



Florida Department of Transportation

RICK SCOTT
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

ANANTH PRASAD, P.E.
SECRETARY

July 2, 2013

Monica Gourdine
Program Operations Engineer
Federal Highway Administration
545 John Knox Road, Suite 200
Tallahassee, Florida 32303

Re: State Specifications and Estimates Office
Section **916**
Proposed Specification: **9160000 Bituminous Materials.**

Dear Ms. Gourdine:

We are submitting, for your approval, two copies of the above referenced Supplemental Specification.

These changes were proposed by Greg Sholar of the State Materials Office to update the language for current Department and industry practice.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via email to SP965DS or daniel.scheer@dot.state.fl.us.

If you have any questions relating to this specification change, please call me at 414-4130.

Sincerely,

Signature on file

Daniel Scheer, P.E.
State Specifications Engineer

DS/dt
Attachment

cc: Florida Transportation Builders' Assoc.
State Construction Engineer

BITUMINOUS MATERIALS.

(REV 5-163-13)

SECTION 916 (Pages 985 – 995) is deleted and the following substituted:

SECTION 916 BITUMINOUS MATERIALS

916-1 Superpave PG Asphalt Binder:

916-1.1 Requirements: Superpave Performance Graded (PG) asphalt binders, identified as PG 52-28, PG 58-22, and PG 67-22 shall meet the requirements of 916-1.2, and AASHTO M 320-10 Table 1. Polymer Modified Asphalt (PMA) or Asphalt Rubber Binders (ARB), identified as PG 76-22 (PMA), PG 76-22 (ARB), and PG 82-22 (PMA), shall meet the requirements of 916-1.2 and AASHTO MP 19-10. All PG asphalt binders shall meet the following additional requirements:

1. The intermediate test temperature at 10 rad/sec for the Dynamic Shear Rheometer (DSR) test (AASHTO T 315-1012) shall be 26.5°C for PG grades PG 67 and higher.

2. An additional high temperature grade of PG 67 is added for which the high test temperature at 10 rad/sec for the DSR test (AASHTO T 315-1012) shall be 67°C.

3. All PG asphalt binders having a high temperature designation of PG 67 or lower shall be prepared without modification.

4. All PMA binders having a high temperature designation higher than PG 67 shall be produced with a styrene-butadiene-styrene (SBS) or styrene-butadiene (SB) elastomeric polymer modifier and the resultant binder shall meet all requirements of this Section.

5. In addition, polyphosphoric acid may be used as a modifier not exceeding 1.25% by weight of asphalt binder for PG 76-22 (PMA), PG 76-22 (ARB), and PG 82-22 (PMA) binders.

5. The phase angle (tested in accordance with AASHTO T 315-10) shall be a maximum of 75 degrees at 76°C for PG 76-22 (PMA) and PG 76-22 (ARB) and a maximum of 65 degrees at 82°C for PG 82-22 (PMA).

6. PG 76-22 (ARB) shall meet the additional requirements of 916-1.1.1.

7. Do not substitute a PG binder with a high temperature grade more than 5.9°C higher than the specified PG grade, (for example, if a PG 58-22 is specified, do not supply a PG 64-22 or higher).

For all PG binder used in all hot mix asphalt, silicone may be added to the PG binder at the rate of 25 cubic centimeters of silicone mixed to each 5,000 gallons of PG binder. If a disbursing fluid is used in conjunction with the silicone, the resultant mixture containing the full 25 cubic centimeters of silicone shall be added in accordance with the manufacturer's recommendation. The blending of the silicone with the PG binder shall be done by the supplier prior to the shipment.

All PG binder for friction course mixes and for other hot mix asphalt products containing reclaimed asphalt pavement (RAP) shall contain 0.5% heat stable anti-strip additive by weight of PG binder unless specifications for the hot mix asphalt

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product requires testing by FM 1 T 283 and the test results indicate it is not required, or the mixture contains hydrated lime. Where FM 1 T 283 indicates an anti-strip additive is required, per the requirements of Sections 334 and 337, the amount shall be from 0.25% to 0.75% by weight of the asphalt binder. The anti-strip additive shall meet the requirements of 916-5. The anti-strip additive shall be introduced into the PG binder by the supplier during loading.

Comment [GS1]: Included in 334-3.2.6.

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916-1.1.1 Additional Requirements for PG- 76-22 (ARB): The following additional requirements apply only to PG 76-22 (ARB):

1. The asphalt binder shall contain a minimum of 7.0% ground tire rubber (GTR) by weight of asphalt binder.

2. The GTR shall meet the requirements of Section 919.

3. Polymer modification is optional for PG 76-22 (ARB).

4. All testing performed with the DSR

(AASHTO T 315-10-12 and AASHTO TP 70-11-12) shall be performed with a 2 mm gap.

5. Use of excess PG 76-22 (ARB): The Contractor may use excess PG- 76-22 (ARB) in other asphalt concrete mixes requiring the use of a PG 67-22 binder by blending with straight PG 67-22 binder so that the total amount of ground tire rubber in the binder is less than 2.0%. The Contractor may use excess PG- 76-22 (ARB) in asphalt concrete mixtures requiring the use of a PG- 52-28 or PG- 58-22 by blending with the designated binder in such proportions that the total amount of ground tire rubber in the binder is less than 1.0%.

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916-1.2 Qualified Products List (QPL): The Superpave PG asphalt binders supplied under this specification shall be one of the products included on the QPL as specified in 6-1. Manufacturers seeking evaluation of their product shall submit an application in accordance with Section 6 and include a report of test results from an independent laboratory confirming the material meets the requirements of this section. In lieu of submitting test results from an independent laboratory, the Department will evaluate the material. 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 QPL.

For each binder grade, the supplier may be required to submit to the State Materials Office (SMO), 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 modifier type shall be indicated on the product evaluation application and in the Quality Control Program below. Additionally, for PG 76-22 (ARB), provide a certification statement on the product evaluation application and in the Quality Control Program that a minimum of 7.0% GTR is used in the formulation of the PG 76-22 (ARB). Suppliers shall not ship any PG asphalt binder until notified that the product is on the QPL and the Quality Control Program meets the requirements of 916-1.3 and has been approved by the Department.

