



ANSI/SPRI IA-1 2010 Standard Field Test Procedure for Determining the Mechanical Uplift Resistance of Insulation Adhesives over Various Substrates

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Disclaimer

This standard is for use by architects, engineers, roofing contractors and owners of low slope roofing systems. SPRI, its members and employees do not Warrant that this standard is proper and applicable under all conditions.

1.0 Introduction

This standard specifies a field-testing procedure to determine the mechanical uplift resistance of a specific roof insulation/adhesive combination. This testing procedure encompasses various types of insulation adhesives, substrates and insulations.

2.0 Definitions

2.1 Tare Weight

The weight of the plate or plywood and the means used to connect the test sample to the load cell.

2.2 Substrate

The surface upon which the roofing or waterproofing membrane is applied.

2.3 Attachment Plate

A component of the testing equipment designed to facilitate the attachment of the test sample to the load applying device.

3.0 Equipment (See Commentary 3)

- 3.1 Use a portable pull testing instrument capable of measuring pounds force (lbf.) (kN) to an accuracy of ± 5 lbf. (.0222kN). The instrument shall display the maximum value achieved during a test pull. If the instrument reads in units other than lbf, the reading shall be converted to lbf.
- 3.2 The instrument shall have a dated calibration certificate showing the calibrated values for the full range of the load instrument. It shall be calibrated every 12 months or sooner if there is reason to suspect that it might be out of tolerance. Calibration shall be performed to a standard that is traceable to a nationally recognized source.

4.0. Testing Procedure (See Commentary 4)

- 4.1 The test area shall include the following components of the proposed new roof assembly (See Figure A for an example of the test cross-section)
 - 4.1.1 Substrate: Bare deck or existing roofing system (recover).
 - 4.1.2 Vapor retarder when a vapor retarder is applied to the substrate.
 - 4.1.3 First insulation layer.
 - 4.1.4 Plywood attachment board.
- 4.2 The sample size shall be 24" x 24" (0.6096m x 0.6096m) with the insulation adhesive applied according to the adhesive manufacturer's specifications. Application of adhesive shall be applied equidistantly from the centerline of the test specimen. (See Figure B) Any excess adhesive (overspray) that falls outside the 24" x 24" (0.6096m x 0.6096m) sample area shall be cut away from the test sample to ensure the results are not skewed.
- 4.3 The area chosen for the test shall be prepared in the same manner as proposed for the new roofing system's assembly.
- 4.4 When the roofing project requires a tear off of the existing roof system, the existing roofing materials shall be removed, exposing the substrate to be adhered to for the test.
- 4.5 This test shall not be performed when the substrate temperature is below freezing. (see commentary caution)
- 4.6 A 24" x 24" (0.6096m x 0.6096m) piece of CDX grade plywood minimum 23/32" (18.2mm) thick shall be adhered to the top of the insulation or cover-board with an appropriate bonding agent, following the insulation adhesive manufacturer's specifications.
- 4.7 Means shall be provided to attach the plywood plate to the pull testing instrument sufficient to exceed the maximum limit of the pull tester load cell. The tare weight of the plywood and the attachment means shall be measured and recorded.
- 4.8 The assembly shall be allowed to cure at least the minimum time specified by the insulation adhesive manufacturer before the pull test is conducted.

