* USE ON ALL PROJECTS INVOLVING BITUMINOUS MATERIALS *

(1005PG, 12/17/20)

SECTION 1005 BITUMINOUS MATERIALS: of the Standard Specifications is revised to read:

1005-1 General Requirements:

Bituminous materials shall conform, when tested in accordance with the tests hereinafter enumerated, to the following requirements, as applicable, for the types and grades designated and used.

Certificates of Compliance conforming to the requirements of Subsection 106.05 of the specifications shall be submitted.

1005-2 Sampling of Bituminous Material:

Sampling of bituminous material shall conform to the requirements of Arizona Test Method 103. Samples shall be taken by the contractor and witnessed by the Engineer. The point of sampling and the number of samples will be specified by the Engineer.

The contractor shall provide convenient facilities for obtaining accurate samples of bituminous material.

1005-3 Bituminous Material Requirements:

1005-3.01 Asphalt Cement:

Asphalt cement shall be a performance grade (PG) asphalt binder conforming to the requirements of AASHTO M 320. Air blown/oxidized asphalt and recycled engine oil bottom (REOB) will not be accepted. Polyphosphoric acid (PPA) modification shall be limited to a maximum of 0.50 percent. The pressure aging temperature for all binders, including Terminal Blend rubberized binder and Polymer modified asphalt binder shall be as specified below:

PG Asphalt Binder	Pressure Aging Temperature
PG 70-XX and above	110 ºC
PG 64-XX and below	100 ºC

If Terminal Blend rubberized binder (XX-XXTR+) is used, it shall conform to the requirements of Table 1005-1 and 1005-1a.

If Polymer modified asphalt binder (XX-XXPM) is used, it shall conform to the requirements of Table 1005-1 and 1005-1b.

If, during asphaltic concrete production, it is determined by testing that asphalt cement fails to meet the requirements for the specified grade, the asphaltic concrete represented by the

corresponding test results shall be evaluated for acceptance. Should the asphaltic concrete be allowed to remain in place, the contract unit price for asphalt cement will be adjusted by the percentage shown in Table 1005-1. Should the asphalt cement be in reject status, the contractor may, within 15 days of receiving notice of the reject status, supply an engineering analysis of the expected performance of the asphaltic concrete in which the asphalt cement is incorporated. The engineering analysis shall detail any proposed corrective action and the anticipated effect of such corrective action on the performance. Within three working days, the Engineer will determine whether or not to accept the contractor's proposal. If the proposal is rejected, the asphaltic concrete shall be removed and replaced with asphaltic concrete meeting the requirements of the specifications at no additional expense to the Department. If the contractor's proposal is accepted, the asphaltic concrete shall remain in place at the applicable percent of contract unit price allowed, and any necessary corrective action shall be performed at no additional cost to the Department.

1005-3.02 Liquid Asphalt:

Liquid asphalt shall conform to the requirements of AASHTO M 82, Cut-back Asphalt (Medium Curing Type).

Adjustments in the contract unit price, in accordance with the requirements of Table 1005-2, will be made for quantities of material represented by the corresponding test results.

1005-3.03 Emulsified Asphalt:

Emulsified asphalt shall conform to the requirements of Table 1005-3 for Anionic Rapid Set (RS-1, RS-2), Anionic Slow Set (SS-1), Cationic Rapid Set (CRS-1, CRS-2) and Cationic Slow Set (CSS-1).

Polymerized Cationic Rapid Set (CRS-2P) emulsified asphalt shall conform to the requirements of Table 1005-3a.

Polymerized High Float (HFE-150P) and (HFE-300P) emulsified asphalt shall conform to the requirements of Table 1005-3b.

Emulsified asphalts shall be homogeneous. If emulsified asphalt has separated, it shall be thoroughly mixed to insure homogeneity. If emulsified asphalt has separated due to freezing, it shall not be used. Emulsified asphalt shall not be used after 30 days from production.

The contract unit price will be adjusted, to the nearest cent, for quantities of emulsified asphalt which do not meet the specified minimum percent residue. The adjusted contract unit price will be determined by the following:

$$\left[\begin{array}{c}\text{Adjusted Contract}\\ \text{Unit Price}\end{array}\right] = \frac{\left[\begin{array}{c}\text{Percent Residue}\\ \text{From Testing}\end{array}\right]}{\left[\begin{array}{c}\text{Specified Minimum}\\ \text{Percent Residue}\end{array}\right]} \times \left[\text{Contract Unit Price}\right]$$

1005-3.04 Emulsified Asphalt (Special Type):

Emulsified asphalt (special type) shall consist of Type SS-1 or CSS-1 diluted with water to provide an asphalt content not less than 26 percent. The water used must be potable. Potable water obtained from public utility distribution lines will be acceptable. The water used shall be free of injurious amounts of oil, acid, alkali, clay, vegetable matter, silt, or other harmful matter. The material shall not be diluted in the field.

