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To: ICC-ES Evaluation Committee
From: Yamil Moya, P.E.
Date: September 29, 2009
Subject: Proposed Revisions to the Acceptance Criteria for Building-integrated Photovoltaic Roof Modules and Panels, Subject AC365-1009-R1 (YM/CA)

MEMO

Public comments have been received regarding the subject criteria. The comments are posted on our web site and will be available at the Evaluation Committee meeting.

The following are staff responses to public comments received:

1. **Mr. Samir Sharma of United Solar Ovonic (Uni-Solar), on September 18, 2009, proposed the following changes:**
 - a. Revise the title and subsequent sections of the criteria when describing BIPV roof modules and panels by adding the term “flexible” when describing modules and by adding the term “rigid” when describing panels. The objective of ICC-ES staff is to maintain general definitions of products since it may be possible for modules to be rigid and panels to be flexible. Therefore, staff does not support the proponent’s request to add these adjectives to the title and to applicable sections of the criteria.
 - b. Include “modified bitumen roof” as one of the new or existing roof coverings in Section 1.4.3 of the criteria. Section 1.4.3 indicates that the BIPV roof module can be installed over a new or an existing single-ply membrane roof covering or a metal roof panel roof covering. Since the phrase “single-ply membrane roof covering” generically refers to several types of membrane products, staff believes that adding specific types such as modified bitumen is redundant and unnecessary.
 - c. Include wind uplift test method FM 4470 as an alternate to the UL 580 test procedure described in Section 3.2.3 of the criteria. Staff recognizes that the wind uplift test method FM 4470 has been replaced with FM 4474 in Section 1504.3.1 of the 2009 IBC. Since the criteria is being revised to reference the 2009 I-Codes, staff proposes the following revisions to Section 1.3 and 3.2.3 of AC365:

1.3.20 FM 4474-04, Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures, Factory Mutual Global Research.

3.2.3 Wind Uplift Resistance: ...in accordance with UL 580 or FM 4474.

- d. Change the term “photovoltaic laminate” to “photovoltaic panel” throughout the criteria. The origin of the term photovoltaic laminate is the standard UL 1703. Staff believes that the term used in the criteria should be consistent with the term used in UL 1703. Therefore, staff does not support the proposed change in terminology.
- e. Do not add durability of adhesive components testing as proposed in Section 3.1.4.3 of the criteria. The proponent believes that this performance requirement does not apply to mechanically attached panels. However, this proposed new requirement is necessary due to another proponent’s submittal of a BIPV roof panel that incorporates an adhesive. Therefore, staff supports the proposed requirements in Section 3.1.4.3 that were presented with the staff letter dated September 1, 2009.
- f. Several revisions to the retention of adhesion after temperature cycling requirements described in Section 3.2.6 of the criteria. Some of the requested revisions are procedural, such as changes in sample size and the speed of the test apparatus; while others apply to the conditions of acceptance described in Section 3.2.6.3. Staff notes that the requirements for retention of adhesion for BIPV roof modules originate in Section 4.5.2 of AC75. Staff is concerned that if the procedures and conditions of acceptance in Section 3.2.6 of AC365 are modified from what has been previously approved, the results of adhesion testing of BIPV roof modules will not show equivalency to the adhesion properties of membrane roof covering systems that serve as the substrate for the adhered modules. Therefore, staff does not support the proposed changes to Section 3.2.6 of AC365.
- g. Based on the inquiry from the proponent, staff proposes the following revision to Section 3.2.6.2 of the criteria:

3.2.6.2. Peel-strength Test Procedure:,except as modified in this section (~~Section 3.5.2.2~~).

2. Proposed changes received from Ms. Joann Surma and Mr. Ryan Gaston of The Dow Chemical Company, in their letter dated September 18, 2009:

- a. Regarding item 1 of the letter, the proponent requests deletion of the term “glass-free” from the BIPV roof module definition shown in Section 1.4.3 of the criteria. Staff seeks input regarding the need for the term glass-free in the definition Section 1.4.3. Additionally, in item 1 of the letter, the writers

propose the inclusion of impact resistance testing in accordance with Section 3.1.4.1.1 for BIPV roof modules incorporating a glass superstrate. Since staff has not received an application for an evaluation of a BIPV roof module incorporating a glass superstrate, it is not clear whether the impact resistance test described in Section 3.1.4.1.1 is the appropriate test for products of this type. Therefore, staff does not support this proposed change.

