

## SECTION 916 BITUMINOUS MATERIALS

### **916-1 Superpave PG Asphalt Binder:**

**916-1.1 Requirements:** Superpave PG asphalt binders, identified as PG 64-22, PG 67-22, and PG 76-22, shall meet the requirements of AASHTO MP-1 and the following additional requirements:

1. The mass loss AASHTO T-240 shall be a maximum of 0.5% for all grades.
2. The spot test AASHTO T-102 with standard naphtha shall be negative for all grades.
3. The smoke point FM 5-519 shall be a minimum of 125°C for all grades.
4. The intermediate test temperature at 10 rad/s. for the Dynamic Shear Rheometer test AASHTO TP-5 shall be 25°C for all grades.
5. An additional high temperature grade of PG 67 is added for which the high test temperature at 10 rad/sec for the Dynamic Shear Rheometer test AASHTO TP-5 shall be 67°C.
6. All PG asphalt binders having a high temperature designation of PG 67 or lower shall be prepared without modification.
7. All PG asphalt binders having a high temperature designation higher than PG 67 shall be produced with a styrene-butadiene-styrene (SBS) or styrene-butadiene (SB) elastomer polymer modifier and resultant binder shall meet all requirements of this Specification; in addition the phase angle at 76°C (AASHTO TP-5) shall be less than or equal to 75 degrees.

All hot mix asphalt (except hot mix asphalt containing 20% RAP or greater) shall contain Superpave PG asphalt binder grade PG 67-22 unless otherwise specified in the plans and/or Specifications for the hot mix asphalt product.

For all PG binder used in all hot mix asphalt, silicone shall be added to the PG binder at the rate of 25 cm<sup>3</sup> of silicone mixed to each 5,000 gal. of PG binder. If a dispersing fluid is used in conjunction with the silicone the resultant mixture containing the full 25 cm<sup>3</sup> of silicone shall be added in accordance with the manufacturers recommendation. The blending of the silicone with the PG binder shall be done by the supplier prior to the shipment.

All PG binder to be used in asphalt rubber binder for Friction Course mixes and other hot mix asphalt products containing RAP shall contain 0.5% heat stable antistrip additive by weight of PG binder unless specifications for the hot mix asphalt product requires testing by AASHTO T-283 and the test results indicate it is not required, or the mixture contains hydrated lime. Where AASHTO T-283 indicates an antistrip additive is required, it shall be from 0.25 to 0.75%. The antistrip additive shall be one of the products included on the Qualified Products List specified in 6-1 of these Specifications. The antistrip additive shall be introduced into the PG binder by the supplier during loading.

**916-1.2 Qualified Products List:** The Superpave PG asphalt binders supplied under this Specification shall be one of the products included on the Qualified Products List as specified in 6-1.3 of these Specifications. Any marked variation from the original test values for a material below the established limits or evidence of inadequate quality control or field performance of a material will be considered to be sufficient evidence that the properties of the material have changed, and the material will be removed from the Qualified Products List.

Suppliers seeking to have their materials placed on the Qualified Products List shall meet the requirements of 6-1.3 of these Specifications. For each binder grade, the supplier may be required to submit to the State Materials Office a split sample of material representative of test results submitted with the Product Evaluation Application. In addition, for modified binders, the original PG binder grade, the modifier product designation, and amount added shall be indicated. Suppliers shall not ship any PG binder until notified that the product is on the Qualified Products List and an approved Quality Control Program meeting the requirements of 916-1.3 has been implemented.

**916-1.3 Quality Control Program:** The supplier of Superpave PG asphalt binder shall have a Quality Control Program meeting the requirements of AASHTO PP-26 as specifically defined in this Specification.

The requirements for the Quality Control program apply to the supply location of PG binders for the use on Florida Department of Transportation projects. The supply location of PG binder may represent refinery production, terminal distribution, blending, processing and/or modification location in accordance with AASHTO MP-1 and these Specifications. The requirements of these Specifications do not apply to Recycle Agents at this time.

