



ICC Evaluation Service, Inc.
Los Angeles Business/Regional Office
5360 Workman Mill Road
Whittier, CA 90601
tel: 562.699.0543
fax: 562.695.4694
www.icc-es.org

September 1, 2009

**TO: PARTIES INTERESTED IN EVALUATION REPORTS ON ADHESIVES
USED TO ATTACH CONCRETE OR CLAY ROOFING TILES**

**SUBJECT: Proposed Revisions to the Acceptance Criteria for Adhesive Attachment of
Concrete or Clay Roofing Tiles, Subject AC152-1009-R1 (MB/CA)**

Hearing Information:

Thursday, October 8, 2009

8:00 a.m.

Sheraton Gateway Hotel Los Angeles

6101 West Century Boulevard

Los Angeles, California 90045

(888) 627-7104

Dear Madam or Sir:

Revisions to the subject acceptance criteria will be considered by the ICC-ES Evaluation Committee at the hearing noted above. The Dow Chemical Company has requested that the subject criteria be revised to delete requirements in Table 1 for testing for water vapor transmission and for closed cell content. The basis for their request is outlined in the enclosed letter from Dow dated June 22, 2009.

Additionally, the criteria is being updated to the 2009 International Codes. Revisions include updating the reference year for ASTM C 67, ASTM E 108 and UL 790, to be consistent with the standards referenced in the codes. It was suggested that other standards referenced in Section 1.2 should be updated to the most current version; however, staff has not determined whether the newer standards would affect testing that has already been conducted, and no changes are proposed at this time.

You are cordially invited to submit written comments on agenda items, or to attend the Evaluation Committee hearing and present verbal comments. If you wish to contribute to the hearing, please note the following:

1. Written comments that are received by the Los Angeles business/regional office by **September 18, 2009**, will be forwarded to the committee prior to the hearing, and will be posted on the ICC-ES web site shortly after the comment deadline.
2. Written comments received up to ten days before the meeting, and staff memos responding to comments, will be posted to the web site on **September 29, 2009**.
3. ICC-ES is no longer providing printed copies at the meeting of proposed acceptance criteria, staff memos or public comments. These documents will be available on a limited number of CDs at the meeting, for uploading to computers;

and ICC-ES will make arrangements with the hotel business center to have hard copies available for photocopying.

4. Written comments that miss the deadline noted in item (1), above, will only be available at the meeting if you provide 35 copies, collated, stapled, and three-hole punched, either at the meeting itself or to the Los Angeles business/regional office by **September 29, 2009**.
5. If you plan to speak for more than 15 minutes, or offer a visual presentation lasting longer, you should notify ICC-ES staff as far as possible in advance. There will be a computer, projector, and screen available at the meeting for anyone wishing to make a visual presentation, and presentations in most cases will need to be in PowerPoint format. Also, ICC-ES will need to be provided with your presentation at least a half-hour before the start of the relevant meeting session (morning or afternoon) on either a CD or a flash card.
6. If you have any special needs related to a presentation, you should contact ICC-ES staff well in advance of the meeting.
7. Any visual aids for viewing at committee meetings (charts, overhead transparencies, slides, videos, electronic presentations, etc.) will be permitted only if a copy is provided to ICC-ES, before the presentation, in a medium that can be retained with other records of the meeting.
8. Any materials submitted for committee consideration are considered nonconfidential and available for public discussion, as noted in Section 2.7 of the ICC-ES Rules of Procedure for the Evaluation Committee.
9. Prior to the meeting, you should refrain from trying to communicate directly with committee members about agenda items, either verbally or in writing. Committee members reserve the right to refuse such communications.

Your cooperation with these guidelines is much appreciated, as is your interest in the deliberations of the Evaluation Committee. If you have any questions, please contact the undersigned at (800) 423-6587, extension 3289, or Chris Allen, at extension 3733. You may also reach us by e-mail at es@icc-es.org.

Yours very truly,



Michael Beaton, P.E.
Senior Vice President

MB/md

Enclosures

cc: Evaluation Committee



200 LARKIN CENTER
June 22, 2009

The Dow Chemical Company
Midland Michigan 48674

Michael Beaton
ICC Evaluation Services, Inc.
5360 Workman Mill Road
Whitter, CA 90601

PROPOSED CHANGES TO ICC-ES ACCEPTANCE CRITERIA AC-152

Mr. Beaton,

We are in the process of testing for conversion of our Tile Bond code report (ICC-ES Legacy Report 2201) After reviewing **AC152- Acceptance Criteria for Adhesive Attachment of Concrete or Clay Roofing Tiles** we are proposing several changes.

