



Standard Test Method for Wind-Resistance of Asphalt Shingles (Fan-Induced Method)¹

This standard is issued under the fixed designation D3161/D3161M; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This test method covers the procedure for evaluating the wind resistance of asphalt shingles that results from the shingle's rigidity (with or without contribution from sealant) or mechanical interlocking (with or without contribution from sealant) or any combination thereof. The shingles are applied to a test panel in accordance with the manufacturer's instructions and tested at a 2:12 (17 %) slope, or at the lowest slope permitted by those instructions.

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

D1079 Terminology Relating to Roofing and Waterproofing

3. Terminology

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

4. Classes of Shingles

4.1 Shingles are of three classes:

4.1.1 *Class A*—Pass at a test velocity of 97 km/h [60 mph].

4.1.2 *Class D*—Pass at a test velocity of 145 km/h [90 mph].

¹ This test method is under the jurisdiction of ASTM Committee **D08** on Roofing and Waterproofing and is the direct responsibility of Subcommittee **D08.02** on Steep Roofing Products and Assemblies.

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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.

4.1.3 *Class F*—Pass at a test velocity of 177 km/h [110 mph].

5. Significance and Use

5.1 Most asphalt shingles that have demonstrated wind resistance by this test have also performed well in use. Natural wind conditions differ with respect to intensity, duration, and turbulence; these conditions are beyond the means of this test to simulate. The results of this test do not directly correlate to wind speeds experienced in service, and no accommodation is made in this test method for building height, building exposure category, or building importance factor.

5.2 Many factors influence the wind resistance of shingles in the field; for example, temperature, time, roof slope, contamination by dirt and debris, and fasteners that are misaligned or under-driven. It is beyond the scope of this test method to address all of these influences. This test method is designed to evaluate the wind resistance of asphalt shingles as described in the scope when representative samples are applied to test panels in accordance with the manufacturer's instructions and conditioned as specified before testing.

6. Apparatus

6.1 *Test Machine*, capable of delivering a horizontal stream of air through a rectangular opening 914 mm [36 in.] wide and 305 mm [12 in.] high at a velocity not less than 97 km/h [60 mph]. At a velocity of not less than 177 km/h [110 mph], it is permissible to add a duct section to the equipment to lower the height of the rectangular opening to 152 mm [6 in.]. The machine shall be equipped with an adjustable stand to receive a test panel and be adapted to setting the test panel at any desired slope, at any horizontal distance from the lower edge of the duct opening, and at various angles incident to the wind direction.

6.1.1 *Calibration*—As a minimum, at the start of each test day, and at the start of each new desired test velocity, the air velocity shall be calibrated. Obtain calibration measurements using a bare panel as described in **7.1**, but without shingles or the test panel with the candidate shingles to be tested. With the panel positioned as described in **9.1**, the velocity shall be measured using calibrated airflow measuring devices, such as pitot tubes or airflow anemometers. Velocity measurements shall be taken at a minimum of three evenly spaced locations



across the duct orifice. The average measured velocity shall not vary more than ± 5 mph from the target test velocity selected to achieve the desired class of shingle.

6.2 *Timer*, capable of reading to the nearest minute.

6.3 *Mechanical Circulation Conditioning Cell or Room*, having forced circulation of air capable of receiving a 1.27-m [50-in.] wide by 1.68-m [66-in.] long, or larger test panel on a slope of 2:12 (17 %), or the lowest slope recommended in the product manufacturer's installation instructions, and of maintaining a uniform temperature of 57 to 60°C [135 to 140°F].

7. Test Samples

7.1 The test panels shall be of plywood, tightly matched sheathing boards, or other suitable decking material and not less than 1.27 by 1.68 m [50 by 66 in.] in size. They are to be of such rigidity that they will not twist or distort with normal handling, or vibrate from the wind velocity during the test.

7.2 Apply shingles to duplicate panels, parallel to the short dimension of the panel, in the normal manner recommended by the manufacturer. Use roofing nails, properly positioned in accordance with the manufacturer's instructions, to fasten each shingle. Do not apply roofing cement to fasten down tabs unless required by the manufacturer's installation instructions. Do not apply pressure to the shingle tabs either during or after application.

7.3 Apply lock-type shingles to an additional two panels, parallel to the short dimension of the panel, in accordance with the manufacturer's instructions.

7.4 Secure the shingles at the outer edge of each test panel by exposed nailing to simulate anchoring at the rake edges of a roof deck.

7.5 Control the temperature at $27 \pm 8^\circ\text{C}$ [$80 \pm 15^\circ\text{F}$] and maintain the slope of the panel at 2:12 (17 %), or the lowest slope recommended in the product manufacturer's installation instructions, during application of the shingles.

8. Conditioning of Shingle Test Panels

8.1 Maintain the test panels at a slope of 2:12 (17 %), or the lowest slope recommended in the product manufacturer's installation instructions, and at a temperature of $27 \pm 8^\circ\text{C}$ [$80 \pm 15^\circ\text{F}$] until beginning heat conditioning.

8.2 Place the test panels in the conditioning cell or room on a slope of 2:12 (17 %), or the lowest slope recommended in the product manufacturer's installation instructions, and maintain at a temperature of 57 to 60°C [135 to 140°F] for a continuous period of 16 h.

