



Methods of testing bitumen and related roadmaking products

Method 12: Determination of penetration



AS 2341.12:2020

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 2341.12:2019.

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ISBN 978 1 76072 817 5



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Method 12: Determination of penetration

Originated as AS 2341.12—1982.
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 2341.12—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 the penetration of bitumen and related roadmaking products. It is applicable to bituminous materials with penetrations less than or equal to 200 (0.1 mm).

This Test Method references ASTM D5/D5M-19, *Standard Test Method for Penetration of Bituminous Materials*, for use in Australia, subject to modifications set out in [Appendix A](#).

[Appendix A](#) lists the variations to ASTM D5/D5M-19, for the application of this Test Method in Australia.

Users of this Test Method are advised that they must purchase ASTM D5/D5M-19 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.

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NOTES

Australian Standard®

Methods of testing bitumen and related roadmaking products

Method 12: Determination of penetration

1 Scope

The objective of this Test Method is to specify the procedures for the determination of the penetration of bitumen and related roadmaking products. It is applicable to bituminous materials with penetrations less than or equal to 200 (0.1 mm).

2 Application

ASTM D5/D5M-19 is the 2019 edition. Only the 2019 edition shall be used in accordance with this Test Method.

3 Normative references

The following normative documents are referred to in this Standard in addition to those referenced in ASTM D5/D5M-19. The following documents are referred to in the text in such a way that some or all of the content constitutes requirements of this Standard.

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

AGPT-T102, *Protocol for Handling Modified Binders in Preparation for Laboratory Testing*

4 Terms and definitions

For the purpose of this document the terms and definitions in this Test Method and ASTM D5/D5M-19 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 D5/D5M-19 shall apply subject to the modifications set out in [Appendix A](#) for Australian conditions.

Appendix A (normative)

Variations to ASTM D5/D5M-19 for Australia

A.1 Scope

This Appendix lists the normative variations to ASTM D5/D5M-19.

A.2 Variations

The following modifications are required for Australian conditions:

Element	Instruction/New text
CI 1.2	<i>Delete</i> clause, including Note 1.
CI 1.3	<i>Delete</i> clause and <i>replace</i> with the following: Values are stated in either SI units or imperial units in this Test Method. All measurements shall be made using SI units.
CI 1.6	<i>Delete</i> clause.
CI 2.1	<i>Delete</i> clause and <i>replace</i> with the following: The following documents are referred to in this Test Method: AS/NZS 2341.1, <i>Method of testing bitumen and related roadmaking products, Part 1: Precision data — Definitions</i> AS/NZS 2341.21, <i>Method of testing bitumen and related roadmaking products, Method 21: Sample preparation</i> AGPT-T102, <i>Protocol for Handling Modified Binders in Preparation for Laboratory Testing</i> ANSI B46.1, <i>Surface Texture</i> NOTE—Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org . ASTM E1, <i>Standard Specification for ASTM Liquid-in-Glass Thermometers</i> ASTM E2251, <i>Standard Specification for Liquid-in-Glass ASTM Thermometers with Low-Hazard Precision Liquids</i> NOTE—For referenced ASTM standards, visit the ASTM website, www.astm.org , or contact ASTM Customer Service at service@astm.org . For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.
CI 2.2	<i>Delete</i> clause.
CI 2.3	<i>Delete</i> clause.
CI 3.1	<i>Delete</i> clause.
CI 3.2.1	<i>Delete</i> clause and <i>replace</i> with the following: <i>penetration</i> — consistency of a bituminous material expressed as the distance in tenths of a millimetre (0.1 mm) that a standard needle vertically penetrates a sample of the material under known conditions of loading, time, and temperature.
CI 5.1	<i>Delete</i> Note 2.
CI 6.1.1	<i>Delete</i> clause.
CI 6.2.1	Ninth sentence, <i>delete</i> “or ISO 468”.
CI 6.2.2	<i>Delete</i> clause.
CI 6.3	<i>Delete</i> clause, including table and Note 3, and <i>replace</i> with the following:

