

ACCEPTANCE CRITERIA FOR METAL COMPOSITE MATERIAL (MCM)

AC25

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PREFACE

Evaluation reports issued by ICC Evaluation Service, LLC (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 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.

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1.0 INTRODUCTION

1.1 Purpose: The purpose of this acceptance criteria is to establish the basis by which metal composite material (MCM) can be recognized in an ICC Evaluation Service, LLC (ICC-ES), evaluation report under the 2009 *International Building Code*[®] (2009 IBC) and the 2006 *International Building Code*[®] (2006 IBC). The basis of recognition for MCM panels as exterior wall coverings is IBC Section 1407; and the bases of recognition of MCM panels as an interior wall finish material are IBC Sections 104.11 and 803.

The reason for this criteria is to establish uniform evaluation guidelines for MCM panels and MCM systems used as exterior wall coverings and for MCM panels used as interior wall finish material that are consistent with the intent of IBC Sections 1407 and 803.

1.2 Scope: This criteria covers MCM used as an exterior wall covering and as an interior wall finish. The criteria is intended for two groups of evaluation report applicants: Group 1 would be MCM panel manufacturers who are independent of the MCM system fabricators, and Group 2 would be MCM panel manufacturers who are also the sole MCM system fabricators. Evaluation reports issued under this criteria will identify properties of the MCM panels that are deemed necessary by an MCM system fabricator for the design and installation of an MCM system curtain wall, including the types of panel stiffeners, fasteners, and connectors that may be used with the MCM panels.

MCM panel manufacturers (Group 1 evaluation report applicants) supply panels to MCM system fabricators. The MCM systems are typically delivered to the project (jobsite) having been modified by the MCM system fabricator, who installs both panel stiffeners and connectors in a fabrication plant, and then designs and installs the MCM system framing and attachments as appropriate to a particular project. The scope of this criteria limits field fabrication of MCM panels to cutting the panels to size and attaching mechanical fasteners. Field application of silicone or acrylate adhesives/tapes for the purpose of structurally supporting MCM panels is outside the scope of this criteria. This criteria contains provisions for an MCM fabricator to modify MCM panels by attaching panel stiffeners with silicone or acrylate adhesives/tapes without being required to submit detailed fabrication and quality control procedures for approval or to perform such work with special inspection, provided the use of the adhesive is to only increase panel stiffness.

1.3 Codes and Referenced Standards:

1.3.1 2009 *International Building Code*[®] (2009 IBC), International Code Council.

1.3.2 2006 *International Building Code*[®] (2006 IBC), International Code Council.

1.3.3 ADM 1-05, Aluminum Design Manual: Part 1-A: Aluminum Structures, Allowable Stress Design; Aluminum Association.

1.3.4 AAMA 620-96; Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Aluminum Substrates; American Architectural Manufacturers Association.

1.3.5 AAMA 2605-05; Voluntary Specification, Performance Requirements, and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; American Architectural Manufacturers Association.

1.3.6 AISI S100-2007 [2009 IBC], North American Specification for the Design of Cold-formed Steel Structural Members with Appendix A, American Iron and Steel Institute.

1.3.7 AISI-NAS-01 [2006 IBC], North American Specification for the Design of Cold-formed Steel Structural Members 2001 edition with Appendix A and 2004 Supplement, American Iron and Steel Institute.

1.3.8 AISI (2008) Cold-formed Steel Design Manual, Part VI, Test Standards, American Iron and Steel Institute.

1.3.9 ASTM C 297-04, Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions, ASTM International.

1.3.10 ASTM C 920-05, Standard Specification for Elastomeric Joint Sealants, ASTM International.

1.3.11 ASTM C 990-09, Standard Specification for Joints for Concrete Pipe, Manholes, Precast Box Sections Using Preformed Flexible Joint Sealants, ASTM International.

1.3.12 ASTM C 1087-00, Standard Test Method for Compatibility of Liquid-applied Sealants with Accessories Used in Structural Glazing Systems, ASTM International.

1.3.13 ASTM C 1184-05, Standard Specification for Structural Silicone Sealants, ASTM International.

1.3.14 ASTM D 1781-98(2004), Standard Test Method for Climbing Drum Peel for Adhesives, ASTM International.

1.3.15 ASTM E 72-05, Standard Test Methods of Conducting Strength Tests of Panels for Building Construction, ASTM International.

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

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

1.3.18 ASTM E 330-02, Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference; ASTM International.

1.3.19 NFPA 285-06, Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components, National Fire Protection Association.

1.3.20 UL 263-03, Standard for Fire Test of Building Construction Materials, Underwriters Laboratories Inc.

1.3.21 UL 723-03, Standard for Test of Surface Burning Characteristics of Building Materials—With Revisions through May 2005, Underwriters Laboratories Inc.

