



**Methods of testing bitumen and related  
roadmaking products**

**Method 3: Determination of  
kinematic viscosity by flow through a  
capillary tube**



AS 2341.3:2020

This Australian Standard® was prepared by CH-025, Bitumen And Related Products (For Roadmaking). It was approved on behalf of the Council of Standards Australia on 6 April 2020.

This Standard was published on 17 April 2020.

The following are represented on Committee CH-025:

- Australian Airports Association
- Australian Asphalt Pavement Association
- Australian Chamber of Commerce and Industry
- Australian Institute of Petroleum
- Australian Road Research Board
- Austroads
- National Association of Testing Authorities Australia

This Standard was issued in draft form for comment as DR AS 2341.3:2019.

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ISBN 978 1 76072 816 8



## **Methods of testing bitumen and related roadmaking products**

### **Method 3: Determination of kinematic viscosity by flow through a capillary tube**

Originated as AS 2341.3:1980.  
Previous edition 1993.  
Third edition 2020.

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# Preface

This Test Method was prepared by the Australian members of Joint Standards Australia/Standards New Zealand Committee CH-025, Bitumen and Related Products (for Roadmaking), to supersede AS 2341.3—1993.

After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Test Method as an Australian Test Method rather than an Australian/New Zealand Test Method.

The objective of this Test Method is to specify procedures for the determination of kinematic viscosity of bituminous materials having kinematic viscosities in the range 6 mm<sup>2</sup>/s to 100 000 mm<sup>2</sup>/s (approximate dynamic viscosities 0.006 Pa.s to 100 Pa.s) using four different types of reverse flow capillary tube viscometers.

This Test Method references ASTM D2170/D2170M-18, *Standard Test Method for Kinematic Viscosity of Asphalts*, for use in Australia, subject to modifications set out in [Appendix A](#).

[Appendix A](#) lists the variations to ASTM D2170/D2170M-18 for the application of this Test Method in Australia.

Users of this Test Method are advised that they must purchase ASTM D2170/D2170M-18 in addition to this Test Method.

The terms “normative” or “mandatory information” and “informative” or “nonmandatory information” are used in Standards to define the application of the appendices or annexes to which they apply. A “normative” appendix or “mandatory information” annex is an integral part of a Standard, whereas an “informative” or “nonmandatory information” appendix is only for information and guidance.



Contents

**Preface ..... ii**

**1 Scope ..... 1**

**2 Application ..... 1**

**3 Normative references ..... 1**

**4 Terms and definitions ..... 1**

**5 Operation ..... 1**

**Appendix A (normative) Variations to ASTM D2170/D2170M-18 for Australia ..... 2**

NOTES

# Australian Standard<sup>®</sup>

## Methods of testing bitumen and related roadmaking products

### Method 3: Determination of kinematic viscosity by flow through a capillary tube

#### 1 Scope

The objective of this Test Method is to specify procedures for the determination of kinematic viscosity of bituminous materials having kinematic viscosities in the range 6 mm<sup>2</sup>/s to 100 000 mm<sup>2</sup>/s (approximate dynamic viscosities 0.006 Pa.s to 100 Pa.s) using four different types of reverse flow capillary tube viscometers.

#### 2 Application

ASTM D2170/D2170M-18 is the 2018 edition. Only the 2018 edition shall be used in accordance with this Test Method.

#### 3 Normative references

The following normative document is referred to in this Standard in addition to those referenced in ASTM D2170/D2170M-18. The following document is referred to in the text in such a way that some or all of its content constitutes requirements of this Standard.

AS/NZS 2341.21, *Method of testing bitumen and related roadmaking products, Method 21: Sample preparation*

#### 4 Terms and definitions

For the purpose of this document the terms and definitions in this Test Method and ASTM D2170/D2170M-18 apply.

##### 4.1

##### **may**

indicates the existence of an option

##### 4.2

##### **shall**

indicates that a statement is mandatory

##### 4.3

##### **should**

indicates a recommendation

#### 5 Operation

The requirements of ASTM D2170/D2170M-18 shall apply subject to the modifications set out in [Appendix A](#) for Australian conditions.