Looking at the performance properties in Table 1, we identified the three critical tests to determine product performance for a foam adhesive. Those tests are *Tensile Adhesion* (ASTM D1623), *Water Absorption* (ASTM D2842), and *Thermal and Humid Aging* (ASTM D2126). These tests assess the performance of the foam adhesive under high temperature and humidity, dimensional changes in the foam adhesive, and the amount of water the foam adhesive absorbs. We believe these test adequately address key performance issues for foam adhesives.

There are however, two other tests which we believe are not pertinent and do not assess a foam adhesive' performance. Those tests are *Water Vapor Transmission* (ASTM E96) and *Closed Cell Content* (ASTM D2856). Both of these tests are typically measurements for foam plastics insulation when control of water vapor through a wall is desired.

Please consider the following information:

- In a tile roof system the most important assessment of a foam adhesive is its ability to maintain adhesive strength under varied conditions. The three keys for assessment are:
 - *Tensile Adhesion* (ASTM D1623). This will assess the adhesive bond performance or bond strength of the foam adhesive. Higher tensile adhesion provides better adhesion for the tile to the underlayment. Also, Tensile Adhesion testing provides assessment of adhesion under rigorous conditions (aged at 180F at 65% humidity for up to 120 days).
 - *Water Absorption* (ASTM D2842). This will assess the amount of water that the foam adhesive will absorb. Lower water absorption indicates that a foam adhesive will have less performance change with water absorption. Our experience indicates that closed cell foam content does not directly correlate to water absorption for foam adhesive. In fact the closed cell content method requires the surface skin of foam to be removed; this is not representative of a field applied foam adhesive. Also when a foam adhesive is field applied it is compressive flat and as such the geometry of testing does not correlate to the field applied geometry.
 - *Thermal and Humid Aging* (ASTM D2126). This will assess dimensional stability of the foam adhesive under varied conditions. Lower changes in dimensional stability indicate less shrinkage or swelling of the foam adhesive and thus more stable performance under varied environmental conditions.
- In a tile roof system the underlayment and tiles provide the moisture control, not the adhesive, which covers less than 1/3 of the roof.
 - *Water Vapor Transmission* (ASTM E 96). Testing and reporting of Water Vapor Transmission for foam adhesives provides no meaningful data and as such we are requesting that it be deleted from AC-152.

- *Closed Cell Content* (ASTM D2856). As explained above, in a tile roof system the closed cell content of foam adhesive does not provide meaningful information to system performance and as such we are requesting that it be deleted from AC-152.

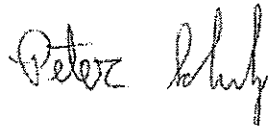
In summary, we believe the following parameters are critical and adequately address the performance of foam adhesives in concrete or clay roofing tile applications:

- *Tensile Adhesion* (ASTM D1623)
- *Water Absorption* (ASTM D2842)
- *Thermal and Humid Aging* (ASTM D2126)

We are requesting that the proposed changes of removal of *Water Vapor Transmission* (ASTM E 96) and *Closed Cell Content* (ASTM D2856) from AC152, be placed on the October ICC-ES hearing agenda. Also, we do not yet have an open ICC-ES conversion file. If this is required to pursue this change to AC-152, please let us know and we will file the required paperwork.

We'd be happy to discuss this with you or others at ICC-ES, please feel free to give either of us a call. Thanks so much!

Sincerely,



Peter Schulz
The Dow Chemical Company
Dow Building Solutions
Application Development Engineer
989-638-8393



Joann Surma
The Dow Chemical Company
Dow Building Solutions
Leader Codes and Standards
989-636-8655



ICC EVALUATION SERVICE, INC., RULES OF PROCEDURE FOR THE EVALUATION COMMITTEE

1.0 PURPOSE

The purpose of the Evaluation Committee is to monitor the work of ICC-ES, in issuing evaluation reports; to evaluate and approve acceptance criteria on which evaluation reports may be based; and to sponsor related changes in the applicable codes.

2.0 MEETINGS

2.1 The Evaluation Committee shall schedule meetings that are open to the public in discharging its duties under Section 1, subject to Section 3.

2.2 All scheduled meetings shall be publicly announced.

2.3 Two-thirds ($\frac{2}{3}$) of the voting Evaluation Committee members shall constitute a quorum. A majority vote of members present is required on any action.

2.4 In the absence of the nonvoting chairman-moderator, Evaluation Committee members present shall elect an alternate chairman from the committee for that meeting. The alternate chairman shall be counted as a voting committee member for purposes of maintaining a committee quorum and to cast a tie-breaking vote of the committee.

2.5 Minutes of the meetings shall be kept.

2.6 An electronic audio record of meetings shall be made by ICC-ES; no other audio, video, electronic or stenographic recordings of the meetings will be permitted. Visual aids (including, but not limited to, charts, overhead transparencies, slides, videos, or presentation software) viewed at meetings shall be permitted only if the presenter provides ICC-ES before presentation with a copy of the visual aid in a medium which can be retained by ICC-ES with its record of the meeting and which can also be provided to interested parties requesting a copy. A copy of the ICC-ES recording of the meeting and such visual aids, if any, will be available to interested parties upon written request made to ICC-ES together with a payment as required by ICC-ES to cover costs of preparation and duplication of the copy. These materials will be available beginning five days after the conclusion of the meeting but will no longer be available after one year from the conclusion of the meeting.

