Designation: D 6381 – 00

Standard Test Method for Measurement of Asphalt Shingle Tab Mechanical Uplift Resistance[1]

This standard is issued under the fixed designation D 6381; 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 This test method covers measuring the tab uplift resistance of asphalt roofing shingles by mechanical means. It is applicable to shingles that use a factory-applied or field-applied adhesive. This test can only be used in laboratories to screen different sealant systems within the same laboratory.

NOTE 1—There are several types of shingles designed for service without a factory-applied or field-applied adhesive. These shingles, when applied in accordance with the manufacturers' application instructions, employ other means to provide resistance against the forces generated by the action of wind such as tab geometry and shingle construction. Field experience has shown that these types of shingles function satisfactorily in service. Because there are a variety of these shingle designs, it is not practical to describe in this test method how to test these shingles for uplift resistance. The testing of these types of shingles, therefore, goes beyond the scope of this test method.

1.2 This test method shall be permitted to be used over a range of sealing time and temperature combinations and testing temperatures to simulate a variety of actual field use conditions. The times and temperatures used must be stated in the report.

1.3 The values stated in SI units are to be regarded as the standard.

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 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 228 Test Methods for Asphalt Roll Roofing, Cap Sheets, and Shingles[2]

D 1079 Terminology Relating to Roofing, Waterproofing, and Bituminous Materials[2]

3. Summary of Test Method

3.1 The test specimens are constructed from pieces of shingles, overlaid and sealed prior to testing. All specimens are then conditioned and tested at selected temperatures. Specimens are tested by lifting the exposed tab edge and recording the uplift force required.

4. Significance and Use

4.1 Tab uplift resistance is one of the properties of an applied shingle that relates to its ability to withstand wind forces. This mechanical test is a laboratory method to measure that resistance at a designated temperature.

4.1.1 No quantitative relationship has been established between the mechanical tap uplift resistance and uplift forces due to the wind.

4.2 Many factors influence the sealing characteristics of shingles in the field; for example, temperature, time, contamination by dirt and debris, roof slope, and interference by misplaced fasteners. It is not the objective of this test method to address all of these influences. This test method is designed to determine the tab mechanical uplift resistance when representative specimens of shingles are sealed under selected conditions prior to testing.

5. Apparatus

5.1 The *Tensile Testing Machine*, shall be a constant-rate-of-extension (CRE) type.

5.2 *Heavy-Duty Paper Cutter*, steel rule, die or template 95 by 114 mm (3¾ by 4½ in.) and 95 by 178 mm (3¾ by 7 in.).

5.3 *The Test Fixture* is a specially designed apparatus and drawings are on file at ASTM Headquarters.[3] Fig. 1 is a photo of the apparatus in a typical tensile testing machine with a specimen in place.

5.4 *Temperature-Controlled Chamber*, to seal the specimens, capable of maintaining a temperature within ±1.5°C (±2.5°F) of the selected temperature. The sample tray shall be a rigid support large enough to hold specimens in the chamber.

5.5 *Temperature-Controlled Test Chamber*, capable of control within ±1.5°C (±2.5°F) which shall be used when testing the specimens at other than room temperature.

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[1] This test method is under the jurisdiction of ASTM Committee D08 on Roofing, Waterproofing and Bituminous Materials and is the direct responsibility of Subcommittee D08.02 on Prepared Roofings, Shingles and Siding Materials.

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[2] *Annual Book of ASTM Standards*, Vol 04.04.

[3] The sole source of supply of this commercially available test fixture known to the committee at this time is Ashcraft Machine and Supply Inc., 185 Wilson St., Newark, Ohio 43055. Specify Shingle Tab Uplift Tester, Model 102. If you are aware of alternative suppliers, please provide this information to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

