



Designation: D5751 – 99 (Reapproved 2019)

# Standard Specification for Adhesives Used for Laminate Joints in Nonstructural Lumber Products<sup>1</sup>

This standard is issued under the fixed designation D5751; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This specification covers performance levels for adhesives to be used in laminate joints in nonstructural lumber products. Such products include, but are not limited to, interior and exterior mouldings, window and door components or parts, and bonded lumber panels. This specification is to be used to evaluate adhesives as well as the adhesive bonds in nonstructural-glued-lumber products.

NOTE 1—This specification supersedes the laminate-joint portion of Specification D3110.

NOTE 2—See 3.2.1 and 3.2.2 for descriptions of a dry-use-nonstructural adhesive and a wet-use-nonstructural adhesive.

1.2 This specification applies to laminate-joint specimens made under both laboratory and field conditions. See Section 4 for limitations in using this specification to evaluate industrially manufactured laminate joint products.

1.3 The following safety caveat applies only to the apparatus and test methods portions, Sections 6, 7, 8, and 9 of this specification: *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.*

1.4 The values stated in inch-pound units are to be regarded as standard.

1.5 In this specification, *laminate joint* refers to both face and edge joints.

1.6 The following index is provided as a guide to the test methods in this specification:

	Section
Apparatus	6
Conditioning	7
Material and Preparation of Assemblies and Specimens	8
Exposure Conditions and Treatments	9
Testing, Calculation, and Reporting	10

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee D14 on Adhesives and is the direct responsibility of Subcommittee D14.30 on Wood Adhesives.

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NOTE 3—The conditioning needed for various stages in the preparation of the specimens and for the exposure tests are given in Sections 7, 8, and 9.

1.7 *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:<sup>2</sup>

D905 Test Method for Strength Properties of Adhesive Bonds in Shear by Compression Loading

D907 Terminology of Adhesives

D2555 Practice for Establishing Clear Wood Strength Values  
D3110 Specification for Adhesives Used in Laminate Joints for Nonstructural Glued Lumber Products (Withdrawn 1996)<sup>3</sup>

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

D5266 Practice for Estimating the Percentage of Wood Failure in Adhesive Bonded Joints

E4 Practices for Force Verification of Testing Machines

E6 Terminology Relating to Methods of Mechanical Testing

E41 Terminology Relating to Conditioning (Withdrawn 2019)<sup>3</sup>

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

## 3. Terminology

3.1 *Definitions:* Many terms in this specification are defined in Terminologies D907, E6, and E41.

3.1.1 *bond, n*—the union of materials by adhesives.

<sup>2</sup> 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.

<sup>3</sup> The last approved version of this historical standard is referenced on www.astm.org.

3.1.2 *laminate joint, n—in wood bonding*, a joint made by bonding layers of adherends face-to-face or edge-to-edge to form thicker or wider stock.

3.1.3 *edge joint, n—in wood bonding*, a type of laminate joint made by bonding adherends edge-to-edge with grain directions parallel to form wider stock.

3.1.4 *face joint, n—in wood bonding*, a type of laminate joint made by bonding adherends face-to-face with grain directions parallel to form thicker stock.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *dry-use nonstructural adhesive, n—* an adhesive capable of producing sufficient strength and durability to make the bonded lumber product serviceable in nonstructural use, under conditions in which the EMC of the wood does not exceed 16 %.

3.2.2 *wet-use nonstructural adhesive, n—* an adhesive capable of producing sufficient strength and durability to make the bonded lumber product serviceable in nonstructural use, under conditions in which the EMC of the wood may be 16 % or greater.

3.3 *Abbreviations:*

3.3.1 *EMC*—equilibrium moisture content.

3.3.2 *MC*—moisture content.

4. Significance and Use

4.1 Adhesives are classified as dry use or wet use. Each classification includes consideration of short-term in-transit exposure conditions at temperatures up to 220°F. These test methods are designed to determine the performance level of a nonstructural wood adhesive when used in a laminate joint. See Fig. 1 for a depiction of a laminate joint.

