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February 1, 2010

**TO: PARTIES INTERESTED IN INSULATING CONCRETE FORM SYSTEMS**

**SUBJECT: Proposed Revisions to the Acceptance Criteria for Stay-in-place, Foam Plastic Insulating Concrete Form (ICF) Systems for Solid Concrete Walls, Subject AC353-0210-R1 (YM, DP)**

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 website to allow for public comment. The purpose of the revisions is to update the criteria to the 2009 *International Building Code* (IBC) and the 2009 *International Residential Code* (IRC). For recognition under previous versions of the I-Codes (2006 and earlier) and legacy codes (UBC, BNBC, or SBC), consideration should be given to the requirements found in AC353, approved October 2007 (editorially revised April 2008). Staff would like to highlight some of the proposed changes to the criteria:

1. In the current criteria, the scope of recognition is consistent with the prescriptive provisions of the 2006 IRC, in that compliance with the wall thickness specifications is limited to the minimum dimensions. However, the 2009 IRC has been revised in that Table R611.3 of the 2009 IRC includes minimum and maximum tolerances on the nominal concrete thickness, as well as a maximum 10-inch nominal concrete wall thickness, of ICF flat walls. Therefore, the scope of the proposed criteria has been expanded to include recognition of ICF flat walls that have a nominal thickness greater than 10 inches.
2. The following referenced standards in Section 1.3 of the criteria have been updated to the versions of those standards referenced in the 2009 I-Codes:
  - a. ASTM C578-07.
  - b. ASTM D 635-06.
  - c. ASTM D 1761-06.
  - d. ASTM E 84-07.

- e. ASTM E 119-07.
- f. AISI S100-07.
- g. NFPA 268-07.
- h. NFPA 285-06.
- i. NFPA 286-06.

The updating of these standards does not result in additional data requirements for existing evaluation report holders.

3. The following reference standards have been added to Section 1.3 of the criteria:
  - a. PCA 100-07: This standard, referenced in IRC Sections R404.1.2 and R611.1, provides alternate prescriptive provisions for the construction of flat and waffle-grid ICF concrete walls under the IRC.
  - b. ICC 600-2008: This standard, referenced in IBC Section 1609, provides prescriptive provisions for the design of flat ICF walls to resist wind forces only.
4. Sections R404 and R611 of the IRC have been extensively revised in the 2009 edition. Staff would like to highlight the following revisions that may affect ICF report holders:
  - a. The applicability limits defined in IRC Section R611.2 for the ICF have been revised from those in the 2006 IRC. For example, the 2009 IRC limits the ICFs to Seismic Design Categories A, B, and C. For use in higher Seismic Design Categories, the structure may be constructed under the prescriptive provisions of PCA 100-07, or be designed in accordance with the IBC. Also note that the applicability limits for wind speeds have been revised.
  - b. IRC Table R611.3 includes new dimensional requirements for flat and waffle-grid ICF wall systems. The concrete thickness for flat ICF wall systems has been revised to include a minimum and maximum dimensional tolerance. Therefore, the maximum flat ICF wall thickness is 10 inches. The dimensions for the concrete vertical core of the waffle-grid ICF wall systems have been increased. This may require report holders with waffle-grids complying with the 2006 IRC to reconfigure their waffle-grid dimensions.
  - c. IRC Sections R611.5.3 and R404.1.2.3.6 require that the forms and form ties provide sufficient strength to contain concrete during

concrete placement. Historically, AC353 has not addressed the ICF's ability to contain concrete during concrete placement. It is our understanding that this is typically accomplished by shoring or bracing the ICF walls during concrete placement. In response to this new requirement, staff has included a statement in Section 6.2.6 of the criteria to indicate that compliance with IRC Sections R611.5.3 and R404.1.2.3.6 needs to be shown to the satisfaction of the code official.

5. The design provisions in Section 3.10 of the criteria have been revised as follows:
  - a. ICF flat walls having a nominal concrete thickness greater 10 inches, as referenced in IRC Table R611.3, may be designed in accordance with the applicable provisions of the IBC.
  - b. For wind design under the IBC, the flat ICF wall may be constructed in accordance with the prescriptive provisions in Section 209 of ICC 600, which is referenced in Section 1609 of the IBC. Application of ICC 600 is limited to the provisions found in Exception 1 of Section 1609.1.
  - c. PCA 100, which is referenced in the IRC, has been included as an alternate prescriptive approach to construct ICF walls.
6. If compliance with Section 3.6 of the criteria is sought, then testing will need to be submitted in accordance with the new requirements in Section 4.5.11.5 of the ICC-ES Acceptance Criteria for Foam Plastic Insulation (AC12), dated June 2009.
7. The condition of acceptance for room corner fire tests, referenced in Section 4.3.3 of the criteria, includes reference to IRC Section R302.9.4. Staff would like to point out that the condition of acceptance dealing with the peak rate of heat release, as described in IBC Section 803.1.2.1, is not included in IRC Section R302.9.4. This means that if the testing shows compliance with the peak rate of heat release shown in IBC Section 803.1.2.1, the ICF can be recognized under both the IBC and IRC. Otherwise, the ICF will be limited to use under the IRC.

