

ACCEPTANCE CRITERIA FOR JOIST HANGERS AND SIMILAR DEVICES

AC13

Approved October 2010

Effective November 1, 2010

Previously approved October 2006, October 2003, January 2003,
January 2001

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 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

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 criteria is to establish requirements for ICC Evaluation Service, LLC (ICC-ES), recognition of joist hangers, framing anchors and similar devices under Section 2303.5 of the 2009 and 2006 *International Building Code*® (IBC), Section R104.11 of the 2009 and 2006 *International Residential Code*® (IRC), Section 2312 of the BOCA® *National Building Code/1999* (NBBC), Section 1707.3 of the 1999 *Standard Building Code*® (SBC) and Sections 2304.3, 2304.4.2, and 2318.4 of the 1997 *Uniform Building Code*™ (UBC).

The reason for the development of this criteria is to provide a guideline for the evaluation of joist hangers and similar devices, since the IBC, IRC, NBBC, SBC, UBC and associated reference standards do not specify installation and quality requirements for these products.

1.2 Scope: The devices are used to support or attach wood members, such as joists, rafters, purlins, beams, girders, plates, posts, studs and headers, to wood, metal, concrete or masonry. Attachment may be by means of mechanical fastenings (nails, spikes, lag screws, wood screws, bolts, etc.)

A “device,” as the word is used in this criteria, may consist of one or more pieces or units so arranged as to transfer load vertically or laterally, within safe limits, from the end of a supported member (hereinafter referred to as a “joist”) to a supporting member (hereinafter referred to as a “header”).

1.3 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* (NBBC).

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

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

1.3.6 ANSI/AF&PA National Design Specification for Wood Construction (NDS) and Supplement, American Forest & Paper Association. (Refer to Table 1 of this acceptance criteria for edition date.)

1.3.7 ASTM D 1761-88(2000)^{e1}, Test Methods for Mechanical Fasteners in Wood, ASTM International.

1.3.8 ASTM D 7147-05, Standard Specification for Testing and Establishing Allowable Loads of Joist Hangers, ASTM International.

2.0 BASIC INFORMATION AND TEST REPORTS

2.1 General: The following information shall be submitted:

2.1.1 Product Description: Complete information pertaining to components, material specifications, and manufacturing processes. Materials shall comply with an appropriate recognized national standard(s).

2.1.2 Installation Instructions: Installation details and drawings, noting installation requirements and/or limitations.

2.1.3 Identification: Description of the method of identifying the product. Each device shall bear an imprint which clearly identifies the manufacturer. A registered trademark may serve as such identity. Labeling shall also include the ICC-ES evaluation report number.

2.1.4 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.

2.1.5 Test Reports: Test reports shall comply with AC85. All test reports shall be prepared by an independent testing laboratory in accordance with Section 4.2 of the ICC-ES Rules of Procedure for Evaluation Reports. Test reports shall include a complete description of devices tested; the dimensions of the specimens; the number, size, type, and method of installing fastenings; type of failure; and such other data as may be pertinent.

2.1.6 Sampling: Test specimens shall be sampled in accordance with Section 3.0 of AC85.

3.0 TEST AND PERFORMANCE REQUIREMENTS

3.1 General: Every device shall be rated for direct (vertical) capacity under Allowable Stress Design (ASD) in accordance with Section 3.2 or 3.3 of this criteria. Joist hangers also shall be rated for torsional moment capacity in accordance with Section 3.4 of this criteria.

3.2 Direct (Vertical) Load Capacity Tests: The testing procedure to establish direct load capacity shall be in accordance with ASTM D 1761 and conform to the following provisions:

3.2.1 A minimum of three test specimens for each size of device shall be tested. If the ultimate load for any one of the test specimens varies more than 20 percent from the average, three additional tests shall be conducted.

3.2.2 A test specimen shall consist of an assembly of a joist and two headers of appropriate size fastened together by a device to be tested, as illustrated in Figure 7 of ASTM D 1761. The minimum length for joists and headers shall be 18 inches (457 mm). The joist length need not exceed 24 inches (610 mm). Headers shall have a length sufficient to provide the intended hanger-to-header contact for the hanger, that is, space for nailing and bearing as applicable.

For devices not readily adaptable to such assembly, an alternate assembly producing comparable results may be used.

3.2.3 The species of lumber used shall have a specific gravity not greater than 0.55 as determined in accordance with the NDS.

3.2.4 The moisture content at time of test shall be greater than 11 percent.

3.2.5 A specimen, when inserted in the testing machine, shall have the top of the joist level, and the sides vertical. Except for the restraint provided by the device, the joist shall be unrestricted for vertical movement.

3.2.6 A dial gauge reading to 0.001 inch (0.0254 mm) shall be used for the measurement of vertical movement of the joist with respect to the headers.

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3.2.7 An initial load, ranging from 5 to 20 percent of ultimate load, shall be applied to the joist to seat the test assembly. This load shall then be removed and the gauges shall be set to zero and so recorded, with the amount of the initial load.

3.2.8 Load shall be applied at either a uniform crosshead rate between 0.03 to 0.10 inch (0.8 to 2.5 mm) per minute, or at a rate of loading which will result from approximately this machine head speed. The rate of loading shall be reported with the test data.