4.1.1 The dry test and exposure conditions and treatments are to evaluate adhesives and adhesive bonds of laminate joints in nonstructural bonded lumber products for typical service conditions.

4.1.2 The 220°F test, a more severe test, is designed to evaluate the product after exposure to short-term elevated temperature. This test method is intended to simulate conditions that might be experienced in transit, further processing, or in service.

NOTE 4—These typical service conditions may include stress and time under stress, as well as elevated temperature.

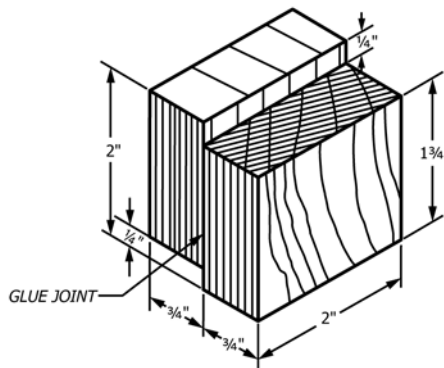
4.2 This specification may be used to evaluate the adhesive bonds in a laminate joint that is the industrial-end product of a manufacturing process. The use of the specification for this purpose requires close evaluation of the configuration of the joint, the wood used, and the manufacturing process.

4.2.1 An industrially manufactured laminate joint should be evaluated using the requirements for compliance to the specification set forth in 5.1.1, 5.1.2, and 5.2.

4.2.2 To measure up to the criteria of the controlled conditions of a laboratory-made specimen, hand pick the lumber, prepare extra joints, and select those joints that most closely meet the requirements of 5.1 and 5.2.

4.3 Special circumstances may require modification of some of the details of these procedures. Record these variations in the report sections, as they may have an impact on the results obtained.

4.4 As the industrially manufactured laminate joint product is often handled, machined, and shipped within a few hours of manufacture, it may not have reached the maximum performance level before it is shipped or tested. To avoid potential



Dimension	Dimensions:	
	Face Joint (Example) <sup>A</sup>	
	Measurement, in. (mm)	Tolerance, in. (mm)
Specimen width	2 (50.8)	+ 0.32 (0.79)
Single lamina length	1.75 (44.4)	+ 0.32 (0.79)
Single lamina thickness (preferred)	0.75 (19)	+ 0.010 (0.25)
Single lamina thickness (alternative)	0.688 (17.5)	+ 0.010 (0.25)
Overall specimen thickness	1.5 (38.1)	+ 0.32 (0.79)
Overlap between adherends	1.5 (38.1)	+ 0.32 (0.79)

<sup>A</sup> The ratio of width to height should be maintained at 4/3.

FIG. 1 Block Shear Specimens

**TABLE 1 Minimum Test Requirements**

Performance Classification and Exposure Conditions <sup>A</sup>	Paragraph No. for Exposure Description	Laminate Joint in Shear <sup>B</sup>					
		Strength <sup>C</sup>		%Wood Failure <sup>D</sup>			
		Group Average, % <sup>E</sup>	Individual Minimum, % <sup>F,G</sup>	Group Average, % <sup>E,G</sup>		Individual Minimum, % <sup>F,G</sup>	
				Soft Wood	Hard Wood	Soft Wood	Hard Wood
Dry Use:							
Cured (Dry)	9.1.1	60	30	60	30	30	15
Three-Cycle Soak	9.1.2	30	15	30	15	15	<sup>H</sup>
Elevated Temperature (220°F)	9.1.3	40	20	40	20	20	<sup>H</sup>
Wet Use:							
Cured (Dry)	9.2.1	60	30	60	30	30	15
Boil	9.2.2	50	25	50	25	25	<sup>H</sup>
Elevated Temperature (220°F)	9.2.3	40	20	40	20	20	<sup>H</sup>
Vacuum Pressure	9.2.4	50	25	50	25	25	<sup>H</sup>

<sup>A</sup> Twenty specimens are required for each classification and exposure.

