



Designation: D7147 – 21

Standard Specification for Testing and Establishing Allowable Loads of Joist Hangers¹

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1. Scope

1.1 This specification covers a procedure for evaluating metal devices used for wood-to-wood, wood-to-concrete, wood-to-concrete masonry, and wood-to-steel connections. This method is intended for use with devices used to connect joists, beams, and girders together. These devices are commonly described as joist hangers.

1.2 This specification describes test methods for evaluating the capacities of joist hangers subject to vertical and torsional loading.

1.3 This specification provides a method of assigning allowable loads to joist hangers based on measured strength and deformation characteristics. Information obtained by the provisions of this specification is applicable to design when using the Allowable Stress Design method.

1.4 *Units*—The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

¹ This specification is under the jurisdiction of ASTM Committee D07 on Wood and is the direct responsibility of Subcommittee D07.05 on Wood Assemblies.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

C31/C31M Practice for Making and Curing Concrete Test Specimens in the Field

C39/C39M Test Method for Compressive Strength of Cylindrical Concrete Specimens

C90 Specification for Loadbearing Concrete Masonry Units

C270 Specification for Mortar for Unit Masonry

C1314 Test Method for Compressive Strength of Masonry Prisms

D245 Practice for Establishing Structural Grades and Related Allowable Properties for Visually Graded Lumber

D9 Terminology Relating to Wood and Wood-Based Products

D1038 Terminology Relating to Veneer, Plywood, and Wood Structural Panels

D1761 Test Methods for Mechanical Fasteners in Wood and Wood-Based Materials

D2395 Test Methods for Density and Specific Gravity (Relative Density) of Wood and Wood-Based Materials

D3737 Practice for Establishing Allowable Properties for Structural Glued Laminated Timber (Glulam)

D4442 Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials

D5055 Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists

D5456 Specification for Evaluation of Structural Composite Lumber Products

D7438 Practice for Field Calibration and Application of Hand-Held Moisture Meters

E4 Practices for Force Verification of Testing Machines

E8/E8M Test Methods for Tension Testing of Metallic Materials

E575 Practice for Reporting Data from Structural Tests of Building Constructions, Elements, Connections, and Assemblies

F606/F606M Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets

F1470 Practice for Fastener Sampling for Specified Mechanical Properties and Performance Inspection

F1575 Test Method for Determining Bending Yield Moment of Nails

2.2 Other Standards:

AWC NDS National Design Specification for Wood Construction³

AISI S100 North American Specification for the Design of Cold-Formed Steel Structural Members⁴

ANSI/AISC 360 Specification for Structural Steel Buildings⁵

ANSI/ASME B18.2.1 Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)⁶

ACI 318/318R Building Code Requirements for Structural Concrete and Commentary⁷

3. Terminology

3.1 The following section defines terms used in this specification. See Terminology D9 and D1038 for other terminology.

3.2 Definitions:

3.2.1 *header*—a member supporting a joist hanger. A header may also be referred to as a “supporting” member.

3.2.2 *joist*—a bending member supported by a joist hanger. A joist may also be referred to as a “supported” member.

3.2.3 *joist hanger*—a metal device, usually cold-formed from light-gage steel sheet or welded from steel plate, used to transfer loads from a joist to a header member or wall in building construction. Face-mount joist hangers contact the side surface of the header and do not contact the top of the header. Top-mount hangers are joist hangers that contact the side and top surface of the header.

3.2.4 *sawn lumber*—see definition for *lumber* in Terminology D9.

3.2.5 *structural composite lumber (SCL)*—see Specification D5456.

3.2.6 *structural glued laminated timber (glulam)*—see Practice D3737.

3.2.7 *wood I-joists*—see Specification D5055.

4. Significance and Use

4.1 Joist hangers are used to transfer vertical loads from a joist to a header in building construction. In addition to vertical load transfer, joist hangers may provide torsional resistance for the ends of a joist. The performance of this connection is influenced by a number of variables, such as the properties of the hanger, the joist material, the header material, and the fasteners. The test described in this specification provide for consistency in evaluating the performance of such assembled units.

³ Available from American Wood Council (AWC), 222 Catoctin Circle SE, Suite 201, Leesburg, VA 20175.

⁴ Available from American Iron and Steel Institute (AISI), 1101 17th St., NW, Suite 1300, Washington, DC 20036.

⁵ Available from American Institute of Steel Construction (AISC), One E. Wacker Dr., Suite 3100, Chicago, IL 60601-2001.

⁶ Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

⁷ Available from American Concrete Institute (ACI), 38800 Country Club Dr., Farmington Hills, MI 48331-3439, <http://www.concrete.org>.

5. Summary of Test Method

5.1 *Vertical Load Test*—Test specimens consisting of a length of joist supported by joist hangers attached to two headers are subjected to a vertical load by a suitable testing machine (see Figs. 1-3), while the vertical load and corresponding deflection of the joist are measured and recorded to provide load-slip data.

5.1.1 Loads applied vertically downward with reference to the intended application of the joist hanger, shall be classified as downward (see Fig. 1).

5.1.2 Loads applied vertically upward with reference to the intended application of the joist hanger, shall be classified as uplift (see Fig. 2).

5.2 *Torsional Moment Test (optional)*—A test method is provided in Appendix X1 for torsional moment capacity evaluation of hangers. This test consists of a joist supported by two joist hangers attached to headers (see Figs. X1.1 and X1.2). The movement of the joist with respect to the headers is measured and recorded to provide data for calculating angular rotation and load-deflection relationships.

6. Apparatus

6.1 *Testing Machine*—A testing machine that is capable of operation at a constant rate of motion of the movable crosshead or a constant rate of loading and a force-measuring device that is calibrated in accordance with Practices E4.

6.2 *Displacement Gage*—All tests shall use a dial gage(s), or equivalent, to measure the relative movement between the joist and header. Devices used for this purpose shall have a least reading of 0.001 in. (0.02 mm).

7. Test Materials

7.1 *Wood*—All wood materials shall be of structural quality with allowable values substantiated by accepted procedures, such as those found in Section 2. The specific gravity of the joists and headers shall be determined in accordance with Test Methods D2395, and moisture content of the joists and headers shall be determined in accordance with Test Methods D4442 or Practice D7438. All specific gravities shall be reported on an

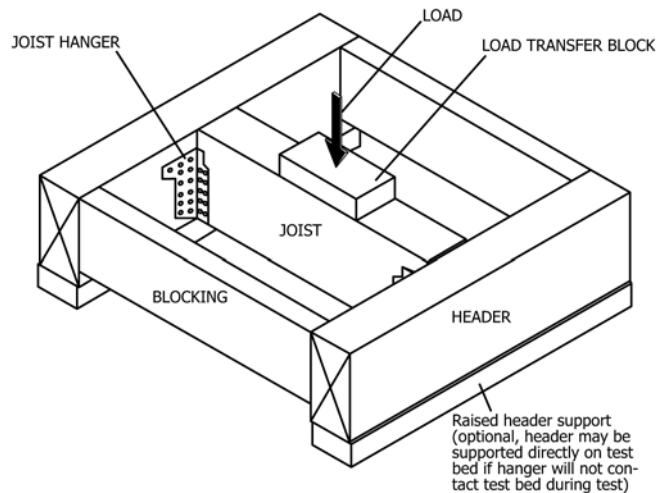


FIG. 1 Typical Vertical Downward Test Setup