

TESTING APPLICATION STANDARD (TAS) No. 103-95

:

TEST PROCEDURE FOR SELF-ADHERED UNDERLAYMENTS FOR USE IN DISCONTINUOUS ROOF SYSTEMS

1. Scope

1.1 This Protocol covers procedures for testing self-adhering, prefabricated, reinforced, polymer modified bituminous, and solid thermoplastic sheet roofing materials intended for use as underlayment in Discontinuous Roof Systems to assist in the waterproofing to function in combination with a Prepared Roof Covering. These products may employ granular surfacing materials on one side in which case the “Granular Adhesion” test, as specified herein, shall also be conducted. The Granular Adhesion test shall be required for all granular surfaced materials used as a bonding surface for mortar or adhesive set tile systems.

1.2 The test procedures outlined in this Protocol cover the determination of the Wind Uplift Resistance; the Thickness; the Dimensional Stability; the Tear Resistance; the Breaking Strength; the Elongation; the Water Absorption; the Low Temperature Flexibility; the Ultraviolet Resistance; the Accelerated Aging Performance; the Cyclic Elongation Performance; the Water Vapor Transmission; the Compound Stability; the Puncture Resistance; the Tile Slippage Resistance; the Crack Cycling Resistance; and the Peel Resistance of an underlayment material; and Granular Adhesion of a mineral surfaced roll roofing material, for use as an underlayment.

1.3 These test methods appear in the following order:

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2. Referenced Documents

2.1 ASTM Test Standards:

D 1079	Standard Definitions and Terms Relating to Roofing, Waterproofing and Bituminous Materials
D 1938	Tear Propagation Resistance of Plastic Film and Thin Sheeting by a Single-Tear Method
D 2523	Testing Load-Strain Properties of Roofing Membranes
D 570	Water Absorption of Plastics
D 1970	Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection (Low Temperature Flexibility)
E 96	Water Vapor Transmission of Materials
D 5147	Sampling and Testing Modified Bituminous Sheet Materials
C 794	Adhesion-in-Peel of Elastomeric Joint Sealants
E 380	Excerpts from the Standard Practice for Use of the Interna-

tional System of Units (SI) (the Modernized Metric System)

- 2.2 *International Conference of Building Officials*
Acceptance Criteria For Roof Underlayment For Use In Severe Climate Areas Acceptance Criteria For Concrete Tile Underlayment On Spaced Sheathing
- 2.3 *American Plywood Association*
Performance Standards and Policies for Structural-Use Panels
- 2.4 *The Florida Building Code, Building.*
- 2.5 *Application Standards*
TAS 124 Test Procedure for Field Uplift Testing of Existing Membrane Roof Systems
- 2.6 *Roof Consultants Institute*
Glossary of Terms
- 3. Terminology & Units**
- 3.1 Definitions - For definitions of terms used in this Protocol, refer to ASTM D 1079; Chapters 2 and 15 (High-Velocity Hurricane Zones) of the *Florida Building Code, Building* and/or the RCI Glossary of Terms. The definitions from the *Florida Building Code, Building* shall take precedence.
- 3.2 Units - For conversion of U.S. customary units to SI units, refer to ASTM E 380.
- 4. Significance and Use**
- 4.1 The test procedures outlined in this Protocol provide a means of determining whether a self-adhering roofing material, intended for use as an underlayment in a Discontinuous Roof System, for use in the High-Velocity Hurricane Zones, meets the requirements of the *Florida Building Code, Building*.
- 5. Conditioning**
- 5.1 Unless otherwise specified, condition test specimens for a minimum of four (4) hours at $73.4 \pm 3.6^\circ\text{F}$ and $50 \pm 5\%$ relative humidity prior to testing. Note sepa-

rate conditioning requirements for cold bend testing in Section 12.1.

6. Thickness

- 6.1 Materials shall be checked at five points across the roll width. Measurements shall be made at two points, each being 6 ± 0.5 inches from each edge, and at three points equally spaced between these two points.
- 6.2 Compute the average thickness and the standard deviation of the thicknesses, in mils, based on the total number of point measurements from all of the rolls taken.
- 6.3 Report the individual point measurements, average, and standard deviation in mils.
- 6.4 Any modified bitumen and bituminous membrane test specimen which exhibits an average thickness less than sixty (60) mils shall be considered as failing the thickness test. Thickness measurements shall be at the selvage edge, not at a granular surface.
- 6.5 Nonbituminous membranes shall not have a thickness minimum. Performance shall be based on physical property testing.

