ICC EVALUATION SERVICE

www.icc-es.org | (800) 423-6587 | (562) 699-0543 *A Subsidiary of the International Code Council®*

ACCEPTANCE CRITERIA FOR POWER-DRIVEN PINS FOR ATTACHING GYPSUM BOARD MATERIALS TO COLD-FORMED STEEL WALL FRAMING

AC259

Approved June 2010

Effective July 1, 2010

Previously approved June 2004

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.

Acceptance criteria are developed for use solely by ICC-ES for purposes of issuing ICC-ES evaluation reports.

ACCEPTANCE CRITERIA FOR POWER-DRIVEN PINS FOR ATTACHING GYPSUM BOARD MATERIALS TO COLD-FORMED STEEL WALL FRAMING (AC259)

1.0 INTRODUCTION

1.1 Purpose: The purpose of this acceptance criteria is to establish requirements for power-driven pins used to attach gypsum board materials to cold-formed steel (CFS) wall framing to be recognized in an ICC Evaluation Service, Inc. (ICC-ES), evaluation report under the 2009 and 2006 *International Building Code*® (IBC), the 2009 and 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 are IBC Section 104.11, IRC Section R104.11, BNBC Section 106.4, SBC Section 103.7, and UBC Section 104.2.8.

The reason for this criteria is the absence of referenced standards in the IBC or IRC that can be used to establish transverse wind load performance of the proprietary power-driven pins used to attach gypsum board materials to CFS wall framing.

1.2 Scope: This criteria applies to power-driven pins used to attach gypsum board materials to the exterior of cold-formed steel (CFS) wall framing of structures of combustible (Type V) and noncombustible (Types I, II, III, and IV) construction where the CFS wall framing is in compliance with the applicable code. This criteria is limited to:

1.2.1 Evaluating the attachment of the gypsum board materials to the CFS wall framing for transverse (wind) load resistance.

1.2.2 Nonfire-resistance-rated applications, unless the fire-resistance rating of the wall assembly is determined in accordance with the test procedures set forth in IBC Section 703.2.

1.3 Codes and Referenced Standards:

1.3.1 2009 and 2006 *International Building Code*® (IBC), International Code Council.

1.3.2 2009 and 2006 *International Residential Code*® (IRC), International Code Council.

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

1.3.4 1999 *Standard Building Code*© (SBC).

1.3.5 1997 *Uniform Building Code*™ (UBC).

1.3.6 AISI S100-2007, AISI Standard—North American Specification for the Design of Cold-Formed Steel Structural Members, American Iron and Steel Institute.

1.3.7 AISI S200-07, AISI Standard—North American Standard for Cold-Formed Steel Framing—General Provisions, American Iron and Steel Institute.

1.3.8 AISI S211-07, AISI Standard—North American Standard for Cold-Formed Steel Framing—Wall Stud Design, American Iron and Steel Institute.

1.3.9 AISI S905-08, Test Methods for Mechanically Fastened Cold-Formed Steel Connections, American Iron and Steel Institute.

1.3.10 ASTM A 370-08a, Standard Specification for Standard Test Methods and Definitions for Mechanical Testing of Steel Products, ASTM International.

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

1.3.12 ASTM E 575-05, Standard Practice for Reporting Data from Structural Tests of Building Constructions, Elements, Connections, and Assemblies, ASTM International.

1.4 Definitions:

1.4.1 Allowable Strength: Allowable strength is the nominal strength, R_n, divided by the safety factor, Ω.

1.4.2 Available Strength: Available strength is the design strength or allowable strength, as appropriate.

1.4.3 Base Steel Thickness: The base steel thickness is the thickness of the steel, exclusive of all coatings.

1.4.4 Corrosion Protection: Corrosion protection is the rust-inhibitive coating suitable for the end-use installation conditions of the power-driven pins.

1.4.5 Design Strength: Design strength is the nominal strength, R_n, multiplied by the resistance factor, Φ.

1.4.6 Nominal Strength: Nominal strength is the strength of a structure, a component, or an assembly (without the resistance factor, Φ, or the safety factor, Ω) to resist the load effects determined in accordance with the applicable code.

1.4.7 Gypsum Board Materials: For purposes of this criteria, gypsum board materials are the gypsum boards, gypsum panels, gypsum sheathing and gypsum substrates for which applicable standards are specified in 2009 and 2006 IBC Table 2506.2, BNBC Table 2503.2, SBC Table 2503 and UBC Section 2502. The applicable editions of these standards are as specified in the applicable code.

1.4.8 Power-driven Pin: A forced-entry nail-like steel fastener designed to attach one material to another, characterized by a round (smooth or knurled) steel-wire shank with an upset head at one end and a point at the other end of the shank, typically hardened for penetrating steel and installed with a power tool reliant on explosive powder, gas combustion, or compressed air or other gas.

