ANSI/SPRI/FM ADT-1

Test Standard for Evaluation of Roofing Adhesive and Board Stock in Tensile Loading for Low Slope Roofing Systems

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Disclaimer
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1.0 Introduction

1.1 Scope

This standard provides requirements and procedures to determine *failure loads* for *adhesive* and board stock when tested for tensile resistance perpendicular to surface.

1.2 Significance and Use

Roofs are frequently exposed to wind conditions that result in uplift forces on the components of the roof assembly. These assemblies are tested for their resistance to this uplift force in accordance with standards such as ANSI/FM 4474, FBC TAS114, and UL 1897. This standard provides a small-scale test method for comparing *adhesive*/substrate combinations and determining criticality. Knowledge of critical combinations can be used to reduce the scope of full-scale wind uplift testing. (See Commentary 1.2)

2.0 General Information

2.1 Definitions

All words defined within this section are italicized throughout the standard.

2.1.1 Adhesive

Adhesives are used to bond materials together within a roof assembly. Examples include membrane bonded to *substrate board*, *substrate board* bonded to *substrate board*, and *substrate board* bonded to structural decking. Depending on the use, the *adhesive* could be in a liquid form, semi-liquid form, of a solid form that is heated.

2.1.2 ANSI

American National Standards Institute

2.1.3 Standard Laboratory Conditions

The enclosure where the test specimens are constructed, cured, and tested. This enclosure shall be protected from the elements and be maintained at a temperature of 73 ± 4°F (23 ± 2°C) and relative humidity of 50% ± 5%.

2.1.4 Failure Load

The peak load value observed when the test specimen is no longer able to resist additional loading, or the test is stopped due to other limiting factors.

2.1.5 Substrate Board

A rigid board used in a roof assembly that can be tested for *adhesive* compatibility and bond strength (e.g., board stock insulation, cover board, thermal barrier, etc.)

2.1.6 Wind Uplift

The force generated by wind that acts on a roof assembly or components of a roof assembly. Wind that is deflected around and across the surfaces of a building causes a drop in air pressure immediately above the roof surface (reduced pressure); the air in the building will flow beneath the roof deck (positive pressure), and the combined uplift pressures attempt to lift the roof assembly upward. *Wind uplift* may also be caused by the introduction of wind underneath the roof edges where it can cause the roof assembly to pull away from the substrate.

2.2 Test Equipment

2.2.1 Tensile Tester

A tensile testing machine capable of applying and measuring a load at a constant cross head speed of 2 in./min (51 mm/min). The tensile tester shall be calibrated within 12 months of the date of testing in accordance with a nationally recognized standard. (See Commentary 2.2.1)

2.2.2 6 × 6 Test Jig

The 6 × 6 test jig includes two solid 6 in. × 6 in. metal plates. The plates have a minimum of 4 holes where screws can be used to attach the plate to the test specimen. An additional hole at the center of the plate contains a bolt that is used for securing the test specimen to a tensile tester. (See Commentary 2.2.2)

2.3 Safety Precautions

2.3.1 This is a destructive test in which specimens will be brought to failure. All personnel conducting the test, or in close proximity to the test, should be wearing safety shoes and safety glasses.

2.3.2 Safety glasses and gloves should be worn when applying *adhesives* during specimen preparation. Specimen preparation area should be well ventilated.

3.0 ADT-1 Procedure

3.1 Specimen Construction

3.1.1 If an *adhesive*/substrate combination is to be tested, prepare the test specimen by adhering two 6 in. × 6 in. (150 mm × 150 mm) samples of the substrate together using the *adhesive* being evaluated. Adhere a 6 in. × 6 in. (150 mm × 150 mm) piece of plywood to both sides of the 6 in. × 6 in. (150 mm × 150 mm) test specimen using a compatible *adhesive* with a bond strength anticipated to be stronger than the test specimen under evaluation. All *adhesives* shall be applied according to the manufacturer's installation instructions. See Commentary C3.1.1 for coverage rate. Excess material should be removed from the perimeter of the sample prior to testing.

3.1.2 If an *adhesive* is to be tested without an identified substrate, adhere the 6 in. × 6 in. (150 mm × 150 mm) pieces of plywood to each other using the *adhesive* being evaluated. The *adhesive* being evaluated is to be applied per the manufacturer's specifications.

