

AMERICAN LUMBER STANDARD COMMITTEE, INCORPORATED®

GLUED LUMBER POLICY

November 8, 2013

This policy authorizes the Board of Review of the American Lumber Standard Committee to monitor the implementation by an accredited agency of procedures for the certification and quality control of structural glued lumber where such products are grade marked as conforming to the American Lumber Standard. Glued lumber includes finger-jointed, face-glued and edge-glued lumber. This monitoring by the Board of Review is to determine adherence to specified certification and quality control procedures for structural glued lumber. Additionally, the Board is authorized to determine the competency, reliability, and adequacy of agencies that apply for approval as accredited inspection agencies for glued lumber.

(A) An applicant agency shall provide the Board with written certification and quality control procedures that it shall use when authorizing mills to grade-mark glued lumber. The procedures shall require that:

1. Adhesives

- 1.1. Glued structural lumber shall be glued with adhesives which meet the requirements of ASTM D2559 or other approved consensus standard suitable for exterior exposure for structural application, except in the case of STUD USE ONLY finger-jointed lumber.
- 1.2. STUD USE ONLY finger-jointed lumber shall be glued with:
 - a) PVA adhesives that meet the requirements of Type 1 as specified in ASTM D4317; or wet use requirements of ASTM D5572.

Note: ASTM D5572 explicitly covers mechanical properties of wood adhesives in finger-jointed non-structural wood products. It is provided as an alternate adhesive standard as the test methods described and the minimum test requirements are consistent with the general requirements of adhesives for STUD USE ONLY finger-jointed lumber and PVA Type 1 adhesives described in ASTM D4317.

- b) An adhesive that meets the requirements of ASTM D2559 with the exception of the test for "Resistance to Deformation Under Static Loading". Adhesive verification tests using ASTM D2559 shall be carried out using either Douglas fir, western hemlock, southern yellow pine, western larch or other ALSC approved species that meet the requirements of Table 1 in ASTM D2559.
 - 1.3. Strength and durability requirements stated in the agency's procedures shall be performed on finger-jointed lumber. The procedures shall require that either:
 - a) the certification and daily quality control specimens selected for strength tests are subject to a durability cycle prior to strength tests, or
 - b) cyclic delamination tests shall be performed on selected specimens as part of the certification and daily quality control tests.
 - 1.4. Heat Resistant Adhesives
 - 1.4.1. End-jointed lumber manufactured with adhesives which meet the requirements of 1.4.2 shall include the designations "Heat Resistant Adhesive" or "HRA" in the grade stamp or structural glued lumber quality mark. (For Non-Heat Resistant Adhesives see Section (B) 2)
 - 1.4.2. Heat resistant adhesives shall be evaluated according to the procedure provided in ASTM D7374 Practice for Evaluating Elevated Temperature Performance of Adhesives Used in End-Jointed Lumber or ASTM D7470 Evaluating Elevated Temperature Performance of End-Jointed Lumber Studs using lumber end-jointed with the adhesive to be qualified according to

section 2 and framed into a wall test specimen. ASTM E119 conditions of acceptance for temperature and passage of flame or hot gases are to be recorded and reported but are not acceptance criteria for the end-jointed lumber adhesive qualification and the ASTM E119 hose stream test is not required. Wall plates shall be selected such that the design load capacity of the wall specimen is limited by the lumber used for studs in compression. The applied static load shall be based on the design load capacity of the lumber used for studs in compression determined according to NDS. The fire resistance of the wall specimen shall meet or exceed 60 minutes to structural failure when tested in accordance with ASTM E119.

- 1.4.3. A heat resistant adhesive qualified under the provision of 1.4.2 is applicable to end-jointed lumber restricted to species and grades having an applied static design load value, determined according to the NDS and based on the applicable Modulus of Elasticity (MOE) and Compression Parallel to the Grain (F-c) stress values, not to exceed that for the lumber used for studs used in the wall test specimen, see ASTM D7374 or ASTM D7470.