2.7 Parties interested in the deliberations of the committee should refrain from communicating, whether in writing or verbally, with committee members regarding agenda items. All written communications and submissions regarding agenda items should be delivered to ICC-ES. All such written communications and submissions shall be considered nonconfidential and available for discussion in open session of an Evaluation Committee meeting, and shall be delivered at least ten days before the scheduled Evaluation Committee meeting if they are to be forwarded to the committee. Materials delivered to ICC-ES at least ten

days before the scheduled meeting will be posted on the ICC-ES web site (www.icc-es.org) prior to the meeting. After this time, parties wishing to submit materials for consideration by the Evaluation Committee must deliver a sufficient number of copies as directed by ICC-ES. Consideration of materials not received by ICC-ES at least ten days before the meeting is at the discretion of the Evaluation Committee. Following the meeting, ICC-ES will make all materials considered by the Evaluation Committee available on the web site for a maximum period of one year following the meeting. The committee reserves the right to refuse recognition of communications which do not comply with the provisions of this section.

3.0 CLOSED SESSIONS

Evaluation Committee meetings shall be open except that the chairman may call for a closed session to seek advice of counsel.

4.0 ACCEPTANCE CRITERIA

4.1 Acceptance criteria are established by the committee to provide a basis for issuing ICC-ES evaluation reports on products and systems under codes referenced in Section 2.0 of the Rules of Procedure for Evaluation Reports. They also clarify conditions of acceptance for products and systems specifically regulated by the codes.

Acceptance criteria may involve a product, material, method of construction, or service. Consideration of any acceptance criteria must be in conjunction with a current and valid application for an ICC-ES evaluation report, an existing ICC-ES evaluation report, or as otherwise determined by the Evaluation Committee.

4.2 Procedure:

4.2.1 Proposed acceptance criteria shall be developed by the ICC-ES staff and discussed in open session with the Evaluation Committee during a scheduled meeting, except as permitted in Section 5.0 of these rules.

4.2.2 Proposed acceptance criteria shall be available to interested parties at least 30 days before discussion at the committee meeting.

4.2.3 The committee shall be informed of all pertinent written communications received by ICC-ES.

4.2.4 Attendees at Evaluation Committee meetings shall have the opportunity to speak on acceptance criteria listed on the meeting agenda, to provide information to committee members.

4.3 Approval of acceptance criteria shall be as specified in Section 2.3 of these rules.

4.4 Actions of the Evaluation Committee may be

ICC EVALUATION SERVICE, INC., RULES OF PROCEDURE FOR THE EVALUATION COMMITTEE

appealed in accordance with the ICC-ES Rules of Procedure for Appeal of Acceptance Criteria or the ICC-ES Rules of Procedure for Appeals of Evaluation Committee Technical Decisions.

5.0 COMMITTEE BALLOTING FOR ACCEPTANCE CRITERIA

5.1 Acceptance criteria may be issued without a public hearing following a 30-day public comment period and a majority vote for approval by the Evaluation Committee when, in the opinion of ICC-ES staff, one or more of the following conditions have been met:

1. The subject is nonstructural, does not involve life safety, and is addressed in nationally recognized standards or generally accepted industry standards.
2. The subject is a revision to an existing acceptance criteria that requires a formal action by the Evaluation Committee, and public comments raised were resolved by staff with commenters fully informed.
3. Other acceptance criteria and/or the code provide precedence for the revised criteria.

5.2 Negative votes must be based upon one or more of the following, for the ballots to be considered valid and require resolution:

- a. *Lack of clarity:* There is insufficient explanation of the scope of the acceptance criteria or insufficient description of the intended use of the product or system; or the acceptance criteria is so unclear as to be unacceptable. (The areas where greater clarity is required must be specifically identified.)
- b. *Insufficiency:* The criteria is insufficient for proper evaluation of the product or system. (The provisions of the criteria that are in question must be specifically identified.)
- c. *The subject of the acceptance criteria is not within the scope of the applicable codes:* A report issued by ICC-ES is intended to provide a basis for approval under the codes. If the subject of the acceptance criteria is not regulated by the codes, there is no basis for issuing a report, or a criteria. (Specifics must be provided concerning the inapplicability of the code.)

d. *The subject of the acceptance criteria needs to be discussed in a public hearings.* The committee member requests additional input from other committee members, staff or industry.