**916-1.3.1 Identification of Personnel and Supply Locations:** The supplier's primary and secondary representatives shall be identified by name, title, address, telephone, fax and e-mail address. The supply locations shall be identified by name, address and telephone.

**916-1.3.2 Specification Compliance and Quality Control Testing:** Specification Compliance Testing shall consist of complete testing of each PG binder shipped in accordance with AASHTO MP-1 and 916-1.1 of these Specifications. Specification Compliance Testing shall be conducted by a testing laboratory that participates at least annually in the AMRL Reference Sample Testing Program. The testing laboratory shall forward their results from each AMRL proficiency Sample to the State Materials Office. Acceptable performance in the AMRL proficiency Sample Testing Program shall be a minimum of 3 for each test. A rating of less than 3 shall require identification of appropriate action on the part of the supplier acceptable to the State Materials Engineer.

Quality Control testing as a minimum shall consist of testing a representative sample of each PG binder shipped by the supplier in accordance with either:

(1) AASHTO T-202 Standard Test Method for Viscosity of Asphalts by Vacuum Capillary Viscometer or

(2) AASHTO TP-5 Test Method for Determining Rheological Properties of Asphalt Binder using a Dynamic Shear Rheometer (DSR).

**916-1.3.3 Sampling and Testing:** Specification Compliance test results shall be provided to the State Materials Office for each PG binder grade for each incoming bulk shipment to the supplier which will be further subjected to Quality Control Testing in accordance with 916-1.3.2. In addition the following:

(1) Any PG binder shipped to a Department project during any one month shall be tested at least monthly for Specification Compliance in accordance with 916-1.3.2.

(2) When being shipped to Department projects, samples shall be obtained by the supplier and tested for Quality Control testing in accordance with 916-1.3.2. A single one quart representative sample of each PG binder shall be obtained and tested by the supplier weekly; for each rack blended PG binder, representative samples shall be obtained daily. Each Quality Control sample shall be retained not less than eight weeks by the supplier. Any PG binder not shipped to Department projects is not required to be sampled or tested.

(3) Split samples of any PG binder will be provided when requested by a representative of the Department. In this situation three representative one quart samples will be obtained by the supplier under the direction of the Department. One sample will be submitted to the State Materials Office, one will be tested by the supplier for Specification Compliance and one will be tested by the supplier for Quality Control. The method of obtaining the three representative one quart samples is to obtain a single gallon sample, which is then stirred and poured into three one quart cans. When split samples are requested by the Department, the results from both parties will be made available within ten working days.

For each rack blended PG binder, identify minimum daily Process Control Testing in the QC Plan.

**916-1.3.4 Reporting:** A monthly report by the supplier containing Specification Compliance and Quality Control Test results shall be submitted to the State Materials Office. Test results for split samples shall also be included. Process Control Test results shall not be included.

The report shall consist of the Specification compliance testing and Quality Control Testing of the following as applicable by these specifications.

SUPERPAVE PG ASPHALT BINDER		
Test and Method	Conditions	Specification Minimum/Maximum Value
Original Binder		
Superpave PG Asphalt Binder Grade		Report
Qualified Products List Number		Report
Polymer Modifier Type	As Required	Report
Spot Test, AASHTO T102	Standard with Naphtha Solvent	Negative for all grades
Solubility, AASHTO T44	in Trichlorethylene	Minimum 99.0%
Smoke Point, FM 5-519	COC	Minimum 260°F (125°C)
Flash Point, AASHTO T48	COC	Minimum 450°F (230°C)
Rotational Viscosity, ASTM D4402	275°F (135°C)	Maximum 3 Pa-s
Absolute Viscosity, AASHTO T202	140°F (60°C)	As Required for Quality Control Testing
Dynamic Shear Rheometer, AASHTO TP5	$G^*/\sin \delta$ , Test Temperature @ 10 rad/sec, °F (°C) Phase Angle, $\delta$ , (PG 76-22 Only)	Minimum 1.00 kPa $\leq 75$ degree
Rolling Thin Film Oven Test Residue (AASHTO T240)		
Rolling Thin Film Oven, AASHTO T40	Mass Loss%	Maximum 0.50
Dynamic Shear Rheometer, AASHTO TP5	$G^*/\sin \delta$ , Test Temperature @ 10 rad/sec, °F (°C)	Minimum 2.20 kPa
Pressure Aging Vessel Residue (AASHTO PP1) at 212°F (100°C)		
Dynamic Shear Rheometer, AASHTO TP5	$G^* \sin \delta$ , Test Temperature @ 10 rad/sec, 77°F (25°C)	Maximum 5,000 kPa
Creep Stiffness, AASHTO TP1	S (Stiffness), Test Temperature @ 60 sec, 10°F (-12°C) m-value, Test Temperature @ 60 sec, 10°F (-12°C)	Maximum 300 Mpa Minimum 0.300

