

TECHNICAL SPECIFICATIONS

Item 00300 ASPHALTS, OILS, AND EMULSIONS

300.1. Description. Provide asphalt cements, cutback and emulsified asphalts, performance graded asphalt binders, and other miscellaneous asphalt materials as specified in the plans.

300.2. Materials. Provide asphalt materials that meet the stated requirements when tested in accordance with the referenced AASHTO, and ASTM test methods.

Acronyms used in this Item are defined in Table 1.

**Table 1
Acronyms**

Acronym	Definition	Acronym	Definition
Test Procedure Designation		Polymer Modifier Designations	
T	AASHTO	SBR or L	Styrene-Butadiene Rubber (Latex)
D	ASTM	SBS	Styrene-Butadiene-Styrene Block Co-Polymer
		TR	Tire Rubber, from ambient temperature grinding of truck and passenger tires
		P	Polymer Modified
AC	Asphalt Cement	SS	Slow Setting
RC	Rapid Curing	H-suffix	Harder Residue (Lower Penetration)
MC	Medium Curing	AE	Asphalt Emulsion
SCM	Special Cutback Material	S-suffix	Stockpile Usage
HF	High Float	AE-P	Asphalt Emulsion Prime
C	Cationic	EAP&T	Emulsified Asphalt Prime and Tack
RS	Rapid Setting	PCE	Prime, Cure, and Erosion Control
MS	Medium Setting	PG	Performance Grade

A. Asphalt Cement. Asphalt cement must be homogeneous, water-free, and nonfoaming when heated to 347°F, and must meet Table 2 requirements.

**Table 2
Asphalt Cement**

Viscosity Grade		AC-0.6		AC-1.5		AC-3		AC-5		AC-10	
Property	Test Procedure	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Viscosity											
140°F, poise	T 202	40	80	100	200	250	350	400	600	800	1200
275°F, poise	T 202	0.4	-	0.7	-	1.1	-	1.4	-	1.9	-
Penetration, 77°F, 100 g, 5 sec.	T 49	350	-	250	-	210	-	135	-	85	-
Flash Point, C.O.C., °F	T 48	425	-	425	-	425	-	425	-	450	-
Solubility in Trichloroethylene, %	T 44	99.0	-	99.0	-	99.0	-	99.0	-	99.0	-
Tests on Residue from Thin Film Oven Test:	T 179										

Viscosity, 140°F, poise	T 202	-	180	-	450	-	900	-	1500	-	3000
Ductility ¹ , 77°F, 5cm/min., cm	T 51	100	-	100	-	100	-	100	-	100	-

¹If AC-0.6 or AC-1.5 Ductility at 77°F is less than 100 cm, material is acceptable if Ductility at 60°F is more than 100 cm.

B. Polymer Modified Asphalt Cement. Polymer modified asphalt cement must be smooth, homogeneous, and comply with the requirements of Table 3. If requested, supply samples of the base asphalt cement and polymer additives.

Table 3
Polymer Modified Asphalt Cement

Polymer Modified Viscosity Grade		AC-5 w/2% SBR		AC-10 w/2% SBR		AC-15P		AC-15-5TR	
Property	Test Procedure	Min	Max	Min	Max	Min	Max	Min	Max
Polymer		SBR		SBR		SBS		Tire Rubber	
Polymer Content, % (solids basis)		2.0	-	2.0	-	3.0	-	5.0	-
Viscosity									
140°F, poise	T 202	700	-	1300	-	1500	-	1500	-
275°F, poise	T 202	-	7.0	-	8.0	-	8.0	-	8.0
Penetration, 77°F, 100 g, 5 sec.	T 49	120	-	80	-	100	150	75	125
Ductility, 5cm/min., 39.2°F, cm	T 51	70	-	60	-	-	-	-	-
Elastic Recovery, 50°F, %		-	-	-	-	55	-	55	-
Softening Point, °F	T 53	-	-	-	-	-	-	113	-
Flash Point, C.O.C., °F	T 48	425	-	425	-	425	-	425	-
Tests on Residue from Thin Film Oven Test:	T 179								
Retained Penetration Ratio, 77°F	T 49	-	-	-	-	0.60	1.00	0.60	1.00

C. Cutback Asphalt. Cutback asphalt must meet the requirements of Tables 4, 5, and 6 for the specified type and grade. If requested, supply samples of the base asphalt cement and polymer additives.