<sup>B</sup> Parallel to the grain.

<sup>C</sup> The shear strength of the test specimens expressed as a percentage of the average shear strength of the wood species at 12 % MC. (See Table 2.) Adjustments are required for lower MC values. (See Footnote A in Table 2 (a).)

<sup>D</sup> The wood failure values given are for softwoods and hardwoods. Groups 3 and 4 hardwoods (Table 3) are listed at 50 % of the softwood value, with no requirement if the wood failure value calculates to 15 % or less. (See 5.1.2.2 and Table 3.)

<sup>E</sup> For all specimens tested.

<sup>F</sup> For 90 % of the specimens tested, they shall meet or exceed the minimum wood failure values shown. If a zero value is obtained for any of the specimens, the test shall be ruled a failure.

<sup>G</sup> See recommended average specific gravity in Table 4.

<sup>H</sup> No requirement.

product damage, the adhesive-performance level should be determined by the laminate-joint manufacturer prior to initial handling and early shipment. Before beginning the full testing process, the testing laboratory should ensure that the product conforms with the performance level certified by the adhesive manufacturer and has not been damaged by early handling and shipping.

## 5. Test Requirements

### 5.1 Test Adhesive:

5.1.1 To comply with this specification, the test adhesive shall be tested for performance in accordance with Sections 7 through 10, and it shall meet the requirements in Table 1 for the selected performance classification as measured against the average shearing strength of lumber from common species of wood as shown on Table 2(a) and Table 2(b).

5.1.1.1 For certification, a test shall be conducted on a laminate joint using the test adhesive.

5.1.1.2 Lumber with various grain orientations (for example, flat sawn or quarter sawn) shall be allowed to be used interchangeably, provided they do not fall outside the requirements of 8.1.1.

5.1.2 Compliance with this specification shall warrant certification of the adhesive for use on a designated grouping of wood, either softwood or hardwood, when tested and found to be in accordance with any one of the species of that group. See Table 3 for the designated groupings of commonly used domestic and imported woods, as accepted in this specification.<sup>4</sup>

<sup>4</sup> For wood property information on imported woods, refer to U.S. Forest Service, Agricultural Handbook No. 72, *Wood Handbook*, 1987 ed., Table 4.4.

5.1.2.1 The wood failure requirements of Table 1 are given for softwoods, Groups 1 and 2, and for hardwoods, Groups 3 and 4.

5.1.2.2 In the event that the adhesive user or supplier, or both, cannot accept the designated groupings in Table 3, either party shall have the option of requesting a test on an individual species.

5.2 *Industrially Manufactured Laminate Joints*—An industrially manufactured laminate joint may be used to evaluate the adhesive used to produce it, provided its construction meets the requirements in Sections 7 and 8, and the joint is tested in accordance with the requirements in Table 1.

## 6. Apparatus

6.1 *Environmental Chambers*—For moist-heat aging, capable of conditioning specimens at 80 ± 5°F (27 ± 3°C) and 80 ± 5 % relative humidity, and with capacity for up to 20 specimens well-spaced and supported on racks to allow free air flow.

6.2 *Oven(s)*—Capable of meeting all the temperature requirements of 9.1.2, 105 ± 5°F (41 ± 3°C); 9.1.3, 220 and 230 ± 5°F (104 and 110 ± 3°C); 9.2.2 and 9.2.3, 145 ± 5°F (63 ± 3°C), with sufficient air circulation to remove moisture from the chamber. An oven capable of enclosing the testing machine is also recommended. (See 9.1.3.1.)

6.3 *Tank for Soaking*, meeting the requirements of 9.1.2, so that all of the specimens are completely covered with water for the duration of the soak cycles.

6.4 *Tank for Boiling*, meeting the requirements of 9.2.2, so that all of the specimens are completely covered with water for the duration of the boil cycles.