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August 3, 2009

**TO: PARTIES INTERESTED IN EVALUATION REPORTS ON
TRANSLUCENT FIBERGLASS REINFORCED PLASTIC (FRP)
FACED PANEL WALL, ROOF AND SKYLIGHT SYSTEMS**

**SUBJECT: Proposed Revisions to the Acceptance Criteria for Translucent
Fiberglass Reinforced Plastic (FRP) Faced Panel Wall, Roof and
Skylight Systems, AC177-0809-R1 (DP/RK)**

Dear Madam or Sir:

The revisions proposed to the subject acceptance criteria, as presented in the enclosed criteria draft, are being posted on the ICC-ES web site to allow for public comment. The revisions proposed to Section 4.1.2 of the subject acceptance criteria are being requested by an evaluation report applicant, Kalwall Corporation, as described in the attached August 14, 2008, letter prepared by Ken Schmidtchen. ICC-ES staff concurs with the proposal for weatherometer testing to be conducted with the interior facers placed directly behind the exterior facers in the weathering chamber. Also, staff agrees with the proposed exception that, if allowable panel spans are not based on the interior facer of the panels or the facer's attachment to the grid members of the panel, determination of the interior facer's strength properties, before and after weathering, is not required. Furthermore, staff agrees that testing for retention of fire-retardant qualities of the exterior and interior facers remain a requirement, and be based on testing in accordance with either the proposed revisions to Section 4.1.2.2 with the interior facers placed directly behind the exterior facers in the weathering chamber; or the proposed revisions to Section 4.1.2.3.

You are cordially invited to submit written comments, within 30 days of the date of this letter. Please use the comment form on the web site attaching any letters to the form. An explanation of the alternate criteria process can be found on our web site at http://www.icc-es.org/Criteria_Development/alternative_criteria_process.shtml.

All comments received in the 30-day comment period will be considered. During this same 30-day period, however, the draft criteria will be balloted to the Evaluation Committee. If the public comments raise major issues, generate controversy, or require the criteria to be substantially rewritten, then ICC-ES staff may decide to rebalot the criteria; or place a revised draft on the web site for further public

comment; or put the criteria on the agenda for a future Evaluation Committee meeting.

Correspondence received and a memo outlining staff's resolution of the comments in the correspondence will be posted on the web site shortly after the close of the comment period.

Your cooperation is requested in forwarding to the Los Angeles business/regional office all material directed to the Evaluation Committee. Parties interested in the deliberations of the committee should refrain from communicating, whether in writing or verbally, with committee members. The committee reserves the right to refuse communications that do not comply with this request.

Newly approved acceptance criteria may involve test methods or test protocols that are not currently included in the scope of testing services offered by accredited testing laboratories. As noted in the ICC-ES Rules of Procedure for Evaluation Reports, the scope of the laboratory's accreditation must include the type of testing that is to be reported to ICC-ES. We encourage accredited laboratories to expand their scopes of accreditation to include testing under newly approved acceptance criteria. Please note that testing laboratories must be accredited by the International Accreditation Service (IAS) or by another accreditation body that is a signatory to the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement. For further information, please contact IAS at (562) 699-0541, extension 3309, or send an e-mail to pmccullen@iasonline.org.

Please submit all comments using the form on the web site. Attach any letters to the comment form. If you have any questions (not comments), please contact the undersigned at (800) 423-6587, extension 3275, or Russ Krivchuk, at extension 3275. You may also reach us by e-mail at es@icc-es.org.

Yours very truly,

A handwritten signature in black ink, appearing to read "D Pereg". The signature is stylized and written in a cursive-like font.

David Pereg, P.E.
Staff Engineer

DP/cm;raf

Enclosure

cc: Evaluation Committee



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August 14, 2008

Mr. David Pereg, PE
ICC Evaluation Service
5360 Workman Mill Road
Whittier, CA 90601

RE: Revisions to AC177

Dear David:

Subsequent to our recent discussions regarding the suitability of Section 4.1.2 to the interior face material, we request that AC177 be revised based on the following points.

The interior and exterior faces of the panel are formulated for differing requirements: weathering resistance on the exterior and interior finish requirements for flame spread and smoke developed on the interior. Modification of the interior to withstand the same UV exposure as the exterior would lead to a compromise in its fire performance. This reduced fire performance may reduce the usability of the product based on the IBC and other regulatory requirements.

Sections 3.2.3.2, 3.3.3.2, 3.4.4.2 and 3.5.3.2 outline the procedure for determining allowable spans for the FRP faced panels based on the properties of the aluminum grid members alone. This approach does not include the properties of either face material in the calculation, nor is the face a stressed component of the panel using this method. Therefore, the physical properties of the faces, both interior and exterior, are not a factor in the panel span. In a practical sense, we know that the exterior face must be capable of distributing the load to the grid members. This load transfer capability is verified by section 4.7. The interior face is never loaded; therefore its mechanical properties are irrelevant to panel strength when using the "aluminum grid only" method of determining allowable panel spans.

If the allowable spans are determined by load testing (Section 3.2.3.1 and similar sections), the faces do contribute to the overall load capacity of the panel and are stressed elements. In this instance, the mechanical properties of both faces are germane and should be determined.

Further to this, the currently required Weatherometer testing per ASTM D2565 places unusual stresses on the material that it would not experience in use: the interior face is not exposed to direct sunlight, UV or water spray as in the Weatherometer. The attached letter from Atlas Material Testing Technology (the manufacturers of the Weatherometer apparatus and an IAS recognized testing facility) proposes a variation of the procedure. This revised procedure would more closely replicate real world applications of the panels.

To attempt to summarize, if the panel span capability is determined according to the aluminum grid alone, Section 4.1.2 should not be applied to the interior face. Sections 4.1.3, 4.1.4 and 4.1.5 also should not be applied to the interior face material.

If the panel span is determined on the basis of test (Sections 3.2.3.1 and similar), Section 4.1.2.1 should be revised to incorporate the revised Weatherometer specimen construction outlined in the letter from Atlas. The wording of Section 4.1.2.3 should be revised to state that complete panels should be exposed rather than exposing the interior face directly to the sun for 5 years.

To meet the requirements of Section 4.13.3.1, the modified Weatherometer specimens or Florida exposed panels outlined in the Atlas letter should be used.

Please review our request and advise of any issues or comments. We remain willing to meet and discuss the modified approach and reasoning behind it at your convenience. Feel free to contact me with any questions.