Table 4
Rapid Curing Cutback Asphalt

Type – Grade		RC-250		RC-800		RC-3000	
Property	Test Procedure	Min	Max	Min	Max	Min	Max
Kinematic Viscosity, 140°F, cSt	T 201	250	400	800	1600	3000	6000
Water, %	T 55	-	0.2	-	0.2	-	0.2
Flash Point, T.O.C., °F	T 79	80	-	80	-	80	-
Distillation Test:	T 78						
Distillate, percentage by volume of total distillate to 680°F							
to 437°F		40	75	35	70	20	55
to 500°F		65	90	55	85	45	75
to 600°F		85	-	80	-	70	-
Residue from distillation, volume %		70	-	75	-	82	-
Tests on Distillation Residue:							
Penetration, 100 g, 5 sec., 77°F	T 49	80	120	80	120	80	120
Ductility, 5 cm/min., 77°F, cm	T 51	100	-	100	-	100	-
Solubility in Trichloroethylene, %	T 44	99.0	-	99.0	-	99.0	-

**Table 5
Medium Curing Cutback Asphalt**

Type-Grade		MC-30		MC-250		MC-800		MC-3000	
Property	Test Procedure	Min	Max	Min	Max	Min	Max	Min	Max
Kinematic Viscosity, 140°F, cSt	T 201	30	60	250	500	800	1600	3000	6000
Water, %	T 55	-	0.2	-	0.2	-	0.2	-	0.2
Flash Point, T.O.C., °F	T 79	100	-	150	-	150	-	150	-
Distillation Test:	T 78								
Distillate, percentage by volume of total distillate to 680°F									
to 437°F		-	25	-	10	-	-	-	-
to 500°F		40	70	15	55	-	35	-	15
to 600°F		75	93	60	87	45	80	15	75
Residue from distillation, volume %		50	-	67	-	75	-	80	-
Tests on Distillation Residue:									
Penetration, 100 g, 5 sec., 77°F	T 49	120	250	120	250	120	250	120	250
Ductility, 5 cm/min., 77°F, cm ¹	T 51	100	-	100	-	100	-	100	-
Solubility in Trichloroethylene, %	T 44	99.0	-	99.0	-	99.0	-	99.0	-

¹If the Penetration of residue is more than 200 and the Ductility at 77°F is less than 100 cm, the material is acceptable if its Ductility at 60°F is more than 100 cm.

**Table 6
Special Use Cutback Asphalt**

Type-Grade		MC-2400L		SCM I		SCM II	
Property	Test Procedure	Min	Max	Min	Max	Min	Max
Kinematic Viscosity, 140°F, cSt	T 201	2400	4800	500	1000	1000	2000
Water, %	T 55	-	0.2	-	0.2	-	0.2
Flash Point, T.O.C., °F	T 79	150	-	175	-	175	-
Distillation Test:	T 78						
Distillate, percentage by volume of total distillate to 680°F							
to 437°F		-	-	-	-	-	-
to 500°F		-	35	-	0.5	-	0.5
to 600°F		35	80	20	60	15	50
Residue from distillation, volume %		78	-	76	-	82	-
Tests on Distillation Residue:							
Polymer			SBR		-		-
Polymer Content, % (solids basis)							
Penetration, 100 g, 5 sec., 77°F	T 49	150	300	180	-	180	-
Ductility, 5 cm/min., 39.2°F, cm	T 51	50	-	-	-	-	-
Solubility in Trichloroethylene, %	T 44	99.0	-	99.0	-	99.0	-

D. Emulsified Asphalt. Emulsified asphalt must be homogeneous, does not separate after thorough mixing, and must meet the requirements for the specified type and grade in Tables 7, 8, 9, and 10.