- b. In item 2 of the letter, the writers request inclusion of the UL 580 standard in Section 3.1.2.1 as an alternate test procedure to determine the wind uplift resistance of mechanically attached BIPV roof panels. Section 3.1.2.1 requires testing in accordance with UL 1897, and staff believes this standard is better suited to the testing of mechanically attached panels than UL 580. During UL 1897 testing, the uplift pressure is exerted on the roof covering and on the mechanical fasteners that attach the roof covering to the roof deck. During UL 580 testing, the uplift pressure is exerted on both the roof covering and on the roof deck including the means for attaching the roof deck to the supporting framing structure. Due to differences in the way the uplift pressure is applied in these two standards, staff believes that UL 1897 is the preferred method for testing mechanically fastened roof coverings. Therefore, staff does not support the proposed change to Section 3.1.2.1.

The writers also request the inclusion of UL 1897 in Section 3.2.3, as an alternate test procedure to determine wind uplift resistance for adhered BIPV roof modules. During the UL 1897 test procedure, a plastic sheet is placed between the roof deck or underlayment and the mechanically attached roof covering. This method of testing is not suitable for adhered systems, since it introduces a plastic sheet that is not representative of the intended installation: a BIPV roof module adhered to an approved roof covering. Staff feels that testing in accordance with either UL 580, or FM 4474 is the appropriate method for determining the wind uplift resistance of adhered BIPV roof modules. While staff does not support the proposed change to Section 3.2.3 to include UL 1897, staff does support the inclusion of FM 4474 as an alternate to UL 580 as previously indicated in item 1c of this memo.

- c. Regarding item 3 of the letter, the writers request that the criteria be revised to require wind-driven rain testing of BIPV roof modules similar to the requirements specified in Section 3.1.3 of the criteria for BIPV roof panels. Staff feels that wind-driven rain testing is not applicable to BIPV roof modules when the modules are adhered to new or existing approved roof coverings. Therefore, staff does not support this proposed change.
- d. Regarding item 4 of the letter, the proponent requests that the criteria be revised to require polymeric or elastomeric material testing of the BIPV roof

modules, similar to the requirements in Section 3.1.4.2.2 of the criteria for BIPV roof panels. Although these material tests are not required for BIPV roof modules, Section 3.2.5 of the criteria requires testing that in staff's opinion are sufficient to establish the durability of the modules. Staff notes that unlike plastic BIPV roof panels that may serve as the primary roof covering, plastic BIPV roof modules intended for installation over an approved roof covering are not considered the primary roof covering. Therefore, staff does not support this proposed change.

- e. Regarding item 5 of the letter, the writers request a revision to the language in Section 3.2.6 of the criteria to include the term "or module material". Staff seeks input to determine if this revision is warranted.
- f. Regarding item 6 of the letter, the writers request revisions to the language in Section 3.2.6.3 of the criteria to indicate that "no significant" loss in adhesion shall take place. Staff does not support this change, since the proposed language in Section 3.2.6.3 of AC365 has a precedent in AC75.
- g. Regarding item 7 of the letter, staff agrees with the proposed deletion of the reference to Section 3.5.2.2, as indicated in item 1g of this memo.
- h. Regarding the response to Comment 2 in the staff letter dated September 1, 2009 letter, item 7 of the letter raises potential issues about the performance of BIPV roof modules adhered to existing roof coverings. Staff seeks additional input on this issue.
- i. Regarding the response to Comment 3 in the staff letter dated September 1, 2009, item 7 of the letter states that single-ply membranes from different manufacturers may produce different adhesion performance results during testing of the BIPV roof modules. Staff seeks input on this issue.
- j. Regarding the response to Comment 4 in the staff letter dated September 1, 2009, staff agrees to include the IEC test method as an alternate to the UL 1703 impact test in Section 3.1.4.1.1 of AC365.
- k. Regarding the response to Comment 5 in the staff letter dated September 1, 2009, staff agrees that the requirements in Section 3.2.9.2 of AC07 are not needed, provided the plastic BIPV roof modules are manufactured under an approved quality control program with inspections by an accredited inspection agency, as currently required in Section 5.1 of AC365.