

Australian/New Zealand Standard™

Methods of testing bitumen and related roadmaking products

Method 2: Determination of dynamic viscosity by vacuum capillary 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 2341.2—1993, *Methods of testing bitumen and related roadmaking products*, Method 2: *Determination of dynamic (coefficient of shear) viscosity by flow through a capillary tube*.

The most significant modifications are removal of references to tar, and addition of a table on viscometers to be used based on Table 2 of Austroads AG:PT/T161 *Determination of dynamic viscosity by flow through a capillary tube—Test tube schedule* to indicate the types of Asphalt Institute vacuum capillary viscometers (including recognition of the AI 400R and AI 800R) to be used with different classes of bitumen. ASTM 2171 *Standard Test Method for Viscosity of Asphalts by Vacuum Capillary Viscometer* has also been referenced in this Standard.

METHOD

1 SCOPE

This Standard sets out procedures for the determination of dynamic viscosity of materials having viscosities in the range 0.0036 Pa.s to 580 000 Pa.s, using two different types of vacuum capillary viscometers. In particular, the method is applicable to bitumen for pavements (as specified in AS 2008), and cutback bitumen (as specified in AS 2157).

2 SAFETY DISCLAIMER

WARNING: THE USE OF THIS 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.

3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS	
2008	Bitumen for pavements
2157	Cutback bitumen

AS/NZS

2341 Methods of testing bitumen and related roadmaking products

2341.1 Method 1: Precision data—Definitions

2341.10 Method 10: Determination of the effect of heat and air on a moving film of bitumen (rolling thin film oven (RTFO) test)

2341.21 Method 21: Sample preparation

ASTM

E1 Standard Specification for ASTM Liquid-in-Glass Thermometers

D2171 Standard Test Method for Viscosity of Asphalts by Vacuum Capillary Viscometer

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

4 PRINCIPLE

The time for a fixed volume of the liquid to be drawn up through a capillary tube under conditions of closely controlled temperature and pressure is measured. The dynamic viscosity is calculated by multiplying the flow time by the viscometer bulb calibration factor.

5 APPLICATION TO AS 2008 AND AS 2157

Dynamic viscosity measurements at 60°C on bitumen and multigrade bitumen shall be performed using Asphalt Institute vacuum capillary viscometers. Cannon-Manning vacuum capillary viscometers may be used for cutback bitumen and viscosity measurements at temperatures greater than 60°C.

6 APPARATUS

Alternative viscometer types for different applications are as follows:

- (a) *Cannon-Manning vacuum capillary viscometer* Conforming to ASTM D2171 when purchased. For standard viscometer sizes, approximate calibration factors and viscosity ranges refer to Table X1.1 in ASTM D2171. See Figure 1 for an illustration of a Cannon-Manning vacuum capillary viscometer.

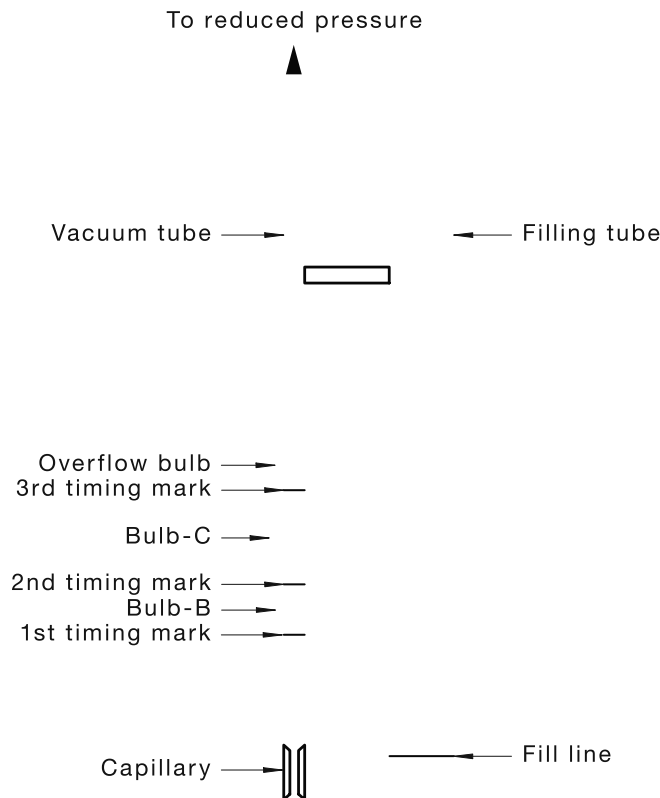


FIGURE 1 CANNON-MANNING VACUUM CAPILLARY VISCOMETER

- (b) *Asphalt Institute vacuum capillary viscometer* conforming to ASTM D2171 when purchased. For standard viscometer sizes, capillary radii, approximate calibration factors and viscosity ranges refer to Table X2.1 in ASTM D2171. See Figure 2 for illustrations of Asphalt Institute vacuum capillary viscometers.

An Asphalt Institute vacuum capillary viscometer without the 'R' suffix [see Figure 2(a)] has measuring bulbs (labelled B, C and D) located on the vacuum tube which is a precision bore glass capillary. The measuring bulbs are 20 mm long capillary segments and are separated by timing marks. The AI 400R and AI 800R viscometers [see Figure 2(b)] are similar except that the equivalent to bulb B of the non-R instruments is now divided into 3 portions, B, C and D, which together are designated BCD, measuring 20 mm in total. The next three bulbs of 20 mm length each are designated E, F and G.

