



## ACCEPTANCE CRITERIA FOR REFLECTIVE FOIL INSULATION

### AC02

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### 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.

This acceptance criteria has been issued to provide all interested parties with guidelines for demonstrating compliance with performance features of the applicable code(s) referenced in the acceptance criteria. The criteria was developed and adopted following public hearings conducted by the ICC-ES Evaluation Committee, and is effective on the date shown above. All reports issued or reissued on or after the effective date must comply with this criteria, while reports issued prior to this date may be in compliance with this criteria or with the previous edition. If the criteria is an updated version from the previous edition, a solid vertical line (|) in the margin within the criteria indicates a technical change, addition, or deletion from the previous edition. A deletion indicator (→) is provided in the margin where a paragraph has been deleted if the deletion involved a technical change. This criteria may be further revised as the need dictates.

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 set forth in this document, and otherwise demonstrate compliance with the performance features of the codes. Notwithstanding that a product, material, or type or method of construction meets the requirements of the criteria set forth in this document, or that it can be demonstrated that valid alternate criteria are equivalent to the criteria in this document and otherwise demonstrate compliance with the performance features 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 if 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.

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## 1.0 INTRODUCTION

**1.1 Purpose:** The purpose of this acceptance criteria is to establish requirements for reflective foil insulation to be recognized in an ICC Evaluation Service, Inc. (ICC-ES), evaluation report under the 2006 *International Building Code*® (IBC), the 2006 *International Mechanical Code*® (IMC), the 2006 *International Residential Code*® (IRC), the BOCA® *National Building Code/1999* (BNBC), the 1999 *Standard Building Code*® (SBC) and the 1997 *Uniform Building Code*™ (UBC). The bases of recognition include IBC Sections 104.11 and 719, IMC Sections 105.2, 602.2.1 and 604, IRC Sections R104.11 and R316, BNBC Sections 106.4 and 723, SBC Sections 103.7 and 107.8 and Appendix E, and UBC Sections 104.2.8 and 707.

The reason for development of this criteria is to provide guidelines for evaluating *R*-values for reflective foil insulations, since the IBC, IMC and IRC do not contain requirements for these products.

**1.2 Scope:** This acceptance criteria is intended to establish *R*-values for single- and multiple-layer reflective foil insulations and reflective bubble insulation, installed in general thermal envelope applications or on air ducts. This criteria does not cover sheet radiant barriers, which are addressed in ICC-ES EG220.

### 1.3 Codes and Referenced Standards:

**1.3.1** 2006 *International Building Code*® (IBC), International Code Council.

**1.3.2** 2006 *International Mechanical Code*® (IMC), International Code Council.

**1.3.3** 2006 *International Residential Code*® (IRC), International Code Council.

**1.3.4** BOCA® *National Building Code/1999* (BNBC).

**1.3.5** 1999 *Standard Building Code*® (SBC).

**1.3.6** 1997 *Uniform Building Code*™ (UBC).

**1.3.7** ASTM C 168-00, Standard Terminology Relating to Thermal Insulating Materials, ASTM International.

**1.3.8** ASTM C 236-89, Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box, ASTM International.

**1.3.9** ASTM C 335-03a, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation, ASTM International.

**1.3.10** ASTM C 411-97, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation, ASTM International.

**1.3.11** ASTM C 518-98, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus, ASTM International.

**1.3.12** ASTM C 976-90, Standard Test Method for Thermal Performance of Building Assemblies by Means of a Calibrated Hot Box, ASTM International.

**1.3.13** ASTM C 1224-01, Standard Specification for Reflective Insulation for Building Applications, ASTM International.

**1.3.14** ASTM C 1363-97, Standard Test Method for the Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus, ASTM International.

**1.3.15** ASTM C 1371-98, Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emitters, ASTM International.

**1.3.16** ASTM E 84-04, Standard Test Method for Surface Burning Characteristics of Building Materials, ASTM International.

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

**1.3.18** ASTM E 408-71, Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques, ASTM International.

**1.3.19** ASTM E 970-00, Standard Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source, ASTM International.

**1.4 Definitions:** For definitions of terms not covered herein, see ASTM C 168.

**1.4.1 Reflective Bubble Insulation:** Reflective bubble insulation, aka bubble packs, are one or more layers of polyethylene incorporating premanufactured bubbles, laminated between two layers of foil or polyethylene and foil.

**1.4.2 Core Materials:** Core materials are materials laminated to or between one or more layers of foil to produce a finished product. Core materials include polymer bubblepack; polymer foams; fibrous materials like fiberglass, cellulose, and cotton; and single-sheet materials.