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1.3.22 UL 1040-96, Fire Test of Insulated Wall Construction—With Revisions through April 2001, Underwriters Laboratories Inc.

1.3.23 UL 1715-97, Fire Test of Interior Finish Material—With Revisions through October 2002, Underwriters Laboratories Inc.

1.4 Definitions:

1.4.1 MCM: For purposes of this criteria, there are two types of MCM panels:

1.4.1.1 Bonded MCM: A bonded MCM panel conforms to the definition of MCM in 2009 and 2006 IBC Section 1402, and has a plastic core complying with 2009 and 2006 IBC Section 1407.1.1.

1.4.1.2 Injection Molded MCM: An injection molded MCM panel is manufactured by a reaction injection molding process in which the liquid plastic core material, under a minimum pressure of 2,000 psi (13.8 MPa), is injected between two metal skins. An injection molded MCM panel conforms to the definition in 2009 and 2006 IBC Section 1402, and its plastic core complies with 2009 and 2006 IBC Section 1407.1.1.

1.4.2 MCM Connectors: A structural element or a combination of structural elements used to transmit forces between MCM panels and structural members.

1.4.3 MCM Fasteners: A screw, bolt, or rivet (or similar type of fastener that may be proprietary) used to connect to an MCM and transfer forces applied to the panel to MCM connectors or framing members.

1.4.4 MCM Panel Manufacturer: An entity that manufactures the MCM panel as defined in Section 1.4.1 of this criteria, and that has no control over the design and installation of an MCM system, including joints, seams, attachments, substrate, framing and other details as appropriate to a particular project. An MCM system fabricator may also be an MCM panel manufacturer (Group 2 evaluation report applicant described in Section 1.2 of this criteria).

1.4.5 MCM System: An MCM system is defined in 2009 and 2006 IBC Section 1402.

1.4.6 MCM System Fabricator: An entity that designs and installs a complete MCM system, including joints, seams, attachments, substrate, framing and other details as appropriate to a particular project. An MCM system fabricator procures MCM panels and modifies them as appropriate for a particular design.

2.0 BASIC INFORMATION

2.1 General: The following information shall be submitted:

2.1.1 MCM Panel Description: In addition to the information specified in 2009 and 2006 IBC Section 1407.1, the MCM panel description shall include complete information on MCM metal skin material specifications, including tensile and yield strengths, thickness, and finishes (if applicable); and the core material specifications, including material specifications, thickness, and density. The description shall include sectional (moment of inertia, radius of gyration, area, etc.) and material properties of panel stiffeners, and the manufacturer and brand name of the silicone or acrylate

adhesive and/or tapes used to attach stiffeners to MCM panels.

2.1.2 MCM System Description: An evaluation report shall include a complete description of the MCM system, as defined in 2009 and 2006 IBC Section 1402, when the evaluation report includes recognition of any of the following uses:

2.1.2.1 MCM system installed without a water-resistive barrier in accordance with 2009 and 2006 IBC Section 1404.2.

2.1.2.2 MCM system installed on a fire-resistance-rated wall in accordance with 2009 and 2006 IBC Section 1407.8.

2.1.2.3 MCM system installed on an exterior wall of buildings classified as Type I, II, III and IV construction in accordance with 2009 and 2006 IBC Section 1407.10.

2.1.2.4 MCM system installed on an interior wall or partition to meet the requirements of 2009 and 2006 IBC Section 1607.13.

2.1.3 Installation Instructions: Installation instructions shall be submitted, and include details on the method of attaching MCM panels to their connectors, use of structural silicone or acrylate adhesives/tapes (if applicable), and installation of sealants. Installation instructions shall describe allowable field modification of MCM panels (if applicable).

2.1.4 Packaging and Identification: A description of the method of packaging and field identification of MCM panels shall be provided. The labeling requirements of MCM shall comply with 2009 IBC Sections 1407.14 and 1703.5 (2006 IBC Sections 1407.13 and 1703.5). The “definitive information” required by IBC Section 1703.5.3 shall be construed as the MCM product name, MCM panel total thickness, the flame-spread and smoke-developed indices associated with the MCM panels described in the evaluation report, and the evaluation report number (ESR-xxxx).

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 and Specimen Assembly: Sampling of MCM and assembly of MCM test specimens for tests under this criteria shall comply with Sections 3.1 and 3.3, respectively, of AC85.

3.0 TEST AND PERFORMANCE REQUIREMENTS

3.1 Exterior Use of MCM: The provisions of IBC Section 1407 shall govern the materials, construction and quality of MCM for use as an exterior wall covering. Sections 3.1.1 through 3.1.6 of this criteria are intended to clarify provisions of 2009 and 2006 IBC Section 1407.

