

Australian Standard®

Methods of testing bitumen and related roadmaking products

Method 6: Determination of density using a hydrometer

PREFACE

This Standard was prepared by the Standards Australia Committee on Bitumen and Related Products (for Roadmaking) to supersede AS 2341.6—1982.

This third edition contains an editorial change for referencing appropriate density conversion tables.

METHOD

1 SCOPE This Standard sets out a procedure for the determination of density of bituminous materials using a hydrometer.

This method is applicable to low viscosity materials (1.0 Pa.s or less at the temperature of test) which contain a negligible amount of highly volatile materials.

It has a particular application for road tars and cutback bitumens.

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

AS

2026 Density hydrometers

2163 Graduated measuring cylinders

2341 Methods of testing bitumen and related roadmaking products

2341.1 Part 1: Precision data — Definitions

ASTM

D 4311 Standard practice for determining asphalt volume correction to a base temperature

E 1 Specification for ASTM thermometers

3 APPARATUS The following items of apparatus are required:

- (a) *Density hydrometer* — complying with the requirements of L50 or M100 of AS 2026, calibrated for use in liquids of low surface tension.

NOTES:

- 1 The hydrometer should be examined before use to see that there has been no previous displacement of the paper scale. Displacement can be detected by reference to the means provided for this purpose; for example, a horizontal line etched on the stem and the corresponding datum line marked on the paper scale, thus . If the scale has been displaced the hydrometer must be recertified.
 - 2 The readings of a hydrometer depend to some extent on the surface tension of the liquid in which the instrument is used, but standard hydrometers of series L50 are calibrated at surface tensions appropriate to tar and petroleum products and respond little, in relation to the subdivision of their respective scales, to the differences in surface tension that occur in these liquids.
 - 3 Hydrometers calibrated at 20°C may be used in the range 15°C to 25°C.
- (b) *Hydrometer vessel* — a cylindrical glass vessel, free from local irregularities producing distortion, and at least 20 mm greater in diameter than the hydrometer bulb; a measuring cylinder of 1000 mL capacity and complying with AS 2163 is suitable.
- (c) *Thermometers* — ASTM 12C as specified in ASTM E1.
- (d) *Means of maintaining a temperature of 15 ± 0.1°C* — a waterbath thermostatically controlled or an air conditioned room such that the contents of a 1 L measuring cylinder filled with kerosene maintains a temperature between 15°C and 25°C accurate to ±0.1°C.

4 PROCEDURE

4.1 Mobile and transparent liquids (viscosity less than 0.2 Pa.s at the temperature of test)

The determination shall be carried out with the sample at 15°C to 25°C as follows:

- (a) Fill a clean hydrometer vessel with the sample to a sufficient depth so that the hydrometer will not touch the bottom of the vessel when it is immersed in the liquid. Pour the sample down the sides of the vessel to avoid formation of air bubbles.
- (b) Fix the vessel in the waterbath with the level of the sample in the vessel immersed at least 10 mm below the level of the water.

NOTE: Alternatively the test may be carried out in a temperature-controlled room so that the sample reaches equilibrium and a steady temperature reading is obtained. This may be readily achieved by standing the sample in the room for 2 h prior to the test.

- (c) Stir the sample with a thermometer, again avoiding the formation of air bubbles.
- (d) When the temperature of the sample has stabilized, hold the hydrometer by the top of the stem, insert it carefully into the liquid and release it when approximately in the position of equilibrium, taking care to avoid wetting the stem above the level to which it will be immersed in the sample.

NOTE: A little experience soon enables the user to appreciate when the hydrometer is approaching equilibrium and to release it in such a position that it rises or falls only by a small amount when released.

- (e) Continuously stir the sample with the thermometer, taking care that the mercury thread is kept fully immersed and that the stem of the hydrometer is not wetted above the immersion level. As soon as a steady reading is obtained, record the temperature and remove the thermometer.
- (f) Depress the hydrometer about two scale divisions into the liquid and then release it. The remainder of the stem must be kept dry since unnecessary liquid on the stem affects the reading obtained. Note the reading when the hydrometer is steady after a few oscillations about the equilibrium position.

NOTE: The meniscus is observed during this period. If the stem and liquid surfaces are clean, the meniscus shape will remain unchanged during the hydrometer movement; if the meniscus shape changes, the hydrometer should be cleaned.

- (g) Record the hydrometer reading where the meniscus merges into the stem of the hydrometer.

4.2 Viscous and opaque liquids (viscosity greater than 0.2 Pa.s and less than 1.0 Pa.s at the temperature of test) Use the same procedure as for mobile liquids (Clause 4.1) but do not immerse the hydrometer beyond the expected reading. Allow adequate time for the hydrometer to settle to its final equilibrium position before taking the reading.

5 CALCULATION Calculate the density (ρ) of the sample at the temperature of test (i.e. the corrected hydrometer reading) by the following equation:

$$\rho = R + C_m + C_c$$

where

R = the hydrometer reading

C_m = the meniscus height correction (+0.0007 to be applied for opaque liquids) (see Note)

C_c = the certification correction (see Note)

Calculate the density at 15°C by applying the appropriate correction factor.

NOTE: Correction factors are given in ASTM D 4311. This Standard gives factors for the temperature range -25°C to +275°C.

6 PRECISION The following criteria should be used for judging the acceptability of results (see AS 2341.1) (95 percent probability):

- (a) *Repeatability* — duplicate results obtained by the same operator should not be considered suspect unless they differ by more than 0.0005 kg/L.
- (b) *Reproducibility* — single results submitted by each of two laboratories should not be considered suspect unless they differ by more than 0.0012 kg/L.

7 TEST REPORT The test report shall contain the following:

- (a) The density at 15°C of the sample in kilograms per litre corrected to the third decimal place.
- (b) The method used to determine the density, i.e. hydrometric (see AS 2341.1).
- (c) Reference to this Australian Standard, i.e. AS 2341.6.