Table 1 lists the Asphalt Institute vacuum capillary viscometers that shall be used for dynamic viscosity at 60°C measurements on different classes of bitumen.

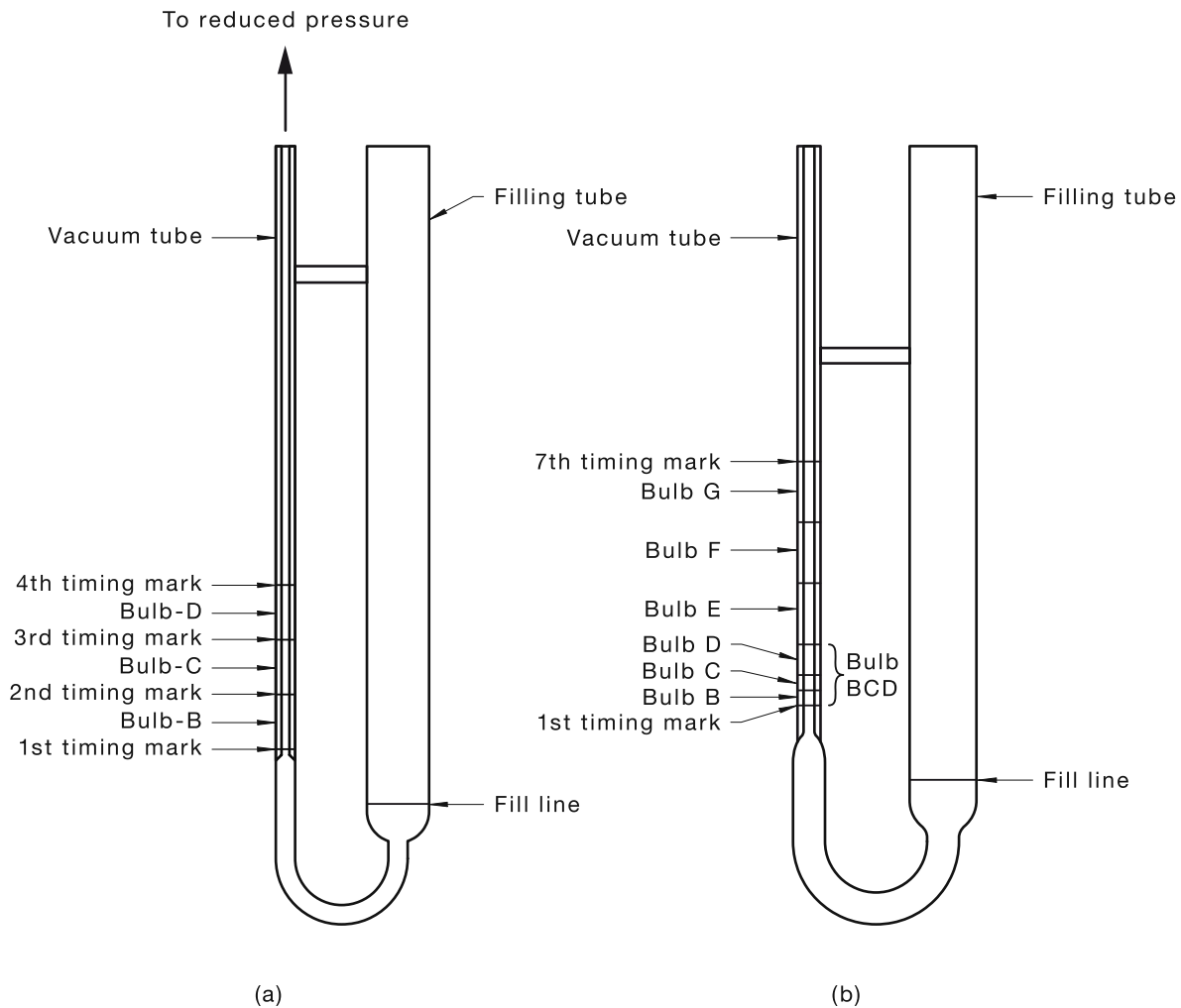


FIGURE 2 ASPHALT INSTITUTE VACUUM CAPILLARY VISCOMETER

- (c) *Thermometer* Selected in accordance with the following, as appropriate:
- (i) For determination at 60°C: ASTM 47C as specified in ASTM E1.
 - (ii) For determination at 135°C: ASTM 110C as specified in ASTM E1.
- NOTE: Other thermometric devices are permissible provided that their accuracy, precision and sensitivity are equal to or better than those of the thermometer prescribed.
- (d) *Bath* As described in ASTM 2171 except the temperature of the bath medium shall not vary by more than $\pm 0.1^\circ\text{C}$.
- (e) *Timer* as described in ASTM 2171.
- (f) *Oven* Capable of heating the viscometer.
- (g) *Vacuum system* Capable of maintaining a pressure of $40.00 \pm 0.07 \text{ kPa}$ ($300.0 \pm 0.5 \text{ mm mercury}$) below ambient.

Any vacuum pump that can maintain the correct pressure is suitable for the vacuum source. The vacuum pump should be connected by tubing to a manometer (or equivalent), which is in turn connected to another tube that contains a toggle switch or stopcock. The tube containing the toggle switch or stopcock is connected to the viscometer during testing. A bleed valve for adjusting the pressure, or an appropriate pressure regulator, should be included in the system.