



Designation: D 228 – 00b

Standard Test Methods for Asphalt Roll Roofing, Cap Sheets, and Shingles¹

This standard is issued under the fixed designation D 228; 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 These test methods cover the procedures for the physical testing and analyses of roofing and shingles composed of asphalt saturated or glass fiber felt coated to various extents with asphalt and having the coated portion surfaced with powders, laminates or granules.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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:

- D 95 Test Method for Water in Petroleum Products and Bituminous Materials by Distillation²
- D 224 Specification for Smooth-Surfaced Asphalt Roll Roofing (Organic Felt)³
- D 225 Specification for Asphalt Shingles (Organic Felt) Surfaced with Mineral Granules³
- D 249 Specification for Asphalt Roll Roofing (Organic Felt) Surfaced with Mineral Granules³
- D 371 Specification for Asphalt Roll Roofing (Organic Felt) Surfaced with Mineral Granules; Wide Selvage³
- D 1079 Terminology Relating to Roofing, Waterproofing, and Bituminous Materials³
- D 2178 Specification for Asphalt Glass Felt Used in Roofing and Waterproofing³
- D 2626 Specification for Asphalt-Saturated and Coated Organic Felt Base Sheet Used in Roofing³
- D 3018 Specification for Class A Asphalt Shingles Surfaced with Mineral Granules³
- D 3462 Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules³
- D 3909 Specification for Asphalt Roll Roofing (Glass Felt)

Surfaced with Mineral Granules³

D 4601 Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing³

D 4897 Specification for Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing³

D 6380 Specification for Asphalt Roll Roofing (Organic Felt)³

3. Terminology

3.1 For definitions of terms used in this test method, see Terminology D 1079.

4. Significance and Use

4.1 These test methods cover the sampling, physical testing, and compositional analyses of asphalt roofing products fabricated with asphalt coatings. Other components may include, but are not limited to, felts, mats, films, foils, mineral stabilizers, papers, and mineral surfacing.

4.2 Five random samples are required from lots equal to or less than 1000 packages. The number of samples required for lots greater than 1000 packages is dependent on the variation in the unit mass within the lot and is determined by the two-step sampling plan in 6.5.

4.3 The results of a visual examination, physical testing and compositional analysis are required for each sample. The analytical data are further used to compute the probable minimum and the probable range for the average mass of each of the components.

5. Types of Roofing

5.1 Asphalt coated roll roofing and shingles are divided into the following types for the purposes of this test method (see Fig. 1).

5.1.1 *Type 1*—A single thickness of glass felt, coated with asphalt and mineral surfacing such as in Specifications D 2178, D 3462, D 3909, D 4601 and D 4897. The backing material (designated “Fine Mineral Surfacing” in Fig. 1) shall be permitted to be any suitable material that prevents these products from sticking together while packaged.

5.1.2 *Type 2*—A single thickness of asphalt saturated felt coated with asphalt and mineral surfacing such as in Specifications D 224, D 225, D 249, D 2626, and some of the products in Specification D 6380. The backing material (designated “Fine Mineral Surfacing” in Fig. 1) shall be permitted to be any suitable material that prevents these products from sticking

¹ These test methods are under the jurisdiction of ASTM Committee D08 on Roofing, Waterproofing, and Bituminous Materials and are the direct responsibility of Subcommittee D08.02 on Prepared Roofing, Shingles, and Siding Materials.

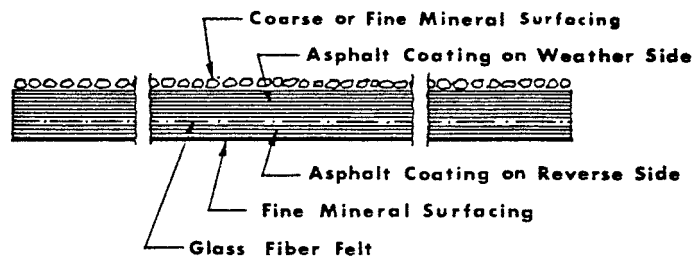
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² *Annual Book of ASTM Standards*, Vol 05.01.

