



Florida Department of Transportation

RICK SCOTT
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

ANANTH PRASAD, P.E.
SECRETARY

July 23, 2012

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

Re: Office of Design, Specifications
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 and for formatting.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via email to SP965TT or trey.tillander@dot.state.fl.us.

If you have any questions relating to this specification change, please call me at 414-4140.

Sincerely,

Signature on file

V. Y. "Trey" Tillander, III, P.E.
State Specifications Engineer

TT/dt

Attachment

cc: Florida Transportation Builders' Assoc.
State Construction Engineer

BITUMINOUS MATERIALS.(REV ~~5-8147-23~~-12)

SECTION 916 (of the Supplemental Specifications) 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~~, PG 64-22, PG 67-22, and PG 76-22, shall meet the requirements of 916-1.2, AASHTO M 320-~~10~~ Table 1 and the following additional requirements:

~~1. The mass change per AASHTO T 240 shall be a maximum of 0.5% for all grades.~~

~~21.~~ The intermediate test temperature at 10 rad/s. for the Dynamic Shear Rheometer test AASHTO T 315-~~10~~ shall be 25°C for ~~all~~ grades ~~PG 64 and higher~~.

~~32.~~ 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 T 315-~~10~~ shall be 67°C.

~~43.~~ All PG asphalt binders having a high temperature designation of PG 67 or lower shall be prepared without modification.

~~54.~~ 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) elastomeric polymer modifier and resultant binder shall meet all requirements of this Specification; in addition the phase angle at 76°C (AASHTO T 315-~~10~~) shall be a maximum of 75 degrees.

~~6. The maximum viscosity AASHTO T 202 shall be 2400 poises for PG 64-22 and 3600 poises for PG 67-22.~~

~~5. Do not substitute a PG binder with a high temperature PG grade higher than the specified PG grade, i.e. (for example, if a PG 58-22 is specified, do not supply a PG 64-22 or higher).~~

~~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 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 and asphalt rubber binder for ~~F~~friction ~~C~~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 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, it shall be from 0.25 to 0.75%. 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.

~~Where PG binder is used in mixes containing reclaimed asphalt pavement (RAP), the requirements of 334-2.3.4 must also be met.~~

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 ~~Qualified Products List~~ 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. 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~~.

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 on the Product Evaluation Application and in the Quality Control Program below. 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 at a minimum have a Quality Control Program meeting the requirements of this Specification ~~which is~~ based on AASHTO R 26-01 (2009). The Quality Control Program shall be submitted in electronic format to the State Materials Office for approval.

The requirements for the Quality Control ~~p~~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. 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 modified asphalt shall be described in the Quality Control ~~p~~Program. ~~The requirements of these Specifications for a Quality Control Program 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 responsible for Quality Control (QC) 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 ~~C~~compliance ~~T~~esting shall consist of complete testing of each PG binder shipped in accordance with AASHTO M 320-10 and 916-1.1 of these Specifications. Results of Specification ~~C~~compliance ~~T~~esting shall be available to the supplier within five working days of sampling. Specification ~~C~~compliance ~~T~~esting shall be conducted by

a testing laboratory that participates at least annually in the AASHTO Materials Reference Laboratory (AMRL) Proficiency Sample Program for ~~both~~ Performance Graded Asphalt Binder ~~and Viscosity Graded Asphalt Cement~~. The primary testing lab and any other labs to be used for ~~S~~pecification ~~E~~compliance ~~T~~esting 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 State Materials Office. Acceptable performance in the AMRL Proficiency Sample 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 and be 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 T 315-10 Test Method for Determining Rheological Properties of Asphalt Binder using a Dynamic Shear Rheometer (DSR).~~

Results of ~~Quality Control T~~esting shall be available to the supplier within five hours of sampling. A ~~Quality Control~~ test result outside the specification limits will require immediate sampling and testing for ~~S~~pecification ~~E~~compliance and appropriate action taken. The ~~Quality Control~~ testing and location where the test will be done shall be identified in the suppliers Quality Control Program.

