



SECTION 409

SEAL COAT

409.1 Description. This work shall consist of the application of bituminous material followed by the application of cover coat material in accordance with these specifications and in conformity with the lines shown on the plans or established by the engineer.

409.2 Material. All material shall conform to Division 1000, Materials Details, and specifically as follows:

Item	Section
Aggregate for Seal Coats The grade of aggregate will be specified in the contract.	1003
Aggregate for Polymer Modified Asphalt Seal Coats Aggregate for polymer modified asphalt seal coats shall be crushed stone, Grade 3, 4, 5 or 7; or porphyry, Grade 3.	1003
Liquid Asphalt (RC-3000) or (MC-3000)	1015
Asphalt Binder (PG 46-28)	1015
Emulsified Asphalt (RS-2, CRS-2, RS-1 or CRS-1) Unless otherwise specified in the contract, the type of bituminous material and grade of liquid asphalt or asphalt binder may be selected by the contractor from any of those specified above. The grade of emulsified asphalt will be designated by the engineer after examination of the aggregate the contractor proposes to furnish.	1015
Polymer Modified Asphalt Emulsion Unless otherwise specified in the contract, the grade of polymer modified asphalt emulsion shall be either CRS-2P or EA-90P.	1015

409.2.1 In addition to these requirements, the aggregate and bituminous material shall show satisfactory adhesion when tested for stripping in accordance with MoDOT Test Method T12. Consideration will be given to use of bituminous material to which an anti-stripping agent has been added.

409.3 Equipment. The following equipment or its equivalent will be required:

(a) A distributor for heating and applying bituminous material. The distributor shall meet the requirements of Sec 405.3.2.

(b) A rotary power broom.

(c) A minimum of one oscillating-type pneumatic-tire roller. The pneumatic-tire roller shall be self-propelled, weighing from 5 to 8 tons (having a mass of 4.5 to 7.5 Mg). Pneumatic-tire rollers shall be operated at a speed not to exceed 5 miles per hour (8 km/h).

(d) A self-propelled aggregate spreader of approved design. The aggregate spreader shall be equipped with a means of applying the larger cover aggregate to the surface ahead of the smaller cover aggregate and with positive controls so that the required quantity of material

will be deposited uniformly over the full width of the bituminous material. Other types of aggregate spreaders may be used only with written approval of the engineer.

409.4 Construction Requirements.

409.4.1 Weather Limitations. Bituminous material shall not be applied when either the air temperature or the temperature of the surface to be sealed is below 70 F (21 C). Bituminous material shall not be applied on a wet surface or when weather conditions would prevent the proper construction of the seal coat. Temperatures are to be obtained in accordance with MoDOT Test Method T20.

409.4.2 Preparation of Surface. The surface to be treated shall be thoroughly cleaned and swept to remove all mud, matted earth, dust and other foreign material.

409.4.3 Application of Bituminous Material. Bituminous material shall be applied by means of a pressure distributor in a slow, uniform, continuous spread, without missing or overlapping, at a truck speed consistent with the placement of the cover aggregate. Unless otherwise provided, the bituminous material shall be applied to one half the width of the surface at a time, with the center lap of the application placed at the lane line of the traveled way and kept as narrow as is practicable. The other side of the roadbed shall be left open to traffic. The application on one lane shall not exceed that on the adjacent lane by more than 3 miles (5 km). The bituminous material shall be within the temperature range specified by the engineer in accordance with the limits provided in Sec 1015, except that asphalt binder shall be between 315 and 350 F (155 and 175 C). The actual quantity of bituminous material to be used per square yard (square meter) shall be as specified by the engineer. The rate of application is based on the specified minimum residual binder content as it applies directly to asphalt binder. The rate of application of liquid asphalt and emulsified asphalt shall be such that the residual binder content is equivalent to asphalt binder.

409.4.3.1 The angle of the spray nozzles and the height of the spray bar shall be set to provide a triple coverage fan pattern. The frame of the distributor shall be blocked or snubbed to the axle of the truck to maintain a constant height of the spray bar above the road surface during discharge of the load. An alternate method of maintaining constant spray bar height may be approved.

