Designation: ~~D977 – 13ε1~~ D977 – 17

Standard Specification for Emulsified Asphalt[1]

This standard is issued under the fixed designation D977; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

~~ε[1] NOTE—Editorially corrected 5.1.1 in January 2014.~~

1. Scope

1.1 This specification covers ~~thirteen~~13 grades of emulsified asphalt for use in pavement construction in the manner designated.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

~~D5~~D5/D5M Test Method for Penetration of Bituminous Materials
D113 Test Method for Ductility of Bituminous Materials (Withdrawn 2016)[3]
D139 Test Method for Float Test for Bituminous Materials
~~D140~~D140/D140M Practice for Sampling ~~Bituminous~~Asphalt Materials
D244 Test Methods and Practices for Emulsified Asphalts
D2042 Test Method for Solubility of Asphalt Materials in Trichloroethylene
D3910 Practices for Design, Testing, and Construction of Slurry Seal
D6930 Test Method for Settlement and Storage Stability of Emulsified Asphalts
D6933 Test Method for Oversized Particles in Emulsified Asphalts (Sieve Test)
D6935 Test Method for Determining Cement Mixing of Emulsified Asphalt
D6936 Test Method for Determining Demulsibility of Emulsified Asphalt
D6997 Test Method for Distillation of Emulsified Asphalt
D7226 Test Method for Determining the Viscosity of Emulsified Asphalts Using a Rotational Paddle Viscometer
D7496 Test Method for Viscosity of Emulsified Asphalt by Saybolt Furol Viscometer
D7553 Test Method for Solubility of Asphalt Materials in N-Propyl Bromide

3. Requirements

3.1 The emulsified asphalt shall be tested within 14 days of delivery. The emulsified asphalt shall be homogeneous after thorough mixing provided separation has not been caused by freezing. Emulsified asphalts separated by freezing shall not be tested.

3.2 Emulsified asphalt shall conform to the requirements prescribed in Table 1 ~~or Table 2~~. ~~If no table is specified, default is~~Specify the test method to be used. ~~Table 1~~Specify either Test Method D7226 or D7496.

4. Sampling

4.1 Samples of emulsified asphalt shall be taken in accordance with Practice ~~D140~~D140/D140M.

[1] This specification is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.41 on Emulsified Asphalt Specifications.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

TABLE 1 Requirements for Emulsified Asphalt

NOTE 1—QS-1h ~~emulsified asphalt~~ emulsions shall meet the requirements outlined in ~~Practice~~Practices D3910.

NOTE 2—QS-1h is used for ~~Quick Set Slurry Seal~~ quick-set slurry seal systems.