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](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 reballot 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](mailto: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 3260, or David Pereg, Staff Engineer, at extension 3275. You may also reach us by e-mail at [es@icc-es.org](mailto:es@icc-es.org).

Yours very truly,



Yamil Moya, P.E.  
Staff Engineer

YM/md

Enclosure

cc: Evaluation Committee

# PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR STAY-IN-PLACE, FOAM PLASTIC INSULATING CONCRETE FORM (ICF) SYSTEMS FOR SOLID CONCRETE WALLS

AC353

Proposed February 2010

Previously approved October 2007

## 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 by ICC-ES for purposes of issuing ICC-ES evaluation reports.*

# PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA STAY-IN-PLACE, FOAM PLASTIC INSULATING CONCRETE FORM (ICF) SYSTEMS FOR SOLID CONCRETE WALLS

## 1.0 INTRODUCTION

**1.1 Purpose:** The purpose of this acceptance criteria is to establish requirements for stay-in-place, flat and waffle-grid, solid-wall, foam plastic insulating concrete forms (ICFs) to be recognized in an ICC Evaluation Service, Inc. (ICC-ES), evaluation report under the ~~2009~~ 2006 *International Building Code*<sup>®</sup> (IBC); ~~and the 2009~~ 2006 *International Residential Code*<sup>®</sup> (IRC); ~~the BOCA<sup>®</sup> National Building Code/1999 (BNBC), 1999 Standard Building Code<sup>®</sup> (SBC) and 1997 Uniform Building Code<sup>™</sup> (UBC).~~ The bases of recognition are IBC Section 104.11; ~~and IRC Sections R104.11 and R611; BNBC Section 106.4, SBC Section 103.7 and UBC Section 104.2.8.~~

The reason for the development of this criteria is to provide guidelines for the evaluation of material properties of ICFs for solid walls, and their components, that clarify requirements in the codes.

**1.2 Scope:** This criteria is applicable to flat solid-wall ICFs ~~complying with IRC dimensional specifications~~ (see Section 3.1.1 of this criteria), and sets forth material requirements and design provisions for flat solid-wall ICFs when they are used for construction under the IBC, ~~and IRC, BNBC, SBC and UBC.~~

This criteria is applicable to waffle-grid solid-wall ICFs complying with IRC dimensional specifications (see Section 3.1.2 of this criteria), and sets forth material requirements and prescriptive construction provisions for waffle-grid solid-wall ICFs when they are used for construction under the IRC, ~~SBC and UBC.~~

This criteria is applicable to factory-manufactured forms for jobsite-constructed solid concrete walls, where the ICFs remain in place after concrete placement. The ICFs consist of foam plastic panels that are connected by plastic or steel cross-ties, which are embedded in the foam plastic panels. Interior wall coverings are applied over the interior wall surface of the ICFs at the jobsite by fastening to the flanges of the cross-ties. Exterior wall coverings are applied over the exterior wall surface of the ICFs at the jobsite by fastening to the flanges of the cross-ties, fastening to the concrete, or adhesion to the foam plastic surface.

This criteria is applicable to ICFs that are used to construct reinforced or structural plain concrete, load-bearing and nonload-bearing, above- and below-grade walls, and in construction of plain and reinforced concrete beams, lintels, exterior and interior walls, and foundation and retaining walls.

This criteria is applicable to flat solid-wall concrete walls of combustible (Type V) and noncombustible (Types I, II, III and IV) construction, and to buildings constructed in accordance with the IRC.

### 1.3 Codes and Referenced Standards:

**1.3.1** ~~2009~~ 2006 *International Building Code*<sup>®</sup> (IBC), International Code Council.

**1.3.2** ~~2009~~ 2006 *International Residential Code*<sup>®</sup> (IRC), International Code Council.

**1.3.3** ICC 600-08, Standard for Residential Construction in High Wind Regions, International Code Council.

**1.3.4** PCA 100-07, Prescriptive Design of Exterior Concrete Walls for One- and Two-family dwellings, Portland Cement Association.

**1.3.5** ~~BOCA<sup>®</sup> National Building Code/1999 (BNBC).~~

**1.3.6** ~~1999 Standard Building Code<sup>®</sup> (SBC).~~

**1.3.7** ~~1997 Uniform Building Code<sup>™</sup> (UBC).~~

**1.3.8** ACI 318-08, Building Code Requirements for Structural Concrete, American Concrete Institute.

**1.3.9** ASTM C 578-07, Specification for Rigid Cellular Polystyrene Thermal Insulation, ASTM International.

**1.3.10** ASTM D 635-06, Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position, ASTM International.

**1.3.11** ASTM D 1761-06 88(2000)<sup>e04</sup>, Standard Test Method for Mechanical Fasteners in Wood, ASTM International.

**1.3.12** ASTM D 1929-96(2001)<sup>e01</sup>, Standard Test Method for Determining Ignition Properties of Plastics, ASTM International.

**1.3.13** ASTM E 84-07, Standard Test Methods for Surface Burning Characteristics of Building Materials, ASTM International.