7. Wind Uplift

- 7.1 This test covers the determination of the wind uplift resistance of materials specified in Section 1 of this Protocol in accordance with TAS 124 except as noted below.

7.1.1 Sampling

7.1.1.1 Test is being conducted on materials noted in Section 1 of this Protocol; therefore, any reference to "roof membrane" in TAS 124 shall be regarded as "underlayment."

7.1.1.2 Four (4) 8' x 8' test decks shall be constructed of 40/20 $^{19}/_{32}$ in. APA Rated Sheathing attached to wood joists spaced 24 o.c. Each test deck shall con-

sist of four (4) panels of said sheathing, the corners of which shall meet at the center of each test deck, leaving a $\frac{1}{8}$ in. gap between panels.

- 7.1.1.3 Adhere one (1) layer of underlayment to each test deck.

7.1.2 Procedure

- 7.1.2.1 Test shall be a laboratory test not a field test; therefore, any instruction in TAS 124 which references “building or outdoor conditions” shall be regarded as “laboratory conditions.”

- 7.1.2.2 Regulate the negative pressure in the chamber. Begin by raising the negative pressure in the chamber to 30 lbf/ft² and holding this pressure for one (1) minute. Thereafter, raise the negative pressure in increments of 15 lbf/ft², holding each incremented pressure for one (1) minute, until the negative pressure has been held at 90 lbf/ft² for one (1) minute.

7.1.3 Report

- 7.1.3.1 Any test specimen which exhibits any deflection or significant blistering from the sheathing surface shall be considered as failing the wind uplift test.

8. Dimensional Stability

- 8.1 Prepare five (5) 2 foot wide x 6 foot long specimens with a 4 inch overlap seam across the center of the 6 foot length. Prepare the specimens: one from each edge of the roll and three from random places in the roll. The length of each specimen should be in the “machine direction” of the roll.

- 8.2 The substrate shall be APA 32/16 span rated sheathing of a $\frac{15}{32}$ in. thickness that has been reinforced on the back side with two angle irons.

- 8.3 Adhere the underlayment specimen on the substrate and install a $1\frac{1}{2}$ in. x $1\frac{1}{2}$ in. x 2' wood termination batten to one “free” end of the underlayment using three (3) equally spaced #12 wood screws to secure the batten through the underlayment and the sheathing. Mechanically attach the other “free” end of the underlayment using three (3) equally spaced 10d roofing nails, located two (2) inches from the “free” end, with one nail at one inch from each edge, penetrating the sheathing a minimum of $\frac{1}{2}$ inch.

- 8.4 Condition each specimen in an oven or under heat lamps maintained at $180 \pm 5^{\circ}\text{F}$ for a minimum of six (6) hours.

- 8.5 Report any tears or “tear drop” conditions which arise at fastener penetrations during and/or after conditioning is complete. Report any shrinking or wrinkling which appears to have compromised the lapped area of underlayment.

- 8.6 Any test specimen which exhibits conditions noted in Section 8.5 of this Protocol shall be considered as failing the dimensional stability test.

- 8.7 Provide before and after photographs of each specimen in the final test report.

9. Tear Resistance

- 9.1 This test covers the determination of the tear propagation resistance of materials specified in Section 1 of this Protocol in accordance with ASTM Test Method D 1938, except as noted below.

- 9.1.1 The prescribed Test Method shall be run in both the machine and the cross-machine direction of the roll material.

- 9.1.2 The final test report shall include average tear propagation force values and standard deviations of these value for both the machine and the cross-machine direction of the material.

9.1.3 Any test specimen which exhibits a tear propagation value less than 3.5 lbf (15.5 N) in either the machine or cross-machine directions shall be considered as failing the tear strength test.

10.1.3.4 Specimens and testing grips shall be conditioned at 77°F for a minimum of one (1) hour prior to testing.

10. Breaking Strength and Elongation

10.1 This test covers the determination of the breaking strength and elongation of materials specified in Section 1 of this Protocol in accordance with ASTM Test Method D 2523, except as noted below.

10.1.4 Report

10.1.1 Sampling

10.1.1.1 Ten specimens; five in the machine direction and five in the cross-machine direction of the roll, shall be cut to dimensions of 1 in. x 6 in.

10.1.4.1 Report the grip separation rate used.

10.1.2 Conditioning

10.1.2.1 Heat Aging, shall consist of seven (7) days in an air circulating oven at a controlled temperature of 149 ± 5°F.

