



June 12, 2008

**TO: PARTIES INTERESTED IN EVALUATION REPORTS ON WALL PANELS USED IN BARNs OR STABLES**

**SUBJECT: Acceptance Criteria for Wall Panels with a Welded Steel Perimeter Frame Used in Agricultural Storage Structures, Subject AC390-0508-R1 (YM/RK)**

Dear Madam or Sir:

Enclosed is the new subject criteria approved by the ICC-ES Evaluation Committee at the May 29, 2008, hearing with a June 1, 2008, effective date.

This acceptance criteria is for wall panels consisting of metal-faced plywood, with or without foam plastic board cores, factory-inserted into a welded steel perimeter frame, that are used as walls in stables and barns for the storage of livestock under Group U Occupancy.

Evaluation reports issued on or after the effective date noted above, and falling within the scope of this criteria, will be required to comply with the enclosed edition of the criteria. Evaluation reports issued prior to the effective date may be in compliance either with the enclosed acceptance criteria or with the previous edition. Evaluation reports based on a superseded version of an acceptance criteria must be brought into compliance with the most recent edition at the time the reports are reissued. Therefore, applicants should submit data verifying compliance at the time they apply for re-examination.

If you have any questions, please contact Yamil Moya, Staff Engineer, at (800) 423-6587, extension 3289. You may also reach us by e-mail at [es@icc-es.org](mailto:es@icc-es.org).

Yours very truly,

A handwritten signature in black ink that reads 'Kurt Stochlia'.

Kurt Stochlia, P.E.  
Vice President

KS/gh

Enclosure

cc: Evaluation Committee



## ACCEPTANCE CRITERIA FOR WALL PANELS WITH A WELDED STEEL PERIMETER FRAME USED IN AGRICULTURAL STORAGE STRUCTURES

AC390

Approved May 2008

Effective June 1, 2008

### 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.

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

Copyright © 2008

# ACCEPTANCE CRITERIA FOR WALL PANELS WITH A WELDED STEEL PERIMETER FRAME USED IN AGRICULTURAL STORAGE STRUCTURES (AC390)

## 1.0 INTRODUCTION

**1.1 Purpose:** The purpose of this criteria is to establish requirements for wall panels with a welded steel perimeter frame, used in agricultural storage structures, to be recognized in ICC Evaluation Service, Inc., (ICC-ES) evaluation reports under the 2006 *International Building Code*<sup>®</sup> (IBC), the BOCA<sup>®</sup> *National Building Code/1999* (BNBC), the 1999 *Standard Building Code*<sup>®</sup> (SBC) and the 1997 *Uniform Building Code*<sup>™</sup> (UBC). Bases of recognition are IBC Section 104.11, BNBC Section 106.4, SBC Section 103.7 and UBC Section 104.2.8.

The reason for development of this criteria is to establish guidelines for the evaluation of wall panels with a welded steel perimeter frame, since the IBC, BNBC, SBC and UBC do not include provisions for the evaluation of these panels.

**1.2 Scope:** This criteria is applicable to panels of metal-faced plywood sheathing factory-inserted into a welded steel perimeter frame used as load-bearing, nonload-bearing and shear walls of stables or barns used for storage of livestock in Group U occupancy with an Occupancy Category of I, under IBC Table 1604.5. The wall panels may also include a laminated foam plastic board sandwiched between two layers of the metal-faced plywood.

### 1.3 Referenced Documents:

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

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

**1.3.3** 1999 *Standard Building Code*<sup>®</sup> (SBC).

**1.3.4** 1997 *Uniform Building Code*<sup>™</sup> (UBC).

**1.3.5** ASTM A 653-04, Specification for Steel Sheet, Zinc-Coated Galvanized or Zinc-iron Alloy-coated Galvannealed by Hot-dip Process, ASTM International.

**1.3.6** ASTM D 2559-92, Specification for Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions, ASTM International.

**1.3.7** ASTM E 72-02, Method of Conducting Strength Tests of Panels for Building Construction, ASTM International.

**1.3.8** ASTM E 564-06, Standard Practice for Static Load Test for Shear Resistance of Framed Walls for Buildings, ASTM International.

**1.3.9** 2001 North American Design for Cold Formed Steel Structural Members, including the 2004 Supplement (AISI-NAS), American Iron and Steel Institute.

**1.3.10** Structural Welding Code—Sheet Steel (AWS D1.3-98), American Welding Society.

**1.3.11** ICC-ES Acceptance Criteria for Sandwich Panel Adhesives (AC05).

## 2.0 BASIC INFORMATION

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

**2.1.1 Product Description:** Complete descriptive information on the wall panels, including the following:

**2.1.1.1** Specifications of each wall component.

**2.1.1.2** Specifications of final product, including fully dimensioned drawings with tolerances.

**2.1.1.3** Foam plastic specifications are to include the density, thickness, manufacturer's company name, type, catalog number, etc.