**Table 7
Emulsified Asphalt**

Type-Grade		Rapid Setting		Medium Setting				Slow Setting			
		HFRS-2		MS-2		AES-300		SS-1		SS-1H	
Property	Test Procedure	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol 77°F, sec.	T 72	-	-	-	-	75	400	20	100	20	100
122°F, sec.		150	400	100	300	-	-	-	-	-	-
Sieve Test, %	T 59	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1
Miscibility	T 59	-	-	-	-	-	-	pass	pass	pass	pass
Cement Mixing, %	T 59	-	-	-	-	-	-	-	2.0	-	2.0
Coating Ability and Water Resistance:	T 59										
dry aggregate/after spray		-	-	-	-	good/fair	-	-	-	-	-
wet aggregate/after spray		-	-	-	-	fair/fair	-	-	-	-	-
Demulsibility, 35 ml of 0.02 N CaCl ₂ , %	T 59	50	-	-	30	-	-	-	-	-	-
Storage Stability, 1 day, %	T 59	-	1	-	1	-	1	-	1	-	1
Freezing Test, 3 cycles ¹	T 59	-	-	pass	-	-	-	pass	pass	pass	pass
Distillation Test:	T 59										
Residue by Distillation, % by wt.		65	-	65	-	65	-	60	-	60	-
Oil Distillate, % by volume of emulsion		-	0.5	-	0.5	-	5	-	0.5	-	0.5
Tests on Residue from Distillation:											
Penetration, 77°F, 100 g, 5 sec.	T 49	100	140	120	160	300	-	120	160	70	100
Solubility in Trichloroethylene, %	T 44	97.5	-	97.5	-	97.5	-	97.5	-	97.5	-
Ductility, 77°F, 5 cm/min., cm	T 51	100	-	100	-	-	-	100	-	80	-
Float Test, 140°F, sec.	T 50	1200	-	-	-	1200	-	-	-	-	-

¹Applies only when the Engineer designates material for winter use.

**Table 8
Cationic Emulsified Asphalt**

Type-Grade		Rapid Setting		Medium Setting		Slow Setting							
		CRS-2		CRS-2H		CMS-2		CMS-2S		CSS-1		CSS-1H	
Property	Test Procedure	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol 77°F, sec.	T 72	-	-	-	-	-	-	-	-	20	100	20	100
		150	400	150	400	100	300	100	300	-	-	-	-
Sieve Test, %	T 59	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1
Cement Mixing, %	T 59	-	-	-	-	-	-	-	-	-	2.0	-	2.0
Coating Ability and Water Resistance:	T 59	dry aggregate/after spray		-		good/fair		good/fair		-		-	
		wet aggregate/after spray		-		fair/fair		fair/fair		-		-	
Demulsibility, 35 ml of 0.8% sodium dioctyl sulfosuccinate, %	T 59	70	-	70	-	-	-	-	-	-	-	-	-
Storage Stability, 1 day, %	T 59	-	1	-	1	-	1	-	1	-	1	-	1
Particle Charge	T 59	positive		positive		positive		positive		positive		positive	
Distillation Test:	T 59	Residue by Distillation, % by wt.		65 -		65 -		65 -		65 -		60 -	
		Oil Distillate, % by volume of emulsion		- 0.5		- 0.5		- 7		- 5		- 0.5	
Tests on Residue from Distillation:	T 49	Penetration, 77°F, 100 g, 5 sec.		120 - 160		70 - 110		120 - 200		300 -		120 - 160	
		Solubility in Trichloroethylene, %		97.5 -		97.5 -		97.5 -		97.5 -		97.5 -	
		Ductility, 77°F, 5 cm/min., cm		100 -		80 -		100 -		-		100 -	