1005-3.05 Recycling Agents:

Recycling agents shall conform to the requirements of Table 1005-4.

1005-3.06 Emulsified Recycling Agents:

Emulsified recycling agents shall conform to the requirements of Table 1005-5.

The contract unit price will be adjusted, to the nearest cent, for quantities of emulsified recycling agent which do not meet the specified minimum percent residue. The adjusted contract unit price will be determined by the following:

$$\left[\begin{array}{c}\text{Adjusted Contract}\\ \text{Unit Price}\end{array}\right] = \frac{\left[\begin{array}{c}\text{Percent Residue}\\ \text{From Testing}\end{array}\right]}{\left[\begin{array}{c}\text{Specified Minimum}\\ \text{Percent Residue}\end{array}\right]} \text{ x } \left[\text{Contract Unit Price}\right]$$

1005-3.07 Other Requirements:

Other requirements for bituminous materials shall conform to the requirements of Table 1005-6.

TABLE 1005-1
ASPHALT BINDER ADJUSTMENT TABLE

Test Property	AASHTO Test Method	Test Result	Percent of Contract Unit Price Allowed
Dynamic Shear of Original Binder: G*/Sin δ, kPa	T 315	≥ 1.00 0.90-0.99 0.70-0.89 < 0.70	100 95 85 70 (1)
Dynamic Shear of RTFO Binder: G*/Sin δ, kPa	T 315	≥ 2.20 2.00-2.19 1.60-1.99 < 1.60	100 95 85 70 (1)
Dynamic Shear of PAV Binder: G*Sin δ, kPa	T 315	≤ 5000 5001-5500 5501-7000 7001-8000 > 8000	100 95 85 75 65 (1)
Creep Stiffness of PAV Binder: S, MPa	T 313	≤ 300 301-330 331-450 451-600 > 600	100 95 85 75 65 (1)
m-value at 60 sec.	T 313	≥ 0.300 0.270-0.299 0.230-0.269 < 0.230	100 95 80 65 (1)

(1) Reject Status: The pay adjustment applies if allowed to remain in place.

Notes:

Specified properties in AASHTO M 320 for flash point, viscosity at 135 °C, and mass loss are not considered performance related. Specification deficiencies for these properties shall be cause for a work stoppage until specification properties are met, but will not be cause for a pay adjustment.

Should the bituminous material be deficient on more than one property, the pay adjustment will be the greatest reduction to the contract unit price specified considering individual test results.

The information presented in this table does not apply to asphalt cement used for tack coats.

TABLE 1005-1a
Terminal Blend rubberized binder (XX-XXTR+)

Test Property	Test Method	Requirement	Test Result	Percent of Contract Unit Price Allowed
Solubility, %, minimum	ASTM D7553 or ASTM 2042	98	-----	-----
Elastic Recovery, @ 10 ºC, %, minimum	AASHTO T 301	75	75 70 - 74 < 70	100 80 65 (1)

(1) Reject Status: The pay adjustment applies if allowed to remain in place.

Notes:

In case of dispute, ASTM D2042 shall be used to determine the Solubility.

The asphalt binder shall contain a minimum of 8 percent crumb rubber and a minimum of 3 percent SBS (styrene-butadiene-styrene) polymer.

The crumb rubber shall be derived from processing whole scrap tires or shredded tire materials. The tires from which the crumb rubber is produced shall be taken from automobiles, trucks, or other equipment owned and operated in the United States. The processing shall not produce, as a waste product, casings or other round tire material that can retain moisture when stored or disposed of above ground.

Modified binders shall be blended at the source of supply and delivered as a homogenous mixture to the job site.

Modified Binders stored at the asphalt concrete mixing plant for more than two weeks or beyond the supplier recommended shelf life, whichever is less, shall be sampled and tested.

TABLE 1005-1b
Polymer Modified Asphalt Binder (XX-XXPM)

Test Property	Test Method	Requirement	Test Result	Percent of Contract Unit Price Allowed
Solubility, %, minimum	ASTM D7553 or ASTM D2042	98	-----	-------
Elastic Recovery @ 10^{o}C, %, minimum	AASHTO T 301	75	≥ 75 70 - 74 < 70	100 80 65 (1)

(1) Reject Status: The pay adjustment applies if allowed to remain in place.

Notes:

In case of dispute, ASTM D2042 shall be used to determine the Solubility.

Asphalt binder shall contain a minimum of 3 percent SBS (styrene-butadiene-styrene) polymer.

Modified binders shall be blended at the source of supply and delivered as a homogenous mixture to the job site.

Modified Binders stored at the asphalt concrete mixing plant for more than two weeks or beyond the supplier recommended shelf life, whichever is less, shall be sampled and tested.