- 4.9 If testing adhesive bond to an existing roof for a recover application cut a 2" (51mm) to 3" (76mm) wide strip through the roof covering around the test panel to the deck. Do not stand on the panel while cutting it and avoid walking on it. Remove the material.
- 4.10 The pull-testing instrument shall then be connected to the plywood plate.
- 4.11 The load shall be applied perpendicularly to the roof deck as follows:
- 4.11.1 The test shall begin when the load equals 120 lbf. (.5338kN) plus the tare weight.
 - 4.11.2 Increase the load in 60 lbf. (.2669kN) increments. Hold each incremental load for 60 seconds. Continue until failure occurs.
 - 4.11.3 Failure occurs when any component of the assembly fails.
 - 4.11.4 The maximum load value maintained for 60 seconds shall be recorded and converted to pounds per square foot (psf.) (KPA) using a form similar to the one shown in Appendix A.
 - 4.11.5 Perform a minimum of 4 pull tests for the first 50,000 square feet (4,650 square meters), and 2 additional pull tests for each additional 50,000 square feet (4,650 square meters) or portion thereof on each project. Test locations shall be selected in the corner and perimeter areas if conditions can not be replicated in the field of the roof. The tests shall not be performed in close proximity to one another so as to provide a representation of the entire roof area. Special caution and fall protection shall be implemented when testing in corner and perimeter areas.
- 4.12 Each roof section with a different elevation or a different substrate, or different surface condition shall be considered as a different roof, and shall be tested separately.
- 4.13 A roof plan shall be included to identify the location of each pull test. The roof plan shall be marked with the corresponding test number of each pull. The plan need not be to scale.
- 4.14 Pull test readings and modes of failure shall be recorded for each roof section. Examples of failure modes are:
- 4.14.1. Adhesive from substrate: Loss of adhesive bond from substrate;
 - 4.14.2. Cohesive: Fracture of adhesive structure;
 - 4.14.3. Insulation Delamination: Facer separation from insulation core; or
 - 4.14.4. Insulation Fracture: Structural break-up of insulation.
- 4.15. The actual instrument readings reflect the tare weight + the pounds (kN) of force resisted by the tested assembly. Actual pressure calculations shall be made by subtracting the tare weight from the instrument reading and dividing that number by the total area of the sample size tested.
- 4.16. Precision and Bias
- Based on tests performed at a SPRI member company laboratory, the test procedure has a sample-to-sample precision of $\pm 10\%$ at the 95% confidence level*. No information can be given on the bias of this test procedure for measuring the mechanical uplift resistance of insulation adhesives because no test material having an accepted reference value is available.

* Test results available through SPRI headquarters.

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Commentary to Standard Field Test Procedure for Determining the Mechanical Uplift Resistance of Insulation Adhesives over Various Substrates

This Commentary is not part of Standard Field Test Procedure for Determining the Mechanical Uplift Resistance of Insulation Adhesives over Various Substrates.

This Commentary consists of explanatory and supplementary material designed to assist users in applying the recommended requirements. It is intended to create an understanding of the requirements through brief explanations of the reasoning employed in arriving at these requirements. "The information contained in this Commentary is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. As such, Commentary may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the standard."

The sections of the Commentary are numbered to correspond to the sections of the standard to which they refer. Since it is not necessary to have supplementary material for every section in the standard itself, there may be gaps in the numbering in the Commentary.

C3.0 EQUIPMENT

A load cell with a 5,000 lb. (2267.96 kg) capacity should be sufficient.

C4.0 Testing Procedure

C4.1 Test Area

Perform the test in areas where damaged is suspected or where water or other chemicals have infiltrated the roof system causing the roof deck or other components to deteriorate and cause lower pull values

C4.5 Temperature of Test

Consult the insulation adhesive manufacturer concerning the application temperature limitations of the adhesive. Certain deck types (gypsum, cementitious wood fiber, or lightweight insulating concrete) may be affected by free water. Pull values obtained over decks in a frozen state may be elevated and therefore unreliable.

C4.9 Care should be taken not to disturb the test specimen.

C4.11.3 Determination of Failure

Failure occurs at the substrate/first layer intersection or any other subsequent adhered intersections. It also occurs within the insulation itself, such as the facer lifting off or the core separating, or failure of the substrate. Separation of the test specimen from the plywood is not considered a failure of the adhesive. Record the value, as it may exceed the design value for the specific project.

C4.11.5 Use the lowest test value as the design load resistance value unless it is shown to be an anomaly. Perform additional pull tests beyond the minimum number required under certain circumstances. These include, but are not limited to, occasions when:

- pull values vary significantly;
- tests are performed in decks that are inherently less consistent such as lightweight insulating concrete, cementitious wood fiber, and gypsum;
- there exist multiple damaged or questionable areas ;
- local building codes require additional tests;
- roofs are subject to high wind loading; and/or
- failure occurs at connection of test apparatus to plywood.