916-1.3 Quality Control Program: The supplier of Superpave PG asphalt binder shall at a minimum have a Quality Control Program meeting the requirements of this

Section based on AASHTO R 26-01 (2009). The Quality Control Program shall be submitted in electronic format to the SMO for approval.

The requirements for the Quality Control Program apply to the supply location of PG asphalt binders for the use on Department projects. The supply location of PG binder may represent refinery production, terminal distribution, blending, processing, and/or modification location. Rack blending (blending from two tank sources) will be permitted to meet the requirements for a PG asphalt binder product. Any special handling requirements such as rack blending and manufacture of polymer and or rubber modified asphalt shall be described in the Quality Control Program.

916-1.3.1 Identification of Personnel and Supply Locations: The supplier's primary and secondary representatives responsible for quality control shall be identified by name, title, address, telephone, fax and e-mail address. At least one of the representatives shall be located at the supply location. The supply locations shall be identified by name, address and telephone.

916-1.3.2 Specification Compliance and Quality Control (QC)

Testing: Specification compliance testing shall consist of complete testing of each PG asphalt binder shipped in accordance with 916-1.1 of these specifications. Specification compliance testing shall be conducted by a testing laboratory that participates at least annually in the AASHTO Materials Reference Laboratory (AMRL) Proficiency Sample Program for PG asphalt binder. Results of specification compliance testing shall be available to the supplier within five working days of sampling. The primary testing lab and any other labs to be used for specification compliance testing shall be identified in the suppliers Quality Control Program. The results from each AMRL Proficiency Sample for each testing laboratory shall be forwarded by the supplier for each supply location in electronic format to the SMO within one week of receiving the results. Acceptable performance in the AMRL Proficiency Sample Program shall be a minimum score of 3 for each test. A rating of less than 3 shall require identification of appropriate action on the part of the supplier and be acceptable to the State Materials Engineer.

QC testing as a minimum shall consist of testing a representative sample of each PG asphalt binder shipped by the supplier in accordance with AASHTO T 315-~~40~~-12 Test Method for Determining Rheological Properties of Asphalt Binder using a DSR.

Results of QC testing shall be available to the supplier within 5 hours of sampling. A QC test result outside the specification limits will require immediate sampling and testing for specification compliance and appropriate action taken. The QC testing and location where the test will be done shall be identified in the suppliers Quality Control Program. In the event that testing equipment goes out of service, the supplier may elect to test at a qualified lab identified in the supplier's Quality Control Program. The QC testing results shall be supplied within 48 hours of the sampling.

916-1.3.3 Frequency of Sampling and Testing: Sampling of PG asphalt binders shall be done in accordance with AASHTO T 40-02 (2006). Initial specification compliance test results shall be required for each PG asphalt binder grade for each new LOT of material which will be further subjected to QC testing in accordance with 916-1.3.2. A new LOT will occur when the material in a tank changes and the specification compliance test may no longer be representative of the material in the tank. This may be

due to an incoming bulk shipment of material, change in refinery run, the manufacture of a product, or a blend of material in a tank. Additional testing is as follows:

(1) Any PG asphalt binder shipped to a Department project during any one calendar month shall be tested at least once during that month 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 QC testing in accordance with 916-1.3.2. A single, 1-quart representative sample of each PG asphalt binder shall be obtained and tested by the supplier each calendar week; for each rack blended PG asphalt binder, additional representative samples shall be obtained daily. Each QC sample and additional daily rack blended samples shall be adequately identified and retained for not less than 8 weeks at the supply location. Any PG asphalt binder not shipped to Department projects is not required to be sampled or tested.

(3) Split samples of any PG asphalt binder will be provided when requested by a representative of the Department. In this situation, three representative 1-quart samples will be obtained by the supplier under the direction of the Department. One sample will be submitted to the SMO, 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 1-quart samples is to obtain a single gallon sample, which is then stirred and poured into three 1-quart cans. When split samples are requested by the Department, the results from both parties will be made available within 10 working days.

(4) For each rack blended PG asphalt binder, identify minimum daily Process Control (PC) Testing in the QC Plan.

916-1.3.4 Reporting: A monthly report by the supplier containing specification compliance and QC test results for each PG asphalt binder LOT shall be submitted by the supplier in electronic format using the form provided by the Department to the SMO within 7 days following the end of the calendar month. Test results for split samples shall also be included. PC test results shall not be included. Copies of these monthly reports and supporting test reports shall be available at the supply location for a minimum of 3 years.

The report shall consist of the specification compliance testing and QC 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
Modifier	Modified binders only	Report

