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**Standard Specification for**

**Materials for Emulsified Asphalt**

**Scrub Seal**

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**AASHTO Designation: M xxx-18<sup>1</sup>**

**Technical Subcommittee: 5b, Bridge and Pavement  
Preservation**

**Release: Group 1 (April 2018)**



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# Materials for Emulsified Asphalt Scrub Seal

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## 1. SCOPE

- 1.1. A scrub seal is the application of emulsified asphalt with a scrub broom followed immediately by an application of a single layer of cover aggregate. The treatment can be applied as a wearing surface or as an interlayer.
- 1.2. This standard specifies quality requirements for aggregate and emulsified asphalt for scrub seals.
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## 2. REFERENCED STANDARDS

2.1. *AASHTO Standards:*

- M 140, Emulsified Asphalt
- M 208, Cationic Emulsified Asphalt
- M 316, Polymer-Modified Emulsified Asphalt
- R 66, Sampling Asphalt Materials
- R 78, Recovering Residue from Emulsified Asphalt Using Low-Temperature Evaporative Techniques
- T 11, Materials Finer Than 75- $\mu$ m (No. 200) Sieve in Mineral Aggregates by Washing
- T 27, Sieve Analysis of Fine and Coarse Aggregates
- T 49, Penetration of Bituminous Materials
- T 59, Emulsified Asphalts
- T 96, Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- T 111, Mineral Matter or Ash in Asphalt Materials
- T 179, Effect of Heat and Air on Asphalt Materials (Thin Film Oven Test)
- T 201, Kinematic Viscosity of Asphalts (Bitumens)
- T 202, Viscosity of Asphalts by Vacuum Capillary Viscometer
- T 240, Effect of Heat and Air on a Moving Film of Asphalt Binder (Rolling Thin-Film Oven Test)
- T 301, Elastic Recovery Test of Asphalt Materials by Means of a Ductilometer
- T 315, Standard Method of Test for Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer (DSR)
- T 335, Determining the Percentage of Fracture in Coarse Aggregate
- T382, Determining the Viscosity of Asphalt by a Rotational Paddle Viscometer

- T 350, Multiple Stress Creep Recovery (MSCR) Test of Asphalt Binder Using a Dynamic Shear Rheometer

2.2. *ASTM Standards:*

- D471, Standard Test Method for Rubber Property—Effect of Liquids
- D4124, Standard Test Method for Separation of Asphalt into Four Fractions
- D7403, Standard Test Method for Determination of Residue of Emulsified Asphalt by Low Temperature Vacuum Distillation
- D7944, Standard Practice for Recovery of Emulsified Asphalt Residue Using a Vacuum Oven
- D8078, Standard Test Method for Ash Content of Asphalt and Emulsified Asphalt Residues

2.3. *Federal Lands Highway (FLH) Standard:*

- FLH T 508, Flakiness Index Value

2.4. *Energy Institute Standard:*

- IP-469: Determination of Saturated, Aromatic, and Polar Compounds in Petroleum Products by Thin Layer Chromatography and Flame Ionization Detection.

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### 3. TERMINOLOGY

3.1. *Definition:*

- 3.1.1. *polymer modified rejuvenating emulsion (PMRE)*—Medium setting emulsified asphalt for scrub seal application that meets the requirements of Table 1 and includes components that meet the requirements of Tables 2 and 3.

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### 4. SIGNIFICANCE AND USE

- 4.1. This standard may be used to select and evaluate materials for the construction of emulsified asphalt scrub seals.

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### 5. POLYMER MODIFIED REJUVENATING EMULSION (PMRE) REQUIREMENTS

- 5.1. Sample, store, and test within the time frame specified in section 3.1 of M 316. Refer to Section 3.1 for definition of sample condition that is indicative of a compromised sample that must be discarded.
- 5.2. Emulsified asphalt (PMRE) for scrub seal shall meet the requirements of medium setting type cationic emulsified asphalt, rejuvenating agent, and modifier in Tables 1 through 3.
- 5.3. Table 1 includes alternate test methods and specification requirements for various tests. For certification and acceptance testing either one or both can be used.

**Table 1**—Requirements for Scrub Seal Emulsified Asphalt (PMRE)

Grade	Method	PMRE <sup>a</sup>	
		Min	Max
Tests on Emulsified Asphalt			
Viscosity, Saybolt Furol, 50°C (122°F) <sup>b</sup> , s	T59	50	600
Or Viscosity, Rotational Paddle Viscometer, 50°C (122°F), cPs	T382	110	1320
Storage stability test, 24 h, % <sup>b</sup>	T59		1.0
Demulsibility, 35 mL, 0.8% Sodium Dioctyl sulfosuccinate, %	T59	5	60
Sieve test, %:	T59		0.10
Particle charge	T59	Positive	
Distillation <sup>c</sup> :			
Oil distillate, by volume of emulsified asphalt, %	T59	—	1
Residue, %	T59	60	—
Tests on residue from distillation <sup>d</sup> :			
Penetration, 4°C (39°F), 200 g, 60 s, 0.1 mm	T49	40	—
Or G*, 4°C (39°F), 10 rad/s, MPa	T315	—	20
Elastic Recovery, 10°C (50°F), %	T301	40	—
Or T350 Percent Recovery at 0.1 kPa, 52°C (126°F), %	T350	20	—
Ash Content, %	D8078	—	1
Viscosity, 60°C (140°F), Pa·S	T202	—	500
Or T350 J <sub>ir</sub> at 3.2 kPa, 52°C (126°F), %	T350	1.0	—

<sup>a</sup> Samples of emulsified asphalt will be taken in accordance with R 66, M 140, M 208, and M 316. Samples must be stored at a temperature of not less than 4°C until tested.