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If there are anomalies in pull values, the deck should be inspected by a qualified professional to determine the cause.

C4.15 The actual instrument readings reflect the tare weight + the pounds (kN) of force resisted by the tested assembly. Actual pressure calculations are made by subtracting the tare weight from the instrument reading and dividing that number by the total area of the sample size tested.

For example:

On a 24" x 24" (0.6096m x 0.6096m) (4 sq. ft) sample, if the tare weight is 10 lbs. (0.0445kN) and the instrument reading is 1010 lbs. (4.4927kN), the calculated uplift resistance of the assembly is $(1010 \text{ lbs} - 10 \text{ lbs}) / 4 \text{ ft}^2 = 250 \text{ psf}$ ($4.4927\text{kN} - 0.0445\text{kN}) / 0.3716 \text{ sq m} = 11.97 \text{ KPA}$)

Personnel

A person who has been trained in the pull test procedure should perform the tests. A representative of the building owner should be present to witness the tests and verify the values. A roofing professional should also be present to repair the test areas and return the roof area to a watertight condition.

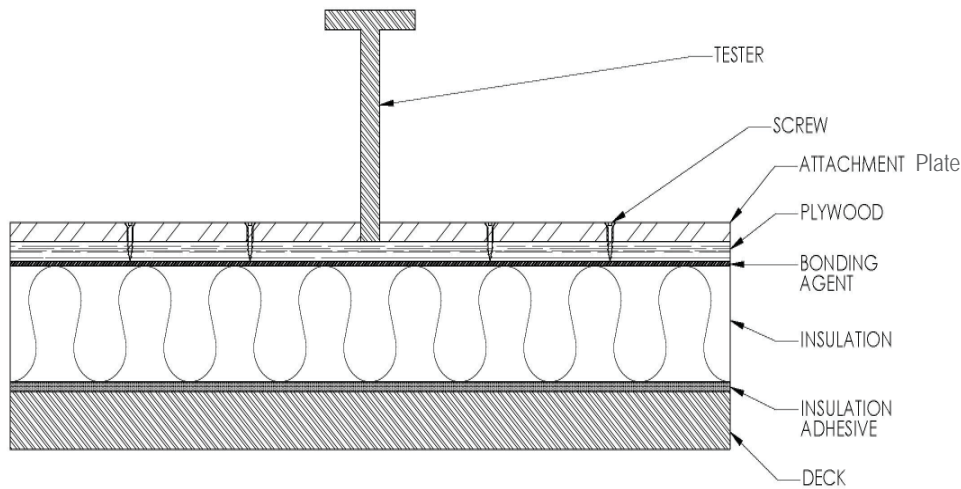
Cautions

See Commentary CIV.E

Deck Loading

This test does not indicate the suitability of the existing roof (if being recovered), the deck or the deck's ability to withstand the uplift loads calculated by this procedure. A structural engineer or roofing design professional should obtain this information.