**2.1.1.4** Adhesive specifications are to include the type, class, thickness of application, number of coats, assembly instructions, etc.

**2.1.1.5** A description of the manufacturing process.

**2.1.1.6** Connections shall be detailed or adequately described.

**2.1.2 Installation Instructions:** Installation instructions and detail drawings, including limitations and fastening methods.

**2.1.3 Packaging and Identification:** A description of the method of packaging and field identification of the panels. Labels on the panels shall include the company name and address, evaluation report number, model designation (when applicable), name or logo of the inspection agency, and serial number or code for traceability.

**2.2 Testing Laboratories:** Testing laboratories shall comply with Section 2.0 of the ICC-ES Acceptance Criteria for Test Reports (AC85) and Section 4.2 of the ICC-ES Rules of Procedure for Evaluation Reports.

**2.3 Test Reports:** Test reports shall comply with AC85. Each test report shall be in sufficient detail to identify specimen properties that might affect performance. In addition the report shall include the following:

**2.3.1** Description of the panels, including dimensioned drawings of the tested product and sufficient information to ascertain compliance of the tested panels with the product specifications in the manufacturer's quality documentation.

**2.3.2** Description of materials used with the panels to assemble the test specimens.

**2.3.3** Description of test setup sufficient to ascertain compliance with this criteria.

**2.4 Product Sampling:** Specimens shall be representative of standard manufacturing in compliance with the minimum requirements of the quality documentation. The specimens shall be sampled in accordance with Section 3.1 of AC85.

## 3.0 TEST AND PERFORMANCE REQUIREMENTS

### 3.1 Panel Materials:

#### 3.1.1 Panel Facing Material:

**3.1.1.1** Plywood sheathing shall be exterior grade complying with PS-1-95 or PS-2-02.

**3.1.1.2** The plywood sheathing shall be factory-laminated on both sides with cold-formed steel sheets having a minimum G90 galvanization coating designation in accordance with ASTM A 653.

## ACCEPTANCE CRITERIA FOR WALL PANELS WITH A WELDED STEEL PERIMETER FRAME USED IN AGRICULTURAL STORAGE STRUCTURES (AC390)

**3.1.2 Foam plastic board:** Foam plastic shall comply with IBC Sections 2602.1 and 2603 and the ICC-ES Acceptance Criteria for Foam Plastic Insulation (AC12).

**3.1.3 Adhesives:** Adhesives, used to laminate the steel sheets to the plywood or the plywood to foam plastic boards of the wall panel specimens tested under Sections 3.5 of this criteria, shall comply with ASTM D 2559 or the ICC-ES Acceptance Criteria for Sandwich Panel Adhesives (AC05) as a Type II, Class 2 adhesive.

**3.2 Welded Steel Frame Assembly:** The specifications for the cold formed steel shall be referenced in the AISI-NAS. The welding of the steel frame assembly shall be in accordance with AWS D 1.3-98. The minimum corrosion protection of the framing members shall be G90 galvanization coating designation in accordance with ASTM A 653.

**3.3 Water-resistive Considerations:** The design of the wall panel shall protect the edges of the plywood from water exposure, and the panel shall have a means for drainage of water from the steel perimeter member at the bottom of the panel. For example, the bottom framing member may incorporate weep holes, and the bottom of the sheathing may be supported in a manner to prevent contact with the bottom framing member.

**3.4 Door and Window Openings:** Details for door and window openings shall be provided to clarify the manner of supporting axial, transverse and/or racking shear loads. This includes the method of resisting wind loads at door and window jambs.

### 3.5 Panel Qualification Load Tests:

#### 3.5.1 General:

**3.5.1.1** Three tests of each panel type are required with none of the results varying by more than 15 percent from the average of three, unless the lowest value is used. The average result based on a minimum of five tests may be used regardless of the variations. The results of two tests may be used when the higher value does not exceed the lower value by more than 5 percent, and the lower value is used with the required factors of safety.

**3.5.1.2** Where tests are not conducted to failure, the highest load achieved for each test will be assumed as ultimate.

**3.5.1.3** A minimum factor of safety of three shall be applied to the ultimate load based on the average of three tests, or as otherwise permitted under Section 3.5.1.1.

**3.5.1.4** The mechanical properties and base-metal thickness of the steel perimeter frame components of the tested assemblies shall be determined either by tensile tests of coupon or a mill certificate related to the test specimens. The actual yield strength must be within 7 percent of the specified yield strength and the base-metal thickness must be equal to, or less than 5 percent greater than, the minimum specified base-metal thickness.

#### 3.5.2 Wall Panel Transverse Load Tests:

**3.5.2.1** For recognition under the IBC, the design load shall be based on the ultimate test load, as described in Section 3.5.1.1, divided by the safety factor. For recognition under the legacy codes, the design load shall be based on

the ultimate test load, as described in Section 3.5.1.1, divided by the safety factor, or the design load at a deflection of  $L / 180$ , whichever is lower. For bearing wall applications under the IBC and legacy codes, the allowable transverse load cannot exceed the average tested load at a deflection of  $L/180$ .