**1.3.14** ASTM E 119-07, Standard Test Methods for Fire Tests of Building Construction and Materials, ASTM International.

**1.3.15** ~~Prescriptive Method for Insulating Concrete Forms in Residential Construction (publication No. EB118), dated May 1998. The document is available from the Portland Cement Association, located at 5420 Old Orchard Road, Skokie, Illinois 60077-1083.~~

**1.3.16** AISI S100-07 /COS/NASPEC, 2004 North American Specification for Design of Cold-formed Steel Structural Members, including 2004 Supplement (NAS-01), American Iron and Steel Institute.

**1.3.17** ~~Specification for Design of Cold formed Steel Structural Members, 1996 edition (1996 AISI), American Iron and Steel Institute.~~

**1.3.18** NFPA 268-07, Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source, National Fire Protection Association (NFPA).

**1.3.19** NFPA 285-06, Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-load Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-scale Multistory Test Apparatus, National Fire Protection Association (NFPA).

**1.3.20** NFPA 286-06, Method of Fire Test for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth, National Fire Protection Association (NFPA).

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**1.3.21** UL 723, Standard for Test for Surface Burning Characteristics of Building Materials, August 29, 2003, Underwriters Laboratories, Inc.

**1.3.22** UBC Standard 26-3, Room Fire Test Standard for Interior of Foam Plastic Systems, 1997 Uniform Building Code™.

**1.4 Definitions:**

**1.4.1 Insulating Concrete Form (ICF):** A concrete forming system, using stay-in-place forms of foam plastic insulation, for constructing cast-in-place, solid concrete walls.

**1.4.2 Flat ICF Wall:** A solid concrete wall of uniform thickness (solid rectangular cross section) produced by an ICF, ~~complying with IRC Figure R611.3.~~

**1.4.3 Waffle-grid ICF Wall:** A solid concrete wall with closely spaced vertical and horizontal concrete members (cores), with a concrete web between the members created by an ICF, complying with IRC Figure R611.3(2)4 and IRC Table R611.32.

**1.4.4 Cross-tie:** Cross-ties are made from plastic or steel, and consist of two flanges and a web that connects the two flanges and, therefore, the two foam plastic panels. The webs have different lengths to provide for different concrete wall thicknesses. The webs may be provided as a separate element that is used to assemble the ICF at the jobsite, by connecting the two foam plastic panels. The flanges may be used as bases of attachment for interior and exterior wall coverings.

**1.4.5 Habitable Space:** As defined in IRC Section R202, a habitable space is a space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces for use under the IRC.

**2.0 BASIC INFORMATION**

**2.1 General:** The following information shall be submitted:

**2.1.1 Product Description:**

**2.1.1.1. ICFs:** Complete descriptive information on the ICFs and the ICF components, including a description of the manufacturing processes and specifications of the ICF, with fully dimensioned drawings with tolerances.

**2.1.1.2. Cross-ties:** Complete descriptive information on the cross-tie assembly, including descriptive information concerning cross-tie accessories and components. Description of the manufacturing processes and specifications of the cross-tie assembly, components and accessories, with fully dimensioned drawings with tolerances. For steel cross-ties, steel specifications shall including material properties, minimum uncoated steel thickness, tensile properties and protective coatings.

**2.1.2 Installation Instructions:** Installation instructions and detail drawings, including limitations. As a minimum, the installation instructions need to address the preparation, assembly and installation of the ICFs (including cross-ties); rebar specifications and placement; concrete specifications and placement; and interior and exterior finish specifications and method of application.

**2.1.3 Packaging and Identification:**

**2.1.3.1. ICFs:** A description of the method of packaging and field identification of the ICFs. Labels on the containers or packages of the ICFs shall include the report holder's name and address, evaluation report number (ESR-XXXX), product name and production location identification, the product serial number and/or date code for traceability and the name of the inspection agency. When the ICFs are recognized for use in noncombustible construction, labels shall also include the information noted in Section 3.8.10 of this criteria.

**2.1.3.2. Cross-ties:** If the cross-tie webs are packaged separately from the ICF, a description is needed of the method of packaging and field identification. Labels shall include the ICF report holder's name and address, evaluation report number (ESR-XXXX), ICF product name and ICF production location identification, and the serial number and/or date code for traceability.

**2.2 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.

**2.3 Test Reports:** Reports of tests required under Section 3.0 of this criteria shall comply with AC85 and also include a description of the ICFs, including dimensioned drawings of the tested products and sufficient information to verify compliance of the tested products with the product specifications in the manufacturer's quality control documentation.

**2.4 Product Sampling:** Sampling of the ICFs for qualifying tests conducted under this criteria shall comply with Section 3.1 of AC85.