5.3 An Evaluation Committee member, in voting on an acceptance criteria, may only cast the following ballots:

- Approved
- Approved with Comments
- Negative: Do Not Proceed

6.0 COMMITTEE COMMUNICATION

Direct communication between committee members, and between committee members and an applicant or concerned party, with regard to the processing of a particular acceptance criteria or evaluation report shall take place only in a public hearing of the Evaluation Committee. Accordingly:

6.1 Committee members receiving an electronic ballot should respond only to the sender (staff). Committee members who wish to discuss a particular matter with other committee members, before reaching a decision, should ballot accordingly and bring the matter to the attention of ICC-ES staff, so the issue can be placed on the agenda of a future committee meeting.

6.2 Committee members who are contacted by an applicant or concerned party on a particular matter that will be brought to the committee will refrain from private communication and will encourage the applicant or concerned party to forward their concerns through the ICC-ES staff in writing, and/or make their concerns known by addressing the committee at a public hearing, so that their concerns can receive the attention of all committee members. ■

Effective March 18, 2008

PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR ADHESIVE ATTACHMENT OF CONCRETE OR CLAY ROOFING TILES

AC152

Proposed September 2009

Previously approved May 2008, February 2006, July 2003, September 1999

PREFACE

Evaluation reports issued by ICC Evaluation Service, Inc. (ICC-ES), are based upon performance features of the International family of codes and other widely adopted code families, including the Uniform Codes, the BOCA National Codes, and the SBCCI Standard Codes. Section 104.11 of the *International Building Code*® reads as follows:

The provisions of this code are not intended to prevent the installation of any materials or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

Similar provisions are contained in the Uniform Codes, the National Codes, and the Standard Codes.

ICC-ES may consider alternate criteria, provided the report applicant submits valid data demonstrating that the alternate criteria are at least equivalent to the criteria proposed in this document, and otherwise meet the applicable performance requirements of the codes. Notwithstanding that a product, material, or type or method of construction meets the requirements of the criteria proposed in this document, or that it can be demonstrated that valid alternate criteria are equivalent to the criteria in this document and otherwise meet the applicable performance requirements of the codes, ICC-ES retains the right to refuse to issue or renew an evaluation report, if the product, material, or type or method of construction is such that either unusual care with its installation or use must be exercised for satisfactory performance, or malfunctioning is apt to cause unreasonable property damage or personal injury or sickness relative to the benefits to be achieved by the use of the product, material, or type or method of construction.

Acceptance criteria are developed for use solely for purposes of issuing ICC-ES evaluation reports.

PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR ADHESIVE ATTACHMENT OF CONCRETE OR CLAY ROOFING TILES

1.0 INTRODUCTION

1.1 Purpose: This acceptance criteria establishes requirements for recognition, in ICC Evaluation Service, Inc. (ICC-ES), evaluation reports, of concrete or clay roofing tiles installed with adhesive set systems, under the ~~2006~~ 2009 *International Building Code*[®] (IBC), the ~~2006~~ 2009 *International Residential Code*[®] (IRC) and the 1997 *Uniform Building Code*[™] (UBC). Bases of recognition are IBC Section 104.11, IRC Section R104.11 and UBC Section 104.2.8.

The reason for the development of this criteria is to provide a guideline for the evaluation of adhered roof tiles, since the prescriptive requirements of Chapter 15 of the IBC, Chapter 9 of the IRC and Chapter 15 of the UBC do not provide requirements for the adhesives used to attach the tiles or for the use of self-adhered underlayments with the roof tiles.

1.2 Scope: The acceptance criteria is limited to expanding polyurethane used to adhesively attach clay or concrete roofing tiles to underlayment that is attached to roof decks complying with Section ~~4609.7.4~~ 1609.5.1 of the IBC. The roof tile shall comply with the limitations of Sections 1507.3 and 1609.~~7.5.3~~ 5.3 of the IBC, or shall comply with Section 1715~~6.2.2~~ 6.2.2 of the IBC. The underlayment may consist of a mechanically attached 30-pound base sheet and a hot-mopped 90-pound cap sheet (30/90 hot-mopped system) or may be a self-adhering membrane. Underlayments in 30/90 hot-mopped systems shall be of materials complying with a standard recognized in the code; self-adhering membranes shall comply with the requirements in Section 3.1.~~3.2~~ 3.2 of AC48. Roof tiles using adhesive set systems shall have at least two-thirds of the tile's area free of adhesive contact.

1.3 Codes and Referenced Standards:

1.3.1 ~~2006~~ 2009 *International Building Code*[®] (IBC), International Code Council.

1.3.2 ~~2006~~ 2009 *International Residential Code*, (IRC), International Code Council.

1.3.3 1997 *Uniform Building Code*[™] (UBC).

1.3.4 SBCCI Test Standard for Determining Wind Resistance of Concrete or Clay Roof Tiles, SSTD 11-99.

1.3.5 ASCE 7-05, Minimum Design Loads for Buildings or Other Structures.

1.3.6 Florida Building Code 2004~~7~~ 7 Test Protocols for High-velocity Hurricane Zones, TAS-100-95, Test Procedure for Wind and Wind Driven Rain Resistance of Discontinuous Roof Systems.

