
Standard Method of Test for Evaluation of Asphalt Release Agents (ARAs)

AASHTO Designation: T 383-23¹

Technically Revised: 2023

Technical Subcommittee: 2b, Liquid Asphalt



**American Association of State Highway and Transportation Officials
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1. SCOPE

- 1.1. This method covers the laboratory evaluation of asphalt release agents (ARAs). These ARAs are used for coating metal surfaces on truck beds, pavers, rollers, slat elevators, and hand tools to prevent asphalt binder or asphalt mixtures from adhering to these surfaces. The ARAs should perform this function without causing degradation (stripping) of the asphalt mixture.
- 1.2. The values stated in SI units are to be regarded as standard. Inch-pound units are provided for reference only.
- 1.3. *This standard may involve hazardous materials, operations, and equipment. It does not purport to address all safety concerns 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.*
- 1.4. *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 R 18 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with R 18 alone does not completely assure reliable results. Reliable results depend on many factors; following the suggestions of R 18 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.*
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2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
- M 231, Weighing Devices Used in the Testing of Materials
 - M 320, Performance-Graded Asphalt Binder
 - M 323, Superpave Volumetric Mix Design
 - M 332, Performance-Graded Asphalt Binder Using Multiple Stress Creep Recovery (MSCR) Test
 - M 339M/M 339, Thermometers Used in the Testing of Construction Materials
 - R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
 - T 85, Specific Gravity and Absorption of Coarse Aggregate
 - T 312, Preparing and Determining the Density of Asphalt Mixture Specimens by Means of the Superpave Gyratory Compactor
- 2.2. *ASTM Standards:*

- D93, Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester
- D1193, Standard Specification for Reagent Water
- D1475, Standard Test Method for Density of Liquid Coatings, Inks, and Related Products
- D2369, Standard Test Method for Volatile Content of Coatings
- E1, Standard Specification for ASTM Liquid in Glass Thermometers
- E70, Standard Test Method for pH of Aqueous Solutions with the Glass Electrode
- E230/E230M, Standard Specification for Temperature Electromotive Force (emf) Tables for Standardized Thermocouples
- E879, Standard Specification for Thermistor Sensors for General Purpose and Laboratory Temperature Measurements
- E1137/E1137M, Standard Specification for Industrial Platinum Resistance Thermometers
- E1252, Standard Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis
- E2877, Standard Guide for Digital Contact Thermometers

2.3. *International Electrotechnical Commission Standards:*

- IEC 60584 1: 2013 Thermocouples – Part 1: EMF Specifications and Tolerances
- IEC 60751: 2008 Industrial Platinum Resistance Thermometers and Platinum Temperature Sensors

3. SUMMARY OF TEST METHOD

3.1. *The test method uses two key measures:*

3.1.1. In the Asphalt Stripping Test, a sample of asphalt mixture is soaked in the ARA for seven days alongside a control sample of ARA with no asphalt mixture. Three samples are evaluated at the end of the soak period to determine the degree of stripping that occurred. A visual interpretation to determine discoloration of the liquid is used for comparison purposes. Gravimetric weights are used to determine mass gain or loss.

3.1.2. In the Asphalt Pull-Off Test, hot asphalt binder is poured onto a metal plate that has been treated with the ARA, allowed to cool, and then pulled away. The amount of retained binder is recorded for each application cycle. This process is repeated, without reapplication of the ARA, until a minimum of 10 percent of the asphalt binder has adhered to the metal plate, or the binder releases 7 times. The degree of adhesion to the metal plate is determined by gain in weight.

3.2. The flash point, infrared spectrum (ATR–FTIR), percent solids, specific gravity, and pH and temperature at the time of the test of the ARA are measured and recorded.

4. SIGNIFICANCE AND USE

4.1. The Asphalt Stripping Test measures the tendency for the ARA to alter the asphalt binder or remove asphalt binder from the asphalt mixture. The ARA is evaluated in both its concentrated, non-diluted strength form and at the dilution ratio recommended for use by the manufacturer.

4.2. The Asphalt Pull-Off Test measures the tendency for asphalt binder to adhere to metal on truck beds, pavers, rollers, slat elevators, or tools when the ARA is used.

4.3. The asphalt mixture used for testing is made under Superpave mix design standards to provide an asphalt mixture with repeatable behavior that will not tend to exhibit stripping when exposed to water.

- 4.4. The flash point and the pH will be used to determine product safety. The infrared spectrum (ATR–FTIR), percent solids, specific gravity, pH, and temperature at the time of the test are intended to be used as reference parameters to verify product formulations of future samples.
- 4.5. This method is intended to determine the properties of these materials. Acceptability of a material, based upon the data generated as a result of the testing and evaluation in this practice, is the responsibility of the user.
- 4.6. Standard laboratory conditions are defined as a temperature of $25 \pm 4^{\circ}\text{C}$ ($77 \pm 7^{\circ}\text{F}$). A thermometer for measuring room temperature shall meet the requirements of M 339M/M 339 with a temperature range of at least 15 to 35°C (59 to 95°F), and an accuracy of $\pm 1.0^{\circ}\text{C}$ ($\pm 1.8^{\circ}\text{F}$) (see Note 1).
- Note 1**—Thermometer types suitable for use include ASTM E1 mercury thermometers; ASTM E2877 digital metal stem thermometer; ASTM E230/E230M thermocouple thermometer, Type T, Standard Class; or IEC 60584 thermocouple thermometer, Type T, Class 1 or Class 2.