916-1.3.3 Frequency of Sampling and Testing: Sampling of PG binders shall be done in accordance with AASHTO T 40-02 (2006). Initial ~~S~~pecification ~~E~~compliance test results shall be required for each PG binder grade for each new LOT of material which will be further subjected to ~~Quality Control T~~esting in accordance with 916-1.3.2. A new LOT will occur when the material in a tank changes and the ~~S~~pecification ~~E~~compliance ~~T~~est 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 binder shipped to a Department project during any one calendar month shall be tested at least once during that month for ~~S~~pecification ~~E~~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 each calendar week; for each rack blended PG binder,; additional representative samples shall be obtained daily. Each ~~Quality Control~~ sample and additional daily rack blended samples shall be adequately identified and retained ~~for~~ not less than eight weeks at the supply location. 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~~ 1-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 ~~S~~pecification ~~C~~ompliance and one will be tested by the supplier for ~~Q~~uality ~~C~~ontrol. The method of obtaining the three representative ~~one~~-~~I~~-quart samples is to obtain a single gallon sample, which is then stirred and poured into three ~~one~~-~~I~~-quart cans. When split samples are requested by the Department, the results from both parties will be made available within ten working days.

(4) 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 ~~S~~pecification ~~C~~ompliance and ~~Q~~uality-~~C~~ontrol ~~T~~est results for each PG binder LOT shall be submitted by the supplier in electronic format using the form provided by the Department to the State Materials Office within seven days following the end of the calendar month. Test results for split samples shall also be included. Process Control 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 three years.

The report shall consist of the ~~S~~pecification ~~e~~compliance ~~t~~esting and ~~Q~~uality-~~C~~ontrol ~~T~~esting of the following as applicable by these ~~S~~pecifications.

| 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 | (PG 76-22 Only) | Report |
| Solubility, AASHTO T 44- 03 (2007) | in Trichloroethylene | Minimum 99.0% |
| Flash Point, AASHTO T 48- 06 (2010) | COC | Minimum 450°F |
| Rotational Viscosity, AASHTO T 316- 11 | 275°F | Maximum 3 Pa-s |
| Absolute Viscosity, AASHTO T 202 | 140°F | Max. 2400 P (PG 64-22) Max. 3600 P (PG 67-22) |
| Dynamic Shear Rheometer, AASHTO T 315- 10 | G [*] /sin -δ, Test Temperature @ 10- rad/sec, °C Phase Angle, δ, (PG 76-22 Only) | Minimum 1.00 kPa Maximum 75- degrees |
| Rolling Thin Film Oven Test Residue (AASHTO T 240- 09) | | |
| Rolling Thin Film Oven, AASHTO T 240- 09 | Mass Change% | Maximum 0.50 1.00 |

| | | |
|---|---|--------------------------------------|
| Dynamic Shear Rheometer, AASHTO T 315-10 | $G^*/\sin \delta$, Test Temperature @ 10- rad/sec, °C | Minimum 2.20 kPa |
| Pressure Aging Vessel Residue (AASHTO R 28-09) at 100°C | | |
| Dynamic Shear Rheometer, AASHTO T 315-10 | $G^* \sin \delta$, 10- rad/sec. @ 25°C | Maximum 5000 kPa |
| Creep Stiffness, AASHTO T 313-10 | S (Stiffness), @ 60 sec. @ 12°C M-value, @ 60 -sec. @ 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 for Specification Compliance (resampling 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 State Materials Office 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, 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 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 binder product. Further shipment of that PG 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 Recycling Agents:

916-2.1 Requirements: The asphalt recycling agent (RA) shall be an asphalt binder (PG asphalt binder) or an asphalt binder blended (as necessary) with a softening agent or flux oil, and shall meet the four Target Viscosity values of 550, 750, 1000, and 1500 poises and the following requirements:

| RECYCLING AGENTS | | |
|---------------------------------------|---|---------------------------------------|
| Test | Conditions | Recycling Agent Minimum/Maximum Value |
| Absolute Viscosity AASHTO T 202 | 140°F | Target Viscosity \pm 20% |
| Viscosity Ratio After AASHTO T 240 | Visc. 140°F after RTFOT Visc. 140°F before RTFOT | maximum 3 |
| Flash Point AASHTO T 48 | COC | minimum 400°F |
| Solubility AASHTO T 44 | in Trichloroethylene | minimum 99.0% |

Rack blending of recycling agents (blending from two RA tank sources) will be permitted to meet a required target viscosity value.