10.1.4.2 Breaking strength shall be reported, in lbf/inch of width, for all test specimens and shall be itemized in grouping of “as received,” after heat conditioning, and after QUV exposure. These grouping shall be itemized in subgroups of machine direction and cross-machine direction. Any test specimen which exhibits a breaking strength value less than those listed in Table 1 shall be considered as failing the breaking strength test.

10.1.2.2 QUV Exposure, shall consist of 460 hours of continuous ultraviolet light exposure.

**TABLE 1
MINIMUM BREAKING STRENGTH VALUES**

SPECIMEN	BREAKING STRENGTH
As Received After Heat Aging After QUV Exposure	(Machine Direction or Cross-Machine Direction) 20 lbf/inch of width (35 N/cm of width) 85% of “as received” 85% of “as received”

10.1.3 Procedure

10.1.3.1 Each set of samples, as specified in 10.1.1.1 herein, shall be tested “as received”, after heat aging, and after QUV exposure, as specified in 10.1.2.1 and 10.1.2.2 herein.

10.1.4.3 Elongation shall be reported, in (%), for all test specimens and shall be itemized in grouping of “as received,” after heat conditioning, and after QUV exposure. These grouping shall be itemized in subgroups of machine direction and cross-machine direction. Any test specimen which exhibits elongation values less than those listed in Table 2 shall be considered as failing the elongation test.

10.1.3.2 Grip separation rate shall be 20 ± 0.2 inches per minute for all tests conducted.

10.1.3.3 Testing shall be performed at 77°F for all tests.

**TABLE 2
MINIMUM ELONGATION VALUES (%)**

SPECIMEN	ORGANIC REINFORCEMENT	FIBERGLASS REINFORCED	POLYESTER OR POLYPROPYLENE REINFORCED	SOLID THERMOPLASTIC SHEATHING
As Received	MD 6% XMD 6%	MD 3% XMD 3%	MD 25% XMD 25%	MD 225% XMD 225%
Aster Heat Aging	85% of "as received"	85% of "as received"	85% of "as received"	85% of "as received"
After QUV Exposure	85% of "as received"	85% of "as received"	85% of "as received"	85% of "as received"

11. Water Absorption

11.1 This test covers the determination of the water absorption of materials specified in Section 1 of this Protocol in accordance with ASTM Test Method D 570, except as noted below.

11.1.1 Preparation

11.1.1.1 Edges of membranes which include internal reinforcement as a component shall be sealed with wax to prevent water absorption through these edges. Wax shall cover not more than 0.25 in. at each edge.

11.1.1 Conditioning

11.1.1.1 Conditioning shall consist of 72 continuous hours of exposure to temperatures and relative humidity specified in Section 5 of this Protocol.

11.1.2 Report

11.1.2.1 Any test specimen which exhibits water absorption values greater than 3% shall be considered as failing the water absorption test.

12. Low Temperature Flexibility

12.1 This test covers the determination of the low temperature flexibility of materials specified in Section 1 of this Protocol in accordance with ASTM Test Method D 1970 (7.4), except as noted below. Membranes shall be tested at -10°F.

12.1.1 Procedure

12.1.1.1 Each set of specimens shall be tested "as received" and after conditioning, as specified in ASTM D 1970 (7.4.2).

12.1.2 Report

12.1.2.1 Low temperature flexibility results shall be reported on a pass/fail basis, for all test specimens and shall be itemized in grouping of "as received" and after conditioning. No cracking at -10°F shall be considered as passing the low temperature flexibility test.

13. Ultraviolet Resistance

13.1 This test covers the determination of the ultraviolet resistance performance of materials specified in Section 1 of this Protocol in accordance with the ICBO Acceptance Criteria For Roof Underlayment For Use In Severe Climate Areas (Section IV-H), except as noted below.

13.1.1 Sampling - Two 18 in. x 18 in. specimens are to be cut.

13.1.2 Conditioning

13.1.2.1 Conditioning shall be in accordance with ICBO Acceptance Criteria For Roof Underlayment For Use In Severe Climate Areas (Section IV-H), except as noted below.

13.1.2.2 Ultraviolet light shall be produced by four 300 watt UV lamps. Recommended lamps are Ultra-Vitalux, 300 W, 220-230 V, #E27, or osram 300 W lamps.

