



IAPMO UNIFORM EVALUATION SERVICES
EVALUATION CRITERIA FOR
JOIST HANGERS AND MISCELLANEOUS
CONNECTORS
EC 002-2014
(Adopted - June 2007, Revision - December 2014)

1.0 INTRODUCTION

1.1 **Purpose:** The purpose of this evaluation criteria is to establish requirements for evaluation of joist hangers and miscellaneous connectors under the 2012, 2009 and 2006 *International Building Code*® (IBC®), the 2012, 2009 and 2006 *International Residential Code*® (IRC®). Basis of recognition are IBC® Section 104.11 and IRC® Section R104.11. The development of this criteria is to provide guidelines for calculating and testing the performance of joist hangers and miscellaneous connectors, based on code provisions and the requirements in this evaluation criteria for conditions where the codes do not address the necessary requirements.

1.2 **Scope:** This evaluation criteria describes the test procedures and analysis methods used to determine allowable loads for joist hangers and miscellaneous connectors for recognition in an IAPMO Uniform Evaluation Service Uniform Evaluation Report.

1.2.1 These criteria may be modified as applicable for the analysis of other connector devices such as hurricane ties, strap ties, column caps and bases, bent plates, truss connectors and roof mounted connectors (used with roof mounted solar collectors) when such modifications result in conditions that more realistically model the end use of the connector. These metal devices may be used for wood-to-wood, wood-to-concrete/masonry, and wood-to-steel connections.

2.0 REFERENCED STANDARDS

2.1 Standards referenced in this criteria shall be applied consistent with the provisions of the applicable edition of the code(s) as noted herein.

2006, 2009, 2012 IBC
2006, 2009, 2012 IRC
2001, 2005, 2012 NDS
ASTM D1761-06
ASTM D7147-11

International Building Code®
International Residential Code®
National Design Specification for Wood Construction
Test Methods for Mechanical Fasteners in Wood
Standard Specification for Testing and Establishing
Allowable Loads of Joist Hangers



3.0 BASIC INFORMATION

3.1 General: Each submittal shall include the following information for an evaluation report:

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

3.3 Installation Instructions: The manufacturer shall provide the evaluation agency and the laboratories conducting the testing a copy of its installation instructions. All test specimens, shall be prepared in accordance with the installation instructions and procedures used in the field.

3.4 Packaging and Identification: Method(s) of packaging and product identification shall be included in the evaluation report. Identification shall include the manufacturer's name and address, product name, and the IAPMO UES Uniform Evaluation Report number.

3.5 Testing Laboratories: Testing laboratories shall be accredited for the applicable testing procedures in accordance with ISO/IEC 17025 by a recognized accreditation body conforming to ISO/IEC 17011. Testing at a non-accredited laboratory shall be permitted by IAPMO UES, provided the testing is conducted under the supervision of an accredited laboratory and the supervising laboratory issues the test report.

3.6 Test Reports: Test reports shall include all of applicable information required by the applicable test standard, and UES Test Report Requirements Procedure No. ES-025.

3.7 Product Sampling: Sampling of the joist hangers or miscellaneous connectors for tests under this criteria shall be conducted by the testing laboratory at the manufacturing locations. As an alternative, the specimens may be submitted to the laboratory by the manufacturer, provided the manufacturer attests that the submitted samples are representative of normal production and are a true representative of the product being evaluated, and the testing laboratory or accredited inspection agency compares the samples with the product specifications and concludes the materials comply.

4.0 TEST AND PERFORMANCE REQUIREMENTS

4.1 Test Procedures: Test procedures, equipment, and materials shall be in accordance with ASTM D7147 Sections 5 through 11 and the provisions of Section 3 of this document. The testing of joist hangers shall be in accordance with IBC Section 1711.1.

4.1.1 For connections that rely in some part on wood bearing for resistance, such as joist hangers resisting vertical down loads, a composite wood member, such as laminated veneer lumber (LVL), may be substituted for solid sawn wood. For connections that rely solely on fasteners for resistance, such as joist hangers resisting vertical up loads, solid sawn wood shall be used in the test set up.

4.1.2 As listed in accordance with AF&PA NDS, joist and header lumber used in the test assemblies shall have a specific gravity from 0.49 to 0.55.