Appendix A  
(normative)

Variations to ASTM D2170/D2170M-18 for Australia

A.1 Scope

This Appendix lists the normative variations to ASTM D2170/D2170M-18.

A.2 Variations

The following modifications are required for Australian conditions:

Element	Instruction/New text
CI 1.1	<p><i>Delete</i> clause and <i>replace</i> with the following:</p> <p>This Test Method covers procedures for the determination of the kinematic viscosity of cutback bitumens (referred to as “liquid asphalts”), flux oils (referred to as “road oils”) and the distillation residues of cutback bitumens at 60 °C. It also covers procedures for the characterization of kinematic viscosity of bitumens (referred to as “liquid asphalt binders”) at 135 °C. It is applicable in the kinematic viscosity range from 6 mm<sup>2</sup>/s to 100 000 mm<sup>2</sup>/s [cSt]. This kinematic viscosity range is approximately equal to a viscosity range of 0.006 Pa.s to 100 Pa.s.</p>
CI 1.2	<p>1 First sentence, <i>delete</i> “viscosity” and <i>replace</i> with “dynamic viscosity (referred to as “viscosity”)”.</p> <p>2 Delete Note 1.</p> <p>3 Delete Note 2.</p>
CI 1.4	<p><i>Delete</i> clause and <i>replace</i> with the following:</p> <p>Values are stated in either SI units or imperial units in this Test Method. All measurements shall be made using SI units.</p>
CI 2.1	<p><i>Delete</i> clause and <i>replace</i> with the following:</p> <p>The following documents are referred to in this Test Method:</p> <p>AS/NZS 2341.1, <i>Method of testing bitumen and related roadmaking products, Part 1: Precision data — Definitions</i></p> <p>AS/NZS 2341.21, <i>Method of testing bitumen and related roadmaking products, Method 21: Sample preparation</i></p> <p>ASTM D2162, <i>Standard Practice for Basic Calibration of Master Viscometers and Viscosity Oil Standards</i></p> <p>ASTM E1, <i>Standard Specification for ASTM Liquid-in-Glass Thermometers</i></p> <p>NOTE—For referenced ASTM standards, visit the ASTM website, <a href="http://www.astm.org">www.astm.org</a>, or contact ASTM Customer Service at <a href="mailto:service@astm.org">service@astm.org</a>. For Annual Book of ASTM Standards volume information, refer to the standard’s Document Summary page on the ASTM website.</p>
CI 3.2	<p><i>Delete</i> clause.</p>
Section 5	<p><i>Delete</i> section, including Clause 5.1 and Note 3.</p>
CI 6.2	<p><i>Delete</i> clause and <i>replace</i> with the following:</p> <p><i>Thermometers</i> — Selected in accordance with the following as appropriate:</p> <p>(a) For determinations at 60 °C — ASTM Kinematic Viscosity Thermometer 47C (IP 35C) as specified in ASTM E1.</p>