13.1.2.3 Specimens to be exposed for 200 hours (10 hours per day for 20 days).

13.1.2.4 Specimen temperature to be maintained at 135-140°F throughout the test period.

13.1.3 Report & Conditions of Acceptance

13.1.3.1 Report any visible peeling, chipping, cracking, flaking, pitting or other damage, under 5x magnification, which resulted from the ultraviolet conditioning. Report the type and location of the damage (if any).

13.1.3.2 Report the type of UV lamps used to condition the samples.

13.1.3.3 Any test specimen which exhibits damage as defined in Section 13.1.2.1 of this Protocol shall be considered as failing the ultraviolet resistance test.

13.1.3.4 Do not subject the ultraviolet exposed specimens to “tensile strength and peel-adhesion test” as noted in the ICBO Acceptance Criteria Document. The “breaking strength” shall be addressed as specified in Section 9 of this Protocol and “peel-adhesion” will not be a requirement of this Protocol.

14. Accelerated Aging

14.1 This test covers the determination of the accelerated aging performance of materi-

als specified in Section 1 of this Protocol in accordance with the ICBO Acceptance Criteria For Roof Underlayment For Use In Severe Climate Areas (Section IV-G), except as noted below.

14.1.1 Sampling

14.1.1.1 The six (6) 12 in. x 12 in. specimens shall be prepared with three (3) in the machine direction and three (3) in the cross-machine direction of the roll.

14.1.2 Conditions of Acceptance

14.1.2.1 Do not subject the aged specimens to “tests in accordance with Section III A, D and E.” Water ponding tests (“Section III D”) and peel-adhesion tests (“Section III E”) are not requirements of this Protocol. The noted “Section III A” shall be addressed in Section 13.1.3 of this Protocol.

14.1.3 Breaking strength and elongation tests of aged specimens shall be conducted in accordance with Section 10 of this Protocol, except as noted below.

14.1.3.1 Sampling - After the six (6) 12 in. x 12 in. aged specimens have been examined for visible damage, prepare ten (10) 1 in. x 6 in. specimens from the aged material; five in the machine direction and five in the cross-machine direction of the roll. In addition to these ten aged specimens, prepare ten “as received” specimens of the same dimensions; five in the machine direction and five in the cross-machine direction of the roll.

14.1.3.2 Conditioning - No further conditioning is to be incurred on the aged specimens.

14.1.3.3 Procedure - Each set of samples, as specified in 13.1.3.1 herein, shall be tested “as received” and after accelerated aging.

14.1.3.4 Report

14.1.3.4.1 Breaking strength shall be reported, in lbf/inch of width, for all test specimens and shall be itemized in grouping of “as received” and after accelerated aging. These grouping shall be itemized in subgroups of machine direction and cross-machine direction. Any aged specimen which exhibits a breaking strength less than 85% of the “as received” value shall be considered as failing the accelerated aging test.

14.1.3.4.2 Elongation shall be reported, in (%), for all test specimens and shall be itemized in grouping of ‘as received’ and after accelerated aging. These grouping shall be itemized in subgroups of machine direction and cross-machine direction. Any aged specimen which exhibits an elongation value less than 85% of the ‘as received’ value shall be considered as failing the accelerated aging test.

15. Cyclic Elongation

15.1 This test covers the determination of the cyclic elongation performance of materials specified in Section 1 of this Protocol in accordance with the ICBO Acceptance Criteria For Roof Underlayment For Use In Severe Climate Areas (Section IV F), except as noted below.

15.1.1 Specimens shall be adhered over the two pieces of sheathing.

15.1.2 The three specimens shall be prepared with $32/16^{15/32}$ in. x 3 in. x 6 in. APA span rated sheathing.

15.1.3 Any test specimen which exhibits cracking of material shall be considered as failing the cyclic elongation test.

16. Water Vapor Transmission

16.1 This test covers the determination of the water vapor transmission of materials specified in Section 1 of this Protocol in accordance with ASTM Test Method E96, procedure B.

16.2 The water vapor transmission of the membrane shall not be greater than 1.0 g/m² in 24 hours.

17. Compound Stability

17.1 This test covers the determination of the high temperature stability of materials specified in Section 1 of this Protocol in accordance with ASTM Test Method D 5147, Section 15, except as noted below.

17.1.1 Any test specimen which exhibits flowing, dripping or drop formation at a temperature less than 220°F shall be considered as failing the compound stability test.

18. Puncture Resistance

18.1 This test covers the determination of the puncture resistance of materials specified in Section 1 of this Protocol in accordance with the ICBO Acceptance Criteria For Concrete Tile Underlayment On Spaced

Sheathing (Section 5.0, d,2), except as noted below.