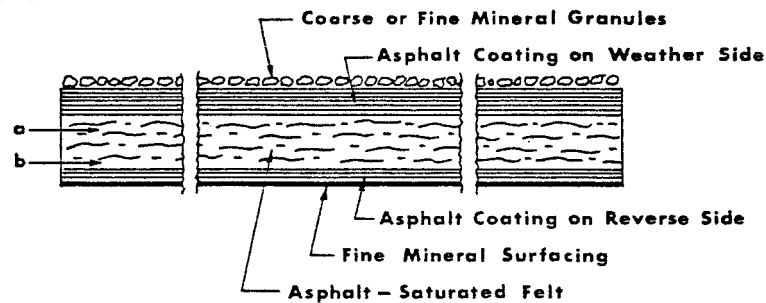
³ *Annual Book of ASTM Standards*, Vol 04.04.

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Type 1



Type 2



Type 3

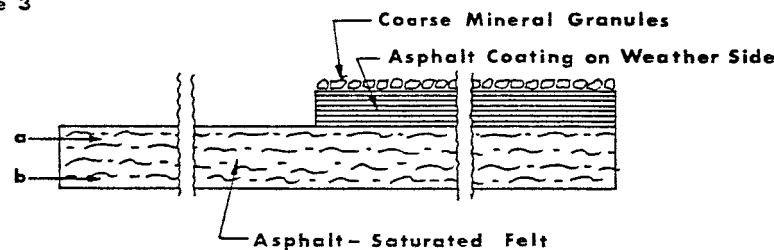


FIG. 1 Types of Asphalt-Coated Roll Roofing and Shingles

together while packaged.

5.1.3 *Type 3*—Similar to Type 2, but asphalt coated and surfaced with mineral granules for part of one side of the saturated felt such as in Specification D 371.

6. Sampling

6.1 The rolls or bundles selected in accordance with this section constitute the representative sample used in Sections 7 and 8. See Fig. 2.

6.2 The lot is defined as a shipment or fraction thereof representing a product of the same kind, class, and mass.

6.3 Select five rolls or packages from the lot at random. Determine the average net mass per g/m^2 ($\text{lb}/100 \text{ ft}^2$) and the standard deviation in accordance with 7.1 to 7.8.

6.4 If the lot is 1000 or fewer rolls or packages proceed to Section 7. If the lot is 1001 or greater in number, follow the second part of the sampling plan in 6.5.

6.5 Calculate the required number of samples based on the standard deviation (s) of the preliminary sampling by:

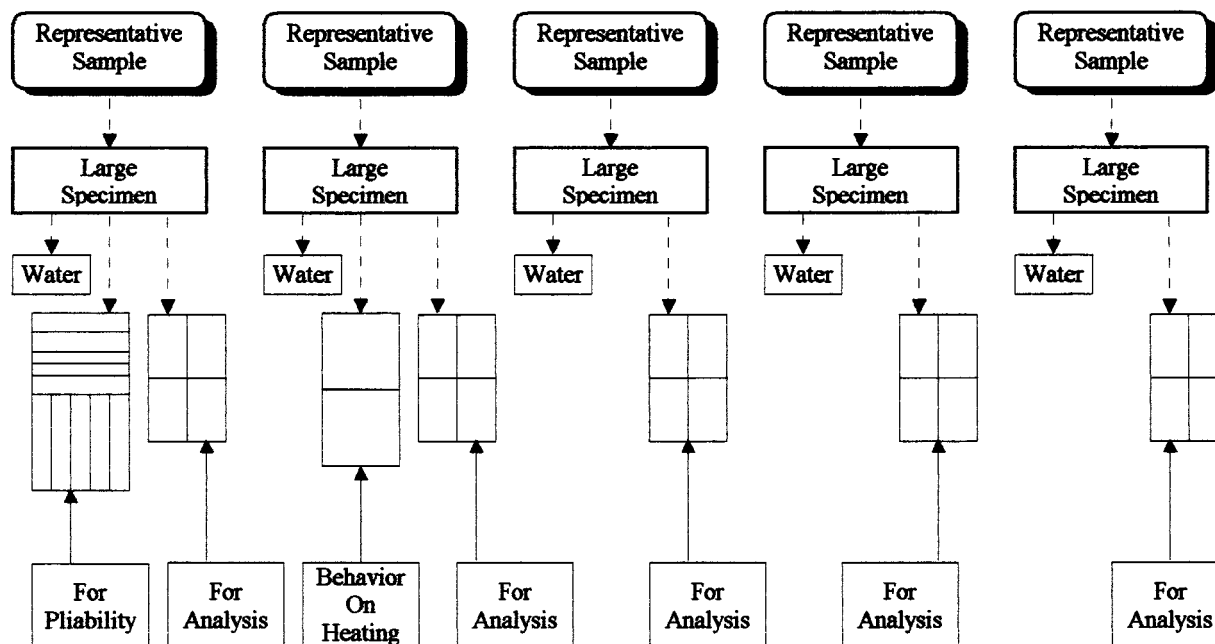
$$n = \frac{t^2 s^2}{d^2} \quad (1)$$

where:

n = total number of samples required ($n - 5$ more rolls or packages must be selected at random as samples),

t = test statistic for number of samples in the preliminary test series for 4° and a 95 % confidence that the calculated average mass will not exceed d ($t = 2.776$), and

d = 100 g/m^2 ($2 \text{ lb}/100 \text{ ft}^2$) (the mean mass obtained from the analysis should be within $\pm 100 \text{ g/m}^2$ of the true value, with 95 % confidence).



In Section 6, initial "Representative Samples" are selected (typically 5 per lot). These are full bundles or rolls. These are the samples used in Section 7.

In Section 8, one large "Specimen" is taken from each Representative Sample (full shingles from Section 7.5 or a portion of each roll selected in Section 6). These are confirmed to be within 1.5 % of the mass per area (from Section 7.6) for the corresponding Representative Sample.

In Section 9, (where product standards require measurement of water content per D 95) 50 gram samples are taken from each "Large Specimen" for determination of water.

In Section 10, 5 MD and 5 CD small test specimens are cut from one of the "Large Specimens" for evaluation of pliability.

In Section 11, 2 test specimens are cut from one of the "Large Specimens" for evaluation of Behavior on Heating.

In Section 12, small test specimens (3 for glass felt, 4 for organic felt) are cut from each of the "Large Specimens" for "analysis" by Section 13 (for glass felt) or by Section 14 (for organic felt).

FIG. 2 Sample selection summary and flow diagram
(See individual sections for sample selection details)

7. As Received Mass and Area Determinations, All Types of Roofing

7.1 Gross Mass—Determine and record the mass of each roll or package in the sample to the nearest 0.1 kg (0.2 lb).

7.2 Net Mass—Disassemble each package or unroll each roll; shake off any loose surfacing and determine and record the net mass of all the shingles or the entire roll to the nearest 0.1 kg (0.2 lb.). Where a product standard requires it, the loose surfacing is to be collected and the mass determined.

7.3 Packaging and Fixture Mass—Determine and record the mass to the nearest 0.1 kg (0.2 lb) of the packaging and all associated fixtures shipped with the roll or package, such as nails and adhesive.

7.4 Dimensions of Roll Products—Measure and record the length and width of each roll of roofing and the selvage width to the nearest 3 mm (1/8 in.).

7.5 Shingle Count and Dimensions—From each of the representative sample packages generated in Section 6, count and record the number of shingles in each package. Select one shingle randomly from each package. Measure the width, length, and cutout dimensions for each of these selected shingles to the nearest 1 mm (1/32 in.). Calculate and record the average for each of these measurements.

7.6 Calculate the area of the roofing and the net mass of the roofing per g/m² (lb/100 ft²) in each roll or package (without packaging, cut outs or loose surfacing).

7.7 Calculate and record the average net mass of the roofing in g/m² (lb/100 ft²).

7.8 Calculate and record the estimate of the standard deviation by:

$$s = \sqrt{\frac{\sum X^2}{n-1} - \frac{(\sum X)^2}{n(n-1)}} \quad (2)$$

where:

s = unbiased estimate of the standard deviation,
 $\sum X^2$ = sum of the squares of the individual mass determinations,
 $(\sum X)^2$ = square of the sum of the individual mass determinations, and
 n = number of samples.

7.9 Calculate the 95 % confidence interval for the average mass by:

$$\frac{\sum X}{n} \pm \frac{ts}{\sqrt{n}} \quad (3)$$

where:

$\sum X$ = sum of the individual mass determinations, and
 t = appropriate t statistic for 95 % confidence and $n - 1$ dF ($t = 2.776$ for $n = 5$; consult standard reference table for other values of n).

8. Selection of Representative Specimens, All Roofing Types

8.1 Several product standards reference sampling as designated in accordance with these Test Methods for tests which are not specifically covered by Test Methods for tests which