

AMERICAN NATIONAL STANDARD

Standard Field Test Procedure For Determining The Withdrawal Resistance Of Roofing Fasteners

During the 2006 review of ANSI/SPRI FX-1 non substantive changes were made to the text to provide clarification and more concise direction. For more information on those changes, contact SPRI.

I. Purpose of the Test

Performance of the fastener/deck interface is an important part of a successful roofing system. These guidelines were developed to standardize the procedures used in the field to test the pullout resistance of all types of fasteners. The data developed from these tests will provide the roof system manufacturer and design professional with pullout resistance values for the specific fastener installed into the load resisting material of the deck.

II. Definitions

Embedment: the length of a fastener that is within the deck after installation (applicable to structural and lightweight concretes, gypsum, cementitious wood fiber, and wood plank).

Protrusion: the length of a fastener that extends beyond the underside of the deck after installation (applicable to steel, plywood, OSB, and fiberglass decks). (See Commentary 1)

III. Equipment

Use a pullout tester with either a hydraulic or electronic load cell. The gauge shall display values in lbf (kN) or psi (ksi). A gauge that displays values in psi (ksi) shall have a conversion chart attached to Form B. The values obtained shall fall within the working range of the gauge. The working range of the gauge is 10% to 90% of the full scale of the gauge.

The load gauge shall have a dated calibration certificate showing the calibrated values for the full range of the load gauge. The load gauge shall be calibrated every 12 months or sooner if it is expected that the gauge is out of calibration. Calibration shall be performed to a standard that is traceable to a nationally recognized source. The gauge shall be accurate to $\pm 5\%$ of the reading. If the load gauge is suspected to be out of calibration, recalibrate immediately.

IV. Procedure

- A. Remove any roofing material (i.e. waterproofing membrane, existing insulation) before the test is performed. (See Commentary 2)
- B. The fastener shall be installed using the same method and tools as will be used during actual construction (i.e. depth of installation, pre-drilled hole diameter, installation tools).
- C. The fastener shall be pulled out perpendicular to the deck. The load shall be applied at 2.0 ± 1.0 inches/minute. (See Commentary 3)
- D. Perform a minimum of 10 pullouts for up to 50,000 square feet (4,650 square meters), and 5 additional pullouts for each additional 50,000 square feet (4,650 square meters) or portion thereof on each project. Perform the pullouts in various areas of the roof, including corners, perimeter, and field, to provide a representative sampling of roof area. 50% of the tests shall be performed in the corners and perimeter areas. (See Commentary 4 & 5)
- E. Each roof section with a different elevation, different deck type, or a different insulation shall be considered a different roof and shall be tested separately.
- F. Include a roof plan to identify the location of each pullout (Form B). The roof plan shall be marked with the corresponding test number of each pullout. The plan need not be to scale. (See Commentary 6)
- F. Complete separate Forms A and B for each roof section. Record all pullouts.



Approved as an American National Standard by ANSI

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V. Personnel

The test must be performed by an individual trained by the manufacturer of the fasteners being tested for the proper installation of the fastener and the use of the installation tools and equipment. A representative of the building owner shall be present to witness the test and verify the values. A roofing professional shall be present to repair the roof in areas where the tests were performed to ensure that it is returned to a watertight condition.

VI. Cautions (See Commentary 6& 7)

On decks that can be affected by free water when the deck is 32° F (0° C) or below (i.e. gypsum, cementitious wood fiber, lightweight structural concrete, and lightweight insulating concrete) the pullout values may be elevated and therefore unreliable.

Commentary

1. Protrusion is commonly referred to as penetration in the roofing industry.
2. A core cutter has found to be an effective method of removing materials above the deck before performing the pull tests.
3. Rates of withdrawal can be pre-set on motorized pullout testers. On testers where the load is applied via a threaded rod, an acceptable method to determine the rate of withdrawal is to calculate the number of seconds per 360° revolution.