Regards,



Kenneth R. Schmidtchen
Engineering Manager



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Recommendation for Application of ICC-ES AC177, Sections 4.1.2. to the Internal Face of a FRP Lamination

Scope:

This recommendation covers applications for FRP laminations in which exterior and interior faces are clearly specified. It applies to FRP faced panel wall, roof and skylight systems in which the internal face of the panels is exposed only to natural sunlight albedo or normal indoor lighting systems.

Objective:

To provide a realistic assessment of the ability of FRP construction panels to withstand normal stresses due to solar and artificial illumination. The intention is to provide a test that will stress the interior face of the FRP to a level to be expected from any normal real world application, without using the extreme radiation stress levels required for the external face.

Background:

In applying the acceptance criteria described in ICC-ES document AC177, the sections under 4.1.2 pertain to testing using a Xenon Arc Weatherometer. A careful reading of the section appears to require preparation of samples of both the interior and exterior facings of the subject FRP product. It then goes on to say that these should be tested by the methodology described in ASTM D2565 using the test cycle 2 which involves alternating intervals of light and light plus water sprays, coupled with a 6 hour dark interval out of each 24 hours at 95% RH. The method does not specify, however, how the samples of inner and outer face stock are to be mounted. There is an implication that both faces should be tested in the same way, but this does not make any practical sense. While the exterior face contains UV absorbers to protect it from the solar spectrum, protecting

the inner face to the same level makes little sense, as the amount of UV radiation that will ever reach the inner face will be, at most, a few percent of what impinges on the exterior face.

Discussion:

As the exterior face material, typically a polyester, will contain the UV protectants, and, because the high energy UV photons will not penetrate this layer to a depth of more than a few thousandths of an inch, there is minimal need to protect the interior face. In even the worst circumstances, the only exposure of the interior face to the UV spectrum will come from a small amount of albedo reflected from outdoors or residual UV from windows or halide interior lighting.

In our opinion, the most realistic approach to testing the outer and inner face would be to sandwich them together to create test specimens for the weatherometer. Orienting the specimens in the standard flat panel racks, the outdoor layer should face the Xenon lamp, and the indoor panel should face outward, away from the lamp. In this configuration, the exterior panel would be tested to the full 340 MJ/m² (in the 3000 hour test), and the inner layer would experience whatever radiation was able to penetrate the exterior panel plus the reflected radiation from the interior of the chamber, which ranges from 5% to 10% depending upon the loading of the chamber. Hence, the interior panel would receive a very realistic, but significantly smaller dose of UV radiation than the exterior panel.

We believe that the method, as written, could be interpreted in this way, and that doing so would make the most practical sense.

One might also examine the alternative procedure 4.1.2.3 of exposing the structure for 5 years in South Florida in a 45-degree south facing position. The logical interpretation of this would mean exposing the composite structure consisting of the exterior face, interior face and any intermediate layers such as foams on a test platform with the exterior panel directed at the sun. This test would result in the exposure of the inner face to the albedo from a grass surface, approximately 2-3% of the total impinging on the exterior face.*

Alternatively, if the inside face is tested in the same way as the exterior, unless a UV protection package is incorporated, the inner layer is sure to show significant yellowing and loss of tensile strength and flexibility

Conclusion:

Based upon our understanding of the behavior of these materials through long experience and volumes of data, and upon the application to which they are focused, it is our opinion that the best criterion for weatherability acceptance would be to apply 4.1.2 by testing a sandwich of the two FRP faces, the exterior to face the light source and the interior to face away from it as described above. We believe that the criterion could be interpreted in this way and that it makes the most realistic sense. In this way, the interior face of the FRP will receive significant radiation, similar to, but somewhat higher than, would normally be expected in practice, but would not receive the heavy radiation dose anticipated for the exterior face.

*Chadysiene and Girgzdys (2008). UV Radiation Albedo of Natural Surfaces, Journal of Env. Engrg. & Landscape Mgmt. 16(2):83-88.

Opinion Prepared by:



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PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR TRANSLUCENT FIBERGLASS REINFORCED PLASTIC (FRP) FACED PANEL WALL, ROOF AND SKYLIGHT SYSTEMS

AC177

Proposed August 2009

Previously approved February 2007 and October 2005

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 TRANSLUCENT FIBERGLASS REINFORCED PLASTIC (FRP) FACED PANEL WALL, ROOF AND SKYLIGHT SYSTEMS

1.0 INTRODUCTION

1.1 Purpose: The purpose of this acceptance criteria is to establish the minimum requirements for translucent fiberglass reinforced plastic (FRP) faced panel wall, roof and skylight systems to be recognized in an ICC Evaluation Service, Inc., evaluation report under the 2006 *International Building Code*[®] (IBC). The basis of recognition is IBC Section 104.11. Applicable code sections are IBC Sections 2606, 2607, 2608, 2609 and 2610.

The reason for the development of this criteria is to provide guidelines for the evaluation of properties of FRP-faced panel wall, roof and skylight systems, which are not addressed in the code.

1.2 Scope: Translucent FRP-faced panel systems under this acceptance criteria consist of translucent FRP-faced panels that are either installed into a frame at the factory of the panel manufacturer or that are field-installed into frames or framing members. The translucent FRP-faced panels are a sandwich-type construction composed of single, seamless, flat, fiberglass reinforced plastic (FRP) facing sheets factory-bonded to, and fully covering, both faces of a grid of extruded aluminum members, FRP members or members that are a composite consisting of extruded aluminum flanges and an FRP web.

Applications of the translucent FRP-faced panel systems under this acceptance criteria are summarized as follows: (1) Section 3.2: Exterior nonload-bearing wall panels regulated under IBC Section 2607; (2) Section 3.3: Exterior wall glazing regulated under IBC Section 2608; (3) Section 3.4: Roof panels regulated under IBC Section 2609; (4) Section 3.5: Skylights regulated under IBC Section 2610.

Translucent FRP-faced panels used as safety glazing under IBC Section 2406 are outside the scope of this acceptance criteria.

Panels, frames and framing members that are, or consist of, poured and debridged, thermally broken, aluminum extrusions are outside the scope of this acceptance criteria.

1.3 Referenced Documents:

1.3.1 2006 *International Building Code*[®], International Code Council.