1.4.9 Type: A family of power-driven pins with a consistent size (nominal diameter), shank design, head style, point style, raw material, coating specification and mechanical property specifications. Power-driven pins within the family may vary in length,

1.4.10 Statistically Equivalent: Two groups of test results shall be considered statistically equivalent if there are no significant differences between the means and between standard deviations of the two groups. Such statistical equivalence shall be demonstrated using a one-sided Student's t-Test at a confidence level of 90%.

ACCEPTANCE CRITERIA FOR POWER-DRIVEN PINS FOR ATTACHING GYPSUM BOARD MATERIALS TO COLD-FORMED STEEL FRAMING (AC259)

2.0 BASIC INFORMATION

2.1 General: The following information shall be submitted:

2.1.1 Power-driven Pins: The following information shall be provided for the power-driven pins:

2.1.1.1 Manufacturer's name, trade name, brand name, and the power-driven pin catalog number.

2.1.1.2 Complete information concerning the manufacturing process of the power-driven pins.

2.1.1.3 Dimensioned (drawn-to-scale) figures and production drawings,

2.1.1.4 Nominal head diameter, shape, thickness, and a description of the pointed end of power-driven pins.

2.1.1.5 Nominal and actual shank diameter.

2.1.1.6 Shank length and total length.

2.1.1.7 Permitted manufacturing tolerances.

2.1.1.8 Washer size and thickness (if used).

2.1.1.9 Alignment tips (if used).

2.1.1.10 Shank style (smooth or knurled). If the shank is knurled, the knurl pattern shall be described and the height of knurl above the wire shank diameter shall be specified.

2.1.1.11 Power-driven pin steel wire specifications, including national standard, if applicable; power-driven pin physical properties, such as tensile strength and/or core and case hardness; and corrosion-protective coating factory-applied to the finished power-driven pins.

2.1.2 Gypsum Board Materials: Brand name, type, thickness, name of manufacturer, and appropriate national standard specification shall be submitted for the gypsum board material used in the transverse load tests described in Section 3.2.

2.1.3 Installation Instructions: Installation details, noting installation limitations; size, location and minimum steel substrate penetration of the power-driven pins; the specification, thickness and installation orientation of each type of gypsum board material; specifications for the grade and base steel thickness of the CFS; and flange width and spacing of the CFS wall framing members.

2.1.4 Packaging and Identification: A description of the method of packaging and field identification of the power-driven pins. The head of each power-driven pin shall bear the manufacturer's name or insignia. Where multiple power-driven pin types or sizes are provided, a mark differentiating the types or sizes shall also be on the head of each pin or product packaging unit. The ICC-ES report number (ESR-XXXX) shall be placed on the product packaging units.

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. In addition, test reports shall include the following information:

2.3.1 Power-driven pin specifications consistent with Section 2.1.1 of this criteria.

2.3.2 The brand name, type, thickness, manufacturer and appropriate national standard specification of each gypsum board material used in the qualification tests.

2.3.3 Steel specifications of the CFS wall framing members used in the qualification tests.

2.3.4 Information as described in ASTM E 575, except that video recording is optional.

2.4 Product Sampling: Sampling of the power-driven pins, gypsum board materials and CFS framing members for tests under this criteria shall comply with Section 3.2 of AC85. The testing laboratory shall witness or verify construction of tested assemblies as required by AC85.

3.0 TEST AND PERFORMANCE REQUIREMENTS

3.1 Test Material Specifications:

3.1.1 Power-driven Pins: Verification of compliance with the manufacturer's submitted product specifications required under Section 2.1.1.11, in the form of test reports complying with Section 2.3, shall be provided for power-driven pins from the same lot of pins used in the load tests performed in accordance with Section 3.2.

3.1.2 Cold-formed Steel Wall Framing Members:

3.1.2.1 The CFS wall framing members shall be representative of the materials and configurations sought for recognition in the evaluation report and intended for end use.

3.1.2.2 The base steel thickness, yield strength, tensile strength, and elongation of the steel of all CFS framing members used in the load tests described in Section 3.2 shall be established by coupon tests of representative members. The measured strengths, based on tests in accordance with ASTM A 370, shall meet the minimum specified strengths for steel grades sought for recognition in the evaluation report and intended for end use. Results of tests described in Section 3.2.2 shall be adjusted in accordance with Section 3.2.2.4 when the thickness or strength of the steel exceeds the specified values.

