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Standard Test Method for Measurement of Apparent Viscosity of Asphalt-Rubber or Other Asphalt Binders by Using a Rotational Handheld Viscometer¹

This standard is issued under the fixed designation D7741/D7741M; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope

1.1 The use of high-viscosity asphalt binders like asphalt-rubber is becoming more common in the United States and worldwide. Specifications such as Specification ~~D6114/D6114M~~ note the need for field control of the apparent viscosity and require the use of a field production rotational viscometer. The testing of asphalt-rubber binder for use in asphalt-rubber hot mix and for asphalt-rubber membrane is necessary to ensure consistent mix properties that will ensure good performance of these materials. Logistics of field applications limits the use of conventional laboratory controls and testing equipment. This test, using a handheld rotational viscometer, can be conducted in either the field or laboratory to determine the apparent viscosity of asphalt-rubber and other high-viscosity binders for field production control and to assess the uniformity of the binder produced, or for other related purposes.

1.2 Asphalt-rubber binder consists of a blend of paving grade asphalt cement and crumb rubber as described in Specification ~~D6114/D6114M~~. Other high-viscosity asphalt binders may consist of asphalts modified with polymer or fiber, or both. Testing is performed following the specified reaction time, if any, within the production process. Control of the raw materials is separate from the test. <https://www.astm.org/catalog/standards/astm/5145ab57-5245-4217-af0f-714e3690bc30/astm-d7741-d7741m-23>

1.3 The values stated in SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; each system shall be used independently of the other. Combining values from the two systems may result in noncompliance with the 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 D04.44 on Rheological Tests.

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2. Referenced Documents

2.1 *ASTM Standards*:²

[D6H4D6114/D6114M](#) Specification for Asphalt-Rubber Binder

3. Significance and Use

3.1 This test is primarily used for field production control of asphalt-rubber (A-R) and other high-viscosity binders; however, the test can also be used in a laboratory setting.

3.2 A handheld rotational viscometer is used to measure the apparent viscosity of a completed blend of A-R or high-viscosity binder. A rotor (spindle), turning at constant speed, is inserted in the liquid binder to be measured. The resistance to movement of the spindle (torque) caused by the viscosity of the surrounding liquid is measured using a special mechanism to obtain direct readings in Pa·s or cP.

NOTE 1—Spindle is generally made of stainless steel, although another metal such as brass could be used.

3.3 The measured apparent viscosity is used to control the production of the A-R or other high-viscosity binder, to assess the uniformity of the binder produced, or for other related purposes.

3.4 As the spindle turns in the A-R or other high-viscosity binder, it has a tendency to “drill” into the sample (that is, for A-R, the spindle spins the rubber particles out of the measurement area). Consequently, the apparent viscosity drops to reflect only the liquid phase of the high-viscosity binder. Therefore, the peak viscosity measurement value is recorded to reflect the viscosity of the blended material.

4. Apparatus

4.1 *Viscometer*—Handheld, rotational-type viscometer (see Fig. 1). The viscometer shall be equipped with a level bubble to ensure proper orientation of the viscometer in the sample to be tested. Spindle (rotor) speed is typically 62.5 rpm; however, it may vary with different manufacturers.

NOTE 2—The viscosity scale readings for the various rotor types overlap in part. For example, the following viscosity ranges can be measured with both of the following rotors:

3 dPa·s to 13 dPa·s: No. 3 or No. 1 rotor
 100 dPa·s to 150 dPa·s: No. 2 or No. 1 rotor

4.2 *Spindle (Rotor)*—Diameter: 24 ± 1.1 mm [1.0 ± 0.05 in.]; Height: 53 ± 0.1 mm [2 ± 0.005 in.] or equivalent (see Fig. 2).

4.3 *Thermometer*—A digital thermometer of suitable range, with subdivisions and maximum scale error of 2 °F [1 °C], with metal jacket.

4.4 *Sample Can*—~~4 L [1 gal]~~ 4 L [1 gal] metal can with wire bale.

4.5 *Viscosity Standard Oils*—Calibrated in absolute viscosity in Pa·s [centipoises, cP] and in the range of 1.0 to 5.0 Pa·s [1000 to 5000 cP].

4.6 *Controllable Heat Source*, such as a hot plate, gas stove, or burner, etc., to maintain the test temperature of the A-R or high-viscosity binder sample during viscosity measurement.

4.7 *Viscometer Holder*—Clean metal can or some type of frame where the viscometer can be stored between tests.

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.



FIG. 1 Handheld Rotational-Type Viscometer

[ASTM D7741/D7741M-23](https://standards.iteh.ai/catalog/standards/astm/5145ab57-5245-4217-af0f-714e3690bc30/astm-d7741-d7741m-23)

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5. Calibration Verification

5.1 Calibration of the rotational viscometer shall be verified prior to use at each site per manufacturer's instructions, using the reference viscosity standard oils.

6. Sampling

6.1 The sample shall consist of at least 3 L [0.75 gal] of the completed mixture of A-R or other high-viscosity binder. Obtain the sample from an appropriate sample valve located to intercept the normal flow of material during production. Perform sampling and testing in close proximity to the plant operation to avoid undue temperature loss during handling.

6.2 Prior to sampling, draw at least 3 L [0.75 gal] from the sampling valve and discard. Then open the sample valve and draw approximately 3 L [0.75 gal] into a new, clean sample can for testing. The sample shall be within one inch from the top of the container.

6.3 Allow the asphalt-rubber binder sample to cool. Do not apply any reheating to the sample until it is ready for viscosity testing in the laboratory.

7. Test and Sampling Procedure

7.1 As immediately as practical, place the sample container with the drawn sample on a smooth, level support for final preparation and testing. Set the open sample container on or over the controllable heat source, as ~~appropriate~~ appropriate.