1.3.2 ICC-ES Acceptance Criteria for Sandwich Panel Adhesives (AC05).

1.3.3 ASTM D 635-03, Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position, ASTM International.

1.3.4 ASTM D 638-03, Standard Test Method for Tensile Properties of Plastics, ASTM International.

1.3.5 ASTM D 790-03, Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials, ASTM International.

1.3.6 ASTM D 1929-96(2000)⁰¹, Test Method for Determining Ignition Properties of Plastics, ASTM International.

1.3.7 ASTM D 2565-99, Practice for Operating Xenon Arc-Type Light-Exposure Apparatus With and Without Water for Exposure of Plastics, ASTM International.

1.3.8 ASTM D 4803-97, Test Method for Predicting Heat Buildup in PVC Building Products, ASTM International.

1.3.9 ASTM E 72-02, Standard Test Methods of Conducting Strength Tests of Panels for Building Construction, ASTM International.

1.3.10 ASTM E 108-04, Test Methods for Fire Tests of Roof Coverings, ASTM International.

1.3.11 ASTM E 283-99, Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen, ASTM International.

1.3.12 ASTM E 547-00, Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Cyclic Static Air Pressure Difference, ASTM International.

1.3.13 ASTM E 661-88(1997), Test Method for Performance for Wood and Wood-Based Floor and Roof Sheathing Under Concentrated Static and Impact Loads, ASTM International.

1.3.14 UL790 - 97 (with revisions through July 1998), Test for Fire Resistance of Roof Covering Materials, Underwriters Laboratories.

1.4 Definitions:

1.4.1 Frame: A member at the perimeter of the translucent FRP-faced panel utilized to attach the panel to the structure of the building, in which the frame is continuously supported, along the length of the frame, by the structural elements of the building. Frames under this acceptance criteria are produced from extruded aluminum or FRP. FRP frames under this acceptance criteria are limited to frame configurations where the frame is not subject to flexural stresses under gravity load conditions.

1.4.2 Framing or Framing Member: A structural member at the translucent FRP-faced panel perimeter used to support the panel, in which the framing member is not continuously supported along the length of the framing member by structural elements of the building. The framing member is either directly supported or is not directly supported by the structural elements of the building. Framing and framing members under this acceptance criteria are limited to those produced from extruded aluminum only.

1.4.3 Skylight: A skylight under this acceptance criteria consists of a translucent FRP-faced panel either factory- or field-installed into a skylight frame.

2.0 BASIC INFORMATION

2.1 General: Data complying with Sections 3.1 through 3.5, as applicable to the evaluation report applicant's intended end use of the translucent FRP-faced panel systems, shall be submitted.

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2.2 Product Description: Complete information concerning materials and the manufacturing process of the translucent FRP-faced panels, frame and framing members shall be provided, and shall include the following:

2.2.1 Generic or trade name of the translucent FRP-faced panel system.

2.2.2 Manufacturer's catalog or model number.

2.2.3 Materials, including physical properties and dimensions, of the frames, framing members, translucent FRP-faced panels and components of the panels. The components of the translucent FRP-faced panels include the facings, adhesives and grid.

2.2.4 Dimensioned, scaled drawings of typical installations, noting all thicknesses; connections; installation and mounting details (including type and spacing of fasteners); caulking; and other information associated with installation, such as flashing and roof slope limitations. Aluminum components must be separated from dissimilar materials in accordance with Section 6.6.1 of Part 1-A of the Aluminum Design Manual. Fasteners in contact with aluminum components shall be aluminum, stainless steel or aluminized, hot-dip galvanized or electrogalvanized steel.

2.3 Product Identification and Labeling: The method of packaging and identifying the translucent FRP-faced panels, frames and framing members shall be specified. A permanent label located on each translucent FRP-faced panel shall bear the manufacturer's name and address, model number (if applicable), the plastic classification of each facing (CC1 or CC2), the thickness of each facing, the ICC-ES evaluation report number and the name or logo of the inspection agency. The exterior face of the translucent FRP-faced panels shall be clearly identified. Containers of framing members shall be identified by labels that bear the company name of the evaluation report holder, the part number and the evaluation report number.

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

2.5 Test Reports: Test reports shall comply with AC85.

2.6 Product Sampling: Sampling of the translucent FRP-faced panels for tests under this criteria shall comply with Section 3.1 of AC85. Sampling of the frames and framing members for tests under this criteria shall comply with Section 3.2 of AC85. Test specimens shall be representative of standard manufacture in conformance with the minimum requirements of the quality control manual required under Section 5.0 of this acceptance criteria.

2.7 Supplementary Information: Supplementary information may be included in the evaluation report, provided it relates to the IBC and is properly justified. Examples include sound transmission as specified in IBC Section 1207, and thermal transmission data as addressed in IBC Chapter 13. Recognition of fire-resistive assemblies requires reports of tests in compliance with IBC Chapter 7.

3.0 TEST AND PERFORMANCE REQUIREMENTS

3.1 General:

3.1.1 Allowable load values developed under this criteria based on testing are not subject to increase due to duration of loading.

3.1.2 Substantial in-service differences in temperature between the exterior face and interior face of translucent FRP-faced panels with high coefficients of thermal expansion require justification that this will not be detrimental to the panel integrity.

3.1.3 When grid members are of a composite construction of aluminum and FRP, the FRP material shall comply with the requirements for exterior panel facings in Section 4.1 (except Sections 4.1.1 and 4.1.2) of this criteria. Some of the requirements may be satisfied by utilizing an FRP plastic recognized in current ICC-ES evaluation report.

3.2 Exterior Nonload-bearing Wall Panels: For recognition as an exterior, nonload-bearing wall panel under IBC Section 2607 for light-transmitting plastic wall panels, the following items shall be addressed:

3.2.1 Panel facing material data in accordance with Section 4.1 of this criteria. Some of the requirements may be satisfied by utilizing an FRP plastic recognized in a current ICC-ES evaluation report.

3.2.2 Data in accordance with Section 4.2 of this criteria for all adhesives used in the panel and panel grid. As a minimum, the adhesive shall qualify as a Type I, Class 2, adhesive, since the panels will be limited to use as nonload-bearing wall panels.