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Solubility, AASHTO T 44-03 (20072011)	in Trichloroethylene	Minimum 99.0% (Not applicable for PG 76-22 (ARB))
Flash Point, AASHTO T 48-06 (2010)	Cleveland Open Cup	Minimum 450°F
Rotational Viscosity, AASHTO T 316-11	275°F	Maximum 3 Pa·s ^(a)
Dynamic Shear Rheometer, AASHTO T 315-4012	$G^* / \sin \delta$, Test Temperature @ 10 rad/sec, °C Phase Angle, δ PG 76-22 (PMA) and PG 76-22 (ARB) ^(b) PG 82-22 (PMA)	Minimum 1.00 kPa Maximum 75 degrees Maximum 65 degrees
	Phase Angle, δ PG 76-22 (PMA) and PG 76-22 (ARB) ^(b) PG 82-22 (PMA)	Maximum 75 degrees Maximum 65 degrees
Separation Test, ASTM D 7173-11 and Softening Point, AASHTO T 53-11	163±5°C 48 hours	Maximum 15°F (PG 76-22 (ARB) only)
Rolling Thin Film Oven Test Residue (AASHTO T 240-09)		
Rolling Thin Film Oven, AASHTO T 240-09	Mass Change%	Maximum 1.00
Dynamic Shear Rheometer, AASHTO T 315-4012	$G^* / \sin \delta$, Test Temperature @ 10 rad/sec, °C (Unmodified binders only)	Minimum 2.20 kPa
Multiple Stress Creep Recovery, $J_{nr, 3.2}$ ^(b,c) AASHTO TP 70-4412	67°C (Modified binders only)	“V” = 1.0 kPa ⁻¹ ·s max “E” = 0.5 kPa ⁻¹ ·s max Maximum $J_{nr, diff}$ = 75%
Multiple Stress Creep Recovery, %Recovery ^(b,c) AASHTO TP 70-4412	67°C (Modified binders only)	$\%R_{3.2} > 29.37(J_{nr, 3.2})^{0.2633}$ (Figure X2.1 in TP 70-11) For $J_{nr, 3.2} \leq 2.0$
Pressure Aging Vessel Residue (AASHTO R 28-0912)		
Dynamic Shear Rheometer, AASHTO T 315-4012	$G^* \sin \delta$, 10 rad/sec.	Maximum 5000 kPa
Creep Stiffness, AASHTO T 313-4012	S (Stiffness), @ 60 sec. M-value, @ 60 sec.	Maximum 300 MPa Minimum 0.300

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- (a) Binders with values higher than 3 Pa·s should be used with caution and only after consulting with the supplier as to any special handling procedures, including pumping capabilities.
- (b) AASHTO T 315-10-12 and AASHTO TP 70-11-12 will be performed at a 2 mm gap for PG 76-22 (ARB)
- (c) All binders with a high temperature designation >67 will be tested at 67°C. PG 76-22 (PMA) and PG 76-22 (ARB) shall pass a "V" graded and PG 82-22 (PMA) shall pass an "E" grade per AASHTO MP 19-10.

916-1.3.5 Notification and Evaluation: In the event that a specification compliance test is outside specification requirements or a QC 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 SMO will be notified and the product retested for specification compliance (re-sampling as appropriate). Where the retest for specification compliance meets all requirements, shipments of that product may resume. Where off-specification material has been shipped and the retest confirms the original test, the Contractor and the SMO will be informed of the steps taken to achieve specification compliance on the product shipped.

Where off-specification materials have 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 certification on the bill of lading for each shipment of PG binder delivered to a Department project that includes: the quantity (including initial weights of the neat binder and GTR and ending GTR percentage by weight of asphalt binder for PG 76-22 (ARB)), the Superpave PG asphalt binder grade (including QPL number), PG binder LOT designation, the customer name, the delivery location, a statement that the binder is in conformance with 916-1 and the suppliers Quality Control Program, and the quantity of silicone and anti-strip agent addition, as applicable, including product designation (QPL number as applicable). 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 asphalt binder from the suppliers storage tank, 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 PG asphalt binder product. Further shipment of that PG asphalt binder 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 Cut-Back Asphalts.

916-2.1 Requirements: Rapid-curing, cut-back asphalt shall conform to the requirements of AASHTO M 81-92 (2008), 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 81-92 (2008) the following values shall be added to the requirements for distillation test:

Distillate, Percentage by Volume of Total Distillate to 680°F	Grade RC-3000 Maximum
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to 320°F	0
to 374°F	10
to 437°F	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 81-92 (2008).

Medium-curing, cut-back asphalt shall conform to the requirements of AASTHO M 82-75 (2008).

916-2.2 Sampling, Certification, and Verification: Sampling of cut-back asphalts shall be done in accordance with AASHTO T 40-02 (2006). For each tank of cut-back asphalt delivered to or prepared at the asphalt terminal, the asphalt supplier shall submit a sample to the SMO for testing before use. A pretest number will then be assigned by the SMO which shall be furnished with all cut-back asphalt delivered to the project. The pretest number shall be valid for three months from the date of issue.

The Department may sample and test pre-tested cut-back asphalt from the supplier's storage tank, the Contractor's transport tank and/or distributor 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 pretested cut-back asphalt product. Further shipment of that pretested cut-back asphalt 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.

916-3 Emulsified Asphalts.

916-3.1 Requirements: Anionic emulsified asphalt shall meet the requirements of AASHTO M 140-08 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 208-01 (2009). 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 Viscosity	122°F	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 ₂ 0.10 N	minimum 75%
Residue by Distillation		minimum 65%
Oil Portion	500°F. Dist.	maximum 1% by volume
Tests on Residue:		
Penetration (0.1 mm)	77°F, 100 g, 5 seconds	minimum 40
Absolute Viscosity	140°F	minimum 3,200 poise

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Ductility	77°F, 50 mm/minute	minimum 400 mm
Float Test	140°F	minimum 1,200 seconds
Solubility	in Trichloroethylene	minimum 97.5%

Test	Conditions	Asphalt Emulsion Grade AE-90
		Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Viscosity	122°F	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 ₂ 0.10 N	minimum 75%
Residue by Distillation		minimum 65%
Oil Portion	500°F. Dist.	maximum 2% by volume
Tests on Residue:		
Penetration (0.1 mm)	77°F, 100 g, 5 seconds	minimum 70
Absolute Viscosity	140°F	minimum 1,600 poise
Ductility	77°F, 50 mm/minute	minimum 400 mm
Float Test	140°F	minimum 1,200 seconds
Solubility	in Trichloroethylene	minimum 97.5%

Test	Conditions	Asphalt Emulsion Grade AE-150
		Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Viscosity	122°F	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 ₂ 0.10 N	minimum 75%
Residue by Distillation		minimum 65%
Oil Portion	500°F. Dist.	maximum 3% by volume
Tests on Residue:		
Penetration (0.1 mm)	77°F, 100 g, 5 seconds	minimum 125
Absolute Viscosity	140°F	minimum 800 poise
Ductility	77°F, 50 mm/minute	minimum 400 mm
Float Test	140°F	minimum 1,200 seconds
Solubility	in Trichloroethylene	minimum 97.5%

Test	Conditions	Asphalt Emulsion Grade AE-200
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		Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Viscosity	122°F	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 ₂ 0.10 N	minimum 75%
Residue by Distillation		minimum 62%
Oil Portion	500°F. Dist.	maximum 8% by volume
Tests on Residue:		
Penetration (0.1 mm)	77°F, 100 g, 5 seconds	minimum 150
Absolute Viscosity	140°F	minimum 400 poise
Ductility	77°F, 50 mm/minute	
Float Test	140°F	minimum 1,200 seconds
Solubility	in Trichloroethylene	minimum 97.5%
(a) The test requirement for settlement may be waived when the emulsified asphalt is used in less than 5 days.		
(b) The 24-hour (one day) storage stability test may be used instead of the 5 day settlement test.		