4.1.3 The minimum moisture content at the time of testing shall be greater than 11 percent.

4.1.4 Test procedures for roof mounted connectors (for use with roof mounted solar collectors) shall be modified to address the roof covering(s) intended for installation. Vertical load tests shall be conducted with the roof mounted connector at the maximum and minimum roof slopes being evaluated. Roof mounted connectors shall be tested as a single unit. Deflection gages or other suitable measurement devices shall be located at the connector's maximum fastener distance(s) (i.e. maximum moment arm).

4.2 The test report shall be in accordance with ASTM D7147 Section 12.

5.0 DETERMINATION OF ALLOWABLE LOADS

5.1 The allowable loads for the connection devices shall be determined in accordance with ASTM D7147 Sections 13 through 15 and Section 5 of this document.

5.2 Allowable Loads Based on Testing shall be determined in accordance with ASTM D7147 Section 13.

5.2.1 When composite wood members are used in accordance with section 3.1.1 of this document, the reduction factor R_j need not be applied. It is understood that any connection limit based on solid sawn wood bearing will be investigated in the calculation section.

5.2.2 Adjustments to Test Strength Limit - the lowest of the specific gravity adjustment factors (Equations 1, 2, or 3) shall be multiplied by the moisture content reduction factor, R_{MC} (Equation 8). This product shall then be compared to the reduction factors derived from equations 7, 9, and 10. The value that causes the greatest reduction shall be multiplied to the tested design value from Section 13.3.1 of ASTM D7147.

Exception: The adjustment factors and reduction factors of ASTM D7147 Section 13 need not be applied to products recognized under 2006 IBC/IRC.

5.2.3 For roof mounted connectors (used with solar collectors) the vertical test deflection at each fastener shall be reported. The limit load shall be the lesser of the ultimate load divided by the factor of safety in accordance with Section 13.3 of ASTM D7147, the load at specified deflections, or the calculated allowable design load based on calculations in accordance with Section 5.3. Alternatively the limit load shall be lesser of the ultimate test load determined in accordance with ASTM D7147 divided by a factor of safety of 5.0, and all other applicable reductions, or the load at specified deflections.

5.3 Allowable Loads Based on Calculations shall be in accordance with ASTM D7147 Section 14.

6.0 QUALITY CONTROL

6.1 Manufacturer's Quality Assurance System shall comply with the IAPMO UES Minimum Requirements for Listee's Quality Assurance System (IAPMO ES-010).

7.0 EVALUATION REPORT RECOGNITION

7.1 Evaluation reports shall include the general information required in Section 3 of this criteria.

7.2 The evaluation report shall include the following special inspection requirements:

1. Periodic special inspection shall be conducted when the product series are components within the main wind-force-resisting system of structures constructed in areas listed in the 2012 IBC Section 1705.10 (2009 IBC Section 1706.1, 2006 IBC Section 1705.4). Special inspection requirements do not apply to structures, or portions thereof, that qualify for exception under the 2012 IBC Sections 1704.2, 1705.3, 1705.10.1 or 1705.10.2 (2009 IBC Sections 1704.1, 1704.4, 1706.2 or 1706.3; 2006 IBC Sections 1704.1 and 1704.4).
2. Periodic special inspection shall be conducted in accordance with the applicable portions of IBC Section 1704 (2006 IBC Section 1707) when the product series are components within the seismic-force-resisting system of structures constructed in Seismic Design Category C, D, E or F. Special inspection requirements do not apply to structures, or portions thereof, that qualify for exception under 2012 IBC Sections 1704.2, 1705.3, 1705.11 or 1705.12 (2009 IBC Sections 1704.1, 1704.4, 1705.3, 1707.3 or 1707.4).
3. For installations under the IRC, special inspection is not normally required. However, for an engineered design where calculations are required to be signed by a registered design professional, periodic special inspection requirements and exemptions are as stated in Sections 7.2.1 and 7.2.2 as applicable for installations under the IRC.

7.3 It shall be noted in the UER that "fasteners used in contact with preservative-treated or fire-retardant-treated wood shall comply with IBC Section 2304.9.5 or IRC Section R317.3 (2006 IRC Section R319.3), as applicable. The report holder or lumber treater shall be contacted for recommendations on minimum corrosion resistance and connection capacities of fasteners used with the specific proprietary preservative-treated or fire-retardant treated lumber".

7.4 The allowable load capacity of roof-mounted connectors shall be reported at specified deflections in 1/8 inch increments.