**3.0 TEST AND PERFORMANCE REQUIREMENTS**

**3.1 Dimensions:**

**3.1.1 Flat Wall ICFs:** When flat wall ICFs are used to construct buildings in accordance with the prescriptive provisions of the IRC, flat wall ICFs shall comply with IRC Table R611.3 and Figure R611.3(1). ~~When flat wall ICFs are used to construct buildings that are designed and constructed in accordance with the IBC, the ICFs shall comply with IRC Table R611.3 and Figure R611.3(1), except that the concrete thickness of the ICF may be greater than the 10-inch nominal thickness referenced in IRC Table R611.3. For recognition under the SBC, the ICFs shall also comply with SBC Figure 1916.3 and shall provide for a minimum concrete core thickness of 4 inches (102 mm).~~

**3.1.2 Waffle-grid ICFs:** Waffle-grid ICFs shall comply with IRC Figure R611.3(2)4. ~~The minimum core dimensions of the waffle-grid ICFs shall comply with IRC Table R611.34-2.~~

**3.2 Foam Plastic:**

**3.2.1 General:** If the foam plastic includes recycled or recovered materials, the production foam plastic, with the worst-case formulation of virgin content and recycled or recovered content, shall meet the requirements of this criteria. See Sections 3.4.3 and 3.4.4 of the ICC-ES Acceptance Criteria for Foam Plastic Insulation (AC12).

**3.2.2 ASTM C 578 Classification:** The foam plastic used to produce the ICFs shall comply with ASTM C 578

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and Section 4.5.15 of the ~~ICC-ES Acceptance Criteria for Foam Plastic Insulation (AC12).~~

**3.2.3 Surface Burning Characteristics:** The foam plastic panels of the ICF shall exhibit a flame-spread index of not more than 75 and a smoke-developed index of not more than 450 when tested in accordance with ASTM E 84 or UL 723 in the thickness and density intended for use. If recognition is sought for use in noncombustible construction, the foam plastic panels of the ICF shall exhibit a flame-spread index of not more than 25.

**3.3 Cross-ties:**

**3.3.1 Plastic Cross-ties:** The plastic cross-ties shall be subjected to the tests described in Section 4.1 of this criteria. If the plastic cross-ties include recycled or recovered materials, the production plastic cross-ties, with the worst-case formulation of virgin content and recycled or recovered content, shall meet the same requirements.

**3.3.2 Steel Cross-ties:** The steel used to produce the cross-ties shall be subjected to the tests described in Section 4.2 of this criteria.

**3.4 Thermal Barrier:** Except as noted in Section 3.6 of this criteria, a thermal barrier is required to be installed over the interior face of the ICFs. Under IRC Section R702.3.4, the thermal barrier is required to be installed over the interior face of the ICFs in habitable spaces. The thermal barrier shall be qualified to remain in place for a minimum of 15 minutes when subjected to room corner testing in accordance with UL 1715 or UBC Standard 26-3, complying with AC12, for testing conducted prior to November 1, 2007, or the room corner fire test described in Section 4.3 of this criteria. The purpose of the test includes qualification to ensure that the thermal barrier remains in place for the required 15-minute period, since the thermal barrier is attached to the wall using proprietary methods (i.e., plastic or steel cross-ties). Superimposed axial loads need not be applied to the walls of the test assembly provided the foam plastic is not used structurally.

**3.5 Interior Finish (Optional):** For recognition in the evaluation report of the ICFs to be used as interior finish, the ICFs shall comply with IBC Section 2604.1 or IRC Section R316.5.10, as applicable. The ICF used in testing shall have the minimum nominal core dimension and the maximum density per intended nominal thickness of use for which recognition is sought. The tested ICF wall assembly shall be constructed such that it is representative of the end-use configuration.

**3.6 Attics and Crawl Spaces (Optional):** For recognition in the evaluation report of the ICFs installed exposed in an attic or crawl space without a covering applied to the attic or crawl-space side of the foam plastic, testing shall be conducted in accordance with Section 4.5.11.5 of AC12.

**3.7 Fire-resistance-rated Construction (Optional):** For recognition of use in fire-resistance-rated construction, testing shall be conducted in accordance with ASTM E 119 (~~UBC Standard 7-1 for recognition under the UBC).~~

**3.8 Noncombustible Construction (Optional):**

**3.8.1 General:** ICFs used as exterior walls on noncombustible construction are regulated by IBC Section 2603.5, ~~BNBC Section 2603.6, SBC Section 2603.6, and~~

~~UBC Section 2602.5.2.~~ Recognition of use in Types I, II, III and IV construction (~~IBC and noncombustible construction (BNBC, SBC and UBC)~~) of flat or waffle-grid ICF solid concrete walls covered with exterior insulation and finish system (EIFS) lamina, exterior plaster, cementitious exterior wall coatings (one-coat stucco), or brick veneer may be based on EIFS incorporating steel framing and gypsum coating justified for noncombustible construction, provided the following data are submitted:

**3.8.2 Wall Covering:**

**3.8.2.1 EIFS:** The EIFS shall comply with the ICC-ES Acceptance Criteria for Exterior Insulation and Finish Systems (AC219) or the ICC-ES Acceptance Criteria for EIFS Clad Drainage Wall Assemblies (AC235), and shall be recognized in a current evaluation report for use in noncombustible construction.