~~Type~~	~~Rapid-Setting~~						~~Medium-Setting~~					
	~~RS-1~~		~~RS-2~~		~~HFRS-2~~		~~MS-1~~		~~MS-2~~		~~MS-2h~~	
~~Grade~~	~~min~~	~~max~~	~~min~~	~~max~~	~~min~~	~~max~~	~~min~~	~~max~~	~~min~~	~~max~~	~~min~~	~~max~~
Type	Rapid-Setting						Medium-Setting					
	RS-1		RS-2		HFRS-2		MS-1		MS-2		MS-2h	
Grade	min	max	min	max	min	max	min	max	min	max	min	max
~~*Tests on emulsions:*~~												
Tests on Emulsions:												
~~Viscosity, Saybolt Furol at 25°C SFS~~	~~20~~	~~100~~	~~...~~	~~...~~	~~...~~	~~...~~	~~20~~	~~100~~	~~100~~	~~...~~	~~100~~	~~...~~
Viscosity, Saybolt Furol at 25 °C SFS	20	100	. . .	. . .	. . .	. . .	20	100	100	. . .	100	. . .
~~Viscosity, Saybolt Furol at 50°C SFS~~	~~...~~	~~...~~	~~75~~	~~400~~	~~75~~	~~400~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~
Viscosity, Saybolt Furol at 50 °C SFS	. . .	. . .	75	400	75	400	. . .	. . .	. . .	. . .	. . .	. . .
~~Storage stability test, 24 h, %~~[A]	~~...~~	~~1~~	~~...~~	~~1~~	~~...~~	~~1~~	~~...~~	~~1~~	~~...~~	~~1~~	~~...~~	~~1~~
Viscosity, Rotational Paddle at 25 °C, mPa s	45	220	. . .	. . .	. . .	. . .	45	220	220	. . .	220	. . .
Viscosity, Rotational Paddle at 50 °C, mPa s	. . .	. . .	165	880	165	880	. . .	. . .	. . .	. . .	. . .	. . .
~~Demulsibility, 35 ml, 0.02 *N* $CaCl_2$, %~~	~~60~~	~~...~~	~~60~~	~~...~~	~~60~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~
Demulsibility, 35 ml, 0.02 *N* CaCl2, %	60	. . .	60	. . .	60	. . .	. . .	. . .	. . .	. . .	. . .	. . .
~~Coating ability and water resistance:~~												
Coating ability and water resistance:												
~~Coating, dry aggregate~~		~~...~~		~~...~~		~~...~~		~~good~~		~~good~~		~~good~~
Coating, dry aggregate		. . .		. . .		. . .		good		good		good
~~Coating, after spraying~~		~~...~~		~~...~~		~~...~~		~~fair~~		~~fair~~		~~fair~~
Coating, after spraying		. . .		. . .		. . .		fair		fair		fair
~~Coating, wet aggregate~~		~~...~~		~~...~~		~~...~~		~~fair~~		~~fair~~		~~fair~~
Coating, wet aggregate		. . .		. . .		. . .		fair		fair		fair
~~Coating, after spraying~~		~~...~~		~~...~~		~~...~~		~~fair~~		~~fair~~		~~fair~~
Coating, after spraying		. . .		. . .		. . .		fair		fair		fair
Cement mixing test, %	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
~~Cement mixing test, %~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~
~~Sieve test, %~~[A]	~~...~~	~~0.10~~	~~...~~	~~0.10~~	~~...~~	~~0.10~~	~~...~~	~~0.10~~	~~...~~	~~0.10~~	~~...~~	~~0.10~~
Sieve test, %	.	0.10	.	0.10	.	0.10	.	0.10	.	0.10	.	0.10
[A]	. . .		. . .		. . .		. . .		. . .		. . .	
~~Residue by distillation, %~~	~~55~~	~~...~~	~~63~~	~~...~~	~~63~~	~~...~~	~~55~~	~~...~~	~~65~~	~~...~~	~~65~~	~~...~~
Residue by distillation, %	55	. . .	63	. . .	63	. . .	55	. . .	65	. . .	65	. . .
~~Oil distillate by volume of emulsion, %~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~
Oil distillate by volume of emulsion, %	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
~~*Tests on residue from distillation test:*~~												
Tests on Residue from Distillation Test:												
~~Penetration, 25°C 100g, 5 s~~	~~100~~	~~200~~	~~100~~	~~200~~	~~100~~	~~200~~	~~100~~	~~200~~	~~100~~	~~200~~	~~40~~	~~90~~
Penetration, 25 °C, 100 g, 5 s	100	200	100	200	100	200	100	200	100	200	40	90
~~Ductility, 25°C 5 cm/min, cm~~	~~40~~	~~...~~	~~40~~	~~...~~	~~40~~	~~...~~	~~40~~	~~...~~	~~40~~	~~...~~	~~40~~	~~...~~
Ductility, 25 °C, 5 cm/min, cm	40	. . .	40	. . .	40	. . .	40	. . .	40	. . .	40	. . .
~~Solubility in trichloroethylene or n-propyl bromide,%~~	~~97.5~~	~~...~~	~~97.5~~	~~...~~	~~97.5~~	~~...~~	~~97.5~~	~~...~~	~~97.5~~	~~...~~	~~97.5~~	~~...~~
Solubility in trichloroethylene or n-propyl bromide, %	97.5	. . .	97.5	. . .	97.5	. . .	97.5	. . .	97.5	. . .	97.5	. . .
~~Float test, 60°C s~~	~~...~~	~~...~~	~~...~~	~~...~~	~~1200~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~
Float test, 60 °C s	. . .	. . .	. . .	. . .	1200	. . .	. . .	. . .	. . .	. . .	. . .	. . .

~~Type~~	~~Medium-Setting~~								~~Slow-Setting~~				~~Quick-Setting~~	
	Medium-Setting								Slow-Setting				Quick-Setting	
	~~HFMS-1~~		~~HFMS-2~~		~~HFMS-2h~~		~~HFMS-2s~~		~~SS-1~~		~~SS-1h~~		~~QS-1h~~	
Type	HFMS-1		HFMS-2		HFMS-2h		HFMS-2s		SS-1		SS-1h		QS-1h	
Grade	min	max	min	max	min	max	min	max	min	max	min	max	min	max
~~*Tests on emulsions:*~~														
Tests on Emulsions:														
~~Viscosity, Saybolt Furol at 25°C SFS~~	~~20~~	~~100~~	~~100~~	~~...~~	~~100~~	~~...~~	~~50~~	~~...~~	~~20~~	~~100~~	~~20~~	~~100~~	~~20~~	~~100~~