Designation: D5100/D5100M – 95a (Reapproved 2010)$^{\varepsilon 1}$

Standard Test Method for
Adhesion of Mineral Aggregate to Hot Bitumen[1]

This standard is issued under the fixed designation D5100/D5100M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ε^1 NOTE—Units information was corrected editorially in July 2010.

1. Scope

1.1 This test method determines the adhesion of mineral aggregate when applied over a pour coat of hot bitumen on a roof membrane.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]
D226 Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
D312 Specification for Asphalt Used in Roofing
D450 Specification for Coal-Tar Pitch Used in Roofing, Dampproofing, and Waterproofing
D1079 Terminology Relating to Roofing and Waterproofing

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, see Terminology D1079.

4. Summary of Test Method

4.1 A small section of roof surface is fabricated with roofing felt or membrane using measured amounts of a bituminous pour coat and mineral aggregate surfacing. The assembly is allowed to cool, the loose aggregate is removed and weighed, and the mass of adhered aggregate is calculated and reported.

5. Significance and Use

5.1 The quantities of mineral aggregate adhered to the surface of a roof vary with the characteristics and total amount of the aggregate. Mineral aggregate shields bituminous membranes from solar radiation. Unadhered mineral aggregate can be displaced by wind, water, and traffic, exposing the bitumen.

5.2 This test method provides a laboratory means of determining and recording the mass of aggregate that adheres to a bituminous pour coat.

6. Apparatus

6.1 *Steel Tray,* measuring 143 mm [5⅝ in.] ± 1 % square by 13 mm [0.5 in.] ± 10 % in height.

6.2 *Scales,* for weighing bitumen and mineral aggregate, balance 1.00-kg [2.2-lb] capacity, sensitive to 0.01 % of the capacity.

6.3 *Containers,* for hot bitumen and mineral aggregate (1-L [1-qt] capacity).

7. Procedure

7.1 Cut a piece of saturated felt to just cover the bottom of the steel tray; the saturated felt shall be Type 1 complying with Specification D226.

7.2 Attach the saturated felt to the inside of the tray with a thin film of a release agent such as silicone stopcock grease or petroleum jelly. Lightly grease the insides of the sides of the tray with the same material.

7.3 Weigh out 400 g [0.88 lb] of gravel, chert, or trap rock, or 300 g [0.66 lb] of slag mineral aggregate surfacing ±1 %. Record this mass as *A*. This is equivalent to 19.5 kg/m^2 [400 lb/100 ft^2] and 14.6 kg/m^2 [300 lb/100 ft^2], respectively.

7.4 Apply top pour coat of bitumen uniformly according to quantities and temperatures listed in Table 1.

7.5 Immediately apply mineral aggregate into hot bitumen and spread uniformly over entire surface within the tray. Allow the assembly to cool for 30 min minimum.

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[1] This test method is under the jurisdiction of ASTM Committee D08 on Roofing and Waterproofing and is the direct responsibility of Subcommittee D08.03 on Surfacing and Bituminous Materials for Membrane Waterproofing and Built-up Roofing.
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[2] 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.

TABLE 1 Bitumen Application Rates and Temperatures

ASTM Standard	Type	Application Temperature °C [°F]	Application Rate
Specification D312	I	177 ± 14 [350± 25]	60 g/tray or 2.9 kg/m²
	II	204 ± 14 [400± 25]	[60 lb/100 ft²]
	III	218 ± 14 [425 ± 25]	
	IV	232 ± 14 [450± 25]	
Specification D450	I	182 ± 14 [360 ± 25]	75 g/tray or 3.7 kg/m²
	III	191 ± 14 [375 ± 25]	[75 lb/100 ft²]

7.6 Turn sample upside down and collect loose aggregate. Weigh the loose aggregate and record this mass as B.

7.7 Repeat the procedure three more times, recording each individual mass determination.

8. Calculation

8.1 Calculate the mass of the adhered aggregate for each test as:

$$C = A - B \qquad (1)$$

where:

C = mass of the adhered aggregate in pounds per square foot ($4.88 (A - B)$ gives the mass of the adhered aggregate in kg/m²).

8.2 Calculate the mean mass of the adhered aggregate C_m by dividing the sum of the four determinations by four.

8.3 Calculate an estimate of the standard deviation s by:

$$s = \sqrt{\frac{4 \sum C^2 - \left(\sum C \right)^2}{12}} \qquad (2)$$

8.4 Calculate the standard error of the mean S by:

$$S = \frac{s}{2} \qquad (3)$$

9. Report

9.1 Report the following information:

9.1.1 The type of aggregate, including screen grading, and the type of bitumen used.

9.1.2 The mass of the adhered aggregate for any single determination as $C_m \pm 3.18 \times s$ (95 % level of confidence).

9.1.3 The mean mass of adhered aggregate as $C_m \pm 3.18 \times S$.

10. Precision and Bias

10.1 *Precision*—The precision of this test method depends on the characteristics of the mineral aggregate. The precision of any single test series can be estimated from the statistics required by the test method. Differences between laboratories can be tested with standard statistical techniques such as the *null hypothesis*.

10.2 *Bias*—The procedure of this test method for the adhesion of mineral aggregate to hot bitumen has no bias because the quantity of aggregate adhered in the laboratory is defined by this test method.

11. Keywords

11.1 adhered mineral aggregate; hot bitumen; roof membrane