**3.8.2.2. Exterior Plaster:** The exterior plaster shall comply with the applicable code.

**3.8.2.3. One-coat Stucco:** The one-coat stucco shall comply with the ICC-ES Acceptance Criteria for Cementitious Exterior Wall Coatings (AC11), and shall be recognized in a current evaluation report for use in noncombustible construction with foam plastic.

**3.8.2.4. Brick Veneer:** The brick veneer shall comply with the applicable code.

**3.8.3** An analysis shall be provided demonstrating that the fuel loading, expressed in Btu/ft<sup>2</sup> (kJ/m<sup>2</sup>), of the foam plastic on the exterior side of the concrete wall is less than, or equal to, the fuel loading of the foam plastic of the assemblies of EIFS with gypsum sheathing and steel framing tested in accordance with NFPA 285, ~~UBC Standard 26-4 or UBC Standard 26-9~~, as justified for noncombustible construction. The fuel loading is calculated using the density [lbs/ft<sup>3</sup> (kg/m<sup>3</sup>)], the thickness [ft (m)] and the potential heat of the foam plastic insulation [Btu/lb (kJ/kg)]. The potential heat of expanded polystyrene (EPS) foam plastic may be assumed to be 18,000 Btu/pound (41 868 kJ/kg). When the foam plastic polymer is the same as that tested, and the thickness and density of the foam plastic used on the exterior side of the concrete wall are exactly the same or less than those tested, no analysis is required.

**3.8.4** An analysis shall be provided by the testing laboratory that conducted the NFPA 285, ~~UBC Standard 26-4 or UBC Standard 26-9~~ test, or by a qualified individual, addressing the differences in construction details between the tested EIFS assembly, consisting of foam plastic adhered to gypsum board that is mechanically fastened to nonload-bearing steel studs, and the solid concrete wall system. The analysis needs to consider that the ICF wall may be a load-bearing wall. Additionally, the analysis needs to comment specifically on whether the condition of acceptance specified in Section 8-1.6 of NFPA 285 or ~~item 5 of UBC Standards 26-4 and 26-9~~ will be maintained. Lastly, the analysis needs to identify product names and detailed specifications of the wall coverings, including covering or coating material (including thickness), mesh, and finish coat material.

**3.8.5** For use of the ICF solid concrete wall system in load-bearing wall assemblies, the NFPA 285, ~~UBC Standard 26-4 or UBC Standard 26-9~~ tests on ICF solid concrete wall systems are not required to be subjected to

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applied loads during the tests where the foam plastic and wall covering are nonstressed elements.

**3.8.6** Ignition tests shall be conducted in accordance with NFPA 268 as required by IBC Section 2603.5.7. If the tested assembly differs from the actual assembly (for example, tests provided by an EIFS manufacturer may incorporate a different density and thickness of foam plastic and different lamina than when application is to concrete walls), an analysis shall be provided demonstrating that the fuel loading, expressed in Btu/ft<sup>2</sup> (kJ/m<sup>2</sup>), of the actual assembly on the exterior side of the concrete wall is less than or equal to the fuel loading of the tested assembly justified for noncombustible construction. The fuel loading for foam plastic insulation is calculated using the density [lbs/ft<sup>3</sup> (kg/m<sup>3</sup>)], the thickness [ft (m)], and the potential heat of the foam plastic insulation [Btu/lb (kJ/kg)]. The potential heat of expanded polystyrene (EPS) foam plastic may be assumed to be 18,000 Btu/pound (41 868 kJ/kg). When the foam plastic polymer and the lamina are the same as those tested, and the thickness and density of the foam plastic used on the exterior side of the concrete wall are exactly the same or less than those tested, no analysis is required.

**3.8.7** Other requirements of IBC Section 2603.5 shall be fulfilled, as applicable.

**3.8.8** An ICC-ES Consent for Transfer and Use of Specific Articles of Data form shall be provided by each applicable EIFS and one-coat stucco report holder and the ICF report holder, acknowledging the use of the EIFS and one-coat stucco lamina over the ICF system.

**3.8.9** Foam plastic on the interior side of exterior walls shall be discontinuous at floor lines. Details of typical floor-to-wall intersections shall be provided, for inclusion in the evaluation report, showing that the intersections are constructed to prevent the passage of flame, smoke and hot gases from one floor to another.

**3.8.10** The ICFs shall be labeled on both sides with the evaluation report number, so that, at a minimum, a label is visible every 160 square feet (14.72 m<sup>2</sup>). Alternatively, the ICFs may be labeled with the information required by IBC Section 2603.5.6.

**3.9 Sound Transmission (Optional):** For recognition of sound transmission properties, testing shall be conducted in accordance with IBC Section 1207, IRC Appendix K and Division II of UBC Appendix Chapter 12, as applicable.

**3.10 Structural Design:** Structural design provisions in the evaluation report shall be consistent with this section (Section 3.10) of the criteria.

**3.10.1 IBC, UBC or BNBC Method:** Solid concrete walls formed by flat ICFs shall be designed and constructed in accordance with IBC, UBC or BNBC Chapters 16 and 19, as applicable. Footings and foundations formed by flat ICFs shall be designed and constructed in accordance with IBC, UBC or BNBC Chapter 18, as applicable.