Element	Instruction/New text										
Cl 6.3 (cont'd)	<p><i>Sample container</i> — A metal, cylindrical and flat-bottomed container shall be used.</p> <p>It shall have no noticeable rocking movement when placed on a flat surface (e.g. a glass plate) and a rocking force is applied by hand.</p> <p>The sample container should nominally have a diameter of 55 mm and an internal depth of 35 mm.</p>										
Cl 6.3.1	Delete clause.										
Cl 6.101 (new)	<p>After Clause 6.5, <i>add</i> the following new clause:</p> <p>Satellite bath — As an alternative to the transfer dish, a satellite bath (which is directly linked by hoses to the water bath) may be used.</p> <p>The satellite bath shall have sufficient depth of water to cover the sample container. It shall be provided with some means for obtaining a firm bearing and prevent rocking of the container. Its temperature shall be maintained at the test temperature by means of water recirculation from the water bath.</p>										
Cl 6.7	Delete third sentence.										
Cl 6.7.1	<p>Delete clause and <i>replace</i> with the following:</p> <p>Suitable thermometers include:</p> <table> <tr> <th>ASTM Number</th><th>Range</th></tr> <tr> <td>17C</td><td>19 °C to 27 °C</td></tr> <tr> <td>63C</td><td>–8 °C to + 32 °C</td></tr> <tr> <td>64C</td><td>25 °C to 55 °C</td></tr> <tr> <td>90C or IP39C</td><td>0 °C to 30 °C</td></tr> </table>	ASTM Number	Range	17C	19 °C to 27 °C	63C	–8 °C to + 32 °C	64C	25 °C to 55 °C	90C or IP39C	0 °C to 30 °C
ASTM Number	Range										
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64C	25 °C to 55 °C										
90C or IP39C	0 °C to 30 °C										
Cl 6.7.2	Delete clause.										
Cl 7.1	<p>Delete clause and <i>replace</i> with the following:</p> <p>Bitumen samples shall be prepared for testing in accordance with AS/NZS 2341.21. Polymer modified binder (PMB) samples shall be prepared for testing in accordance with AGPT-T102.</p>										
Cl 7.2	<p>Delete clause, including Note 5, and <i>replace</i> with the following:</p> <p>Pour the sample into two sample containers to a depth such that, when cooled to the temperature of test, the depth of sample is at least 10 mm greater than the depth to which the needle is expected to penetrate.</p> <p>NOTE 5—If sufficient material is available, the sample container should be filled to near the brim.</p>										
Cl 7.3	<p>Delete clause, including Note 6, and <i>replace</i> with the following:</p> <p>Allow the containers to cool in air at room temperature on a non-conductive surface for 60 min ± 5 min. Then place the two samples together with the transfer dish, if used, in the water bath maintained at the prescribed temperature of the test. Samples shall remain in the water bath for 60 min ± 5 min.</p> <p>NOTE 6—If conditions warrant, it is appropriate to loosely cover each container as a protection against dust.</p>										
Cl 8.1	Delete third sentence.										
Cl 9.1	<p>Delete second sentence and <i>replace</i> with the following:</p> <p>Use the short (standard) needle for the test.</p>										
Cl 9.2	<p>Delete third sentence and <i>replace</i> with the following:</p> <p>If the tests are to be made with the penetrometer outside the bath, place the sample container in the transfer dish or satellite bath, cover the container completely with water from the constant temperature bath and place the transfer dish or satellite bath on the stand of the penetrometer.</p>										
Cl 9.5	Delete clause, including Note 7, and <i>replace</i> with the following:										

Element Instruction/New text**CI 9.5
(cont'd)**

Make three determinations of penetration at points on the surface of the sample not less than 10 mm from the side of the container and not less than 10 mm apart. If the transfer dish is used, return the sample and move the dish to the constant temperature bath between determinations. Use a clean needle for each determination.

If the range of the three penetrations, to the nearest whole penetration, differs by more than the value below, repeat Clauses 9.2 to 9.5, using the second sample container.

Penetration (0.1 mm)	Maximum difference between highest and lowest results (0.1 mm)
0 to 49	2
50 to 149	4
150 to 200	12

CI 10.1 *Delete* clause, including table, and *replace* with the following:

The following information shall be reported:

- (a) Average of three measurements of penetration to the nearest whole number. Average penetration results shall be reported in units of 0.1 mm.
- (b) Test conditions.
- (c) Reference to this Australian Standard, i.e. AS 2341.12.

CI 11.1 *Delete* clause, including table, and *replace* with the following:

The following criteria should be used for determining the acceptability of results for penetrations of bitumen in the range of 20 to 200 (0.1 mm) under the conditions of 25 °C (temperature), 100 g (load) and 5 s (time), as defined in AS/NZS 2341.1 (95 % probability):

- (a) Repeatability — Two test results (each being the mean of three penetration measurements) obtained in the same laboratory should not be considered suspect unless the difference between them is more than the greater of 1 (0.1 mm), or 3 % of their mean.
- (b) Reproducibility — Two test results obtained in different laboratories should not be considered suspect unless the difference between them is more than the greater of 4 (0.1 mm), or 8 % of their mean.

CI 11.2 *Delete* clause.

CI 11.3 *Delete* clause.

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ISBN 978 1 76072 817 5

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