

**SECTION 916**  
**BITUMINOUS MATERIALS**

**916-1 Asphalt Cement.**

The grades of asphalt cement shall conform to the requirements given in the following Table 1:

Table 1 ASPHALT CEMENT		
Test	Conditions	Viscosity Grade Minimum/Maximum Value
		AC-5
Viscosity -P	140°F [60°C]	500 ± 100 [50 ± 10 Pa·s]
Viscosity - cSt	275°F [135°C]	minimum 175 [0.000175m <sup>2</sup> /s]
Penetration (0.1 mm)	77°F [25°C], 100 g, 5 seconds	minimum 140
Flash Point	COC	minimum 350°F [177°C]
Solubility	in Trichlorethylene	minimum 99.0%
Tests on Residue from Thin Film Oven Test:		
Viscosity Ratio	Visc. 140°F [60°C] after TFOT Visc. 140°F [60°C] before TFOT	maximum 4
Loss on Heating		maximum 1.0%
Ductility	77°F [25°C], 50 mm/minute	minimum 1,000 mm
		AC-10
Viscosity -P	140°F [60°C]	1,000 ± 200 [100 ± 20 Pa·s]
Viscosity -cSt	275°F [135°C]	minimum 250 [0.00025 m <sup>2</sup> /s]
Penetration (0.1 mm)	77°F [25°C], 100 g, 5 seconds	minimum 80
Flash Point	COC	minimum 425°F [218°C]
Solubility	in Trichloroethylene	minimum 99.0%
Tests on Residue from Thin Film Oven Test:		
Viscosity Ratio	Visc. 140°F [60°C] after TFOT Visc. 140°F [60°C] before TFOT	maximum 4
Loss on Heating		maximum 0.5%
Ductility	77°F [25°C], 50 mm/minute	minimum 900 mm
		AC-20
Viscosity -P	140°F [60°C]	2,000 ± 400 [200 ± 40 Pa·s]
Viscosity -cSt	275°F [135°C]	minimum 300 [0.0003m <sup>2</sup> /s]
Penetration (0.1 mm)	77°F [25°C], 100 g, 5 seconds	minimum 60
Flash Point	COC	minimum 450°F [230°C]
Solubility	in Trichlorethylene	minimum 99.0%
Test on Residue from Thin Film Oven Test:		
Viscosity Ratio	Visc. 140°F [60°C] after TFOT Visc. 140°F [60°C] before TFOT	maximum 4
Loss on Heating		maximum 0.5%
Ductility	77°F [25°C], 50 mm/minute	minimum 800 mm
		AC-30
Viscosity -P	140°F [60°C]	3000 ± 600 [300 ± 60 Pa·s]
Viscosity -cSt	275°F [135°C]	minimum 350 [0.000350 m <sup>2</sup> /s]

Table 1 ASPHALT CEMENT		
Test	Conditions	Viscosity Grade Minimum/Maximum Value
Penetration (0.1 mm)	77°F [25°C], 100 g, 5 seconds	minimum 50
Flash Point	COC	minimum 450°F [230°C]
Solubility	in Trichlorethylene	minimum 99.0%
Tests on Residue from Thin Film Oven Test:		
Viscosity Ratio	Visc. 140°F [60°C] after TFOT	maximum 4
	Visc. 140°F [60°C] before TFOT	
Loss on Heating		maximum 0.5%
Ductility	77°F [25°C], 50 mm/minute	minimum 500 mm
Spot Test, when and as specified. (See note below.) Standard with Naphtha Solvent- Negative for all grades. Naphtha-Xylene Solvent- percent Xylene-Negative for all grades Heptane-Xylene Solvent- percent Xylene-Negative for all grades.		
Note: The use of the spot test is optional. When it is specified, the Engineer shall indicate whether the standard naphtha solvent, the naphtha-xylene solvent, or the heptane-xylene solvent will be used in determining compliance with this requirement, and also, in the case of xylene solvents, the percentage of xylene to be used.		

All hot bituminous mixtures (except recycled mixtures) must contain Viscosity Grade AC-30 as specified above.