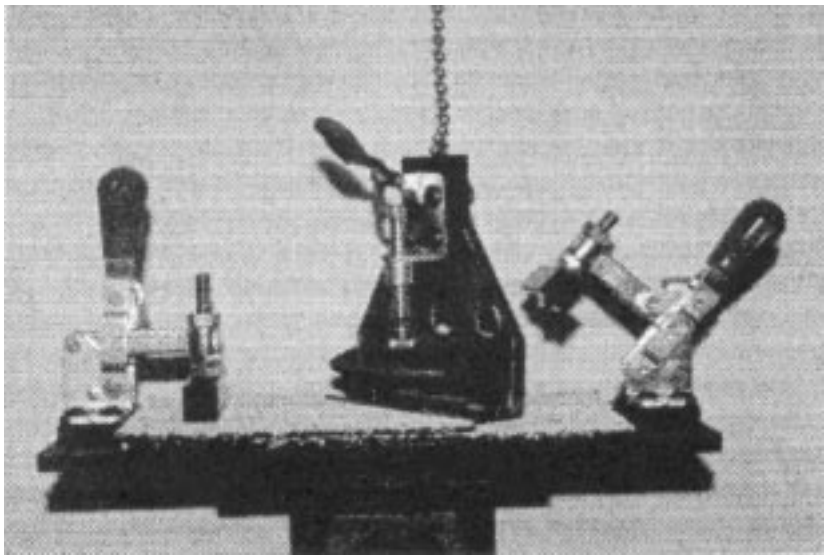

FIG. 1 Shingle Tab Uplift Test Apparatus

6. Specimen Preparation

6.1 Samples for testing shall be selected in accordance with the method specified in the sampling section of Test Methods D 228. The test shall consist of ten specimens per test condition, as described in the following paragraphs.

6.2 Specimens taken from the sample of shingles shall be representative of the typical geometry (area), thickness (caliper), and contamination level (back surface particles, and so forth) of the adhesive in the lot of material being investigated.

6.3 Insertion of the test apparatus can be a problem for cases where the sealant is brittle and weak or where it is applied close to the leading edge of the shingle. For these, and other such cases where normal insertion of the top clamp of the apparatus is a concern, an alternate technique of attaching to the top of the specimen shall be permitted (see 6.8).

6.4 The adhesive present on the specimen to be tested shall be proportionally representative of the adhesive present on the shingle when it is installed in the field. For example, if the linear coverage of the adhesive geometry on a shingle using factory-applied adhesive is 50 %, then the adhesive shall cover 50 % of the width of the test specimen.

6.4.1 For a specimen representing field-applied adhesive, for example, if the adhesive is in a dot pattern then the same dot size and pattern shall be used on the laboratory-prepared specimen, following the manufacturer's application instructions.

6.5 A specimen consists of a bottom piece 95 by 178 mm (3¾ by 7 in.); and a top piece 95 by 114 mm (3 ¾ by 4½ in.); both cut from one shingle as shown in Fig. 2. Longer or shorter specimens are permitted to be used provided both clamps secure the specimen when it is aligned in the test fixture. The length of the specimens shall be determined for proper alignment in the fixture. Dimensional tolerances are ±3 mm (±⅛ in.) on the width of the specimen.

6.6 Lay the top piece over the bottom piece, as shown in Fig. 3, and in a manner representative of the actual alignment as specified in the shingle manufacturer's application instructions.

6.6.1 The critical dimension is the distance the top piece overlaps the sealant on the bottom piece (denoted A in Fig. 3). This dimension shall be equal to the overlap in the specified application.

6.7 Position the specimens on the tray without overlapping or stacking of the individual specimens.

6.8 For cases when an alternate top attachment method is desired (see 6.3) a special metal connector[4] shall be epoxy-bonded to the top piece of the specimen following sealant bonding and prior to conditioning and testing. This metal connector shall be equal to the width of the specimen. It shall be positioned at the edge of the top piece and bonded to adequately attach to the top of the specimen while allowing for easy insertion of the test fixture. A photo of the connector, attached to a test specimen, is shown in Fig. 4. The top clamp assembly attached to this connector is shown in Fig. 5.

7. Calibration and Standardization

7.1 *CRE Tensile Tester*:

7.1.1 Set up the testing machine with the test fixture in place with the following operating parameters:

7.1.1.1 *Crosshead Speed*—2 mm/s (5 in./min), and

7.1.1.2 *Gage Length*—Set to accommodate the test fixture without putting any strain on the sealant joint.

