Designation: D 3161 – 03b

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

This standard is issued under the fixed designation D 3161; 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 testing asphalt shingles that are resistant to wind blow-up or blow-off when applied on low slopes in accordance with the manufacturer's instructions. It is generally used to determine the blow-off resistance of sealed and interlocked shingles at a given wind velocity, but may be used to test unsealed or sealed shingles at other wind velocities as is applicable.

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. Type and Classes of Shingles

2.1 Shingles are of two types:

2.1.1 *Type I*—Shingles with a factory-applied adhesive (self-sealing shingles).

2.1.2 *Type II*—Shingles of the lock type, with mechanically interlocking tabs or ears.

2.2 Shingles are of three classes:

2.2.1 *Class A*—Pass at a test velocity of 97 km/h (60 mph).

2.2.2 *Class D*—Pass at a test velocity of 145 km/h (90 mph).

2.2.3 *Class F*—Pass at a test velocity of 177 km/h (110 mph).

3. Significance and Use

3.1 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.

3.2 Many factors influence the sealing characteristics of shingles in the field; for example, temperature, time, roof slope, contamination by dirt and debris, and interference by misplaced fasteners. It is not the objective of this test method to address all of these influences. When testing shingles with sealant, this test method is designed to determine the wind resistance when representative samples of shingles are sealed under defined conditions before testing.

4. Apparatus

4.1 *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). The test velocity shall not vary more than ±5 % as measured at the orifice. 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.

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

4.3 *Mechanical Circulation Conditioning Cell or Room*, for self-sealing shingles, 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 in. rise per foot (17 % slope) and of maintaining a uniform temperature of 57 to 60°C (135 to 140°F).

5. Test Samples

5.1 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.

5.2 Apply self-sealing 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,

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to fasten each shingle, and no cement other than the factory-applied adhesive shall be used to fasten down the tabs. Do not apply pressure to the shingle tabs either during or after application.

5.3 Apply lock-type shingles to at least four panels, parallel to the short dimension of the panel, in accordance with the manufacturer's instructions. Secure the shingles at the outer edge of the test panel by exposed nailing to simulate anchoring at the rake edges of a roof deck.

5.4 Control the temperature at 27 ± 8°C (80 ± 15°F) and maintain the slope of the panel at 2 in./ft (17 % slope) during application of the shingles.

6. Conditioning of Self-Sealing Shingle Test Decks

6.1 Maintain the test panels at a slope of 2 in./ft (17 % slope) and at a temperature of 27 ± 8°C (80 ± 15°F) until beginning heat conditioning.

6.2 Place the test panels in the conditioning cell or room on a slope of 2 in./ft (17 % slope) and maintain at a temperature of 57 to 60°C (135 to 140°F) for a continuous period of 16 h.

6.3 After completion of the conditioning period, allow the test panels to come to room temperature 27 ± 8°C (80 ± 15°F) while being maintained at a slope of 2 in./ft (17 % slope).

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

7. Conditioning of Lock-Shingle Test Decks

7.1 Maintain the test panels at a temperature of 27 ± 8°C (80 ± 15°F) before conduct of the wind test. No further conditioning of these panels is required.

8. Test Procedure

8.1 *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 ± 1/16 in.). The target course shall be the third course up from the bottom of the panel. The test incline shall be 2 in. to the horizontal foot (17 % slope) for self-sealing shingles, and at the lowest incline recommended by the manufacturer for lock-type shingles.

8.1.1 Test a minimum of two panels for self-sealing shingles.

8.1.2 Since the design of lock-type shingle may make 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.

8.2 *Performing the Test*—Maintain the ambient temperature at 24 ± 3°C (75 ± 5°F) during the tests.

8.2.1 As soon as the panel is set in position, start the fan, adjust the speed to produce a velocity, as previously agreed between the buyer and the seller, not less than 97 km/h (60 mph) and not greater than 177 km/h (110 mph). The test velocity shall not vary more than ±5 % at the orifice during the test, and shall be maintained continuously for 2 h, or until such lesser time as a failure occurs.

8.2.2 During the test, station an observer where he can note any lifting of shingle tabs. He shall record any 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.

8.2.3 If failure occurs during the test, stop the air flow and record the elapsed time. The end point for failure shall be taken as the time at which the sealing feature fails to restrain one or more full shingle tabs, or a locking ear or tab of a lock shingle tears loose or disengages from its locking position. In addition, no free portion of a shingle shall lift so as to stand upright or bend back on itself during the test.

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 at 140°F for 16 h before testing and it is not prohibited to use different criteria for failure than those presented in 8.2.3. It is also not prohibited to interpret the test results on unsealed shingles differently than as described in Section 9.

9. Interpretation of Results

9.1 Any assembly that restrains full shingle tabs from lifting, or locking ears from tearing loose or disengaging, shall be considered as having passed this test.

9.2 Any assembly that does not restrain full shingle tabs or that has locking ears that tear loose or disengage, or that has any free portion of a shingle lift so as to stand upright or bend back on itself during the test, shall be considered as having failed this test.

10. Report

10.1 The report shall include the following information for each specimen that passes:

10.1.1 The velocity maintained during the test, the total time of duration, and the corresponding class.

10.2 The report shall include the following information for each specimen that fails:

10.2.1 The elapsed time and velocity at which the sealing feature fails to restrain one or more full shingle tabs, or a locking ear or tab of a lock shingle tears loose or disengages from its locking position.

10.2.2 The mode of failure shall be reported in accordance with 9.2.

10.3 The report shall include photographs taken immediately before shutting off the wind for each specimen tested.

11. Precision and Bias

11.1 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.

12. Keywords

12.1 fan-induced wind; roofing; shingles; waterproofing; wind resistance