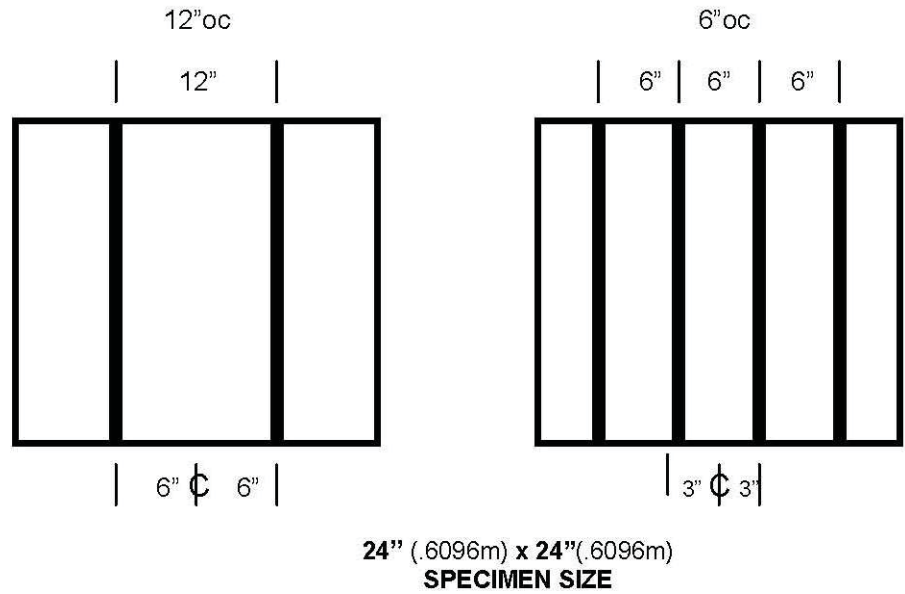
Figure A Cross Section of Assembly



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Figure B BEAD PLACEMENT EXAMPLES



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Appendix A

Insulation Test Report

The following three pages contain forms A, B and C.

These forms or similar ones shall be used to report Mechanical Uplift Resistance of Insulation Adhesives test results.

Insulation Adhesive Test Report

Form A

Job Name: _____ Test Date: _____

Location: _____

Ambient Temp: _____ Roof Area: _____ sq. ft.(sq. m)

Tester Mfgr/Model: _____

Max. Cap. Of Tester: _____ Check One: lbf kN

Date of Last Calibration: _____

Number of Tests Recorded on Form C: _____

Insulation Manufacturer: _____ Adhesive Manufacturer: _____

Insulation Type: _____ Adhesive Type: _____

Insulation Thickness: _____

Test Performed by: _____

Witnessed By: _____

Test Cut Areas Repaired By: _____

Project Type: New Construction Tear-Off Retrofit

Deck Type

- | | |
|---|------------------|
| <input type="checkbox"/> Steel | Gauge: _____ |
| <input type="checkbox"/> Structural Concrete | Thickness: _____ |
| Check One: <input type="checkbox"/> Poured In Place <input type="checkbox"/> Precast | |
| <input type="checkbox"/> Lightweight Concrete | Thickness: _____ |
| <input type="checkbox"/> Insulating Concrete | Thickness: _____ |
| <input type="checkbox"/> Cementitious Wood Fiber | Thickness: _____ |
| <input type="checkbox"/> Gypsum | Thickness: _____ |
| Check One: <input type="checkbox"/> Poured In Place <input type="checkbox"/> Precast | |
| <input type="checkbox"/> Wood | Thickness: _____ |
| Check One: <input type="checkbox"/> OSB <input type="checkbox"/> Plywood <input type="checkbox"/> Plank | |
| <input type="checkbox"/> Fiberglass | Thickness: _____ |
| <input type="checkbox"/> Other: | Thickness: _____ |

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Optional Information:

Test Time: _____ Building Height: _____

Thickness of Existing Roof Assembly: _____

New Roofing System Manufacturer: _____

Roof Cover Type (Check One):

- | | |
|---|---|
| <input type="checkbox"/> Mechanically Attached Single-ply | <input type="checkbox"/> Modified Bitumen |
| <input type="checkbox"/> Ballasted Single-ply | <input type="checkbox"/> Built-up Roofing |
| <input type="checkbox"/> Fully Adhered Single-ply | <input type="checkbox"/> Other: _____ |

DISCLAIMER: Manufacturer's installation requirements shall be followed when using any of the tested adhesives. Neither the technician performing the pullout 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.

Insulation Adhesive Test Report

Form C

Job Name: _____ **Test Date:** _____

(Refer To the "Standard Field Test Procedure for Determining the Mechanical Uplift Resistance of Insulation Adhesives over Various Substrates" for full documentation)

① Tare Weight _____

A Test No.	B Location on Roof (Roof Plan on Form B)	C Measurement Pounds Force (lbf) (kN) ②	D Less Tare ③= ②-① lbf (kN)	E Resistance 4= ③ ÷ 4.0(.3716 sq m) pounds/sq.ft psf Sample size 24"x24" (0.6096m x 0.6096m)	F Failure Mode
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19.					
20.					

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