3.2.3 Uniform transverse (out-of-plane) positive and negative allowable loads shall be based on one of the following (Section 3.2.3.1 or 3.2.3.2):

3.2.3.1. Uniform load testing of the panels and framing members in accordance with Section 4.3 of this criteria.

3.2.3.2. Calculated spans based on the extruded aluminum grid members of the panel in accordance with IBC Chapter 20. The deflection limitations specified for exterior walls with flexible finishes (span/120) in IBC Table 1604.3 shall be applied. See Note 1. If the panels span between framing members, the allowable transverse load of the framing members shall also be based on calculations in accordance with IBC Chapter 20, and the combined deflection of the panel and framing members at the allowable load shall not exceed the deflection limitation. The use of this criteria section to calculate the spans of the framing members is limited to installations where the framing members are directly supported by structural elements of the building. Additionally, the allowable uniform transverse loads of the panel facings shall be established in accordance with Section 4.7. Allowable uniform transverse load recognition will be limited to the lesser of the allowable load calculated for the grid and framing members, and the allowable load based on Section 4.7 for the panel facing material.

NOTE 1—For recognition of use in walls of sunroom additions or patio covers, the total load deflection limitation shall be span/60 (see footnote h of IBC Table 1604.3).

3.2.4 Freeze-thaw test data in accordance with Section 4.1.3 of this criteria.

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3.2.5 Temperature cycling test data in accordance with Section 4.9 of this criteria is needed for panels installed into aluminum frames and framing.

3.2.6 Water penetration tests in accordance with Section 4.11.

3.2.7 Air infiltration tests in accordance with Section 4.12.

3.3 Exterior Wall Glazing: For recognition as an exterior wall glazing under IBC Section 2608 for light-transmitting plastic glazing, the following items shall be addressed:

3.3.1 Panel facing material data in accordance with Section 4.1 of this criteria. Some of the requirements may be satisfied by utilizing an FRP plastic recognized in a current ICC-ES evaluation report.

3.3.2 Data in accordance with Section 4.2 of this criteria for all adhesives used in the panel and panel grid. As a minimum, the adhesive shall qualify as a Type I, Class 2, adhesive, since the panels will be limited to use as exterior wall glazing.

3.3.3 Uniform transverse (out-of-plane) positive and negative allowable loads shall be based on one of the following (Section 3.3.3.1 or 3.3.3.2):

3.3.3.1. Uniform load testing of the panels in accordance with Section 4.4 of this criteria.

3.3.3.2. Calculated spans based on the extruded aluminum grid members of the panel in accordance with IBC Chapter 20. The deflection limitation of IBC Table 1604.3 for exterior walls with flexible finishes (span/120) shall be applied. See Note 2. Additionally, the allowable uniform transverse loads of the panel facings shall be established in accordance with Section 4.7. Allowable uniform transverse load recognition will be limited to the lesser of the allowable load calculated for the grid, and the allowable load based on Section 4.7 for the panel facing material.

NOTE 2—For recognition of use in walls of sunroom additions or patio covers, the total load deflection limitation shall be span/60 (see footnote h of IBC Table 1604.3).

3.3.4 Freeze-thaw test data in accordance with Section 4.1.3 of this criteria.

3.3.5 Temperature cycling test data in accordance with Section 4.9 of this criteria is needed for panels installed into aluminum frames and framing.

3.3.6 Water penetration tests in accordance with Section 4.11.

3.3.7 Air infiltration tests in accordance with Section 4.12.

3.4 Roof Panels: For recognition as a roof panel under IBC Section 2609 for light-transmitting plastic roof panels, the following items shall be addressed:

3.4.1 Panel facing material data in accordance with Section 4.1 of this criteria. Some of the requirements may be satisfied by utilizing an FRP plastic recognized in a current ICC-ES evaluation report

3.4.2 Data in accordance with Section 4.2 of this criteria for all adhesives used in the panel and panel grid. The adhesives shall qualify as Type II, Class 2, adhesives, except the classification may be reduced to Type I, Class

2, for panels for which the strength and stiffness are based on Section 3.4.4.2.

3.4.3 For use in installations under IBC Section 2609 based on the roof panels' complying with IBC Chapter 15 requirements for roof coverings, the following requirements apply:

3.4.3.1. Roof classification testing in accordance with Section 4.13 of this criteria.

3.4.3.2. IBC Section 1504.7.

3.4.4 Uniform transverse (out-of-plane) positive and negative allowable loads shall be based on one of the following (Section 3.4.4.1 or 3.4.4.2):

3.4.4.1. Uniform load testing of the panels and framing members in accordance with Section 4.5 of this criteria.

3.4.4.2. Calculated spans based on the extruded aluminum grid members in accordance with IBC Chapter 20. The total load deflection limitations specified in footnote h of IBC Table 1604.3 shall be applicable (span/60). If the panels span between framing members, the allowable transverse load of the framing members shall also be based on calculations in accordance with IBC Chapter 20, and the combined deflection of the panel and framing members at the allowable load shall not exceed the deflection limit. The use of this criteria section to calculate the spans of the framing members is limited to installations where the framing members are directly supported by structural elements of the building. Additionally, the allowable uniform transverse loads of the panel facings must be established in accordance with Section 4.7 of this criteria. Allowable uniform transverse load recognition will be limited to the lesser of the allowable load calculated for the grid and framing members, and the allowable load based on Section 4.7 for the panel facing material.

3.4.5 Concentrated static load testing in accordance with Section 4.8 of this criteria.

3.4.6 Freeze-thaw test data in accordance with Section 4.1.3 of this criteria.

3.4.7 Temperature cycling test data in accordance with Section 4.9 of this criteria is needed for panels installed into aluminum frames and framing.

3.4.8 Water penetration tests in accordance with Section 4.11.

3.4.9 Air infiltration tests in accordance with Section 4.12.

3.5 Skylights: For recognition as a skylight under IBC Section 2610 for light-transmitting plastic skylight glazing, the following items shall be addressed:

3.5.1 Panel facing material data in accordance with Section 4.1 of this criteria. Some of the requirements may be satisfied by utilizing an FRP plastic recognized in a current ICC-ES evaluation report.

3.5.2 Data in accordance with Section 4.2 of this criteria for all adhesives used in the panel and panel grid. The adhesives shall qualify as Type II, Class 2, adhesives, except the classification may be reduced to Type I, Class 2, for panels for which the strength and stiffness are based on Section 3.5.3.2.