409.4.3.2 To ensure uniform application of the bituminous material at the beginning of each distributor load, a portion of the roadbed surface shall be covered with building paper. The area covered by the building paper shall be used as the starting point for each distributor load or each part of a load after a temporary delay. If the cut-off is not positive, the use of paper may be required at the end of each spread. The paper shall be removed and disposed of in a satisfactory manner. The distributor shall be moving forward at proper application speed when the spray bar is opened. Any skipped areas or deficiencies shall be corrected. Junctions of spreads shall be carefully made to ensure a smooth riding surface. The application of bituminous material on adjacent portland cement or asphaltic concrete pavements, curbs, bridges or any areas not specified to be sealed shall be avoided.

409.4.3.3 If the seal coat is to be constructed on a bituminous surface in which the binder material was other than asphalt binder, the placing of the seal coat will not be permitted until the underlying bituminous course has cured from 15 to 30 days, as directed by the engineer.

409.4.4 Application of Cover Aggregate. In general, the cover aggregate shall be placed within two minutes following the application of the bituminous material. Operations shall not proceed in such manner that bituminous material will be allowed to chill, set up, dry or otherwise impair retention of the cover aggregate. The cover aggregate shall be spread by means of a self-propelled mechanical spreader accurately measuring and uniformly spreading

the aggregate. The actual quantity of cover aggregate to be used per square yard (square meter) shall be as specified by the engineer. Spreading shall be accomplished in a continuous manner, without stopping between trucks, and in such manner that the tires of the trucks or aggregate spreader at no time contact the uncovered and newly applied bituminous material. All portions of the surface not covered by mechanical spreaders shall be hand spotted so that the entire surface will be uniformly covered. Light hand brooming may be necessary to distribute excessive aggregate.

409.4.4.1 If liquid asphalt or asphalt binder is used, cover aggregate shall be surface dry when applied to the bituminous material. Surface dry shall be that condition when no visible film of water exists on the aggregate. If emulsified asphalt is used, the moisture content of the aggregate shall not exceed 5 percent by weight (mass). If specified by the engineer, the cover aggregate shall be moistened with water to enhance cohesive properties of the emulsion.

409.4.4.2 Rolling shall begin immediately behind the spreader and shall consist of two complete coverages with the pneumatic-tire roller. All rolling shall be completed the same day the cover aggregate is applied.

409.4.4.3 After the embedded aggregate has set, the surface shall be lightly broomed or otherwise maintained as directed for a period not to exceed four days. Maintenance of the surface shall include the distribution of cover aggregate over the surface to absorb any free bituminous material, and the removal of excess aggregate. Generally, the maintenance shall be confined to the cooler hours of the day and shall be conducted so as not to displace embedded material. The surface shall be free of excess aggregate at the time of acceptance of the work.

409.5 Traffic Control. No traffic shall be permitted on the seal coat until all rolling has been completed. The contractor shall control traffic by means of pilot vehicles to a maximum speed of 20 miles per hour (30 km/h) for at least two hours after the completion of rolling. The contractor's supply trucks shall observe these traffic controls. Pilot vehicles shall also be used to maintain one-way traffic through areas of placing and rolling.

409.6 Method of Measurement. Measurement of bituminous material, to the nearest 10 gallons (50 L), will be made as specified in Sec 1015.

409.6.1 Measurement of cover aggregate will be made in accordance with the applicable requirements of Sec 310.4.

409.7 Basis of Payment. The accepted quantities of seal coat will be paid for at the unit price for each of the pay items included in the contract. No direct payment will be made for anti-stripping agent added to the bituminous material. If liquid asphalt or emulsified asphalt is used, the quantity for payment purposes will be reduced by dividing the actual gallons (liters) of bituminous material used by the following factors:

- (a) 1.25 for RC-3000 and MC-3000 Liquid Asphalts.
- (b) 1.82 for RS-1, 1.59 for RS-2, 1.67 for CRS-1 and 1.54 for CRS-2 Emulsified Asphalts.
- (c) 1.54 for CRS-2P and EA-90P Polymer Modified Asphalt Emulsion.

409.7.1 Any overrun or underrun from the contract quantity shall not be a basis for claim.



SECTION 1003

AGGREGATE FOR SEAL COATS

1003.1 Aggregate for seal coats shall consist of sound durable rock particles, free from objectionable coatings. When tested in accordance with AASHTO T 96, the percentage of wear shall not exceed 50. The percentage of deleterious substances shall not exceed the following values and the sum of percentages of all deleterious substances shall not exceed 8.0 percent.

