



Designation: D8189 – 19 (Reapproved 2024)

Standard Test Method for Tackiness of Asphalt Binders and Emulsified Asphalt Residue Using the Dynamic Shear Rheometer (DSR)¹

This standard is issued under the fixed designation D8189; 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 test method covers the determination of pull-off force and pull-off work of asphalt binders and emulsified asphalt residue by means of pull-off testing. The tackiness test is conducted using the dynamic shear rheometer (DSR) at one or more temperatures.

NOTE 1—This standard may be used for unconditioned material or material conditioned in accordance with Test Method D2872. The majority of development work on this test method was performed on unconditioned material. The emulsified asphalt residue should never be conditioned.

1.2 A precision and bias statement for this standard has not been developed at this time. Therefore, this standard should not be used for acceptance or rejection of a material for purchasing purposes.

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

1.4 The text of this standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.5 *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.*

1.6 *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.*

¹ This test method is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.47 on Miscellaneous Asphalt Tests.

Current edition approved Nov. 1, 2024. Published November 2024. Originally approved in 2019. Last previous edition approved in 2019 as D8189 – 19. DOI: 10.1520/D8189-19R24.

2. Referenced Documents

2.1 ASTM Standards:²

D8 Terminology Relating to Materials for Roads and Pavements

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

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

D7175 Test Method for Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer

3. Terminology

3.1 For definitions of general terms used in this standard, refer to Terminology D8.

3.2 Definitions:

3.2.1 *pull-off force, n*—the maximum normal force, in newtons, required to separate the upper plate of the DSR instrument from the asphalt sample surface.

3.2.2 *pull-off work, n*—the area under the force-versus-gap separation curve, measured in joules.

3.2.3 *tackiness, n*—the measure of how sticky the asphalt binder or emulsified asphalt residue is at a set temperature is shown in this test method by the combination of the pull-off force and pull-off work.

4. Summary of Test Method

4.1 This test method is used to determine the tackiness of asphalt binders and emulsified asphalt residue materials at a given temperature, by means of pull-off testing. The sample is tested in strain-control mode under tension. Testing a sample at different temperatures (normal testing ranges can be 10 to 70 °C, correlating to pavement surface temperatures during application) will allow for the determination of various degrees of tackiness due to field conditions. The sample preparation and apparatus are in accordance with Test Method D7175,

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

using the 25 mm parallel plate geometry for the bottom plate and the 8 mm parallel plate geometry for the top plate. The initial gap is dependent on the sample thickness. Once thermal equilibrium is achieved, the top geometry is lowered to make contact with the sample. After contact is made, a constant normal force (10.0 ± 0.5 N) is maintained in order to load the sample in compression for a fixed period of time (10 s). After the compression step is finished, the pull-off step is executed. During the pull-off step, the normal force required to raise the upper plate of the geometry at constant vertical speed ($15 \mu\text{m/s}$) is recorded.

5. Significance and Use

5.1 The tackiness test is designed for quantifying how sticky or non-sticky a material is at a certain temperature. The test should be run at various temperatures expected in the field for tack coat materials. If the results show the residue is tacky at pavement temperatures, the material may not be suitable for applications like less-tracking tack coats and bond coats.

5.2 Determining the temperature that the residue becomes tacky by increasing the temperature in successive testing can give formulators an indicator of performance.

NOTE 2—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.

6. Apparatus

6.1 *Dynamic Shear Rheometer (DSR)*—A dynamic shear rheometer as described in the Apparatus section of Test Method D7175, and associated materials as described in the Materials section of Test Method D7175. The bottom rheometer plate will be 25 mm and the top plate will be 8 mm in this test method.

7. Procedure

7.1 The sample should be loaded onto the bottom plate (25 mm) in a way to fully cover the plate. For good repeatability, the sample thickness should be 1.00 ± 0.10 mm. If using an emulsion residue film, the top of the film should be the surface to be tested.

NOTE 3—The sample preparation will vary depending on the material being evaluated. For hot-applied materials, a 1 mm draw-down could be done on the 25 mm plate or on a silicone mat. If done on a silicone mat, it could be allowed to cool and peeled off and loaded on the 25 mm plate. For emulsion samples, the material could be drawn down at a residue content to leave a 1 mm thick specimen on a silicone mat. After moisture evaporation, the film can be peeled off the mat and loaded on to the 25 mm plate. Another option for emulsion specimens is to have a 25 mm silicone button depression made and filled with emulsion to leave a 1 mm film after curing. The sample can then be peeled and loaded on to the 25 mm plate.

7.2 Lower the upper plate (8 mm) of the test geometry within 5 mm of the test specimen. Allow the specimen to reach

thermal equilibrium at the desired test temperature in accordance with the Test Procedure section of Test Method D7175. Once the thermal equilibrium is achieved, lower the upper plate with constant speed ($10 \mu\text{m/s}$) onto the specimen until the desired normal force (10.0 ± 0.5 N) is reached. This is when the compression step starts. Hold the desired normal force constant for the duration of the compression step (10 s).

NOTE 4—The film thickness can be verified by noting the gap when the normal force is first greater than 0.1 N as contact is being made with the sample.

7.3 Once the compression step ends, begin the pull-off step immediately by moving the upper plate away from the sample with constant speed ($15 \mu\text{m/s}$). During the pull-off step, record the normal force required to maintain the constant upward motion of the upper plate. The pull-off step is finished when the normal force required to maintain the upward motion of the plate is zero or constant over a period of 10 s. The pull-off step can also be stopped after a certain height has been reached (9.00 mm).

8. Calculation

8.1 The DSR instrument should be programmed to give the pull-off force (N) in newtons, as well as to calculate the pull-off work (W) in joules defined in 3.2.2 for a given test temperature.

9. Report

9.1 The DSR instrument should be programmed to report the following information:

- 9.1.1 Sample identification.
- 9.1.2 Method of gathering 1 mm film for testing.
- 9.1.3 Film thickness (calculated or DSR measured), mm.
- 9.1.4 Test temperature, °C.
- 9.1.5 Pull-off force (N), newtons.
- 9.1.6 Pull-off work (W), joules.

9.1.7 The graph of the pull-off work (W), which is the area under the curve of the pull-off force versus gap distance, should be reported and calculated. The calculation of the area under the curve shall use an integration technique with a minimum of 100 calculations/second. An example of a graphical representation of this method, along with varying degrees of tackiness, is shown in Fig. 1.

NOTE 5—The graphical representation in Fig. 1 shows three different samples that were tested. These samples are meant to represent an example of three different materials tested at the same temperature, or the same material tested at three different temperatures, showing the differences in tackiness that may occur.

10. Precision and Bias

10.1 Since a precision estimate for this standard has not been developed, this test method is to be used for research and informational purposes only. Therefore, this standard should not be used for acceptance or rejection of a material for purchasing purposes.

11. Keywords

- 11.1 pull-off force; pull-off work; tackiness