

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

METHODS OF TESTING BITUMEN AND RELATED ROADMAKING PRODUCTS

AS 2341.2

DETERMINATION OF DYNAMIC VISCOSITY BY FLOW THROUGH A CAPILLARY TUBE

1 SCOPE. This standard sets out procedures for the determination of dynamic (absolute) viscosity of bituminous materials, using three different types of vacuum capillary viscometers.

2 REFERENCES. This standard requires reference to the following standards:

ASTM E1 ASTM Thermometers
IP Standard Thermometers

3 APPLICATION. The method is applicable to newtonian and near-newtonian materials having viscosities in the range 0.0036 Pa.s to 20 000 Pa.s. In particular the method is applicable to the following materials:

- (a) Residual bitumens for pavements (AS 2008). (Viscosities at 135°C and at 60°C both before and after RTFO treatment.)
- (b) Cutback bitumens (AS 2157). (Viscosity at 60°C and viscosity at 60°C of the residue from distillation.)
- (c) Road tars for pavements (AS 1507). (Viscosity at 50°C.)

NOTE: If the flow response is dependent on the rate of shear strain, then the rotational method (AS 2341.4) can measure an apparent viscosity associated with a specified rate of shear strain. In the case of the capillary tube viscometers, however, the rate of shear strain in the liquid will be a function of tube dimensions and driving force and cannot be precisely defined.

4 PRINCIPLE. The time is measured for a fixed volume of the liquid to be drawn up through a capillary tube by means of reduced pressure under closely controlled conditions of pressure and temperature. The absolute viscosity is calculated by multiplying the flow time in seconds by the viscometer tube calibration factor.

5 APPARATUS. The following items of apparatus are required, with the choice of viscometer optional:

- (a) *Cannon-Manning viscometer.* Available in eleven sizes (see Table 1) covering a range of 0.0036 Pa.s to 8000 Pa.s.
 - (i) Details of the design and construction of Cannon-Manning vacuum capillary viscometers are shown in Fig. 1. The size numbers, approximate bulb constants (K) and viscosity ranges for the series of

Cannon-Manning vacuum capillary viscometers are given in Table 1.

- (ii) For all viscometer sizes, the volume of measuring bulb C is approximately three times that of bulb B. The viscosity ranges shown in Table 1 correspond to filling times of 60 s and 400 s, and apply respectively to bulbs C and B.
 - (iii) A convenient holder can be made by drilling two holes, 22 mm and 8 mm in diameter respectively, through a No 11 rubber stopper. The centre-to-centre distance between holes should be 25 mm. Slit through the rubber stopper between holes and also between the 8 mm hole and edge of the stopper. When placed in a 50 mm diameter hole in the bath cover, the stopper holds the viscometer in place. Such holders and predrilled stoppers are commercially available.
- (b) *Asphalt Institute viscometer.* Available in five sizes (see Table 2) covering a range of 4.2 Pa.s to 20 000 Pa.s.
 - (i) Details of the design and construction of Asphalt Institute vacuum capillary viscometers are shown in Fig. 2. The size numbers, approximate radii, approximate bulb constants (K) and viscosity ranges for the series of Asphalt Institute vacuum capillary viscometers are given in Table 2.
 - (ii) The viscometer has measuring bulbs, B, C, and D located on the vacuum tube M which is a precision bore glass capillary. The measuring bulbs are 20 mm long capillary segments and are separated by timing marks F, G, H and I.
 - (iii) A convenient holder can be made by drilling two holes 22 mm and 8 mm in diameter respectively, through a No 11 rubber stopper. The centre-to-centre distance between holes should be 25 mm. Slit through the rubber stopper between the holes and also between the 8 mm hole and edge of the stopper. When placed in a 50 mm diameter hole in the bath cover, the stopper holds the viscometer in place. Such holders and predrilled stoppers are commercially available.