



Designation: D2829/D2829M – 07 (Reapproved 2023)

Standard Practice for Sampling and Analysis of Existing Built-Up Roof Systems¹

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1. Scope

1.1 This practice is a guide for removing test specimens from existing built-up roofing systems in the field and for determining the *approximate* quantities of the components of that specimen (Note 1). Components determined may be:

1.1.1 Insulation components when they are part of the roof membrane system,

1.1.2 Plies of roofing felt,

1.1.3 Interply layers of bituminous material,

1.1.4 Top coating, and

1.1.5 Surfacing.

NOTE 1—This procedure is for the investigation of existing roofs and is not intended for new construction inspection.

1.2 This practice is applicable to both 914 mm [36 in.] and 1000 mm [39 $\frac{3}{8}$ in.] wide felt rolls.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.4 *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 this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* For specific precautionary information, see 6.3.2.1.

1.5 *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.*

¹ This practice 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.

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2. Referenced Documents

2.1 ASTM Standards:²

D226/D226M Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

D227/D227M Specification for Coal-Tar-Saturated Organic Felt Used in Roofing and Waterproofing

D249 Specification for Asphalt Roll Roofing (Organic Felt) Surfaced with Mineral Granules (Withdrawn 2002)³

D250 Standard Specification for Asphalt-Saturated Asbestos Felt Used in Roofing and Waterproofing (Withdrawn 1991)³

D371 Specification for Asphalt Roll Roofing (Organic Felt) Surfaced with Mineral Granules; Wide Selvage (Withdrawn 2002)³

D1079 Terminology Relating to Roofing and Waterproofing
D2178/D2178M Specification for Asphalt Glass Felt Used in Roofing and Waterproofing

D2626/D2626M Specification for Asphalt-Saturated and Coated Organic Felt Base Sheet Used in Roofing

D3158 Specification for Asphalt Saturated and Coated Organic Felt Used in Roofing (Withdrawn 1983)³

D3617/D3617M Practice for Sampling and Analysis of Built-Up Roof Systems During Application

D3672 Standard Specification for Venting Asphalt-Saturated and Coated Inorganic Felt Base Sheet Used in Roofing (Withdrawn 1990)³

D3909/D3909M Specification for Asphalt Roll Roofing (Glass Felt) Surfaced with Mineral Granules

D4601/D4601M Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing

D4897/D4897M Specification for Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing

D4990 Specification for Coal-Tar Glass Felt Used in Roofing and Waterproofing

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, refer to Terminology D1079.

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 The last approved version of this historical standard is referenced on www.astm.org.

4. Securing of Specimens in the Field

4.1 Do not disturb any surfacing in the area from which a specimen is to be taken. Cut each specimen at least 300 by 300 mm [12 by 12 in.] and use the total specimen taken in the field for laboratory analysis.

4.2 The recommended practice is to use a cutting template (Fig. 1) consisting of a 300 by 300 mm [12 by 12 in.] metal box with an open bottom. Place the box over the roof area that is to be removed, and while the template is held firmly in position, remove the surfacing around the perimeter and then cut through the roof membrane around the perimeter of the box. Lift the specimen, including all associated loose materials, from the roof and place it in a plastic bag. Fully identify the specimen. Note if the insulation is adhered to the specimen or, where insulation is not used, if bitumen is left on the deck, and the type of deck. Estimate bitumen mass per unit area left on the deck.

4.2.1 Alternate Method:

4.2.1.1 Mark each sample as at least a square 356 mm [14 in.] on a side. Try to include a seam in each membrane sample. During cold weather, use a square 457 mm [18 in.] on a side, since cold weather cutting may inadvertently break, distort, or delaminate the sample. If the roofing membrane is mechanically fastened, mark rectangular 864 by 457 mm [34 by 18 in.] sample, with the longer dimension perpendicular to the length of the ply felts. Half of these large samples can be shipped to the laboratory for analysis after the number of fasteners in the larger area is recorded.

