

Australian/New Zealand Standard™

AS/NZS 2341.4:2015

Methods of testing bitumen and related roadmaking products

Method 4: Determination of dynamic viscosity by rotational viscometer

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee CH-025, Bitumen and Related Products (For Roadmaking), to supersede AS 2341.4—1994.

This Standard has been revised to remove obsolete instruments to reflect the use of modern technology by industry. The explanation of the technical basis for manual calculations has been removed.

METHOD

1 SCOPE

This Standard sets out procedures for the determination of viscosity of bituminous materials at a particular shear rate, using a rotational viscometer with standard concentric cylinder measuring geometry. This method is applicable to viscosity measurements on bitumen, cutback bitumen, bituminous emulsions and polymer modified binders (PMBs).

WARNING: THE USE OF THIS AUSTRALIAN/NEW ZEALAND STANDARD MAY INVOLVE HAZARDOUS MATERIALS, OPERATIONS AND EQUIPMENT. THIS STANDARD DOES NOT PURPORT TO ADDRESS ALL OF THE SAFETY PROBLEMS 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 AND RELATED DOCUMENTS

2.1 Referenced documents

The following documents are referred to in this Standard:

AS	
2008	Bitumen for pavements
AS/NZS	
2341	Methods of testing bitumen and related roadmaking products
2341.1	Part 1: Precision data—Definitions
2341.21	Part 21: Sample preparation
Austrroads	
AGPT-T102	Protocol for Handling Modified Binders in Preparation for Laboratory Testing
AGPT-T190	Specification Framework for Polymer Modified Binders

2.2 Related document

Attention is drawn to the following related document:

ASTM

D4402 Standard Test Method for Viscosity Determination of Asphalt at Elevated Temperatures Using a Rotational Viscometer

3 PRINCIPLE

The material being tested is sheared in the annular space between two concentric cylinders in a temperature controlled chamber. The inner cylinder (spindle) is rotated at a constant speed within a static outer cylinder (sample cup). The torque generated in the drive to the spindle by the viscous resistance of the material is measured by a torque transducer, and is converted into a viscosity measurement based on the geometry of the test apparatus.

4 APPLICATION TO AS 2008 and AGPT-T190

Dynamic viscosity measurements on binders specified by AS 2008 or AGPT-T190 shall be performed using a 'Brookfield LV (low viscosity)' type coaxial cylinder viscometer or equivalent. This test method is not applicable for viscosity at 60°C measurements on AS 2008 bitumen.

5 APPARATUS

5.1 Rotational viscometer

The rotational viscometer shall consist of the following:

- (a) *Basic instrument* A 'Brookfield LV (low viscosity)' type, or equivalent coaxial cylinder viscometer and temperature controlled chamber.
- (b) *Spindle* A cylindrical spindle, appropriate to the viscosity of the sample to be tested.

5.2 Temperature controlled chamber device

The temperature controlled chamber shall be capable of maintaining the sample temperature to within $\pm 1.0^\circ\text{C}$ at test temperatures above 40°C and below 150°C ; and within $\pm 2^\circ\text{C}$ at test temperatures at and above 150°C and below 300°C .

NOTE: A 'Brookfield Thermosel System' has been found to be suitable.

5.3 Sample cups

Metal sample cups designed for insertion into the temperature controlled chamber shall be used.

5.4 Balance

A balance of at least 500 g capacity readable to 0.01 g with a limit of performance of 0.05 g.

5.5 Standard temperature measuring device

Accurate to 0.1°C , with a calibration traceable to a National or International Standard, e.g. a platinum resistance thermometer.

6 CALIBRATION

6.1 Temperature controlled chamber calibration

Calibrate the temperature controlled chamber by placing sufficient high flash point oil or bituminous material in the chamber to cover the standard temperature measuring device (Clause 5.5) to an appropriate depth. Set the test chamber to the temperature normally used for testing. Place the sensing element of the standard temperature measuring device in the test chamber and allow sufficient time for the temperature to stabilize. Obtain five temperature measurements at 1 min intervals.

Correct the standard temperature measuring device for any offset. Calculate the average of the five temperature measurements. None of the individual measurements shall differ from the average temperature by more than 1°C.

Subtract the average from the controller set point. If the difference between the average and the set point is greater than 0.1°C, calculate a new controller set point by adding the difference to the controller set point. Repeat the calibration to confirm that the offset set point gives the correct test temperature in the temperature controlled chamber.

6.2 Viscosity calibration check

Verify the accuracy of the viscometer by testing a calibration fluid of known viscosity the value of which is traceable to a standard material at a temperature within 50°C of the test temperature.

The viscosity measured shall be within $\pm 2\%$ of the viscosity of the calibration fluid.

NOTE: The Cannon Instrument Company supplies viscosity calibration fluids for a range of temperatures and viscosities. They have detailed tables online where the applicable fluid for the range desired can be chosen. The Cannon certified viscosity reference standard N450000 has been found suitable for performing viscosity calibration checks with rotational viscometers used to measure the dynamic viscosity of bitumen at 135°C and PMBs at 165°C.

7 PREPARATION OF SAMPLE

Bitumen, cutback bitumen and bituminous emulsion samples shall be prepared in accordance with AS/NZS 2341.21. Polymer modified binder (PMB) samples shall be prepared in accordance with AGPT-T102.

8 PROCEDURE

Operate the viscometer in accordance with the manufacturer's instructions. Record the brand and model number of the viscometer and temperature controlled chamber used. The general procedure shall be as follows:

- (a) Set the temperature controlled chamber to the required test temperature. Apply any offset required.
- (b) Select an appropriate spindle and preheat the sample cup and spindle. If the sample is prepared by heating in an oven, the sample cup and spindle may be preheated by placing them in the same oven as the sample for at least 5 min prior to use. Alternatively, the sample cup and spindle may be preheated for at least 30 min in the temperature controlled chamber. Record the type and model of the spindle used.

NOTE: Spindles for different materials at typical test temperatures that have been found to be suitable are shown in Table 1.