Designation: E 2134 – 01

Standard Test Method for Evaluating the Tensile-Adhesion Performance of an Exterior Insulation and Finish System (EIFS)[1]

This provisional standard is issued under the fixed designation E 2134; the number immediately following the designation indicates the year of original adoption.

1. Scope

1.1 This test method evaluates the tensile-adhesion performance of an exterior insulation and finish System (EIFS) or its individual components by two different procedures: Procedure A, Dry Conditioning and Testing of Specimens; and Procedure B, Wet Conditioning and Testing of Specimens.

1.2 The values stated in SI units are to be regarded as the standard. The inch-pound units given in parentheses are for information only.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

E 4 Practice for Force Verification of Testing Machines[2]

E 631 Terminology of Building Constructions[3]

2.2 *EIFS Industry Members Association (EIMA):*

Guideline Specification for Exterior Insulation and Finish Systems, Class PB[4]

3. Terminology

3.1 *Definitions*:

3.1.1 For definitions of general terms relating to building construction used in this test method, see Terminology E 631.

3.2 *Definitions of Terms Specific to this Standard:*

3.2.1 *adhesion*—the state in which two surfaces are held together by forces at the interface.

3.2.2 *cohesion*—the molecular attraction that holds a body together. The internal strength of a material.

3.2.3 *specimen*—the entire assembled unit cut from the sample and submitted for test as described in Section 7.

3.2.4 *tensile-adhesion strength*—the ultimate strength in tension normal to the plane of the system.

4. Summary of Test Method

4.1 Specimens are tested by applying tensile loads normal to the plane of the system in a controlled environment to determine the tensile adhesion of the system or individual components of the system, of both.

5. Significance and Use

5.1 Maintenance of adequate tensile adhesion of EIFS components to each other, and to the substrate are essential for long term performance of the system.

5.2 The tensile-adhesion properties obtained by this test method are not purported to be representative of wind load or other structural and moisture related properties of the EIFS wall assembly. Tensile-adhesion properties using this test method are used as one of the factors in evaluating substrates and to compare adhesives.

6. Apparatus

6.1 *Tensile Test Machine*, capable of producing a tensile load on the test specimen at a constant cross-head rate of 1.5 mm/min (0.05 in./min).

6.2 *Load Measuring Device*, calibrated according to Practice E 4, the test machine load measuring device shall be capable of measuring the load to an accuracy of ± 1 % of the maximum load applied to the test specimen.

6.3 *Loading Fixtures*— The loading fixtures shall be self-aligning and shall not apply eccentric loads. The loading fixtures shall be a minimum of 12.0-mm (0.5-in.)-thick metal blocks to keep the bonded facings essentially flat under the maximum applied load. The size of the loading blocks shall be not less than the bonded area of the test specimen.

6.4 *Temperature Control Chamber*—A room or chamber capable of maintaining 23 ± 3°C (75 ± 5°F) and 50 ± 5 % relative humidity.

6.5 *Containers*, corrosion resistant containers of sufficient size to hold specimens.

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[1] This test method is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.58 on Exterior Insulation and Finish Systems (EIFS).

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[2] *Annual Book of ASTM Standards*, Vol 03.01.

[3] *Annual Book of ASTM Standards*, Vol 04.11.

[4] Available from EIMA, 3000 Corporate Center Drive, Suite 270, Morrow, GA 30260.

7. Sample Preparation

7.1 Prepare one sample for each test condition described in Sections 9, 10, and 11. Samples shall be not less than 150 by 200 mm (6 by 8 in.) in size, such that, six test specimens no smaller than 50 by 50 mm (2 by 2 in.) can be cut from each sample after the specified sample conditioning. Samples may be cut from larger sheets for ease of system fabrication.

NOTE 1—As required above, test specimen size shall not be smaller than 50 by 50 mm (2 by 2 in.). However, as test specimen size increases, axial loading eccentricities become greater and can compromise the accuracy of the test results. To limit the effect of eccentricities, maximum test sample size should be limited to about 76 by 76 mm (3 by 3 in.).