3.1.1 2009 and 2006 IBC Section 1407.4 (Structural) and Section 1407.5 (Approval):

3.1.1.1 MCM Panel: Allowable transverse loads of MCM panels shall be determined by tests and the strength and serviceability criteria of Section 4.1 of this criteria.

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3.1.1.2 MCM Systems: When applicable, allowable transverse loads of MCM systems shall be determined by tests or an engineering analysis, or both, in accordance with 2009 and 2006 IBC Section 1407.5. Allowable transverse loads of MCM panels shall be determined by tests for strength and serviceability criteria of Section 4.1 of this criteria. Allowable transverse loads of the MCM systems, which includes the MCM framing members attached to a wall framing system as described in the published installation instructions, shall be determined by tests and the serviceability criteria of Section 4.2 of this criteria.

3.1.1.3 MCM Fasteners: Allowable strength of fasteners (bolts, screws, rivets) connected to MCM panels shall be determined in accordance with Section 4.3. Additionally, allowable load shall not exceed established values for the fasteners (screws, bolts and rivets).

3.1.2 2009 and 2006 IBC Section 1407.6—Weather Resistance: MCM systems shall provide weather protection in accordance with 2009 and 2006 IBC Section 1403.2. Corrosion-resistant flashing shall be provided as part of the weather-resistant exterior wall envelope as set forth in Section 1405.4 (2009 IBC) and Section 1405.3 (2006 IBC) and of the IBC. Sealants used with MCM panels and with dissimilar materials (i.e., wall/eave interfaces, penetrations and openings) shall comply with the Section 4.4.1 of this criteria. MCM systems installed without a water-resistive barrier shall be tested in accordance with the provisions set forth in 2009 and 2006 IBC Section 1403.2, Exception 2, and with Section 4.4.2 of this criteria.

3.1.3 2009 and 2006 IBC Section 1407.7—Durability: MCM panel durability shall be determined by conducting bond-strength testing in accordance with Section 4.5 of this criteria and freeze-thaw cyclic testing in accordance with Section 4.6 of this criteria. Additionally, the MCM metal skins shall be made from a corrosion-resistant material. Performance of films or coatings factory-applied to MCM panels with aluminum skins shall comply with AAMA 620 or AAMA 2605, as applicable.

3.1.4 2009 and 2006 IBC Section 1407.8—Fire-resistance Rating (Optional): For purposes of this criteria, “sufficient data” specified in 2009 and 2006 IBC Section 703.2 shall consist of test data determined in accordance with ASTM E 119 or UL 263, and shall verify that the required fire-resistance rating of a wall assembly is maintained when an MCM system is incorporated into it. Unless a report of successful testing of a wall assembly in accordance with ASTM E 119 or UL 263 is submitted, the evaluation report shall limit the use of MCM panels to nonfire-resistance-rated construction. In this regard, the application of the panel to a fire-resistance-rated assembly negates the assembly’s fire-resistance rating, unless one of the following conditions are met:

3.1.4.1 The wall assembly with the MCM system is tested in accordance with ASTM E 119 or UL 263.

3.1.4.2 An engineering analysis as defined in IBC Section 703.3, establishing the fire resistance of the assembly with the MCM system, is submitted. The analysis shall include reports of fire-resistance tests on wall assemblies with and without the MCM system installed, and an investigation of the effect of the MCM system on fire-resistance performance of the complete assembly. Recognition in an evaluation report of MCM

systems incorporated into fire-resistance-rated assemblies shall describe the wall assembly construction, whether bearing or nonbearing, MCM panel core and skin thickness, and MCM system attachment to the wall.

3.1.4.3 (For 2009 IBC only) The MCM system is installed on the outer surface of the fire-resistance-rated exterior wall in a manner such that the attachments do not penetrate through the entire fire-resistance-rated exterior wall assembly.

3.1.5 2009 and 2006 IBC Sections 1407.9 and 1407.10.1—Surface-burning Characteristics: These code sections require MCM panels, having the maximum thickness intended for use, to be tested in accordance with ASTM E 84 or UL 723. For purposes of this test, an MCM assembly consists of MCM panels having a maximum core thickness with minimum skin thicknesses, installed in the test apparatus with transverse joints formed by butting the panels end to end. These MCM panels may be used to establish surface-burning characteristics for panels having thinner cores or thicker skins. Any MCM panel films or coatings having a dry-film thickness equal to or greater than 0.036 inch (0.91 mm) shall also be investigated.