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

EMULSIFIED ASPHALT GRADE CRS-2H		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Viscosity	122°F	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%

EMULSIFIED ASPHALT GRADE CRS-2H		
Test	Conditions	Minimum/Maximum
Residue		minimum 65%
Tests on Residue:		
Penetration (0.1 mm)	77°F, 100 g, 5 seconds	80/140
Ductility	77°F, 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 5 days.		
(b) The 24-hour (one day) storage stability test may be used instead of the 5 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 Viscosity	77°F	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	maximum 12% by volume
Tests on Residue:		
Penetration (0.1 mm)	77°F, 100 g, 5 seconds	40/200
Ductility	77°F, 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 5 days.		
(b) The 24-hour (one day) storage stability test may be used instead of the 5 day settlement test.		

ASPHALT EMULSION GRADE RS-1h		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Viscosity	77°F	20/100 seconds
Storage Stability	24 hour	maximum 1%
Demulsibility	35 mL 0.02N CaCl ₂ (a)	minimum 60%
Sieve Test		maximum 0.10%
Residue by Distillation		minimum 55%
Naphtha Portion	500°F. Dist (b)	maximum 3% by volume
Tests on Residue From Distillation Test:		
Penetration (0.1 mm)	77°F, 100 g, 5 seconds	minimum 45
Viscosity	140°F	minimum 1,600 poise
Ductility	77°F, 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-1H 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 Viscosity	77°F	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, 100 g, 5 seconds	minimum 50
Viscosity	140°F	minimum 800 poise
Solubility	in Trichloroethylene	minimum 97.5%
* Residue by distillation shall be in accordance with AASHTO T 59-09-12 except that the maximum temperature shall be 329°F, plus or minus 10°F [165°C, plus or minus 5°C] and the sample shall be maintained at this temperature for 20 minutes.		

EPR-1 PRIME (e)		
Tests	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Viscosity	77°F	6/24 seconds
Sieve Test (a)		maximum 0.1%
Residue by Distillation (b)		minimum 20%
Particle Charge Test (c)		positive
Test on Residue: (d)		
Flash Point	COC	minimum 410°F
Viscosity	140°F	600/1000cSt
(a) Distilled water shall be used in place of 2% sodium oleate solution. (b) Residue by distillation shall be in accordance with AASHTO T 59-09-12 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 59-09-12 except that the maximum temperature shall be 329°F, plus or minus 10°F [165°C, plus or minus 5°C] and the sample shall be maintained at this temperature for 20 minutes. (e) EPR-1 Prime shall not be diluted. In the event that 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 use.		

EMULSIFIED ASPHALT GRADE CRS-1h		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Viscosity	77°F	20 – 100 seconds
Storage Stability	24 hour	maximum 1%
Demulsibility	35 ml 0.8% Sodium Dioctyl Sulfosuccinate (a)	minimum 60%
Sieve Test		maximum 0.10%
Residue by Distillation	500°F. Distillation	minimum 55%
Naphtha Portion	500°F. Distillation. (b)	maximum 3% by volume

Particle charge		positive
Tests on Residue From Distillation Test:		
Penetration (0.1 mm)	77°F, 100 g, 5 seconds	minimum 45
Viscosity	140°F	minimum 1600 poise
Ductility	77°F	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 CRS-1 has been modified to include naphtha, the 24 hour storage stability will be waived.		

EMULSIFIED ASPHALT GRADE NTSS-1hm		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Viscosity	77°F	20 – 500 seconds
Storage Stability	24 hour	maximum 1%
Settlement	5 days	maximum 5%
Residue by Distillation		minimum 50%
Naphtha Content	500°F. Distillation	maximum 1% by volume
Sieve Test		maximum 0.30% (a)
Tests on Residue From Distillation Test:		
Penetration (0.1 mm)	77°F, 100 g, 5 seconds	maximum 20
Softening Point ASTM D 36-12		minimum 149°F
Dynamic Shear Rheometer AASHTO T 315-10/12	G* $\sin \delta$, 179.6°F @ 10 rad/sec	minimum 1.00 kPa
(a) Sieve test may be waived if no application problems are present in the field.		

916-3.2 Sampling, Certification, and Verification: For each tank of emulsified asphalt delivered to or prepared at the asphalt terminal, the asphalt supplier shall submit a sample to the SMO for testing before use. A pretest number will then be assigned by the SMO which shall be furnished with all emulsified asphalt delivered to the project. The pretest number shall be valid for 3 months from the date of issue.

The Department may sample and test pretested emulsified asphalt from the suppliers storage tank, the Contractors transport tank and/or distributor 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 pretested emulsified asphalt product. Further shipment of that pretested emulsified asphalt 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.

916-4 Liquid Anti-strip Agents.

916-4.1 Requirements: Liquid anti-strip agents shall be tested in accordance with FM 5-508. Tensile strength ratios will be calculated for the following two conditions and expressed as percentages: 1) conditioned mixture without anti-strip to unconditioned mixture without anti-strip and 2) conditioned mixture with anti-strip to unconditioned

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mixture without anti-strip. A 20% gain in tensile strength ratio for condition 2 as compared to condition 1 shall be required.