<sup>b</sup> This test requirement and associated specification limits are waived if successful applications of the material are achieved in the field.

<sup>c</sup> Distill to 175°C (347°F).

<sup>d</sup> Residue preparation for testing may use the alternate methods, R 78, ASTM D7403, or ASTM D7944, so as not to negatively affect the properties of any polymer modifiers contained therein.

5.4. Distillation (T59) is required for determination of percent residue and oil distillate. Alternate recovery methods as defined in Table 1, Footnote d may be used to prepare the emulsified asphalt residue for testing in accordance with Table 1, if approved by the buyer.

**Note 1**—Properties of the residue recovered using alternate methods may differ from those obtained after distillation. The same method to prepare the residue must be used when comparing test results from the residue.

**Note 2**—R78 and D7944 produce residue in quantities best suited for DSR testing. Use of these recovery methods for penetration, viscosity, or elastic recovery (T301) is not recommended.

**Note 3**— For residues recovered using R78 or D7944 limit time between residue recovery and testing to 24 hours.

**Table 2**—Tests on Rejuvenating Agent

	Method	Min	Max
Tests on Rejuvenating Agent			
Viscosity, 60°C (140°F), CST	T 201	15	300
Flash Point, °C (°F)	T 48	182 (360)	
Saturates, %	ASTM D4124 <sup>a</sup>		30
Tests on TFO or RTFO Residue			
Mass Change, %	T 179 or T 240		6.5
Viscosity Ratio	T 179 or T 240		3

a IP-469 is an acceptable replacement for measurement of % saturates.

**Table 3**—Tests on Modifier

	Method	Min	Max
Tests on Modifier			
Mass Change, %	ASTM D471 (modified)		50%

5.5. *Modify ASTM D471 as follows:*

5.5.1. Place 0.8 g of modifier into an 18-mm diameter DSR mold.

5.5.2. If necessary, dry at ambient lab conditions for 72 hr.

5.5.3. Remove the modifier from the mold and place the sample into a forced draft oven on release paper for 48 hr at 40°C.

5.5.4. After 48 hr, cool and weigh the sample to the nearest 0.0001 g. Record the weight.

5.5.5. Pour 30 g of rejuvenating agent in a 90-mL metal container.

5.5.6. Place modifier sample in the container and add another 30 g of rejuvenating agent. Ensure the latex or polymer sample is completely covered; add more rejuvenating agent if necessary.

5.5.7. Cover the container with a metal lid and place it into a 40°C oven for 48 hr.

5.5.8. Remove the sample from the container. Use a paper towel to blot the surface of the sample to remove excess rejuvenator. Allow sample to cool to room temperature and weigh to the nearest 0.0001 g.

5.5.9. Calculate the mass change, expressed in Equation 1. Mass change will be positive.

$$\text{Mass Change (\%)} = \frac{M_2 - M_1}{M_1} \times 100 \quad (1)$$

where:

$M_1$  = Mass of modifier sample before being conditioned in the rejuvenating agent (g); and

$M_2$  = Mass of modifier sample after conditioning in the rejuvenating agent (g).

## 6. AGGREGATE REQUIREMENTS

6.1. Scrub seal cover aggregate shall be durable and free from deleterious materials. Gradation requirements are specified in Table 4. All percentages are by weight. The aggregate type will be determined by the owner agency. Aggregate retained on the 4.75-mm (No. 4) screen shall be crushed by mechanical means meeting the requirements shown in Table 5.

**Table 4**—Scrub Seal Aggregate Gradation Limits

Nominal Sieve Size	Passing, %		
	Type I	Type II	Type III
12.5 mm (1/2 in.)	100	100	100
9.5 mm (3/8 in.)	90–100	90–100	100
7.9 mm (5/16 in.)	—	—	90–100

4.75 mm (No. 4)	5–20	10–30	10–80
2.36 mm (No. 8)	0–5	0–10	5–30
1.18 mm (No. 16)	0–5	0–5	0–15
0.075 mm (No. 200)	0–3	0–3	0–3

**Table 5**—Fracture and Quality Requirements

Property	Scrub Seal Application	
	Interlayer	Surface Treatment
Fracture, 1 Face, % min T 335	70	85
Fracture, 2 Faces, % min T 335	60	80
Los Angeles Abrasion, max. % loss, T 96	37	35
Flakiness Index Value, max. % , FLH T 508 <sup>a</sup>	35	30

<sup>a</sup> Flakiness Index requirement does not apply to Type III gradation.

## 7. KEYWORDS

7.1. Polymer modified emulsion; rejuvenator; scrub seal.

<sup>1</sup> New standard endnote TBD. (Different for provisional vs. full standard.)