For Viscosity Grade AC-30, silicone shall be added to the asphalt cement at the rate of 25 cm<sup>3</sup> of silicone mixed to each 5,000 gallons [19 m<sup>3</sup>] of asphalt cement. If a dispersing fluid is used in conjunction with the silicone, the resultant mixture containing the full 25 cm<sup>3</sup> shall be added, in accordance with the manufacturer's recommendation. The blending of silicone mixture with the asphalt cement shall be done by the producer prior to shipment.

Viscosity Grade AC-30 used in friction course mixes shall contain 0.5% heat-stable antistrip additive by weight of asphalt from an approved source. The antistrip additive shall be introduced and mixed into the asphalt cement at the asphalt terminal during loading or by the Contractor at the asphalt plant in a manner satisfactory to the Engineer.

Material failing to meet the viscosity requirements (140°F [60°C]) shown above will be paid for at reduced rates as shown in Table 2 below:

Table 2	
AC-5: Viscosity in poises at 140°F, [in Pa·s at 60°C]	Percentage of Original Payment
400 - 600 [40 - 60]	100%
375 - 399 or 601 - 625 [37 - 39 or 60 - 63]	90%
340 - 374 or 626 - 660 [34 - 36 or 64 - 66]	80%
Less than 340 [34] or greater than 660 [66]	*50%

AC-10: Viscosity in poises at 140°F, [in Pa·s at 60°C]	Percentage of Original Payment
800 - 1,200 [80 - 120]	100%
750 - 799 or 1,201 - 1,250 [75 - 79 or 120 - 125]	90%
680 - 749 or 1,251 - 1,320 [68 - 74 or 126 - 132]	80%
Less than 680 [68] or greater than 1,320 [132]	*50%

AC-20: Viscosity in poises at 140°F, [in Pa·s at 60°C]	Percentage of Original Payment
1,600 - 2,400 [160 - 240]	100%
1,500 - 1,599 and 2,401 - 2,500 [150 - 159 and 240 - 250]	90%
1,375 - 1,499 and 2,501 - 2,625 [138 - 149 and 251 - 263]	80%
Less than 1,375 [138] or greater than 2,625 [263]	*50%

AC-30: Viscosity in poises at 140°F, [in Pa·s at 60°C]	Percentage of Bid Price square yard or ton [square meter or metric ton]
2,400 - 3,600 [240 - 360]	100%
2,250 - 2,399 or 3,601 - 3,750 [225 - 239 or 360 - 375]	97%
2,075 - 2,249 or 3,751 - 3,925 [208 - 224 or 376 - 393]	94%
Less than 2,075 [208] or greater than 3,925 [393]	*86%

\* May be removed and replaced at the discretion of the Engineer.

**916-1.2 Sampling and Certification:** The supplier shall furnish a certification indicating compliance with the above specifications, including silicone and antistripping when required, for all asphalt cements delivered to the project.

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

All materials delivered to the project shall be identified by viscosity grade.

**916-2 Recycling Agents.**

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

TABLE I

Absolute Viscosity, (V60) after TFOT (Thin Film Oven Test) .....	3:1 Ratio maximum
Smoke Point .....	260°F [125°C] minimum
Flash Point .....	400°F [205°C] minimum
Solubility .....	97.5% minimum

Emulsified recycling agent shall meet the following requirements:

TABLE II

Storage Stability- 24 hour .....	1.0% maximum
Sieve Test.....	0.1% maximum
Residue by Evaporation .....	65.0% minimum

Residue from the emulsified recycling agent shall meet the requirements in Table I.

Recycling Agents may also be standard grade asphalt cements meeting the requirements of Table 1 in 916-1.1.

Silicone shall be added to the recycling agent at a rate of 25 cm<sup>3</sup> for each 5,000 gallons [19 m<sup>3</sup>] of recycling agent. For emulsified recycling agent the silicone shall be added to the residue at the stated rate prior to emulsification. If a dispersing fluid is used in conjunction with the silicone, the

resultant mixture containing the full 25 cm<sup>3</sup> shall be added, in accordance with the manufacturer's recommendation. The blending of silicone mixture with the residue shall be done by the supplier prior to shipment.

