

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard METHODS OF TESTING BITUMEN AND RELATED ROADMAKING PRODUCTS

AS 2341.3

DETERMINATION OF KINEMATIC VISCOSITY BY FLOW THROUGH A CAPILLARY TUBE*

1 SCOPE. This standard sets out procedures for the determination of kinematic viscosity of bituminous materials using two different types of reverse flow capillary tube viscometers.

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

ASTM E1 ASTM Thermometers
BS 593 Laboratory Thermometers
IP Standard Thermometers

3 APPLICATION. The method is applicable to materials having kinematic viscosities in the range 2 mm²/s to 300 000 mm²/s (approximate dynamic viscosities 0.002 Pa.s to 300 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 the tube dimensions and driving force and cannot be precisely defined.

4 PRINCIPLE. The time is measured for a fixed volume of the liquid to flow through a capillary tube under an accurately reproducible head and at a closely controlled temperature. The kinematic viscosity is then calculated by multiplying the efflux time in seconds by a viscometer calibration factor.

NOTES:

1. Results from this method can be used to calculate dynamic viscosity when the density of the liquid at 25°C is known.
2. Flow times will be too long with these instruments for convenient measurement of the viscosity of Class 640 residual bitumens at 60°C.

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

- (a) *Cannon-Fenske viscometer for opaque liquids.* Available in eight sizes covering a kinematic viscosity range 2.00 mm²/s to 20 000 mm²/s. Details of design and construction are given in Fig. 1 and Table 1.

- (b) *BS/IP/RF U-tube modified reverse flow viscometer for opaque liquids.* Available in eight sizes covering a kinematic viscosity range of 6 mm²/s to 300 000 mm²/s. Details of design and construction are shown in Fig. 2 and Table 2.

- (c) *Thermometers.*

- (i) For determinations at 60°C .. IP 35 C or ASTM 47C or BS 593.
- (ii) For determinations at 135°C .. IP 93C or ASTM 110C or BS 593.

- (d) *Bath.* A bath suitable for immersion of the viscometer so that the liquid reservoir or the top of the capillary, whichever is uppermost, is at least 20 mm below the upper bath level and with provisions for visibility of the viscometer and the thermometer. Firm supports for the viscometer shall be provided. The efficiency of the stirring and the balance between heat losses and heat input must be such that the temperature of the bath medium does not vary by more than ± 0.1°C over the length of the viscometer, or from viscometer to viscometer in the various bath positions.

- (e) *Timer.* A stopwatch or other timing device of a resolution of 0.1 s and accurate to within 0.05 percent when tested over intervals of not less than 15 min.

- (f) *Preheating oven.* An oven capable of maintaining a temperature within 5°C of the temperature at which the viscometer is to be filled.

6 CALIBRATION.

6.1 Calibration with a Calibration Fluid. Calibration with a calibration fluid shall be as follows:

- (a) Select from Table 3 a calibration fluid which will have a minimum flow time of 60 s in the viscometer at the calibration temperature.
- (b) Charge the clean, dry viscometer according to the appropriate charging procedure (Clause 8).
- (c) Proceed with the viscosity measurement according to Clause 8 and determine the flow time to the nearest 0.1 s.

*This method is derived from IP 319, Method of Test for Kinematic Viscosity of Asphalts (Bitumens).