916-4.2 Qualified Products List (QPL): Liquid anti-strip agents supplied under this specification shall be one of the products included on the QPL. Manufacturers seeking evaluation of their product shall submit an application in accordance with Section 6 and include a report of test results from an independent laboratory confirming the material meets the requirements of this section. In lieu of submitting test results from an independent laboratory, the Department will evaluate the material. For each liquid anti-strip agent, the supplier will submit to the SMO one pint of a representative sample of liquid anti-strip agent when submitting the QPL application to the Department's Product Evaluation Section.

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 sufficient evidence that the properties of the material have changed, and the material will be removed from the QPL.

916-4.3 Mix Design Verification: Inclusion of a liquid anti-strip agent on the QPL does not guarantee that the anti-strip will be approved for use in an asphalt mixture. Specifications may require subsequent moisture susceptibility testing per FM 1-T 283 for the particular mix design. Results from this testing may indicate the need for a larger dosage rate of anti-strip agent (up to 0.75% maximum) or a different anti-strip agent to meet the specification requirements.

BITUMINOUS MATERIALS.
(REV 5-16-13)

SECTION 916 (Pages 985 – 995) is deleted and the following substituted:

SECTION 916
BITUMINOUS MATERIALS

916-1 Superpave PG Asphalt Binder:

916-1.1 Requirements: Superpave Performance Graded (PG) asphalt binders, identified as PG 52-28, PG 58-22, and PG 67-22 shall meet the requirements of 916-1.2, and AASHTO M 320-10 Table 1. Polymer Modified Asphalt (PMA) or Asphalt Rubber Binders (ARB), identified as PG 76-22 (PMA), PG 76-22 (ARB), and PG 82-22 (PMA), shall meet the requirements of 916-1.2 and AASHTO MP 19-10. All PG asphalt binders shall meet the following additional requirements:

1. The intermediate test temperature at 10 rad/sec for the Dynamic Shear Rheometer (DSR) test (AASHTO T 315-12) shall be 26.5°C for PG grades PG 67 and higher.
2. An additional high temperature grade of PG 67 is added for which the high test temperature at 10 rad/sec for the DSR test (AASHTO T 315-12) shall be 67°C.
3. All PG asphalt binders having a high temperature designation of PG 67 or lower shall be prepared without modification.
4. All PMA binders having a high temperature designation higher than PG 67 shall be produced with a styrene-butadiene-styrene (SBS) or styrene-butadiene (SB) elastomeric polymer modifier and the resultant binder shall meet all requirements of this Section.
5. Polyphosphoric acid may be used as a modifier not exceeding 1.25% by weight of asphalt binder for PG 76-22 (PMA), PG 76-22 (ARB), and PG 82-22 (PMA) binders.
6. PG 76-22 (ARB) shall meet the additional requirements of 916-1.1.1.
7. Do not substitute a PG binder with a high temperature grade more than 5.9°C higher than the specified PG grade, (for example, if a PG 58-22 is specified, do not supply a PG 64-22 or higher).

For all PG binder used in all hot mix asphalt, silicone may be added to the PG binder at the rate of 25 cubic centimeters of silicone mixed to each 5,000 gallons of PG binder. If a disbursing fluid is used in conjunction with the silicone, the resultant mixture containing the full 25 cubic centimeters of silicone shall be added in accordance with the manufacturer's recommendation. The blending of the silicone with the PG binder shall be done by the supplier prior to the shipment.

Where an anti-strip additive is required, per the requirements of Sections 334 and 337, the amount shall be from 0.25% to 0.75% by weight of the asphalt binder. The anti-strip additive shall meet the requirements of 916-5. The anti-strip additive shall be introduced into the PG binder by the supplier during loading.

916-1.1.1 Additional Requirements for PG 76-22 (ARB): The following additional requirements apply only to PG 76-22 (ARB):

1. The asphalt binder shall contain a minimum of 7.0% ground tire rubber (GTR) by weight of asphalt binder.

2. The GTR shall meet the requirements of Section 919.

3. Polymer modification is optional for PG 76-22 (ARB).

4. All testing performed with the DSR

(AASHTO T 315-12 and AASHTO TP 70-12) shall be performed with a 2 mm gap.

5. Use of excess PG 76-22 (ARB): The Contractor may use excess PG 76-22 (ARB) in other asphalt concrete mixes requiring the use of a PG 67-22 binder by blending with straight PG 67-22 binder so that the total amount of ground tire rubber in the binder is less than 2.0%. The Contractor may use excess PG 76-22 (ARB) in asphalt concrete mixtures requiring the use of a PG 52-28 or PG 58-22 by blending with the designated binder in such proportions that the total amount of ground tire rubber in the binder is less than 1.0%.

916-1.2 Qualified Products List (QPL): The Superpave PG asphalt binders supplied under this specification shall be one of the products included on the QPL as specified in 6-1. Manufacturers seeking evaluation of their product shall submit an application in accordance with Section 6 and include a report of test results from an independent laboratory confirming the material meets the requirements of this section. In lieu of submitting test results from an independent laboratory, the Department will evaluate the material. 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 QPL.

For each binder grade, the supplier may be required to submit to the State Materials Office (SMO), 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 modifier type shall be indicated on the product evaluation application and in the Quality Control Program below. Additionally, for PG 76-22 (ARB), provide a certification statement on the product evaluation application and in the Quality Control Program that a minimum of 7.0% GTR is used in the formulation of the PG 76-22 (ARB). Suppliers shall not ship any PG asphalt binder until notified that the product is on the QPL and the Quality Control Program meets the requirements of 916-1.3 and has been approved by the Department.

916-1.3 Quality Control Program: The supplier of Superpave PG asphalt binder shall at a minimum have a Quality Control Program meeting the requirements of this Section based on AASHTO R 26-01 (2009). The Quality Control Program shall be submitted in electronic format to the SMO for approval.