3.1.3 Gypsum Board Materials: The gypsum board materials used in the load tests described in Section 3.2 shall be the materials intended for end use that are regulated by the applicable standard(s) listed in the applicable code (see Section 1.4.7 of this criteria). The gypsum board materials shall be one of the following:

1. Recognized, in a current ICC-ES evaluation report issued to the gypsum board material manufacturer, for compliance with the applicable gypsum board material standard.

2. Recognized, in a current ICC-ES evaluation report issued to the fastener manufacturer, for compliance with the applicable gypsum board material standard.

3. Required to be shown to be in compliance with the applicable gypsum board material standard to the satisfaction of the code official.

3.2 Test Methods and Analysis of Test Data:

3.2.1 General:

3.2.1.1 Small-scale testing and analysis shall be performed in accordance with Section 3.2.2 to establish the available pull-out strength values for each type and

diameter of power-driven pin, installed in each grade and thickness of CFS wall framing member to the depth of protrusion beyond the CFS thickness sought for recognition in the evaluation report.

3.2.1.2 Full-scale wall assembly testing and analysis shall be in accordance with Section 3.2.3 to establish the available uniform load strength values for the gypsum board attachment to the CFS wall framing, where construction variables recognized in the evaluation report include gypsum board material type, thickness, and gypsum board orientation to the CFS wall framing; CFS wall framing member grade, thickness, flange width, and framing spacing; and power-driven pin type, spacing, edge distance, and least protrusion length of the pin beyond the CFS wall framing thickness.

3.2.1.3 Power-driven pins shall be installed using the manufacturer's installation instructions and tools or, where specific deviation is justified, in accordance with accepted field methods or to meet the requirements of the tests. The test report shall include this information.

3.2.1.4 Available transverse uniform loads shall be the lowest available values of Section 3.2.2 and 3.2.3.

3.2.2 Power-driven Pin Pull-out Testing and Analysis:

3.2.2.1 The sample size for determining the average pull-out strength of power-driven pins from CFS wall framing members shall be based on the coefficient of variation of the data set. A minimum of 10 test specimens shall be required when the coefficient of variation of the data set is less than or equal to 15 percent, and a minimum of 30 test specimens shall be required when the data set has a coefficient of variation greater than 15 percent.

3.2.2.2 The pull-out resistance of power-driven pins shall be determined following the general test practice of AISI S905, Section 8.3, with the alternate tension test fixture for each CFS base-steel thickness and grade to be recognized in the evaluation report.

3.2.2.3 The available pull-out resistance shall be determined in accordance with AISI S100, Section F1, and Section 3.2.2.4 of this criteria.

3.2.2.4 If the measured tensile strength of the tested coupons cut out from CFS wall framing members used in the tests described in Section 3.2.2 is greater than the specified minimum tensile strength value, and/or the measured base steel thickness of the same tested coupons is greater than the specified design base steel thickness, the results of tests described in Sections 3.2.2 shall be adjusted using the following adjustment factor, R_s:

$$R_s = \left(\frac{F_{u-specified}}{F_{u-tested}}\right) \times \left(\frac{t_{specified}}{t_{tested}}\right) \leq 1.0$$

where:

$F_{u\text{-}specified}$ = Specified tensile strength of the steel, psi (MPa).

$F_{u\text{-}tested}$ = Measured tensile strength of the steel, psi (MPa).

$t_{specified}$ = Specified design base steel thickness in the evaluation report, inch (mm).

t_{tested} = Measured base steel thickness, inch (mm).

The test results derived according to Section 3.2.2 shall not be allowed to be adjusted upward if the measured tensile strength of the tested coupons cut out from the CFS test framing members is less than the minimum specified tensile strength. The ratio of the specified design base steel thickness to the measured base steel thickness shall be equal to 1.0 if the measured base steel thickness is less than the specified design base steel thickness.

3.2.3 Wall Assembly Testing and Analysis:

3.2.3.1 General: All wall assemblies described in Sections 3.2.3.2, 3.2.3.3, and 3.2.3.4 shall be tested for negative transverse structural performance in accordance with ASTM E 330, Procedure B, except that deflection data shall not be required.

Minimum wall assembly size shall be 48 inches by 96 inches (1219 mm by 2438 mm).

The gypsum board material shall be attached to the CFS wall framing members with the power-driven pins. The power-driven pins shall be installed at the spacing, the edge distance, and the least protrusion beyond the CFS wall framing member thickness sought for recognition in the evaluation report.

The framing of the test wall assembly shall be prevented from deflecting beyond the maximum deflection allowed by the test apparatus, when the assembly is subjected to the maximum load.

3.2.3.2 A minimum of three identical wall assemblies shall be tested with the thickest CFS wall framing members for each combination of variables, described in Section 3.2.1.2, that is sought for recognition in the evaluation report. The variables include CFS wall framing member, gypsum board materials and power-driven pins.