**Table 9
Polymer Modified Emulsified Asphalt**

Type-Grade		Rapid Setting				Medium Setting						Slow Setting	
		RS-1P		HFRS-2P		AES-150P		AES-300P		AES-300S		SS-1P	
Property	Test Procedure	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol 77°F, sec.	T 72	-	-	-	-	75	400	75	400	75	400	30	100
		50	200	150	400	-	-	-	-	-	-	-	-
Sieve Test, %	T 59	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1
Miscibility	T 59	-	-	-	-	-	-	-	-	-	-	-	pass
Coating Ability and Water Resistance: dry aggregate/after spray	T 59	-	-	-	-	good/fair	good/fair	good/fair	good/fair	good/fair	good/fair	-	-
		-	-	-	-	fair/fair	fair/fair	fair/fair	fair/fair	fair/fair	fair/fair	-	-
Demulsibility, 35 ml of 0.02 N CaCl ₂ , %	T 59	60	-	50	-	-	-	-	-	-	-	-	-
Storage Stability, 1 day, %	T 59	-	1	-	1	-	1	-	1	-	1	-	1
Distillation Test: ¹ Residue by Distillation, % by wt. Oil Distillate, % by volume of emulsion	T 59	65	-	65	-	65	-	65	-	65	-	60	-
		-	3	-	0.5	-	3	-	5	-	7	-	0.5
Penetration, 77°F, 100 g, 5 sec.	T 49	225	300	90	140	150	300	300	-	300	-	100	140
Solubility in Trichloroethylene, %	T 44	97.0	-	97.0	-	97.0	-	97.0	-	97.0	-	97.0	-
Viscosity, 140°F, poise	T 202	-	-	1500	-	-	-	-	-	-	-	130	-
Float Test, 140°F, sec.	T 50	-	-	1200	-	1200	-	1200	-	1200	-	-	-
Ductility ² , 39.2°F, 5 cm/min., cm	T 51	-	-	50	-	-	-	-	-	-	-	50	-

¹Exception to AASHTO T 59: Bring the temperature on the lower thermometer slowly to 350°F ± 10°F. Maintain at this temperature for 20 min. Complete total distillation in 60 ± 5 min. from the first application of heat.

²HFRS-2P must meet one of either the Ductility or Elastic Recovery requirements.

Table 10
Polymer Modified Cationic Emulsified Asphalt

Type-Grade		Rapid Setting				Slow Setting	
		CRS-1P		CRS-2P		CSS-1P	
Property	Test Procedure	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol 77°F, sec.	T 72	-	-	-	-	20	100
		50	150	150	400	-	-
Sieve Test, % Demulsibility, 35 ml of 0.8% sodium dioctyl sulfosuccinate, %	T 59	-	0.1	-	0.1	-	0.1
Storage Stability, 1 day, %	T 59	-	1	-	1	-	1
Particle Charge	T 59	positive		positive		positive	
Distillation Test: ¹ Residue by Distillation, % by wt. Oil Distillate, % by volume of emulsion	T 59	65	-	65	-	62	-
		-	3	-	0.5	-	0.5
Tests on Residue from Distillation:							
Penetration, 77°F, 100 g, 5 sec.	T 49	225	300	90	150	55	90
Viscosity, 140°F, poise	T 202	-	-	130	0	-	-
Solubility in Trichloroethylene, %	T 44	97.0	-	97.0	-	97.0	-
Softening Point, °F	T 53	-	-	-	-	135	-
Ductility, 77°F, 5 cm/min., cm	T 51	-	-	-	-	70	-
Ductility ² , 39.2°F, 5 cm/min., cm	T 51	-	-	50	-	-	-

¹Exception to AASHTO T 59: Bring the temperature on the lower thermometer slowly to 350°F ± 10°F. Maintain at this temperature for 20 min. Complete total distillation in 60 ± 5 min. from the first application of heat.

²CRS-2P must meet one of either the Ductility or Elastic Recovery requirements.

E. Specialty Emulsions. Specialty emulsions may be either asphalt-based or resin-based and must meet the requirements of Table 11.

