



## ACCEPTANCE CRITERIA FOR FIBER-REINFORCED MAGNESIUM-OXIDE-BASED SHEETS

AC386

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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*<sup>®</sup> 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 fiber-reinforced magnesium-oxide-based interior substrate sheets to be recognized in an ICC Evaluation Service, Inc. (ICC-ES), evaluation report under the 2006 *International Building Code*<sup>®</sup> (IBC), the 2006 *International Residential Code*<sup>®</sup> (IRC), and the 1997 *Uniform Building Code*<sup>™</sup> (UBC). Bases of recognition are IBC Section 104.11, IRC Section R104.11, and UBC Section 104.2.8.

The reason for the development of this criteria is that the code does not provide guidance for qualifying fiber-reinforced magnesium-oxide-based materials that are used as sheathing, as flooring or as backer boards for adhered veneers.

**1.2 Scope:** This criteria is applicable to mechanically attached, fiber-reinforced, magnesium-oxide-based substrate sheets complying with the physical property requirements described in Section 3.1 of this criteria. End use of the substrate sheets is determined by testing under other acceptance criteria: the substrate sheets may be used as wall sheathing and floor underlayment when qualified in accordance with the applicable sections of the Acceptance Criteria for Reinforced Cementitious Sheets Used as Wall Sheathing and Floor Underlayment (AC376); as interior substrates, when qualified in accordance with the applicable sections of the Acceptance Criteria for Fiber-cement Interior Substrate Sheets Used in Wet and Dry Areas (AC378); and as structural floor sheathing when qualified in accordance with the applicable sections of the Acceptance Criteria for Acceptance Criteria for Fiber-cement Sheet Structural Floor Sheathing (AC367). The substrate sheets are suitable for decoration with paint, wallpaper, resilient flooring, ceramic tile, natural stone or dimensional stone veneers on floors and walls in interior dry areas. The substrate sheets are limited to use on interior surfaces as defined in IBC Section 2502 and UBC Section 2501, and may not be used in wet areas as defined in IBC Section 2509. Under the IRC, the substrate sheets may not be used in showers.

Recognition is limited to Type V construction unless the substrate sheets comply with Section 3.6 of this criteria.

### 1.3 Codes and Referenced Standards:

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

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

**1.3.3** 1997 *Uniform Building Code*<sup>™</sup> (UBC).

**1.3.4** ASTM C 666-97, Test Method for Resistance of Concrete to Rapid Freezing and Thawing, ASTM International.

**1.3.5** ASTM C 1185-99, Test Methods for Sampling and Testing Non-asbestos Fiber-cement Flat Sheet, Roofing and Siding Shingles, and Clapboards, ASTM International.

**1.3.6** ASTM E 119-00, Test Methods for Fire Tests of Building Construction and Materials, ASTM International.

**1.3.7** ASTM E 136-99<sup>01</sup>, Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C, ASTM International.

**1.3.8** ASTM D 1037-99, Test Methods for Evaluating Properties of Wood-base Fiber and Particle Panel Materials, ASTM International.

**1.3.9** ASTM D 2394-83 (1999), Methods for Simulated Service Testing of Wood and Wood-base Finish Flooring, ASTM International.

**1.3.10** ANSI A 118.1-99, Standard Specifications for Dry-set Portland Cement Mortar, American National Standards Institute.

**1.3.11** ANSI A 118.4-99, Standard Specifications for Latex-Portland Cement Mortar, American National Standards Institute.

**1.3.12** ICC-ES Acceptance Criteria for Reinforced Cementitious Sheets Used as Wall Sheathing and Floor Underlayment (AC376).

**1.3.13** ICC-ES Acceptance Criteria for Reinforced Cementitious Interior Substrate Sheets Used in Wet and Dry Areas (AC378).

**1.3.14** ICC-ES Acceptance Criteria for Fiber-reinforced Cement Sheet Structural Floor Sheathing (AC367).

**1.3.15** ASTM C 1325-04, Standard Specification for Non-asbestos Fiber-mat Reinforced Cement Substrate Sheets, ASTM International.

**1.3.16** ASTM C 1396-02, Standard Specification for Gypsum Wallboard, ASTM International.

**1.3.17** ASTM E 84-04, Test Methods for Surface Burning Characteristics of Building Materials, ASTM International.

### 1.4 Definitions:

**1.4.1 Fiber-reinforced Magnesium-oxide-based Sheets:** Fiber-reinforced magnesium-oxide-based sheets are sheet products consisting of a proprietary composition of magnesium oxychloride that is reinforced by a fiber mat or fiber scrim made of organic or inorganic fibers. The sheets may contain proprietary additives and have factory-applied coatings. The sheets are manufactured in various lengths and widths, and in thicknesses from 1/4 to 1 inch (6.3 to 25.4 mm).

**1.4.2 Wet Areas:** Shower and public toilet areas, as defined in IBC Section 2509.1.

**1.4.3 Dry Areas:** All areas not included in the definition under Section 1.4.2 of this criteria.

**1.4.4 Fastening System:** A fastening system is defined as a method to mechanically attach the sheathing or single floor grade sheets to framing.

**1.4.5 Span Rating:** The recommended maximum center-to-center spacing in inches (mm) of floor framing used to support the sheets for the specified end use under normal use conditions.

**1.4.6 Single Floor Grade:** Sheets used as a combination subfloor and underlayment installed with edge treatment, blocking or covered with one of the materials described in footnote d of IBC Table 2304.7(3), footnote j of IRC Table R503.2.1.1(1) or footnote 4 of UBC Table 23-II-E-1, as applicable.

