Designation: D4552/D4552M – 20

Standard Classification for Hot-Mix Recycling Agents[1]

This standard is issued under the fixed designation D4552/D4552M; 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.

1. Scope

1.1 This standard covers a standardized method whereby recycling agents to be used in hot recycling of asphalt concrete can be classified. The recycling agents are classified by viscosity in mm^2/s measured at 60 °C [140 °F]. This classification does not apply to emulsified recycling agents.

1.2 This standard does not address the performance of asphalt binder blends with recycling agents, or that of hot-mix asphalt mixture containing recycling agents. Adherence of a recycling agent to this specification does not necessarily relate to the performance of asphalt binders and mixtures containing the recycling agents.

NOTE 1—The impact of recycling agents has been evaluated by extracting the asphalt binder from the pavement to be recycled, and combining with the recycling agent to meet the appropriate grade within Specification D946/D946M or Table 1, 2, or 3 of Specification D3381/D3381M. More recently, some specifications have referred to performance grading as described in Specification D6373 or D8239.

NOTE 2—Efforts are underway to utilize performance-based testing of the asphalt mixture containing recycling agents as a measure of compliance.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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]

D70 Test Method for Density of Semi-Solid Asphalt Binder (Pycnometer Method)

D92 Test Method for Flash and Fire Points by Cleveland Open Cup Tester

D140/D140M Practice for Sampling Asphalt Materials

D946/D946M Specification for Penetration-Graded Asphalt Binder for Use in Pavement Construction

D1298 Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method

D2007 Test Method for Characteristic Groups in Rubber Extender and Processing Oils and Other Petroleum-Derived Oils by the Clay-Gel Absorption Chromatographic Method

D2170/D2170M Test Method for Kinematic Viscosity of Asphalts

D2872 Test Method for Effect of Heat and Air on a Moving Film of Asphalt (Rolling Thin-Film Oven Test)

D3381/D3381M Specification for Viscosity-Graded Asphalt Binder for Use in Pavement Construction

D3666 Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials

D6373 Specification for Performance Graded Asphalt Binder

D8239 Specification for Performance-Graded Asphalt Binder Using the Multiple Stress Creep and Recovery (MSCR) Test

3. Significance and Use

3.1 Recycling of deteriorated asphalt pavements is being used with increasing frequency for its economy and benefit of conserving raw materials. The objective of recycling is to reuse the two ingredients of asphalt concrete-aggregate and asphalt binder and to restore the desired properties to the mixture. Recycling is carried out hot or cold, depending on the condition of the deteriorated pavement, construction

[1] This classification is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.40 on 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.

procedure, availability of equipment, and cost. This classification is for classifying recycling agents to be used in recycled asphalt mixtures.

NOTE 3—The quality of the results produced by this standard are dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of Specification D3666 are generally considered capable of competent and objective testing, sampling, inspection, etc. Users of this standard are cautioned that compliance with Specification D3666 alone does not completely ensure reliable results. Reliable results depend on many factors; following the suggestions of Specification D3666 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.

4. Basis of Classification

4.1 This classification describes recycling agents (RA) as belonging to one of the following seven groups: RA 0, RA 1, RA 5, RA 25, RA 75, RA 250, or RA 500, as shown in Table 1. The viscosity ranges are designed to avoid overlap and to provide sufficient flexibility to satisfy a wide range of products. Other properties specified include flash point (handling), weight percent of saturates (compatibility), selected properties of the RTFO residue (durability), and specific gravity.

5. Physical Properties

5.1 All classified recycling agents must be homogeneous, free-flowing at pumping temperature, and must conform to the requirements shown in Table 1.

5.2 The final acceptance of recycling agents meeting the requirements shown in Table 1 is subject to the compliance of the reconstituted asphalt blends with current asphalt specifications.

6. Sampling

6.1 All sampling shall be carried out in accordance with Practice D140/D140M.

7. Keywords

7.1 asphalt; hot-mix asphalt; recycling agents

TABLE 1 Physical Properties of Hot-Mix Recycling Agents

Test	ASTM Test Method	RA 0 Min	RA 0 Max	RA 1 Min	RA 1 Max	RA 5 Min	RA 5 Max	RA 25 Min	RA 25 Max	RA 75 Min	RA 75 Max	RA 250 Min	RA 250 Max	RA 500 Min	RA 500 Max
Viscosity · 60 °C [140 °F], mm^2/s	D2170/D2170M	10	49	50	175	176	900	901	4500	4501	12 500	12 501	37 500	37 501	60 000
Flash Point, COC, °C [°F]	D92	219 [425]	. . .	219 [425]	. . .	219 [425]	. . .	219 [425]	. . .	219 [425]	. . .	219 [425]	. . .	219 [425]	. . .
Saturates, wt, %[A]	D2007	. . .	30	. . .	30	. . .	30	. . .	30	. . .	30	. . .	30	. . .	30
Tests on Residue from RTFO 163 °C [325 °F]	D2872														
Viscosity Ratio[B]	D2872	. . .	3	. . .	3	. . .	3	. . .	3	. . .	3	. . .	3	. . .	3
Wt Change, ±, %	D2872	. . .	4	. . .	4	. . .	4	. . .	4	. . .	4	. . .	4	. . .	4
Specific Gravity at 25 °C [77 °F]	D70 or D1298	0.900	1.100	0.900	1.100	0.900	1.100	0.900	1.100	0.900	1.100	0.900	1.100	0.900	1.100

[A] The suitability of Test Method D2007 for measurement of saturates content and determination of compatibility of non-petroleum-based recycling agents has not been established. Additional testing may be required for assessment of the compatibility of non-petroleum-based recycling agents.

[B] $$\text{Viscosity Ratio} = \frac{\text{Viscosity of residue from RTFO test at } 60\ °\text{C } [140\ °\text{F}]}{\text{Original viscosity at } 60\ °\text{C } [140\ °\text{F}]}$$