7.2 Apply the adhesive in a uniform, continuous layer, such that the measured tensile load is representative of a fully bonded 50 by 50 mm (2 by 2 in.) test specimen. Apply the specified amount of adhesive. Smooth-out the adhesive using a flat trowel to ensure a uniform, continuous layer.

7.3 Samples conditioned wet under Section 11 or exposed to optional environmental conditioning under Section 9 may optionally have their back-sides protected from moisture using minimum 0.4-mm (0.015-in.)-thick aluminum foil bent half the distance up each edge of the sample. Following application of the aluminum foil, all four sample edges shall be dipped in hot wax to protect the edge from ingress of moisture.

7.4 For system testing, each sample shall consist of a substrate, adhesive, 25 mm (1 in.)-thick insulation board, reinforced base coat, primer (if used) and a finish coat.

7.5 For testing the interface between the substrate and adhesive, each sample shall consist of a substrate and adhesive only.

7.6 For testing the interface between the adhesive and insulation board, each sample shall consist of an adhesive and 25 mm (1 in.)-thick insulation board.

7.7 For testing the interface between the base coat and insulation board, each sample shall consist of 25 mm (1 in.)-thick insulation board and reinforced base coat.

7.8 For testing the interface between the base coat, primer (if used) and finish coat, each sample shall consist of the reinforced base coat and finish coat.

NOTE 2—For mechanically attached EIF Systems, tensile-adhesion performance is only required for the interface between the reinforced base coat and finish coat.

8. Sample Curing

8.1 Allow samples to cure a minimum of seven days (28 days for samples containing hydraulic cement) at a constant 23 ± 3°C (73 ± 5°F) and 50 ± 5 % relative humidity unless otherwise specified.

9. Specified Sample Exposure (When Specified)

9.1 Often it is desired to determine the effects of a specified sample exposure condition on tensile-adhesion strength. The tensile-adhesion test shall be conducted on companion samples before and after each exposure period.

NOTE 3—Depending on project objectives, it may be desired to determine retention of tensile-adhesion strength after extended wetting periods, freeze-thaw cycles, accelerated aging exposure, accelerated weathering cycles, other simulated static or cyclic environmental exposure conditions, conditions simulating system breach (that is, cracking), or actual field exposure.

9.2 After the specified exposure period, condition samples prior to testing dry or wet according to Sections 10 or 11, respectively.

10. Procedure A—Dry Conditioning and Testing of Specimens

10.1 *Dry Conditioning*— Condition all samples prior to testing in a dry state. Condition samples for seven days at a constant 23 ± 3°C (73 ± 5°F) and 50± 5 % relative humidity. Dry conditioning may be omitted for new samples that have been cured according to Section 8.

10.2 *Test Specimen Preparation*—Prepare six 50 by 50 mm (2 by 2 in.) test specimens from each 150 by 200 mm (6 by 8 in.) sample by sawing with a dry saw blade capable of dry-cutting the sample with negligible test specimen disturbance. Samples damaged during preparation shall not be tested.

10.3 *Test Procedure*— Attach the loading fixtures to the test specimens. For test specimens bonded to loading fixtures, use a paste consistency epoxy to avoid penetration of epoxy into the test plane (see Note 4). Take care during epoxy application such that epoxy does not squeeze-out from between fixtures and coat specimen sides, thereby potentially increasing the measured tensile-adhesion load.

NOTE 4—EPOWELD Extra Fast Setting Epoxy (Parts A and B), Part A (Reorder No. 04001-A) and Part B (Reorder No. 04001-B)[5] has given suitable results when used in accordance with the manufacturer's instructions. After use, place loading fixtures in oven at 204°C (400°F) for 1 h for easy cleaning with scraper.

10.3.1 Place loading fixtures in position without eccentric loading on the tensile-test machine.

10.3.2 Apply a tensile load at a constant rate of cross-head movement such that a maximum load will occur between 3 and 6 min.

NOTE 5—It has been found that a cross-head movement rate of 25µm/s (0.05 in./min.) is satisfactory to achieve maximum load in the appropriate amount of time for a 25-mm (1-in.)-thick test specimen.