7.1.2 Zero the tester with the top clamp assembly in place.

8. Sealing and Conditioning

8.1 Seal the specimens on a sample tray, oriented horizontally, at the designated temperature, ±1.5°C (±2.5°F) for the desired time, ±2 %.

8.2 Without disturbing the specimen arrangement, after sealing, condition the specimens at the desired test temperature, ±1.5°C (±2.5°F), for at least 1 h.

[4] The sole source of supply of the apparatus known to the committee at this time is Ashcraft Machine and Supply, 185 Wilson Sheet, Newark, Ohio 43055, and specified on the drawings for the apparatus. If you are aware of alternative suppliers, please provide this information to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

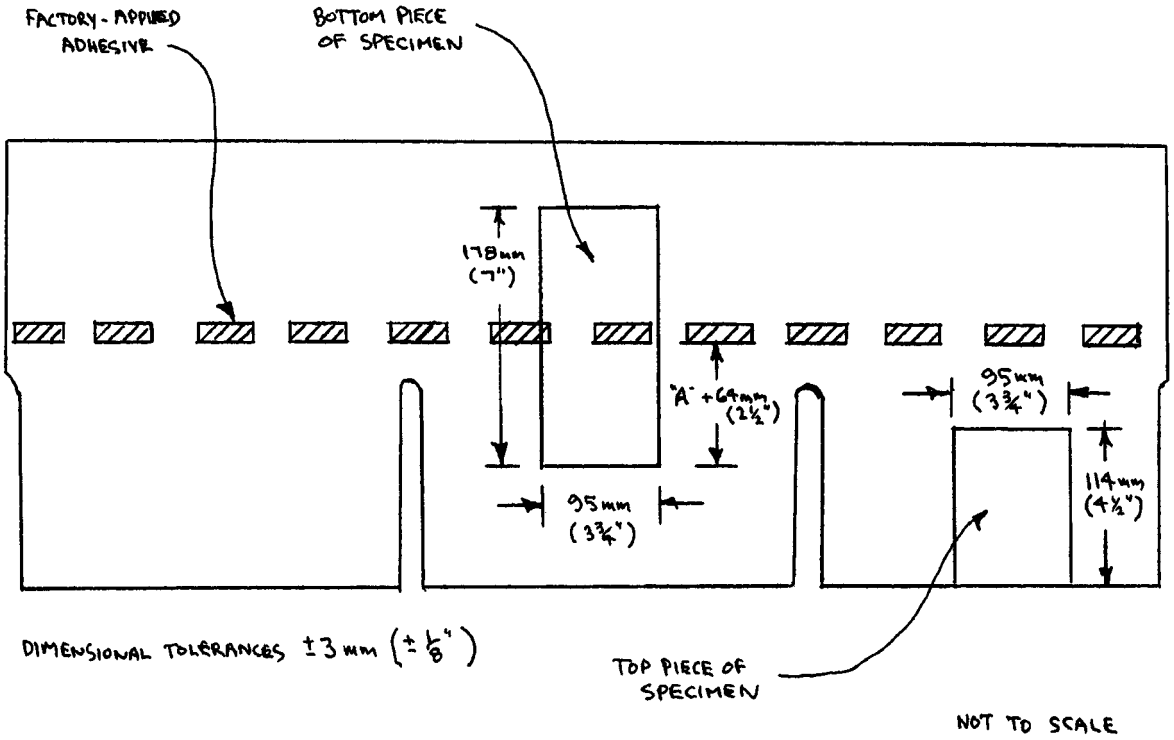

FIG. 2 Plan View of Shingle

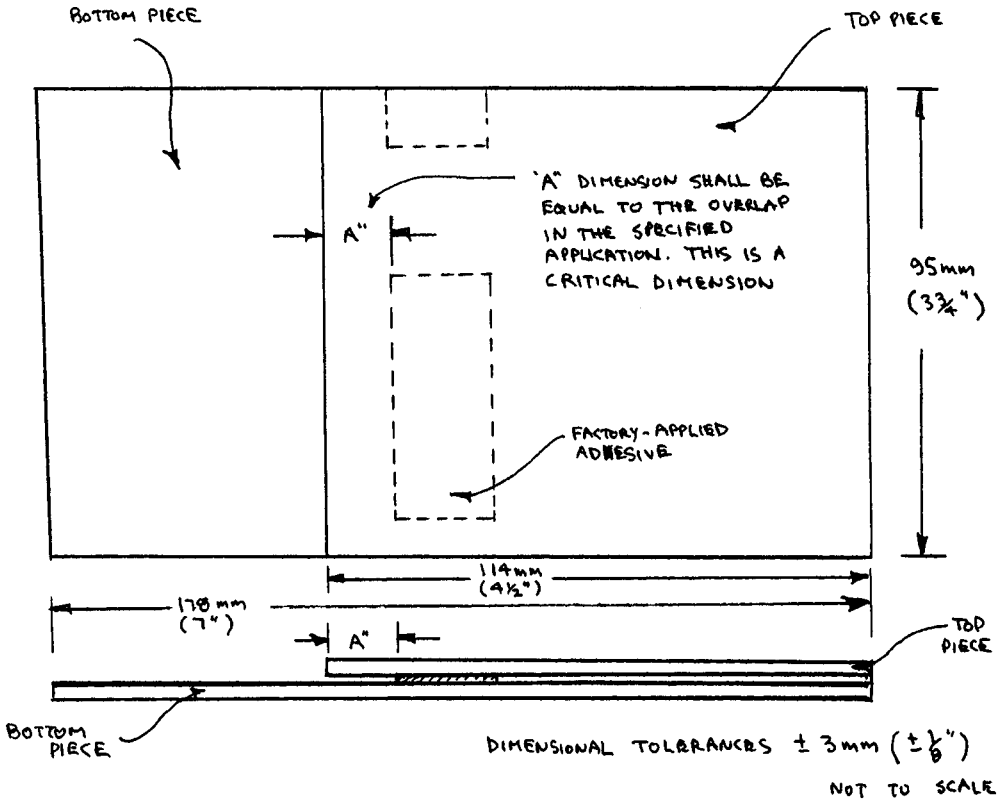

FIG. 3 Top and Side View of Test Specimen

9. Procedure

9.1 Open both clamps and carefully slide the conditioned specimen into the test fixture. Align the specimens so that the adhesive centerline corresponds to the vertical centerline of the test apparatus and centered in the fixture in both directions. Exercise care in positioning specimens in the test fixture to avoid disturbing the temperature of the specimens or the nature of the seal.