The requirements for the Quality Control Program apply to the supply location of PG asphalt binders for the use on Department projects. The supply location of PG binder may represent refinery production, terminal distribution, blending, processing, and/or modification location. Rack blending (blending from two tank sources) will be permitted to meet the requirements for a PG asphalt binder product. Any special handling requirements such as rack blending and manufacture of polymer and or rubber modified asphalt shall be described in the Quality Control Program.

916-1.3.1 Identification of Personnel and Supply Locations: The supplier's primary and secondary representatives responsible for quality control shall be identified by name, title, address, telephone, fax and e-mail address. At least one of the representatives shall be located at the supply location. The supply locations shall be identified by name, address and telephone.

916-1.3.2 Specification Compliance and Quality Control (QC)

Testing: Specification compliance testing shall consist of complete testing of each PG asphalt binder shipped in accordance with 916-1.1 of these Specifications. Specification compliance testing shall be conducted by a testing laboratory that participates at least annually in the AASHTO Materials Reference Laboratory (AMRL) Proficiency Sample Program for PG asphalt binder. Results of specification compliance testing shall be available to the supplier within five working days of sampling. The primary testing lab and any other labs to be used for specification compliance testing shall be identified in the suppliers Quality Control Program. The results from each AMRL Proficiency Sample for each testing laboratory shall be forwarded by the supplier for each supply location in electronic format to the SMO within one week of receiving the results. Acceptable performance in the AMRL Proficiency Sample Program shall be a minimum score of 3 for each test. A rating of less than 3 shall require identification of appropriate action on the part of the supplier and be acceptable to the State Materials Engineer.

QC testing as a minimum shall consist of testing a representative sample of each PG asphalt binder shipped by the supplier in accordance with AASHTO T 315-12 Test Method for Determining Rheological Properties of Asphalt Binder using a DSR.

Results of QC testing shall be available to the supplier within 5 hours of sampling. A QC test result outside the specification limits will require immediate sampling and testing for specification compliance and appropriate action taken. The QC testing and location where the test will be done shall be identified in the suppliers Quality Control Program. In the event that testing equipment goes out of service, the supplier may elect to test at a qualified lab identified in the supplier's Quality Control Program. The QC testing results shall be supplied within 48 hours of the sampling.

916-1.3.3 Frequency of Sampling and Testing: Sampling of PG asphalt binders shall be done in accordance with AASHTO T 40-02 (2006). Initial specification compliance test results shall be required for each PG asphalt binder grade for each new LOT of material which will be further subjected to QC testing in accordance with 916-1.3.2. A new LOT will occur when the material in a tank changes and the specification compliance test may no longer be representative of the material in the tank. This may be due to an incoming bulk shipment of material, change in refinery run, the manufacture of a product, or a blend of material in a tank. Additional testing is as follows:

(1) Any PG asphalt binder shipped to a Department project during any one calendar month shall be tested at least once during that month 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 QC testing in accordance with 916-1.3.2. A single, 1-quart representative sample of each PG asphalt binder shall be obtained and tested by the supplier each calendar week; for each rack blended PG asphalt binder, additional

representative samples shall be obtained daily. Each QC sample and additional daily rack blended samples shall be adequately identified and retained for not less than 8 weeks at the supply location. Any PG asphalt binder not shipped to Department projects is not required to be sampled or tested.

(3) Split samples of any PG asphalt binder will be provided when requested by a representative of the Department. In this situation, three representative 1-quart samples will be obtained by the supplier under the direction of the Department. One sample will be submitted to the SMO, 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 1-quart samples is to obtain a single gallon sample, which is then stirred and poured into three 1-quart cans. When split samples are requested by the Department, the results from both parties will be made available within 10 working days.

(4) For each rack blended PG asphalt binder, identify minimum daily Process Control (PC) Testing in the QC Plan.

916-1.3.4 Reporting: A monthly report by the supplier containing specification compliance and QC test results for each PG asphalt binder LOT shall be submitted by the supplier in electronic format using the form provided by the Department to the SMO within 7 days following the end of the calendar month. Test results for split samples shall also be included. PC test results shall not be included. Copies of these monthly reports and supporting test reports shall be available at the supply location for a minimum of 3 years.

The report shall consist of the specification compliance testing and QC 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
Modifier	Modified binders only	Report
Solubility, AASHTO T 44-03 (2011)	in Trichloroethylene	Minimum 99.0% (Not applicable for PG 76-22 (ARB))
Flash Point, AASHTO T 48-06 (2010)	Cleveland Open Cup	Minimum 450°F
Rotational Viscosity, AASHTO T 316-11	275°F	Maximum 3 Pa·s ^(a)
Dynamic Shear	$G^*/\sin \delta$	Minimum 1.00 kPa

Rheometer, AASHTO T 315-12	Phase Angle, δ PG 76-22 (PMA) and PG 76-22 (ARB) ^(b) PG 82-22 (PMA)	Maximum 75 degrees Maximum 65 degrees
Separation Test, ASTM D 7173-11 and Softening Point, AASHTO T 53-11	163±5°C 48 hours	Maximum 15°F (PG 76-22 (ARB) only)
Rolling Thin Film Oven Test Residue (AASHTO T 240-09)		
Rolling Thin Film Oven, AASHTO T 240-09	Mass Change%	Maximum 1.00
Dynamic Shear Rheometer, AASHTO T 315-12	$G^* / \sin \delta$, (Unmodified binders only)	Minimum 2.20 kPa
Multiple Stress Creep Recovery, $J_{nr, 3.2}$ ^(b,c) AASHTO TP 70-12	67°C (Modified binders only)	“V” = 1.0 kPa ⁻¹ max “E” = 0.5 kPa ⁻¹ max Maximum $J_{nr, diff} = 75\%$
Multiple Stress Creep Recovery, %Recovery ^(b,c) AASHTO TP 70-12	67°C (Modified binders only)	$\%R_{3.2} > \frac{29.37(J_{nr, 3.2})}{0.2633}$ (Figure X2.1 in TP 70-11) For $J_{nr, 3.2} \leq 2.0$
Pressure Aging Vessel Residue (AASHTO R 28-12)		
Dynamic Shear Rheometer, AASHTO T 315-12	$G^* \sin \delta$, 10 rad/sec.	Maximum 5000 kPa
Creep Stiffness, AASHTO T 313-12	S (Stiffness), @ 60 sec. M-value, @ 60 sec.	Maximum 300 MPa Minimum 0.300
(a) Binders with values higher than 3 Pa·s should be used with caution and only after consulting with the supplier as to any special handling procedures, including pumping capabilities. (b) AASHTO T 315-12 and AASHTO TP 70-12 will be performed at a 2 mm gap for PG 76-22 (ARB) (c) All binders with a high temperature designation >67 will be tested at 67°C. PG 76-22 (PMA) and PG 76-22 (ARB) shall pass a “V” graded and PG 82-22 (PMA) shall pass an “E” grade per AASHTO MP 19-10.		

