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# Standard Test Methods for End Joints in Structural Wood Products[1]

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## INTRODUCTION

Adhesive bonded end joints are used in structural glued wood products. The bond performance of these end joints is only one of several parameters that influence the in-service performance of these products. Evaluating the performance of these end joints require specific tests.

The testing regimen, which consists of one or more of the test methods specified in this standard, is dependent on the type of product, the stage in the manufacturing of the product or sub-components when the testing is to be performed, and the objective of the evaluation. Appendix X1 – Appendix X7 provide an overview of considerations for developing a testing regimen.

## 1. Scope

1.1 This standard provides test methods for evaluating the structural capacity and integrity of end joints in structural wood products.

1.2 Off-line test methods include: *(1)* Axial Tension, *(2)* Bending, and *(3)* Cyclic Delamination.

1.3 In-line test methods include: *(1)* Tension Proofload and *(2)* Bending Proofload.

1.4 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]

D9 Terminology Relating to Wood and Wood-Based Products

D198 Test Methods of Static Tests of Lumber in Structural Sizes

D1101 Test Methods for Integrity of Adhesive Joints in Structural Laminated Wood Products for Exterior Use

D1151 Practice for Effect of Moisture and Temperature on Adhesive Bonds

D1183 Practices for Resistance of Adhesives to Cyclic Laboratory Aging Conditions

D2559 Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions

D2915 Practice for Sampling and Data-Analysis for Structural Wood and Wood-Based Products

D3434 Test Method for Multiple-Cycle Accelerated Aging Test (Automatic Boil Test) for Exterior Wet Use Wood Adhesives

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

D5456 Specification for Evaluation of Structural Composite Lumber Products

D4688 Test Method for Evaluating Structural Adhesives for Finger Jointing Lumber

[1] These test methods are under the jurisdiction of ASTM Committee D07 on Wood and are the direct responsibility of Subcommittee D07.01 on Fundamental Test Methods and Properties.

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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.

D4761 Test Methods for Mechanical Properties of Lumber and Wood-Based Structural Materials
D7247 Test Method for Evaluating the Shear Strength of Adhesive Bonds in Laminated Wood Products at Elevated Temperatures
D7438 Practice for Field Calibration and Application of Hand-Held Moisture Meters
E4 Practices for Force Calibration and Verification of Testing Machines
E6 Terminology Relating to Methods of Mechanical Testing
E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

## 3. Terminology

3.1 Terms used in these methods shall be as defined in Terminologies D9 and E6 and Practices E4 and E177.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *delamination, n*—separation of a bondline due to dimensional changes (swelling and shrinkage) of the wood around the joint caused by extreme changes in the moisture content.

3.2.2 *end joint, n*—joint formed by adhesive bonding of machined, mated surfaces at the ends of two pieces of a structural wood product.

3.2.2.1 *Discussion*—Typical end joint configurations include finger joints and scarf joints.

3.2.3 *end-joint specimen, n*—assembly including one or more end joints of the structural wood product.

3.2.4 *finger joint, n*—end joint formed by multiple interlocking tapered profiles (“fingers”) (Fig. 1).

3.2.5 *finger length, n*—length of machined finger along the longitudinal axis of the full-size member from the finger tip to the base of the finger (Fig. 1).

3.2.6 *finger pitch, n*—distance from a point on one finger to a corresponding point on the adjacent finger measured perpendicular to the length of the finger (Fig. 1).

3.2.7 *gauge length, n*—clear distance between the grips for a specimen subjected to axial tensile loading.

3.2.8 *horizontal finger joint, n*—finger joint where the finger profile appears only on the narrow face of the structural wood product.

3.2.9 *in-line test, n*—a test that is carried out on all production from a continuous manufacturing process.

3.2.10 *joint misalignment, n*—non-zero slope between the longitudinal axes of two adjoining pieces in the direction of depth or thickness, or both.

3.2.11 *joint offset, n*—distance between joint profile surfaces of two adjoining pieces in a cross-sectional direction perpendicular to the finger or scarf joint length.

3.2.12 *off-line test, n*—test that is carried out on a sample taken from a continuous manufacturing process or from inventory of the product.

3.2.13 *outer finger, n*—finger at the edges of the face showing the finger profile (Fig. 1).

3.2.14 *proofload testing, n*—test where a preselected load or stress level is applied to the specimen.

3.2.15 *scarf joint, n*—end joint formed by a single tapered profile (Fig. 2).