3.1.6 2009 and 2006 IBC Section 1407.10.4—Full-scale Tests (Optional): IBC Section 1407.10.4 requires testing of an MCM system, with the MCM having the maximum thickness intended for use, utilizing a representative attachment system, in accordance with NFPA 285. For purposes of this criteria, MCM panels having a maximum core thickness with minimum skin thickness may be used to establish exterior wall fire-propagation characteristics when testing is according to NFPA 285 for panels having thinner cores and thicker skins. For testing conducted in accordance with NFPA 285, a thermal barrier shall not be used on the interior of the MCM system test assembly when recognition is sought for deletion of the thermal barrier under IBC Section 1407.10.3. Conversely, compliance with the provisions in IBC Section 1407.10.3 shall not allow for the omission of a thermal barrier installed on the interior face of the MCM system that is required to satisfy the conditions of acceptance in NFPA 285.

3.2 Interior Use of MCM (Optional): When the evaluation report includes recognition of MCM panels as an interior wall finish material or MCM systems as interior partitions, the following provisions are applicable:

3.2.1 Interior Finish: Compliance with IBC Section 803.1.1 or 803.1.2, Section 803.9, and Section 803.10 (2009 IBC) and Section 803.1 or 803.2, Section 803.3, and Section 803.5 (2006 IBC) shall be required.

3.2.2 Structural: For use on interior walls and partitions, MCM panels and MCM systems shall have adequate strength to resist the horizontal load requirements of 2009 and 2006 IBC Section 1607.13, as determined by testing in accordance with Section 4.1 and showing compliance with the condition of acceptance in Section 4.1.6 of this criteria.

3.2.3 Fire-resistance-rated Construction: Where MCM panels are applied as an interior finish on walls, ceilings, or structural elements required to have a fire-resistance rating, the installation of the MCM system shall comply with IBC Section 803.11 (2009 IBC) and Section 803.4 (2006 IBC).

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4.0 TEST METHODS AND CONDITIONS OF ACCEPTANCE

4.1 Structural Load Tests—MCM Panels:

4.1.1 General: When the evaluation report applicant is an MCM panel manufacturer, the evaluation report may recognize panels with stiffeners adhered to their backside by an MCM system fabricator without the applicant's being required to submit detailed fabrication and quality control procedures and without such work (i.e., application of the adhesive) being performed under special inspection, provided the allowable transverse strength of the MCM panels is based on loading the panels, without the adhered stiffeners, to failure or the highest load achievable (see Section 4.1.2.2) and on complying with the conditions of acceptance set forth in Section 4.1.4. The serviceability of MCM panels shall be based on loading the panels, with stiffeners adhered to their backside, to an allowable deflection limit set forth in Section 4.1.5. The lowest value from the strength test criteria (Section 4.1.4) and the serviceability test criterion (Section 4.1.5) shall be the basis for the allowable transverse load of the MCM panel recognized in the evaluation report.

When the evaluation report applicant is both the MCM panel manufacturer and the sole MCM system fabricator, the allowable transverse strength and stiffness of the MCM panels may be determined by testing panels with stiffeners adhered to the backside of the panels. The quality system documentation required by Section 5.0 of this criteria shall include adhesive specifications, such as type, surface preparation, method of application, thickness, and assembly instructions. Additionally, the MCM system shall be tested in accordance with Section 4.2 of this criteria.

4.1.2 Test Method: Transverse load tests shall be performed on each MCM panel configuration, which includes MCM panel type (skin material and thickness, and core material and density), stiffeners (when applicable), and typical panel connectors. Testing shall be conducted in accordance with ASTM E 72, except for the following modifications:

4.1.2.1 The chamber (bag) method of loading specified in Section 11.3 or 12.3 of ASTM E 72 shall be used. Structural members of the test chamber supporting the panel specimens shall be of sufficient strength and rigidity to minimize deflection of the panel edges. The size of support members in this test method shall not preclude the use of smaller framing members in actual MCM systems designed in accordance with IBC Chapter 22.

4.1.2.2 When evaluating panel specimens for strength, and when tests are not conducted to failure, the highest load achieved for each test will be assumed as the peak test load.

4.1.2.3 MCM panel specimens shall be tested at the maximum panel width intended for use in an MCM system. The example shown in Figure 1 is for a panel with a maximum width of 60 inches (1524 mm). Although the strength of the panels may be based on testing panel specimens without adhered stiffeners, the length of the panel specimens shall be a function of panel stiffener spacing. The length of panel test specimens used for strength testing shall equal the maximum centerline spacing of two stiffeners and shall include an overhang at each end equal to 25 percent of the stiffener spacing. For example, a 36-inch-long (914 mm) test specimen is based

on two stiffeners spaced 24 inches (610 mm) apart and a 6-inch-long (152 mm) overhang at each panel end. The length of panel test specimens for serviceability (deflection) testing shall be the same as for strength testing.