916-1.3.5 Notification and Evaluation: In the event that a specification compliance test is outside specification requirements or a QC 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 SMO will be notified and the product retested for specification compliance (re-sampling as appropriate). Where the retest for specification compliance meets all requirements, shipments of that product may resume. Where off-specification material has been shipped and the retest confirms the original test, the Contractor and the SMO will be informed of the steps taken to achieve specification compliance on the product shipped.

Where off-specification materials have 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 certification on the bill of lading for each shipment of PG binder delivered to a Department project that includes: the quantity (including initial weights of the neat binder and GTR and ending GTR percentage by weight of asphalt binder for PG 76-22 (ARB)), the Superpave PG asphalt binder grade (including QPL number), PG binder LOT designation, the customer name, the delivery location, a statement that the binder is in conformance with 916-1 and the suppliers Quality Control Program, and the quantity of silicone and anti-strip agent addition, as applicable, including product designation (QPL number as applicable). 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 asphalt binder from the suppliers storage tank, 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 PG asphalt binder product. Further shipment of that PG asphalt binder 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 Cut-Back Asphalts.

916-2.1 Requirements: Rapid-curing, cut-back asphalt shall conform to the requirements of AASHTO M 81-92 (2008), 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 81-92 (2008) the following values shall be added to the requirements for distillation test:

Distillate, Percentage by Volume of Total Distillate to 680°F	Grade RC-3000 Maximum
to 320°F	0
to 374°F	10
to 437°F	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 81-92 (2008).

Medium-curing, cut-back asphalt shall conform to the requirements of AASTHO M 82-75 (2008).

916-2.2 Sampling, Certification, and Verification: Sampling of cut-back asphalts shall be done in accordance with AASHTO T 40-02 (2006). For each tank of cut-back asphalt delivered to or prepared at the asphalt terminal, the asphalt supplier shall submit a sample to the SMO for testing before use. A pretest number will then be assigned by the SMO which shall be furnished with all cut-back asphalt delivered to the project. The pretest number shall be valid for three months from the date of issue.

The Department may sample and test pre-tested cut-back asphalt from the supplier's storage tank, the Contractor's transport tank and/or distributor 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 pretested cut-back asphalt product. Further shipment of that pretested cut-back asphalt 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.

916-3 Emulsified Asphalts.

916-3.1 Requirements: Anionic emulsified asphalt shall meet the requirements of AASHTO M 140-08 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 208-01 (2009). 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 Viscosity	122°F	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 ₂ 0.10 N	minimum 75%
Residue by Distillation		minimum 65%
Oil Portion	500°F. Dist.	maximum 1% by volume
Tests on Residue:		
Penetration (0.1 mm)	77°F, 100 g, 5 seconds	minimum 40
Absolute Viscosity	140°F	minimum 3,200 poise
Ductility	77°F, 50 mm/minute	minimum 400 mm
Float Test	140°F	minimum 1,200 seconds
Solubility	in Trichloroethylene	minimum 97.5%

Test	Conditions	Asphalt Emulsion Grade AE-90
		Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Viscosity	122°F	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 ₂ 0.10 N	minimum 75%
Residue by Distillation		minimum 65%
Oil Portion	500°F. Dist.	maximum 2% by volume

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Tests on Residue:		
Penetration (0.1 mm)	77°F, 100 g, 5 seconds	minimum 70
Absolute Viscosity	140°F	minimum 1,600 poise
Ductility	77°F, 50 mm/minute	minimum 400 mm
Float Test	140°F	minimum 1,200 seconds
Solubility	in Trichloroethylene	minimum 97.5%

Test	Conditions	Asphalt Emulsion Grade AE-150
		Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Viscosity	122°F	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 ₂ 0.10 N	minimum 75%
Residue by Distillation		minimum 65%
Oil Portion	500°F. Dist.	maximum 3% by volume
Tests on Residue:		
Penetration (0.1 mm)	77°F, 100 g, 5 seconds	minimum 125
Absolute Viscosity	140°F	minimum 800 poise
Ductility	77°F, 50 mm/minute	minimum 400 mm
Float Test	140°F	minimum 1,200 seconds
Solubility	in Trichloroethylene	minimum 97.5%

Test	Conditions	Asphalt Emulsion Grade AE-200
		Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Viscosity	122°F	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 ₂ 0.10 N	minimum 75%
Residue by Distillation		minimum 62%
Oil Portion	500°F. Dist.	maximum 8% by volume
Tests on Residue:		
Penetration (0.1 mm)	77°F, 100 g, 5 seconds	minimum 150
Absolute Viscosity	140°F	minimum 400 poise
Ductility	77°F, 50 mm/minute	
Float Test	140°F	minimum 1,200 seconds
Solubility	in Trichloroethylene	minimum 97.5%

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

(b) The 24-hour (one day) storage stability test may be used instead of the 5 day settlement test.

