



Designation: D4074/D4074M – 11 (Reapproved 2022)

Standard Test Method for Bitumen and Aggregate Content of Bitumen-Aggregate Mixtures From Roofing Samples¹

This standard is issued under the fixed designation D4074/D4074M; 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.

1. Scope

1.1 This test method covers the determination of the bitumen content of adhered aggregate surfacing on a roof, and the approximate mass per unit area of the flood coat and adhered aggregate.

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 nonconformance 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D71 Test Method for Relative Density of Solid Pitch and Asphalt (Displacement Method)

D2829/D2829M Practice for Sampling and Analysis of Existing Built-Up Roof Systems

¹ This test method is under the jurisdiction of ASTM Committee D08 on Roofing and Waterproofing and is the direct responsibility of Subcommittee D08.20 on Roofing Membrane Systems.

Current edition approved May 1, 2022. Published May 2022. Originally approved in 1985. Last previous edition approved in 2015 as D4074/D4074M – 11 (2015). DOI: 10.1520/D4074_D4074M-11R22.

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.

3. Summary of Test Method

3.1 The proportions of bitumen and aggregate in a mixture are determined from their relative densities and the relative density of their mixture.

4. Significance and Use

4.1 This test method offers a convenient alternative to solvent extraction for the approximate determination of top-coating bitumen and adhered aggregate in roofing samples, particularly when the bitumen is coal-tar pitch.

5. Apparatus

5.1 *Beaker*, 500 mL minimum capacity, without a pour spout.³

5.2 *Glass Cover Plate*, 127 by 127 by 3 mm [5 by 5 by 0.12 in.].

5.3 *Balance*, 1000 \pm 0.1 g capacity.

6. Materials

6.1 *Isopropyl Alcohol*, (CH₃)₂CHOH, commercial grade.

6.2 *Paper Cups*, paraffin-coated, 61 mm [2.4 in.] in diameter by 76 in. [3 mm] high, 150 mL [5 oz] capacity.

7. Sampling

7.1 Obtain samples in the field in accordance with Practice **D2829/D2829M**.

8. Procedure

8.1 Cut a 100-mm [5 $\frac{5}{8}$ -in.] square specimen from the roofing sample and collect any associated loose, bitumen-free aggregate in a tared paper cup.

8.2 Add additional loose, bitumen-free aggregate to the cup from the remaining sample, if necessary, to obtain a 100 to

³ The sole source of supply of the beaker, Kimble Chase, part #14020-600 Kimax 600 mL without spout, known to the committee at this time is Fisher Scientific, 1022 Spruce St., P.O. Box 1502, Vineland, NJ 08362-1502. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.

200-g specimen of the aggregate. Weigh the aggregate to the nearest 0.1 g and record as M_a .

8.3 Place the roofing specimen on aluminum foil or release paper and carefully remove the adhered aggregate and top coating with a hot knife or scraper without damaging the top felt.

NOTE 1—This will usually leave 200 to 400 g/m² [4 to 8 lb/100 ft²] of bitumen on the surface of the roofing felt.

8.4 Collect the adhered aggregate and top coating removed in 8.3 in a tared paper cup and add any associated loose, bitumen-coated aggregate. Weigh to the nearest 0.1 g and record as M_m .

8.5 Overfill the clean 500-mL beaker with isopropyl alcohol and carefully slide the glass cover plate over the top so as to exclude air. Blot the excess alcohol from the exterior of the beaker. Weigh the assembly to the nearest 0.1 g and record as T .

8.6 Remove the glass cover plate and place the aggregate specimen from 8.2 in the beaker. Again, overfill the beaker with alcohol, and carefully replace the cover plate. Blot the excess alcohol from the exterior of the beaker. Weigh the assembly to the nearest 0.1 g and record as W_a .

8.7 Discard the contents of the beaker and rinse with alcohol. Place the adhered aggregate and top coating specimen from 8.4 in the beaker. Overfill with alcohol, replace the cover plate, and blot the exterior as before. Weigh the assembly to the nearest 0.1 g and record as W_m .

8.8 Recover a 10 to 20-g specimen of the top coating bitumen from the remaining roofing sample. Prepare cast cubes and weigh them suspended in air and suspended in isopropyl alcohol in accordance with Sections 8 and 9 of Test Method D71, using alcohol in place of water. Record the weight in air as a , and the weight in alcohol as b .

NOTE 2—If a clean aggregate or bitumen sample cannot be obtained, use relative densities of 3.36 for gravel, 3.18 for slag, 1.30 for asphalt, and 1.65 for coal-tar pitch.

9. Calculation

9.1 Calculate the relative density of the aggregate (S_a) as follows:

$$S_a = M_a / (T + M_a - W_a) \quad (1)$$

where:

M_a = weight of the aggregate in air, g,
 T = weight of the covered beaker filled with alcohol, g, and
 W_a = weight of the covered beaker containing the aggregate and filled with alcohol, g.

9.2 Calculate the relative density of the aggregate-bitumen mixture (S_m) as follows:

$$S_m = M_m / (T + M_m - W_m) \quad (2)$$

where:

M_m = weight of the mixture in air, g,
 T = weight of the covered beaker filled with alcohol, g, and
 W_m = weight of the covered beaker containing the mixture and filled with alcohol, g.

9.3 Calculate the relative density of the bitumen (S_b) as follows:

$$S_b = a / (a - b) \quad (3)$$

where:

a = weight of the bitumen cube in air, g, and
 b = weight of the bitumen cube in alcohol, g.

9.4 Calculate the bitumen fraction of the mixture (p) as follows:

$$p = S_b(S_a - S_m) / S_m(S_a - S_b) \quad (4)$$

9.5 Calculate the approximate mass of top coating bitumen (B) as follows:

$$B = pM_m \quad (5)$$

9.6 Calculate the mass of adhered aggregate (A) as follows:

$$A = M_m - B \quad (6)$$

10. Report

10.1 Report the approximate mass per unit area of bitumen. If the 100 by 100-mm specimen was used, multiply B by 100 to get g/m². If the 5⁵/₈ by 5⁵/₈-in. specimen was used, B expressed in grams is numerically equivalent to lb/100 ft².

10.2 Report the approximate mass per unit area of aggregate. If the 100 by 100-mm specimen was used, multiply A by 100 to get g/m². If the 5⁵/₈ by 5⁵/₈-in. specimen was used, A expressed in grams is numerically equivalent to lb/100 ft².

10.3 Report the type of bitumen and aggregate if known.

11. Precision and Bias

11.1 The precision of this test method indicates the probable error of a single determination is $\pm 1.4\%$ of the true value. Duplicate samples should not differ by more than 2% between laboratories.

11.2 There are no known biases in this test method.

12. Keywords

12.1 aggregate; asphalt; bitumen; built-up roofing; coal-tar pitch