Designation: D7226 – 13

Standard Test Method for Determining the Viscosity of Emulsified Asphalts Using a Rotational Paddle Viscometer[1]

This standard is issued under the fixed designation D7226; 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 utilizes the rotational paddle viscometer to measure the viscosity of emulsified asphalt. It is applicable to all the emulsified asphalts described in Specifications D977 and D2397.

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 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D140 Practice for Sampling Bituminous Materials
D977 Specification for Emulsified Asphalt
D2397 Specification for Cationic Emulsified Asphalt
E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

3. Terminology

3.1 *Definitions:*

3.1.1 *viscosity, n*—ratio of shear stress to shear rate.

3.1.1.1 *Discussion*—The SI unit of viscosity is the Pascal second (Pa·s).[3]

4. Summary of Test Method

4.1 The rotational paddle viscometer method is used to measure the apparent viscosity of emulsified asphalt at 50°C, 25°C, or other agreed-upon temperatures. A microprocessor circuitry system functioning in tandem with a temperature probe and equipped with internal electronic sensors detects and analyzes the preset temperature. A paddle is immersed in the emulsified asphalt sample and is rotated at 100 RPM. The apparent viscosity of the sample is obtained and read from the electronic display or an optional printer.

5. Significance and Use

5.1 The viscosity of emulsified asphalts characterizes their flow properties and affects their utility at 50°C or at other temperatures. The sprayability and workability of an emulsified asphalt are directly related to its viscosity for many applications. The material must be thin enough to be sprayed yet thick enough such that it will not flow from the crown or grade of the road. For mixing grade emulsified asphalts the viscosity will affect its workability and resulting film thickness on the aggregate. This test method is useful to measure the apparent viscosity of emulsified asphalt at a temperature of 50°C, 25°C, or another agreed-upon temperature. The preset temperature and rotational speed at 100 RPM allow for an automated and consistent determination of an emulsified asphalt viscosity within a short time.

6. Apparatus

6.1 The rotational paddle viscometer test system consists of a paddle, temperature probe, sample cup, the sample cup cover, a means of controlling the sample temperature to within ±0.1°C and a readout system to display viscosity. The dimensions of the sample cup and paddle are shown in Figs. 1-3.

6.2 *Thermometer*—Any thermometric device can be used to monitor the temperature of the sample being conditioned for testing.

6.3 *Sieve*—An 850-µm sieve or a 20-mesh strainer of wire cloth, framed or unframed, conforming to Specification E11 is used.

6.4 *Oven/Water Bath*—An oven/water bath capable of maintaining the required testing temperature within the limit of ±3°C.

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[1] This test method is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.42 on Emulsified Asphalt Test.

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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 centimetre gram second (cgs) unit of viscosity is the poise (dynes/cm^2) and is equivalent to 0.1 Pa·s. One centipoise (cP) is one millipascal second (mPa·s).