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3.5.3 Uniform transverse (out-of-plane) positive and negative allowable loads shall be based on one of the following (Section 3.5.3.1 or 3.5.3.2):

3.5.3.1. Uniform load testing of the skylight in accordance with Section 4.6 of this criteria.

3.5.3.2. Calculated spans based on the extruded aluminum grid members in accordance with IBC Chapter 20. The total load deflection limitation specified in footnote h of IBC Table 1604.3 shall be applicable (span/60). Additionally, the allowable uniform transverse loads of the panel facings shall be established in accordance with Section 4.7. Allowable uniform transverse load recognition will be limited to the lesser of the allowable load calculated for the grid, and the allowable load based on Section 4.7 for the panel facing material.

3.5.4 The allowable wind uplift load from Section 3.5.3 shall not result in loads, on the fasteners attaching the skylight frame to the roof structure, exceeding the connection capacity. The connection capacity shall be based on code-recognized allowable values for the fasteners. In the absence of code-recognized fastener allowable loads, small-scale fastener connection tests are necessary. Prior to the fastener connection test being conducted, a suggested test program (including proposed conditions of acceptance and safety factor) should be submitted to ICC-ES for review.

3.5.5 Concentrated static load testing in accordance with Section 4.8 of this criteria.

3.5.6 Freeze-thaw test data in accordance with Section 4.1.3 of this criteria.

3.5.7 Temperature cycling test data in accordance with Section 4.9 of this criteria is needed for skylights with aluminum frames.

3.5.8 Class B burning-brand testing, in accordance with Section 4.14 of this criteria, is required for skylights mounted at slopes of less than 4:12 (33 percent slope).

3.5.9 Use of the skylight shall be limited to installations where nonclassified roof coverings are permitted, unless the edge of the plastic glazing material of the skylight is protected by metal or other noncombustible material.

3.5.10 Skylights with FRP frames shall be limited to use on structures permitted to be of Type 3, 4 or 5 construction as required by IBC Section 2405.4. Skylights with FRP frames shall be further limited to installations permitting nonclassified roof coverings, unless reports of tests in accordance with Section 4.15 of this acceptance criteria are submitted.

3.5.11 Temperature cycling test data in accordance with Section 4.10 of this criteria is needed for skylights with FRP frames.

3.5.12 Water penetration tests in accordance with Section 4.11.

3.5.13 Air infiltration tests in accordance with Section 4.12.

3.5.14 For skylights with FRP frames, weathering and strength tests of the FRP frame material in accordance with Section 4.10.

4.0 TEST PROCEDURES

4.1 Translucent FRP-faced Panel Facing Material:

4.1.1 Plastics Specifications Testing: Reports of tests of the FRP of the panels in accordance with the test procedures specified in IBC Section 2606.4 shall be submitted. The performance of the specimens shall comply with the specifications for light-transmitting plastics noted in IBC Section 2606.4.

4.1.2 Weatherometer Testing:

4.1.2.1. Specimens: Representative test specimens shall be prepared from the interior and exterior FRP facings of the panels and shall be of sufficient size to allow for conducting tensile and elongation tests (Section 4.1.4) and flexural tests (Section 4.1.5) of the FRP in both the machine and cross-machine directions, of both control and weather exposed specimens. In addition, the test specimens' size shall be sufficient to allow for conducting ignition properties and rate of burn tests (Section 4.13.3), when required by this criteria.

Exception: When the allowable loads or spans of the panels are not based on the interior facer or the facer's attachment to the grid members of the panel, tensile and elongation tests (Section 4.1.4) and flexural tests (Section 4.1.5) of the interior facer are not required.

4.1.2.2. Procedure: The weather-exposed specimens shall be tested in accordance with ASTM D 2565, utilizing cycle No. 2 for a minimum duration of 3000 hours. Each exposure test specimen used for exposure of interior facers shall consist of the interior facer placed directly behind the exterior facer, with the exterior facer of the test specimen facing the xenon lamp. The facers shall be placed in the specimen holder without being affixed or sealed to each other.

4.1.2.3. Alternative Procedure: The exposure specimens shall be exposed for five years in southern Florida at a 45-degree south-facing exposure. The exposure test specimens shall consist of full-thickness panels, with the exterior facer exposed to the sun.

4.1.2.4. Conditions of Acceptance: There shall be no cracking, checking, crazing, erosion, or chalking of the exposed specimens. In addition, see Sections 4.1.4.2 and 4.1.5.2.

4.1.3 Freeze-thaw Test:

4.1.3.1. Specimens: Representative test specimens shall be prepared from the exterior plastic facing of the panels and shall be of sufficient size to allow for conducting tensile and elongation tests (Section 4.1.4) and flexural tests (Section 4.1.5) in both the machine and cross-machine directions, of both control and freeze-thaw conditioned specimens.

4.1.3.2. Procedure: The freeze-thaw specimens shall be subjected to a minimum of 10 cycles of freeze-thaw conditioning, with each freeze-thaw cycle consisting of a minimum of eight hours at 120°F, submersion in room-temperature water for a minimum of eight hours, and a minimum of 16 hours at -20°F (-29°C).

4.1.3.3. Conditions of Acceptance: There shall be no crazing, cracking or other deleterious surface changes after freeze-thaw conditioning. In addition, see Sections 4.1.4.2 and 4.1.5.2.

4.1.4 Tensile and Elongation Test:

4.1.4.1. Procedure: Comparative tensile testing shall be conducted on control, weathered, and freeze-thaw specimens in accordance with ASTM D 638.

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4.1.4.2. Conditions of Acceptance: The test results shall demonstrate that the mean of the ultimate tensile load and the mean of the elongation of both the weathering test and the freeze-thaw test specimens is not less than the mean of the ultimate tensile loads and the mean elongation of the control specimens, respectively, or that the mean values are not significantly different based on a Student's t-test comparison at a 95 percent confidence level.

4.1.5 Flexural Test:

4.1.5.1. Comparative flexural testing shall be conducted on control, weathered and freeze-thaw specimens in accordance with ASTM D 790, Procedure A.

4.1.5.2. Conditions of Acceptance: The test results shall demonstrate that the mean of the ultimate flexural strength of both the weathering test and the freeze-thaw test specimens is not less than the mean of the ultimate flexural strength of the control specimens or that the mean values are not significantly different based on a Student's t-test comparison at a 95 percent confidence level.

4.2 Adhesives: Any adhesives used must comply with AC05. Adhesive specifications shall include the type, class, thickness of application, number of coats and assembly instructions, etc.