4.1.2.4 MCM panel test specimens shall be installed in the test frame as a simple span condition, where panel edge restraint (fasteners and connectors) shall simulate as accurately as possible the conditions of structural support of MCM panels encountered in the field. Steel rollers specified in Section 11.2.1 or Section 12.2.2 of ASTM E 72 shall not be used. Refer to Figure 1 for a typical test setup. All parts of test specimens shall be full size, except for panel length as described in Section 4.1.2.3, using the same materials, details, and methods of construction and anchorage as used in a typical MCM system.

4.1.2.5 Panel ends shall not have any structural attachments to ensure a simple span test condition described in Section 4.1.2.4. Panel ends shall be sealed against the frame with a flexible material that allows unrestricted movement, such as a single thickness of polyethylene film having a thickness of 6 mils [0.006 inch (0.15 mm)] loosely applied with extra folds of the film at the panel perimeter.

4.1.2.6 Application of load and duration of load application shall be in accordance with Sections 4.2 and 4.3 of ASTM E 72, respectively, except that a 60-second load duration for each increment shall be used. Where preloading is applied, the loading, deflection and recovery shall be noted. The amount of preloading shall not exceed 10 percent of the anticipated peak load.

4.1.2.7 When testing panels for serviceability (stiffness), deflection shall be measured at supports and at the center of the panel between panel stiffeners.

4.1.3 Number of Test Specimens: The evaluation of strength and deflection test results shall be made on the basis of at least three identical specimens for positive and negative loading. If the deviation from the average value exceeds ± 10 percent, at least three more tests of the same kind shall be performed, unless the lowest test value is used.

4.1.4 Strength Testing—Conditions of Acceptance for Exterior Installations of MCM Panels: Allowable positive and negative transverse loads of an MCM panel shall be the lowest value determined by the following criteria:

4.1.4.1 The average maximum test load for a group of three test specimens, when each maximum test load is within 10 percent of the average maximum test load, divided by safety factor equal to 2.

4.1.4.2 The lowest maximum test load from a group of three test specimens, when a maximum test load is not within 10 percent of the average maximum test load, divided by safety factor equal to 2.

4.1.4.3 The average maximum test load for a group of six panels, regardless of the coefficient of variation, divided by a safety factor equal to 2.

4.1.5 Serviceability Testing—Conditions of Acceptance for Exterior Installations of MCM Panels: The average test load that produces a deflection limit of

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$1/60$ of the panel span (the distance from panel edge to opposite panel edge) with respect to the test frame.

4.1.6 Condition of Acceptance for Interior Installations of MCM Panels: For use on interior walls and partitions, the MCM panels and their supports shall have adequate strength to resist a 15 psf (0.72 kN/m²) transverse pressure, which is based on the load requirements of IBC Section 1607.13 with an applied safety factor of 3.

4.2 Structural Load Tests—MCM Systems:

4.2.1 General: Testing shall be in accordance with ASTM E 330, Procedure B, or with ASTM E 72, including test procedure modifications as described in Sections 4.2 and 4.3 of AC04 (the ICC-ES Acceptance Criteria for Sandwich Panels). MCM system test specimens shall be prepared and installed in accordance with the applicant's published instructions. Application of load shall be in at least four increments, with a load duration as specified within the ASTM standard for each increment.

4.2.2 Conditions of Acceptance: Allowable loading shall be based on requirements in Section 4.2 of AC04 and shall include the following:

4.2.2.1 Allowable transverse loads of the MCM system shall not exceed allowable loads for screws, bolts and rivets (as applicable) attached to the MCM panels established in accordance with Section 4.3 of this criteria and MCM connectors established in accordance with an engineering analysis.

4.2.2.2 At the maximum design loading, normal to the plane of the wall between structural supports, deflection of the attached MCM system perimeter framing members shall not exceed $1/175$ of the span length or $3/4$ inch (19 mm), whichever is less. The deflection at the midpoint-center of any MCM panel shall not exceed $1/60$ of the maximum span at the design load.

4.2.2.3 At 1.5 times design pressure, permanent deformation of the MCM system framing members, excluding the cold-formed steel structural curtain wall members, shall not exceed $1/1000$ of the span length, and components shall not experience failure or gross permanent deformation. At connection points of the MCM system framing members to anchors, permanent set shall not exceed $1/16$ inch (1.6 mm).

4.3 MCM Panel Fasteners (Screws, Bolts, and Rivets): Screws, bolts, and rivets designed to transfer loads applied to MCM panels to their supporting connectors or framing members shall have allowable loads established by tests in accordance with Section 4.3.1 or Section 4.3.2 of this criteria. In lieu of testing, the allowable loads for fasteners may be derived by an engineering analysis based on the thickness of the metal skins without considering the MCM panel plastic core.

4.3.1 MCM Panels with Aluminum Skins: The test method, the number of fastener tests, and evaluation of test results shall be in accordance with Section 8.3 of Part 1-A of the Aluminum Design Manual.