**3.10.1.1 Alternative IBC Wind UBC Design Method:** Solid concrete walls formed by flat ICFs and waffle-grid ICFs may be designed and constructed in accordance with the provisions of Section 209 of ICC 600, subject to the limitations found in Exception 1 of IBC Section 1609.1.1 and IBC Section 1609.1.1.1. Design and construction under the provisions of ICC 600 are limited to resisting

~~wind forces, that are limited to a maximum of two stories plus a basement, and a maximum unsupported wall span of 10 feet (3048 mm), may be designed in accordance with Publication No. EB118 (dated May 1998), subject to all applicability limits in Section 1.3 and Table 1.1 of that document.~~

**3.10.2 IRC or SBC Method:** Solid concrete walls formed by ICFs complying with IRC Table R611.3 and Figure R611.3(1) Section 3-1.4 (flat) or IRC Table R611.3 and Figure R611.3(2) Section 3-1.2 (waffle-grid) of this criteria may be designed and constructed in accordance with the prescriptive provisions of IRC Sections R404.1.2 4 and R611, or SBC Sections 1804.6.2 and 1916, as applicable.

**3.10.2.1 Alternative IRC Method:** When the flat wall ICFs are used to construct buildings under the IRC that do not conform to the applicability limits of IRC Sections R404.1.2 4.4 and R611.2, construction shall be in accordance with the prescriptive provisions of PCA 100 or a structural analysis and design of the concrete shall be in accordance with ACI 318-085 and IBC Chapters 16, 18, and 19. Use of the empirical design approach specified in the code shall be permitted for the design of solid concrete walls formed by the flat wall ICFs.

**3.10.3 Alternative SBC Method:** When the flat wall ICFs are used to construct buildings under the SBC that do not conform to the applicability limits of SBC Sections 1916.2 and 1804.6.2.1, the structural analysis and design of the concrete shall be in accordance with ACI 318-95 and SBC Chapter 19. Use of the empirical design approach specified in the code shall be permitted for the design of solid concrete walls formed by the flat wall ICFs.

**3.10.3 Foundation Stem Walls:** Wall systems constructed with the ICFs are permitted to be used as foundation stem walls when supporting wood-framed construction, provided the forms are supported on approved concrete footings complying with the applicable code. Design and installation of flat-wall, foundation stem walls shall be in accordance with IBC Section 1807.1 1805.5, or IRC Section R404.1.2, 4, BNBC Section 1812.0 or SBC Section 1804.6.2, as applicable; design and installation of waffle-grid, foundation stem walls shall be in accordance with IRC Section R404.1.2, 4 or SBC Section 1804.6.2, as applicable. In jurisdictions adopting the UBC, compliance with UBC Table 18-1 C is required.

**3.10.4 Retaining Walls:** Wall systems constructed with the flat-wall ICFs can be recognized for use as retaining walls, provided reinforcement is designed in accordance with accepted engineering principles and Section 3.10.1 of this criteria. When used in below-grade applications, materials used to damp-proof basement walls shall be specified by report applicant, and shall comply with the applicable code or a current evaluation report, and shall be compatible with the foam plastic units. Applicable damp-proofing and waterproofing requirements are in IBC Section 1805.7, or IRC Section R406, UBC Appendix Chapter 18, BNBC Section 1813.0 and SBC Section 1814. Applicable drainage requirements are in IBC Section 1805.7.4, or IRC Section R405.1, UBC Section 1804.7, BNBC Section 1813.5 or SBC Section 1814. No backfill shall be permitted to be applied against the wall until the complete floor system is in place, unless

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the wall is designed as a freestanding wall that does not rely on the floor system for structural support.

**4.0 TEST METHODS**

**4.1 Qualification Testing of Plastic Cross-ties:**

**4.1.1 Self-ignition Temperature:**

**4.1.1.1. Procedure:** The material used to produce the plastic cross-ties shall be tested in accordance with ASTM D1929.

**4.1.1.2. Condition of Acceptance:** The self-ignition temperature shall be a minimum of 650F (343C).

**4.1.2 Rate of Burn:**

**4.1.2.1. Procedure:** The material used to produce the plastic cross-ties shall be tested in accordance with ASTM D635.

**4.1.2.2. Condition of Acceptance:** When tested in the thickness intended for end use, the plastic shall have either a CC1 or CC2 classification, as defined in IBC Section 2606.4.

**4.1.3 Fastener Strength:**

**4.1.3.1. General:** *The test specimens shall consist of the cross-tie inserted in the foam plastic panel of the ICF in a manner representative of the end-use configuration. The forms shall either be filled with concrete or the cross-tie shall be positioned in the test equipment so the flange and web are secured in a manner representative of the end-use configuration to reflect the load path of transferring fastener loads to the concrete wall.*

**4.1.3.2. Lateral Load Strength:**

**4.1.3.2.1. Procedure:** The fastener shall be inserted into the cross-tie flange in a manner representative of the end-use configuration. Lateral load strength testing shall be performed in accordance with ASTM D 1761 procedures on a minimum of ten specimens. The ultimate load and 75 percent of the proportional limit load shall be determined for each test specimen.