**916-1.3.5 Notification and Evaluation:** In the event that a Specification Compliance test is outside specification requirements or a Quality Control test is outside limits established by the supplier as part of his Quality Control Program shipments of that product to Department projects will cease immediately and the Contractor and the State Materials Office will be notified and the product retested (resampling as appropriate). Where off-specification material has been shipped and the retest confirms the original test, the Contractor and State Materials Office will be informed of the steps taken to achieve specification compliance on the product shipped.

Where off-specification materials has been shipped, further shipment of that product to Department projects shall remain suspended until the cause of the problem is evaluated and corrected by the supplier to the satisfaction of the State Materials Engineer.

**916-1.3.6 Certification and Verification:**

The supplier shall furnish a certification for each shipment of PG binder delivered to a Department project indicating the Superpave PG asphalt binder grade, that it has been produced in conformance with 916-1 and the suppliers Quality Control Program, and the silicone and antistrip agent addition as applicable, including product designation and amount. Any special handling or

temperature requirements shall be indicated on the certification and are solely the responsibility of the Contractor to follow.

The Department may sample and test PG binder from the delivery vehicle, and/or Contractors storage tank to verify and determine compliance with this and other specification requirements. Where these tests identify material outside specification requirements, the State Materials Engineer may require the supplier to cease shipment of that product. Further shipment of that product to Department projects may remain suspended until the cause of the problem is evaluated and corrected by the supplier as necessary to the satisfaction of the State Materials Engineer.

**916-2 Recycling Agents.**

**916-2.1 Requirements:** The asphalt recycling agent shall be an asphalt cement or an asphalt cement blended (as necessary) with a softening agent or flux oil, and shall meet the following requirements:

RECYCLING AGENTS		
Test	Conditions	Recycling Agent Minimum/Maximum Value
Viscosity –P (Pa·s)	140°F [60°C]	Target Viscosity ± 20%
Viscosity Ratio (Residue from Thin Film Oven Test)	Visc. 140°F [60°C] after TFOT	maximum 3
	Visc. 140°F [60°C] before TFOT	
Smoke Point	COC	minimum 260°F [125°C]
Flash Point	COC	minimum 400°F [205°C]
Solubility	in Trichlorethylene	minimum 97.5%

Silicone shall be added to the recycling agent at a rate of 25 cm<sup>3</sup> for each 5,000 gallons [19 m<sup>3</sup>] of recycling agent. If a dispersing fluid is used in conjunction with the silicone, the resultant mixture containing the full 25 cm<sup>3</sup> shall be added, in accordance with the manufacturer’s recommendation. The blending of silicone mixture with the residue shall be done by the supplier prior to shipment.

The recycling agent shall contain 0.5% heat-stable antistrip additive by weight of asphalt from an approved source. The antistrip additive shall be introduced and mixed into the recycling agent, or emulsified recycling agent, at the terminal.

**916-2.2 Sampling and Certification:** The supplier shall furnish a certification indicating compliance with the above specification for all recycling agents delivered to the project.

For each shipment delivered to the asphalt terminal, the asphalt supplier shall submit a test report to the State Materials Office to include all properties specified for a particular recycling agent. The test results may be from a sample taken from the storage tank(s) after delivery or from a random sample taken from the barge or rail car(s).