**1.4.3 Laminates:** Laminates are products resulting from the bonding of one or both sides of a core material to a layer (or layers) of foil.

## 2.0 BASIC INFORMATION

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

**2.1.1 Product Description:** Complete information concerning material specifications, thickness, size and the manufacturing process.

**2.1.2 Installation Instructions:** Installation details and limitations, field cutting, fastening methods, joint treatments, and face treatments.

**2.1.3 Packaging and Identification:** A description of the method of packaging and field identification of the panel. Identification provisions shall include the evaluation report number.

**2.1.4 Field Preparation:** A description of the methods of field-cutting and application.

**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:** Test reports shall comply with AC85.

**2.4 Product Sampling:** Sampling of products for testing must be in accordance with Section 3.2 of AC85. Upon submission of qualifying test data to ICC-ES, the applicant shall submit an affidavit certifying that the product tested is

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representative of the standard manufactured product to be covered in the evaluation report. As an alternative, the testing laboratory may independently draw samples from the manufacturing site.

### 3.0 TEST METHODS AND PERFORMANCE REQUIREMENTS

**3.1 General:** Insulations addressed by this criteria which are intended for general thermal envelope applications shall conform with Sections 3.2 through 3.5. Insulations for use on air ducts shall conform with Section 3.6.

#### 3.2 Aluminum Foil:

**3.2.1** Foil shall be no less than 99 percent pure aluminum with an emittance, after lamination, no greater than 0.10 when measured in accordance with ASTM E 408 or ASTM C 1371.

**3.2.2** Exposed, unsupported foil shall have a minimum thickness of 0.0004 inch (0.0102 mm). Unsupported foil that is sandwiched in a multilayer sheet shall have a minimum thickness of 0.00035 inch (0.0089 mm). Foil bonded to polyethylene, mylar or other plastic films shall have a minimum thickness of 0.00025 inch (0.0064 mm).

**3.3 ASTM C 1224 Testing:** Reports of tests shall be submitted showing conformance of the material to ASTM C 1224, except as noted in Sections 3.2, 3.3.1, 3.3.2 and 3.4.

#### 3.3.1 Thermal Performance:

**3.3.1.1 General:** Thermal performance shall be determined in accordance with Section 9.7 of ASTM C 1224. Products may be tested in accordance with ASTM C 236, ASTM C 976 or ASTM C 1363, with the insulation installed in a manner representative of end use.

#### 3.3.1.2 Test Assemblies:

**3.3.1.2.1 Horizontal Assemblies:** Test assemblies shall be framed with nominal 2-by-4-inch or 2-by-6-inch framing members spaced 16 or 24 inches (406 or 610 mm) on center. Larger, or smaller, framing members may be used, depending on end-use conditions. Minimum  $\frac{1}{2}$ -inch (12.7 mm) gypsum wallboard or  $\frac{1}{2}$ -inch (12.7 mm) plywood shall be installed on both sides of the test assembly.

**3.3.1.2.2 Wall Assemblies:** Test assemblies shall be framed with nominal 2-by-4-inch or 2-by-6-inch framing members spaced 16 or 24 inches (406 or 610 mm) on center. Larger or smaller framing members may be used, depending on end-use conditions. Minimum  $\frac{1}{2}$ -inch (12.7 mm) gypsum wallboard or minimum  $\frac{1}{2}$ -inch (12.7 mm) plywood shall be installed on the faces of the test assembly.

#### 3.3.1.3 Test Method:

**3.3.1.3.1** Testing and reporting shall be in accordance with ASTM C 1224.

**3.3.1.3.2** Where the actual stud cavity depth is  $5\frac{1}{2}$  inches (139.7 mm) or greater, the test frame shall be a minimum of 8 feet by 8 feet (2438 mm by 2438 mm). Where the actual stud cavity depth is less than  $5\frac{1}{2}$  inches (139.7 mm), the test frame shall be a minimum of 64 inches by 64 inches (1625 mm by 1625 mm).

**3.3.1.3.3** Where the stud spacing is greater than 16 inches on center, the metering box area shall be a minimum of 4 feet by 4 feet (1219 mm by 1219 mm). Where the stud

spacing is a maximum of 16 inches on center, the metering box area shall be a minimum of 32 inches by 32 inches (812.8 mm by 812.8 mm).

**3.3.1.3.4** The assembly shall be tested with heat flow in the direction of intended use.

**3.3.1.3.5** Insulation *R*-value obtained in accordance with ASTM C 1224 shall be reported for heat flow directions of intended applications.

#### 3.3.1.3.6 Miscellaneous Requirements:

a. Insulation installation and completed assembly shall be representative of typical assemblies in the field.

b. Dimensional cross-sectional drawings and photographic records shall be made of each assembly tested.

c. Representative samples of tested product shall be retained by the testing laboratory for a period of one year from the date of test.

