



Standard Practice for Classifying Hot-Mix Recycling Agents¹

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1. Scope

1.1 This practice covers a standardized method whereby petroleum product additives to be used in hot recycling of asphalt concrete can be identified. The products are classified by viscosity in centistokes measured at 140°F (60°C). This practice does not apply to emulsified materials.

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

2. Referenced Documents

2.1 ASTM Standards:

- D 70 Test Method for Specific Gravity and Density of Semi-Solid Bituminous Materials²
- D 92 Test Method for Flash and Fire Points by Cleveland Open Cup³
- D 140 Practice for Sampling Bituminous Materials²
- D 946 Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction²
- D 1298 Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method³
- D 1754 Test Method for Effect of Heat and Air on Asphaltic Materials (Thin-Film Oven Test)²
- D 2007 Test Method for Characteristic Groups in Rubber Extender and Processing Oils by the Clay Gel Adsorption Chromatographic Method⁴
- D 2170 Test Method for Kinematic Viscosity of Asphalts (Bitumens)²
- D 2171 Test Method for Viscosity of Asphalts by Vacuum Capillary Viscometer²
- D 2872 Test Method for Effect of Heat and Air on a Moving Film of Asphalt (Rolling Thin-Film Oven Test)²
- D 3381 Specification for Viscosity-Graded Asphalt Cement

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² *Annual Book of ASTM Standards*, Vol 04.03.

³ *Annual Book of ASTM Standards*, Vol 05.01.

for Use in Pavement Construction²

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 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 procedure, availability of equipment, and cost. This practice is for classifying recycling agents to be used in hot recycling.

4. Classification

4.1 This practice describes recycling agents (RA) as belonging to one of the following six groups: 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 mix proportions. Other properties specified include flash point (handling), weight percent of saturates (compatibility), selected properties of the RTF or TF oven residue (durability), and specific gravity.

4.2 The choice of RA grade will depend on the amount and hardness of the asphalt in the aged pavement. In general, the lower viscosity RA types can be used to restore aged asphalts of high viscosity and vice versa. Additionally, grades RA 1, RA 5, RA 25, and RA 75 will generally be most appropriate for hot-mix recycling of salvaged asphalt concrete when no more than 30 % virgin aggregate is added, while grades RA 250 and RA 500 will generally be most appropriate when more than 30 % virgin aggregate is incorporated into the mix.

5. Physical Properties

5.1 All 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 D 140.

TABLE 1 Physical Properties of Hot-Mix Recycling Agents

NOTE 1—Compliance requires the asphalt be extracted from the pavement to be recycled and combined with the recycling agent being tested. This combination should be in accordance with ratio of recycling agent to recovered asphalt used in the mix. The resulting mixture must meet all specifications for the appropriate grade within Specification D 946 or Table 1, 2 or 3 of Specification D 3381.

| Test | ASTM Test Method | RA 1 | | RA 5 | | RA 25 | | RA 75 | | RA 250 | | RA 500 | |
|--|------------------------|--------|-----|--------|-----|--------|------|--------|-------|--------|-------|--------|-------|
| | | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max |
| Viscosity • 140°F, cSt | D 2170 or D 2171 | 50 | 175 | 176 | 900 | 901 | 4500 | 4501 | 12500 | 12501 | 37500 | 37501 | 60000 |
| Flash Point, COC, F | D 92 | 425 | ... | 425 | ... | 425 | ... | 425 | ... | 425 | ... | 425 | ... |
| Saturates, wt, % | D 2007 | ... | 30 | ... | 30 | ... | 30 | ... | 30 | ... | 30 | ... | 30 |
| Tests on Residue from RTFO or TFO oven 325°F | D 2872 or D 1754 | | | | | | | | | | | | |
| Viscosity Ratio ^A | " | ... | 3 | ... | 3 | ... | 3 | ... | 3 | ... | 3 | ... | 3 |
| Wt Change, ±, % | " | ... | 4 | ... | 4 | ... | 3 | ... | 3 | ... | 3 | ... | 3 |
| Specific Gravity | D 70 or D 1298 | Report | | Report | | Report | | Report | | Report | | Report | |

$$^A \text{Viscosity Ratio} = \frac{\text{Viscosity of Residue from RTFO or TFO Oven Test} \cdot 140^\circ\text{F, cSt}}{\text{Original Viscosity} \cdot 140^\circ\text{F, cSt}}$$

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