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

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

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

### 916-3 Cut-Back Asphalts.

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

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

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

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

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

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

### 916-4 Emulsions.

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

### HIGH FLOAT EMULSIONS

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

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

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

Test	Conditions	Asphalt Emulsion Grade AE-200
		Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc	122°F [50°C]	minimum 45 seconds
Settlement	5 days (a)	maximum 5%
Storage Stability	24 hour (b)	maximum 1%
Sieve Test		maximum 0.10%
Demulsibility	50 mL CaCl <sub>2</sub> 0.10 N	minimum 75%
Residue by Distillation		minimum 62%
Oil Portion	500°F. Dist. [260°C. Dist.]	maximum 8% by volume
Tests on Residue:		
Penetration (0.1 mm)	77°F [25°C], 100 g, 5 seconds	minimum 150
Absolute Viscosity	140°F [60°C]	minimum 400 poise [40 Pa·s]
Ductility	77°F [25°C], 50 mm/minute	
Float Test	140°F [60°C]	minimum 1,200 seconds
Solubility	in Trichlorethylene	minimum 97.5%

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

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

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

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

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

ASPHALT EMULSION GRADE RS-1		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc	77°F [25°C]	20/100 seconds
Storage Stability	24 hour	maximum 1%
Demulsibility	35 mL 0.02N CaCl <sub>2</sub> (a)	minimum 60%
Sieve Test		maximum 0.10%
Residue by Distillation		minimum 55%
Naphtha Portion	500°F. Dist [260°C. Dist.](b)	maximum 3% by volume
Tests on Residue From Distillation Test:		
Penetration (0.1 mm)	77°F [25°C], 100 g, 5 seconds	minimum 60
Viscosity	140°F [60°C]	minimum 1,600 poise [160 Pa·s]
Ductility	77°F [25°C], 50 mm/minute	minimum 400 mm
Solubility	in Trichloroethylene	minimum 97.5%
(a) The demulsibility test shall be made within 30 days from the date of shipment.		
(b) When RS-1 has been modified to include naphtha, the 24-hour storage stability test will be waived.		

EMULSION PRIME (RS TYPE)		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc.	77°F [25°C]	minimum 75 seconds
Storage Stability	24 hour	maximum 1.0%
Sieve Test		maximum 0.1%
Naphtha Content		5/15% by volume
Residue		minimum 55%
Tests on Residue:*		
Penetration (0.1 mm)	77°F [25°C], 100 g, 5 seconds	minimum 50
Viscosity	140°F [60°C]	minimum 800 poise [80 Pa·s]
Solubility	in Trichloroethylene	minimum 97.5%

\* Residue by distillation shall be in accordance with AASHTO T 59 except that the maximum temperature shall be 329 ± 10°F [165 ± 5°C] and the sample shall be maintained at this temperature for 20 minutes.

EPR-1 PRIME		
Tests	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc.	77°F [25°C]	6/24 seconds
Sieve Test (a)		maximum 0.1%
Residue by Distillation (b)		minimum 15%
Particle Charge Test (c)		positive
Tests on Residue: (d)		
Flash Point	COC	minimum 410°F [210°C]
Viscosity	cSt-140°F [60°C]	350/600 [0.00035/0.00060 m <sup>2</sup> /s]
Aniline Point		85°/110°F [29°/43°C]

(a) Distilled water shall be used in place of 2% sodium oleate solution.  
(b) Residue by distillation shall be in accordance with AASHTO T 59 with the exception that a 50 g sample is heated to 300°F [149°C] until foaming ceases, then cooling immediately and calculating results.  
(c) Caution: this material has a positive particle charge, and therefore should not be mixed with materials having a negative particle charge.  
(d) Residue by distillation shall be in accordance with AASHTO T 59 except that the maximum temperature shall be 329 ± 10°F [165 ± 5°C] and the sample shall be maintained at this temperature for 20 minutes.

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

For all emulsion prime (EPR-1) delivered directly to the project for use, the supplier shall furnish a certification indicating compliance with all the specification requirements for EPR-1 Prime. When the EPR-1 is shipped to the Contractor in concentrated form, the supplier shall furnish a certification indicating compliance with all the specification requirements for EPR-1 Prime for each batch of material when blended with the appropriate amount of water. The Contractor shall blend the concentrate EPR-1 with the appropriate amount of water indicated by the supplier prior to use as a prime coat, and for each distributor load of material delivered to the project, shall furnish a certification indicating compliance with the supplier's requirements for blending along with a copy of the supplier's certification for the concentrate. In the event that the diluted EPR-1 Prime is not used in a 12-hour period, the material shall be thoroughly mixed by circulation or other suitable means prior to its use.