TABLE 1005-2
MC LIQUID ASPHALT PAY ADJUSTMENT TABLE

Grade	Kinematic Viscosity (AASHTO T 201): Centistokes, Deviations	Percent of Contract Unit Price Allowed
70	70 - 140	100
	63 - 69 or 141 - 154	90
	52 - 62 or 155 - 175	75
	Less than 52 or greater than 175	60 (1)
250	250 - 500	100
	225 - 249 or 501 - 550	90
	187 - 224 or 551 - 625	75
	Less than 187 or greater than 625	60 (1)
800	800 - 1600	100
	720 - 799 or 1601 - 1760	90
	600 - 719 or 1761 - 2000	75
	Less than 600 or greater than 2000	60 (1)
3000	3000 - 6000	100
	2700 - 2999 or 6001 - 6600	90
	2250 - 2699 or 6601 - 7500	75
	Less than 2250 or greater than 7500	60 (1)

(1) Reject Status: The pay adjustment applies if allowed to remain in place.

Note:

Since volatile solvents utilized in the manufacture of MC Liquid Asphalt may volatilize in varying amounts during transporting, handling, and storage operations, whenever such Liquid Asphalts are used for prime coats or curing seals, deviations from the maximum specification limits greater than those listed may be permitted when justified. In such cases, when material is allowed to remain in place, 60 percent of the contract unit price is allowed.

TABLE 1005-3
EMULSIFIED ASPHALTS

Tests On Emulsion	Test Method	Requirement					
		RS-1	CRS-1	RS-2	CRS-2	SS-1	CSS-1
Viscosity: Saybolt Furol, seconds, range 77 °F 122 °F	AASHTO T 59	20-100	20-100	50-400	50-400	20-100	20-100
Settlement: 5 days, %, maximum	AASHTO T 59	5	5	5	5	5	5
Sieve: Retained on No. 20, %, maximum	AASHTO T 59 (1)	0.10	0.10	0.10		0.10	0.10
Particle Charge	AASHTO T 59		Pos.		Pos.		Pos. (2)
Demulsiability: 35 mL, 0.02 N calcium chloride %, minimum	AASHTO T 59	60		60			
Classification: Uncoated particles, %, minimum	Ariz. 502				55		
Residue: (3) Residue, %, minimum (4)		55	60	63	65	57	57

Notes:

(1) Distilled water shall be used. Two percent sodium oleate solution will not be accepted.

(2) If the Particle Charge Test result is inconclusive, material having a maximum PH value of 6.7 will be acceptable.

(3) Residue will be obtained in accordance with the requirements of Arizona Test Method 504 and shall conform to all the requirements of AASHTO M 320 for PG 64-16, except that for CRS-2 the dynamic shear ($G^*/\sin\delta$) on the original residue shall be a minimum of 1.00 kPa and a maximum of 1.50 kPa.

(4) Residue by evaporation may be determined in accordance with the requirements of Arizona Test Method 512; however, in case of dispute, AASHTO T 59 will be used.

TABLE 1005-3a POLYMERIZED CATIONIC RAPID SET (CRS-2P) EMULSIFIED ASPHALT (1)		
Tests on Emulsion:	**Test Method**	**Requirement**
Viscosity, Saybolt Furol seconds @ 50 ºC (122 ºF), range	AASHTO T 59	100-400
Storage Stability, 24 hours, % maximum	AASHTO T 59	1
Demulsibilty, 35 mL of 0.8% DSS, % minimum	AASHTO T 59	40
Particle Charge Test	AASHTO T 59	Positive
Sieve Test, retained on 850 μm (No. 20), % maximum	AASHTO T 59	0.10
Residue from Distillation to 176.7 ºC (350 ºF), % minimum	AASHTO T 59	66
Oil Distillate to 176.7 ºC (350 ºF), Volume of Emulsion, % maximum	AASHTO T 59	0.5
Tests on Residue from Distillation:		
Penetration, 25 ºC (77 ºF), 100 grams, 5 seconds, range in 0.1 mm	AASHTO T 49	40-100
Ductility, 4 ºC (39.2 ºF), 10 mm/minute, cm, minimum	AASHTO T 51	35
Elastic Recovery by means of Ductilometer, 25 ºC (77 ºF), % minimum	AASHTO T 301 (2)	55

Notes:

(1) The introduction of polymer shall occur before emulsification.

(2) Testing shall be performed on residue by distillation. Testing on residue by oven evaporation will not be accepted.