Percent by Weight (Mass)	
Deleterious Rock	8.0
Shale	1.0
Other Foreign Material	0.5

1003.1.1 Crushed stone shall be obtained from rock of uniform quality. Rock from individual ledges and gravel tested for preliminary source approval shall meet the following criteria.

Absorption, AASHTO T 85, percent, max	6.0
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1003.2 The aggregate shall comply with the following requirements for the grade specified in the contract:

ENGLISH							
Grade	Kind of Material	Percent Passing by Weight					
		Sieve Sizes					
		1 in.	3/4 in.	1/2 in.	3/8 in.	No. 4	No. 10
1	Crushed Stone	100	90-100	....	30-65	....	0-5
2	Crushed Stone, Gravel or Chat	....	100	90-100	30-65	0-5	....
3	Crashed Stone, Gravel or Chat	....	....	100	80-100	0-5	....
4	Crushed Stone, Gravel or Chat	....	....	100	80-100	....	0-5
5	Crushed Stone, Gravel or Chat	....	....	100	80-95	....	0-10
6	Gravel or Chat	....	....	100	90-100	....	0-15
7	Crushed Stone, Gravel or Chat	....	....	100	95-100	....	0-5
8	Gravel or Chat	....	....	....	100	45-85	0-10

METRIC							
Grade	Kind of Material	Percent Passing by Mass					
		Sieve Sizes					
		25.0 mm	19.0 mm	12.5 mm	9.5 mm	4.75 mm	2.00 mm
1	Crushed Stone	100	90-100	....	30-65	....	0-5
2	Crushed Stone, Gravel or Chat	....	100	90-100	30-65	0-5	....
3	Crashed Stone, Gravel or Chat	....	....	100	80-100	0-5	....
4	Crushed Stone, Gravel or Chat	....	....	100	80-100	....	0-5
5	Crushed Stone, Gravel or Chat	....	....	100	80-95	....	0-10
6	Gravel or Chat	....	....	100	90-100	....	0-15
7	Crushed Stone, Gravel or Chat	....	....	100	95-100	....	0-5
8	Gravel or Chat	....	....	....	100	45-85	0-10



SECTION 1015

BITUMINOUS MATERIAL

1015.1 General.

1015.1.1 Approval of Source. The contractor shall obtain approval of the source of bituminous material from the engineer before any shipments to the work are made.

1015.1.2 Sampling, Testing and Acceptance Procedures. The supplier shall guarantee by certification that bituminous material complies with the specification requirements.

1015.1.2.1 The supplier shall furnish the truck driver a copy of the bill of lading, manifest or truck ticket that is to be available to the engineer at destination prior to unloading. The engineer at the source is also to be furnished a copy. The bill of lading, manifest or truck ticket shall show the following information regarding the shipment: type and grade of material, specific gravity at 60 F (15.6 C), net gallons (liters), consignee, truck number, identification number, weight (mass) of truck before and after loading, destination, date loaded, name and location of the source, and a certification statement. The certification statement shall be signed by an authorized representative of the supplier and shall be substantially as follows:

"This certifies that the bituminous material in this shipment complies with MoDOT specifications for the grade specified and the weights (masses) shown hereon were obtained on MoDOT approved scales and are correct within the specified scale requirements."

1015.1.2.2 The engineer will at random observe the sampling and testing of truck shipments and tanks, and will select representative samples of the material being supplied. These samples will be tested by the engineer in the field or in the Central Laboratory. When test results certified by the supplier are not representative of the material being shipped, the source approval will be withdrawn. A source may be reinstated when proof is furnished that the deficiency has been corrected and adequate controls are in effect to guarantee delivery of material meeting specifications.

1015.1.2.3 The supplier shall furnish the required sampling equipment and shall sample the truck under the direction of the engineer. The supplier shall be responsible for keeping all sampling equipment clean and in good condition. Sampling devices on truck transports will be approved provided an adequately insulated valve is used with a pipe or nipple inserted a suitable distance into the tank.

1015.1.2.4 Each truck transport shall carry a log showing the types of material and dates hauled, with respect to recent shipments or the supplier shall furnish the engineer such information with respect to the previous load.