4.3 Uniform Transverse Load Testing—Exterior Wall Panels:

4.3.1 Three assemblies of each panel type are required to be tested, with none of the results varying by more than 15 percent from the average of the three, unless the lowest test value is used. The average result based on a minimum of five tests may be used regardless of the variations. The results of two tests may be used when the higher value does not exceed the lower value by more than 5 percent and the lower value is used with the required factor of safety.

4.3.2 Where tests are not conducted to failure, the highest load achieved for each test will be assumed as ultimate.

4.3.3 The allowable uniform transverse load shall be based on a minimum factor of safety of 3 applied to the ultimate load based on the average of three tests or as permitted in Section 4.3.1 of this criteria.

4.3.4 With the allowable wind load imposed, the average deflection of the tested assemblies shall not exceed $L/240$. See Note 3. This deflection shall be measured at the assembly's mid-width and mid-length.

NOTE 3—For recognition of use in walls or roofs of sunroom additions or patio covers, the total load deflection limitation shall be $\text{span}/120$ (see footnote h of IBC Table 1604.3).

4.3.5 The test assembly shall comply with either Section 4.3.5.1 or Section 4.3.5.2.

4.3.5.1. For exterior wall panels consisting of multiple panels with a framing member between each panel, each assembly shall consist of a minimum of four framing members and three panels with one framing member on each side of each panel. The framing members at both edges of the assemblies parallel to the framing member length shall be free to deflect, such that the span of the test assembly is parallel to the length of the framing members and the panels span between the

framing members. The ends of each assembly, perpendicular to the test span, shall be provided with continuous support during the load tests, representative of field installation.

4.3.5.2. For exterior wall panels consisting of a single panel installed into a frame with the frame on all four edges of the panel, each assembly shall consist of one panel installed into the frame. The frame on all four edges of each assembly shall be supported during the load tests in a manner representative of field installation.

4.3.6 The "bag method" or vacuum chamber loading shall be used.

4.3.7 Positive and negative pressure conditions shall tested.

4.3.8 All assemblies shall be loaded in increments to failure with deflections taken to obtain deflection and set characteristics. Application of load and duration of load application shall be in accordance with Sections 4.2 and 4.3 of ASTM E 72. Where preloading is applied, the loading, deflection and recovery shall be noted. The amount of preloading shall not exceed 10 percent of the final allowable load unless permitted by ICC-ES.

4.3.9 Allowable loads determined from these tests shall be limited to the sizes, materials and spans of the tested assemblies and may be used for shorter spans or heights, but extrapolation to greater spans, heights or loads is not permitted. As an alternate, additional full-scale testing must include the maximum and minimum assembly spans intended for recognition. No extrapolation beyond these spans or corresponding loads will be permitted.

4.3.10 Variations in facing thickness will require additional full-scale testing. Thicknesses tested must "envelope" the range desired with interpolation of results between tested values.

4.3.11 Variations in the pattern of the panel grid require additional full-scale testing.

4.3.12 Multiple-span full-scale testing will be required if recognition of multiple spans is desired.

4.4 Uniform Transverse Load Testing—Exterior Wall Glazing: Allowable loads for exterior wall glazing shall be determined as for exterior wall panels in Section 4.3 of this criteria, with the assembly as described in Section 4.3.5.2.

4.5 Uniform Transverse Load Testing—Roof Panels: Allowable loads for roof panels shall be determined as for exterior wall panels in Section 4.3 of this criteria, with the assembly as described in Section 4.3.5.1.

4.6 Uniform Transverse Load Testing—Skylights: Allowable loads for skylights shall be determined as for exterior wall panels in Section 4.3 of this criteria, with the assembly as described in Section 4.3.5.2.

4.7 Panel Facing Uniform Transverse Load:

4.7.1 A minimum of three specimens of panels for each exterior FRP facing sheet type and thickness shall be subjected to the tests under this section of this criteria (Section 4.7). If the result of any of the tests of three specimens varies by more than 15 percent from the average value, either the lowest test value shall be used in the analysis of test data or the average for a minimum of five test specimens shall be used.

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4.7.2 For panels with variations in the grid pattern, the tested panels shall have the grid pattern that creates the highest flexural stresses in the exterior FRP facing sheet.

4.7.3 A minimum factor of safety of 3 shall be applied to the average of the test results to determine the allowable uniform transverse load, or as permitted in Section 4.7.1 of this criteria.

4.7.4 The translucent FRP-faced panel edges and grid are permitted to be supported during the positive load tests and restrained in the negative load tests. In the negative load tests the test setup shall not restrict the movement of the exterior FRP facing material.

4.7.5 Uniform transverse loads shall be applied using either a "bag method" or vacuum chamber procedure. The tested conditions shall be such that the test pressure differential is between the inner and outer sides of the exterior FRP facing material.

4.7.6 Positive (gravity) and negative (wind uplift) pressure conditions shall be tested.

4.7.7 Application of load and duration of load application shall be in accordance with Sections 4.2 and 4.3 of ASTM E 72.

4.8 Concentrated Static Load Testing:

4.8.1 Procedure: A minimum of three tests shall be conducted for each facing and grid combination. Tests shall be conducted on the panel's exterior facing in accordance with Section 7.1 of ASTM E 661.

4.8.2 Conditions of Acceptance: Exterior facings of panels installed on roofs shall be capable of supporting, without failure, a 300-pound (1334 N) concentrated load applied through a 3-inch-diameter (76 mm) disc.

4.9 Temperature-cycling Tests:

4.9.1 Procedure: A minimum of five assemblies, consisting of full-thickness panels installed in representative frames, shall be subjected to 25 consecutive exposure cycles, with each cycle consisting of one hour of water exposure at room temperature prior to six hours at minus 40°F (-40°C), two hours at 70°F (21°C), 14 hours at 180°F (82°C), and one hour at 70°F (21°C). Between cycles, such as on weekends, holidays, etc., the specimens may be maintained at 70°F (21°C). A plus 5°F (3°C) tolerance is allowed on the above temperatures. Spray nozzles for the water exposure must be located approximately 7 feet (2134 mm) above the specimens and must deliver 6 inches (152 mm) of water per hour at a temperature of 40°F to 60°F (4°C to 16°C). The specimens must be installed at the lowest slope recommended for field installation. At the conclusion of the 25 cycles, the specimens shall be examined under 5× magnification.

