

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

RECONFIRMATION

OF

AS/NZS 2341.5:1997

Methods of testing bitumen and related roadmaking products

Method 5: Determination of apparent viscosity by 'Shell' sliding plate micro-viscometer

RECONFIRMATION NOTICE

Technical Committee CH-025 has reviewed the content of this publication and in accordance with Standards Australia procedures for reconfirmation, it has been determined that the publication is still valid and does not require change.

Certain documents referenced in the publication may have been amended since the original date of publication. Users are advised to ensure that they are using the latest versions of such documents as appropriate, unless advised otherwise in this Reconfirmation Notice.

Approved for reconfirmation in accordance with Standards Australia procedures for reconfirmation on 14 May 2013.

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The following are represented on Technical Committee CH-025:

Australian Road Research Board (ARRB)
Australian Asphalt Pavement Association
Australian Chamber of Commerce and Industry
Australian Institute of Petroleum
AUSTROADS
Engineers Australia
National Association of Testing Authorities Australia
Roading New Zealand
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NOTES

Australian/New Zealand Standard®

Methods of testing bitumen and related roadmaking products

Method 5: Determination of apparent viscosity by 'Shell' sliding plate micro-viscometer

1 SCOPE This Standard sets out a procedure for the determination of apparent viscosity of bitumens at a specified shear strain rate by means of the 'Shell' sliding plate micro-viscometer.

2 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS

2341 Methods of testing bitumen and related roadmaking products

AS/NZS

2341.1 Method 1: Precision data—Definitions

AS

2341.13 Method 13: Long-term exposure to heat and air

ASTM

E1 Specification for ASTM thermometers

3 APPLICATION This method of test is particularly applicable to the assessment of the—

- (a) increase in viscosity of a bitumen, which has been hardened in accordance with AS 2341.13 by measuring the apparent viscosity at 45°C, and at a shear strain rate of $5 \times 10^{-3} \text{ s}^{-1}$ after the treatment; and
- (b) condition of bitumen recovered from pavements by measuring apparent viscosity at 45°C and $5 \times 10^{-3} \text{ s}^{-1}$.

4 PRINCIPLE A bitumen film of known thickness is sheared between a matched pair of parallel flat glass plates. One plate is clamped in a fixed position and the other is displaced in the direction of the plane of the film by a constant force. The displacement velocity of the moving plate is measured. Shear strain rate, shear stress, and apparent viscosity are calculated from the dimensions of the specimen, displacement velocity, and load. Measurements are taken at several different loads and the relationship between apparent viscosity and shear strain rate is determined.

5 APPARATUS

5.1 Analytical balance—readable to 0.0001 g and accurate to 0.0003 g.

5.2 Chart recorder—having a full-scale deflection of 100 mV and chart speeds in the range 1 cm/h to 60 cm/min. The chart width should preferably be 200 mm or greater.

NOTE: A data logger can be used as long as its sensitivity and sampling rate give equal or better data resolutions.

5.3 Constant temperature water bath—capable of control to an accuracy of $\pm 0.1^\circ\text{C}$ of the required temperature.

5.4 Infrared lamp—preferably with a height adjustment or operable from a variable transformer.

5.5 Sliding plate micro-viscometer (Shell Development Co. design, and manufactured by Stanhope-Seta, Park Close, Englefield Green, Surrey, UK)—shown schematically in Figure 1. The sample is contained between two plates. One plate is clamped in a fixed position in the frame and the other is held in a spring clamp at the end of the operating rod which has a contact plate attached to it. The operating rod and a weight holder are attached to opposite ends of a balance arm by knife edges which are equidistant from the pivot point.

When a load is applied to the weight holder, the resultant upward movement of the sample plate is followed by a resistance contact servo system. The servo motor rotates an insulated micrometer, which maintains a (high resistance) contact between its tip and the contact plate attached to the operating rod. The electrical circuit to ground is normally completed through the water in the water bath.

Coupled to the micrometer is a potentiometer which enables an electrical voltage proportional to the plate movement to be recorded as a function of time.

5.6 Spatula—of stainless steel or nickel.

5.7 Viscometer plates—of polished plate glass, nominally 6 mm thick and free of visual defects (e.g. edge chips), with edges ground together to accurate rectangular prisms, $20 \pm 0.1 \text{ mm} \times 30 \pm 0.1 \text{ mm}$, so that all plates and faces of plates are interchangeable.

5.8 Water bath thermometer—partial immersion type, graduated to 0.1°C , and calibrated to an uncertainty of $\pm 0.05^\circ\text{C}$ (or any other temperature-measuring instrument with equal or better resolution and accuracy). An ASTM 91°C thermometer has been found suitable for this purpose (see ASTM E1).

6 CALIBRATION Prior to testing, or at least daily when testing, adjust the viscometer-recorder system so that one complete turn of the micrometer, i.e. a sample plate displacement of 0.5 mm, corresponds to a full chart deflection in the recorder.

NOTES:

- 1 The need for frequent adjustments generally indicates a weak battery.

The specified battery may be difficult to obtain, and it is possible to fit a solid state voltage reference* to replace the battery.

- 2 A damaged or contaminated micrometer tip and contact plate have been found to cause irregular movements of the micrometer and produce a faulty recorder trace. The tip and contact plate need to be carefully cleaned with ammonia at regular intervals and replaced or replaced if damaged.

It is recommended that the contact plate be gold plated and the micrometer tip be fitted with a small solid gold pin and remachined to a 0.5 mm radius contact point*.

- 3 It has been found that the electrical circuit to ground through the water is often poor (especially when using distilled or deionized water in the bath), and can result in faulty recorder traces similar to those caused by damaged micrometer tips, etc. or even in complete failure.

It is recommended that a thin, flexible earthing wire be fitted between the centre of the balance arm and the instrument chassis*.

* Further information is available from the Bituminous Material Group of the ARRB Transport Research.