Element	Instruction/New text
Cl 6.2 (cont'd)	<p>(b) For determinations at 135 °C — ASTM Kinematic Viscosity Thermometer 110C (IP 93C) as specified in ASTM E1.</p> <p>NOTE 3(A)—Other thermometric devices are permissible provided that their accuracy, precision and sensitivity are equal to or better than those of the thermometer prescribed.</p>
Cl 6.2.1	Delete clause, including Note 4.
Cl 6.2.2	Delete clause, including Note 5.
Cl 6.2.3	Delete clause, including Note 6.
Cl 6.3	<p>1 Delete last sentence and <i>replace</i> with the following:</p> <p>The efficiency of the stirring and the balance between heat losses and heat input shall 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.</p> <p>2 Delete Note 7 text and <i>replace</i> with the following:</p> <p>Water is a suitable bath medium for determinations at 60 °C. Transparent paraffinic or silicone oils with a suitably high flashpoint (&gt; 215 °C) have been found suitable for determinations at 135 °C.</p>
Cl 6.4	Delete second sentence.
Cl 6.4.1	Delete clause.
Cl 6.4.1.1	Delete clause.
Cl 7.1	<p>Delete clause and <i>replace</i> with the following:</p> <p>Bitumen and cutback bitumen samples shall be prepared in accordance with AS/NZS 2341.21.</p>
Cl 7.1.1	Delete clause.
Cl 7.1.1.1	Delete clause.
Cl 7.1.1.2	Delete clause.
Cl 7.1.1.3	Delete clause.
Cl 7.1.1.4	Delete clause.
Cl 7.1.2	Delete clause.
Cl 7.1.2.1	Delete clause.
Cl 7.1.2.2	Delete clause.
Cl 8.2	<p>Delete clause and <i>replace</i> with the following:</p> <p>Maintain the bath at the test temperature to within ±0.1 °C. Apply the necessary corrections, if any, to all thermometer readings.</p>
Cl 8.8	<p>Delete clause, including Note 8, and <i>replace</i> with the following:</p> <p>The following procedure has been found satisfactory for cleaning the viscometer. Remove the viscometer from the bath, invert it and hang it in the oven until the bitumen is drained thoroughly from it. The viscometer can then thoroughly be cleaned by washing with an appropriate solvent completely miscible with the sample, followed by, where necessary, a completely volatile solvent (cleaning agents are available commercially). The tube can be dried by sucking a slow stream of room air, through the capillary for at least 2 min.</p>
Cl 8.8.1	Delete clause.
Cl 9.1	Delete Note 9.
Cl 10.1	<p>Delete clause, including Equation (2), and <i>replace</i> with the following:</p> <p>The following information shall be reported:</p> <p>(a) Kinematic viscosity, in millimetres squared per second (mm<sup>2</sup>/s) to three significant figures.</p> <p>(b) Test temperature, in degrees Celsius (°C).</p> <p>(c) Dynamic viscosity, in Pascal seconds (Pa.s) to three significant figures (where required).</p>



Element	Instruction/New text
Cl 10.1 (cont'd)	(d) Reference to this Test Method, i.e. AS 2341.3.
Cl 11.1	<p>Delete clause and <i>replace</i> with the following:</p> <p>The following should be used for determining the acceptability of results (refer to AS/NZS 2341.1) (95 % probability):</p> <p>(a) <i>Repeatability</i> — Duplicate results by the same operator using the same equipment should not be considered suspect unless they differ by more than 7 % of their mean.</p> <p>(b) <i>Reproducibility</i> — Results submitted by two laboratories should not be considered suspect unless the two results differ by more than 12 % of their mean.</p>
Tbl 1	Delete table, including Note 1 and footnotes.
Cl 11.2	Delete clause.
Anx A1	<p>Delete heading, and <i>replace</i> with the following:</p> <p><b>A1 CALCULATION OF DYNAMIC VISCOSITY OF A NEWTONIAN LIQUID</b></p>
Anx A1.1	<p>Delete annex and <i>replace</i> with the following:</p> <p>The following conversion equation shall be used when converting kinematic viscosity to dynamic viscosity (in Pa.s):</p> $\eta = \frac{v \times \rho \times 10^{-6}}{1 + f(T - 15)}$ <p>where</p> <p><math>\eta</math> = dynamic viscosity, in Pa.s</p> <p><math>v</math> = kinematic viscosity in mm<sup>2</sup>/s</p> <p><math>\rho</math> = density at 15 °C in kg/m<sup>3</sup></p> <p><math>f</math> = coefficient of expansion in °C<sup>-1</sup></p> <p>= 0.00061 °C<sup>-1</sup> for bitumen and related products</p> <p><math>T</math> = test temperature in °C</p>
Anx A1.2	Delete annex.
Anx A1.3	Delete annex.
Anx A2.2.1	<p>Delete second sentence and <i>replace</i> with the following:</p> <p>The kinematic viscosity range is based on a 60 s minimum flow time in this method.</p>
Anx A2.3.1	First sentence, <i>delete</i> “Section 7” and <i>replace</i> with “Section 8”.
Anx A2.3.3	Delete second sentence.
Anx A2.3.4	<p>Delete annex and <i>replace</i> with the following:</p> <p>Allow the viscometer to remain in the constant temperature bath for 30 min ± 5 min to ensure the sample reaches temperature equilibrium.</p>
Appendix X1	Delete appendix.

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ISBN 978 1 76072 816 8

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