### 3.3.2 Surface-burning Characteristics:

**3.3.2.1 Flame-spread Testing:** Surface-burning characteristics shall be determined in accordance with UBC Standard 8-1 or ASTM E 84, and shall not exceed a flame-spread index of 25 and a smoke-developed index of 450.

#### EXCEPTIONS:

1. For reflective bubble insulation products, a flame-spread index of up to 200 and a smoke-developed index up to 450 is accepted for the plastic core, provided a thermal barrier complying with IBC Section 2603.4, BNBC Section 2603.4, IRC Section R318.1.2 or UBC Section 2602.4 is provided.

2. For reflective foil insulation:

a. In buildings of Type I and II construction: insulations placed between two layers of noncombustible materials without an intervening airspace shall be allowed to have a flame-spread index of 100.

b. In buildings of Type I and II construction: insulation installed between a finished floor and solid decking without intervening airspace shall be allowed to have a flame-spread index of not more than 200.

c. In buildings of Type III, IV or V construction: flame-spread and smoke-developed limitations do not apply to facings, coverings, and layers of reflective foil that are installed behind and in substantial contact with the unexposed surface of the ceiling, wall or floor finish.

#### 3.3.2.2 Test Procedure:

**3.3.2.2.1** Multilayer foil insulations, composed of two or more layers separated by an air space, shall be tested at least twice and an average taken (within the same flame-spread classification) of the results, to indicate the flame spread. Material may be in either 8-foot (2438 mm) sections or continuous lengths.

**3.3.2.2.2** Reflective bubble insulation shall be tested at least once in continuous length, at least once with a geometrically centered longitudinal joint sealed in accordance with manufacturer's instructions, and at least once with the plastic core exposed to the tunnel flame. This will require a minimum  $\frac{1}{8}$ -inch-wide (3.2 mm) slit in the facing material to a depth necessary to expose the core

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material to the tunnel flame. The slit shall be geometrically centered between the tunnel sides and shall extend the full length of the test specimen. The results of each of these tests shall satisfy the maximum limits of Section 3.3.2.1 of this criteria.

**3.3.2.2.3** When insulation contains foam plastic the installation shall comply with IBC Section 2603, IRC Section R314, BNBC Section 2603.0, SBC Section 2603 and UBC Section 2602.

### 3.4 Water Vapor Transmission:

**3.4.1** Reflective insulations intended to provide resistance to water vapor transport shall have a water vapor permeance of 1.0 perm (grains/ft<sup>2</sup>·h·inch Hg) or less when tested in accordance with ASTM E 96.

**3.4.2** Reflective insulations intended to allow passage of water vapor shall have a water vapor permeance of at least 5 perms (grains/ft<sup>2</sup>·h·inch Hg) when measured in accordance with ASTM E 96.

**3.5 Installation on Attic Floors:** If the product is to be installed exposed on an attic floor, results of tests in accordance with ASTM E 970 shall be submitted showing a critical radiant flux of not less than 0.12 watt per square centimeter.

### 3.6 Reflective Bubble Insulation for Use as Air Duct Insulation:

**3.6.1** Surface-burning characteristics shall be determined in accordance with ASTM E 84 or UBC Standard 8-1, and shall not exceed a flame-spread index of 25 and a smoke-developed index of 50 when tested both with and without a tape seam along the long axis of the assembly.

**3.6.2** When tested in accordance with ASTM C 411 at the higher of the exposed temperature or 250°F (121°C), the insulation shall not flame, glow, smolder or smoke. The report shall state the temperature indicated by testing as the maximum the insulation shall be exposed to in the field.

**3.6.3** *R*-values shall be determined using ASTM C 518 on flat sections at a mean temperature of 75°F (23.9°C). The report shall specify the insulation *R*-value without air film resistance.

**Exception:** In the case of reflective insulation systems which include enclosed air spaces, testing at a mean temperature of 75°F (23.9°C) in accordance with ASTM C 335 is permitted in lieu of the ASTM C 518 testing required by Section 3.6.3.

**3.6.4** When recognition is sought for use on cooling ducts without an additional vapor retarder, the permeance shall be 0.05 or less when testing is in accordance with Section 3.4 above.

## 4.0 QUALITY CONTROL

**4.1** A quality control manual complying with the ICC-ES Acceptance Criteria for Quality Control Manuals (AC10) shall be submitted.

**4.2** Third-party follow-up inspections are not required under this acceptance criteria.

**Exception to Section 4.0:** Reflective foil insulations containing foam plastic shall also satisfy AC12. ■