4.2.1.2 Carefully broom off the loose aggregate, and spud off the adhered aggregate and flood coating at the perimeter of

the sample. (The application of dry ice at the areas to be spudded will ease the removal of the top coating during hot weather. A large propane torch can also be used as an alternate to the dry ice method, to melt the top coating so that it can be easily removed with a scraper and facilitate cutting.) Record the length and width of the sample. If the quantities of unadhered surfacing or total surfacing are desired, collect and package the unadhered surfacing from the sample area.

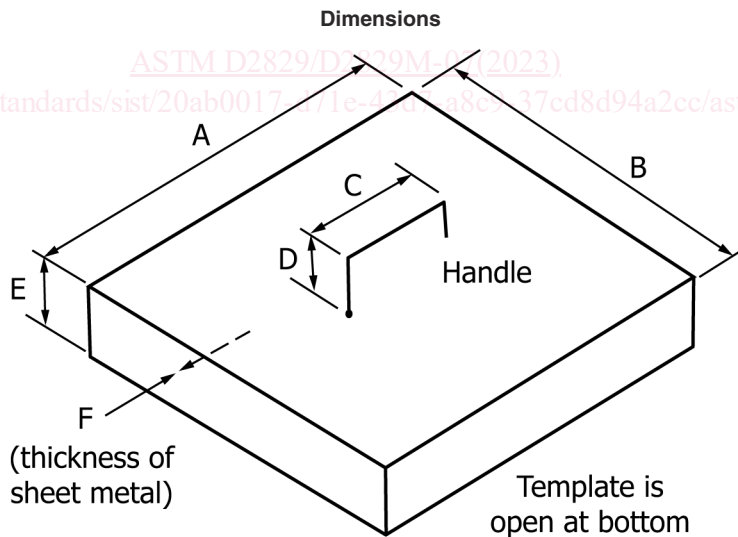
4.2.1.3 Cut through the roofing membrane with a razor knife or sharp power cutting tool, taking care not to damage the edge of the sample. Do not pound on the sample, as this might cause interply delamination. Carefully loosen and remove the roofing membrane including all adhered insulation. Observe and record the kind and degree of attachment between the roofing membrane and the insulation or deck.

4.2.1.4 Cut through the roof insulation with a blade long enough to penetrate all of the insulation layers. Observe and record the type and thickness of each insulation layer, and the percent of the sample area adhered between the layers and between the insulation and the deck and vapor retarder.

4.2.1.5 Cut and remove a small specimen of the vapor retarder, if it is present, to observe its attachment to the deck and to obtain a specimen for moisture content and analysis.

NOTE 2—This procedure will not provide as accurate a measure of total aggregate as the procedure described in 4.2.

4.3 If bituminous material has been absorbed by the insulation (4.2), remove sufficient insulation to allow laboratory analysis of absorbed bitumen mass (weight).



Dimension	Square (3.2)		Rectangular (3.4)	
	mm	in.	mm	in.
A	300	12	100	4
B	300	12	1000	40
C	150	6	150	6
D	40	1.5	40	1.5
E	40	1.5	40	1.5
F	3	1/8	3	1/8

FIG. 1 Cutting Template

4.4 If felt lapping is to be determined, take a separate specimen at least 100 mm [4 in.] wide and not less than 1.12 m [44 in.] long, cut at right angles to the long dimension of the roofing felts.

4.5 Protect each specimen from physical damage such as bending or breakage of the felts or coating layers during removal and transportation. Protect from moisture, excessive heat, and loss of material.

5. Significance and Use

5.1 This practice is for the sampling and analysis of existing built-up roof systems. For roofs under construction, use Practice [D3617/D3617M](#).

6. Procedure

6.1 Preserve all identifications and log the specimens in the laboratory. Ensure continued identity and location of the components within each specimen. Remove the insulation fully (if present), removing as little bituminous coating from the underside of the membrane as possible.

6.2 Calculate the area of the specimen from eight different measurements taken in each direction. Weigh the specimen, including all associated loose materials (except insulation), being careful to avoid loss of any component, and calculate the mass per unit area. Dry the insulation removed in [4.3](#) to constant mass and record.

6.3 Place the specimen on aluminum foil or release paper and carefully scrape off the top surfacing (if any) and top coating without damaging the top felt. Use heat only to produce the lowest temperature required to remove the coating.

NOTE 3—This will usually leave 200 to 400 g/m² [4 to 8 lb/100 ft²] of bituminous material on the surface of the roofing felt.