3.2 Fixturing

3.2.1 Secure the 6 in. × 6 in. metal plates to the plywood with a minimum of 4 wood screws of appropriate length. (See Commentary 3.2.1)

3.2.2 When ready for testing, the specimen is secured to the tensile testing machine using the bolts attached to the metal plates. If the weight of the specimen or method of fixturing exerts a force on the load cell, the load should be zeroed. (See Commentary 3.2.2)

3.3 Conducting the Test

3.3.1 Testing shall be conducted in *standard laboratory conditions*.

3.3.2 Force is exerted in a direct line perpendicular to the plane of the *adhesive* interface at a crosshead speed of 2 in./min (51 mm/min).

3.3.3 The load shall be applied until the specimen fails or until higher forces are unable to be attained or maintained. (See Commentary 3.3.3)

3.3.4 The *failure load* and mode of failure shall be recorded for each specimen tested. (See commentary 3.3.4 for information on test specimen sampling size)

4.0 Results

4.1 Record the manufacturer of all component materials used.

4.2 Record information about the conditioning of the test specimen including temperature, RH, and *adhesive* cure time.

4.3 Record *adhesive* application method.

4.4 Record *adhesive* application rate.

4.5 Record the manufacturer of the tensile testing equipment and model number if applicable.

4.6 Record the calibration date of the tensile testing equipment.

4.7 Record the *failure load* of each specimen tested.

4.8 Record the mode of failure for each specimen tested.

5.0 Precision and Bias

There is not enough data available to establish precision and bias.

Appendix A

Commentary

This Commentary is not a part of this standard. It consists of explanatory and supplementary material designed to assist users in complying with the requirements. It is intended to create an understanding of the requirements through brief explanations of the reasoning employed in arriving at these requirements or to provide other clarifications. It therefore has not been processed in accordance with *ANSI* Essential Requirements and may contain material that has not been subjected to public review or a consensus process. Thus, it does not contain requirements necessary for conformance with 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.

C1.2 Significance and Use

This standard is intended to be a basis of practical comparative testing for roof system components that are within the scope of this standard. Acceptable applications include, but aren't limited to:

1. Determination of the comparative performance of component combinations—Prior to full scale roof assembly testing, it is reasonable to perform small scale testing in accordance with this standard to determine the lowest performing component combination(s). Using the lowest performing component combination(s) in full-scale roof assembly testing would allow the inclusion of the component combination(s) tested in accordance with this standard to be included in the full-scale assembly listings or approvals.
2. Inclusion of alternate components into existing roof assembly listings or approvals—Should a manufacturer desire to change a component, or include an alternate component, it is reasonable to perform comparative small-scale testing in accordance with this standard to determine if the proposed components perform as well or better than the existing components.

C2.2.1 Tensile Tester

The tensile testing mean should be equipped with a load cell that is appropriate for the expected or discovered loads. In some cases, load cells have a recommended load range that differs from the stated maximum load capacity due to non-linearity near zero or near maximum load.