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**1.4.7 Sheathing Grade:** Sheets used as sheathing that require a separate underlayment installed on top of the sheets.

### 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, 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 substrate sheets. Identification provisions shall include the evaluation report number and, if applicable, the name or logo of the inspection agency.

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

**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:** Products for testing under this criteria shall be sampled in accordance with Sections 3.1, 3.3 and 3.4 of AC85.

### 3.0 TEST AND PERFORMANCE REQUIREMENTS

Reports of tests shall be submitted in accordance with the following requirements:

#### 3.1 Physical Properties:

**3.1.1 Flexural Strength:** Testing in accordance with ASTM C1185, with conditions of acceptance of 580 psi (4000 kPa) minimum average flexural strength, both wet and dry.

**3.1.2 Freeze/Thaw Cycling:** When tested in accordance with ASTM C 666, Procedure B, the test samples shall show no disintegration following 25 cycles. A minimum of 5 specimens shall be tested.

**3.1.3 Dimensions and Tolerances:** Testing in accordance with ASTM C1185 with conditions of acceptance as noted in Section 7 of ASTM C 1186.

**3.1.4 Moisture Movement:** When tested in accordance with ASTM C 1185, linear variation with change in moisture content shall be stated as the percentage change in length based on a relative humidity change from 30 to 90 percent. Sampling for tests shall be in accordance with Section 4 of ASTM C 1185.

**3.1.5 Water Absorption:** When tested in accordance with ASTM C 1185, the water absorption shall be reported as the percentage increase in weight of dry specimens following submersion for a period of 48 hours. Sampling for tests shall be in accordance with Section 4 of ASTM C 1185.

**3.1.6 Compression Indentation:** When tested in accordance with ASTM D 2394, samples shall show a value greater than 1250 psi (8620 kPa) at less than 0.05 inch (1.3 mm). A minimum of 5 specimens shall be tested.

**3.1.7 Nail-head Pull Through:** The substrate sheets shall have a minimum saturated nail-head pull-through resistance of 125 lbf (560 N) when tested in accordance with ASTM D 1037 utilizing a roofing nail with a 0.375-inch-diameter (10 mm) head and a shank diameter of 0.121 inch (3 mm). A minimum of 5 specimens shall be tested.

**3.1.8 Falling Ball Impact:** When tested in accordance with ASTM D 1037, samples shall show no damage to top or bottom surfaces at a 12-inch (305 mm) drop. A minimum of 5 specimens shall be tested.

#### 3.1.9 Shear Bond Strength:

**3.1.9.1 Dry-set Portland Cement:** The substrate sheets shall be tested in accordance with ANSI A 118.1, using test specimens consisting of the substrate sheet adhered to substrate sheet, and shall demonstrate a minimum shear bond strength at seven-day curing of 50 psi (345 kPa). A minimum of 5 specimens shall be tested.

**3.1.9.2 Latex-Portland Cement Mortar:** The substrate sheets shall be tested in accordance with ANSI A 118.4, using test specimens consisting of the substrate sheet adhered to substrate sheet, and shall demonstrate a minimum shear bond strength at seven-day curing of 50 psi (345 kPa). A minimum of 5 specimens shall be tested.

**3.1.10 Humidified Deflection:** Testing in accordance with ASTM C 1396. Conditions of acceptance are as described in Section 5.1.2 of ASTM C 1396. For use as ceiling boards, the sheathing boards shall have a maximum humidified deflection of  $\frac{5}{16}$  inch (7.9 mm), when used as ceiling finish (textured or painted), or 0.0639 inch (1.62 mm), when used as a base for tile.

**3.1.11 Surface Burning Characteristics:** The substrate sheets shall be tested in accordance with ASTM E 84 and shall have a flame-spread index of 10 or less and a smoke-developed index of 5 or less.

**3.2 Use as Structural Floor Sheathing:** For use as structural floor sheathing, testing and conditions of acceptance in accordance with Sections 3.2 through 3.6 of AC367.

**3.3 Use as Wall Sheathing or Floor Underlayment:** For use as wall sheathing or floor underlayment, testing and conditions of acceptance in accordance with Sections 3.6 and 3.7 of AC376.

**3.4 Use as a Substrate in Interior Areas:** For use as a substrate in interior areas, testing and conditions of acceptance in accordance with Sections 3.2, 3.3, 3.6 and 3.7 of AC378.

**3.5 Fire-resistance-rated Construction:** For use in fire-resistance-rated construction, tests shall be conducted in accordance with ASTM E 119.

**3.6 Noncombustible Construction:** For use in Types I, II, III and IV construction under the IBC and noncombustible construction under the UBC, tests shall be conducted in accordance with ASTM E 136.

### 4.0 QUALITY CONTROL

**4.1** 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.

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

### **5.0 EVALUATION REPORT RECOGNITION**

**5.1** The evaluation report shall include a statement that support framing shall be designed for a maximum allowable assembly deflection of  $L/360$  under seismic or wind loads for exterior or interior walls; or live loads for ceilings supported by floor framing; or live, seismic, or wind loads for ceilings supported by roof framing.

**5.2** When use is as a structural floor sheathing, the evaluation report shall include information required in Section 7.0 of AC367.

**5.3** When use is as a substrate in interior wet and dry areas, the evaluation report shall include information required in Section 6.0 of AC378.

**5.4** The evaluation report shall include a condition of use that the substrate sheets are limited to use on interior surfaces as defined in IBC Section 2502 and must not be used in wet areas as defined in IBC Section 2509; under the IRC, the substrate sheets must not be used in showers. ■