4.3.2 MCM Panels with Metal Skins (Other Than Aluminum): Testing shall be conducted in accordance with AISI S905-08 (Standard Procedures for Panel and Anchor Structural Tests). The number of fastener tests and evaluation of test results shall be in accordance with

Section F of AISI S100 (2009 IBC) and AISI-NAS (2001) (2006 IBC).

4.4 Weather Resistance Testing:

4.4.1 Sealant Qualification: Sealants shall be compatible with MCM panels. Compatibility may be determined in accordance with the procedures specified in ASTM C 1087.

4.4.1.1 Elastomeric Sealants: Elastomeric sealants shall comply with ASTM C 920 as minimum Type S or M, minimum Grade NS, minimum Class 25, and Use O sealant. Under the Use O classification, the sealant shall be qualified by adhesion-and-cohesion-under-cyclic-movement testing and adhesion-in-peel testing as described in Sections 8.8 and 8.9 of ASTM C 920, respectively, for each material to which the sealant will be applied.

4.4.1.2 Structural Silicone Sealants: Structural silicone sealants shall comply with ASTM C 1184 as minimum Type S or M, and Use O, sealant.

4.4.1.3 Butyl Sealants: Butyl sealants shall comply with ASTM C 990.

4.4.2 Water-penetration Tests:

4.4.2.1 General: Water-penetration tests for MCM systems that are installed without a water-resistive barrier shall be conducted in accordance with IBC Section 1403.2, Exception 2. At least one configuration of each MCM system shall be tested, where a configuration shall consider system components; openings, joints, and penetrations in the system; and system terminations (wall/eave and wall/sill conditions). Joints, intersections or terminations of the panels at dissimilar materials; wall/eave interface; and configuration and methods of making the penetrations and openings waterproof, including the panel interface at doors and windows; as used in the tests will be the basis for recognition of the system in an evaluation report. Sealants shall comply with Section 4.2.1 of this criteria and shall be installed with the width and thickness intended for recognition. If a range of sealant widths is to be recognized, the tested assembly shall include penetrations, with minimum and maximum sealant widths. Flashing and gasketing shall comply with Section 3.1.2 of this criteria. Windows shall be the typical type and construction of window, unless the tests are conducted on an assembly configuration that is not dependent on a sealant and not dependent on the water penetration resistance capability of the window, and include the intended flashing system; or the evaluation report will need to include dimensioned drawings of the type of window and door frame used in the tests.

4.4.2.2 Conditions of Acceptance: Conditions of acceptance are as set forth in 2009 and 2006 IBC Section 1403.2, Exception 2.

4.5 Bond Strength Test:

4.5.1 General: MCM panel test specimens shall be representative of typical manufacture for each panel construction with various types of core and skin materials. Total sample size for each MCM panel construction shall be 18 specimens taken from three randomly selected panels and collected into three groups as follows (refer to Figure 2 for details of specimen location from an MCM panel):

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- Group 1: Six specimens from one edge of the three panels
- Group 2: Six specimens from the center of the three panels
- Group 3: Six specimens from the opposite edge of the three panels

Specimens taken from bonded MCM panels shall be approximately 3 inches (76 mm) wide by at least 12 inches (305 mm) long. Specimens taken from injected molded MCM panels shall be at least 2 inches square (1290 mm²). Groups of specimens shall be tested for bond strength as described in Section 4.5.2 for bonded MCM panels or Section 4.5.3 for injected molded MCM panels, after being conditioned as follows:

4.5.1.1 Group 1 Conditioning: Exposure at a constant 70°F (21°C) and 50 percent relative humidity for 48 hours.

4.5.1.2 Group 2 Conditioning: Submersion in water at 212°F (100°C) for eight hours.

4.5.1.3 Group 3 Conditioning: Submersion in water at 70°F (21°C) for 21 days.

4.5.2 Bonded MCM:

4.5.2.1 Test Method: Each group of conditioned bonded MCM specimens shall be tested in accordance with ASTM D 1781.

4.5.2.2 Conditions of Acceptance: Each group of six specimens shall exhibit a minimum average peel torque of 22.5 inch-pounds per inch (100 N-mm/mm). Individual values within each group shall be within 15 percent of the group average, or the lowest test value shall be used.

4.5.3 Injection Molded MCM:

4.5.3.1 Test Method: Each group of conditioned injected molded MCM specimens shall be tested in accordance with ASTM C 297.

4.5.3.2 Conditions of Acceptance: Each group of six specimens shall exhibit a minimum average flatwise tensile strength of 400 psi (0.28 kg/mm²). Individual values within each group shall be within 15 percent of the group average, or the lowest test value shall be used.