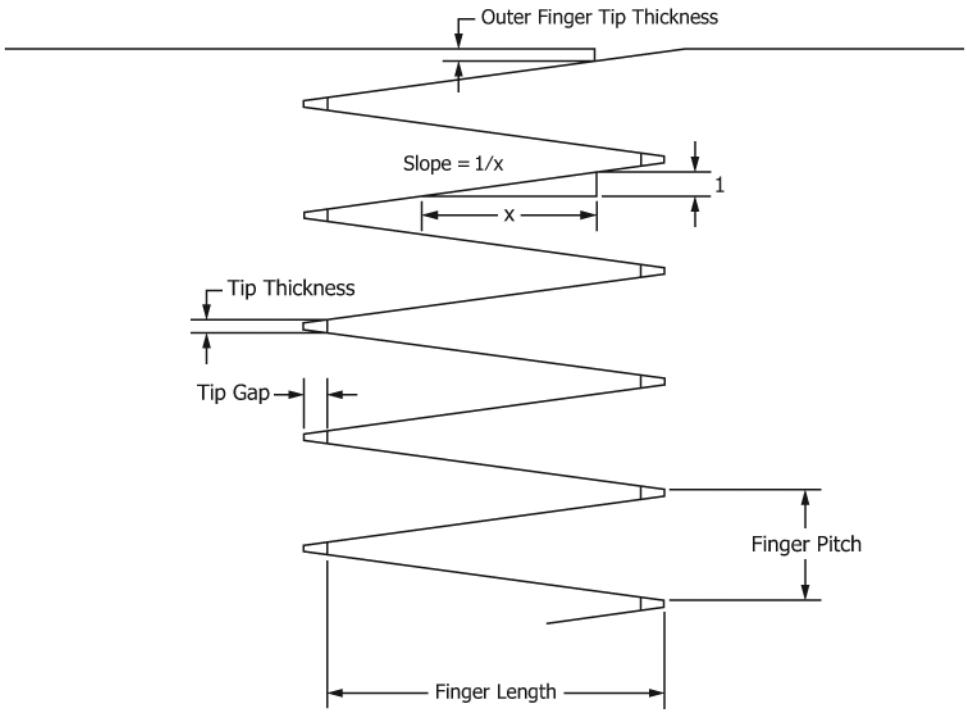


**FIG. 1 Finger Joint Profile**

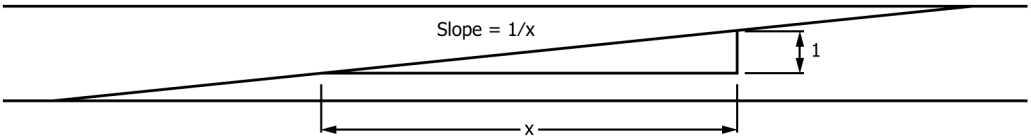


FIG. 2 Scarf Joint Profile

3.2.16 *span, n*—distance between the centerlines of end reactions on which the test specimen is supported to accommodate a transverse bending load.

3.2.17 *standard dry dimensions, n*—cross-sectional size used in design for sawn lumber, this is also known as the standard dry size.

3.2.18 *tip gap, n*—distance between the finger tip and the base of the finger in the opposing segment (Fig. 1).

3.2.19 *tip thickness, n*—smallest width of machined finger (Fig. 1).

3.2.20 *vertical finger joint, n*—finger joint where the finger profile appears only on the wide face of the structural wood product.

## 4. Significance and Use

4.1 These test methods are applicable to specimens with or without specific conditioning regimens. Tests are permitted to be performed on specimens that are not at moisture equilibrium, such as under production conditions in a plant, or on specimens that have been conditioned to specified moisture content or durability conditioning prior to testing.

4.2 These test methods can be used as follows:

4.2.1 To standardize the determination of strength properties for the material and joint being tested.

4.2.2 To investigate the effect of parameters that may influence the structural capacity of the joint, such as joint profile, adhesive type, moisture content, temperature, and strength-reducing characteristics in the assembly.

4.3 These test methods do not intend to address all possible exposure or performance expectations of end joints. The following are some performance characteristics not considered:

4.3.1 Long-term strength and permanence of the wood adhesive.

4.3.2 Time dependent mechanical properties of the joint.

4.3.3 Elevated temperature performance of the joint.

# AXIAL TENSION TEST METHOD (OFF-LINE)

## 5. Scope

5.1 This test method provides procedures for the determination of the axial tensile capacity of full-size end-joint specimen off-line.

5.2 Applications of this test method include: end-joint qualification and daily quality control of production, and other purposes where the strength of a full-size end joint must be verified or determined.

## 6. Summary of Test Method

6.1 The test specimen is subjected to an axial tensile load. The length of the specimen is short enough such that failures occur primarily at or as a result of the joint, but long enough such that the stresses around the joint are not affected by the grips.

6.2 Except as specified below, the specimens shall be tested in accordance with Test Methods D4761 for Axial Strength in Tension.

6.3 The specimen is loaded so that failure occurs or a preselected load is reached within the prescribed amount of time.

NOTE 1—It is preferred to apply load at a constant rate of increase. Either load or displacement control is acceptable. Apply load at a rate that is as close to constant as is practical. Sudden increases in load should be avoided.

## 7. Apparatus

7.1 *Test Machine*—As specified in Test Methods D4761.

7.2 *Grips or Clamping Devices*—As specified in Test Methods D4761.

NOTE 2—Grip designs that do not minimize damage from clamping may result in a high frequency of failure at the edge of the grips. Generally, if a specimen fails at the edge of the grips, the result should be disregarded unless the load level attains a load level that is sufficient to demonstrate a minimum end-joint capacity. When a high frequency of grip related failure occurs at or below the load levels of interest, the grips should be redesigned as excessive culling of specimens for this reason may impact the representativeness of the tensile strength for the sample tested.

7.3 *Distance Between Grips*—The gauge length for finger-joint testing shall be selected such that the edges of the grips are 2 ft (610 mm) apart. The gauge length for scarf joint testing shall be set to the nearest 1 ft (305 mm) increment greater than the length of the joint plus 2 ft (610 mm). With either joint type, the tolerance for gauge length shall be ±2 in. (51 mm).

NOTE 3—The gauge length used for the test is intended to be long enough to result in uniform tensile stress across the joint and short enough to minimize the number of failures that occur away from the joint. The specification outlined in 7.3 has proven reasonable for testing commonly fingerjoined dimension lumber sizes. larger cross-sections may require longer gauge lengths.

7.4 *Accuracy*—As specified in Test Methods D4761.

## 8. Test Specimens and Conditioning

8.1 *Cross-Section*—The specimen shall be tested without modifying the dimensions of the commercial cross-section. The use of reduced cross-section test specimens is permissible according to considerations and guidelines for developing test procedures provided in Appendix X5.

8.2 *Length*—The minimum specimen length shall be the gauge length, determined in accordance with 7.3, plus any required length to achieve contact along the full length of the grips.