1.3.7 ASTM C 67-~~03a-04~~ 07, Test Methods of Sampling and Testing Brick and Structural Clay Tile, ASTM International.

1.3.8 ASTM C 297-94, Test Method for Flatwise Tensile Strength of Sandwich Constructions, ASTM International.

1.3.9 ASTM D 1621-94, Test Method for Compressive Properties of Rigid Cellular Plastics, ASTM International.

1.3.10 ASTM D 1622-93 (1995), Test Method for Apparent Density of Rigid Cellular Plastics, ASTM International.

1.3.11 ASTM D 1623-78, Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics, ASTM International.

1.3.12 ASTM D 1970-01, Self-adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection, ASTM International.

1.3.13 ASTM D 2126-94, Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging, ASTM International.

1.3.14 ASTM D 2842-97, Test Method for Water Absorption of Rigid Cellular Plastics, ASTM International.

~~**1.3.15** ASTM D 2856-94, Test Method for Open-cell Content of Rigid Cellular Plastics by the Air Pycnometer, ASTM International.~~

1.3.15 ASTM D 4977-03, Standard Test Method for Granule Adhesion to a Mineral Surfaced Roofing by Abrasion, ASTM International.

~~**1.3.17** ASTM E 96-00e01, Test Methods for Water Vapor Transmission of Materials, ASTM International.~~

1.3.16 ASTM E 108-04~~07a~~ 07a, Test Methods for Fire Tests of Roof Coverings, ASTM International.

1.3.17 UL 790-97~~04~~ 04, Tests for Fire Resistance of Roof Covering Materials ~~with Revisions through July 1998~~, Underwriters Laboratories Inc.

1.3.18 ICC-ES Acceptance Criteria for Special Roofing Systems (AC07).

1.3.19 ICC-ES Acceptance Criteria for Roof Underlayment for Use in Severe Climate Areas (AC48).

2.0 BASIC INFORMATION AND REPORTS OF TESTS

2.1 Product Description: Description of the materials and of the manufacturing process shall be submitted.

2.2 Installation Instructions: Installation instructions shall be submitted.

2.3 Packaging and Identification: Description of the method of packaging and identification of the materials shall be submitted.

2.4 Testing Laboratories, Reports of Tests and Product Sampling:

2.4.1 Testing laboratories shall comply Section 2.0 of the ICC-ES Acceptance Criteria for Test Reports (AC85) and Section 4.2 of the Rules of Procedure for Evaluation Reports.

2.4.2 Test reports shall comply with AC85. All reports of tests shall be prepared by an independent testing laboratory accredited by the International Accreditation Service or otherwise acceptance to ICC-ES.

2.4.3 Sampling of the roof tile adhesive for tests under this criteria shall comply with Section 3.2 of AC85.

3.0 REQUIRED DATA AND TEST REQUIREMENTS

Reports of the following tests shall be submitted:

3.1 Physical Characteristics Tests: Roof tile adhesives shall be tested and shall comply with the five physical properties specified in Table 1. Tests shall be conducted using the underlayment for which recognition is

sought. If a 30/90 hot-mopped system is qualified under this criteria, self-adhering underlayments may be qualified as equivalent to a 30/90 hot-mopped system under Section 3.4 of this criteria.

3.2 Performance Requirements:

3.2.1 Overturning Moment Tests: Tests shall be conducted in accordance with SSTD 11 for each tile type, tile size, underlayment, adhesive area and substrate combination for which recognition is sought.

3.2.2 Wind Uplift:

3.2.2.1 UBC: For each combination of tile type, tile size, adhesive, underlayment, substrate, mean roof height, roof pitch and wind speed for which recognition is sought, the overturning moment determined in accordance with Section 3.2.1 of this acceptance criteria, or the aerodynamic overturning moment determined in accordance with either Section 800 or 900 of SSTD 11, shall be equal to or greater than the aerodynamic uplift moment calculated in accordance with the following formula:

$$M_a = L_a \cdot A \cdot C_e \cdot r \cdot C_q \cdot q_s \cdot I_w$$

where:

- A = Exposed area, feet² (mm²).
- C_e = Combined height, exposure and gust factor coefficient from Table 16-G of the code.
- C_q = Pressure coefficient from Table 16-H of the code = 2.6.
- I_w = Importance factor = 1.0.
- L = Length of tile, feet (mm).
- L_a = Moment arm, in feet (mm), from the axis of rotation to the point of uplift on the roof tile. The point of uplift shall be taken at 0.76L from the head of the tile and the middle of the exposed width.
- M_a = Aerodynamic uplift moment, ft.-lbf. (N-mm).
- q_s = Wind stagnation pressure at standard height of 33 feet, from Table 16-F of the code, psf (kN/mm²).
- r = Aerodynamic Moment ratio = 0.25.