3.2.9 Both load and gauge readings shall be recorded at appropriate intervals of load.

3.2.10 Test results may be presented in tabular form or by means of a graph.

3.2.11 For compliance with the applicable code, each device shall be rated for direct load (vertical) capacity at the lowest value determined from the following:

3.2.11.1 The allowable vertical load for a normal duration of loading of the joist hanger or similar device shall be the lowest value determined from tests using the criteria given in Sections 3.2.11.1.1 through 3.2.11.1.3.

3.2.11.1.1 The lowest ultimate vertical load for a single device from any test divided by 3 (where three tests are conducted and each ultimate vertical load does not vary more than 20 percent from the average ultimate vertical load).

3.2.11.1.2 The average ultimate vertical load for a single device from all tests divided by 3 (where six or more tests are conducted).

3.2.11.1.3 The average from all the tests of the vertical load that produces a vertical movement of the joist with respect to the header of 0.125 inch (3.2 mm).

3.2.11.2 The device shall have a direct load capacity rating no greater than calculated in accordance with the NDS for nails or other fasteners utilized to attach the joist hanger or similar device to the wood members and allowable bearing loads that contribute to the capacity of the hanger.

3.2.11.3 The device shall have a direct load capacity rating no greater than the allowable design load determined in accordance with the NDS for the wood members forming the connection.

3.3 Alternative Test Method for Direct (Vertical) Load Capacity Testing: As an alternative to ASTM D 1761, the provisions of ASTM D 7147 may be followed to establish direct load capacity, provided that analysis of test data and derivation of allowable loads are in accordance with Sections 13, 14 and 15 of ASTM D 7147.

3.4 Torsional Moment Capacity Test for Joist Hangers:

3.4.1 The torsional moment capacity for the joist hanger shall be determined in accordance with ASTM D 1761. At least three specimens of each size of device shall be tested. Specimens shall be prepared and tested in a manner that will show the torsional moment in inch-pounds required to deflect either the top or bottom of the joist 0.125 inch (3.2 mm) from its initial position, provided the moment is applied by rotating the joist at a distance of not less than 12 inches (305 mm) from the device.

EXCEPTION: Hangers supporting glued-laminated beams or hangers specifically designed to support only prefabricated wood I-joists.

3.4.2 The torsional moment capacity rating of the device shall be the average torsional load at which the lateral movement of the top or bottom of the joist with respect to the original position of the joist is 0.125 inch (3.2 mm), such load to be the average for three or more tests.

3.4.3 Every device supporting a joist shall have a torsional moment capacity of not less than 75 pounds (334 N) times the depth of the joist. Any device supporting roof joists having one end twisted more than one-half of one degree per foot length relative to the other end (such as in framing a breached bay between a bowstring truss and a wall) shall have a torsional moment capacity of 200 pounds (890 N) times the depth of the joist, unless other means (such as solid blocking, etc.) are provided to satisfy this requirement.

4.0 ANALYSIS DETAILS

4.1 Compression Perpendicular to Grain: When the transfer of loads on the joist to the header is accomplished primarily by means of compression perpendicular to grain of the wood against the device, the allowable loads specified in the NDS shall not be exceeded.

4.2 Fastener Values: When the transfer of loads on the joist to the header is accomplished primarily by means of fasteners in wood, the allowable strength of fasteners specified in the NDS shall not be exceeded.

4.3 Multiple Devices: When more than one device is used at a joint, the devices shall be capable of operating in unison.

4.4 Provision for Shrinkage: Dimensions of devices, or methods of installation, shall make appropriate provisions for shrinkage of joist relative to header.

4.5 Design Value Modifications for Joist Hangers or Similar Devices: Allowable design values for joist hangers or similar devices that are determined by calculation (Sections 3.2.11.2 and 3.2.11.3) shall be permitted to be modified by the appropriate duration of loading factors as specified in the NDS, *except when limited by a test-based design value. Allowable design values determined by test results (Section 3.2.11.1) shall not be modified by duration of load factors.*

5.0 MATERIALS AND WORKMANSHIP

Materials shall be of uniform quality and shall comply with the provisions of each applicable code when specified, otherwise material shall be limited to the following:

5.1 Minimum thickness of steel shall be as follows:

Sheet—No. 18 gage, U.S. Standard Gage.

Wire—No. 18 gage, U.S. Steel Wire Gage.

EXCEPTION: Face-mounted joist hangers, supporting 2-by-4, 2-by-6, 2-by-8, and 2-by-10 wood joists or rafters, may be fabricated from minimum No. 20 gage sheet steel provided applicable sections of this criteria are complied with.

5.2 Steel shall be corrosion-resistant or shall be protected by galvanizing, electroplating, or with approved steel primer.

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5.3 The device, after forming, shall evidence no fracturing in either the protective coating or the base metal.

5.4 The radius of a 90-degree bend intended to fit the corner of a joist or header shall be no greater than two times the thickness of the steel.

6.0 QUALITY CONTROL

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

6.2 Welded joist hangers or similar devices 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. ■

TABLE 1—REFERENCED STANDARDS

STANDARD	DATE OF STANDARD				
	<i>2009 and 2006 International Building Code®</i>	<i>2009 and 2006 International Residential Code®</i>	<i>BOCA® National Building Code/1999</i>	<i>1999 Standard Building Code®</i>	<i>1997 Uniform Building Code™</i>
ANSI/AF&PA National Design Specification for Wood Construction (NDS) and Supplement	2005	2005	1997	1997	1991 (revised)