**916-3 Cut-Back Asphalts.**

**916-3.1 Requirements:** Rapid-curing, cut-back asphalt shall conform with the requirements of AASHTO M 81, except that the penetration range shall be from 60-120 instead of 80-120.

For Grade RC-3000, in addition to the requirements shown in Table 1 of AASHTO M 81 the following values shall be added to the requirements for Distillation Test:

Distillate, Percentage by Volume of Total Distillate to 680°F [360°C]	Grade RC-3000 Maximum
to 320°F [160°C]	0
to 374°F [190°C]	10
to 437°F [225°C]	40

All other requirements for the distillation test (and for other properties included in the table) shall be as shown in Table 1 of AASHTO M 81.

Medium-curing, cut-back asphalt shall conform with the requirements of AASTHO M 82.

**916-3.2 Sampling and Certification:** For each tank of cut-back asphalt delivered to or prepared at the asphalt terminal, the asphalt supplier shall submit a sample to the State Materials Office for testing before use. A pretest number will then be assigned by the State Materials Office which shall be furnished with all cut-back asphalt delivered to the project. The pretest number shall be valid for six months from the date of issue.

#### 916-4 Emulsions.

**916-4.1 Requirements:** Anionic Emulsified Asphalt shall meet the requirements of AASHTO M 140 with the exception that the cement mix test will be waived when the asphalt is used in non-mix application, such as tack coats and primes. Cationic Emulsified Asphalt shall meet the requirements of AASHTO M 208. Additional emulsions permitted by specifications shall meet the following requirements:

HIGH FLOAT EMULSIONS		
Test	Conditions	Asphalt Emulsion Grade AE-60
		Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc	122°F [50°C]	75/400 seconds
Settlement	5 days (a)	maximum 5%
Storage Stability	24 hour (b)	maximum 1%
Sieve Test		maximum 0.10%
Demulsibility	50 mL CaCl <sub>2</sub> 0.10 N	minimum 75%
Residue by Distillation		minimum 65%
Oil Portion	500°F. Dist. [260°C. Dist.]	maximum 1% by volume
Tests on Residue:		
Penetration (0.1 mm)	77°F [25°C], 100 g, 5 seconds	minimum 40
Absolute Viscosity	140°F [60°C]	minimum 3,200 poise [320 Pa·s]
Ductility	77°F [25°C], 50 mm/minute	minimum 400 mm
Float Test	140°F [60°C]	minimum 1,200 seconds
Solubility	in Trichlorethylene	minimum 97.5%

Test	Conditions	Asphalt Emulsion Grade AE-90
		Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc	122°F [50°C]	75/400 seconds
Settlement	5 days (a)	maximum 5%
Storage Stability	24 hour (b)	maximum 1%
Sieve Test		maximum 0.10%
Demulsibility	50 mL CaCl <sub>2</sub> 0.10 N	minimum 75%
Residue by Distillation		minimum 65%
Oil Portion	500°F. Dist. [260°C. Dist.]	maximum 2% by volume
Tests on Residue:		
Penetration (0.1 mm)	77°F [25°C], 100 g, 5 seconds	minimum 70
Absolute Viscosity	140°F [60°C]	minimum 1,600 poise [160 Pa·s]
Ductility	77°F [25°C], 50 mm/minute	minimum 400 mm
Float Test	140°F [60°C]	minimum 1,200 seconds
Solubility	in Trichlorethylene	minimum 97.5%

Test	Conditions	Asphalt Emulsion Grade AE-150
		Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc	122°F [50°C]	75/400 seconds
Settlement	5 days (a)	maximum 5%
Storage Stability	24 hour (b)	maximum 1%
Sieve Test		maximum 0.10%
Demulsibility	50 mL CaCl <sub>2</sub> 0.10 N	minimum 75%
Residue by Distillation		minimum 65%
Oil Portion	500°F. Dist. [260°C. Dist.]	maximum 3% by volume
Tests on Residue:		
Penetration (0.1 mm)	77°F [25°C], 100 g, 5 seconds	minimum 125
Absolute Viscosity	140°F [60°C]	minimum 800 poise [80 Pa·s]
Ductility	77°F [25°C], 50 mm/minute	minimum 400 mm
Float Test	140°F [60°C]	minimum 1,200 seconds
Solubility	in Trichlorethylene	minimum 97.5%