10.3.3 Record the tensile-adhesion load at failure and the observed failure mode of all test specimens.

10.3.4 After testing, measure the actual thicknesses of each component layer for each specimen to the nearest 0.1 mm (0.005 in.) Calculate the average thickness of each component from measurements taken near the center of each specimen side, and record.

11. Procedure B—Wet Conditioning and Testing of Specimens

11.1 *Wet Conditioning*— Condition all samples prior to testing in a wet state. Condition by immersing samples face-up under 13 mm (0.5 in.) of potable water at a constant 23 ± 3°C (73 ± 5°F) for 48 h.

[5] The sole source of supply of the apparatus known to the committee at this time is Hardman Division, Harcrus Chemicals, Inc. Belleville, NJ 07109. If you are aware of alternative suppliers, please provide this information to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.

NOTE 6—If edges of sample are NOT to be sealed with aluminum foil prior to wet conditioning, then the sample shall be sawn into test specimens prior to wet conditioning according to 11.2 to eliminate the potential for non-uniform absorption.

11.2 *Test Specimen Preparation*—Remove samples from wet conditioning. Remove the protective aluminum foil (if used). Prepare six 50 by 50 mm (2 by 2 in.) test specimens from each 150 by 200 mm (6 by 8 in.) sample by sawing with a dry saw blade capable of dry-cutting the sample with negligible test specimen disturbance. Samples damaged during preparation shall not be tested.

11.3 *Test Procedure*— Attach the loading fixtures to the test specimens and place specimens into a sealed plastic bag to be tested within 2 h. For test specimens bonded to loading fixtures, use an epoxy specifically manufactured for bonding to wet surfaces (see Note 7). Take care during epoxy application such that epoxy does not squeeze-out from between fixtures and coat specimen sides, thereby potentially increasing the measured tensile-adhesion load.

NOTE 7—WET SURFACE PATCHING EPOXY, Part A (Reorder No. 04003-A) and Part B (Reorder No. 04003-B)[5] has given suitable results when used in accordance with the manufacturer's instructions. After use, place loading fixtures in oven at 204°C (400°F) for 1 h for easy cleaning with scraper.

11.3.1 Place loading fixtures in position without eccentric loading on the tensile-test machine.

11.3.2 Apply a tensile load at a constant rate of cross-head movement such that a maximum load will occur between 3 and 6 min.

NOTE 8—It has been found that a cross-head movement rate of 1.5 mm/min. (0.05 in./min.) it satisfactory to achieve maximum load in the appropriate amount of time for a 25-mm (1-in.)-thick test specimen.

11.3.3 Record the tensile-adhesion load at failure and the observed failure mode for all test specimens.

11.3.4 After testing, measure the actual thicknesses of each component layer for each specimen to the nearest 0.1 mm (0.005 in.). Calculate the average thickness of each component from measurement taken near the center of each specimen side, and record.

12. Calculation

12.1 Calculate the tensile-adhesion strength as follows:

$$F_T = P / A \quad (1)$$

F_T = tensile-adhesion strength,
P = maximum load, and
A = bonded surface area of test specimen.

13. Report

13.1 Report the following information:

13.1.1 Date of test and date of report,

13.1.2 Identification of the specimen by manufacturer's brand or trade name and its components,

13.1.3 Details of assembly, including a description of components, mixing and application, and measured average thicknesses of components,

13.1.4 Description of optional sample exposure conditioning (if used),

13.1.5 Description of method used to attach fixtures to the specimens,

13.1.6 Test procedure used (Procedure A or Procedure B),

13.1.7 Tensile-adhesion strength for each test specimen and the average tensile-adhesion strength for the set of six test specimens. The standard units for reporting purposes shall be kPa (psi),

13.1.8 Description of failure: whether cohesive or adhesive, whether progressive or sudden, and approximate percentage of area failed in substrate, adhesive, insulation board, base coat or finish coat, and

13.1.9 A statement that the tests were conducted in accordance with this test method, or a complete description of any deviations from this test method.

14. Precision and Bias

14.1 No statement is made either on the precision or bias of this test method.

15. Keywords

15.1 extension insulation and finish system (EIFS); tensile-adhesion