3.2.2.2 IBC: For each combination of tile type, tile size, adhesive, underlayment, substrate, mean roof height, roof pitch and wind speed for which recognition is sought, the overturning moment determined in accordance with Section 3.2.1 of this acceptance criteria, or the aerodynamic overturning moment determined in accordance with either Section 800 or 900 of SSTD 11, shall be equal to or greater than the aerodynamic uplift moment calculated in accordance with Section 1609.7.5.3 of the IBC, as follows:

$$M_a = q_h \cdot C_L \cdot b \cdot L \cdot L_a \cdot [1.0 - GC_p]$$

For **SI**: $M_a = q_h \cdot C_L \cdot b \cdot L \cdot L_a \cdot [1.0 - GC_p]/1,000$

where:

- b = Exposed width of the roof tile, in feet (mm).
- C_L = Lift coefficient. The lift coefficient for concrete and clay tile shall be 0.2 or shall be determined by testing in accordance with either Section 800 or 900 of SSTD 11.

G_{c_p} = Roof pressure coefficient for each applicable roof zone, determined from from the applicable Figure in Chapter 6 of ASCE 7. Roof pressure coefficients shall not be adjusted for internal pressure.

L = Length of the roof tile, in feet (mm).

L_a = Moment arm, in feet (mm), from the axis of rotation to the point of uplift on the roof tile. The point of uplift shall be taken at 0.76L from the head of the tile and the middle of the exposed width.

M_a = Aerodynamic uplift moment, in ft.-lbf. (N-mm), acting to raise the tail of the tile.

q_h = Wind velocity pressure, in psf (kN/m²), determined from Section 6.5.10 of ASCE 7.

3.2.3 Lift Coefficient: The lift coefficient, C_L, for rigid tile complying with Section 1609.7.5.3 of the IBC shall be 0.2. Accessory tiles, such as hip and ridge tiles, and tiles that do not satisfy the limitations for rigid tile in Section 1609.7.5.3 of the IBC, shall be tested in accordance with either Section 800 or 900 of SSTD-11, and the value of C_L shall be determined. As an alternative, the roof assembly shall be designed to withstand the wind uplift forces determined for cladding and components in the applicable code.

3.2.4 Underlayment: When the roof tiles are adhered to the underlayment, which is mechanically attached to the roof deck, data shall be submitted to demonstrate that the underlayment can support gravity loads resulting from the weight of the tile. When the underlayment is a 30/90 hot-mopped system, the method of attachment of the 30-pound base sheet to the roof deck shall be justified for the applicable wind loads.

3.2.5 Wind-driven Rain Test: Wind-driven rain tests shall be conducted when the expanding polyurethane adhesive is used either as a weather blocking at hips and ridges. Tests shall be conducted in accordance with either Section 3.2.5.1, 3.2.5.2 or 3.2.5.3 of this acceptance criteria for each combination of tile type, tile size, adhesive, underlayment and substrate for which recognition is sought.

3.2.5.1 Reports shall be provided of testing of hip and ridge applications in accordance with Section 4.10, Wind-driven Rain Test, of the ICC-ES Acceptance Criteria for Special Roofing Systems (AC07), with the following exceptions:

3.2.5.1.1 The hip and ridge tiles shall be installed in accordance with the adhesive manufacturer's instructions.

3.2.5.1.2 The wind velocity shall be determined at the hip or ridge.

3.2.5.1.3 The condition of acceptance is that there shall be no leaking on the underside of the roof deck. The test report shall indicate the extent of tile fluttering during the test periods, and the cause of fluttering.

3.2.5.1.4 Recognition in the evaluation report will be limited to areas subject to a maximum basic (3-second gust) wind speed of 100 miles per hour (161 km/h).

3.2.5.2 Reports shall be provided of testing of the field tile application in accordance with Section 4.10 of AC07. Recognition in the evaluation report will be limited

PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR ADHESIVE ATTACHMENT OF CONCRETE OR CLAY ROOFING TILES

to areas subject to a maximum basic (3-second gust) wind speed of 100 miles per hour (161 km/h).

3.2.5.3 Reports shall be provided of tests of hip and ridge tiles or field tiles, as applicable, in accordance with Dade County Protocol PA 100-95. The test specimens shall be representative of the assembly for which recognition is sought. Recognition in the evaluation report will be limited to areas subject to a maximum basic (3-second gust) wind speed of 130 miles per hour (209 km/h).

3.2.6 Freeze-thaw Tests: Freeze-thaw tests shall be conducted in accordance with both Section 8 of ASTM C 67, as specified for clay tile, and Sections 3.2.6.1 through 3.2.6.5 of this acceptance criteria.