Test	Conditions	Asphalt Emulsion Grade AE-200
		Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc	122°F [50°C]	minimum 45 seconds
Settlement	5 days (a)	maximum 5%
Storage Stability	24 hour (b)	maximum 1%
Sieve Test		maximum 0.10%
Demulsibility	50 mL CaCl <sub>2</sub> 0.10 N	minimum 75%
Residue by Distillation		minimum 62%
Oil Portion	500°F. Dist. [260°C. Dist]	maximum 8% by volume
Tests on Residue:		
Penetration (0.1 mm)	77°F [25°C], 100 g, 5 seconds	minimum 150
Absolute Viscosity	140°F [60°C]	minimum 400 poise [40 Pa·s]
Ductility	77°F [25°C], 50 mm/minute	
Float Test	140°F [60°C]	minimum 1,200 seconds
Solubility	in Trichlorethylene	minimum 97.5%
(a) The test requirement for settlement may be waived when the emulsified asphalt is used in less than five days.		
(b) The 24-hour (one day) storage stability test may be used instead of the five day settlement test.		

SPECIAL MS-EMULSION		
Test	Conditions	Minimum/Maximum
		Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc	77°F [25°C]	minimum 45 seconds
Storage Stability	24 hour	maximum 1%
Sieve Test	50 mL CaCl <sub>2</sub> 0.10 N	maximum 0.10%
Demulsibility		minimum 65%
Residue by Distillation		minimum 62%
Naphtha Content	500°F. Dist. [260°C. Dist]	maximum 8% by volume
Tests on Residue:		
Penetration (0.1 mm)	77°F [25°C], 100 g, 5 seconds	minimum 50
Ductility	77°F [25°C], 50 mm/minute	minimum 400 mm
Absolute Viscosity	140°F [60°C]	minimum 800 poise [80 Pa·s]
Solubility	in Trichloroethylene	minimum 97.5%
Maximum application temperature shall be 170°F [75°C].		

EMULSIFIED ASPHALT GRADE CRS-2H		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc.	122°F [50°C]	100/400 seconds
Settlement	5 days (a)	maximum 5%
Storage Stability	24 hour (b)	maximum 1%
Demulsibility	35 mL 0.8% Sodium Dioctyl Sulfosuccinate (c)	minimum 40%
Particle Charge		positive
Sieve Test		maximum 0.1%
Residue		minimum 65%
Tests on Residue:		
Penetration (0.1 mm)	77°F [25°C], 100 g, 5 seconds	80/140
Ductility	77°F [25°C], 50 mm/minute	minimum 400 mm
Solubility	in Trichloroethylene	minimum 97.5%
(a) The test requirement for settlement may be waived when the emulsified asphalt is used in less than five days.		
(b) The 24-hour (one day) storage stability test may be used instead of the five day settlement test.		
(c) The demulsibility test shall be made within 30 days from date of shipment.		

ASPHALT EMULSION PRIME (AEP)		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc.	77°F [25°C]	20/150 seconds
Settlement	5 days (a)	maximum 5%
Storage Stability	24 hour (b)	maximum 1%
Sieve Test		maximum 0.1%
Residue		minimum 55%
Naphtha Content	500°F. Dist [260°C. Dist.]	maximum 12% by volume
Tests on Residue:		
Penetration (0.1 mm)	77°F [25°C], 100 g, 5 seconds	40/200
Ductility	77°F [25°C], 50 mm/minute	minimum 400 mm
Solubility	in Trichloroethylene	minimum 97.5%
(a) The test requirement for settlement may be waived when the emulsified asphalt is used in less than five days.		
(b) The 24-hour (one day) storage stability test may be used instead of the five day settlement test.		

