinder with a second one. After the distillation is complete, determine the volume of oil distillate in both cylinders and record the sum. Calculate the oil portion of the distillate as a percentage of the original weight of primer:

   % Oil = (Total Volume of oil distillate, ml X 100) / (200 g primer)
2. Apply to emulsified asphalt used in paving material or in paving, construction and maintenance operations during the ozone season in accordance with 'Code of Practice for the Reduction of Volatile Organic Compound (VOC) Emissions from the Use of Cutback and Emulsified Asphalt' with distillation temperature to 260°C.
3. Follow ASTM D7402 with the modification that the asphalt does not deposit due to an electrical charge on either the anode (positive electrode) or the cathode (negative electrode). Equal adherence to both electrodes due to the viscous nature of the material is not considered deposition.
4. Follow ASTM D6930 to obtain the percentage of residue from the top samples and bottom samples, and the testing results will be for information purposes only. The compliance of storage stability shall be based on any visual separation of 500 ml representative sample in the glass cylinder after 24 hours.

TABLE 6
Solvent-Free Emulsified Asphalt

Requirements	Min.	Max.	Test Method
Viscosity, Saybolt Furol Seconds at 25 °C	5	50	ASTM D7496
Residue by Distillation to 260 °C, % by Mass	40	-	ASTM D6997
Sieve Test, % by Mass	-	0.1	ASTM D6933
Oil Portion of Distillate, % by Volume/Mass	-	0.5	ASTM D6997 (Note 1)
Storage Stability, 24 h, %	No visible separation		ASTM D6930 (Note 2)
Particle Charge	Negative or Neutral		ASTM D7402
Tests on Residue			
Penetration (at 25 °C, 100 g, 5 s), 0.1 mm	40	150	ASTM D5M
Ductility (at 25 °C, 5 cm/min), cm	40	--	ASTM D113
Ash Content, % by Mass of Residue	--	1.0	ASTM D8078

Notes:

1. Since the total distillate will exceed 100 ml, follow ASTM D6997 with the following modification:

   Prior to reaching 100 ml of distillate, carefully replace the first 100 ml graduated cylinder with a second one. After the distillation is complete, determine the volume of oil distillate in both cylinders and record the sum. Calculate the oil portion of the distillate as a percentage of the original weight of solvent-free emulsified asphalt:

   % Oil = (Total Volume of oil distillate, ml X 100) / (200 g solvent-free emulsified asphalt)

2. Follow ASTM D6930 to obtain the percentage of residue from the top samples and bottom samples, and the testing results will be for information purposes only. The compliance of storage stability shall be based on any visual separation of 500 ml representative sample in the glass cylinder after 24 hours.

TABLE 7
Temperature for Spraying and Mixing Emulsified Asphalts, °C

Grade	Spraying		Mixing	
	Minimum	**Maximum**	**Minimum**	**Maximum**
RS-1, RS-1P, RS-1HH	30 (Note 1) 20 (Note 2)	70 70	-- --	-- --
RS-2, RS-2P	60 (Note 1)	80	--	--
MS-1	--	--	30	70
MS-2	--	--	30	70
SS-1	20	70	20	70
SS-1H, SS-1HH	20	70	20	70
HFRS-2	60	80	--	--
HFMS-2(ON), HFMS-2P(ON)	60	80	--	--
HF-100S, HF-100SP	60	80	--	--
HF-150S, HF-150SP	60	80	--	--
HF-250S	60	80	--	--
HF-150M, HF-150MP	--	--	40	80
HF-1000M	--	--	40	75
CRS-1, CRS-1P, CRS-1HH	60	80	--	--
CRS-2, CRS-2P	60	80	--	--
CMS-2	--	--	30	70
CMS-2H	--	--	30	70
CSS-1	--	--	30	70
CSS-1H	--	--	30	70
CSS-1P	--	--	20	60
CSS-1HH	20	70	--	--
CSS-H (Slurry)	--	--	20	35
CQS-1HP	--	--	Manufacturer's Requirements	
Emulsified Asphalt Primer (EAP)	Manufacturer's Requirements		--	--
Solvent-Free Emulsified Asphalt	Manufacturer's Requirements		--	--

Notes:
1. For surface treatment.
2. For other uses.