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

EMULSIFIED ASPHALT GRADE CRS-2H		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Viscosity	122°F	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, 100 g, 5 seconds	80/140
Ductility	77°F, 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 5 days. (b) The 24-hour (one day) storage stability test may be used instead of the 5 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 Viscosity	77°F	20/150 seconds
Settlement	5 days (a)	maximum 5%
Storage Stability	24 hour (b)	maximum 1%
Sieve Test		maximum 0.1%
Residue		minimum 55%

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Naphtha Content	500°F. Dist	maximum 12% by volume
Tests on Residue:		
Penetration (0.1 mm)	77°F, 100 g, 5 seconds	40/200
Ductility	77°F, 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 5 days.		
(b) The 24-hour (one day) storage stability test may be used instead of the 5 day settlement test.		

ASPHALT EMULSION GRADE RS-1h		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Viscosity	77°F	20/100 seconds
Storage Stability	24 hour	maximum 1%
Demulsibility	35 mL 0.02N CaCl ₂ (a)	minimum 60%
Sieve Test		maximum 0.10%
Residue by Distillation		minimum 55%
Naphtha Portion	500°F. Dist (b)	maximum 3% by volume
Tests on Residue From Distillation Test:		
Penetration (0.1 mm)	77°F, 100 g, 5 seconds	minimum 45
Viscosity	140°F	minimum 1,600 poise
Ductility	77°F, 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-1H 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 Viscosity	77°F	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, 100 g, 5 seconds	minimum 50
Viscosity	140°F	minimum 800 poise
Solubility	in Trichloroethylene	minimum 97.5%
* Residue by distillation shall be in accordance with AASHTO T 59-12 except that the maximum temperature shall be 329°F, plus or minus 10°F [165°C, plus or minus 5°C] and the sample shall be maintained at this temperature for 20 minutes.		

EPR-1 PRIME (e)		
Tests	Conditions	Minimum/Maximum

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Tests on Emulsion:		
Saybolt Furol Viscosity	77°F	6/24 seconds
Sieve Test (a)		maximum 0.1%
Residue by Distillation (b)		minimum 20%
Particle Charge Test (c)		positive
Test on Residue: (d)		
Flash Point	COC	minimum 410°F
Viscosity	140°F	600/1000cSt
(a) Distilled water shall be used in place of 2% sodium oleate solution.		
(b) Residue by distillation shall be in accordance with AASHTO T 59-12 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 59-12 except that the maximum temperature shall be 329°F, plus or minus 10°F [165°C, plus or minus 5°C] and the sample shall be maintained at this temperature for 20 minutes.		
(e) EPR-1 Prime shall not be diluted. In the event that 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 use.		

EMULSIFIED ASPHALT GRADE CRS-1h		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Viscosity	77°F	20 – 100 seconds
Storage Stability	24 hour	maximum 1%
Demulsibility	35 ml 0.8% Sodium Dioctyl Sulfosuccinate (a)	minimum 60%
Sieve Test		maximum 0.10%
Residue by Distillation	500°F. Distillation	minimum 55%
Naphtha Portion	500°F. Distillation. (b)	maximum 3% by volume
Particle charge		positive
Tests on Residue From Distillation Test:		
Penetration (0.1 mm)	77°F, 100 g, 5 seconds	minimum 45
Viscosity	140°F	minimum 1600 poise
Ductility	77°F	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 CRS-1 has been modified to include naphtha, the 24 hour storage stability will be waived.		

EMULSIFIED ASPHALT GRADE NTSS-1hm		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Viscosity	77°F	20 – 500 seconds
Storage Stability	24 hour	maximum 1%
Settlement	5 days	maximum 5%
Residue by Distillation		minimum 50%
Naphtha Content	500°F. Distillation	maximum 1% by volume
Sieve Test		maximum 0.30% (a)
Tests on Residue From Distillation Test:		

Penetration (0.1 mm)	77°F, 100 g, 5 seconds	maximum 20
Softening Point ASTM D 36-12		minimum 149°F
Dynamic Shear Rheometer AASHTO T 315-12	$G \cdot \sin \delta$, 179.6°F @ 10 rad/sec	minimum 1.00 kPa
(a) Sieve test may be waived if no application problems are present in the field.		

916-3.2 Sampling, Certification, and Verification: For each tank of emulsified asphalt delivered to or prepared at the asphalt terminal, the asphalt supplier shall submit a sample to the SMO for testing before use. A pretest number will then be assigned by the SMO which shall be furnished with all emulsified asphalt delivered to the project. The pretest number shall be valid for 3 months from the date of issue.

The Department may sample and test pretested emulsified asphalt from the suppliers storage tank, the Contractors transport tank and/or distributor 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 pretested emulsified asphalt product. Further shipment of that pretested emulsified asphalt 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.

916-4 Liquid Anti-strip Agents.

916-4.1 Requirements: Liquid anti-strip agents shall be tested in accordance with FM 5-508. Tensile strength ratios will be calculated for the following two conditions and expressed as percentages: 1) conditioned mixture without anti-strip to unconditioned mixture without anti-strip and 2) conditioned mixture with anti-strip to unconditioned mixture without anti-strip. A 20% gain in tensile strength ratio for condition 2 as compared to condition 1 shall be required.

916-4.2 Qualified Products List (QPL): Liquid anti-strip agents supplied under this specification shall be one of the products included on the QPL. Manufacturers seeking evaluation of their product shall submit an application in accordance with Section 6 and include a report of test results from an independent laboratory confirming the material meets the requirements of this section. In lieu of submitting test results from an independent laboratory, the Department will evaluate the material. For each liquid anti-strip agent, the supplier will submit to the SMO one pint of a representative sample of liquid anti-strip agent when submitting the QPL application to the Department's Product Evaluation Section.

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 sufficient evidence that the properties of the material have changed, and the material will be removed from the QPL.

916-4.3 Mix Design Verification: Inclusion of a liquid anti-strip agent on the QPL does not guarantee that the anti-strip will be approved for use in an asphalt mixture. Specifications may require subsequent moisture susceptibility testing per FM 1-T 283 for the particular mix design. Results from this testing may indicate the need for a larger dosage rate of anti-strip agent (up to 0.75% maximum) or a different anti-strip agent to meet the specification requirements.

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