ASPHALT EMULSION GRADE RS-1		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc	77°F [25°C]	20/100 seconds
Storage Stability	24 hour	maximum 1%
Demulsibility	35 mL 0.02N CaCl <sub>2</sub> (a)	minimum 60%
Sieve Test		maximum 0.10%
Residue by Distillation		minimum 55%
Naphtha Portion	500°F. Dist [260°C. Dist.](b)	maximum 3% by volume
Tests on Residue From Distillation Test:		
Penetration (0.1 mm)	77°F [25°C], 100 g, 5 seconds	minimum 60
Viscosity	140°F [60°C]	minimum 1,600 poise

		[160 Pa·s]
Ductility	77°F [25°C], 50 mm/minute	minimum 400 mm
Solubility	in Trichloroethylene	minimum 97.5%
(a) The demulsibility test shall be made within 30 days from the date of shipment.		
(b) When RS-1 has been modified to include naphtha, the 24-hour storage stability test will be waived.		

EMULSION PRIME (RS TYPE)		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc.	77°F [25°C]	minimum 75 seconds
Storage Stability	24 hour	maximum 1.0%
Sieve Test		maximum 0.1%
Naphtha Content		5/15% by volume
Residue		minimum 55%
Tests on Residue:*		
Penetration (0.1 mm)	77°F [25°C], 100 g, 5 seconds	minimum 50
Viscosity	140°F [60°C]	minimum 800 poise [80 Pa·s]
Solubility	in Trichloroethylene	minimum 97.5%
* Residue by distillation shall be in accordance with AASHTO T 59 except that the maximum temperature shall be 329 ± 10°F [165 ± 5°C] and the sample shall be maintained at this temperature for 20 minutes.		

EPR-1 PRIME (Concentrate Form)		
Tests	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc.	77°F [25°C]	20/100 seconds
Storage Stability	24 hour	maximum 0.5%
Sieve Test (a)		maximum 0.1%
Residue by Distillation (b)		minimum 60%
Particle Charge Test (c)		positive
Tests on Residue: (d)		
Flash Point	COC	minimum 410°F [210°C]
Viscosity	cSt-140°F [60°C]	600/1000 [0.00060/0.00100 m <sup>2</sup> /s]
(a) Distilled water shall be used in place of 2% sodium oleate solution.		
(b) Residue by distillation shall be in accordance with AASHTO T 59 with the exception that a 50 g sample is heated to 300°F [149°C] until foaming ceases, then cooling immediately and calculating results.		
(c) Caution: this material has a positive particle charge, and therefore should not be mixed with materials having a negative particle charge.		
(d) Residue by distillation shall be in accordance with AASHTO T 59 except that the maximum temperature shall be 329 ± 10°F [165 ± 5°C] and the sample shall be maintained at this temperature for 20 minutes.		

**916-4.2 Sampling and Certification:** For each tank of emulsified asphalt delivered to or prepared at the asphalt terminal, the asphalt supplier shall submit a sample to the State Materials Office for testing before use. A pretest number will then be assigned by the State Materials Office which shall be furnished with all emulsified asphalt delivered to the project. The pretest number shall be valid for six months from the date of issue.

For each batch of concentrated emulsion prime (EPR-1) delivered to or prepared at the asphalt terminal, the asphalt supplier shall submit a sample to the State Materials Office for testing before use. A pretest number will then be assigned by the State Materials Office which shall be furnished with all concentrated EPR-1 Prime delivered to the project. The pretest number shall be valid for six months from the date of issue. When the EPR-1 is shipped to the Contractor in concentrated form, the supplier shall furnish a certification indicating compliance with all the specification requirements for EPR-1 Prime for each batch of material when blended with the appropriate amount of water. The Contractor shall blend the concentrated EPR-1 at the ratio of one part emulsified prime to two parts water prior to use as a prime coat, and for each distributor load of material delivered to the project, shall furnish a certification indicating compliance with the supplier's requirements for blending along with a copy of the supplier's certification for the concentrate. In the event that the diluted EPR-1 Prime is not used in a 12-hour period, the material shall be thoroughly mixed by circulation or other suitable means prior to its use.