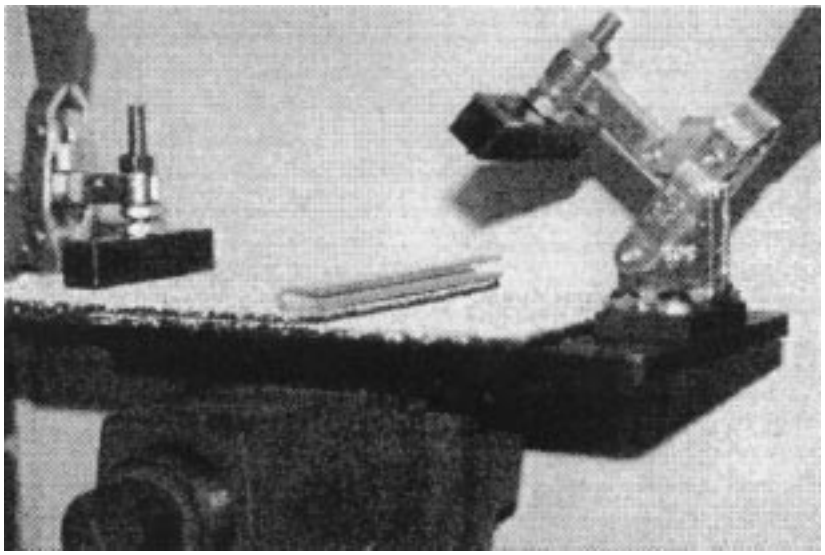

FIG. 4 Connector for Special Top Attachment

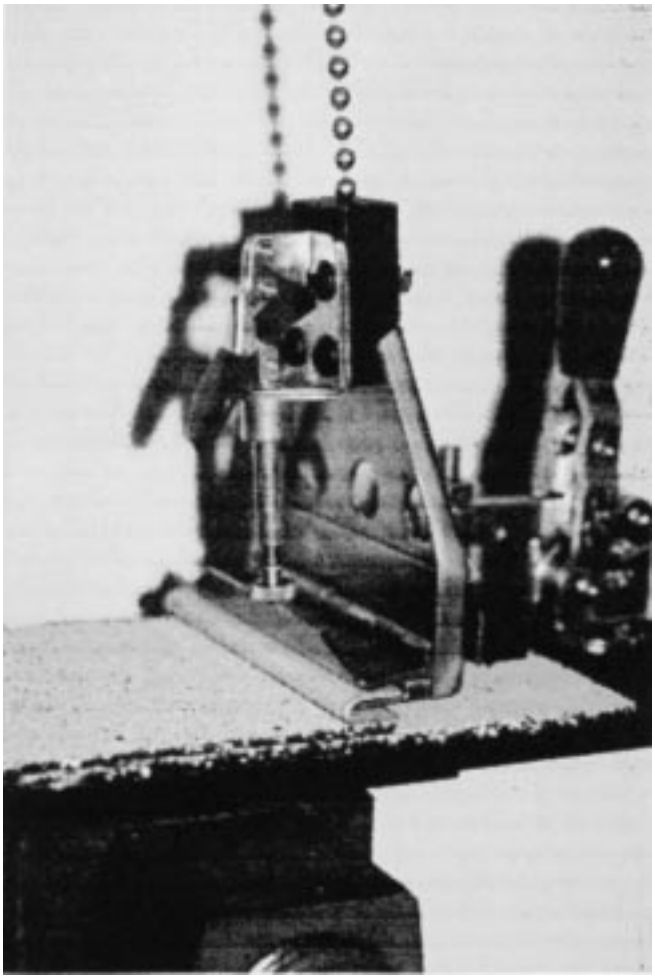

FIG. 5 Top Clamp Assembly Attached to Connector

9.2 Position the top clamp assembly under the top overlap, using the thumb to operate the clamp. Close the clamps to secure the specimen. Operate the tensile tester and record maximum force to the nearest 1.0 *N* (0.2 lbf).

9.3 Repeat 9.1 and 9.2 for the remaining specimens.

10. Report

10.1 Report the following information:

10.1.1 Basic identifying information about the shingle, if available, including manufacturer, shingle type, production date code, lot number, adhesive type, and adhesive pattern,

10.1.2 The type of test machine and the rate of jaw movement employed,

10.1.3 The time and temperature used to seal the specimens and the test temperature,

10.1.4 The average of the force needed to break the seal of ten specimens, to the nearest 1.0 *N* (0.2 lbf).

10.1.5 The type of back-surfacing on the shingle and any other distinguishing features; for example, extent of coverage, evidence of contamination of the adhesive, and so forth, and

10.1.6 Any other observations about the bond performance.

11. Precision and Bias

11.1 *Precision*:

11.1.1 Because of the high level of variability between laboratories, the reproducibility is still being evaluated. This is why this test method can only be used in laboratories to screen different sealant systems within the same laboratory. Results of statistically invalid grab samples and the same specimens tested in different laboratories cannot be compared.

11.1.2 *Repeatability*—Duplicate results by the same operator shall be considered suspect if they differ by more than 12 % for levels up to 50 *N* and 15 % for levels greater than 50 *N*.

NOTE 2—Repeatability estimates were developed using laboratory–applied rather than factory-applied adhesive, which is a departure from this test method as written. Uniformity of laboratory-applied adhesive typically results in substantial reduction of repeatability when compared with factory-applied adhesive.

11.2 *Bias*—This test method has no bias because shingle tab uplift resistance is defined only in terms of this test method.

12. Keywords

12.1 asphalt shingle; bond strength; factory-applied adhesive; field-applied adhesive; tab mechanical uplift resistance