For all recycling agents used in all hot mix asphalt, silicone may be added to the recycling agent at the rate of 25 cubic centimeters of silicone mixed to each 5,000 gallons of recycling agent. If a dispersing 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 recycling agent shall be done by the supplier prior to the shipment.

All recycling agents for hot mix asphalt products containing RAP shall contain 0.5% heat stable anti-strip additive by weight of the recycle agent unless specifications for the hot mix asphalt 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, it shall be from 0.50 to 0.75%. The anti-strip additive shall meet the requirements of 916-5. The anti-strip additive shall be introduced into the recycling agent by the supplier during loading.

Where a recycling agent is used in mixes containing reclaimed asphalt pavement (RAP), the requirements of 334-2.3.4 must also be met.

916-2.2 Sampling and Reporting: Sampling of recycling agents shall be done in accordance with AASHTO T-40. Initial Specification Compliance test results shall be required for each new LOT of material. A new LOT will occur when the material in a tank changes and the Specification Compliance Test may not 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.

A monthly report by the supplier containing Specification Compliance Test results for each RA LOT shall be submitted by the supplier in electronic format using the form provided by the Department to the State Materials Office within seven days following the end of the calendar month. Copies of these monthly reports and

~~supporting test reports shall be available at the supply location for a minimum of three years.~~

~~**916-2.3 Certification and Verification:** The supplier shall furnish certification on the bill of lading for each shipment of recycling agent delivered to a Department project that includes: the quantity, the RA target viscosity, the RA LOT designation, customer name, delivery location, a statement that the RA is in conformance with 916-2, and the quantity of silicone and anti-strip agent addition, as applicable, including product designation (QPL number as applicable).~~

~~The Department may sample and test recycling agents 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 RA binder from that RA LOT(s). Further shipment of RA binder from that RA LOT(s) 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.~~

916-3.2 Cut-Back Asphalts.

916-3.2.1 Requirements: Rapid-curing, cut-back asphalt shall conform with 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 ~~D~~istillation ~~T~~est:

| 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 with the requirements of AASTHO M 82.

916-3.2.2 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 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 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.

916-4.3 Emulsified Asphalts.

916-4.3.1 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 |
| 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 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 |
| 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 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 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 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-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 60 |
| 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- <i>09</i> except that the maximum temperature shall be 329°, ± <i>plus or minus</i> 10°F [165°, ± <i>plus or minus</i> 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: | | |

| 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 | 600/1000-cSt |
| (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 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 except that the maximum temperature shall be 329°, plus or minus- 10°F [165°, 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 | | minimum 149°F |
| Dynamic Shear Rheometer AASHTO T 315-10 | G* sin δ , 186.8°F @ 10 rad/sec | minimum 1.00 kPa |
| Solubility | in Trichloroethylene | minimum 97.5% |
| (a) Sieve test may be waived if no application problems are present in the field. | | |

916-43.2 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 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 three 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.

916-54 Liquid Anti-strip Agents.

916-54.1 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.

916-54.2 Qualified Products List (QPL): Liquid anti-strip agents supplied under this Specification shall be one of the products included on the [Qualified Products List \(QPL\)](#). 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 State Materials Office 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 [Qualified Products List](#).

916-54.3 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 7-23-12)

SECTION 916 (of the Supplemental Specifications) 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, PG 64-22, PG 67-22, and PG 76-22, shall meet the requirements of 916-1.2, AASHTO M 320-10 Table 1 and the following additional requirements:

1. The intermediate test temperature at 10 rad/s. for the Dynamic Shear Rheometer test AASHTO T 315-10 shall be 25°C for grades PG 64 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 Dynamic Shear Rheometer test AASHTO T 315-10 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 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) elastomeric polymer modifier and resultant binder shall meet all requirements of this Specification; in addition the phase angle at 76°C (AASHTO T 315-10) shall be a maximum of 75 degrees.
5. Do not substitute a PG binder with a high temperature PG grade 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 and asphalt rubber 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 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, it shall be from 0.25 to 0.75%. 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.