1015.1.2.5 Intermediate storage tanks for storage and transfer of material between the refinery or terminal and the point of acceptance shall be equipped for sealing and shall be reserved exclusively for State work. Use of any material from unsealed tanks will be subject to delay until the material can be sampled, tested and approved.

1015.1.2.6 At sources from which liquid bituminous material is being accepted by certification, the applicable requirements of the foregoing sections shall be followed for shipments of material in transportation units other than trucks. The certification and all information regarding each shipment shall be furnished to the engineer at the source.

1015.1.2.7 For railroad shipments from refineries where inspection is not being maintained by the engineer, the supplier shall sample each car load at the source and submit the sample promptly to the Central Laboratory. A bill of lading or identification sheet shall accompany each sample and contain the following information: car number, type and grade of material, quantity represented including gross gallons (liters), temperature and net gallons (liters) at 60 F (15.6 C), destination of shipment, project number and consignee. A certification statement as specified in Sec 1015.1 shall accompany each sample. Approval of the source will be withdrawn when samples submitted are not representative of the material shipped in the car.

1015.1.3 Proportioning and Blending Bituminous Material Constituents. All material shall be properly proportioned and thoroughly blended in suitable tanks prior to delivery to transportation equipment or may be proportioned and blended by use of automatic proportioning equipment. All automatic proportioning blenders shall meet the approval of the engineer and shall be equipped with precision instruments, including electrically interlocked motors and automatic meters. Blending in tanks in quantities of less than 8000 gallons (30,000 L) or in tank trucks will not be permitted.

1015.2 Performance Graded Asphalt Binder. The grade shall be as specified in the contract.

1015.2.1 Performance graded asphalt binder shall be an asphalt-based binder produced from petroleum residue either with or without the addition of non-particulate organic modifiers.

1015.2.2 Performance graded asphalt binder shall be tested in accordance and comply with the requirements of AASHTO MPI for the grade specified. The physical hardening and direct tension tests are waived.

1015.2.3 Performance graded asphalt binder shall be furnished as a uniform mixture shipped directly to the project site from the asphalt binder supplier's permanent plant address or intermediate storage facility, suitable for direct use. Asphalt binder shall be capable of storage at the project site without separation or settling. Automatic blending will be allowed, however no intermediate blending of asphalt binder and any other modifiers will be allowed at the project site.

1015.2.4 Certification and Acceptance. Suppliers furnishing performance graded asphalt binders to MoDOT projects by certification shall comply with all requirements of AASHTO PP26, except as noted herein. To become pre-qualified to furnish material, a written request shall be sent to the Division Engineer, Materials, along with a copy of the supplier's QC plan. Split samples may be required. In order to maintain qualification, the supplier shall submit satisfactory results of all quality control testing monthly to MoDOT. Changes in formulation, base stock or methods of manufacture of qualified performance graded binders shall be noted and may require re-qualification.

1015.2.4.1 Quality Control Plan Requirements. The QC plan shall comply with AASHTO PP26 with the following exceptions and modifications:

(a) It may be written to cover multiple terminals or shipping facilities, in addition to the primary manufacturing facility, provided specific requirements for each location are clearly stated.

(b) It shall state the lot size used to designate the frequency of QC and specification compliance testing for each performance grade to be supplied. The lot size will depend upon the method of manufacture and may be designated on a tank basis, or on a time basis in the case of binders that are blended into trucks or tanks or that are continually blended into "live" tanks.

(c) For terminals or manufacturing facilities, the minimum reduced frequency of testing for QC or specification compliance shall be one series of tests every two weeks for "live" tanks or blenders and one series of tests every four weeks for "static" tanks that have had no material added between testing, per lot per grade of binder shipped.

(d) QC testing may be used to determine that binders being shipped from terminals or manufacturing facilities have not been contaminated, provided that such testing is shown to be of sufficient accuracy to detect contamination and to assure that material meets required specifications. Surrogate tests may be used for QC testing of non-modified performance graded binders.

(e) Terminals or shipping facilities that blend performance graded binders from different sources, that blend to produce a different performance grade, or that blend to modify the properties of an existing performance grade shall perform complete AASHTO MP1 specification compliance testing.