**4.1.3.2.2. Analysis:** The allowable lateral strength of the connection shall not exceed 75 percent of the average proportional limit load, or the average ultimate load divided by a factor of 3.2, whichever is lower. The factor of 3.2 assumes a maximum coefficient of variation (COV) of 15 percent. Where the COV is greater than 15 percent, the allowable load shall be computed using the following equation:

$$F_{all} = F \left( \frac{1 - 2COV}{2.24} \right)$$

where:

- $F_{all}$  = Allowable load, pounds (N).
- $COV$  =  $s/F$  = Coefficient of variation in a test series.
- $s$  = Standard deviation in a test series.
- $F$  = Average ultimate load in test series, pounds (N).

**4.1.3.3. Withdrawal Load Strength:**

**4.1.3.3.1. Procedure:** The fastener shall be inserted into the cross-tie flange in a manner representative of the end-use configuration. Withdrawal strength testing shall be performed in accordance with ASTM D 1761 procedures on a minimum of ten specimens. The ultimate load shall be determined for each test specimen.

**4.1.3.3.2. Analysis:** The allowable withdrawal strength of the connection shall be determined based on the average ultimate load divided by a safety factor of 5.

**4.2 Qualification Testing of Steel Cross Ties:**

**4.2.1 Fastener Strength:**

**4.2.1.1. General:** The test specimens shall consist of the cross-tie inserted in the foam plastic panel of the ICF in a manner representative of the end-use configuration. The forms shall either be filled with concrete or the cross-tie shall be positioned in the test equipment so the flange and web are secured in a manner representative of the end-use configuration to reflect the load path of transferring fastener loads to the concrete wall.

**4.2.1.2. Lateral Load Strength:**

**4.2.1.2.1. Procedure:** The fastener shall be inserted into the cross-tie flange in a manner representative of the end-use configuration. Lateral load strength testing shall be performed in accordance with ASTM D 1761 procedures on a minimum of ten specimens.

**4.2.1.2.2. Analysis:** The allowable lateral strength of the connection shall be determined in accordance with Chapter F of ~~S100-07 NAS-01 (IBC)~~ or Chapter F of the 1996 AISI (BNBC, SBC, UBC).

**4.2.1.3. Withdrawal Load Strength:**

**4.2.1.3.1. Procedure:** The fastener shall be inserted into the cross-tie flange in a manner representative of the end-use configuration. Withdrawal strength testing shall be performed in accordance with ASTM D 1761 procedures on a minimum of ten specimens. The ultimate load shall be determined for each test specimen.

**4.2.1.3.2. Analysis:** The allowable withdrawal strength of the connection shall be determined in accordance with Chapter F of ~~S100-07 NAS-01 (IBC)~~ or Chapter F of the 1996 AISI (BNBC, SBC, UBC).

**4.3 Room Corner Fire Test:**

**4.3.1 General:** Testing under this section (Section 4.3) is required for ICFs that complete room corner fire testing on or after November 1, 2007.

**4.3.2 Procedure:** A room corner fire test shall be conducted in accordance with NFPA 286. The ICF used in testing shall have the minimum nominal core dimension and the maximum density per intended nominal thickness of use for which recognition is sought. The tested ICF wall assembly shall be constructed such that it is representative of the end-use configuration, and the thermal barrier to be tested shall be fastened to the flanges of the cross-ties in a manner representative of end-use.

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**4.3.3 Conditions of Acceptance:** Conditions of acceptance shall comply with IBC Section 803.1.2.1 or IRC Section R302.9.4, as applicable. 2-4. The tested thermal barrier shall remain in place for a minimum of 15 minutes.

**5.0 QUALITY CONTROL**

**5.1** The products 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. The quality control program shall verify continued ICF (foam plastic panel and cross-ties) compliance with this criteria.

**5.2** Quality documentation complying with the ICC-ES Acceptance Criteria for Quality Documentation (AC10) shall be submitted.

**5.3 Special Inspection:** Special inspection shall be required as follows:

**5.3.1 IBC:** Special inspection is required as noted in IBC Section 1704 for placement of reinforcing steel and concrete, and for concrete cylinder testing.

Special inspection in accordance with IBC Sections 1704.1 and 1704.142 are required when the EIFS wall covering system is applied. Duties of the special inspector include verifying field preparation of materials, expiration dates, installation of components, curing of components, and installation of joints and sealants.

**5.3.2 IRC:** For walls constructed in accordance with the prescriptive provisions of the IRC or PCA 100, as described in Sections 3.10.2 and 3.10.2.1, respectively, Section 3.10.3 of this criteria, special inspection is not required. For flat walls designed in accordance with the IBC as described in Section 3.10.2.1 4 of this criteria or designed in accordance with the IBC, as permitted by IRC Sections R104.11 and R301.1.2, special inspection in accordance with Section 5.3.1 of this criteria shall be required.