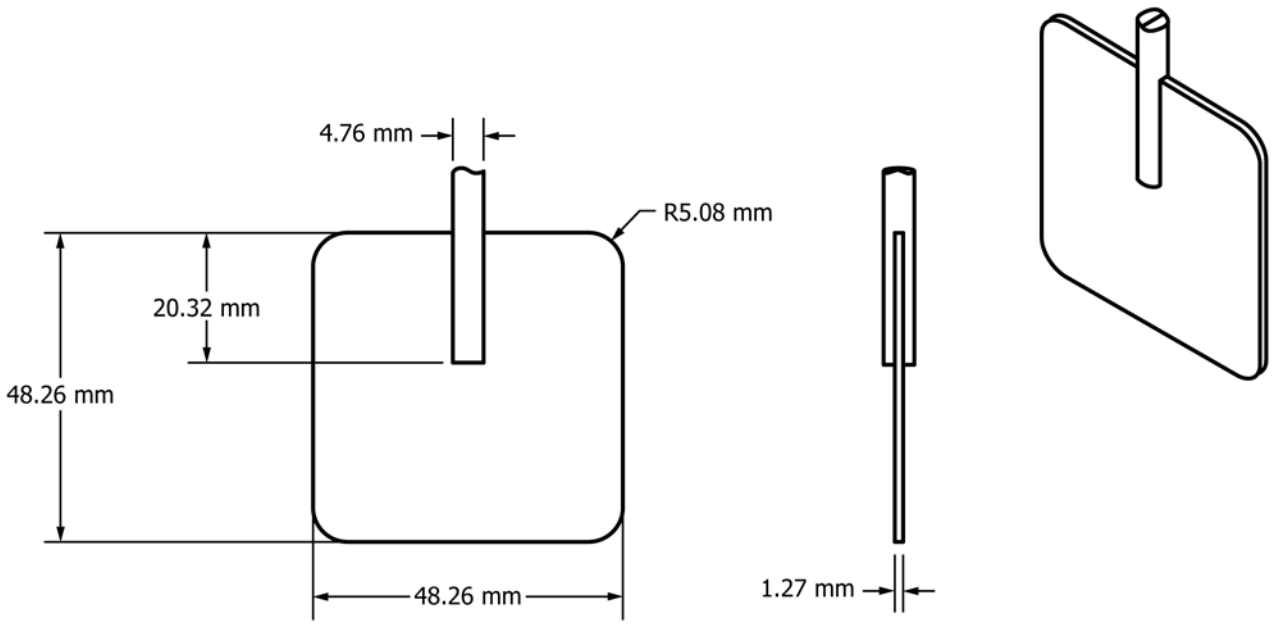

FIG. 1 Paddle Dimensions

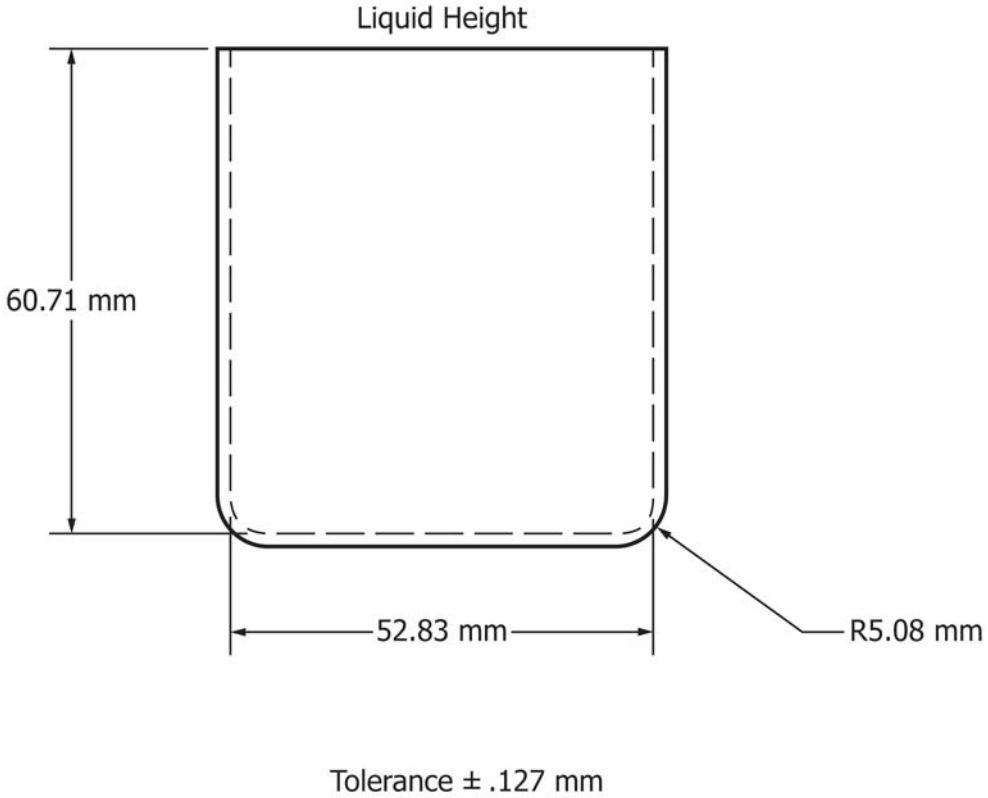

FIG. 2 Sample Cup Dimensions

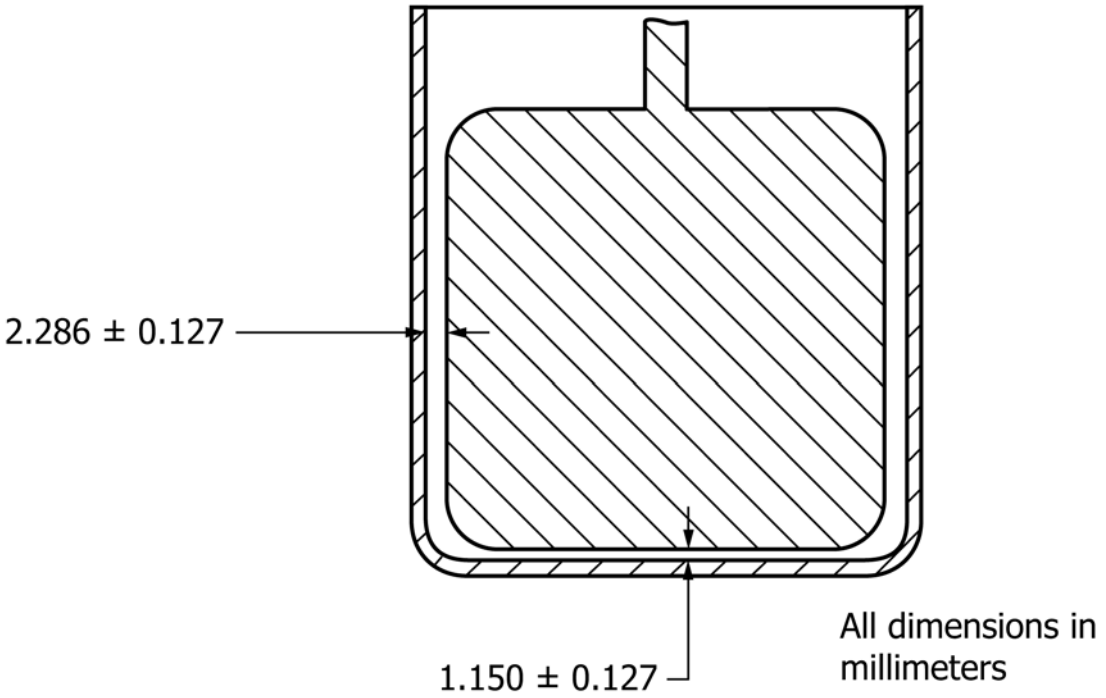

FIG. 3 Paddle and Sample Cup

7. Hazards

7.1 **Warning—**Mercury has been designated by EPA and many state agencies as a hazardous material that can cause central nervous system, kidney and liver damage. Mercury, or its vapor, may be hazardous to health and corrosive to materials. Caution should be taken when handling mercury and mercury containing products. See the applicable product Material Safety Data Sheet (MSDS) for details and EPA's website – http://www.epa.gov/mercury/faq.htm - for additional information. Users should be aware that selling mercury and/or mercury containing products into your state may be prohibited by state law.

8. Calibration and Standardization

8.1 Calibrate the rotational paddle viscometer at periodic intervals or as required by measuring the viscosity at 25°C of an appropriate standard following the procedure in Section 9.

8.2 If the measured viscosity standard differs from the certified value by more than 11 % calculate a correction factor, F, for the viscometer as follows:

$$F = \eta_s/\eta$$

where:

η_s = certified viscosity of the standard at the test temperature, and
η = measured viscosity at 25°C.

8.3 Calibrate the rotational paddle viscometer in the same manner as above, using a viscosity standard for 50°C.

9. Procedure

9.1 Obtain a representative sample of the material for testing using standard procedures as specified in Practice D140.

9.2 Turn on the viscometer power and set to the test temperature and attach the paddle to the viscometer. Allow the instrument to warm up for a minimum of 30 min.

9.3 Emulsified asphalts with a viscosity testing requirement of 50°C shall be heated to 50 ± 3°C in the original sample container in a water bath or oven as described herein. If the sample temperature is greater or less than 50°C then it should be conditioned to the required test temperature. Pour the sample into a clean sample cup through the 850-µm sieve or 20-mesh strainer to the fill line of the viscometer sample cup.

9.4 Emulsified asphalts with a viscosity testing temperature requirement of 25°C should be conditioned at 25 ± 3°C in the original sample container to achieve homogeneity. Pour the sample into the sample cup after passing through an 850-µm or 20-mesh sieve.