18.1.1 Two 12 in. x 25 in. specimens shall be prepared; one ultraviolet light conditioned and one accelerated aging conditioned, as specified in Sections 13 and 14 of this Protocol, respectively.

18.1.2 Any test specimen which exhibits any sign of puncture shall be considered as failing the puncture test.

19. Slippage Resistance

19.1 Prepare three (3) 4 foot wide x 8 foot long specimens with a 4 inch overlap seam across the center of the 8 foot length. Prepare the specimens: one from one edge of the roll and one from the center of the roll. The length of each specimen should be in the “machine direction” of the roll.

19.2 The substrate shall be 32/16 ¹⁵/₃₂ in. APA span rated sheathing that has been reinforced on the back side with two angle irons.

19.3 Adhere the underlayment to the substrate.

19.4 Condition each test deck in an oven or under heat lamps maintained at 135 ± 5°F for a minimum of four (4) hours. Thereafter, the deck shall be cooled for three hours at 75° ± 5°F.

19.5 After conditioning, position one test deck at a slope of 4 in:12 in.; one at a slope of 5 in:12 in.; and the third at a slope of 6 in:12 in. The 5 in:12 in. test deck may be omitted if requested by the client.

19.6 Onto each sloped test deck, place one (1) stack of 10 flat concrete tiles and one (1) stack of 10 profiled tiles manufactured with “lugs” on the underside of each tile. Allow the tile stacks to sit on the underlayment surface for 72 hours while maintaining a controlled surface temperature of 165° ± 5°F. Temperature to be maintained by a surface mounted thermocouple.

19.7 Report any tears or tile slippage on any portion of the underlayment.

19.8 Any test specimen which exhibits conditions noted in Section 19.7 of this Protocol shall be considered as failing the tile slippage resistance test.

19.9 Provide before and after photographs of each specimen in the final test report.

20. Crack Cycling

20.1 This test covers the determination of the crack cycling performance of materials specified in Section 1 of this Protocol in accordance with the ICBO Acceptance Criteria For Roof Underlayment For Use In Severe Climate Areas (Section IV, F), except as noted below.

20.1.1 Specimens shall be adhered over the two pieces of sheathing.

20.1.2 The three specimens shall be prepared with 32/16 ¹⁵/₃₂ in. x 3 in. x 6 in. APA span rated sheathing.

20.1.3 Conditioning shall consist of exposure to a controlled temperature of 180 ± 5°F and 55 ± 5% relative humidity for a period of seven (7) days.

20.1.4 Any test specimen which exhibits cracking of material shall be considered as failing the cyclic elongation test.

21. Peel Adhesion

21.1 This test covers the determination of the peel adhesion to substrate performance of materials specified in Section 1 of this Protocol in accordance with ASTM Test Method D 1970 (7.4), except as noted below.

21.1.1 Specimen Preparation

21.1.1.1 The substrate shall be APA 32/16 span rated sheathing of a ¹⁵/₃₂ in. thickness.

21.1.2 Conditioning

21.1.2.1 One set of samples shall be conditioned at 75 ± 2°F for four (4) hours; a sec-

ond and third set shall be conditioned as specified in the ICBO Acceptance Criteria For Roof Underlayment For Use In Severe Climate Areas, Sections IV-G and IV-H for accelerated aging and ultraviolet resistance, respectively.

21.1.1 Report

21.1.3.1 Peel Adhesion shall be reported, in lbf/foot of width, for all test specimens and shall be itemized in grouping of “conditioned at 75°F,” “after accelerated aging” and “after ultraviolet conditioning.”

21.1.3.2 Any “conditioned” specimen which exhibits a peel strength less than 6.5 lbf/foot of width shall be considered as failing the peel adhesion test.

21.1.3.3 Any aged or ultraviolet conditioned specimen which exhibits a peel strength less than 75% of the “conditioned at 75°F” value shall be considered as failing the peel adhesion test.

**FOR MINERAL SURFACED ROLL MATERIAL
TO BE
: USED AS A MORTAR OR ADHESIVE SET TILE
UNDERLAYMENT**

22. Granule Adhesion

22.1 This test covers the determination of granule loss of materials specified in Section 1 of this Protocol, which employ a granular surfacing on one side, in accordance with ASTM Test Method D 5147, Section 14, except as noted below.

22.1.1 Any test specimen which exhibits an average granule loss greater than 0.75 grams shall be considered as failing the granule adhesion test.