2. Required Tests and Data Adjustments for Finger-jointed Lumber

- 2.1. Bending and/or tension strength tests shall be performed as part of the certification and quality control procedures for structural finger-jointed dimension lumber. Minimum test requirements are:
- 2.2. Bending
- 2.2.1. Bending joint requirements are based on full size specimen testing in accordance with ASTM D4761 edge-wise bending. Testing in flat-wise orientation is permitted. Testing of reduced width (ripped) specimen from full board width finger-jointed dimension lumber is permitted.
- 2.2.2. Minimum qualification sample size = 53 specimens (joints), see Table 5.
- 2.2.3. The required joint strength for both the fifth percentile tolerance limit (75% confidence) and the base joint strength shall be computed in accordance with Equation 1, except as provided in section 2.3.4:

$$\text{Eq. 1: } \text{MOR} = 2.1 * F_b * C_{1b} * C_{2b} * C_3$$

where:

- MOR = adjusted bending strength requirement
- F_b = assigned F_b for the species/species group, size and grade tested
Note: for testing in flat-wise orientation, apply Adjustment Factor For Flat-wise Use provided in certified grading rules of ALSC agencies
- C_{1b} = finger-jointing factor of 1.15 for the fifth percentile estimates (Exception for 2x3 C_{1b} = 1.10), and 1.00 for the base joint strength (see Table 5)
- C_{2b} = finger-joint profile bending factor as shown in Table 1
- C_3 = reduced finger-joint width factor. For unreduced width (full board width) test specimen for edge-wise or flat-wise bending, use 1. Otherwise, use the value in Table 2 for reduced width (ripped) test specimen
Note: One of the reasons for testing a reduced width instead of a full board width specimen is to facilitate edge-wise bending testing at a short span.

Table 1 Values of Finger-Joint Profile Bending Factors, C_{2b}			
Test Specimen Type	Bending Test Specimen Orientation	Fifth Percentile or Base Joint Strength	
		Vertical Joint Profile	Horizontal Joint Profile
Full Cross-section	Edge-wise	1.00	1.00
	Flat-wise	1.15	1.00
Reduced Width Cross-section	Edge-wise	1.10	1.00
	Flat-wise	1.00	1.10
Durability Tested Full or Reduced Width Cross-section	Edge-wise or Flat-wise	0.80	0.75

Notes to Table 1: The edge-wise "Bending Test Specimen Orientation" means the wide face surfaces of the board are parallel to the applied load direction. The flat-wise "test specimen bending orientation" means the wide face surfaces are perpendicular to the load direction. The load configuration is for four point loading with the load heads positioned at the third points of the span or a minimum of 4" apart located equidistant from the center of the span. The joint to be tested shall be positioned at the midpoint of the span. Joint profile refers to the orientation of the joint fingers relative to the cross section of the board. If the profile of the fingers is visible on the wider face of the board, the profile is considered vertical. If the profile of the fingers is visible on the narrower face of the board, the profile is considered horizontal.

Table 2 Values of C_3 Factors for Finger-Joint Specimen Reduced in Width (ripped) for Testing					
Reduced specimen width (actual)	Original (un-ripped) Lumber Board Width (nominal)				
	2x4	2x6	2x8	2x10	2x12
1.5 inches by original thickness (e.g. reduced to nominal 2" width)	1.05	1.11	1.17	1.24	1.33
2.5 inches by original thickness (e.g. reduced to nominal 3" width)	1.03	1.08	1.14	1.21	1.29
Half of original product width less saw kerf	1.05	1.08	1.11	1.15	1.19

*Note to Table 2: $C_3 = (7270 - (177 * h_1)) / (7270 - (177 * h_2))$*

*Where h_1 = Reduced width specimen dimension in the direction of the applied test load
 h_2 = Full Board width specimen dimension*

2.2.4. When the ratio of F_t/F_b assigned to the highest grade level qualified exceeds the value of k in Table 3, and no tension qualification tests are conducted, the following factors shall be substituted in Equation 1

F_b = assigned F_t for the species/species group, size and grade tested
 C_{1b} = finger-jointing factor of 1.84 for the fifth percentile estimates (Exception for 2x3 C_{1b} = 1.76), and 1.60 for the base joint strength

Table 3 Value of k	
Joint Profile	k
Vertical	0.50
Horizontal	0.60

2.3. Tension

- 2.3.1. Tension joint requirements are based on full size specimen testing in accordance with AITC Test T119. Testing on reduced width (ripped) specimen from full width finger-jointed dimension lumber is permitted. Reduced width cross-section specimens shall be at least 0.75" in thickness. The test span shall be of sufficient length to minimize extraneous influences in the joint area resulting from gripping the test specimen.
- 2.3.2. Minimum qualification sample size = 53 specimens (joints), see Table 5.
- 2.3.3. The required joint strength for both the fifth percentile tolerance limit (75% confidence) and the base joint strength shall be computed in accordance with Equation 2, except as provided in section 2.3.4:

$$\text{Eq. 2} \quad \text{UTS} = 2.1 * F_t * C_{1t} * C_{2t} * C_3$$

where:

UTS= adjusted tension strength requirement

F_t = assigned F_t for the species/species group, size and grade tested

C_{1t} = finger-jointing factor of 1.25 for the fifth percentile estimates, and 1.00 for the base joint strength (see Table 5)

C_{2t} = finger-joint profile tension factors as shown in Table 4

C_3 = reduced finger-joint width factor. For unreduced width (full board width) test specimen, use 1. Otherwise, use the value in Table 2 for reduced width (ripped) test specimen

Note: One of the reasons for testing a reduced size specimen is facilitate gripping or testing at a short span.

Table 4 Values of Finger-Joint Profile Tension Factors, C_{2t}		
Test Specimen Type	Fifth Percentile or Base Joint Strength	
	Vertical Joint Profile	Horizontal Joint Profile
Full Cross-section	1.00	1.00
Reduced Width Cross-section	1.15	1.15
Durability Tested Full or Reduced Width Cross-section	1.05	1.05

2.3.4. When the ratio of F_t/F_b assigned to the highest grade level qualified is less than the value of k in Table 3, and no bending qualification tests are conducted, the following factors shall be substituted in Equation 2:

F_t = assigned F_b for the species/species group, size and grade tested

C_{1t} = finger-jointing factor of 0.75 for the fifth percentile estimates, and 0.60 for the base joint strength

Table 5 Nonparametric Order Statistics for Several Sample Sizes*		
Sample Size	Number of Pieces Permitted Below Base Joint Strength**	Order statistic equal to 5% nonparametric TL, 75% confidence
53	0	2
78	0	3
102	1	4
125	1	5
148	2	6

* *Sample sizes selected from ASTM D2915, Table 2. Sample sizes which have whole number order statistics for the 5% NTL, 75% confidence.*

** *See 2.2.3, 2.2.4, 2.3.3, and 2.3.4 for the required base joint strength.*

2.4. Alternate Qualification Requirements.

2.4.1. The factor designated as C_{1b} in Equation 1 and C_{1t} in Equation 2 can be reduced when it can be demonstrated and continually verified through daily quality control that the stipulated glued lumber manufacturing process results in a longer average lumber segment length than assumed under this policy or less variability in glue joint strength than assumed under this policy.

2.4.2. An agency shall provide written documentation to the Board of Review supporting all requested reductions as provided in 2.4.1. Such reductions shall not be permitted under this policy until approved by action of the Board of Review.

2.4.3. Factors C_{2b} in Equation 1 and C_{2t} in Equation 2 are based on comparative studies of the listed test protocols. Factors for additional test protocols shall be permitted when approved by the Board of Review. The agency proposing the use and acceptance of additional test modes,

specimen sizes, and factors shall provide the Board of Review with documentation providing the following minimum information:

- a) A complete description of the test mode and specimen dimensions, conditioning, and test orientation.
 - b) Any and all additional information considered necessary or critical to the proper conduction of the proposed test method/specimen combination.
 - c) The results of a comparative study of the proposed test method (and specimen conditions) with one or both of the Baseline tests. The tests shall be conducted in accordance with the methodology of the Baseline study as closely as possible to minimize the potential need for additional data adjustments. The report shall include a full description of all pertinent test details and conditions. A minimum of 80 joints shall be tested for each reported test mode/specimen combination.
 - d) Proposed factors for Equations 1 and 2 as appropriate to this policy.
- 2.4.4. All test modes and associated factors approved under 2.4.3 shall be included in this policy, and made available to all accredited agencies.

2.5. Wood Quality in the Joint

2.5.1. Knots

- a) Agency quality control procedures shall permit knots in the joint area no larger than those listed in Table 6.