9.5 Pull the heater block forward and clear of the paddle. Place the filled sample cup into the heater block and rotate the cup to lock it in place. Push the heater block back until it stops beneath the paddle.

9.6 Raise the heater block to submerge the paddle into the sample. Verify that the paddle and temperature probe are totally submerged in the sample. The paddle should be free to rotate. Place the sample cover over the sample cup.

9.7 Verify that the temperature of the sample is a few degrees lower than the target temperature before beginning the automatic test sequence then enter Run Test. The rotational speed is preset by the manufacturer to 100 RPM.

9.8 After the test is completed, record the viscosity reading from the viscometer and if appropriate apply the correction factor as described in Section 8.

10. Report

10.1 Report the apparent viscosity in mPa·s to the nearest 0.1 mPa·s from the viscometer.

10.2 Report the temperature to the nearest 0.1°C.

11. Precision and Bias

11.1 The following criteria should be used for judging the acceptability of results (95 % probability):[4]

11.1.1 *Single-Operator Precision*—Duplicate results by the same operator should not be considered suspect unless they differ by more that the following amount:

Test Temperature °C	Viscosity mPa.s	Repeatability % of the mean
25	25 to 200	8.2
50	100 to 1000	12.9

11.1.2 *Multilaboratory Precision*—The results submitted by each of two laboratories should not be considered suspect unless they differ by more than the following amount:

Test Temperature °C	Viscosity mPa.s	Reproducibility % of the mean
25	25 to 200	22
50	100 to 1000	64

11.2 *Bias*—No information can be presented on the basis of the procedure because no material having the accepted reference value is available.

12. Keywords

12.1 emulsified asphalt; rotational; rotational paddle viscometer; viscosity

[4] Research Report RR:D04-1037 and RR:D04-1038 presents the results of the Interlaboratory Study used to establish the precision and bias statement for ASTM D7226, Standard Test Method for Determining the Viscosity of Emulsified Asphalt Using a Rotational Paddle Viscometer. The collaborative study included respectively 14 labs and 15 labs who used method D7226 to analyze the viscosity of several types of emulsified asphalt of varying viscosity levels, including three different standards. The research report presents summary method performance statistics as well as the measurement data used to calculate results for the study.