4.6 Freeze-thaw Test:

4.6.1 General: Total sample size for each MCM panel construction shall be six specimens taken from the same MCM panels from which the bond strength specimens described in Section 4.5.1 of this criteria were taken. Two specimens shall be taken from the same panel edge of the first panel, two specimens shall be taken from the center of the second panel, and two specimens shall be taken from the opposite edge of the third panel. One specimen from each location shall consist of the panel core and the top skin, and the other specimen from each location shall consist of the panel core and the bottom skin. Refer to Figure 2 for details of specimen location. The six specimens shall be conditioned as described in Section 4.6.2 and then tested as described in Section 4.6.3.

4.6.2 Conditioning: Specimens shall be subjected to 10 freeze-thaw cycles, where each cycle consists of exposure to air at 120°F (49°C) for a minimum of eight

hours, followed by submersion in water at 75±5°F (23.9±0.6°C) for eight hours, and exposure to air at -20°F (-28.9°C) for 16 hours.

4.6.3 Testing: Following conditioning described in Section 4.4.2, the six bonded MCM specimens shall be tested in accordance with ASTM D 1781, and the six injected molded MCM specimens shall be tested in accordance with ASTM C 297.

4.6.4 Condition of Acceptance: Freeze-thaw failure is defined as delamination, or indications of delamination, within or between components. Individual test values shall be within 15 percent of the sample average, unless the lowest test value is used.

4.6.4.1 Bonded MCM: Each of the six conditioned specimens shall exhibit a peel torque value of no less than 18.0 inch-pounds per inch (80 N-mm/mm). Additionally, the average peel torque value of the six conditioned specimens shall be equal to or greater than 100 N-mm/mm (22.5 inch-pounds per inch).

4.6.4.2 Injected Molded MCM: Each of the six conditioned specimens shall exhibit a flatwise tensile strength no less 320 psi (0.22 kg/mm²). Additionally, the average flatwise tensile strength of the six conditioned specimens shall be equal to or greater than 400 psi (0.28 kg/mm²).

5.0 QUALITY CONTROL

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

5.2 MCM panels shall be manufactured at a location or locations where a quality system specific to the manufacture of the product to be recognized in the evaluation report is implemented and maintained. The program shall include provisions for inspections by an inspection agency accredited by the International Accreditation Service (IAS) or by an accreditation body that is a partner with IAS in a mutual recognition arrangement pertaining to inspection bodies, and that complies with ISO/IEC Standard 17020, *General Criteria for the Operation of Various Types of Bodies Performing Inspection*, and with the ICC-ES Acceptance Criteria for Inspection Agencies (AC304).

6.0 EVALUATION REPORT RECOGNITION

6.1 The following statements shall appear in the Conditions of Use section of the evaluation report:

- The design of the MCM system vapor retarders (2009 IBC), framing members, connections, and curtain wall framing members must be submitted to and approved by the code official for each project.
- Allowable transverse loads for the MCM panels are as specified in this report.
- (*If the evaluation report recognizes the use of MCM panels based on IBC Section 1407.10, but the omission of the thermal barrier has not been established in accordance with IBC Section 1407.10.3, the following Condition of Use shall be included:*) For MCM systems used on exterior walls of Types I, II, III or IV construction in accordance with IBC Section 1407.10, an approved thermal barrier shall be installed to separate the MCM from the interior of the building as specified in IBC Section

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1407.10.2, except when the MCM is an element of a balcony or similar projection, such as architectural trim or embellishments.

- The MCM system fabricator must provide a certificate of compliance to the code official attesting that the MCM system fabrication includes the use of adhesives approved for use, that the adhesive application complies with the adhesive manufacturer's installation guidelines, and that the MCM system fabrication complies with approved construction documents.
- Panels are manufactured at the MCM panel manufacturer's facility located in *(all manufacturing locations, i.e., city and state, shall be specified in this Condition of Use)*, with inspections by *(the name of the accredited inspection agency, along with their IAS certificate number, shall be specified in this Condition of Use)*.

6.2 The report shall indicate the allowable transverse loads for the panels.

6.3 The report shall indicate the conditions of use that pertain to type of construction, and any height limitations, if evaluated under Section 1407.11 of the IBC.

6.4 When compliance with Section 3.2 of this criteria is established, the evaluation report shall indicate the interior wall finish classification of the MCM in accordance with IBC Section 803.1.1 (2009) and Section 803.1 (2006 IBC), or shall indicate the MCM as an acceptable interior wall finish material in accordance with IBC Section 803.1.2 (2009 IBC) and Section 803.2 (2006 IBC).

6.5 Application of silicone or acrylate adhesives/tapes to an MCM system for the purpose of strengthening the MCM panels to resist design loads shall be performed by a fabricator approved to perform such work or shall be done under special inspection in accordance with IBC Section 1704.15 (2009 IBC) and Section 1704.13 (2006 IBC).