**Table 11
Specialty Emulsions**

Type-Grade		Medium Setting				Slow Setting	
		AE-P		EAP&T		PCE ¹	
Property	Test Procedure	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol 77°F, sec.	T 72	-	-	-	-	10	100
		15	150	-	-	-	-
122°F, sec.							
Sieve Test, %	T 59	-	0.1	-	0.1	-	0.1
Miscibility ²	T 59	-	-	pass		pass	
Demulsibility, 35 ml of 0.10 N CaCl ₂ , %	T 59	-	70	-	-	-	-
Storage Stability, 1 day, %	T 59	-	1	-	1	-	-
Asphalt Emulsion Distillation to 500°F followed by Cutback Asphalt Distillation of Residue to 680°F: Residue after both Distillations, % by wt.	T 59 & T 78	40	-	-	-	-	-
		25	40	-	-	-	-
Total Oil Distillate from both distillations, % by volume of emulsion							
Distillation: Residue by Distillation, % by wt.	T 59	-	-	60	-	-	-
Evaporation: ⁴ Residue by Evaporation, % by wt.	T 59	-	-	-	-	60	-
Tests on Residue after all Distillation(s):							
Viscosity, 140°F, poise	T 202	-	-	800	-	-	-
Kinematic Viscosity, 140°F, cSt	T 201	-	-	-	-	100	350
Flash Point, C.O.C., °F	T 48	-	-	-	-	400	-
Solubility in Trichloroethylene, %	T 44	97.5	-	-	-	-	-
Float Test, 122°F, sec.	T 50	50	200	-	-	-	-

¹Supply with each shipment of PCE:

- a) a copy of a lab report from an approved analytical lab, signed by a lab official, indicating the PCE formulation does not meet any characteristics of a Resource Conservation Recovery Act (RCRA) hazardous waste;
- b) a certification from the producer that the formulation supplied does not differ from the one tested and that no listed RCRA hazardous wastes or PCB's have been mixed with the product; and
- c) a Material Safety Data Sheet.

²Exception to AASHTO T 59: In dilution, use 350 ml of distilled or deionized water and a 1000-ml beaker.

³Test method should include distilled or deionized water as a medium and no dispersant, or other approved method.

⁴Exception to AASHTO T 59: Leave sample in the oven until foaming ceases, then cool and weigh.

F. Recycling Agent. Recycling agent and emulsified recycling agent must meet the requirements in Table 12. Additionally, recycling agent and residue from emulsified recycling agent, when added in the specified proportions to the recycled asphalt, must meet the properties specified on the plans.

**Table 12
Recycling Agent and Emulsified Recycling Agent**

Property	Test Procedure	Recycling Agent		Emulsified Recycling Agent	
		Min	Max	Min	Max
Viscosity, Saybolt Furol, 77°F, sec.	T 72	-	-	15	100
Sieve Test, %	T 59	-	-	-	0.1
Miscibility ¹	T 59	-	-	No Coagulation	
Evaporation Test: ² Residue by Evaporation, % by wt.	T 59	-	-	60	-
Tests on Recycling Agent or Residue from Evaporation:					
Flash Point, C.O.C., °F	T 48	400	-	400	-
Kinematic Viscosity, 140°F, cSt	T 201	75	200	75	200
275°F, cSt		-	10.0	-	10.0

¹Exception to AASHTO T 59: Use 0.02 N CaCl₂ solution in place of water.

²Exception to AASHTO T 59: Maintain sample at 300°F until foaming ceases, then cool and weigh.

G. Crumb Rubber Modifier. Crumb rubber modifier (CRM) consists of automobile and truck tires processed by ambient temperature grinding.

CRM must be:

- free from contaminants including fabric, metal, and mineral and other nonrubber substances;
- free-flowing; and
- nonfoaming when added to hot asphalt binder.

When tested, using a 50-g sample, the rubber gradation must meet the requirements of the grades in Table 13.