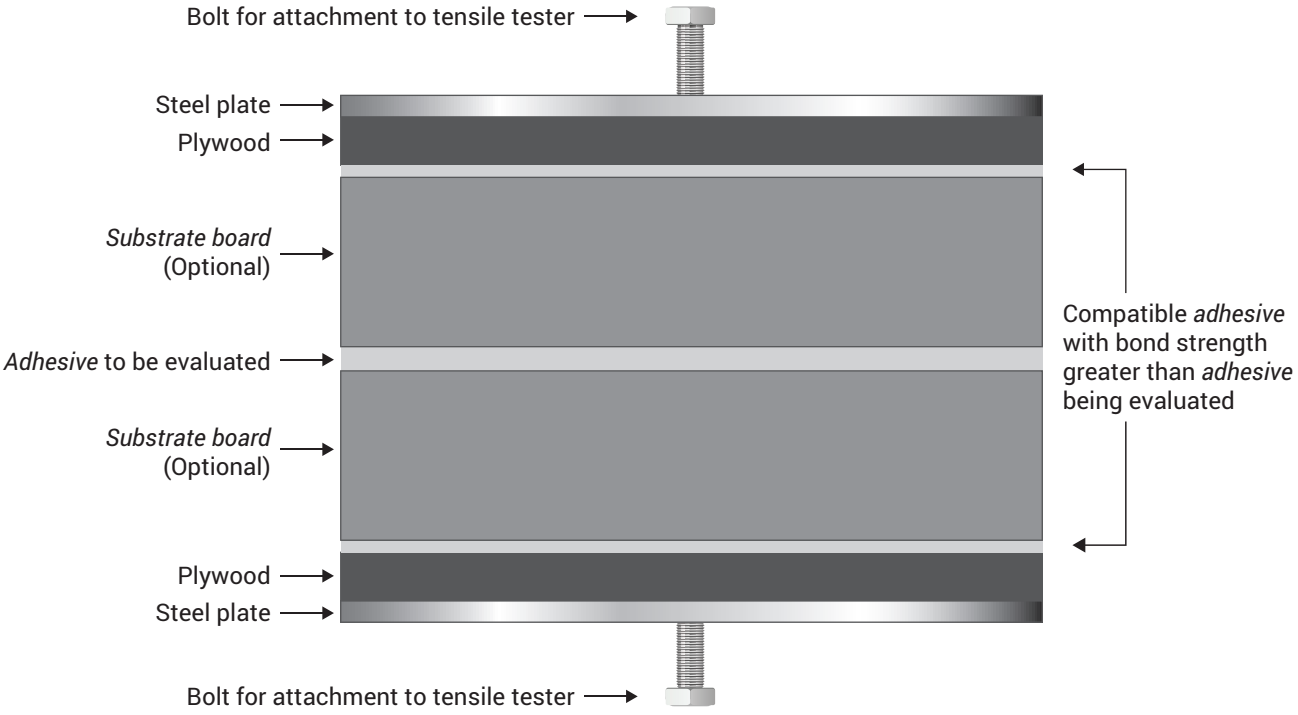
C2.2.2 6 × 6 Test Jig

The metal plates are typically a minimum of ¼" thick. The material used should be strong enough to prevent deformation while under load. Additional holes may be necessary to prevent fastener withdrawal from the plywood blocks. The center bolt can be substituted with another appropriate attachment point such as an eyehook or threaded rod.

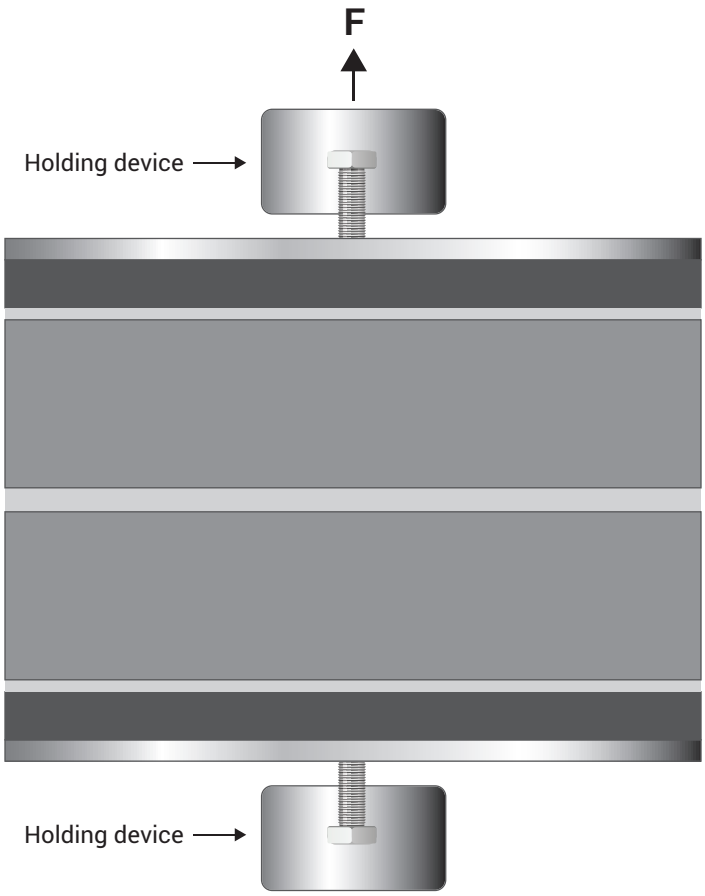
C3.1.1 Specimen Construction

Adhesive is applied as a single or multiple bead/ribbon, or in full coverage. When using this standard to evaluate and compare *adhesive*/substrate combinations, it is imperative the *adhesive* coverage is consistent between samples. For approval purposes, the approval body having jurisdiction shall determine the required coverage. Full coverage can reduce sample-to-sample variation and can yield more repeatable results.

C3.2.1



C3.2.2



C3.3.3 Failure can occur at the *adhesive* layer or within another layer of the assembly. The test can also end when the maximum capacity of the tensile testing equipment is reached. If failure occurs due to fastener withdrawal from the plywood blocks, it may be necessary to increase the number of fasteners used to secure the metal plates. Plywood of appropriate grade and thickness should be used to minimize the likelihood of failure within the plywood.

C3.3.4 This standard does not provide requirements for test specimen sampling size. It is the responsibility of the program sponsor to determine their needs to meet the requirements of the authority having jurisdiction.