4.9.2 Condition of Acceptance: The assembly is considered to have passed this test if no crazing, cracking or other deleterious surface changes are noted at the end of test.

4.10 Temperature-cycling Tests—Skylights With FRP Frames:

4.10.1 Specimen: A representative sample skylight with FRP frame shall be subjected to 24 consecutive cycles of this test. The specimens shall be installed in a

rigid wood frame simulating the field installation procedure recommended by the manufacturer. The test decks shall be installed at the minimum horizontal slope recommended for recognition. Test specimens shall be mounted in a compartment so the interior side of the specimens can be maintained at 73.4°F (23°C) throughout testing. The apparatus shall allow variable temperatures to the exterior side (weather side) of the specimen.

4.10.2 Procedure: During the first hour, the weather side temperature shall be decreased from 73.4°F (23°C) to -22°F (-30°C) and then maintained at -22°F (-30°C) for one hour. During the third hour, the weather side temperature shall be increased to 73.4°F (23°C). In the next hour the weather side temperature shall be raised to 122°F (49°C) and then maintained for an additional hour. During the two-hour period, radiant heat shall be applied to the weather side of the specimens. The radiant heat must impose, and maintain for one hour, a temperature on the frame equivalent to the sum of the maximum heat buildup plus the ambient test temperature of 122°F (49°C). Maximum heat buildup shall be determined in accordance with ASTM D 4803 using horizontal samples and using the darkest colors being recognized. During the sixth hour, the radiant heat source shall be turned off and the temperature of the weather side compartment lowered to 73.4°F (23°C). The exposures may be suspended between cycles, such as on weekends or holidays, provided the samples are maintained at 73.4°F (23°C).

4.10.3 Conditions of Acceptance: At the conclusion of 24 cycles (end of the test), the skylight with FRP frame shall display no crazing, cracking or other deleterious surface or joint changes. Additionally, there shall be no sign of failure or distress at fastener locations or at skylight frame corners.

4.11 Water Penetration Tests:

4.11.1 Procedure: The test specimen shall be in accordance with ASTM E 547 and installed in compliance with the manufacturer's published installation instructions. The specimen shall be tested at the lowest slope for which recognition is sought. Testing shall be in accordance with ASTM E 547, with an air pressure differential of 2.86 psf (137 Pa) or 15 percent of the allowable positive load, whichever is greater. The water penetration test shall consist of four cycles, with each cycle consisting of five minutes with the pressure applied and one minute with the pressure released, during which the water spray is continuously applied.

4.11.1.1. Conditions of Acceptance: There shall be no water leakage to the interior side of the test specimen.

4.12 Air Infiltration Tests:

4.12.1 Procedure: The test specimen shall be in accordance with ASTM E 283 and installed in compliance with the manufacturer's published installation instructions. The specimen shall be tested at the lowest slope for which recognition is sought. Testing shall be in accordance with ASTM E 283, with an air pressure differential of 1.57 psf (75 Pa). The test results (air leakage) shall be expressed in cfm/ft² (m³/min/m²), where the area is based on the rough opening dimensions.

4.12.1.1. Conditions of Acceptance: The air leakage shall not exceed 0.3 cfm/ft² (0.0914 m³/min/m²).

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4.13 Roof Classification Tests:

4.13.1 Procedure:

4.13.1.1. The roof classification tests shall be conducted in accordance with ASTM E 108 or UL 790, and this acceptance criteria, on assemblies of the panels and framing members to be specified in the evaluation report. The roof classification tests shall be performed on specimens with the greatest spacing between longitudinal and transverse core grid members. A minimum Class C classification is required. For recognition as a Class A assembly, burning brand tests shall be conducted in accordance with ASTM E 108 or UL 790, but with both Class A and Class B burning brands.

4.13.1.2. Wind must be directed on the specimen at the most critical direction as determined by the testing laboratory.

4.13.1.3. The brands shall be located on the test specimen at locations that represent the most severe condition, including placing the brands so they are centered between grid members of the translucent FRP-faced panels. Each brand shall be secured to the specimen by No. 18, B. & S. gage soft wire. The second brand shall be applied after all burning resulting from the first brand has ceased.

4.13.1.4. Each test shall be continued until the brand is consumed and all evidence of flame, glow and smoke has disappeared from both the exposed surface of the material being tested and the underside of the panel, or until failure occurs. The results of any test in which the brands do not show progressive and substantially complete consumption after application to the specimen are to be disregarded.

4.13.2 Conditions of Acceptance:

4.13.2.1. At no time during the intermittent-flame, spread-of-flame or burning-brand tests shall:

4.13.2.1.1. Any portion of the specimen be blown or fall off in the form of flaming or glowing brands.

4.13.2.1.2. Any portion of the underside of the panel be exposed due to breaking, cracking or warping of the bottom facing.

4.13.2.2. For the purpose of the requirements, any piece of the panel that continues to glow or flame upon landing on the test room floor shall be considered to be a glowing or flaming brand, respectively.

4.13.2.3. At no time during the intermittent-flame or burning brand tests shall there be sustained flaming of the underside of the panel.

Exception: If flaming does occur, another series of tests may be conducted and the results accepted provided no additional sustained flaming occurs.

4.13.2.4. For the spread-of-flame test, the flaming of the material shall not have spread beyond 6 feet (1.83 m) for Class A, 8 feet (2.44 m) for Class B and 13 feet (3.96 m) (the top of the panel) for Class C. There shall have been no significant lateral spread of flame from the path directly exposed to the test flame.

4.13.3 Retention of Fire-retardant Qualities:

4.13.3.1. General: Data on retention of fire-retardant qualities of the interior and exterior FRP panel facings over the expected life shall be submitted. Facing

materials specimens shall be subjected to the weatherometer test described in Section 4.1.2. The number of specimens shall be sufficient to conduct the ignition properties and rate of burn tests on exposed specimens and control specimens in accordance with ASTM D 1929 and ASTM D 635, respectively.

4.13.3.2. Conditions of Acceptance:

4.13.3.2.1. Ignition Properties: The test results from the control and exposed specimens shall demonstrate that the self-ignition temperature of the exposed specimen is not less than the self-ignition temperature of the control specimen.