TABLE 1005-3b POLYMERIZED HIGH FLOAT EMULSIFIED ASPHALT (1)			
Tests on Emulsion:	**Test Method**	**Requirement**	
		HFE-150P	**HFE-300P**
Viscosity, Saybolt Furol seconds @ 50 ºC (122 ºF), range	AASHTO T 59	50-400	50-400
Sieve test, retained on 850 μm (No. 20), % maximum	AASHTO 59 (2)	0.10	0.10
Storage Stability, 24 hours, % maximum	AASHTO T 59	1	1
Residue from Distillation to 204.4 ºC (400 ºF), % minimum	AASHTO T 59	65	65
Oil Distillate to 176.7 ºC (350 ºF), Volume of Emulsion, % maximum	AASHTO T 59	7.0	7.0
Tests on Residue from Distillation:			
Penetration, 25 ºC (77 ºF), 100 grams, 5 seconds, range in 0.1 mm	AASHTO T 49	150-300	300 +
Float Test at 60 ºC (140 ºF), seconds, minimum	AASHTO T 50	1200	1200
Ductility, 25 ºC (77 ºF), 5 cm/minute, cm, minimum	AASHTO T 51	100	N/A
Elastic Recovery by means of Ductilometer, 4 ºC (39.2 ºF), % minimum	AASHTO T 301(3)	25	25

Notes:

(1) The introduction of polymer shall occur before emulsification.

(2) Distilled water shall be used. Two percent sodium oleate solution will not be accepted.

(3) Testing shall be performed on residue by distillation. Testing on residue by oven evaporation will not be accepted.

TABLE 1005-4
RECYCLING AGENTS

Tests On Recycling Agent	Test Method	Requirement							
		RA-1		RA-5		RA-25		RA-75	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Viscosity: 140 °F, centistokes	AASHTO T 201	100	200	200	800	1000	4000	5000	10000
Flash Point: Cleveland Open Cup, °F, minimum	AASHTO T 48	340		375		425		450	
Saturate by weight: %	ASTM D2007		30		30		30		30
Test on Residue: Weight Change, %	AASHTO T 240		6.5		4		3		2
Viscosity Ratio: (1)			3		3		3		3

Notes:

(1) Viscosity Ratio:

$$\frac{\text{Viscosity of residue at 140 °F, centistokes}}{\text{Viscosity of recycling agent at 140 °F, centistokes}}$$

TABLE 1005-5
EMULSIFIED RECYCLING AGENTS

Tests on Emulsified Recycling Agent	Test Method	Requirement			
		ERA-1	ERA-5	ERA-25	ERA-75
Viscosity: Saybolt Furol, 77 °F, seconds range	AASHTO T 59	15 - 40	15 - 100	15 - 100	15 - 100
Miscibility	AASHTO T 59	Passes	Passes	Passes	Passes
Sieve Test: %, maximum	AASHTO T 59 (1)	0.10	0.10	0.10	0.10
Particle Charge	AASHTO T 59	Positive	Positive	Positive	Positive
Residue: (2) Residue, %, minimum	(3)	60	60	60	60

Notes:

(1) Distilled water shall be used. Two percent sodium oleate solution will not be accepted.

(2) Residue will be obtained in accordance with the requirements of Arizona Test Method 504 and shall conform to the requirements specified in Table 1005-4.

(3) Residue by evaporation may be determined in accordance with the requirements of Arizona Test Method 512; however, in case of dispute, AASHTO T 59 will be used.

TABLE 1005-6 OTHER REQUIREMENTS			
Grade of Asphalt Specification Designation	**Range of Temperatures for Application by Spraying, °F (Not applicable for Plant Mixing)**	**Range of Aggregate Temperatures for Plant Mixing, °F**	**Basis of Conversion, Average Gallons Per Ton at 60 °F**
Paving Asphalt	275 - 400	------	
PG 76-XX			232
PG 70-XX			233
PG 64-XX			235
PG 58-XX			236
PG 52-XX			238
PG 76-22 TR+			229
PG 70-22 TR+			230
PG 64-28 TR+			231
PG 76-22 PM			231
PG 70-22 PM			232
PG 64-28 PM			233
Liquid Asphalt			
MC-70	105 - 175	90 - 155	253
MC-250	140 - 225	125 - 200	249
MC-800	175 - 225	160 - 225	245
MC-3000	215 - 290	200 - 260	241
Emulsified Asphalt		-----	240
RS-1	70 - 140		
CRS-1	125 - 185		
RS-2	125 - 185		
CRS-2	125 - 185		
CRS-2P	125 - 185 (1)		
SS-1	70 - 160		
CSS-1	70 - 160		
HFE-150P	-----		
HFE-300P	-----		
Emulsified Asphalt (Special Type)	70 - 160	-----	240
Recycling Agent (RA-1, RA-5,	-----	-----	240
Emulsified Recycling Agent (ERA-1, ERA-5, ERA-25, ERA-75)	70 - 160	-----	240
(1) Or as directed by the Engineer.			