5. ASPHALT STRIPPING TEST

- 5.1. *Apparatus:*
- 5.1.1. *Graduated Glass Cylinder*—used to measure asphalt release agent;
- 5.1.2. *Containers*—eight (8) 600 mL graduated, glass beakers and a suitable sized piece of parafilm for sealing;
- 5.1.3. *Oven*—capable of maintaining a minimum temperature of $60 \pm 1^{\circ}\text{C}$ ($140 \pm 2^{\circ}\text{F}$) and $143 \pm 1^{\circ}\text{C}$ ($290 \pm 2^{\circ}\text{F}$). Oven(s) shall be capable of operation at the temperatures required, as corrected, if necessary, by standardization. More than one oven may be used, provided each is used within its proper operating temperature range. The thermometer for measuring the temperature of the oven shall meet the requirements of M 339M/M 339 with a temperature range of at least 55 to 150°C (131 to 302°F), and an accuracy of $\pm 0.25^{\circ}\text{C}$ ($\pm 0.45^{\circ}\text{F}$) (see Note 2).
- Note 2**—Thermometer types suitable for use include ASTM E1 mercury thermometers; ASTM E879 thermistor thermometer; ASTM E1137/E1137M Pt-100 RTD platinum resistance thermometer, special order; or IEC 60751: 2008 Pt-100 RTD platinum resistance thermometer, special order.
- 5.1.4. *Sieve*—No. 200 (0.075 mm) or similar, 12-in. diameter.
- 5.1.5. *Balance*—5,000-g capacity readable to 0.01 g and accurate to ± 0.02 g meeting the requirements of a Class G1 as defined in M 231, Table 2.
- 5.2. *Materials:*
- 5.2.1. Either a plant- or a laboratory-mixed sample of asphalt mixture meeting the following requirements:
- 5.2.1.1. Meets M 323 requirements for 12.5-mm (0.5-in.) nominal maximum aggregate size.
- 5.2.1.2. Contains an asphalt binder meeting the requirements of PG 58-28 as defined in M 320, Table 1 or PG 58S-28 as defined in M 332.
- 5.2.1.3. The percent absorption of the coarse aggregates in the asphalt mixture is less than 0.5 percent when tested according to T 85.

- 5.2.1.4. Prepared according to the procedure outlined in T 312, Section 8.
- 5.2.2. Reagent water, Type II according to ASTM D1193.
- 5.2.3. Asphalt release agent (ARA).
- 5.3. *Procedure:*
- 5.3.1. Obtain 2000 ± 20 g of a representative sample of asphalt mixture as specified in Section 5.2.1.
- 5.3.2. Heat the mixture in an oven set at 143°C (290°F) for 15 to 30 min to elevate the asphalt mixture temperature enough to allow the samples to be split as specified herein. While the samples are still warm, separate the particles by hand to reduce agglomerations such that the fine aggregate particles are not larger than 6.3 mm (0.25 in.), taking care to avoid fracturing the aggregate.
- 5.3.3. Split 1800 ± 20 g of asphalt mixture into six equal amounts of 300 ± 5 g each. Place each 300 g sample into six of the eight 600 mL graduated, glass beakers. Weigh each 300-g sample to the nearest 0.01 g, record each mass as W_i .
- 5.3.4. Pour the non-diluted ARA into one of the 600 mL graduated glass beakers containing the asphalt mixture until the asphalt mixture and non-diluted ARA volume reaches the 400 mL graduate line on the beaker. Ensure the sample is completely covered by the ARA. Repeat this step with two additional 600 mL graduated glass beakers holding the asphalt mixture.
- 5.3.5. Pour additional non-diluted ARA into one of the two remaining empty 600 mL graduated glass beakers to the 400 mL level as those in Section 5.3.4 and use this material as the control sample.
- 5.3.6. When applicable, for testing of diluted ARA, prepare a minimum of 2000 mL of ARA diluted with reagent water to the concentration (dilution ratio) recommended by the manufacturer.
- 5.3.7. Pour the diluted ARA into one of the remaining three 600 mL graduated glass beakers holding the asphalt mixture described in Section 5.3.2, until the asphalt mixture and diluted ARA volume reaches the 400 mL graduate line on the beaker. Ensure the sample is completely covered by the ARA. Repeat this step with two additional 600 mL graduated glass beakers holding the asphalt mixture.
- 5.3.8. Pour additional diluted ARA into the last empty 600 mL graduated glass beaker to the same 400 mL level as those in Section 5.3.7 and use this material as the control sample.
- 5.3.9. Cover the eight 600 mL graduated glass beakers with parafilm and leave them undisturbed at standard laboratory conditions for 168 ± 2 h.
- 5.3.10. At the end of the specified time while retaining the asphalt mixture and liquid in the 600 mL graduated glass beakers, compare the color of each replicate of asphalt mixture and ARA samples against the control samples, per Section 5.3.14.
- 5.3.11. Decant the ARA liquid from one replicate of the non-diluted strength sample on a No. 200 sieve. While rotating the beaker, lightly rinse with room temperature tap water, the mixture and agent until “clean.” “Clean” is indicated when the color of the ARA has turned clear or ceases to foam during the rinsing (see Figure 1). Recover any asphalt mixture that may have dislodged from the 600 mL beaker, retained on the No. 200 sieve, and place it back into the beaker that has been rinsed. Repeat with the other two non-diluted strength and all three diluted strength replicate samples.