(f) The shipping facility shall document that each transport vessel was inspected prior to loading and was found to be acceptable for the material being shipped. The inspection shall be documented by a statement on the bill of lading or truck ticket or by maintaining a record of transport vessel inspections at the shipping facility, which shall be available for review by MoDOT.

1015.2.4.2 Quality Control Plan Monthly Report. A report of QC activity shall be forwarded monthly to MoDOT. This report shall contain, as a minimum, the name of the facility covered by the report, the dates covered by the report, results of individual specification compliance and QC tests identified by blender or tank number, and the mean, minimum and maximum test result for each specification compliance and QC test performed during the period covered by the report. Data shall be furnished in the report for each performance grade shipped during the period covered by the report. The report shall be forwarded to MoDOT no later than two weeks following the end of the period covered by the report. Each set of test results shall be labeled with the exact test description as given in AASHTO MP1.

1015.2.4.3 Approval of Laboratories. The supplier's primary testing laboratory shall be approved by MoDOT. The approval process will include split sample testing and may include an on-site visit by department personnel. The primary testing laboratory shall be regularly inspected by the AASHTO Materials Reference Laboratory (AMRL). Any satellite testing laboratory operated by a supplier shall be inspected at the same frequency by the supplier's primary AMRL inspected laboratory staff, and a copy of the inspection report shall be forwarded to MoDOT.

1015.2.4.4 Failure to Comply. Failure to fulfill any of these requirements may result in disqualification of the performance graded binder supplier. If a primary manufacturing facility is disqualified, all terminals shipping performance graded binder that is manufactured at the primary facility and who are not performing AASHTO MP1 specification compliance

testing will automatically be disqualified also. In cases of dispute, test results obtained by MoDOT will be considered referee and final.

1015.3 Liquid Bituminous Materials. Suppliers furnishing liquid bituminous materials shall comply with the following. All truck shipments shall be loaded from approved storage tanks, which have been sampled, tested and certified by the supplier to the engineer. If automatic blending equipment is used, blender material will be approved for use provided the finished product complies with specifications. At least one complete test shall be conducted every 2 weeks on each grade of material furnished for MoDOT work from the blender. A certified copy of the test results shall be furnished to the engineer. Sampling and testing for certification purposes shall be conducted prior to shipping material to MoDOT work. After loading, the supplier shall sample and make identifying tests on a sufficient number of truck shipments of material consigned to a construction project to ensure that proper quality control is being maintained and that all such shipments comply with the specification requirements. The identifying test is viscosity for liquid bituminous material.

1015.3.1 Type RC Liquid Asphalt. This material shall be produced by fluxing an asphaltic base with suitable petroleum distillates. The material shall show no separation or curdling prior to use and shall not foam when heated to the application temperature. The material shall conform to the requirements of Table I for the grade specified in the contract.

TABLE I - Type RC Liquid Asphalt								
Tests	RC-70		RC-250		RC-800		RC-3000	
	Min	Max	Min	Max	Min	Max	Min	Max
Water, percent	----	0.2	----	0.2	----	0.2	----	0.2
Flash point (Tag open cup), degrees C	----	----	27	----	27	----	27	----
Viscosity, 60 C, centistokes	70	140	250	500	800	1600	3000	6000
Distillation test:								
Distillate, percentage by volume of total distillate to 360 C:								
to 190 C	10	----	----	----	----	----	----	----
to 225 C	50	----	35	----	15	----	----	----
to 260 C	70	----	60	----	45	----	25	----
to 315 C	85	----	80	----	75	----	70	----
Residue from distillation to 360 C, volume percentage of sample by difference	55	----	65	----	75	----	80	----
Tests on residue from distillation:								
Penetration, 25 C								
100 g, 5 sec	80	120	80	120	80	120	80	120
Ductility, 25 C								
5 cm/min, cm	100	----	100	----	100	----	100	----
Solubility in trichloroethylene, percent	99.0	----	99.0	----	99.0	----	99.0	----

1015.3.2 Type MC Liquid Asphalt. This material shall be produced by fluxing an asphaltic base with suitable petroleum distillates. The material shall show no separation or curdling prior to use and shall not foam when heated to the application temperature. The material shall conform to the requirements of Table II for the grade specified in the contract.