Seconds per Revolution =
 $60 \div (\text{number of threads per inch} \times \text{desired number of inches per minute})$

4. Tests should be performed in any area where the roof has been damaged or where water or other chemicals may have infiltrated the roof system. These elements may cause the roof deck to deteriorate and cause lower pullout values.
5. On certain projects, it may be necessary to perform additional pullout tests beyond the minimum number required in Section IV part D. This includes, but is not limited to, occasions when:
 - pullout values vary significantly
 - tests are performed in decks that are inherently less consistent such as lightweight insulating concrete, cementitious wood fiber and gypsum
 - there exists multiple damaged or questionable areas
 - local building codes require additional tests
 - roofs with high wind loading should have pulls taken in all corners

If there are anomalies in pull values deck at the point of the anomaly should be inspected to determine cause. An anomaly is defined as one or more pullout values that fall exceedingly high or low from the population.

6. Additional data on the pullout form (Form A) exists for informational purposes for the roof designer. These areas have been marked optional, and are to be completed at the discretion of the personnel completing the Pullout Test Report.
7. The temperature of the deck may be taken to determine if it is subject to freezing conditions.
8. Precision & Bias
 - A. Precision: The precision of this test method indicates the probable error of a single determination is +- 5% of the true value.
 - B. Since there is no accepted reference material suitable for determining bias for this test method, bias has not been determined.

Reference document: A "Pullout Resistance of Roofing Fasteners Using Different Methods," Baskaran. A., Sexton. M., Lei. W. and S. Molleti.

Roofing Research and Standards Development: 5th Volume, ASTM STP 1451, W.J. Rossiter and T.J. Wallace Eds., ASTM International, West Conshohocken PA, 2003

Form A PULL OUT TEST REPORT

Refer to the "Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners" for full Documentation. Report results on Form B.

Job Name: _____

Location: _____

Test Date: _____ Ambient Temp.: _____ Roof Area: _____ Sq. Ft.

Tester Mfg.: _____ Max. Cap. of Tester: _____ Circle One: lbf Kn

Date of Last Calibration: _____ Number of Pulls Recorded on Form B: _____

Fastener Tested: _____ Fastener Manufacturer: _____

Test Performed By: _____

Witnessed By: _____

Test Cut Areas Repaired By: _____

Project Type: New Construction Tear Off Retrofit

Deck Type:

- Steel Gauge _____
- Structural Concrete Thickness _____ Check One: Poured in Place Precast
- Lightweight Concrete Thickness _____
- Insulating Concrete Thickness _____
- Cementitious Wood Fiber Thickness _____
- Gypsum Thickness _____ Check One: Poured in Place Precast
- Wood Thickness _____ Check One: OSB Plywood Plank
- Fiberglass Thickness _____
- Other _____ Thickness _____

Depth of Fastener Embedment or Protrusion: _____

Drill Bit Diameter, Where Applicable: _____

OPTIONAL INFORMATION: (See Commentary 7)

Test Time: _____ Building Height: _____

Thickness of Existing Roof Assembly: _____

New System Manufacturer: _____

Roof Cover Type (Check One):

- Mechanically Attached Single-Ply Modified Bitumen
- Ballasted Single-Ply Built-Up Roofing
- Fully Adhered Single-Ply Other _____

New Insulation Type: _____ Thickness: _____

DISCLAIMER: MANUFACTURER'S INSTALLATION REQUIREMENTS SHALL BE FOLLOWED WHEN USING ANY OF THE TESTED FASTENERS. NEITHER THE TECHNICIAN PERFORMING THE PULL-OUT TESTS NOR HIS/HER COMPANY IS RESPONSIBLE FOR THE WATERPROOFING INTEGRITY OF THE REPAIRS. THIS TEST REPORT DOES NOT CERTIFY THE STRUCTURAL INTEGRITY OF THE ROOF DECK.

Form B PULL OUT TEST RESULTS

(Report all test results and units of measure)

1 _____	6 _____	11 _____	16 _____
2 _____	7 _____	12 _____	17 _____
3 _____	8 _____	13 _____	18 _____
4 _____	9 _____	14 _____	19 _____
5 _____	10 _____	15 _____	20 _____

Deviation from standard procedure authorized by:

Reason for deviation:

ROOF PLAN NOT TO SCALE: Identify where the pullouts were performed with corresponding test number.

Comments:
