Standard Test Method for
Bitumen and Aggregate Content of Bitumen-Aggregate Mixtures From Roofing Samples[1]

This standard is issued under the fixed designation D 4074; 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.

ε¹ NOTE—Footnote 1 was changed editorially in July 1996.

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 inch-pound units are to be regarded as 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 and regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*
D 71 Test Method for Relative Density of Solid Pitch and Asphalt (Displacement Method)[2]
D 2829 Practice for Sampling and Analysis of Built-Up Roofs[2]

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 capacity, without a pour spout.[3]

5.2 *Glass Cover Plate*, 5 × 5 × 0.12 in. (127 by 127 by 3 mm).

5.3 *Balance*, 1000 ± 0.1-g capacity.

6. Materials

6.1 *Isopropyl Alcohol*, $(CH_3)_2$ CHOH, commercial grade.

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

7. Sampling

7.1 Obtain samples in the field in accordance with Practice D 2829.

8. Procedure

8.1 Cut either a 5⅝-in. or a 100-mm 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 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 4 to 8 lb/100 ft² (200 to 400 g/m²) 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 D 71, 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:

$$S_a = M_a /(T + M_a - W_a) \tag{1}$$

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:

$$S_m = M_m /(T + M_m - W_m) \tag{2}$$

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:

$$S_b = a/(a - b) \tag{3}$$

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:

$$p = S_b (S_a - S_m)/S_m (S_a - S_b) \tag{4}$$

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

$$B = pM_m \tag{5}$$

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

$$A = M_m - B \tag{6}$$

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/m^2. If the 5⅝ by 5⅝-in. specimen was used, B expressed in grams is numerically equivalent to lb/100 ft^2.

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/m^2. If the 5⅝ by 5⅝-in. specimen was used, A expressed in grams is numerically equivalent to lb/100 ft^2.

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 ± 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