EXCEPTION: Freeze-thaw tests are not required if tiles are restricted to areas in which the mean annual rainfall does not exceed 20 inches (508 mm) and the average of the daily lows for any month is at least 30°F (-1.1°C).

3.2.6.1 Specimens shall be a minimum of 6 inches (152 mm) square and shall consist of the assembly for which recognition is sought, with respect to underlayment, adhesive and tile type. A minimum of ten specimens shall be prepared, five for freeze-thaw exposure and five for use as control specimens.

3.2.6.2 The underlayment shall be solidly cemented to the substrate.

3.2.6.3 During the water-soak phase, the samples shall be submerged in trays and containers of sufficient size to allow the tiles to be placed horizontally in the water, and submerged with the tile side of the sample down and the water touching the underlayment.

3.2.6.4 At the conclusion of 50 freeze-thaw cycles, both the test specimens and the control specimens shall be tested in accordance with ASTM C 297.

3.2.6.5 Condition of Acceptance: Condition of acceptance is that the ultimate tensile strength of any one of the exposed specimens shall not be less than 50 percent of the average ultimate tensile strength of the control specimens.

3.2.7 Roofing Classification: For each combination of tile type, tile size, adhesive, underlayment and substrate for which recognition is sought, tests shall be conducted in accordance with ASTM E 108 or UL790 (UBC Standard 15-1). Conditions of acceptance are as specified in ASTM E 108 or UL 790 (UBC Standard 15-1).

3.2.8 Installation: Installation shall be by installers qualified through the manufacturer's training program. Details of the training program shall be submitted. The manufacturer's training program shall include personal instruction and verification of proficiency and shall require requalification at intervals to be determined by the manufacturer. The manufacturer shall have a means to track performance of certified installers and shall have a means to decertify installers.

An installation card shall be completed by the installer and shall be presented to the building official, at the completion of each project. An exemplary copy of the card shall be included in the evaluation report. The installation card shall include, at a minimum, verification of installation in accordance with the manufacturer's instructions and the evaluation report and shall include requirements for ensuring proper adhesion of the roof tiles.

3.3 IRC: Use of the tile adhesive under the the IRC is applicable where an engineered design is submitted to the code official in accordance with IRC Section R301.1.3.

3.4 Alternate Underlayments: For recognition of a self-adhering underlayment as an alternative to the 30/90 hot-mopped underlayment system recognized in the roof tile adhesive manufacturer's evaluation report, data as described in this section (Section 3.4) shall be submitted.

3.4.1 The underlayment shall comply with Section 3.1.2 of AC48.

3.4.2 Fastener penetrations shall be sealed by placing asphalt cement between the underlayment and the roof sheathing under each fastener penetration, or sealability of fasteners shall be tested in accordance with Section 4.1 of this criteria. Condition of acceptance is that there shall be no sign of water on the underside of the plywood, between the underlayment and the plywood or on the fastener shanks.

3.4.3 Roof loading slippage resistance tests shall be conducted in accordance with Section 4.2 of this criteria. Condition of acceptance is that there shall be no tears or tile slippage on any portion of the underlayment.

3.4.4 For self-adhering underlayment having a granular surface, granule adhesion tests shall be conducted in accordance with ASTM D 4977. Condition of acceptance is that granule displacement shall be no greater than 2.0 g.

3.4.5 Tensile adhesion tests shall be conducted in accordance with Item 3 of Table 1 of this criteria, using the subject underlayment as the substrate.

3.4.6 Roof classification tests in accordance with Section 3.2.7 shall be conducted on assemblies utilizing the self-adhering underlayment.

4.0 TEST METHODS

4.1 Sealability of Fastener Penetrations:

4.1.1 Fastener penetrations shall be sealed by placing asphalt cement between the underlayment and the roof sheathing under each fastener penetration, or the underlayment shall pass the testing required by this section (Section 4.1).

4.1.2 The test method assesses the ability of the underlayment sheet to seal around a roofing fastener and prevent standing water from leaking through to the underside of the sheet after the underlayment has been exposed to ultraviolet light for a period of time corresponding to the underlayment manufacturer's recommended maximum exposure prior to being covered by any roof covering. If the manufacturer does not provide a recommended maximum exposure, the test shall be done for a minimum exposure of 30 days.

4.1.3 Preparation of test specimens and the conducting of the test shall be in accordance with Section 7.9 of ASTM D 1970.

4.1.4 Ultraviolet Light Conditioning:

4.1.4.1 Ultraviolet light shall be produced by four 300-watt UV lamps. Lamps shall be Ultra-Vitalux, 300W, 220-230V, #E27, or Osram 300W lamps, or equivalent. The ultraviolet light shall be placed 24 inches (610 mm) from the specimen and adjusted to maintain a controlled surface temperature of 140°F ± 5°F (60°C ± 2°C).

PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR ADHESIVE ATTACHMENT OF CONCRETE OR CLAY ROOFING TILES

4.1.4.2 Specimens shall be exposed for 10 hours per day for each day of the manufacturer's maximum recommended underlayment exposure, but not less than 30 days.

4.1.4.3 Specimen temperature shall be maintained between 140°F and 145°F (60°C and 62.7°C) during the hours the specimen is exposed to ultraviolet light under Section 4.1.4.2.

4.1.4.4 The specimen shall equilibrate to 75°F ± 5°F (24°C ± 2°C) before the beginning of each 10 hours of ultraviolet light exposure.

4.2 Roof Slippage Resistance:

4.2.1 This test is intended to assess the maximum allowable roof pitch for the underlayment before tile slippage occurs or before construction loading will damage the underlayment. The maximum allowable roof pitch shall be determined for the underlayment without any mechanical fasteners. Battens shall be required at each row of tiles for installations when the roof pitch is greater than the maximum allowable roof pitch determined under this section (Section 4.2) and for roof pitches greater than 7:12.

4.2.2 Specimens:

4.2.2.1 Three 4-foot-wide-by-8-foot-long (1.25 m by 2.5 m) specimens shall be prepared with a 4-inch (102 mm) overlap seam across the center of the 8-foot (2.5 m) length. Two sections of each specimen shall be taken, one from one edge of the roll and one from the center of the roll. The length of each specimen shall be in the "machine direction" of the roll.

4.2.2.2 The underlayment shall be tested on each substrate for which recognition is sought.

4.2.2.3 The underlayment shall be applied to the substrate in accordance with the manufacturer's installation instructions.

4.2.2.4 The test specimens shall be conditioned in an oven or under ~~heat~~ UV lamps (see Section 4.1.4.1)

maintained at 140°F ± 5°F (60°C ± 2°C) for a minimum of four hours. Thereafter, the deck shall be cooled for three hours at 75°F ± 5°F (57°C ± 2°C).

4.2.2.5 After conditioning, the test deck shall be positioned at the desired slope to be tested. Individual test slope can be predetermined or multiple tests can be performed at various pitches. The minimum slope is 2:12. The incline can be raised incrementally up to and including 7:12.

4.2.2.6 The roof component shall be placed on each sloped test deck as a roof is typically stacked on a roof plane; or one stack of flat concrete tiles having a minimum total weight of 100 pounds (45.3 kg) is put in place, along with one stack of profiled tile having a minimum total weight of 100 pounds (45.3 kg). The roof tiles shall have "lugs" on the underside of each tile. The tile stacks shall sit on the underlayment surface for 72 hours while a controlled surface temperature of 140°F ± 5°F (60°C ± 2°C) is maintained. The temperature shall be monitored by a surface-mounted thermocouple.

4.2.2.7 Tears or tile slippage on any portion of the underlayment shall be reported.

4.2.2.8 Before-and-after photographs of each specimen shall be included in the final test report.

4.2.3 Conditions of Acceptance: There shall be no tile slippage or damage to the underlayment when tested at the maximum roof pitch for which recognition is sought.

5.0 QUALITY CONTROL

5.1 The adhesive shall be manufactured under a quality control program documented in accordance with the ICC-ES Acceptance Criteria for Quality Documentation (AC10).

5.2 Follow-up inspections by an inspection agency are not required under this criteria.■

TABLE 1—PHYSICAL PROPERTIES FOR ROOF TILE ADHESIVES

NO.	PROPERTY	TEST METHOD	CONDITION	NO. OF SPECIMENS	REQUIREMENT
1	Compressive Strength	ASTM D 1621	Per standard	5	8 psi, min.
2	Density	ASTM D 1622	Per standard	Per standard	1.5 pcf, min.
3	Tensile Adhesion	ASTM D 1623, Type B or C	180°F, 65% relative humidity	5 per substrate per test period (7, 14, 30, 60, 90 and 120 days) ¹	15 psi, min.
4	Water Absorption	ASTM D 2842	Per standard	3	10 percent, max.
5	Water Vapor Transmission	ASTM E 96	Per standard	4	Report value
6	Thermal and Humid Aging	ASTM D 2126	158°F, 100% relative humidity	3, per test period (1, 7 and 14 days)	Percent change: ± 12%
			-40°F, ambient relative humidity	3, per test period (1, 7 and 14 days)	Percent change: ± 6%
7	Closed-Cell Content	ASTM D 2856	Procedure C	3	70%, min.

For SI: 1 psi = 6.8948 kPa, 1 pcf = 16.018 kg/m³, 1°F = ⁵/₉ (°C) + 32.0

¹Substrate specimens include those with concrete tile to concrete tile, clay tile to clay tile, concrete tile to 90-pound (440.2 kg/m²) mineral-surface roll roofing, and clay tile to 90-pound (440.2 kg/m²) mineral-surface roll roofing.