ANSI/SPRI/FM BPT-1 2021

Test Standard for Comparative Pull-Through Strengths of Insulation Fastening Systems and Substrate Board Materials Used with Low Slope Roofing Systems

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Disclaimer
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1 Introduction

1.1 Scope

This standard provides basic requirements and procedures for determining the *maximum failure load of substrate boards, fasteners, or fastening systems* when tested for dynamic pull-through resistance.

1.2 Reference Document

The Florida Building Code Application Standards TAS 117(B) Test Procedure for Dynamic Pull-Through Performance of Roofing Membranes over Fastener Heads or *Fasteners* with Metal Bearing Plates

1.3 Significance and Use

1.3.1 Roof assemblies are tested for wind uplift resistance in accordance with various Standards, such as *ANSI*/FM 4474, Florida Building Code TAS 114, or UL 1897. Each assembly is made up of various components. The test procedure in this standard is useful in qualifying components or component combinations to reduce the dependence on large scale roof assembly testing. See Commentary C1.3 for additional information.

1.3.2 This test procedure is used to determine the *maximum failure load* of a *substrate board* when secured with a *fastener*, or a *fastener* and *stress plate* combination and introduced to a linear load perpendicular to the *substrate board*.

2 General Information

2.1 Definitions

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

2.1.1 ANSI

American National Standards Institute

2.1.2 Fastener

A mechanical component used alone or in conjunction with a *stress plate* to secure *substrate boards* to the roof deck.

2.1.3 Fastening System

An assembly that includes a *fastener* and *stress plate* that will be used to test the pull-through resistance of the *substrate board*.

2.1.4 Maximum Failure Load

The peak load value observed when the test specimen is no longer able to resist the application of additional load.

2.1.5 Stress Plate

A specially designed metal or plastic washer, or plastic sleeve, intended to secure a *substrate board* and resist uplift loads.

2.1.6 Substrate Board

A rigid board that can be tested for pull-through resistance in combination with the *fastener* or *fastening system*, e.g. board stock insulation, cover board, thermal barrier, etc.

2.2 Apparatus

2.2.1 A tensile test machine that applies load with a constant rate of speed and can measure the applied load. The equipment shall be calibrated within 12 months of the date of testing, in accordance with a standard that is traceable to a nationally recognized source. The load cell shall be of appropriate load capacity to ensure accurate results. See Commentary C2.2.1.

2.2.2 A *substrate board* holding device which shall have an open area of 12 in. x 12 in. (305 mm x 305 mm) or 18 in. x 18 in. (457 mm x 457 mm). See Commentary C2.2.2 for additional information.

2.3 Test Specimen Sourcing

2.3.1 All specimens shall be provided by the program sponsor or component supplier and tested as received.

2.3.2 All specimens shall be preconditioned at standard laboratory conditions, 73 ± 4°F (23 ± 2°C) and 50% relative humidity ± 5%.

3 BPT-1 Procedure

3.1 Test Specimen Setup

3.1.1 The *substrate board* shall be cut to a size that is appropriate for the proposed *substrate board* holding device. See Commentary C3.1.1.

3.1.2 The *fastener* or *fastening system* shall be installed in accordance with manufacturer's guidelines through the center of the *substrate board*.

3.1.3 The test specimen shall be installed and secured in a tensile test machine, in preparation for a load to be applied perpendicular to the plane of the *substrate board*.

3.1.3.1 Statically secure the substrate holding device and move the *fastener*, or statically secure the *fastener* and move the substrate holding device. See Commentary C3.1.3.1.

3.1.4 Information on test specimen sampling size is provided in Commentary C3.1.4.

3.1.5 Adequate personal protective equipment shall be available and in use, such as eye protection.

3.2 Test Method

3.2.1 Testing shall be conducted in standard laboratory conditions, 73 ± 4°F (23 ± 2°C) and 50% relative humidity ± 5%.

3.2.2 Load is applied perpendicular to the plane of the *substrate board* at a speed of 2.0 in./min (50 mm/min).

3.2.3 The *maximum failure load* and mode of failure shall be recorded for each test sample.

3.2.3.1 Potential modes of failure include pull through of the *fastener* head or *stress plate* in the substrate, fracture of the substrate around the *fastener* head, *stress plate*, or *fastener* stem, or breakage of the *fastener*, *fastener* head, or *stress plate*.

4 Reporting

Test reports shall include the following:

4.1 Name and address of the manufacturer or supplier of each test specimen component.

4.2 Name or other identification marks of each test specimen component, including any relevant listing and labeling marks.