3.2.3.3 For wall assemblies where the CFS wall framing member has a nominal base steel thickness equal to or greater than 0.0329 inch (0.837 mm), three wall assembly tests shall also be conducted using the CFS wall framing member having a nominal base steel thickness equal to 0.0329 inch (0.837 mm), or the minimum thickness if the thickness is greater than 0.0329 inch (0.837 mm). These wall assemblies shall replicate the wall assemblies tested under Section 3.2.3.2 (in terms of variables described in Section 3.2.1.2 for CFS wall framing member, gypsum board material, and power-driven pins) with the greatest average transverse pressure.

3.2.3.4 Wall assemblies where the CFS wall framing member has a nominal base steel thickness of less than 0.0329 inch (0.837 mm) shall be tested for all construction combinations at all CFS wall framing member thicknesses to be recognized in the evaluation report.

3.2.3.5 The allowable negative transverse pressure shall be the average peak pressure divided by a safety factor of 3, provided none of the results vary by more than 15 percent from the average. Otherwise, the lowest result of the three tests shall be used. Where tests

are not conducted to failure, the highest pressure achieved for each test will be assumed as ultimate (peak).

3.2.3.6 The matching wall assembly tests for the thickest CFS to be recognized (Section 3.2.3.2) and the thinnest CFS to be recognized (Section 3.2.3.3) shall be compared:

(1) If the tested wall assembly described in Section 3.2.3.2 has allowable transverse strength pressure statistically equivalent to or less than that for the test wall assembly described in Section 3.2.3.3, the allowable transverse strength pressure for wall assemblies with the thickest CFS wall framing to be recognized in the evaluation report shall be assigned to wall assemblies with thinner CFS wall framing for each equivalent combination of gypsum board, CFS framing spacing, power-driven pin spacing, edge distance, and the least amount of pin penetration protrusion beyond the CFS wall framing thickness, provided the allowable loads derived under Section 3.2.2 for pin pull-out are not exceeded.

(2) If the wall assembly tested under Section 3.2.3.2 has an allowable transverse load strength pressure greater than that of the wall assembly tested under Section 3.2.3.3, then additional wall assembly testing of all assembly configurations as noted in Section 3.2.3.2 shall be required to establish allowable transverse load strength pressures for each CFS framing thickness intended for recognition in the evaluation report.

4.0 QUALITY CONTROL

4.1 Quality documentation complying with the ICC-ES Acceptance Criteria for Quality Documentation (AC10) shall be submitted. The quality documentation shall be sufficient to demonstrate that an operating and effective quality system has been implemented at the manufacturing location to ensure the power-driven pin properties, noted in Section 2.1.1 of this criteria, are maintained.

4.2 Third-party follow-up inspections are not required under this acceptance criteria for the power-driven pins.

5.0 EVALUATION REPORT RECOGNITION

The evaluation report shall include, at a minimum, the following:

5.1 Descriptive information required by Section 2.1.1 of this acceptance criteria concerning the power-driven pins, (except that providing manufacturing tolerances and proprietary properties in the evaluation report is optional), installation procedures (Section 2.1.3), and packaging and identification information (Section 2.1.4).

5.2 Specifications for the steel of the CFS wall framing members (including applicable standard, grade and base steel thickness), minimum flange width, maximum wall framing spacing, and statements that the CFS wall framing members and the installation of the CFS wall framing members must comply with the applicable code.

5.3 A description of the specific gypsum board materials, including manufacturer's name, product designation, and thickness. The ICC-ES evaluation report number shall also be included for gypsum board material recognized in a current ICC-ES evaluation report issued to the gypsum board material manufacturer, if available.

5.4 Installation orientation and specifications for each gypsum board material.

5.5 Available uniform transverse load strengths for each wall assembly configuration sought for recognition in the evaluation report, based on analysis of data in compliance with this criteria.

5.6 A requirement that the design of curtain wall framing members and their connections comply with applicable provisions of the applicable code.

5.7 A statement that the evaluation report will be limited to the specific gypsum board materials used in the load tests, including the manufacturer's name, product designation, and thickness.

5.8 A statement that for exterior wall applications, the sheathing must be designed by a registered design professional to satisfy building officials as regards wind loads.

5.9 For gypsum board materials not recognized in a current ICC-ES evaluation report, the evaluation report shall include a statement that the gypsum board materials must comply with the applicable gypsum board material standard.

5.10 A statement that recognition of power-driven pins used to attach gypsum board materials to CFS wall framing to resist in-plane shear loads is outside the scope of the evaluation report.

5.11 A statement that for exterior wall applications, the sheathing must be covered by a water-resistive barrier and exterior wall covering in accordance with the requirements of the applicable code. ■