6.6 Application of silicone or acrylate adhesives/tapes to an MCM system for the purpose of increasing panel stiffness only, in accordance with Section 4.4.1 of this criteria, may be performed by an MCM fabricator at a fabricator's facility without there being a requirement for submittal of detailed fabrication and quality control procedures for approval and without a requirement that such work be performed under special inspection. ■

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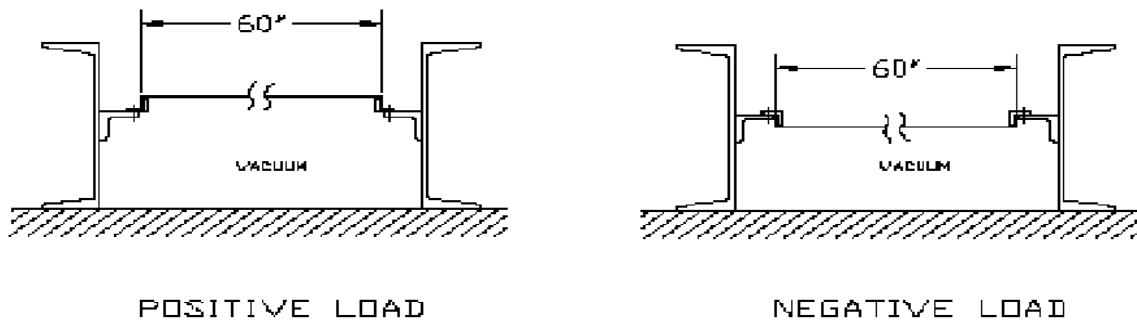


FIGURE 1—STRUCTURAL LOAD TEST SETUP FOR MCM PANELS WITH CONNECTIONS (REFERENCE SECTION 4.1)

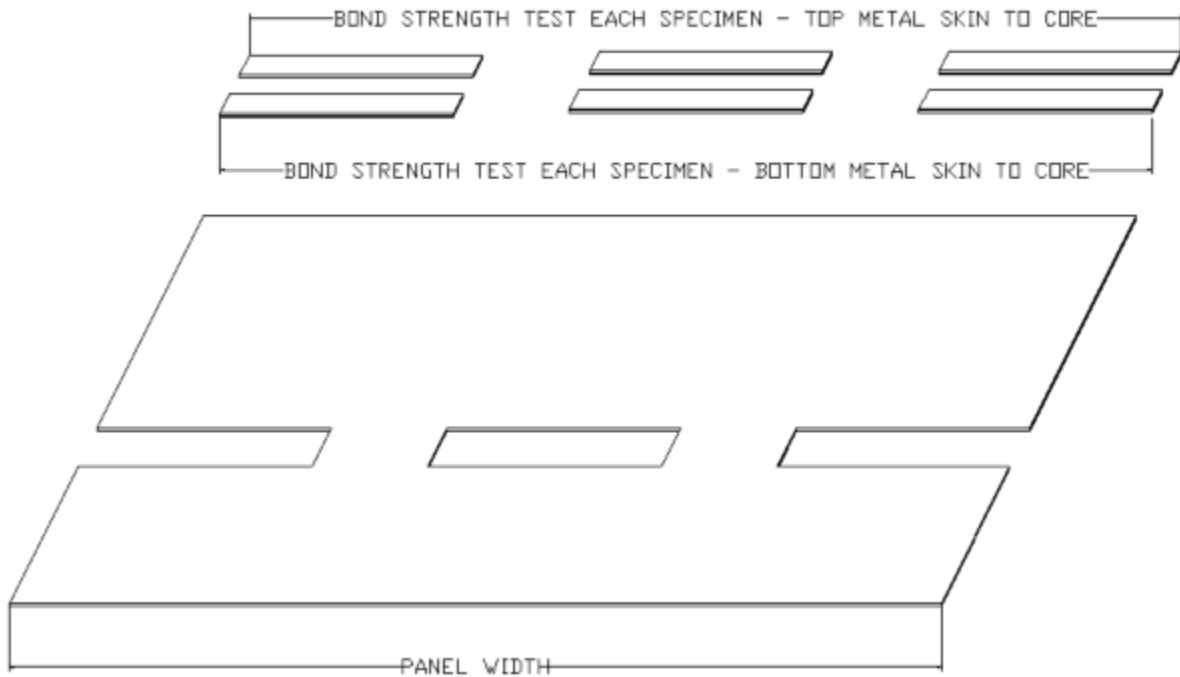


FIGURE 2—SPECIMEN LOCATION FROM MCM PANELS FOR BOND-STRENGTH TESTING (REFERENCE SECTION 4.5) AND FREEZE-THAW TESTING (REFERENCE SECTION 4.6)