4.3 Description of each test specimen component.

4.4 Conditioning of the test specimens, environmental data during the test (temperature, RH, etc.).

4.5 Identification of the laboratory technician.

4.6 Identification of the test equipment and instruments used, including open area dimensions of the *substrate board* holding device.

4.7 Calibration date of the tensile test machine.

4.8 Any deviations from the test method.

4.9 *Maximum Failure Load* of each test specimen (lbf and N).

4.10 Mode of failure of each test specimen.

4.11 Statistics. See Commentary C4.9 for additional information.

5 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.

C1.3 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 Load Cell

Ensure the load cell 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 Substrate Board Holding Device

FM Approvals uses a 12 in. x 12 in. (305 mm x 305 mm) open area holding device, while TAS 117(b) requires the use of an 18 in. x 18 in. (457 mm x 457 mm) open area holding device. It is the responsibility of the program sponsor to determine their needs to meet the requirements of the authority having jurisdiction.

C3.1.1 Substrate Board Size

The *substrate board* should be of sufficient size to prevent premature buckling or failure at the restrained edges of the open area. The *substrate board* should be at least 2 inches (51 mm) larger than the length and width of the open area but may vary depending on the characteristics of the board and the holding device. This may mean that the program sponsor and laboratory will need to work together to determine the best practices for the proposed *substrate board* to ensure valid results.

C3.1.3.1 Test Specimen and Fixturing Schematics

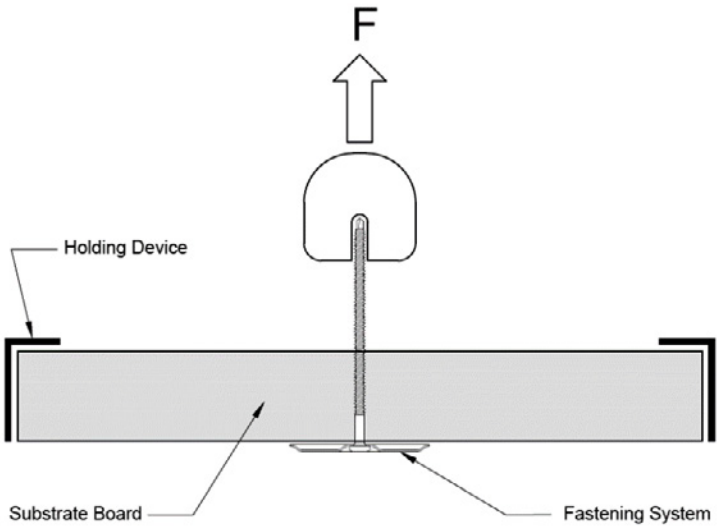

Figure C3.1.3.1A

Cross-sectional view of a test apparatus setup whereby the holding device is statically secured and the fastener is free to move when a load is applied.

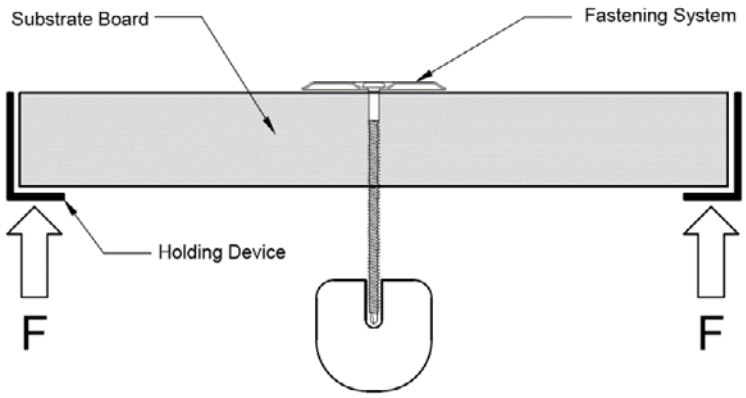

Figure C3.1.3.1B

Cross-sectional view of a test apparatus setup whereby the fastener is statically secured and the holding device is free to move when a load is applied.

C3.1.4 Test Specimen Sampling Size

This standard does not provide requirements for test specimen sampling size. FM Approvals requires a sampling size of three (n=3) for their purposes and The Florida Building Code Application Standards TAS 117(B) requires a sampling size of fourteen (n=14) for their purposes, but other jurisdictions may have different requirements. It is the responsibility of the program sponsor to determine their needs to meet the requirements of the authority having jurisdiction.

C4.11 Statistics

Statistical information required for approvals or listings may vary depending on the jurisdictional requirements. It is the responsibility of the program sponsors to determine the appropriate statistics to report.