**5.3.3 UBC:** Special inspection is required as noted in UBC Section 1701 for placement of reinforcing steel and concrete, and for concrete cylinder testing. When approved by the code official, special inspection may be waived when all of the following conditions are met:

1. Walls are a maximum of 8 feet (2.4 m) high, and are limited to use in single story construction of Group R, Division 3, or Group U, Division 1, Occupancies.

2. Maximum height of a concrete deposit is 48 inches (1219 mm). Succeeding deposits must be placed in accordance with UBC Section 1905.10.5.

3. Installation is by installers approved by the evaluation report holder.

4. Half the allowable stresses or loads permitted by the UBC are used for the design of the walls.

5. Installation instructions indicate methods used to verify proper placement of concrete.

**5.3.4 BNBC:** Special inspection is required as noted in BNBC Section 1705.0, and is to include, but not be limited to: concrete, reinforcing steel and formwork materials, installation of reinforcing steel, formwork installation, bracing, and concreting operations.

~~**5.3.5 SBC:** Special inspection is required as noted in SBC Section 1707.1, and is to include, but not be limited to: concrete, reinforcing steel and formwork materials, installation of reinforcing steel, formwork installation, bracing, and concreting operations.~~

**6.0 EVALUATION REPORT RECOGNITION**

**6.1** The evaluation report shall include the following information:

**6.1.1** A description of the ICFs, including dimensioned drawings of the ICFs.

**6.1.2** If data addressing use in noncombustible construction is provided in accordance with Section 3.8 of this criteria, the ICFs shall include the additional labeling described in Section 3.8.10 of this criteria.

**6.1.3** Allowable loads for fasteners installed in cross-tie flanges.

**6.1.4** Structural design provisions shall be as described in Section 3.10 of this criteria.

**6.1.5** Special inspection provisions shall be as described in Section 5.3 of this criteria.

**6.1.6** Identification of each ICF manufacturing facility, including facility name and location.

**6.1.7** Statements that when required by the code official, calculations showing compliance with the general design requirements of Chapters 16, 18 and 19 of the IBC, BNBC, SBC or UBC, as applicable, shall be submitted to the code official for approval, except that calculations are not required when the building design is based on Section 3.10.2 or 3-10-3 constructed in accordance with the prescriptive provisions of the IRC or PCA 100, as described in Sections 3.10.2 or 3.10.2.1, respectively, of this criteria, or when foundation design is based on IRC Section R404 or SBC Section 1804.6.2. The calculations and details shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

**6.1.8** Statements requiring that the ICFs be separated from the interior of the building (habitable spaces under the IRC) with an approved 15-minute thermal barrier, such as 1/2-inch-thick (12.7 mm) gypsum wallboard complying with the applicable code and installed in accordance with Section (X.X) of this report. If the evaluation report includes the recognition noted in Section 3.6 of this criteria, the evaluation report shall include the following limitations:

- a. Entry to the attic or crawl space is only to service utilities, and no heat-producing appliances are permitted.
- b. There are no interconnected attic or basement areas.
- c. Air in the attic or crawl space is not circulated to other parts of the building.
- d. The foam plastic insulation is limited to maximum thickness and density (and, for EPS, the bead type) tested.
- e. Attic and under-floor ventilation are provided in accordance with the applicable code.

**6.2** The evaluation report shall include the following statements:

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**6.2.1** For flat-wall ICFs: The flat-wall ICFs shall be limited to buildings of combustible construction [~~Type V (IBC and UBC), Type 5 (BNBC) and Type VI (SBC),~~ and buildings under the IRC], as applicable. This statement is needed, unless data is provided in accordance with Section 3.8 of this criteria.

**6.2.2** For waffle-grid ICFs: The waffle-grid ICFs shall be limited to buildings of combustible construction [~~Type V (UBC) and Type VI (SBC),~~ and buildings under the IRC].

**6.2.3** The ICFs must be covered on the exterior with an approved wall covering in accordance with the applicable code or a current evaluation report.

**6.2.4** Concrete quality, mixing and placement must comply with IBC Section 1905, ~~or~~ IRC Section R611.5 ~~6-4,~~ ~~UBC Section 1905, SBC Section 1916.6.1,~~ or ACI 318-95 Chapter 5 (under the BNBC), as applicable.

**6.2.5** In jurisdictions that have adopted the IBC, or IRC ~~or SBC,~~ where the probability of termite infestation is

defined as “very heavy” by the code official, the foam plastic must be installed in accordance with IBC Section 2603.8, ~~or~~ IRC Section R318.4 ~~20.5 or SBC Sections 1916.7.5 and 2603.3,~~ as applicable. Areas of very heavy termite infestation must be determined in accordance with IBC Figure 2603.8, ~~or~~ IRC Figure R301.2(6) ~~or SBC Figure 2304.1.4,~~ as applicable.

**6.2.6** When required by the code official, calculations and details showing compliance with the provisions found in IRC Sections R404.1.2.3.6 and R611.5.3 shall be submitted to the code official for approval. The calculations and details, establishing that the ICFs provide sufficient strength to contain concrete during placement and that the cross-ties are capable of resisting the forces created by fluid pressure of fresh concrete, shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed. ■