Table 6							
Nominal Width	STUD USE ONLY			LUMBER GLUED WITH ADHESIVES MEETING REQUIREMENTS OF ASTM D2559			
	Select Structural	No. 1, No. 2, Construction	Stud, No. 3, Standard, Utility	Select Structural	No.1	No. 2	Construction, Standard, Utility, Stud, No. 3
2"	1/4"	1/4"	3/8"	3/16"	1/4"	1/4"	3/8"
3"	3/8"	1/2"	3/4"	1/4"	3/8"	1/2"	5/8"
4"	1/2"	5/8"	1"	3/8"	1/2"	3/4"	7/8"
5"	5/8"	3/4"	1 1/4"	1/2"	5/8"	7/8"	1 1/8"
6"	3/4"	7/8"	1 1/2"	5/8"	3/4"	1"	1 3/8"
8"				3/4"	1"	1 1/8"	1 5/8"
10"				1"	1 1/8"	1 3/8"	1 7/8"
12"				1 1/4"	1 1/4"	1 1/2"	2"

3. Required Tests for Face-glued and Edge-glued Lumber

3.1. Shear Parallel to the grain

- 3.1.1. Shear strength tests shall be performed as part of the certification and quality control procedures for face- or edge-glued lumber. Shear strength requirements are based on testing in accordance with ASTM D905 or the AITC Test T107. The specimens shall be obtained from pieces selected from normal production at moisture content typical of production.

Crosshead movement shall provide approximately a uniform rate of loading not exceeding 0.50 inch per minute.

3.1.2. Minimum qualification sample size = 53 specimens (joints), see Table 5.

3.1.3. The required shear strength for the fifth percentile tolerance limit (75% confidence) shall be computed in accordance with Equation 3:

$$\text{Eq. 3} \quad F_{v*} = 2.1 * F_v$$

where:

F_{v*} = Shear strength requirement

F_v = assigned F_v for the species/species group tested

4. Required Tests for All Structural Glued Lumber

4.1. Durability/Delamination Test

4.1.1. The certification and quality control procedures for all glued structural lumber shall include durability or cyclic delamination tests based on the applicable sections of recognized consensus standards. In addition, finger jointed lumber shall comply with Section 1.3.

4.1.2. Green lumber shall be dried to 19% or less moisture content before testing for the cyclic delamination test or durability cycle test.

4.2. Moisture content

4.2.1. Adjustments to test data for moisture content shall be in accordance with ASTM D1990 Annex A1, section 4.2 or other recognized consensus standard.

5. Inspections

5.1. Agencies shall conduct at least 12 inspections per year of the visual grading accuracy, production process and records of grademarked glued lumber except in cases where the producing plant is inactive for a period in excess of 2 months during any 12 month period in which case an inspection of the visual grading accuracy, production process and records of grademarked glued lumber is required for each month the plant is actively producing glued lumber.

6. Records

6.1. Agencies shall require in-plant test records to be retained for at least one year.

7. Labeling

7.1. Agencies shall provide for obliteration of grade marks when lots are rejected by the in-plant procedures.

7.2. If design values are assigned to the glued lumber product, a special grade mark or a separate mark shall be used to indicate that joint integrity is subject to agency quality control. Facsimiles of these marks shall be on file with the Board of Review.

8. Agency Quality Control procedures

8.1. Agency quality control procedures shall require each qualified plant to collect and test glue joint samples as part of the daily plant quality control procedures.