**Table 13
Crumb Rubber Modifier Gradations**

CRM Grade	Grade A		Grade B		Grade C		Grade D	Grade E
	Min	Max	Min	Max	Min	Max		
Sieve Size (% Passing)								
#8	100	-	-	-	-	-	As Shown	As Approved
#10	95	100	100	-	-	-		
#16	-	-	70	100	100	-	On The Plans	
#30	-	-	25	60	90	100		
#40	-	-	-	-	45	100		
#50	0	10	-	-	-	-		
#200	-	-	0	5	-	-		

H. Crack Sealer. Polymer modified asphalt-emulsion crack sealer must meet the requirements of Table 14. Rubber-asphalt crack sealer must meet the requirements of Table 15.

**Table 14
Polymer Modified Asphalt Emulsion Crack Sealer**

Property	Test Procedure	Limits	
		Min	Max
Rotational Viscosity, 77°F, cP	ASTM D 2196, Method A	10,000	25,000
Sieve Test, %	T 59	-	0.1
Storage Stability, 1 day, %	T 59	-	1
Tests on Residue from Evaporation:			
Penetration, 77°F, 100 g, 5 sec.	T 49	35	75
Softening Point, °F	T 53	140	-
Ductility, 39.2°F, 5 cm/min., cm	T 51	100	-

**Table 15
Rubber-Asphalt Crack Sealer**

Property	Test Procedure	Class A		Class B	
		Min	Max	Min	Max
Virgin Rubber Content ¹ , % by wt.		-	-	2	-
Flash Point ² , COC, °F	T 48	400	-	400	-
Penetration ³ , 77°F, 150g, 5 sec.	T 49	30	50	30	50
Penetration ³ , 32°F, 200g, 60 sec.	T 49	12	-	12	-
Softening Point, °F	T 53	-	-	170	-

¹Provide certification that the min. % virgin rubber was added.

²Before passing the test flame over the cup, agitate the sealing compound with a 3/8 to 1/2-in. (9.5 to 12.7-mm)-wide, square-end metal spatula in a manner so as to bring the material on the bottom of the cup to the surface, i.e. turn the material over. Start at one side of the thermometer, move around to the other, and then return to the starting point using 8 to 10 rapid circular strokes. Accomplish agitation in 3 to 4 sec. Pass the test flame over the cup immediately after stirring is completed.

³Exception to AASHTO T 49: Substitute the cone specified in ASTM D 217 for the penetration needle.

⁴No crack in the crack sealing materials or break in the bond between the sealer and the mortar blocks over 1/4-in. deep for any specimen after completion of the test.

I. Asphalt-Rubber Binders. Asphalt-rubber binders are mixtures of asphalt binder and CRM, which have been reacted at elevated temperatures. The asphalt-rubber binders meet ASTM D 6114 and contain a minimum of 15% CRM by weight. Types I or II, containing CRM Grade C, are used for hot mixed aggregate mixtures. Types II or III, containing CRM Grade B, are used for surface treatment binder. Table 16 describes binder properties.

**Table 16
Asphalt-Rubber Binders**

Asphalt-Rubber Binder Type	Test Procedure	Type I		Type II		Type III	
		Min	Max	Min	Max	Min	Max
Property							
Apparent Viscosity, 347°F, cP	D 2196, Method A	1500	5000	1500	5000	1500	5000
Penetration, 77°F, 100 g, 5 sec.	T 49	25	75	25	75	50	100
Penetration, 39.2°F, 200 g, 60 sec.	T 49	10	-	15	-	25	-
Softening Point, °F	T 53	135	-	130	-	125	-
Resilience, 77°F, %	D 5329	25	-	20	-	10	-
Flash Point, C.O.C., °F	T 48	450	-	450	-	450	-
Tests on Residue from Thin Film Oven Test:	T 179						
Retained Penetration Ratio, 39.2°F, 200 g, 60 sec., % of original	T 49	75	-	75	-	75	-

J. Performance Graded Binders. Performance graded binders must be smooth and homogeneous, show no separation and must meet Table 17 requirements.