**3.5.2.2** Positive and negative pressure conditions shall be considered. Nonsymmetrical wall panels shall be tested for loads acting both inwardly and outwardly where there is a question of the most critical direction.

**3.5.2.3** All wall panels shall be loaded in increments to failure with deflections taken to obtain deflection and set characteristics. Application of load and duration of load application shall be in accordance with Sections 4.2 and 4.3 of ASTM E 72. Where preloading is applied, the loading, deflection and recovery shall be noted. The amount of preloading shall not exceed 10 percent of the final allowable load to be specified in the evaluation report.

**3.5.2.4** The test panel shall be supported to match the proposed end-use installation condition.

**3.5.2.5** The "bag method" or vacuum chamber shall be used. Load application shall be done in a manner that reflects field loading conditions.

**3.5.2.6** Sufficient deflection measurement devices shall be used to measure the deflection of the steel framing members and plywood sheathing of the panels. The quantity and location of the measurement devices will vary based on the configuration of the panels.

**3.5.2.7** Variations in facing thickness or steel frame assembly dimensions will require additional full-scale testing.

**3.5.2.8** Transverse load tests on panels having window or door openings are required, unless subject to rational analysis.

### 3.5.3 Wall Panel Axial Compression Load Tests (Optional):

**3.5.3.1** For recognition of the panels for use as bearing walls, the wall panels shall be tested and evaluated under this criteria section.

**3.5.3.2** Load-bearing wall panels shall support an axial loading applied with an eccentricity of one-sixth the panel thickness to the interior or towards the weaker facing material of an interior panel. The test setup shall be capable of accommodating rotation of the test specimen at the top of the wall due to out-of-plane deflection, with the load applied throughout the duration of the test with the required eccentricity.

**3.5.3.3** The allowable axial load shall be determined from the axial load at a net axial deformation of 0.125 inch (3.18 mm) or the ultimate load divided by the factor of safety noted Section 3.4.1.3, whichever is lower.

**3.5.3.4** The test panel shall be supported to match the proposed end-use installation condition. Axial loads shall be applied uniformly or at the anticipated spacing of the floor or roof framing.

**3.5.3.5** All wall panels shall be loaded in increments to failure with deflections taken to obtain deflection and set characteristics. Application of load and duration of load

**ACCEPTANCE CRITERIA FOR WALL PANELS WITH A WELDED STEEL PERIMETER FRAME USED IN AGRICULTURAL STORAGE STRUCTURES (AC390)**

application shall be in accordance with Sections 4.2 and 4.3 of ASTM E 72. Where preloading is applied, the loading, deflection and recovery shall be noted. The amount of preloading shall not exceed 10 percent of the final allowable load, unless a greater preloading is permitted by ICC-ES.

**3.5.3.6** Axial load tests of panels having window or door openings are required. Lintel sections shall meet the deflection criteria of IBC Section 1604.3.6 for use under the IBC and IRC, and BNBC Section 1604.5, SBC Section 1610, and UBC Section 1613, as applicable.

**3.5.4 Racking Shear Tests (Optional):**

**3.5.4.1** For recognition for use as shear walls, the wall panels shall be racking shear tested and evaluated under this criteria section.

**3.5.4.2 Test Panels:** The anchorage of the test panels to the panel supports and the height-to-width ratio of the shear walls shall be representative of end-use installation conditions.

**3.5.4.3 Test Procedure:** Test specimens shall be subjected to wet conditioning in accordance with Section 15.3 of ASTM E 72 prior to testing in accordance with ASTM E 564.

**3.5.4.4 Design Load:** The allowable shear load (pounds per foot or N/m) for the test samples shall be the lesser of the allowable loads based on a drift limit or ultimate load limit, determined as follows:

**3.5.4.5 Ultimate Load Limit:** The allowable shear load (pounds per foot or N/m) is the average ultimate load

divided by the safety factor, then divided by the length of the wall panel.

**3.5.4.6 Drift Limit:** The allowable shear load (pounds per foot) is the applied average test load in pounds (N) at a horizontal displacement of 0.5 inch (12.7 mm) divided by the length of the wall panel.

**4.0 QUALITY CONTROL**

**4.1** The panels 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.

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

**6.0 EVALUATION REPORT RECOGNITION**

The evaluation report shall include the following:

1. Basic information referenced in Section 2.1 of this criteria.
2. Statement on limitations on use of wall panels under the evaluation report to walls of stables or barns used for storage of livestock in Group U occupancy.
3. Statement indicating that exception 3 of IBC Section 1613.1 excludes agricultural storage structures from the seismic load resistance design provisions of Section 1613 of the IBC. ■