TABLE II - Type MC Liquid Asphalt										
Tests	Grade									
	MC-30		MC-70		MC-250		MC-800		MC-3000	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Water, percent	----	0.2	----	0.2	----	0.2	----	0.2	----	0.2
Flash point (Tag open cup), degrees C	38	----	38	----	66	----	66	----	66	----
Viscosity, 60 C, centistokes	30	60	70	140	250	500	800	1600	3000	6000
Distillation test:										
Distillate, percentage by volume of total distillate to 360 C:										
to 225 C	----	25	----	20	----	10	----	----	----	----
to 260 C	40	70	20	60	15	55	----	35	----	15
to 315 C	75	93	65	90	60	87	45	80	15	75
Residue from distillation to 360 C, volume percentage of sample by difference	50	----	55	----	67	----	75	----	80	----
Tests on residue from distillation:										
Penetration, 25 C 100 g, 5 sec	120	250	120	250	120	250	120	250	120	250
Ductility, 5 cm/min, cm (1)	100	----	100	----	100	----	100	----	100	----
Solubility in trichloroethylene, percent	99.0	----	99.0	----	99.0	----	99.0	----	99.0	----

- (1) If the ductility at 25 C is less than 100 cm, the material will be acceptable if its ductility at 15.6 C is more than 100 cm.

1015.3.3 Emulsified Asphalt. This material shall meet the requirements of AASHTO M 140 or M 208, for the type and grade specified in the contract.

1015.3.3.1 Bituminous material for polymer modified asphalt emulsion shall comply with the requirements of Table III.

TABLE III - POLYMER MODIFIED ASPHALT EMULSION				
Tests	CRS-2P		EA-90P	
	Min	Max	Min	Max
Viscosity, SSF @ 50 C	100	400	100	400
Storage Stability Test (2), 24 hour, percent	----	1	----	1
Classification Test	Pass	----	----	----
Particle Charge Test	Positive	----	----	----
Sieve Test, 850 µm mesh, percent	----	0.3	----	0.3
Demulsibility, 0.02 N CzCl ₂ , percent	----	----	30	----
Distillation:				
Oil distillate by volume of emulsion, percent	----	3	----	3
Residue from distillation (3), percent	65	----	65	----
Tests on Residue from Distillation:				
Penetration, 25 C, 100 g, 5 sec	100	200	100	200
Ductility, 4 C, 5 cm/minute, cm	30	----	25	----
Ash (4), percent	----	1	----	1
Float Test at 60 C, sec	----	----	1200	----
Elastic Recovery (5), percent	58	----	58	----

- (1) All tests are performed in accordance with AASHTO T 59 except as noted.
- (2) In addition to AASHTO T 59, upon examination of the test cylinder and after standing undisturbed for 24 hours, the surface shall show no appreciable white, milky colored substance and shall be a homogeneous brown color throughout.
- (3) AASHTO T 59 modified to maintain a 204 ± 5 C maximum temperature for 15 minutes.
- (4) AASHTO T 111, Ash in Bituminous Material.
- (5) Condition the ductilometer and samples to be treated at 10 C. Prepare the brass plate, mold and briquet specimen in accordance with AASHTO T 51. Keep the specimen at the specified test temperature of 10 C for 85 - 95 minutes. Immediately after conditioning, place the specimen in the ductilometer and proceed to elongate the sample to 20 cm at a rate of pull of 5 cm/min. After the 20 cm elongation has been reached, stop the ductilometer and hold the sample in its elongated position for 5 minutes. After 5 minutes, clip the sample approximately in half by means of scissors or other suitable cutting devices. Let the sample remain in the ductilometer in an undisturbed condition for one hour. At the end of this time period, retract the half sample specimen until the two broken ends touch. At this point note the elongation (x) in cm. Calculate the percent recovery by the following formula:

$$\% \text{ Recovery} = \frac{20 - X}{20} \times 100$$

1015.4 Sampling and Test Methods for Asphalt.

Property	Method	RC	MC	PG
Sampling	AASHTO T 40	X	X	X
Water	AASHTO T 55	X	X	X
Flash Point (Tag Open Cup)	AASHTO T 79	X	X	
Flash Point (Cleveland Open Cup)	AASHTO T 48			X
Viscosity, Centistokes	AASHTO T 201	X	X	
Distillation	AASHTO T 78	X	X	
Penetration	AASHTO T 49	X	X	
Ductility	AASHTO T 51	X	X	
Solubility in Trichlorethylene	AASHTO T 44	X	X	X
Viscosity (Rotational)	ASTM D 4402			X
Dynamic Shear	AASHTO TP 5			X
Rolling Thin Film Oven Test	AASHTO T 240			X
Pressure Aging Test	AASHTO PP 1			X
Creep Stiffness	AASHTO TP 1			X
Direct Tension	AASHTO TP 3			X