8.2. The minimum sampling rate required shall be either:

8.2.1. One (1) specimen per hour per shift (8 hours) with not fewer than five (5) specimens

- collected during any production shift of less than five (5) hours.
- 8.2.2. When all structural glued lumber production is subjected to a proof load of at least 1.3 times the assigned allowable stress the sampling frequency may be reduced to one (1) specimen per four (4) hours per shift (8 hours) with not fewer than two (2) specimens collected during any production shift of less than eight (8) hours.
 - 8.3. All pieces tested shall equal or exceed the base joint strength for the property tested in accordance to Table 5.
 - 8.4. When a daily QC test value falls below the fifth (5th) percentile value for the property tested, but not below the base joint strength value, the test values of at least 27 of the next 28 pieces shall equal or exceed the fifth (5th) percentile target value.
 - 8.5. An agency may adopt other acceptance criteria provided it can demonstrate the procedures provide an equivalent or better degree of control and ability to detect non-complying product.
 - 8.6. Failure to meet the above criteria shall indicate an "out-of-control" condition, requiring reaffirmation by the mill or the agency of the process, and removal of grade marks from non-complying product.
- (B)** The American Lumber Standard Committee has established the following general policies with regard to structural glued lumber:
1. STUD USE ONLY finger jointed lumber shall be in sizes 2x2 through 2x6 and 3x4 only and in lengths not to exceed 12 feet.
 2. End-jointed lumber shall be labeled "Non-Heat Resistant Adhesive" or "Non-HRA", except those manufactured with a heat resistant adhesive meeting the provision of 1.4.1.
 3. The Board may employ consultants to review any evidence submitted. All consultant expenses shall be borne by the applicant agency.
- (C)** The American Lumber Standard Committee (ALSC) has established the following procedures for the Board in carrying out its responsibility to monitor agencies that are approved as accredited inspection agencies for glued lumber:
1. Each agency shall provide the Board of Review with the certification and quality control procedures it utilizes in authorizing mills to grade mark glued lumber.
 2. Non-rules-writing inspection agencies shall require certification procedures, quality control testing and record keeping to provide product performance at least equivalent to requirements of rules-writing agencies. The Board may employ consultants to review product performance levels in the event the Board has reason to believe agencies are not meeting stated product performance levels. Such consultant fees shall be borne by the agency.
 3. ALSC Inspectors shall review mill records to ascertain whether producers maintain records as required by inspection agencies. ALSC Inspectors shall inspect glued lumber to determine if it meets visual requirements.
 4. ALSC Inspectors shall review agency records to ascertain if the agency is performing those inspections/tests required by its quality control program. ALSC Inspectors shall perform or witness physical tests of glued lumber products if there is reason to believe the agency is not following stated testing procedures or the adhesive is not in conformance with the criteria specified in (A) 1 or (A) 2.
 5. Rules-writing agencies shall include in their rule books an explanation that structural glued lumber certification and quality control procedures are developed for the species and grades included in the particular rules and that they comply with the ALSC Glued Lumber Policy.
 6. Rules-writing agencies shall include provisions for specification, qualification and labeling of heat resistant adhesive structural glued lumber in their rules, and certification and quality control manuals. See (A) 1.4.

7. ALSC accredited agencies shall include in their certification and quality control procedures an explanation that their structural glued lumber certification and quality control procedures comply with the ALSC Glued Lumber Policy, that the responsibility for the certification and quality control procedures is that of the agencies and that the Board shall monitor whether the certification and quality control procedures are being carried out by the agencies.
8. Grading agencies accredited by ALSC to grademark glued lumber shall use their ALSC recognized logo only on glued lumber products which conform to a procedure referenced in the ALSC Glued Lumber Policy. Conversely, such agencies shall not authorize the use of their ALSC recognized logo on glued lumber products manufactured to procedures other than those referenced in the ALSC Glued Lumber Policy.

Addendum to ALSC Glued Lumber Policy Remanufactured Products

Structural glued lumber products manufactured in accordance with ANSI A190.1 and which are resawn or remanufactured subsequent to initial manufacture, and marked with a grade stamp or other approved mark to indicate compliance with the ALSC Glued Lumber Policy shall be produced in full compliance with the ALSC Glued Lumber Policy. This addendum is applicable only to glulam beams which were initially manufactured under third party inspection of a code approved and accredited inspection agency, manufactured in compliance with all requirements of ANSI A190.1, and marked with a code approved label. No other glulam timbers may be remanufactured under this policy.

Certification of the glue joints of the remanufactured stock may be verified by either:

1. Direct agency qualification, quality control oversight, and documentation of the initial joint manufacturer, or
2. Standard approved lot sampling and testing procedures such as ANSI/ASQC Z1.4.

When joint quality verification is through qualification and quality control of the initial joint manufacturer, the agency shall be able to link the remanufactured product directly to the manufacturer of the glue joint through appropriate documentation and verification. The joint manufacturer shall be qualified and quality controlled in compliance with the ALSC Glued Lumber Policy and the agency glue joint certification and quality control procedures.

If there is reason to believe that the remanufactured product does not comply with the original glue joint certification, or the original glue joint certification cannot be verified and documented, the agency shall require that the remanufacturer verify joint quality by sampling and testing procedures such as ANSI/ASQC Z1.4 or other consensus standard. Such testing shall include durability or cyclic delamination testing and evaluation in compliance with the agency qualification and quality control procedures.

The remanufactured product shall be marked in conformance with the ALSC policies and procedures.

Resawn or remanufactured glulam beams.

Lumber produced in compliance with this policy by resawing or remanufacturing glued laminated timber shall not be approved and marked for any grade with assigned allowable properties higher than No. 1 grade (NGR) of that species or species group.