4.13.3.2.2. Rate of Burn: The test results from the control and exposed specimens shall demonstrate that the mean rate of burn of the exposed specimens is not more than the mean rate of burn of the control specimens

4.14 Class B Burning-brand Test—Skylights Installed at Slopes of Less Than 4:12:

4.14.1 Procedure:

4.14.1.1. Translucent FRP-faced panels, installed as skylights mounted at a slope of less than 4:12, shall pass the Class B burning-brand test conducted in accordance with ASTM E 108 or UL 790, and this acceptance criteria. The Class B brand shall be ignited as required by ASTM E 108 or UL 790. This test shall be performed on translucent FRP-faced panels with the greatest spacing between longitudinal and transverse core grid members.

4.14.1.2. The brands shall be located on the test specimen at locations that represent the most severe condition, including placing the brands so they are centered between grid members of the translucent plastic panels. Each brand shall be secured to the specimen by No. 18, B. & S. gage soft wire. The second brand shall be applied after all burning resulting from the first brand has ceased.

4.14.1.3. Wind shall be directed on the brand at the most critical direction as determined by the testing laboratory.

4.14.1.4. Each test shall be continued until the brand is consumed and all evidence of flame, glow and smoke has disappeared from both the exposed surface of the material being tested and the underside of the panel, or until failure occurs. The results of any test in which the brands do not show progressive and substantially complete consumption after application to the unit are to be disregarded.

4.14.2 Conditions of Acceptance:

4.14.2.1. At no time during the Class B burning brand test shall:

4.14.2.1.1. Any portion of the specimen be blown or fall off in the form of flaming or glowing brands.

4.14.2.1.2. Any portion of the underside of the panel be exposed due to breaking, cracking or warping of the bottom facing.

4.14.2.2. For the purpose of the requirements, any piece of the panel that continues to glow or flame upon landing on the test room floor shall be considered to be a glowing or flaming brand, respectively.

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4.14.2.3. At no time during the burning-brand test shall there be sustained flaming of the underside of the panel.

Exception: If flaming does occur, another series of tests may be conducted and the results accepted provided no additional sustained flaming occurs.

4.15 Class B Burning-brand Test—Skylights with FRP Frames:

4.15.1 General: For skylights with FRP frames to be installed where classified roof covering assemblies are required, the skylights shall be subjected to and pass the Class B burning-brand test conducted in accordance with ASTM E 108 or UL 790, and this acceptance criteria.

4.15.2 Procedure: The Class B brand shall ignited as required by ASTM E 108 and placed as shown in Figure 1.

4.15.3 Conditions of Acceptance: The burning brand shall self-extinguish without ignition of the FRP exterior facing, interior facing or grid of the translucent FRP-faced panel.

5.0 QUALITY CONTROL

5.1 The panels, FRP frames and composite aluminum and FRP grid members shall be manufactured under an approved quality control program with inspections by an inspection agency accredited by the International Accreditation Service (IAS) or otherwise acceptable to ICC-ES.

5.2 Third-party follow-up inspections are not required under this acceptance criteria for the extruded aluminum frames and framing members.

5.3 Quality documentation complying with the ICC-ES Acceptance Criteria for Quality Documentation (AC10) shall be submitted for the panels, frames, framing members and composite aluminum and FRP grid members. The purpose of the quality control program, as described in the quality documentation, shall be to assure that the panels, frames, framing members and composite aluminum and FRP grid members manufactured under the program continue to comply with the IBC and this acceptance criteria for structural, durability and fire performance. The documentation needs to include the information required by Sections 2.2 and 2.3.

6.0 EVALUATION REPORT RECOGNITION

6.1 Evaluation reports on products evaluated under Section 3.4 (including Section 3.4.3) of this acceptance criteria shall include the roof classification and a statement that the product can be installed in accordance with the provisions of IBC Section 2609 through item 3 of IBC Section 2609.1.

6.2 The following statement shall be included when the evaluation report includes recognition of use as a roof panel: For roof panels, water accumulation or water ponding shall be addressed in accordance with Footnote e of IBC Table 1604.3.

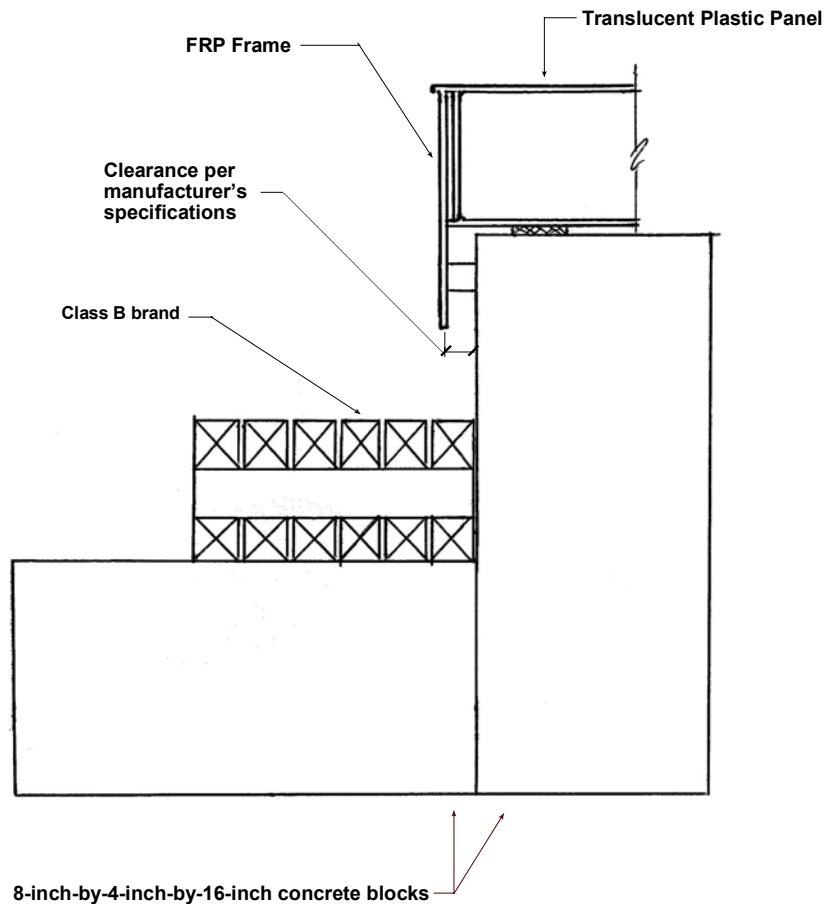


FIGURE 1—BURNING BRAND LOCATION FOR SKYLIGHTS WITH FRP FRAMES