1015.5 Application Temperatures for Bituminous Materials.

Bituminous Material	Temperature, Degrees Fahrenheit (Celsius)			
	Spraying		Mixing	
	Min	Max	Min	Max
Asphalt Binder PG 46-28	260 (125)	325 (165)	----	----
All Other Grades	285 (140)	350 (175)	275 (135)	350 (175)
Liquid Asphalt RC-MC Grade				
30	70 (20)	150 (65)	50 (10)	110 (45)
70	100 (40)	180 (80)	90 (30)	140 (60)
250	150 (65)	220 (105)	130 (55)	170 (75)
800	180 (80)	260 (125)	170 (75)	210 (100)
3000	210 (100)	290 (145)	200 (95)	240 (115)
Asphalt Emulsions				
RS-1	70 (20)	140 (60)	----	----
RS-2	125 (50)	185 (85)	----	----
SS-1	70 (20)	160 (70)	70 (20)	160 (70)
SS-1h	70 (20)	160 (70)	70 (20)	160 (70)
CRS-1	125 (50)	185 (85)	----	----
CRS-2	125 (50)	185 (85)	----	----
CSS-1	70 (20)	160 (70)	70 (20)	160 (70)
CSS-1h	70 (20)	160 (70)	70 (20)	160 (70)
EA-90P	130 (55)	180 (80)	----	----
CRS-2P	130 (55)	180 (80)	----	----

Application temperatures of other grades of emulsions will be as specified in the contract.

The spraying temperature for non-modified PG 46-28 asphalt binder is 260 - 325 F (125 - 165 C) and for all other higher temperature non-modified performance grades is 285 - 350 F (140 - 175 C). The mixing and compaction temperatures for performance graded asphalt binder shall be determined by rotational viscosity testing as defined in AASHTO TP4.

When material to be applied by pressure distributor is, due to refining or blending procedures, delivered at a temperature above the specified limits, the material may be applied at the higher

temperature provided satisfactory application can be obtained at the specified rate and provided sufficient precaution is exercised with respect to the fire hazard.

1015.6 Measurement of Bituminous Material. Field weight (mass) or field volumetric determinations of the material actually incorporated into the work will be used for measurement of the quantity of bituminous material for payment. The volume of material supplied from intermediate storage tanks will be determined from the net weight (mass) of the material. The net weight (mass) will be determined from the gross weight (mass) of the loaded transport vehicle used to deliver the material to the project less the empty transport vehicle weight (mass). The volume correction methods specified below will be used for determining the volume of bituminous material. Scales for determining the weight (mass) of bituminous material shall comply with the requirements of Sec 310.

1015.6.1 Liquid Bituminous Material and Asphalt Binder - Volumetric Determination. Measurement of the material will be based on the volume at 60 F (15.6 C). The volume correction factors of ASTM D 1250, Table 24b, will be used for converting the material from the volume at the observed temperature to the volume at 60 F (15.6 C). The volume of uncalibrated distributors and tank trucks will be determined from the net weight (mass) of the material. The net weight (mass) will be determined from the gross weight (mass) of the loaded delivery vehicle less the empty delivery vehicle weight (mass). For computing the volume in gallons (liters) from weight (mass), the following formula will be used:

ENGLISH

$$G = \frac{W}{SG \times 8.328}$$

where:

G = Volume in gallons at 60 F.
W = Weight of material in pounds.
SG = Specific Gravity of material at 60 F.

METRIC

$$L = \frac{M}{SG \times 997.914}$$

where:

L = Volume in liters at 15.6 C.
M = Mass of material in kilograms
SG = Specific Gravity of material at 15.6 C.

1015.6.2 Emulsified Asphalt. Measurement of the material will be based on the volume at 60 F (15.6 C) using a coefficient of expansion of 0.0003 per degree F (0.00054 per degree C) for converting the material from the volume at the observed temperature to the volume at 60 F (15.6 C).