8.3 After completion of the conditioning period, allow the test panels to come to room temperature $27 \pm 8^\circ\text{C}$ [$80 \pm 15^\circ\text{F}$] while being maintained at a slope of 2:12 (17 %), or the lowest slope recommended in the product manufacturer's installation instructions.

8.4 Exercise care to avoid pressure on, or damage to, shingle tabs by any twisting or distortion of the test panels in handling.

9. Test Procedure

9.1 *Location of the Test Panel*—Install the panel on the test carriage and accurately adjust it in relation to the duct so that

the exposed edge of the target course will be on the same level as the lower edge of the duct orifice at a horizontal distance of 178 ± 1 mm [$7 \pm \frac{1}{16}$ in.]. The target course shall be the third course up from the bottom of the panel. The test slope shall be 2:12 (17 %) or the lowest slope recommended by the manufacturer for the product being tested.

9.1.1 Test a minimum of two panels for each product being tested.

9.1.2 Since the design of lock-type shingle makes it difficult to determine the most critical angle of wind direction, conduct the test at a minimum of three different angles using a separate panel for each test (head-on, with the bottom of the target course parallel to and 178 mm [7 in.] away from the machine orifice; and with the panel rotated 30 and 60° from the head-on position, with the bottom corner of the third-course tab nearest the duct being 178 mm [7 in.] away from and in the same horizontal plane as the bottom of the machine orifice). Test another panel at the position judged to be most critical on the basis of the first three tests.

9.2 *Performing the Test*—Maintain the ambient temperature at $24 \pm 3^\circ\text{C}$ [$75 \pm 5^\circ\text{F}$] during the tests.

9.2.1 When the test panel is set in position, start the fan to produce the target test velocity, as established during calibration. The fan shall be operated continuously without adjustment for 2 h, or until such lesser time as a failure occurs.

9.2.2 During the test, observations are to be made by an observer and/or by video and recorded when any lifting of shingle tabs can be seen or noted. Any observable damage to a full shingle or the disengaging of a locking ear or tab, or a shingle tab, including any failure of adhesive, with its time of occurrence shall be recorded. The full assessment of damage, as required by 10.3, is possible only after the cessation of the test.

9.2.3 In the event that observable failure occurs during the test, stop the air flow and record the elapsed time. The observable end point for failure shall be taken at the time of the observed failure or upon review of the video at the conclusion of the test in which any one or more full shingle tabs lift beyond upright (beyond perpendicular to the deck), or a locking ear or tab of a lock shingle tears loose or disengages from its locking position.

NOTE 1—It is not prohibited to use this test method with different test velocities and different time intervals of stop-and-go frequencies to do research on the performance of shingles in an unsealed condition. If this is done, shingles do not have to be conditioned as specified in 8.2 before testing, and it is not prohibited to use different criteria for failure than those presented in 9.2.3. It is also not prohibited to interpret the results obtained in research testing of unsealed shingles differently than as described in 10.3.

10. Interpretation of Results

10.1 Any sealed shingle assembly that restrains full shingle tabs from lifting shall be considered as having passed this test.

10.2 Any interlocked shingle assembly that restrains full shingle tabs from tearing loose, or disengaging from their locked position, shall be considered as having passed this test.

10.3 Any unsealed shingle assembly that restrains full shingle tabs from lifting beyond upright (beyond perpendicular to the deck) during the test, and shows no permanent damage



as a result of the test (such as by creasing, tearing, cracking, or splitting), and has its leading edge return to within 3 mm [$\frac{1}{8}$ in.] of its pre-test location within 1 h of cessation of the test, shall be considered as having passed this test.

10.4 Any shingle assembly that fails to restrain full shingle tabs as described in 10.1, 10.2, or 10.3, shall be considered as having failed this test.

10.5 When evidence of permanent damage caused by the testing (such as creasing, tearing, cracking, or splitting) is found during post-test examination of any shingle assembly, that assembly shall be considered as having failed this test.

11. Report

11.1 The report shall include the following information for each test panel:

11.1.1 Name of the manufacturer of the product.

11.1.2 Name of the product.

11.1.3 Description of the product wind resistance design (refer to 1.1).

11.1.4 Slope at which testing was conducted.

11.2 The report shall include the following information for each test panel that passes:

11.2.1 The test velocity as established during calibration, the total time of duration, and the corresponding class.

11.3 The report shall include the following information for each test panel that fails:

11.3.1 The elapsed time and velocity at which any full shingle tab (or full shingle if single-tab) lifts so as to bend beyond perpendicular to the plane of the assembly, or where any locking feature either tears loose or disengages from its locking position.

11.3.2 The mode of failure (refer to 10.4 and 10.5).

11.4 The report shall include photographs taken immediately before shutting off the wind for each test panel.

12. Precision and Bias

12.1 No statement is made about either precision or bias of this test method, since the result merely states whether there is conformance to the criteria for success specified in the procedure.

13. Keywords

13.1 fan-induced wind; interlocking; rigidity; roofing; sealant; shingles; waterproofing; wind resistance

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