Separation testing is not required if:

- a modifier is introduced separately at the mix plant either by injection in the asphalt line or mixer,
- the binder is blended on site in continuously agitated tanks, or
- binder acceptance is based on field samples taken from an in-line sampling port at the hot mix plant after the addition of modifiers.

**Table 17
Performance Graded Binders**

Performance Grade	PG 58			PG 64			PG 70			PG 76			PG 82					
	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28
Average 7-day Max Pavement Design Temperature, °C ¹	58			64			70			76			82					
Min Pavement Design Temperature, °C ¹	>-22	>-28	>-34	>-16	>-22	>-28	>-34	>-16	>-22	>-28	>-34	>-16	>-22	>-28	>-34	>-16	>-22	>-28
ORIGINAL BINDER																		
Flash Point, AASHTO T 48: Min, °C	230																	
Viscosity, AASHTO TP 48: ^{2,3} Max, 3.0 Pa*s, Test Temperature, °C	135																	
Dynamic Shear, AASHTO TP 5: ⁴ G*/sin(δ), Min, 1.00 kPa Test Temperature @ 10 rad/sec., °C	58			64			70			76			82					
Elastic Recovery, ASTM D 6084, 50°F, % Min	-	-	30	-	-	30	50	-	30	50	60	30	50	60	70	50	60	70
ROLLING THIN FILM OVEN																		
Mass Loss, Max, %	1.0																	
Dynamic Shear, AASHTO TP 5: G*/sin(δ), Min, 2.20 kPa Test Temperature @10 rad/sec., °C	58			64			70			76			82					
PRESSURE AGING VESSEL (PAV) RESIDUE (AASHTO PP 1)																		
PAV Aging Temperature, °C	100																	
Dynamic Shear, AASHTO TP 5: G*/sin(δ), Max, 5000 kPa Test Temperature @10 rad/sec., °C	25	22	19	28	25	22	19	28	25	22	19	28	25	22	19	28	25	22
Creep Stiffness, AASHTO TP 1: ^{5,6} S, Max, 300 MPa, <i>m</i> - value, Min, 0.300 Test Temperature @ 60 sec., °C	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18
Direct Tension, AASHTO TP 3: ⁶ Failure Strain, Min, 1.0% Test Temperature @1.0 mm/min., °C	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18

¹Pavement temperatures are estimated by following the procedures outlined in AASHTO MP 2 and PP 28.

²This requirement may be waived at the City's discretion if the supplier warrants that the asphalt binder can be adequately pumped, mixed, and compacted at temperatures that meet all applicable safety, environmental, and constructability requirements. At test temperatures where the binder is a Newtonian fluid, any suitable standard means of viscosity measurement may be used, including capillary (AASHTO T 201 or T 202) or rotational viscometry (AASHTO TP 48).

³Viscosity at 135°C is an indicator of mixing and compaction temperatures that can be expected in the lab and field. High values may indicate high mixing and compaction temperatures. Additionally, significant variation can occur from batch to batch. Contractors should be aware that variation could significantly impact their mixing and compaction operations. Contractors are therefore responsible for addressing any constructability issues that may arise.

⁴For quality control of unmodified asphalt binder production, measurement of the viscosity of the original asphalt binder may be substituted for dynamic shear measurements of G*/sin(δ) at test temperatures where the asphalt is a Newtonian fluid. Any suitable standard means of viscosity measurement may be used, including capillary (AASHTO T 201 or T 202) or rotational viscometry (AASHTO TP 48).

⁵Silicone beam molds, as described in AASHTO TP 1-93, are acceptable for use.

⁶If creep stiffness is below 300 MPa, direct tension test is not required. If creep stiffness is between 300 and 600 MPa, the direct tension failure strain requirement can be used instead of the creep stiffness requirement. The *m*-value requirement must be satisfied in both cases.