916-1.2 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. 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 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 on the Product Evaluation Application and in the Quality Control Program below. Suppliers shall not ship any PG binder until notified that the product is on the QPL 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 at a minimum have a Quality Control Program meeting the requirements of this specification based on AASHTO R 26-01 (2009). The Quality Control Program shall be submitted in electronic format to the State Materials Office for approval.

The requirements for the Quality Control Program apply to the supply location of PG 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 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 (QC) 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 binder shipped in accordance with AASHTO M 320-10 and 916-1.1 of these specifications. Results of specification compliance testing shall be available to the supplier within five working days of sampling. 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 Performance Graded Asphalt Binder. 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 State Materials Office. Acceptable performance in the AMRL Proficiency Sample 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 and be acceptable to the State Materials Engineer.

QC testing as a minimum shall consist of testing a representative sample of each PG binder shipped by the supplier in accordance with AASHTO T 315-10

Test Method for Determining Rheological Properties of Asphalt Binder using a Dynamic Shear Rheometer (DSR).

Results of QC testing shall be available to the supplier within five 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.

916-1.3.3 Frequency of Sampling and Testing: Sampling of PG binders shall be done in accordance with AASHTO T 40-02 (2006). Initial specification compliance test results shall be required for each PG 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 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, one quart representative sample of each PG binder shall be obtained and tested by the supplier each calendar week; for each rack blended PG 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 eight weeks at the supply location. 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 1-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 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 ten working days.

(4) 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 QC test results for each PG binder LOT shall be submitted by the supplier in electronic format using the form provided by the Department to the State Materials Office within seven days following the end of the calendar month. Test results for split samples shall also be included. Process Control 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 three 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 |
| Polymer Modifier Type | (PG 76-22 Only) | Report |
| Solubility, AASHTO T 44-03 (2007) | in Trichloroethylene | Minimum 99.0% |
| Flash Point, AASHTO T 48-06 (2010) | COC | Minimum 450°F |
| Rotational Viscosity, AASHTO T 316-11 | 275°F | Maximum 3 Pa-s |
| Dynamic Shear Rheometer, AASHTO T 315-10 | $G^*/\sin \delta$, Test Temperature @ 10 rad/sec, °C Phase Angle, δ , (PG 76-22 Only) | Minimum 1.00 kPa Maximum 75 degrees |
| 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 315-10 | $G^*/\sin \delta$, Test Temperature @ 10 rad/sec, °C | Minimum 2.20 kPa |
| Pressure Aging Vessel Residue (AASHTO R 28-09) at 100°C | | |
| Dynamic Shear Rheometer, AASHTO T 315-10 | $G^* \sin \delta$, 10 rad/sec. @ 25°C | Maximum 5000 kPa |
| Creep Stiffness, AASHTO T 313-10 | S (Stiffness), @ 60 sec. M-value, @ 60 sec. | 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 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 State Materials Office will be notified and the product retested for specification compliance (resampling 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 State

Materials Office 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, 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 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 binder product. Further shipment of that PG 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 with 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 with the requirements of AASTHO M 82.

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 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 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 |
| 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 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 |
| 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 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 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 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-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 60 |
| 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 except that the maximum temperature shall be 329°, plus or minus 10°F [165°, 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 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 except that the maximum temperature shall be 329°, plus or minus 10°F [165°, 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 econds |
| 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 | | minimum 149°F |
| Dynamic Shear Rheometer AASHTO T 315-10 | G* sin δ , 186.8°F @ 10 rad/sec | minimum 1.00 kPa |
| Solubility | in Trichloroethylene | minimum 97.5% |
| (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 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 three 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 State Materials Office 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.