6.3.1 Collect the surfacing and top coating, including any loose material taken with the specimen, and weigh.

6.3.2 Separate surfacing material from the surfacing-top coating mixture by solvent washing on an 850 μm (No. 20) sieve.

NOTE 4—The recommended solvent for coal-tar pitch is carbon disulfide (CS₂). Complete extraction of coal-tar pitch is not possible. Extraction with carbon disulfide may result in a recovery error of coal-tar pitch in the range from 17 to 38 %.

6.3.2.1 **Warning**—Carbon disulfide is toxic when taken internally or when inhaled. Conduct the test in a hood or other well-ventilated location. Avoid prolonged or repeated contact with the skin and inhalation of vapors.

6.3.3 When all traces of bituminous materials have been removed, dry the surfacing retained on the sieve in an oven at 100 °C [212 °F], cool, and weigh. The approximate mass per unit area of the top coating is the difference between this mass and the mass obtained in [6.3.1](#), divided by the specimen area obtained in [6.2](#).

6.4 Remove all bituminous material from the bottom of the membrane (see [6.3](#)), then weigh the membrane. Separate the plies, using a heat lamp as needed, to achieve minimum temperature required for separation. Do not distort the felts (see [6.8](#) for an alternative method of separating the plies).

6.4.1 Measure the individual felts and calculate the area of each ply (due to lapping, not all plies will be the size of the original specimen). Follow the procedure in [6.2](#). Record the total area of all felts.

6.4.2 Divide the sum of all individual felt areas ([6.4.1](#)) by the area of the original specimen ([6.2](#)) and record the results as “number of plies.”

6.5 Calculate the mass per unit area of the original saturated felts by multiplying the area of each ply determined in [6.4.1](#) by the following values in g/m² [lb/100 ft²] and dividing by the specimen area determined in [6.2](#). Add the masses per unit area for each felt to find the total mass per unit area of the original saturated felts. If all plies are the same, simply multiply the assumed felt mass per unit area by the number of plies ([6.4.2](#)). Use the manufacturer’s information for components not within the scope of the specifications in [Table 1](#), using the factor 48.825 to convert from lb/100 ft² to g/m², and 0.02048 to convert from g/m² to lb/100 ft².

6.6 Calculate the total interply bituminous material per unit area by subtracting the total mass per unit area of the original “saturated felts” determined in [6.5](#) from the mass per unit area determined by dividing the mass of felts and interply bitumen in [6.4](#) by the specimen size in [6.2](#).

6.6.1 To obtain the average interply mopping, take the “total interply bitumen per unit area” determined in [6.6](#) and divide by one less than the previously determined number of plies ([6.4.2](#)).

6.6.2 Remove any bitumen absorbed by the insulation ([6.2](#)) by solvent extraction. Dry the residue to constant mass and cool to room temperature. Determine the absorbed bitumen per unit area by subtracting the mass of residue from the mass recorded in [6.2](#) and dividing the result by the specimen area ([6.2](#)).

6.6.3 Determine the total applied bitumen by deducting the mass per unit area of surfacing ([6.3.3](#)) and of all felt ([6.5](#)) from the specimen mass per unit area ([6.2](#)); add the absorbed bitumen per unit area determined in [6.6.2](#), or the estimated bitumen per unit area left on the deck ([4.2](#)).

6.7 For specimens from smooth surface roofs, omit [6.3.2](#) and [6.3.3](#).

6.8 To determine the lapping distance of felts, use the specimen described in [4.4](#). Delaminate the felts and measure the lap spacing. Report the number of plies and spacing by the representative spacing diagram. (Separation of the plies can be accomplished by warming or by cooling the specimen with dry ice and fracturing the interply moppings.)

7. Calculation

7.1 Carry out all calculations to the following significance:

7.1.1 *Number of Plies*, in the built-up roofing to the nearest hundredth of a ply.

7.1.2 *Mass of Felts*, interply mopping, top coating, total applied bituminous material, and surfacing to the nearest 1 g [0.002 lb].

7.1.3 *Mass per Unit Area*, to the nearest 10 g/m² [0.2 lb/100 ft²].