300.3. Equipment. Provide all equipment necessary to transport, store, sample, heat, apply, and incorporate asphalts, oils, and emulsions.

300.4. Construction.

A. Typical Material Use. Table 18 shows typical materials used for specific applications. These are typical uses only. Circumstances may require use of other material.

**Table 18
Typical Material Use**

Material Application	Typically Used Materials
Hot-Mixed, Hot-Laid Asphalt Mixtures	PG Binders, Modified PG Binders, Asphalt-Rubber Types I and II
Surface Treatment	AC-5, AC-10, AC-5 w/2% SBR, AC-10 w/2% SBR, AC-15P, AC-15-5TR, HFRS-2, MS-2, CRS-2, CRS-2H, HFRS-2P, CRS-2P, Asphalt-Rubber Types II and III
Surface Treatment (Cool Weather)	RS-1P, CRS-1P, RC-250, RC-800, RC-3000, MC-250, MC-800, MC-3000, MC-2400L
Precoating	AC-5, AC-10, PG 64-22, SS-1, SS-1H, CSS-1, CSS-1H
Tack Coat	RC-250, SS-1, SS-1H, CSS-1, CSS-1H, EAP&T
Fog Seal	SS-1, SS-1H, CSS-1, CSS-1H
Hot-Mixed, Cold-Laid Asphalt Mixtures	AC-0.6, AC-1.5, AC-3, AES-300, AES-300P, CMS-2, CMS-2S
Patching Mix	MC-800, SCM I, SCM II, AES-300S
Recycling	AC-0.6, AC-1.5, AC-3, AES-150P, AES-300P, Recycling Agent, Emulsified Recycling Agent
Crack Sealing	SS-1P, Polymer Mod AE Crack Sealant, Rubber Asphalt Crack Sealers (Class A, Class B)
Microsurfacing	CSS-1P
Prime	MC-30, AE-P, EAP&T, PCE
Curing Membrane	SS-1, SS-1H, CSS-1, CSS-1H, PCE
Erosion Control	SS-1, SS-1H, CSS-1, CSS-1H, PCE

B. Storage, Heating, and Application Temperatures. Use storage, heating, and application temperatures in accordance with Table 19. Store and apply materials at the lowest temperature yielding satisfactory results. Follow Manufacturer's instructions for any agitation requirements in storage. Manufacturer's instructions regarding recommended application and storage temperatures supercede those of Table 19.

**Table 19
Storage, Heating, and Application Temperatures**

Type - Grade	Application		Storage Maximum , °F
	Recommend ed Range, °F	Maximum Allowable , °F	
AC-0.6, AC-1.5, AC-3	200 - 300	350	350
AC-5, AC-10	275 - 350	350	350
AC-5 w/2% SBR, AC-10 w/2% SBR, AC-15P, AC-15-5TR	300 - 375	375	360
RC-250	125 - 180	200	200
RC-800	170 - 230	260	260
RC-3000	215 - 275	285	285
MC-30, AE-P	70 - 150	175	175
MC-250	125 - 210	240	240
MC-800, SCM I, SCM II	175 - 260	275	275
MC-3000, MC-2400L	225 - 275	290	290
HFRS-2, MS-2, CRS-2, CRS-2H, HFRS-2P, CRS-2P, CMS-2, CMS-2S, AES-300, AES-300S, AES-150P, AES-300P	120 - 160	180	180
SS-1, SS-1H, CSS-1, CSS-1H, PCE, EAP&T, SS-1P, RS-1P, CRS-1P, CSS-1P, Recycling Agent, Emulsified Recycling Agent, Polymer Mod AE Crack Sealant	50 - 130	140	140
PG Binders, Modified PG Binders	275 - 350	350	350
Rubber Asphalt Crack Sealers (Class A, Class B)	350 - 375	400	-
Asphalt-Rubber Types I, II, and III	325 - 425	425	425

300.5. Measurement and Payment. The work performed, materials furnished, equipment, labor, tools, and incidentals will not be measured or paid for directly, but are included in payment for other bid items.